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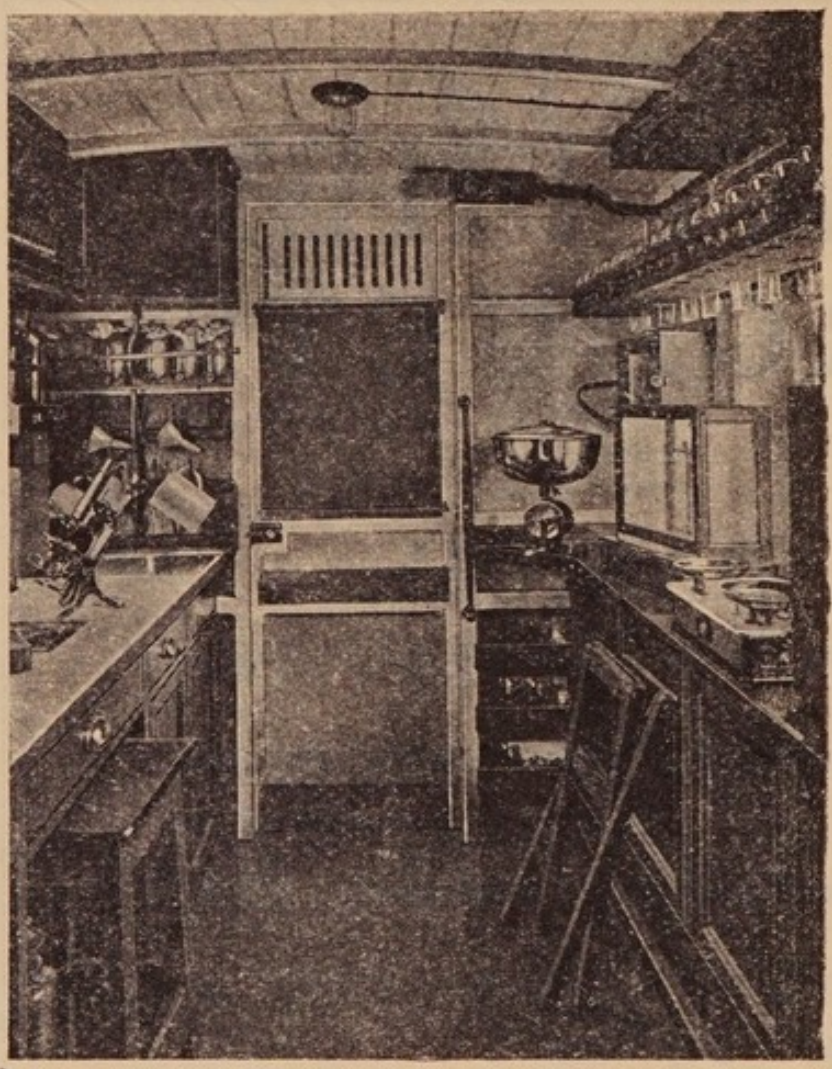
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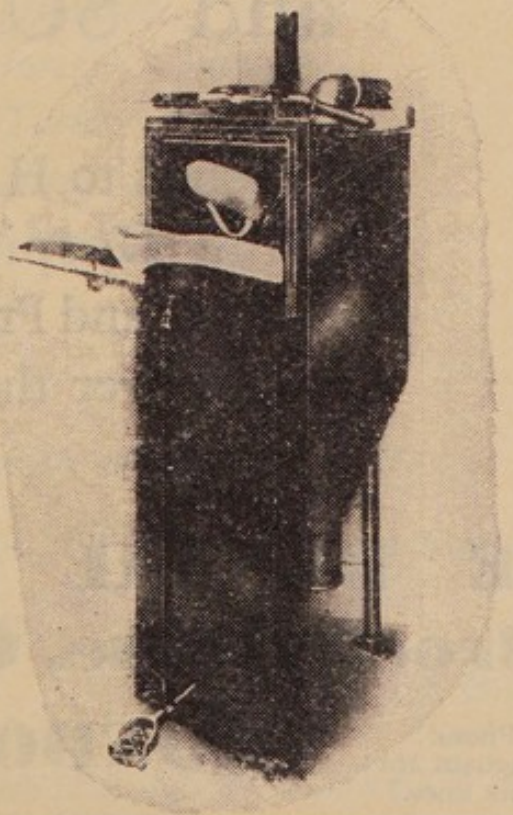
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ABBREVIATIONS

A.	Adjutant-General's Branch.
A. and D. (book)	Admission and discharge (book).
A. and Q. ...	Assistant Adjutant and Quarter-Master-General's Branch.
A.A. and Q.M.G.	Assistant Adjutant and Quarter-Master-General.
A.B.	Army book.
A.D.H.	Assistant Director of Hygiene.
A.D.M.S. ...	Assistant Director of Medical Services.
A.D.P.	Assistant Director of Pathology.
A.D.S.	Advanced dressing station.
A.F.	Army form.
A.G.	Adjutant-General.
A.P.M.	Assistant Provost-Marshal.
A.T.S.	Anti-tetanic serum.
B.G.S.	Brigadier, General Staff.
Cav. Fd. Amb....	Cavalry Field Ambulance.
C.C.S.	Casualty Clearing Station.
C.G.S.	Chief of the General Staff in the Field.
C.-in-C.	Commander-in-Chief.
C.O.	Commanding officer.
C.R.E.	Commander Royal Engineers.
D.A.D.H. ...	Deputy Assistant Director of Hygiene.
D.A.D.M.S. ...	Deputy Assistant Director of Medical Services.
D.A.G.	Deputy Adjutant-General.
D.A.P.M. ...	Deputy Assistant Provost-Marshal.
D.A. and Q.M.G.	Deputy Adjutant and Quarter-Master-General.
D.D.M.S. ...	Deputy Director of Medical Services.
D.G.A.M.S. ...	Director-General, Army Medical Services.
D.M.G.O. ...	Deputy Master-General of the Ordnance.
D.M.S.	Director of Medical Services.
D.Q.M.G. ...	Deputy Quarter-Master-General.
E.M.O.	Embarkation medical officer.
Fd. Amb. ...	Field Ambulance.
Fd. Hyg. Sec. ...	Field Hygiene Section.
F.M. (card) ...	Field medical (card).
F.S.	Field service.
F.S.M.	Field Service Manual.
F.S.R.	Field Service Regulations.
G.	General Staff Branch.
Gen. Hosp. ...	General Hospital.
G.H.Q.	General Headquarters.
G.O.C. (in C.) ...	General Officer Commanding (-in-Chief).
G.S.O.1	General Staff Officer 1st Grade.
H.Q.	Headquarters.
L.-of-C. ...	Line or lines of communication.

ABBREVIATIONS—*continued*

M.A.C.	...	Motor Ambulance Convoy.
M.D.S.	...	Main dressing station.
M.O.	...	Medical officer.
M.T.	...	Mechanical transport.
N.C.O.	...	Non-commissioned officer.
O.C.	...	Officer commanding.
O. i/c.	...	Officer-in-charge.
Q.	...	Quarter-Master-General's Branch.
Q.M.G.	...	Quarter-Master-General.
R.A.F.	...	Royal Air Force.
R.A.M.C.	...	Royal Army Medical Corps.
R.A.O.C.	...	Royal Army Ordnance Corps.
R.A.P.	...	Regimental aid post.
R.A.S.C.	...	Royal Army Service Corps.
R.E.	...	Royal Engineers.
R/T.	...	Radio-telephony.
T.E.W.T.	...	Tactical exercise(s) without troops.
V.A.D.	...	Voluntary Aid Detachment.
W.O.	...	Warrant officer.
W/T.	...	Wireless telegraphy.
W.W.C.P.	...	Walking wounded collecting post.

KEY TO FIGURES

Commanding Officer.

Company or Section Commander (Field units).
Company Officer (Peace units).

Other R.A.M.C. Officers.

A.D. Corps Officer.

Quarter-master.

R.A.S.C. Officer.

Regimental Serjeant-major.

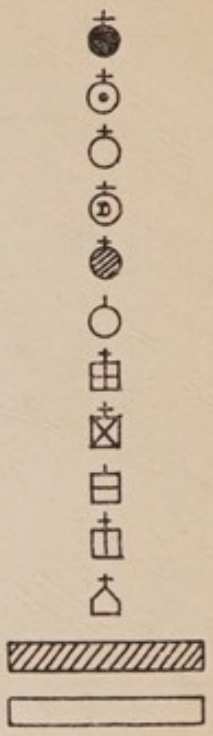
Quarter-master-serjeant.

Company Serjeant-major, R.A.S.C., or Staff-serjeant or Serjeant, R.A.S.C.

Staff-serjeant or Serjeant.

Bugler.

R.A.M.C., rank and file.
Front rank.
Rear rank.



Motor Ambulance.

Bicycle.

Car, 2 seater, 4 wheeled.

Car, 4 seater, 4 wheeled.

Cart, Maltese.

Cart, Officers' Mess.

Cart, Water.

Kitchen, travelling.

Lorry, 30 cwt.

Motor cycle, solo.

Trailer, 2 wheeled, kitchen.

Trailer, 2 wheeled, water tank.

Wagon, Limbered, G.S.

Wagon, Ambulance, Mk. VI.



PART A.—MILITARY TRAINING

SECTION 1.—GENERAL TRAINING

CHAPTER I

GENERAL INSTRUCTIONS

1. The Royal Army Medical Corps is maintained to carry out the following duties :—

(1) The maintenance of health and the prevention of disease.
(2) The care and treatment of the sick and wounded.
(3) The collection and evacuation of the sick and wounded in the field.
(4) The preparation of professional records of the sick and wounded.

In order to perform these duties efficiently officers of the R.A.M.C. must not only keep their professional knowledge thoroughly up to date, but must also have a knowledge of the organization and administration of the whole army in peace and war, and of the principles laid down in Field Service Regulations so far as these concern the medical services.

2. In order to be in a position to give advice with the object of improving the soldier's physical efficiency, officers of the R.A.M.C. should make themselves acquainted with the details of the soldier's life and work. The prevention of disease is dealt with in the Army Manual of Hygiene and Sanitation, which must be studied by every officer, W.O., N.C.O. and man. Every opportunity must be taken, especially at camps of exercise, to study the practical application of the instructions given in this manual.

3. In the field R.A.M.C. officers are responsible for the immediate treatment of the sick and wounded, their collection and transportation from the fighting area, their care, treatment and discipline while in medical units or when sick in quarters, the compilation of statistics and records of general and professional interest regarding them, and the replenishment of medical equipment. These duties must be carried out in conformity with the general scheme of administration of the Army.

4. For the efficient performance of their duties in the field R.A.M.C. officers must have some knowledge of the general principles on which military operations are conducted.

5. In order to assist newly commissioned officers of the R.A.M.C. to acquire a working knowledge of army organization and administration, and of the special circumstances affecting the life of a soldier, courses of instruction are held at the Royal Army Medical College and at the R.A.M.C. Depot and Training Establishment.

6. D.Ds.M.S., A.Ds.M.S. and Os.C. hospitals and companies are responsible for the training of junior officers in the interior economy and administration of military hospitals, and for the progressive instruction of all officers serving under them in the organization and administration of the medical service, as well as for the supervision of the technical military training of all ranks of the Corps.

7. Under the authority of the G.O.C.-in-C., the General Staff (with such assistance from other branches of the staff as may be required) give instruction to officers of the Corps in the principles of military science.

8. General instructions regarding the training of all ranks of the army are contained in Training Regulations. Following the system therein laid down, the training of officers, R.A.M.C. in military subjects, and that of W.Os., N.C.Os. and men in the duties of the Corps is divided into (i) individual training ; (ii) collective training.

9. The object of individual training is to prepare the individual for the duties and responsibilities which he will be required to carry out in peace or war.

10. The object of collective training is to instruct officers in medical administration in the field and all ranks of the Corps in the work of field medical units, so that on the outbreak of war they may be capable of fulfilling their duties.

CHAPTER II

INDIVIDUAL TRAINING

Officers

11. The individual training of officers is effected by means of tactical exercises without troops (T.E.W.T.), war games, lectures, regimental exercises and schemes.

12. When T.E.W.T. are held for the study of strategical and tactical problems, officers of the R.A.M.C. should, if possible, attend in order to keep in close touch with new developments and their bearing on the medical services in the field.

13. When T.E.W.T. are specially arranged for the instruction of officers of the R.A.M.C., strategical and tactical schemes should be drawn up by the General Staff in consultation with officers of the medical services.

The senior medical officer on the directing staff should detail the medical officers to the appointments laid down for the medical services in war. These officers should then be ordered to write an appreciation, together with the orders and instructions which they would issue in war time. When completed, their work should be handed in to the directing staff for criticism.

14. During the winter months, at centres where a number of officers of the R.A.M.C. can be assembled, the D.D.M.S. or A.D.M.S. will arrange to hold periodical discussions on army medical organization and administration in the field. An officer of the R.A.M.C. will be selected to read a paper, preferably based on his own observations, and every officer should be called on to take part in the ensuing discussion. This fosters interest in the subject under discussion and assists in training officers to express their ideas clearly.

The D.D.M.S. or A.D.M.S. will also arrange through the G.O.C.-in-C. for one or more lectures to be given by officers of the General Staff on the principles of strategical and tactical operations.

15. War games with the aid of a sand table form a valuable means of instruction, especially in regard to the location of

aid posts, etc., the road space and time required for the movement of units and the evacuation of casualties.

Schemes worked out on paper are useful in making officers familiar with establishments, *e.g.* strengths of units and formations, available transport, accommodation in medical units, etc.

W.Os., N.C.Os. and Men

16. The training of W.Os., N.C.Os. and men in the special duties of the Corps is carried out under the direction of the Training Officer and the assistant training officers in accordance with the instructions laid down in Standing Orders, R.A.M.C.

CHAPTER III

COLLECTIVE TRAINING

17. The field training of the R.A.M.C. is carried out (i) by corps training, (ii) during divisional and command training and army manœuvres.

In addition to practising corps exercises, all ranks should, wherever possible, be given opportunities for examining, packing and loading the equipment, and practising the formation and field work of medical units.

18. The instruction at the C.O.'s weekly parades should not be restricted to corps exercises. Where circumstances permit, it is desirable that occasionally, in place of drill, a senior officer should give a brief review of some phase of the work of the medical services on mobilization or in a theatre of war, so that all ranks may gain a general knowledge of the duties which they will be called on to carry out in war.

19. A camp of instruction will, if possible, be formed each year, and as many officers and other ranks as can be spared will attend. A commandant with an adjutant and an instructional staff will be appointed. Each course of instruction will occupy about three weeks. As the time available for instruction at a camp is limited, all ranks should, during the weekly drill at their stations, make themselves thoroughly familiar with corps exercises, so that most of the time in camp may be available for collective field training. The scheme at the end of this chapter is recommended as a guide in drawing up programmes for camps of instruction.

[*To face page* 14.

SYLLABUS OF TRAINING IN CAMP

This syllabus is for the purpose of guiding officers in preparing programmes for camps of instruction in the R.A.M.C. (Regular Army) and for annual camps of field medical units in the R.A.M.C. (Territorial Army). It may be adapted to camps of varying duration by repeating or omitting such stages or items as may be considered advisable. As a rule not more than two days should be occupied in preliminary training, which in suitable cases may be shortened or omitted.

Every opportunity should be taken of giving instruction in general and medical organization; methods of field sanitation and the prevention of disease; general rules for marches, camps and bivouacs; orders, messages and reports; interior economy of units in the field; methods of field cooking; reports, returns and indents; and horsemastership. Map reading and simple field sketching should be practised as occasion may offer. Special attention should be paid to instruction in individual and collective measures for defence against gas and to the protection of medical units from observation from the air when on the line of march or in camps, etc.

The personnel of the R.A.S.C. attached to medical units will attend such parts of the preliminary and intermediate training as are applicable, and in addition will be instructed in riding, driving, fitting harness and saddlery, and the care of horses or mechanical transport duties, as the case may be.

	Preliminary Training		Intermediate Training		
	Stage A	Stage B	Stage C	Stage D	Stage E
Morning—1 hour.	Squad drill.	Squad drill, or stretcher exercises.	Hand-seats and improvised carriage of patients.	Preparing operating tent and tents for sick. Preparing wagons and vehicles of various types for carriage of wounded.	Field ambulance or cavalry field ambulance formations and movements.
Forenoon — 1 hour.	Stretcher exercises	Equipping, loading, and unloading ambulance wagons, cars, litters and travois.	Lecture on Geneva Convention and the system of evacuation of sick and wounded from front to base.	Preparing wagons and vehicles of various types, including railway wagons, motor-lorries, boats and barges, if available, for carriage of wounded, and practice in loading and unloading wounded.	Collecting wounded including improvised carriage; formation of dressing station of field ambulance or collecting post and dressing station of cavalry field ambulance; laying out field ambulance or cavalry field ambulance encampment, and reception of wounded. Preparation of walking wounded collecting post. Preparation of bivouacs and shelters.
2 hours ...	Checking equipment and examining contents.	Packing and loading field ambulance or cavalry field ambulance equipment.	First aid and removal of wounded according to injuries and carriage required.	Practical instruction in making field kitchens and latrines, and in methods of refuse disposal.	
Afternoon—Number of hours as required.	W.Os., N.C.Os. and men— Tent pitching.—During these exercises opportunity should be taken to give N.C.Os. such instruction as may be necessary in guard and piquet duties in camps of medical units. Officers— Lecture on field medical organization and the rôles of medical units.	W.Os., N.C.Os. and men— Tent pitching and preparing tents for patients. Officers— Lecture on duties in camp, on the line of march, and in the field, including the duties of regimental medical establishments in action, and the tactical use of field medical units.	W.Os., N.C.Os. and men— Demonstrations of water purification and explanation of methods of sanitation in the field. The different forms of gas poisoning. The treatment of gas casualties. The use of anti-gas respirators. The protection of dug-outs, etc. Officers— Selection of sites for encampments, billets, hospitals, etc., including study of ground, map reading, and simple field sketching with a view to the above.	W.Os., N.C.Os. and men— Packing and loading field ambulance or cavalry field ambulance equipment. Forms and returns in the field. Officers— The various forms of gas poisoning and their treatment. The methods of protecting individuals and buildings, dug-outs, etc. Selection of sites for dressing stations with reference to the ordinary danger zones for rifle and shell fire, including study of ground, map reading, and simple field sketching with a view to the above. Selection of sites for walking wounded collecting posts.	Coupling horses; mounting and dismountingwounded men. Demonstration in stable management in horse-lines.

Advanced Training

Stage F (Number of working days as available)	Stage G (Number of working days as available)
Exercises as a unit in the field. Large numbers of "wounded" to be collected, treated, and classified for disposal; reports and returns to be prepared. *Field Ambulances* The exercises to be practised under varying conditions, *e.g.* under the conditions of (1) a force holding a defensive position; (2) a force carrying out a deliberate attack on a position; (3) an encounter battle requiring arrangements to be carried out unexpectedly from the line of march; (4) a retirement. *Cavalry Field Ambulances* The exercises to be practised (1) as if with cavalry engaged in operations involving concentration, under conditions similar to those enumerated under field ambulances; (2) as if with cavalry engaged in operations involving dispersion.	Exercises as a unit in the field with other troops. (1) It will be to the advantage of the medical units under training if field days, with a small number of troops representing larger formations, can be arranged for the special purpose of affording them practice in their duties, and of illustrating the work of medical units of various types. (2) When special field days cannot be arranged, or in addition to special field days, medical units under training should be afforded such opportunities as may occur of taking part in tactical field days, if of a nature suitable for their instruction.

20. In commands where arrangements can be made, special exercises will be conducted upon a larger scale, at which, with the assistance of other troops, the more important problems of medical organization and work in the field may be studied practically.

21. At manœuvres and on field days, the medical services will be represented as completely as circumstances permit, and every advantage should be taken of exercising all ranks in field medical and sanitary duties.

22. The medical and sanitary arrangements and organization will be based upon those of an army in the field; the training in the latter subject will be supervised by the A.D.H. or D.A.D.H.

23. The N.C.Os. and men of regimental medical establishments will be given practical instruction in their duties by the officer in medical charge of the unit. The regimental stretcher bearers will be practised in rendering first aid and carrying casualties on stretchers, in taking up positions for regimental aid posts, and in maintaining communication with field ambulance bearers.

24. Sanitary and water duty personnel of regimental units are trained at the Army School of Hygiene, and the medical officer in charge of a unit will, in consultation with the C.O., arrange that they are employed on these duties whenever possible, and especially during the period of annual training, to ensure that they are fully acquainted with their duties.

SECTION 2.—DRILLS AND EXERCISES

CHAPTER IV

GENERAL INSTRUCTIONS

25. Drill.—The detail of drill in use in the R.A.M.C. will be found in the Manual of Elementary Drill (All Arms), the Manual of Ceremonial and in Chapters V and VI of this manual.

26. Corps march.—The regimental march of the corps is " Bonnie Nell," which is published by Messrs. Hawkes and Son (London), Ltd.

27. Bugle calls.—The calls for the R.A.M.C. are given in Trumpet and Bugle Sounds for the Army. The following is the R.A.M.C. call :—

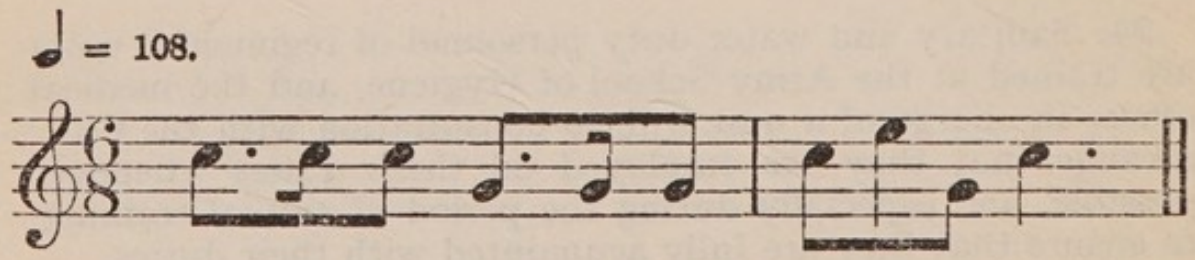


FIG. 1.—R.A.M.C. CALL

28. Parties marching.—The following rules are given for the guidance of officers marching parties from place to place :—

(1) Except for very short distances, all movements should be in column of route. Columns of route will march on the left side of the road unless direct orders to the contrary are issued. Exact distances and covering will be maintained at all times ; the fact of marching at ease will not affect the relative position of men in the ranks, or that of supernumeraries or commanders, unless orders to the contrary are issued.

(2) If, on arrival at the destination, the party is to form up on a marker, it is better to advance from the flank on which it is intended to form up, *i.e.* if to form up on a left marker, advance with the left leading ; if on a right marker, with the right leading.

(3) In other cases the party should advance from whichever flank is the more convenient.

(4) An O.C. a party places himself three paces in advance of the leading section of fours, and leads the party to its destination, *i.e.* on the march he does not require to give any words of command to wheel, etc., on coming to an angle in the road ; he makes the wheel and his men follow him.

(5) The compliments to be paid on the march are laid down in King's Regulations and the Manual of Elementary Drill (All Arms)..

In addition, it is customary for officers' parties to pay the compliment of "EYES—RIGHT (OR LEFT)" to the following officers, the officer in command saluting with the right hand :— (i) The O.C. the R.A.M.C. in the command or division to which the party belongs ; (ii) the O.C. the company or group of companies to which the party belongs. To the C.O. this compliment is only paid once a day.

(6) Individual officers meeting a party salute the officer in command, if senior to them.

CHAPTER V

CEREMONIAL DRILL

REVIEW OF A COMPANY

29. A company of the R.A.M.C. will be drawn up for review on the principles described for a company of an infantry battalion (*see* Manual of Ceremonial). The modified formation necessary for a company of the R.A.M.C. is shown in Fig. 2 (below).

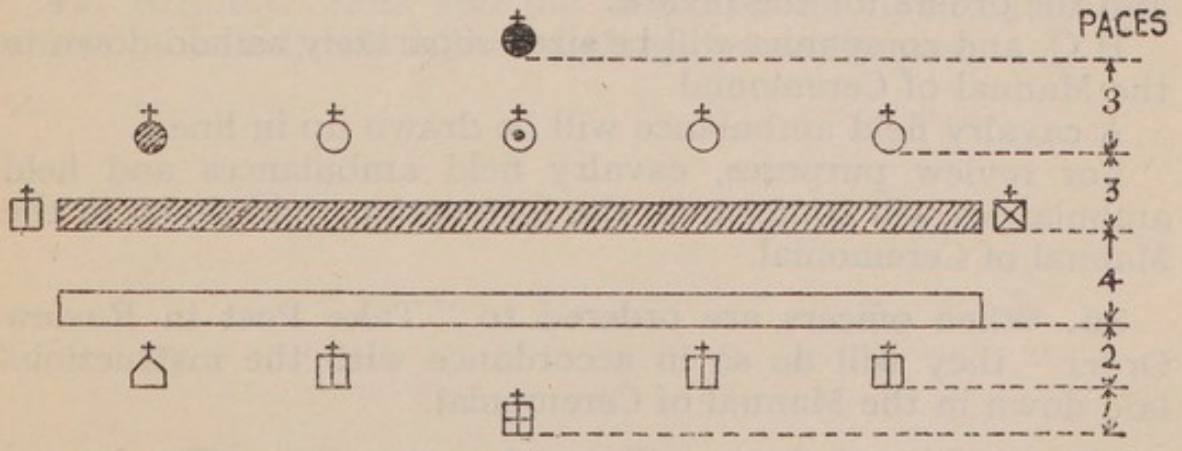


FIG. 2.—COMPANY IN LINE

30. When the reviewing officer comes to a halt in front of the centre of the company, he will be received with a salute ; the C.O. will give the command " General Salute," the bugler sounding the general salute, and the officers saluting with the right hand, taking the time from the C.O.

31. The C.O. will walk or ride on the side further from the troops, and will accompany the reviewing officer as he passes down the front of the line from right to left, returning along the rear, the other officers remaining steady. The C.O. then takes the orders of the reviewing officer as to the movements to be performed.

32. When two or more companies parade together, they will be drawn up in close column of companies (*see* Manual of Ceremonial). Before the arrival of the reviewing officer, officers will be drawn up in review order as laid down in the Manual of Ceremonial.

When the companies are reviewed, the C.O. of each company will receive the reviewing officer with a salute and follow him during the inspection of his company.

33. A company will march past in the manner described for a company of an infantry battalion (*see* Manual of Ceremonial) ; officers saluting with the right hand on the command " Eyes—Right," and completing the salute on the command " Eyes—Front."

34. A group of companies ordered to march past will do so in the manner described for an infantry battalion, modified as may be necessary to suit special requirements.

Review of Field Ambulances

35. A field ambulance may be drawn up for inspection in line or in close column, according to the ground available and the orders for the review.

H.Q. and companies will be sized separately as laid down in the Manual of Ceremonial.

A cavalry field ambulance will be drawn up in line.

For review purposes, cavalry field ambulances and field ambulances will conform to the instructions laid down in the Manual of Ceremonial.

36. When officers are ordered to " Take Post in Review Order " they will do so in accordance with the instructions laid down in the Manual of Ceremonial.

37. A field ambulance will march past in line. The general principles for the march past of a R.A.M.C. company (*see*

para. 33) will be adhered to, the transport following in rear under the senior transport W.O. or N.C.O.

A distance of 20 yards between units, measured from tail-boards to commanders of units, will be observed when more than one field ambulance is to march past.

38. The position of the O.C. divisional R.A.M.C. on ceremonial parades is laid down in the Manual of Ceremonial.

R.A.M.C. Officers and Other Ranks attached to Units

39. It is not usual for R.A.M.C. personnel attached to units of other arms of the service to be present with such units on ceremonial parades.

40. If, however, they are present, their positions are as follows :—

(*a*) When attached to infantry battalions :—

When the battalion is formed up in line, or is marching past, the M.O. will be five paces on the left of the personnel of the headquarter wing when in line and ten paces in rear of the support company when marching past. Not more than one M.O. will march past with each battalion; the remainder, if more than one is present, will take post in rear of the saluting point.

(*b*) When attached to other units :—

Personnel of the R.A.M.C. will occupy corresponding positions in rear.

41. M.Os. marching past with units will salute with the right hand.

42. R.A.M.C. rank and file attached to mounted troops, unless mounted, will fall out before the march past.

CHAPTER VI

FORMATIONS AND MOVEMENTS OF FIELD AMBULANCES (other than ceremonial)

The Field Ambulance

43. Field ambulances in line (Fig. 3).—On parades except ceremonial, the companies and H.Q. will be drawn up as three companies in line, " A " Company on the right, " B " Company in the centre, and H.Q. on the left. This is to ensure that the companies lead off on the line of march so that they can easily be sent forward if required.

44. Position of officers.—When the field ambulance parades as a unit, the O.C. (mounted) will be two horse-lengths in front of the centre company commander. The company commanders of " A " and " B " companies, who are also mounted, will be one horse-length in front of their companies. The senior officer of H.Q., who will act as a company commander and who is on foot, will be three paces in front of the centre of his company. The other officers of " A " and " B " companies (mounted) will be one horse-length and officers of H.Q. (dismounted) three paces behind the supernumerary rank. The quarter-master, if on parade, will be on the left three paces behind the supernumerary rank of H.Q. in line with the other officers.

45. Transport.—The transport will be drawn up in rear as shown in Fig. 3.

46. Column of route from field ambulance in line.—A field ambulance may move off from line in column of route (*a*) as a unit, the transport following under the transport officer or transport W.O., R.A.S.C.; (*b*) by companies, each company being followed by its own transport (Fig. 4).

M.T. will usually proceed separately to a defined area as ordered by the O.C.

47. (*a*) *As a unit,* the transport following the rear company.

Note.—In this and the following paragraphs, in the left-hand column is shown, in **thick type**, the movement and in SMALL CAPITALS the caution or executive word of command given by the O.C.; in the right-hand column, the detail where necessary.

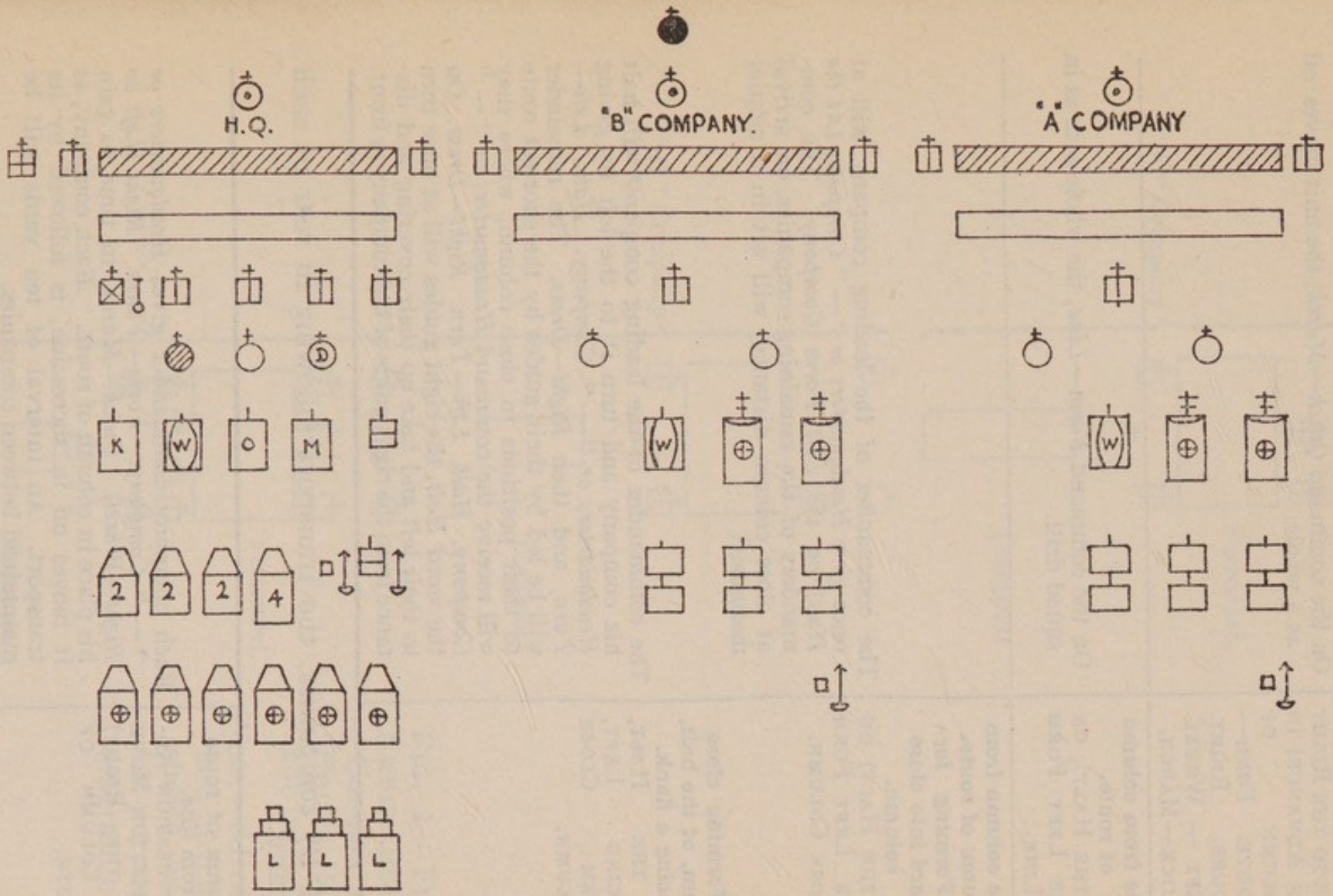


FIG. 3.—FIELD AMBULANCE IN LINE BY THE RIGHT

(For particulars of officers *see* para. **44.**)

Column of route from line. MOVE TO THE RIGHT (OR ADVANCE) IN COLUMN OF ROUTE. FORM—FOURS. RIGHT. LEFT — WHEEL. QUICK—MARCH.	On the command *Quick—March*, the unit moves off as a whole.
Line from column of route. (AT THE HALT), ON THE LEFT FORM —LINE.	On the command *Form—Line*, the whole acts as in squad drill.
Close column from column of route. **1. Forming forward into close column.** (AT THE HALT) ON THE LEFT FORM CLOSE COLUMN.	The commander of the leading company will at once give *Headquarters or "—" Company (At the Halt) on the Left Form Company.* The commanders of the remaining companies, on arrival at close column distance, will act in a similar manner.
2. Forming close column, at the halt, facing a flank. AT THE HALT, FACING LEFT, FORM CLOSE COLUMN.	The commander of the leading company will halt his company and turn it to the left by giving *Headquarters or "—" Company. Halt. Left—Turn,* and then *Right—Dress.* The remainder will be led by their guides by the shortest route to their positions in close column, where they will receive the command *Headquarters or "—" Company. Halt. Left—Turn. Right—Dress.* On the word *Halt*, the right guides will at once turn to their left and take up their covering and distance from the right guide of the company in front.

(*b*) *By companies,* the transport following in rear of each company.

Column of route from line. IN SUCCESSION ADVANCE (OR MOVE TO THE RIGHT) IN COLUMN OF ROUTE.	Each company commander gives *Headquarters or "—" Company. Form—Fours. Right (Left or Right—Wheel). Quick—March,* in time to gain his place in column of route. Each company, as it moves off in succession, is followed by its transport. An interval of ten yards will be maintained between companies.

Note.—It is unlikely that a field ambulance will march in column of route by companies when the complete unit is proceeding to the same destination.

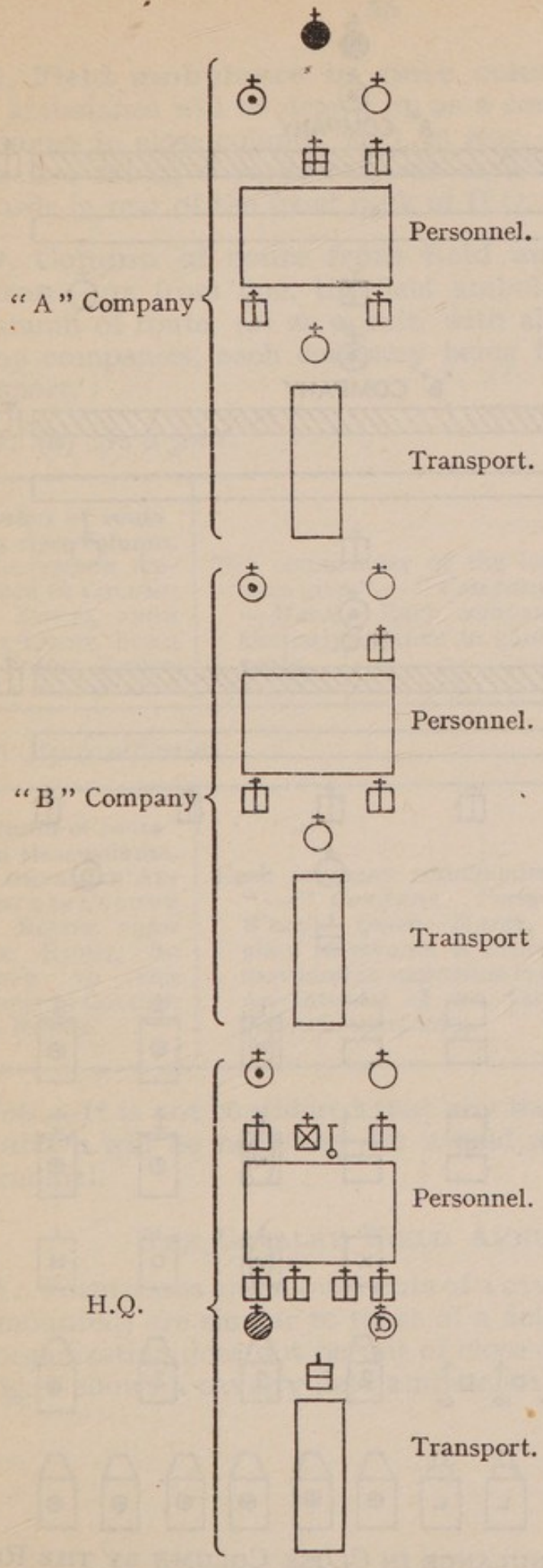


FIG. 4.—FIELD AMBULANCE IN COLUMN OF ROUTE [M.T. not included]

Note.—All officers and R.S.M. are shown on foot for purposes of diagram only.

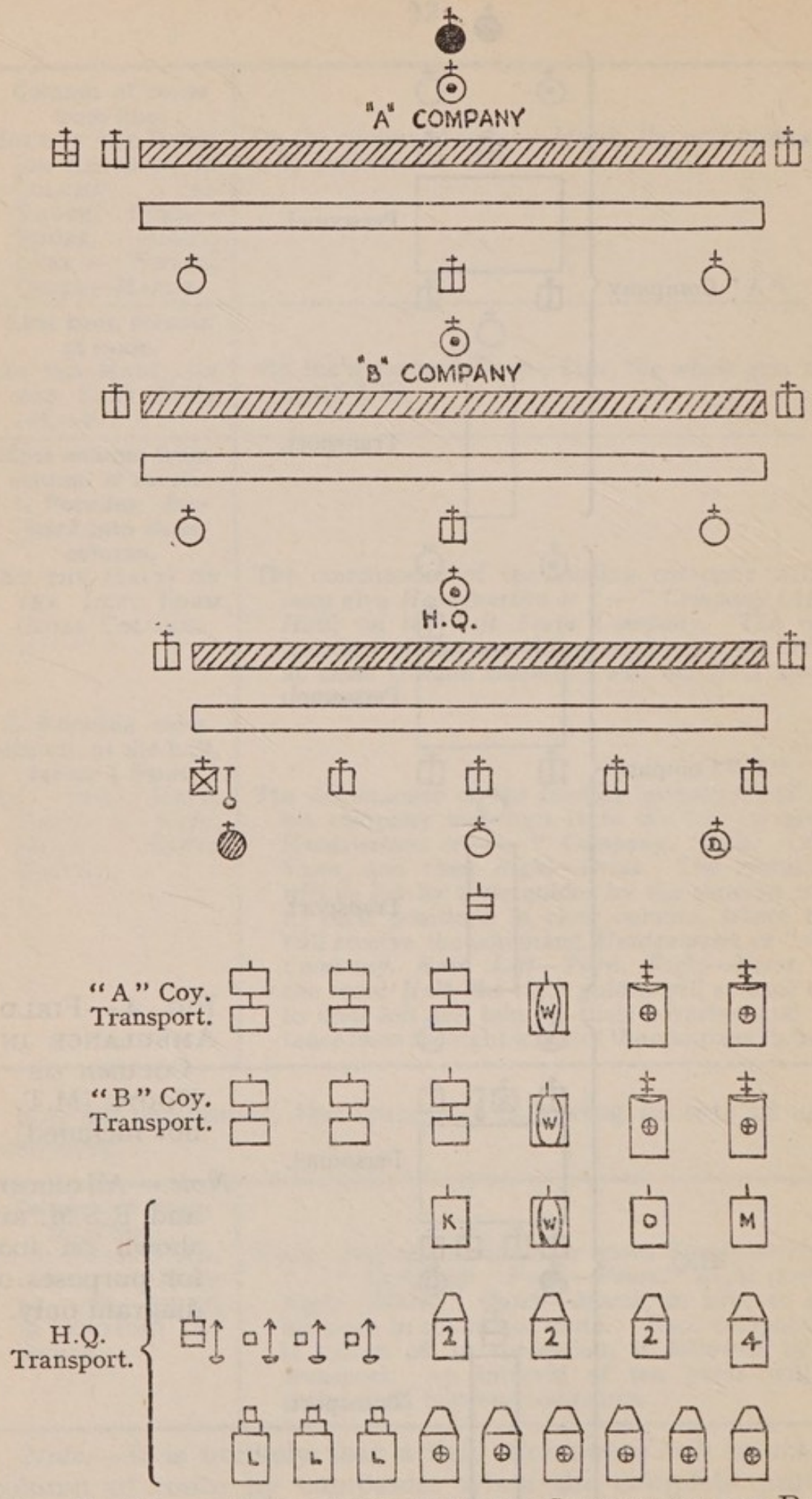


FIG. 5.—FIELD AMBULANCE IN CLOSE COLUMN BY THE RIGHT
(All motor cycles are grouped together with H.Q. Transport.)

48. Field ambulance in close column (Fig. 5).—The field ambulance will be drawn up as a complete unit of three companies in close column, H.Q. in rear. The transport will be in five ranks, 4 yards between each rank, the first rank 20 yards in rear of the front rank of H.Q.

49. Column of route from field ambulance in close column.—As from line, the field ambulance may move off in column of route, (*a*) as a unit, with all transport in rear; (*b*) by companies, each company being followed by its own transport.

50. (*a*) *As a unit.*

Column of route from close column. IN SUCCESSION ADVANCE IN COLUMN OF ROUTE FROM THE RIGHT. FORM — FOURS. RIGHT.	The commander of the leading company will at once give "—" *Company. Left—Wheel. Quick—March.* Each company commander will act similarly in time to gain his place in column o route.

(*b*) *By companies.*

Column of route from close column. BY COMPANIES ADVANCE IN COLUMN OF ROUTE FROM THE RIGHT, OR MOVE TO THE RIGHT IN COLUMN OF ROUTE.	Each company commander gives *Headquarters or* "—" *Company. Form—Fours. Right* (*Left—Wheel*). *Quick—March*, in time to gain his place in column of route. Each company as it moves off in succession is followed by its transport. An interval of ten yards will be maintained between companies.

Note.—It is not considered that any movements other than the above will be necessary for a field ambulance except in ceremonial.

THE CAVALRY FIELD AMBULANCE

51. Formations and movements of a cavalry field ambulance (dismounted) are similar to those of a field ambulance in line. Its organization does not permit of close column formation.

Fig. 6 shows a cavalry field ambulance in line.

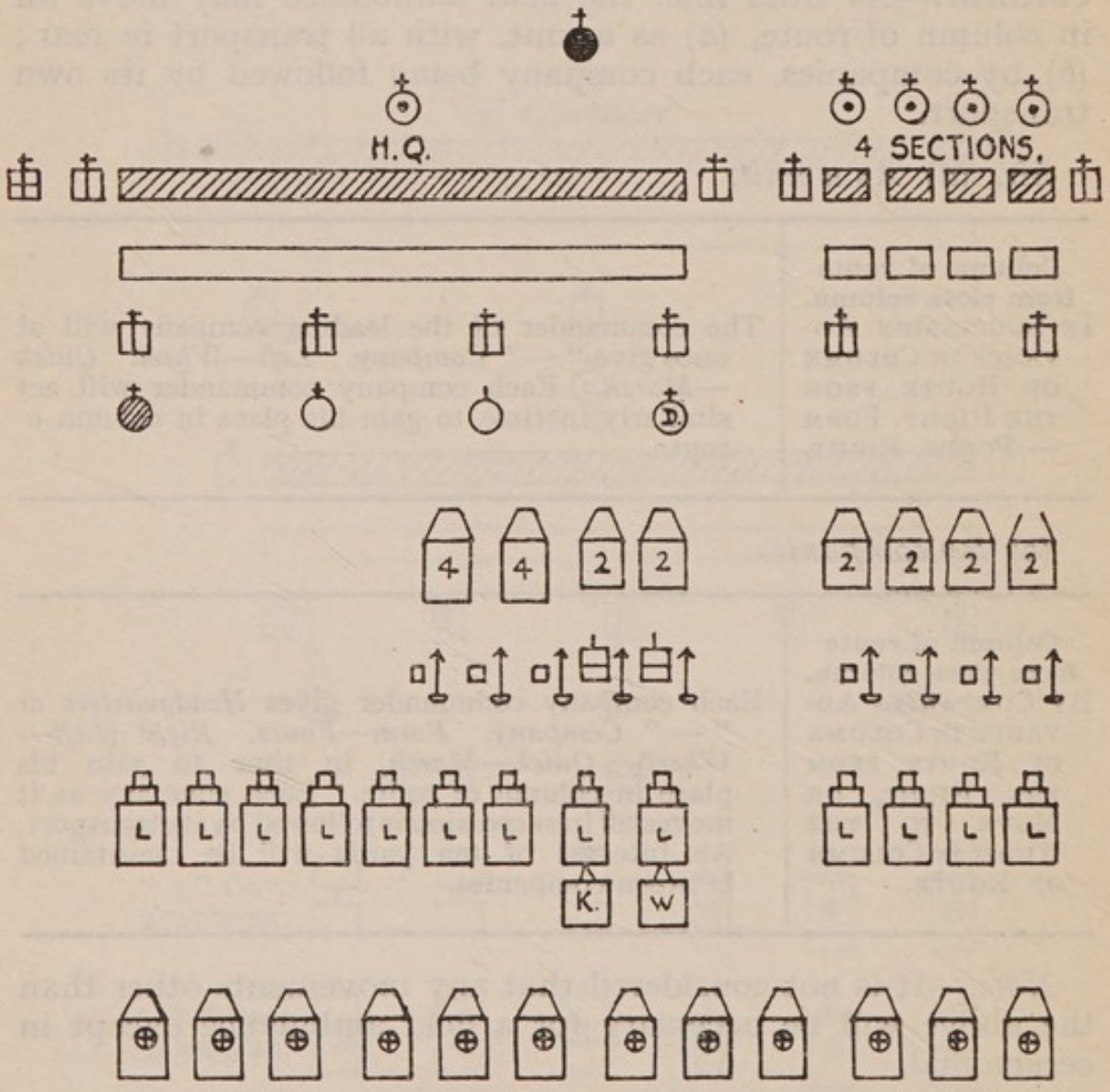


FIG. 6.—CAVALRY FIELD AMBULANCE IN LINE BY THE RIGHT

CHAPTER VII

STRETCHER EXERCISES

PART I

52. General remarks.—The following exercises have been framed for the instruction of stretcher bearers, with a view to the careful handling of the wounded and their transport on stretchers, and in ambulance vehicles.

The important point to impress on every man is that in the field he may be No. 1 of the stretcher squad, and so be responsible for the wounded man until the latter is brought directly under the care of the M.O.

In a *medical unit* the handling of large numbers of stretcher cases should be practised with both two and four bearers; instruction will be given in the loading and unloading of ambulance trains and of motor ambulance convoys at railway stations or at the reception sections of medical units.

Men detailed for stretcher exercises must previously be well grounded in squad drill. Knee caps will be worn on the left knee at all exercises in which the men are required to kneel. Soldiers acting as " patients " will be provided with ground sheets to protect their clothing. The normal number of men in a stretcher squad will be four.

The details of the dimensions and weight of the stretcher in common use (Mark II) will be found in para. **441.**

BEARER FORMATION

Before the parade the stretchers will be laid in a heap on the ground—unless a wagon or other suitable place is available. On the command " Fall In " the men will arrange themselves in two ranks at a place indicated by the instructor.

Note.—In this and the following paragraphs the name of the movement is shown in **thick type** in the left-hand column, and is followed by the caution or executive word of command in SMALL CAPITALS. The right-hand column contains the

detail. When, however, words of command are given by the No. 1 of the stretcher squad, these are shown in the second column and the detail in the third column.

53. Sizing the bearers.	The squad will be sized as in ceremonial drill (Manual of Ceremonial).
54. Forming the Squads.	
FROM THE RIGHT, AT HALF A PACE INTERVAL, RIGHT —DRESS.	The file on the right stand fast; the remainder of the company ease off from the right. The correct interval is obtained by each man of the front rank placing his right hand on his hip and easing off until the elbow is just clear of the man on his right. He turns his head and eyes to the right and corrects his alignment. The rear rank conform with the movements of the front rank; they cover off without placing the hand on the hip.
EYES—FRONT.	All turn the head and eyes to the front and the right arm is cut smartly to the side.
COMPANY — NUMBER.	The front rank number from right to left.
Proving the Bearers.	
FRONT RANK—ODD NUMBERS, NUMBER ONE BEARERS, STAND AT —EASE.	
EVEN NUMBERS, NUMBER TWO BEARERS, STAND AT—EASE.	After proving in this manner, the bearers will be called to attention before proceeding with the next movement.
REAR RANK—ODD NUMBERS, NUMBER THREE BEARERS, STAND AT—EASE.	
EVEN NUMBERS, NUMBER FOUR BEARERS, STAND AT—EASE.	

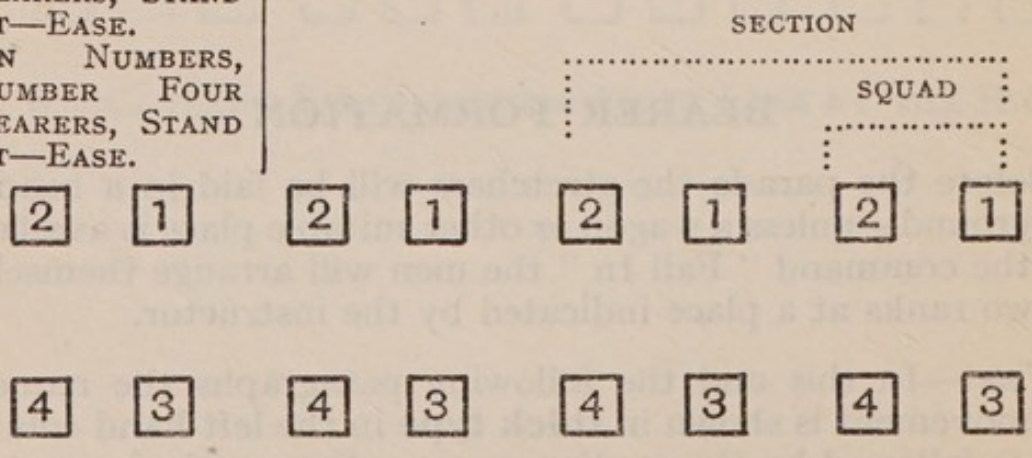


FIG. 7.

55. Supplying Stretchers. SUPPLY — STRETCHERS, QUICK — MARCH.	The Nos. 2 and 4 bearers lead out in file from the right and march by the shortest route to the stretchers, followed by the Nos. 2 and 4 bearers of the remaining squads in succession. On arriving at the stretchers, the bearers stoop, grasp both handles of a stretcher with the right hand and rise, holding it at the full extent of the arm, runners to the right. The No. 2 bearers take the front and the No. 4 bearers the rear handles. As soon as the bearers are supplied in turn with a stretcher, they rejoin their squads in succession, moving in rear of the supernumerary rank. The No. 3 bearers then take a pace to the rear and align themselves with the Nos. 4.
56. Lowering and Lifting Stretchers. LOWER — STRETCHERS.	The Nos. 2 and 4 bearers stoop, place the stretcher quietly on the ground, the front ends of the handles in line with the toes of Nos. 1 and 2 bearers, and the runners to the right; then rise smartly together.
LIFT—STRETCHERS.	The Nos. 2 and 4 bearers stoop, grasp both handles of the stretcher with the right hand and rise together holding the stretcher at the full extent of the arm, runners to the right.
57. Organizing the Company. BY SQUADS — NUMBER.	The No. 1 bearers will be in charge of the squads. The No. 1 bearers number from right to left.
Telling off Sections. NOS. 2, 4, 6, ETC. SQUADS.	Each section will consist of two stretcher squads. The No. 2 bearers of the squads named extend the left forearm horizontally.
LEFT OF—SECTIONS.	The No. 2 bearers cut the left forearm smartly to the side.
BY SECTIONS — NUMBER.	The No. 1 bearers of each *odd* numbered squad number from right to left. No. 1 Section—No. 2 Section, etc.

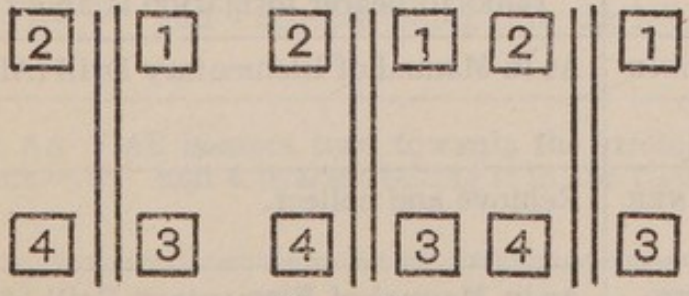


FIG. 8.

58. The company is now in readiness for exercises or duty. This is called " Bearer Formation " and is of value in the following ways :—

1. During exercises, if it is desired to reassemble the company, owing to the dispersal of the squads, etc., it is only necessary to place the right marker (either the instructor himself or No. 1 of the right-hand squad) and give the order :—" BEARER FORMATION ON RIGHT MARKER—FALL IN." In this way the early exercises can be dispensed with when the bearers are sufficiently proficient.

2. When bearers are constantly employed in the same positions as in companies of field ambulances, the company should fall in with stretchers in bearer formation, for duty or exercises.

DISMISSING

59. Piling Stretchers. LIFT—STRETCHERS.	As detailed above.
PILE—STRETCHERS. QUICK—MARCH.	The Nos. 2 and 4 bearers on the right lead out in quick time followed by the remaining Nos. 2 and 4 bearers in succession. After disposing of their stretchers quietly, the bearers rejoin their squads in succession, moving in rear of the supernumerary rank.
Closing Ranks. REAR RANK, ONE PACE FORWARD—MARCH.	The rear rank step forward one pace.
COMPANY, RIGHT—DRESS.	The men take up their dressing by the right and correct their interval and distance as in Manual of Elementary Drill (All Arms).
	NOTE.—One pace forward only is necessary to form close order, since the distance between ranks in bearer formation is about three paces.
COMPANY, STAND AT—EASE. STAND—EASY.	As in Manual of Elementary Drill (All Arms).
REMOVE KNEE CAPS.	Remove and collect.
COMPANY—ATTENTION. DISMISS.	As in Manual of Elementary Drill (All Arms).

EXERCISES WITH CLOSED STRETCHERS

60. General remarks.—It will seldom be found necessary to move a company of bearers with closed stretchers. Stretchers are never carried by bearers on ceremonial parades, and when a field ambulance is on the march, the stretchers are normally carried on the wagons, limbered, G.S., until actually required.

If carried on the march, etc., in marching at attention, the stretcher will be carried at the full extent of the right arm by Nos. 2 and 4 bearers. In marching at ease, the stretcher may be carried on the shoulders of one or more bearers, runners downwards, and steadied with either hand.

When stretcher bearers are required, squads usually move independently. Bearers should invariably be instructed in making every possible use of ground and cover to effect concealment of their movements.

To allow of a company in bearer formation carrying stretchers to be moved, the following exercises are included. Frequent marching and counter-marching are unnecessary and should be avoided.

61. Moving to a Flank. LIFT—STRETCHERS.	As before detailed.
COLUMN OF ROUTE, SECTIONS RIGHT (OR LEFT) WHEEL, QUICK—MARCH.	Each section (of two squads) wheels to the right (or left) and moves off in quick time.
	The company is now marching in fours, one section abreast. A distance of one pace will be maintained between sections.
COMPANY WILL RETIRE, ABOUT—TURN.	All bearers turn towards the stretcher, the Nos. 2 and 4 bearers taking it in the left hand.
COMPANY WILL ADVANCE, ABOUT—TURN.	All bearers turn towards the stretcher, the Nos. 2 and 4 bearers taking it in the right hand.
	NOTE.—The command "About Turn" should be followed by another similar command before exercises are carried out.

62. Forming Line to the Front from Column of Route. ON THE LEFT, FORM—LINE.	This movement brings the company into bearer formation. The leading section leads on four paces and marks time. The remaining sections left incline, and then right incline when clear of the section in front of them, marking time as they come into alignment.
FOR—WARD.	The company moves on in line in the direction in which it was originally marching in column of route.
	If the command is "At the Halt. On the Left, Form—Line", the leading section leads on four paces and halts. The remaining sections left incline, and then right incline when clear of the section in front of them, halting and dressing as they reach their places in line.

PREPARATION AND CARRIAGE OF STRETCHERS

The preparation of stretchers and all movements with prepared stretchers will be performed in extended order.

63. Extending. FROM NO.—SQUAD TO FOUR PACES—EXTEND.	From "bearer formation." The squad named remains steady; the remaining squads make a full turn away from the named squad and march in quick time to their positions, turn to their front and pick up their dressing by the named squad.
Closing. ON NO.—SQUAD—CLOSE.	The named squad remains steady; the remaining squads make a full turn towards the named squad and march in quick time to their positions in bearer formation.
64. Preparing and closing stretchers. PREPARE—STRETCHERS.	The Nos. 1 and 3 bearers take a side pace to the right. The Nos. 2 and 4 bearers then turn to the right, kneel on the left knee, unbuckle the transverse strap, separate the poles and straighten the traverses. They then rise and turn to their left, working independently.
CLOSE—STRETCHERS.	The Nos. 2 and 4 bearers turn to the right, kneel on the left knee, push in the traverses, raise the canvas and approximate the poles. They stand the stretcher on the runners, wrap the canvas round the poles and buckle off. They then lay the stretcher on the ground with the runners to the right and rise and turn to their left, working independently. The Nos. 1 and 3 bearers then take a side pace to the left.

65. Shoulder Carrying. ON SHOULDERS LIFT — STRETCHERS.	The bearers turn inwards together, stoop and grasp the stretcher, hands wide apart, palms uppermost, lift it slowly and evenly to the level of the shoulders. They then turn to the front end of the stretcher, supporting the handle of the pole on the inner shoulder, steadying the stretcher with the outer hand.
ADVANCE.	All bearers step off together with the inner foot, taking short shuffling paces.
SQUADS—HALT	The whole halt, care being taken not to jolt or jar the stretcher.
SQUADS WILL RETIRE. ABOUT — TURN.	The bearers grasp the handle with both hands, lift the stretcher, and turn about, placing the handle on the inner shoulder, steadying the stretcher with the outer hand, and remain steady.
RE—TIRE.	All bearers step off together as before detailed.
	NOTE.—In turning about the squads should first be halted. "About turn" should then be given, followed by "Advance" or "Retire", as the case may be. This will ensure that all bearers step off together.
LOWER—STRETCHER.	The bearers turn inwards, supporting the stretcher with both hands, palms uppermost, lower the stretcher gently and evenly to the ground, rise and turn to the foot end of the stretcher.
66. Hand Carrying. FOR HAND CARRIAGE, LIFT — STRETCHERS.	The Nos. 2 and 4 bearers take a side pace in between the handles of the stretcher, stoop, grasp the handles and, taking the time from the right, rise slowly together, keeping the stretcher level throughout the movement.
WILL ADVANCE. AD—VANCE.	The whole move off together, stepping short, the rear carrying bearer stepping off with his right foot, the remainder of the bearers with the left foot, Nos. 2 and 4 bearers keeping their knees bent and raising their feet as little as possible.
SQUADS—HALT.	The squads halt.
LOWER—STRETCHER.	Taking the time from the right, the Nos. 2 and 4 bearers stoop, place the stretcher gently on the ground, rise smartly together and side-step to their original positions.

Note.—The intention of exercise in the hand-carriage of stretchers is to accustom bearers to carrying when two only are available.

LOADING AND UNLOADING STRETCHERS

67. Loading Stretchers.

NOTE.—Men to act as patients will be provided with ground sheets and placed in front of the company, extended to four paces and lying with their heads towards the squads.

The company will be in bearer formation or column of route.

COLLECT—WOUNDED.

Each squad doubles by the shortest route to the corresponding patient and halts three paces from the head of, and in line with, the patient.

No. 1 bearer proceeds to the right of the patient in quick time, halting at the patient's hips, turns to the left, kneels on the left knee, examines the patient and, if his carriage on a stretcher is necessary, gives the commands :—

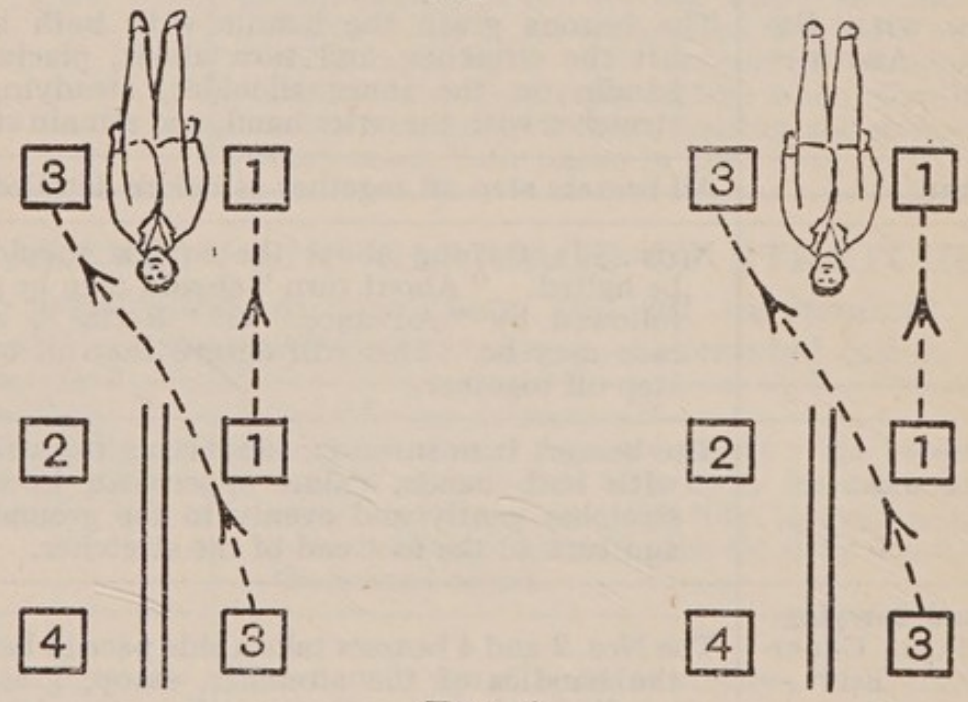


FIG. 9.

LOWER—STRETCHER.
PREPARE—STRETCHER.

While the stretcher is being prepared by Nos. 2 and 4 bearers, No. 3 bearer proceeds to the left side of the patient, halting at the patient's hips, turns to the right, kneels on the left knee and assists No. 1 bearer, who will be responsible for the dressing and subsequent care of the patient during transport. As soon as the stretcher has been prepared, Nos. 2 and 4 bearers proceed to the left side of the patient, No. 2 halting at the knees of the patient and No. 4 at the shoulders, turn to the right and kneel on the left knee. Assuming that the patient is then ready for removal on the stretcher, the bearers pass their hands beneath the patient ; No. 2 supports the legs, No. 3 (who assumes the hook grip with No. 1) the thighs and hips and No. 4 the upper part of the trunk.

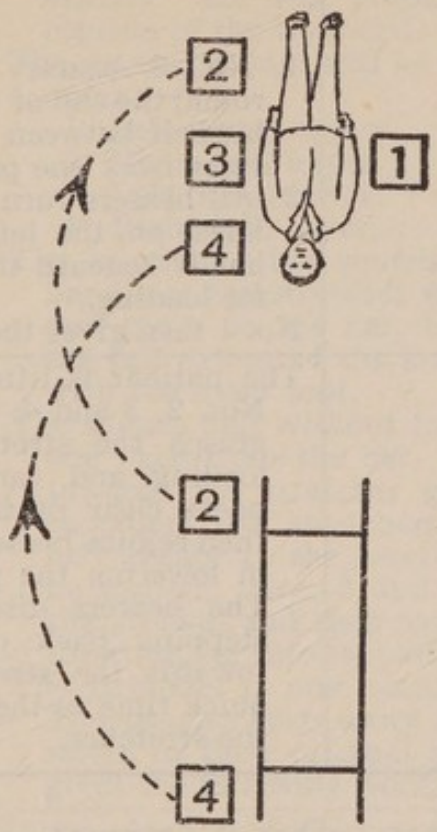


FIG. 10.

	LIFT.	The patient is carefully lifted on to the knees of Nos. 2, 3 and 4 bearers. No. 1 disengages, rises, steps back one pace, turns to his left, doubles to the stretcher and takes hold of it, left hand across and resting the near pole on his left hip. He then returns to the patient and places the stretcher directly beneath him, kneels on the left knee and assists in lowering him.
	LOWER.	The patient is lowered slowly and gently to the stretcher. The bearers then disengage, rise and turn to the foot end of the stretcher. The bearers then resume their permanent positions; Nos. 1 and 2 step forward, No. 4 steps back. No. 3 takes a side pace to the left, turns about and proceeds round the head end of the stretcher to his place on the right of the stretcher.
		NOTE.—The above detail of the position of bearers, which is given for the purpose of the exercise, will be modified at the discretion of the No. 1 bearer, if on account of the nature of the injury to the patient it would be better to do so.

68. Unloading Stretchers. UNLOAD—STRETCHER.		1. No. 3 bearer turns about, doubles round the end of the stretcher and places himself between Nos. 2 and 4. No. 1 steps back one pace. 2. All bearers turn towards the stretcher, kneel on the left knee and pass their hands beneath the patient as described for loading. No. 1 then gives the word of command :—
	LIFT.	The patient is lifted on to the knees of Nos. 2, 3 and 4. No. 1 disengages and grasps the stretcher as described for loading and carries it forward three paces clear of the patient's feet. He then rejoins his squad, kneels and assists in lowering the patient to the ground. The bearers disengage by rising and stepping back one pace. They turn towards the stretcher and step off in quick time to their permanent places at the stretcher.

LOADING AND UNLOADING AMBULANCE VEHICLES

69. Loading Ambulance Cars.	The ambulance cars will be drawn up in line. The class will fall in in " Bearer Formation " ten paces in rear of, and facing away from, the ambulance cars. The squads will be extended to two paces, the stretchers prepared and the patients will take their places on the stretchers with their heads towards the cars. The command " About Turn " will now be given.

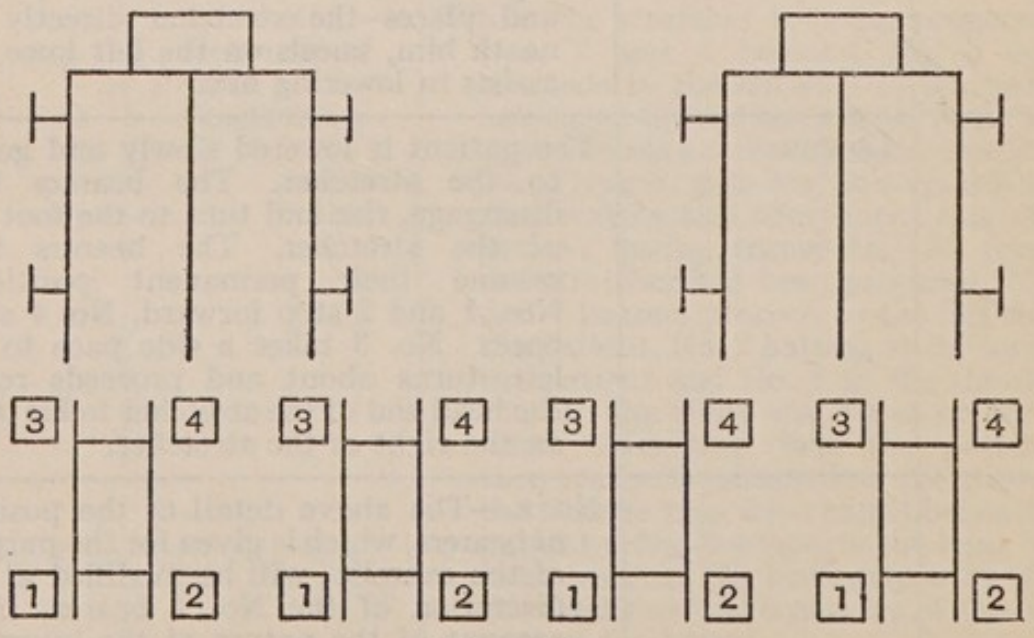


FIG. 11.

SQUADS WILL LOAD IN SUCCESSION. Nos. 1, 5, 9, ETC. SQUADS—LOAD.	One additional man will be told off to each car as orderly. He will prepare the car for the reception of the wounded. The compartments will be loaded in the following order :— 1. Left (near) upper. 2. Right (off) upper. 3. Left (near) lower. 4. Right (off) lower. The bearers of the squads named stoop, grasp a handle of the stretcher with the inner hand, rise and move to the car, holding the stretcher at the full extent of the arm. All bearers step off with the inner foot. The squads halt without further word of command one pace from the car. The bearers then turn towards the stretcher grasping it as for "On shoulders lift stretchers" and raise it gently and evenly to the level of the compartment to be loaded. Nos. 3 and 4 place the runners in the grooves and then assist Nos. 1 and 2 to push the stretcher into its place. The stretcher is now secured by the car orderly. The bearers turn away from the car and place selves in their original positions. No. 1 bearer gives the following words of command :—	
	QUICK—MARCH. HALT. ABOUT — TURN. STAND AT— EASE.	They march back to their places in the line of squads.
70. Unloading Ambulance Cars.	The company and cars will be in the positions occupied at the completion of loading. The car orderlies will prepare the stretchers for unloading.	
	The compartments will be unloaded in the following order :— 1. Right (off) lower. 2. Left (near) lower. 3. Right (off) upper. 4. Left (near) upper.	
SQUADS WILL UNLOAD IN SUCCESSION. Nos. 4, 8, 12, ETC. SQUADS—UNLOAD.		The named squads lead directly to the compartments to be unloaded. Nos. 3 and 4 open out, Nos. 1 and 2 pass between them, grasp the handles of the stretcher with both hands. They withdraw the stretcher, raising the handles slightly in doing so. As soon as the stretcher is sufficiently withdrawn, Nos. 3 and 4 take the further handles, all bearers take the weight, and grasping the stretcher as before, lower it to the full extent of the arms. Now facing away from the ambulance cars, the bearers carry the stretchers by the inner hand and, stepping off with the inner foot, lead back to the position which they have just vacated.

	HALT. LOWER— STRETCHER. STAND AT— EASE.	The No. 1 bearer then gives the following words of command :—
71. Ambulance Wagons.		As the construction of a horsed ambulance wagon only permits of a patient being loaded feet first, the ambulance wagons will be drawn up in front of the class and the only change will be the alteration of Nos. 1 and 2 for Nos. 3 and 4, and *vice versa*, in the detail.

72. Stretcher exercises should not be used for the purpose of drill, *i.e.* the inculcation of smartness in the soldier. Squad and company drill exist for this purpose.

The exercises in Part I should be taught during the period of recruit training. Time therefore should not be spent on these exercises by trained soldiers, except as is necessary for the carrying out of the exercises in Part II, and occasional practice in the loading and unloading of ambulance vehicles.

All trained soldiers should be frequently practised in (*a*) Part II, and (*b*) the methods of hand carriage and improvisation of stretchers referred to in Chapter XX.

PART II

73. Special instructions and demonstrations.—The following special additional methods with reference to the preparation and carriage of stretchers and the care of a patient in relation to his wound or injury will be explained by the instructor to the squads, followed by practical demonstrations. For the details of methods of hand seat carriage and improvisation of stretchers, etc., *see* Chapter XX.

74. Preparation of a stretcher with blankets.—In all cases, before the man is placed on the stretcher, it should be covered with a blanket folded lengthwise or with the man's greatcoat, so that he does not lie in direct contact with the canvas. This arrangement helps to make the man comfortable and to keep him warm, thus greatly reducing the liability to shock. It is more important to place blankets between the man and the stretcher than over the man. With two layers

of blanket underneath and one over him, he will be fairly comfortable and warm—with one layer underneath and two on top, he will be uncomfortable and cold. When three army blankets are available, they should be folded and used as shown in Fig. 12.

The ordinary army blanket is about three times the width of a stretcher; advantage is taken of this to increase the covering of the patient by folding the blankets in the following way. The two blankets to be placed under the patient are folded lengthwise in three folds; two folds of each blanket are placed on the stretcher, thus making four layers of blanket under him; the third fold of each blanket is left hanging over the side of the stretcher. The third blanket is folded

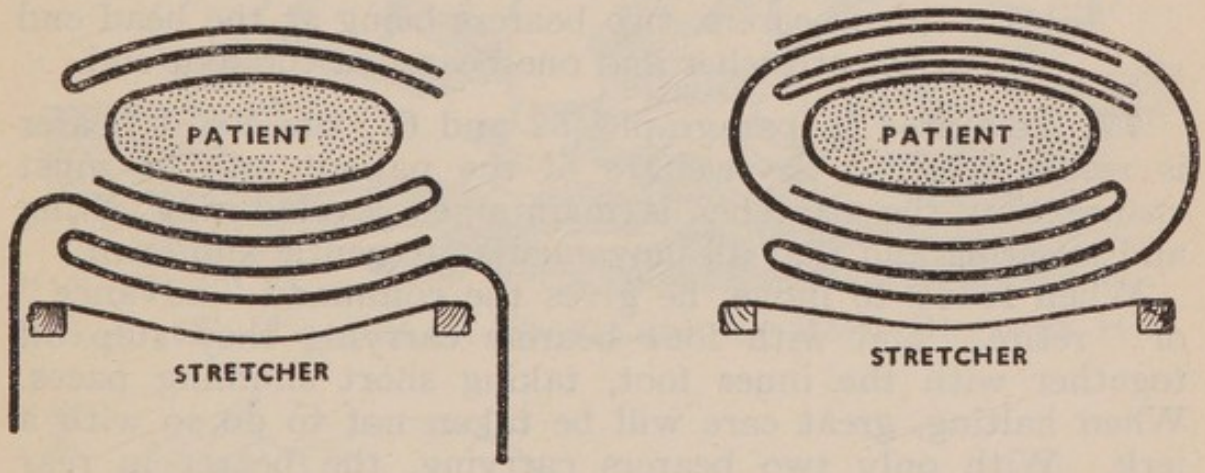


FIG. 12.—THREE ARMY BLANKETS FOLDED FOR USE ON STRETCHER

lengthwise in two and placed over the patient, the ends being tucked round his feet. The spare folds of the two under blankets are then folded over the patient and fixed by pins.

A pillow, or an improvised one such as a pack, placed under the patient's head adds greatly to his comfort, but the head must not be pressed on to the chest. A waterproof sheet placed on the top of the blankets will protect the patient from rain. In cold weather, or in the case of a patient suffering from shock, covered hot-water bottles, if available, should be placed round him. In all cases when bearers hand over a patient on a stretcher with blankets, waterproof sheet, hot-water bottles, Thomas splint, etc., the squad should return with similar articles in place of them; otherwise the area in front will gradually be denuded of these articles.

75. Waterproof-sheet blanket packet.—A method of carrying a dry blanket in a stretcher was devised in France during the Great War, known as the "Waterproof-sheet blanket packet."

A blanket is folded across four times and then placed lengthwise over the centre of a waterproof sheet. The edges of the sheet are turned in and the whole again folded four times. This makes a packet of the same size as the stretcher pillow, 20 in. by 15 in. This is doubled on itself and carried in the stretcher in the ordinary way, being retained in the centre of the stretcher after closing by two pieces of white bandage. In this way a comfortable pad is provided for carrying the stretcher on the shoulder and the white ties are easily undone, when required, in the dark.

76. Special methods of carrying stretchers by hand :—

(i) By four bearers, each grasping a handle and carrying at full length of the arm.

(ii) By three bearers, two bearers being at the head end of the stretcher and one bearer at the foot end.

77. As stated in paragraphs 52 and 67, the No. 1 bearer is responsible for the welfare of the patient and he must ensure that the stretcher is maintained level during lifting and lowering and that all movements are gentle and even.

When ready to move, he gives the command " advance " or " retire," and with four bearers carrying they step off together with the inner foot, taking short shuffling paces. When halting, great care will be taken not to do so with a jerk. With only two bearers carrying, the bearer in rear steps off with the right foot.

Special Methods of Loading Stretchers

78. The lifting of a patient on to a stretcher by means of a ground sheet, greatcoat or other improvised substitute carefully rolled underneath him should be practised by squads.

79. The following special method will be employed where the amount of space does not permit of four bearers loading a patient on to a stretcher such as in narrow cuttings, trenches, etc.

80. Loading a stretcher by two bearers.—Nos. 1 and 2 bearers carefully place the stretcher in line with the injured man's body, the foot of the stretcher being, if possible, close to the head. No. 2 places his feet one on each side of the patient between his body and arms, the toe of each foot being as near the armpits as possible. He then stoops down and passes his hands between the sides of the chest and the arms underneath the shoulders and locks the fingers. No. 1 straddles across the patient's legs, placing his right foot with the toe turned outwards a little below the patient's knees

and with the toe of the left foot close to the heel of No. 2: he then stoops down, passes the left hand under the patient's thighs and the right hand under the patient's calves. If the



FIG. 13.—LOADING A STRETCHER BY TWO BEARERS (1)

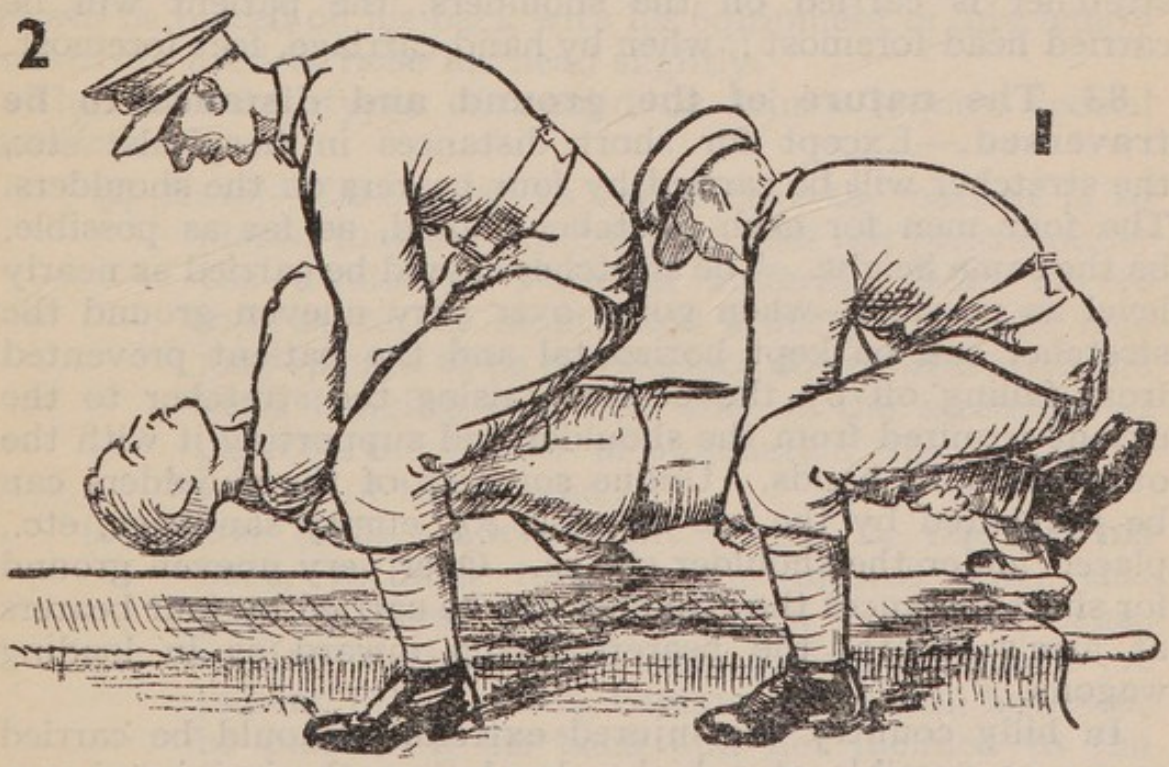


FIG. 14.—LOADING A STRETCHER BY TWO BEARERS (2)

patient's arms are uninjured, he may put them round the neck of No. 2, and by this means gently assist him in lifting.

When both are ready, No. 1 gives the order "Lift and Move Forward."

The patient is then slowly lifted just sufficiently to allow his body to clear the stretcher.

Both bearers slowly and gradually move the patient forward, No. 2 by very short steps, No. 1 by bending his body forward as much as he can, without moving his feet. No. 1 now gives the order " Halt," whereupon No. 2 remains steady and No. 1 brings his right foot level with his left and then advances his left foot until the toe touches the heel of No. 2. No. 1 then gives the order " Advance," when the patient is again moved forward. These movements must be repeated until the patient is over the stretcher, when he is gently lowered (Figs. 13 and 14).

General Rules for the Carriage of Stretchers

81. The rules given in the following paragraphs are based on three considerations.

(i) The methods of carriage in use.
(ii) The nature of the ground and distance to be traversed.
(iii) The nature of the injury to the patient.

82. The methods of carriage in use.—When the stretcher is carried on the shoulders, the patient will be carried head foremost ; when by hand carriage, feet foremost.

83. The nature of the ground and distance to be traversed.—Except for short distances in hospitals, etc., the stretcher will be carried by four bearers on the shoulders. The four men for each stretcher should, as far as possible, be the same height. The stretcher should be carried as nearly level as possible—when going over very uneven ground the stretcher can be kept horizontal and the patient prevented from falling off by the bearers raising the stretcher to the extent required from the shoulder and supporting it with the outer or both hands. Undue soreness of the shoulders can be prevented by the use of pads, *e.g.* empty sandbags, etc., placed under the shoulder straps. Over very uneven ground for short distances the stretcher can be carried by four bearers at arm's length, the bearers facing inward as in loading wagons.

In hilly country the injured extremity should be carried as far as possible at a higher level than the uninjured, *e.g.* a patient with *head injuries* should be carried head first up a hill ; one with a *fracture or wound of the lower limb* head first down hill.

84. *Crossing a wall or fence.*—No attempt should be made to carry a patient over a wall or fence if it can be avoided.

Even if it involves a longer carry, a gap should be sought. If a gap is not available, the front handles of the stretcher should be rested on the wall or fence and the stretcher maintained in a level position by the bearers in rear, the remaining bearers crossing the wall. All bearers lifting together, the stretcher is moved forward until the rear handles can be rested on the wall and maintained level by the bearers in front. The rear bearers then cross the wall and the carriage of the stretcher is resumed.

85. *Crossing a ditch.*—On arrival at a ditch, the stretcher will be lowered as near the edge as possible. The two bearers at the front end of the stretcher descend into the ditch. All four bearers, lifting together, move the stretcher forward until the rear handles can be rested on the near edge of the ditch. The rear bearers now enter the ditch. Again all working together, the stretcher is lifted until the front handles are resting on the far side. By similar movements the stretcher is lifted out of the ditch on the far side and the march is resumed.

86. The nature of the injury to the patient.—The position of the patient on the stretcher often depends on the location of the wound or injury, but generally speaking he will be placed on his back with his equipment or any handy substitute used to raise his head slightly.

The following types of wound or injury require special positions.

(i) *Head.*—Care must be taken that the patient is so placed that the injured part does not press against the stretcher. Patients suffering from severe injuries to the mouth and lower part of the face may require to be carried face downwards with the head hanging over the end of the stretcher to prevent the danger of suffocation due to loss of control of the tongue.

(ii) *Lower limbs.*—The patient should be laid on his back, inclined towards the injured side, this position being less liable than others to cause motion of the injured limb during transport. A patient fitted with a Thomas splint will, however, be placed on his back and not inclined to the injured side.

(iii) *Upper limbs.*—If it is necessary to place the patient in a lying down position, he should be placed on his back or on the uninjured side as, in case of fracture, there is thus less liability of displacement of bone during transport.

(iv) *Chest.*—As there is often difficulty of breathing in such cases, the patient should be placed with the chest well raised, his body being inclined towards the injured side.

(v) *Abdomen.*—The patient should be placed on his back and the abdominal wall relaxed by flexing the knees over a pack or similar article.

(vi) *Spinal column.*—If there is evident injury to the cervical region of the spinal column, the patient should be carried lying on his back with a pad under his shoulders to allow the head to fall well back and additional pads at each side of the head so as to prevent it rolling about; if the injury is in the dorsal or lumbar region, the patient should be placed and transported face downwards, unless other injuries exist at the same time which render this impossible (*see also* para. **633**).

Action by Stretcher Bearers when Exposed to Gas

87. For the sake of instruction it is assumed that the wounded man is being carried on a stretcher by four bearers. All the bearers and the wounded man have their respirators in the alert position and are wearing steel helmets.

88. On the gas alarm being given, the bearers halt and lower the stretcher to the ground as rapidly as possible. All the bearers and the patient, if able, put on their respirators. If the patient is unable to put on his respirator for himself, it will be put on for him by whichever bearer has first adjusted his own. Care will be taken to ensure, before drawing the tape over the top of the patient's head, that the lower part of the facepiece is drawn well under the chin. It must not be forgotten to replace the patient's steel helmet.

89. Should there be a likelihood of a gas attack, before the stretcher is lifted No. 1 bearer will proceed as follows:—

(i) Take the face-piece of the patient's respirator out of its haversack and place it loose on his chest ready for application.

(ii) Undo the collar and top button of the tunic; this facilitates the application of the face-piece and adds to the comfort of the patient.

(iii) In the case of patients suffering from head wounds, bandages should be removed to ensure gas tightness of the respirator. Gas tightness of the respirator can be obtained by ensuring contact between the

fitting surface of the facepiece and the skin which lies over the bony structure of the forehead, cheeks and chin. Any dressings applied between the fitting surface and the skin will permit the entrance of gas, and no dressings should therefore be placed over these parts if this can possibly be avoided. Should it be found absolutely necessary to place a dressing on a wound over these parts, the minimum amount of gauze should be used. It may be necessary to remove some of the padding over the wound in order to ensure sufficiently close fitting of the facepiece. It will be found that, by correctly adjusting the harness tension by first loosening the elastics, applying the dressing and then gradually tightening, the harness itself will act as an excellent substitute for a bandage.

Note.—When an unconscious patient is wearing a respirator, it should be inspected at frequent intervals, to see that it is properly adjusted.

CHAPTER VIII

TENT PITCHING EXERCISES*

90. Tentage.—The following are the only tents authorized by War Equipment Tables (A.F. G 1098 series) for medical units.

Tents, C.D. (Circular, double).
,, C.S., Mark V (Circular, single).
,, Marquee, G S. single (General Service).
,, ,, H.P. large (Hospital).
,, ,, H.P. small (Hospital).
,, Operating.
,, Store.

In field medical units the double circular or single circular tent, Mark V, is used for the accommodation of the sick. The double circular tent consists of inner roof, outer roof fitted with three ventilators, wall and 22 bracing lines, pole, valise, pin bag, 60 pins and two mallets, the whole weighing 112 lb. The single circular tent consists of roof fitted with three ventilators, wall, 20 tying-up lines and 24 bracing lines,

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* Various useful knots are illustrated in the F.S. Pocket Book.

pole, valise, pin bag, 47 pins and two mallets, the whole weighing 84 lb.

91. Pitching a circular tent by two men.—The following instructions refer to the pitching and striking of the Mark V circular tent. Other marks of the same tent still in use will require slight modification according to the number of bracing lines. No. **1** is told off as pole man; No. **2** is tent man. No. **1** falls in with the pole in his left hand, a mallet and five pegs in his right; No. **2** covers him, carrying a tent and pin bag. When No. **1** has moved to the position which his tent is to occupy, No. **2** follows with a tent and falls in five paces to the rear of him.

No. **1** having put the pole together, takes up his dressing. No. **2** drives a peg upright between the feet of No. **1** at the foot and in front of the pole; No. **1**, when the peg is driven, lays the pole on the ground. He then takes three-and-a-half paces from the centre peg to his front, *i.e.* the way the door is to face, and drives in the front peg. He then turns about, goes to the centre peg, takes three-and-a-half paces to the rear from it, drives in another (the rear) peg, returning to the centre, and following a like course to the right and left. As the length of the pace of individuals varies, it is convenient to take the distance from the centre peg as the length of the pole, less one foot.

The tent is now taken out of the valise and spread on the ground, door uppermost, to form a triangle, the centre of the base resting against the centre peg and the apex directed backwards over the rear peg. Both men now proceed to the tent: one to the right, the other to the left of the door. Each takes the second rope on either side, beginning to count from the lower corner rope of the door flaps. Both these ropes are then attached to the front peg. The men then count the ropes until they come to the seventh, and attach them to the right and left pegs. Each then counts five more ropes on either side, and fastens the twelfth rope thus obtained (one on each side) to the rear peg. All these ropes are fixed at full length. No. **1** takes up the pole and fits the smaller end of it into the cap of the tent (in the case of a double circular tent by passing it through the hole in the inner lining), keeping the bottom of the pole to the front. No. **2** assists in fitting the pole into the top of the tent. No. **1** gets inside the tent, and No. **2** then hooks the fly of the tent over the pole and under the ropes. No. **1** then raises the pole about three feet from the ground, keeping the bottom of it on the ground.

On the command being given to raise the tent, No. **1** works the bottom of the pole inwards until it comes against and

immediately behind the centre peg, lifting the upper end of the pole at the same time. No. **2**, when the tent is raised, tightens the ropes already fixed to the four pegs. No. **1** continues to support the pole upright until this is done.

When the tent is secure, No. **1** comes out and assists No. **2** in driving pegs and fastening ropes in the following manner :— The two second ropes which were first fixed to the front peg are now separated. The runner of each rope is slid half way up. The loop thus formed is drawn out in a line with the seam of the tent. It is then brought down to the ground, and at the spot where it touches the ground a peg is driven in. This is continued until all the ropes have been made fast. The curtain of the tent is now pegged down. The door of the tent is opened, the ropes attached to the lower corners being fastened to the second peg on the right and left of the doorway. The mallets, spare pegs and pin bag are put into the valise, which is then placed inside the right-hand side of the door of the tent.

When the tent is correctly pitched, the pegs should form a perfect circle.

The pegs should be driven into the ground at an angle of 45 degrees, with the point directed towards the centre of the tent until the notch is one inch above the level of the ground.

The axis of the peg should be in line with the respective rope and tent seam. The man driving in the tent peg should stand between the peg and tent, back directed towards the pole and one foot steadying the peg as it is driven into the ground. (On no account should the rope be placed over the peg when the latter is being driven into the ground.)

In sandy country, when the ordinary wooden peg will not hold the ground, long iron pickets may be used instead.

92. Trenching a circular tent.—If it is necessary to trench a tent, it is done in the following manner :—Before the curtain of a tent is pegged down, a cut is made with a spade all round where the edge of the curtain touches the ground. This cut is made about six inches deep with a spade held upright. A second cut is made leading into it, about six inches from it all round. The turf so cut is laid with the grass downwards round the outer edge of the trench. The curtain is then pegged down into the inner vertical wall of the trench, the water thus draining into it. Surface drains should be constructed to prevent water from lodging in the trenches. The position of these is best determined on the first wet day when the natural run of the water can be seen.

93. Precautions in wet weather.—When rain falls, the ropes, as they become wet, get tight, and, if not attended to,

will pull the pegs out of the ground or break the poles. They will also get tight with heavy dew. Thus it will be necessary to slacken them when rain is expected, and also at night when the dew is heavy. Again, if the ropes have become wet, they will slacken as they dry and will require to be braced up; otherwise the tent may flap and draw the pegs.

In wet weather care should be taken to ensure that nothing touches the inside of the tent; otherwise the rain will drip through.

Note.—The foregoing instruction applies to all canvas tents.

94. Striking a circular tent.—To strike a tent, both men take off and coil up with a double hitch all the ropes except those attached to the two front, right, left and one of the rear pegs. The fly is unhooked; No. **1** goes inside and takes hold of the pole; No. **2** in the meantime draws out all pegs to which the ropes are not fixed.

Note.—The pegs holding the curtain will have been drawn out already and the curtain lowered if rolled up.

On the command to strike being given, No. **1** runs out of the door of the tent with the pole. The five remaining ropes are now cast off and coiled up. No. **2** now takes hold of the point of the tent and draws it to the rear, door upwards. Keeping the door upwards in the centre, the tent is spread out flat on its side, No. **1** placing his foot on the point of the tent. No. **2**, taking the edges, folds them over so that they meet at the door. This is again done and then the right half of the tent is folded over the left. No. **1** now takes the point and brings it half-way down the tent. Nos. **1** and **2** then roll the tent as tightly as possible from the smaller to the larger end and put it end on into the valise.

Mallets are taken apart, and their heads put into the peg bag with the pegs. Their handles are put into the tent valise vertically one on each side of the tent. The pin bag is then put into the valise on top of the tent and the valise laced up. No. **1** takes the pole to pieces and holds it in his left hand. No. **2** falls in in rear of him with the valise.

In folding the tent, care should be taken that the curtain is pulled well down and the sides well straightened out; otherwise the tent, when rolled, may be difficult to get into the valise.

In all types of tents, if possible, the material should be quite dry and reasonably clean before finally being rolled up and packed.

Tent, Marquee, H.P., Large

95.—Description.—A large marquee, inside dimensions 35 feet long and 17 feet wide, weighing 1,149 lb., complete;

consisting of 1 outside linen roof with 2 vases and 6 weather lines (each 45 feet long), packed in a canvas valise, laced up the centre, and marked on the outside " Marquee hospital, large, roof, outer " ; 1 inside cotton roof, 4 porchways, cotton, packed in canvas valise, laced up the centre, and marked on the outside " Marquee, hospital, large, roof, inner " ; 1 wall in 12 pieces, and 8 porchway poles, viz., 2 end, 2 side, and 2 doorway pieces of wall, and 4 porchway poles packed in each valise, packed in 2 canvas valises, laced up the centre and marked " Marquee, hospital, large, walls," 1 set of poles consisting of 8 pieces, viz., 1 ridge pole and 3 standards or uprights each in 2 pieces lashed together in 2 bundles by 4 cords ; and 3 bases, pole, 94 large wooden pegs, 116 small wooden pins, 3 mallets, 2 vases for poles, contained in 2 pin bags, marked on the outside with contents and " Marquee, hospital (large) " ; a sledge hammer, 14 lb., and six steel pins, 3 feet, loose.

96.—Pitching a large marquee (*see* Fig. 15).—Undo and empty the two pin bags (keeping separate the large pins for the bracing lines of the inner and outer roofs and the small pins for pegging down the walls) ; fit the handles in the mallets and fix the two pieces of the ridge pole together. This done, proceed to lay out the ground for pitching the marquee as follows : lay the ridge pole on the ground selected and drive in a large peg at its centre and at each of its two end holes ; the " bases " should be placed against these pegs, and will mark the position of the standard poles. From each end peg, and in line with the ridge pole, step twelve paces and place a steel pin for the end weather lines. Then, to each side from each end peg, and on a line at right angles to the ridge pole, take eleven paces and a pace inwards parallel to the ridge pole ; this will give the position of the steel side weather line pins. To find the position of the pegs for the double corner bracing lines, one man, " A ", places himself one pace from the side of the side weather line pin and parallel to the ridge pole, and another man, " B ", at the side of the end weather line pin and at right angles to the ridge pole ; they then march straight to their front, halting where they meet ; they then face the end standard peg, take three paces towards it, halt, turn outwards, take a pace forward and lay down a peg.

For the sides of the marquee, on a straight line parallel to the ridge pole, and six paces from it, lay eight pegs two feet apart, leaving a space of four feet between the fourth and fifth pegs for the side doorways, the centres of which are immediately opposite the centre standard peg. The pegs should now be driven in.

The position of the pegs for the ends of the outer roof and

for the side triangles are best determined after the marquee has been raised, owing to the distance from one peg to another

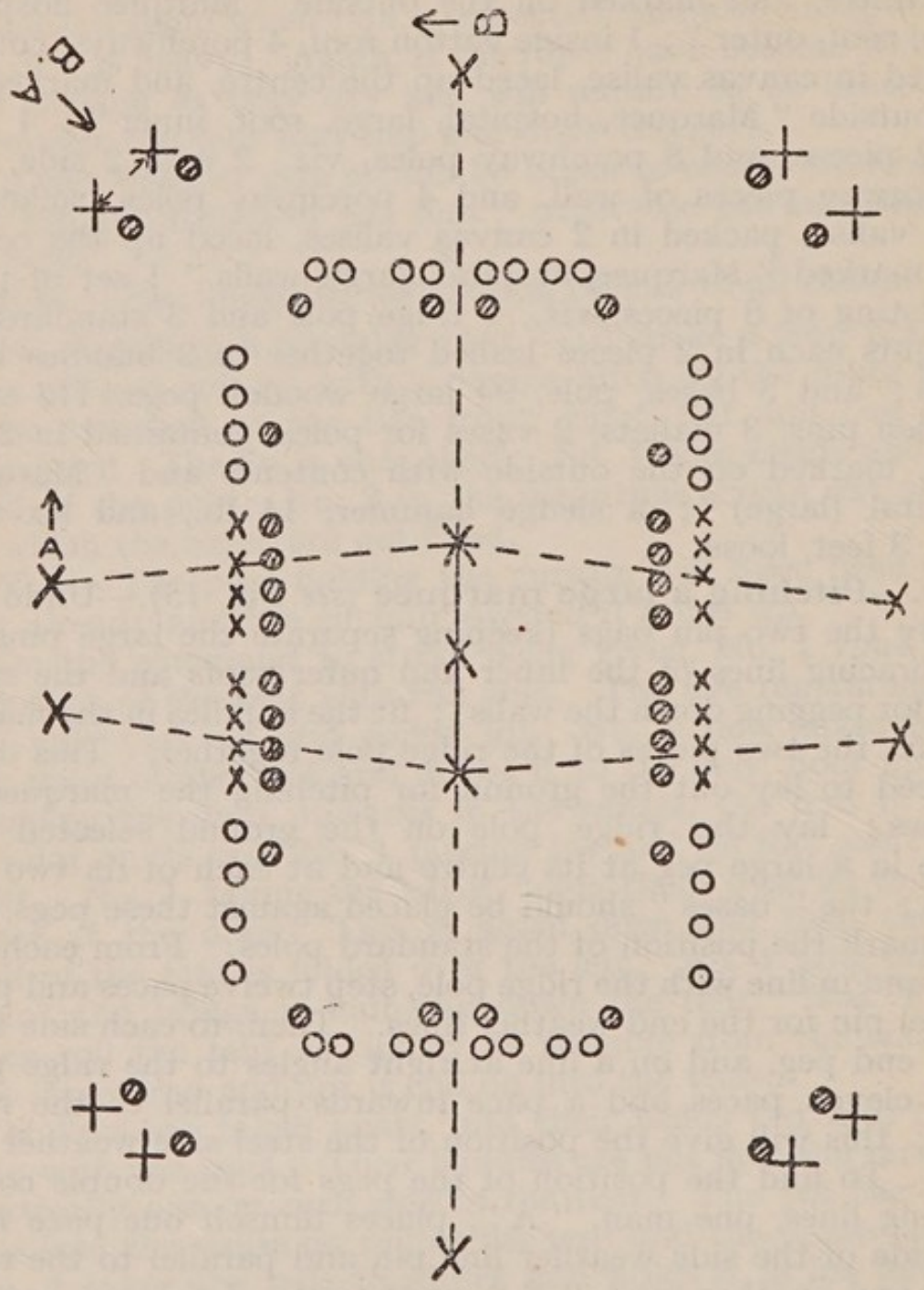


FIG. 15.—GROUND PLAN OF PEGS OF TENT, MARQUEE, H.P., LARGE

(Showing direction of weather lines.)

× Pegs driven in before marquee is raised.
O Pegs driven in after marquee is raised.
⊗ Pegs for inner roof.

A and B show manner in which positions of pegs for corner bracing lines are found. Pitching space, 80 feet by 55 feet.

varying. The pegs for the inner roof are driven one pace further in from those for the outer roof.

The ground being laid out, undo the two valises containing

the inner and outer roofs and carry the two roofs within the line of pegs. Then spread out the marquee, the roofs one inside the other, top to windward and base touching the ridge pole. Roll up the upper side of the outer roof as far as the ridge so as to expose the web slings of the inner roof, thread the ridge pole through these slings and roll up the upper side of the inner roof in a similar manner. Fix the pieces of the standards together, and pass them through the openings in the inner roof and then pull down the upper side of the inner roof on the lower. The standard with the short iron spike must be the centre one ; those at the end have longer spikes. Now pass their pins through the holes in the ridge pole, through the eyelets in the two end web slings and also through the eyelet holes in the ridge of the outer roof. The short spike of the centre standard only reaches through to the upper side of the ridge pole—there is no eyelet hole in the web sling or the outer roof for it. Now fit the vases on the pins of the end standards. Before proceeding to raise the tent, care should be taken that the ropes for the ventilators are in correct position. Those for the outer roof must be on the outer side of the outer roof. The lines for opening the ventilators on the inner roof must pass from the ventilators on the outer side of the inner roof through small eyelets near the ridge of the inner roof by the side of the standards to the inner side—those for closing them from the ventilators on the outer side through small eyelets near the free edge of the inner roof to the inner side. When the ventilator ropes have been placed in position, the ends should be knotted to prevent them slipping through the eyelet holes. Unroll the inner and outer roofs to their proper position, bring the ends of the standard poles so as to rest against their standard pegs and on their bases, and square the ridge pole on the standards thus placed.

To raise the marquee, 2 N.C.Os. and 21 men are required, viz., 12 weather line men, and 9 standard men ; 2 weather line men take up position at each steel pin, holding the weather line ; 3 standard men take up position at each pole, 2 at the foot and the other at the top facing them. When the senior N.C.O. sees that all are ready, he gives the word to raise ; then, all working together, steadily erect the standards, taking care not to raise one end before the other. To prevent the marquee inclining endways, the end weather lines should be kept taut and in direct continuation of the ridge pole, the linesmen closing in to the pins as the marquee is raised. The senior N.C.O. now dresses the standard poles from both end and side, and, when perpendicular, the weather lines are made fast round the steel pins. The weather line men must not

leave their posts until the bracing lines are on. The standard men now put the bracing lines on the pegs already in position, beginning with the four double corner ones, which should be well stayed out by means of the triangular runners, after which pegs for the bracing lines of the ends and side triangles of the outer roof and all the inner roof are driven in and the lines put on (the side triangles are gored and the pegs must be placed in a direct line with the seams, so that the strain will be direct from the top of the end poles). The wall is in 12 pieces, fitted with brass eyelets, through which the loops of the inner roof are reeved. Four of the pieces of wall are marked, "side," four "end," and four "doorway," and the four flaps that form the roof of the four porchways are marked "centre" on the inside lining. The spikes of the porchway poles should now be inserted through the corresponding eyelets in the porchway roof and the latter reeved to its corresponding portion in the inner roof. After this has been done, the lacing of the walls can be begun, starting with the doorway pieces. It is most important to note that the centre of each of the four doorway pieces of wall, where marked "centre of porchway," must be exactly under that point of the roof flap of each of the four porchways where marked "centre" before the side wall is laced on, which is done in continuation of the doorway piece. The end wall is laced to the side wall. The loops on the wall are so placed as to permit of the walls being interchangeable. The wall, when laced on, should be securely pegged down. The marquee can be ventilated as required by disconnecting and unlacing the wall.

97. Trenching a marquee.—A trench, nine inches broad, and four to six inches deep, should be dug round the curtain, especially on the upper side if the ground be sloping. The trench should be cut well under the curtain so as not to leave a ledge; otherwise the water will drip on to the ledge and run under the tent wall.

98. Striking a large marquee.—Unlace the wall from the inner roof, freeing the loop-lines from the pegs; detach the wall; unfasten and roll up the bracing lines, beginning with the inner roof. The pegs should be taken up as the lines are removed from them and put away in the peg bags.

To lower the marquee, the men take up position as in pitching, 2 to each weather line and 3 to each pole. The marquee should then be carefully lowered to windward. The end weather lines must be kept taut in lowering.

To repack the marquee roll up the six weather lines, and take the vases off the pole spikes. Spread out the roofs and

roll back the upper portion of the outer roof so as to expose the ridge pole ; next pull away the standard poles and remove the ridge pole from the slings. The roofs are folded thus :— For the inner roofs the ends are folded over to the centre, and three folds are then made from side to side ; the porchways should be folded up with the inner roof. The inner roof is then rolled up. For the outer roof, the under side is spread out flat and the upper side drawn over it ; next fold the roof in two equal parts by bringing over one end and laying it on top of the other ; see that the ventilating irons are together. Turn back the ends in a line with and as far as the ventilating irons ; now make two folds about the width of the valise from the opposite direction and then fold over the remaining portions of the ends ; the corner containing the irons is turned back, thus bringing them on top and in a proper position for rolling. Roll up the outer roof from the thick end. To put a roof into its valise, spread out the valise and, pushing one of the side flaps under the roof, roll it in. Having arranged the flaps, lace them, beginning with the ends.

The wall is rolled up the width of the bamboos inserted in the wall ; two side, two end, two doorway pieces of wall and four bamboo porch poles being packed in each valise. Two of the poles in each valise are turned the reverse way, *i.e.* the bottoms are placed alongside the spikes ; this prevents the spikes from piercing the canvas valise.

Tent, Marquee, H.P., Small

99. Description.—A marquee, outside dimensions, 22 feet by 19 feet, weighing about 600 lb. complete, consisting of : 1 outer roof, 1 inner roof, 4 pieces walls, outer ; 4 pieces walls, inner, 2 porchways, 2 large and 10 small vases, 2 weather lines, 4 windows in green satchel, 2 valises, 2 pin bags, 1 ridge pole, 2 uprights, 8 wall poles, 4 upright porchway poles (each in 2 pieces), 2 porchway doorway cross pieces, 2 short upright poles, 2 bases (pole), 20 large and 166 small pins (wood), 3 mallets, 2 tying up cords. Canvas bottoms suitable for this tent are provided in 4 pieces and are issued separately when authorized.

100. Pitching a small marquee (*see* Fig. 16).—1 N.C.O. and 12 men are required, 4 as pole men, 8 as tent men.

Place the ridge pole in the centre of the site selected and at each end put in a large peg. Place 2 pole men at each end of the ridge pole, back to back. These men march out 8 paces, at right angles to the pole, and place in large pegs

for the weather lines. They then turn outwards and march 6 paces parallel with the line of the ridge pole, and put in large pegs for one outer roof corner line. They then continue

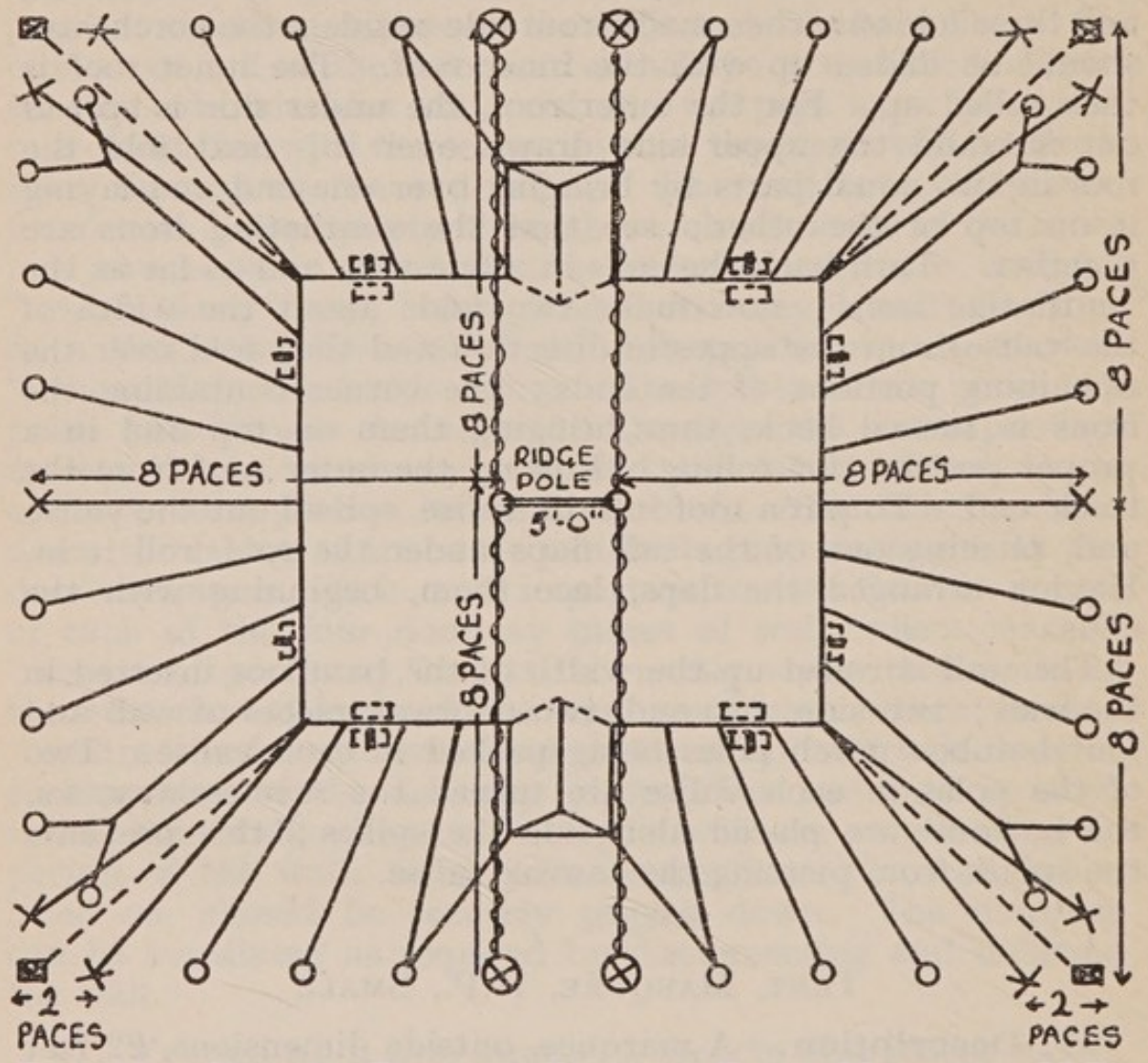


FIG. 16.—GROUND PLAN OF PEGS OF TENT, MARQUEE, H.P., SMALL

⊗ Weather line pegs (large)
X Outer roof pegs (large)
⊠ Inner roof pegs (large)
} placed in position before marquee is raised.

○ Small pegs in position after marquee is raised.
Weather lines.
— Outer roof lines.
- - - Inner roof lines.
Inner wall windows.
Outer wall windows.

another 2 paces and put in large pegs for the inner roof corner line.

The 4 pole men are then placed 2 at each end of the ridge pole and march out 8 paces in continuation of the line of the

ridge pole. A large peg is then put in between each pair. The pole men then turn outwards and march forward 6 paces. They then put in a large peg for the outer roof corner lines.

The ridge pole, uprights and bases are placed in position, as detailed for marquee, hospital, large.

The outer walls are placed in position as follows :—

Each piece of wall is begun from the centre hook of the side porchway on the outer roof in such a manner that, when the whole of the outer wall has been put up, there should be 2 windows on each side of the marquee.

The inner walls are placed in position as follows :—

Each piece of wall is begun from the centre hook of the long side porchway on the inner roof in such a manner that the windows come opposite those of the outer walls on the long side of the marquee.

If the porchways are required on the short side, the walls will be begun from the centre hooks of the short side porchways.

Tent, Operating

101. Description.—The tent is rectangular in shape and has a doorway at each end. It is fitted with 6 ventilators of the ordinary type, and also with a large ventilator on each side, to give extra light and air. The wall is permanently attached to the tent. The poles used with it consist of 2 upright poles and 1 ridge pole, each made in 2 pieces.

It is 20 feet in length, 14 feet in width, and 9 feet 4 inches in height, the wall being 3 feet high. The tent itself weighs 116 lb., or, with poles and appurtenances complete, 181 lb.

The duck used in making this tent is of the same quality as for Mark V circular tents. The valise and pin bag are the same as used for the laboratory tent. The pins and mallets are of the ordinary service pattern. The complement is 2 mallets, 1 pin bag, 60 small pins and 8 large pins ; this allows 2 spare small pins.

Note.—On account of the rods in the large ventilator, this tent must be folded and rolled up lengthwise, and the weather lines must not cross the ventilator when the tent is pitched.

102. Pitching an operating tent (*see* Fig. 17).—1 N.C.O. and 6 men are required, 2 men as pole men and 4 men as tent men.

Marking out the ground.—The pole men put the ridge pole together and lay it in the centre of the site selected for the tent, and a small wooden peg is driven in at each end of it. The pole men then take a mallet and 4 large pegs each.

The 4 tent men place themselves one on each side at the

ends of the ridge pole, back to back. They then march forward 6 paces at right angles to the ridge pole, turn outwards, and proceed forward 2 paces parallel to the ridge pole and halt.

At these points the pole men drive in a large peg with

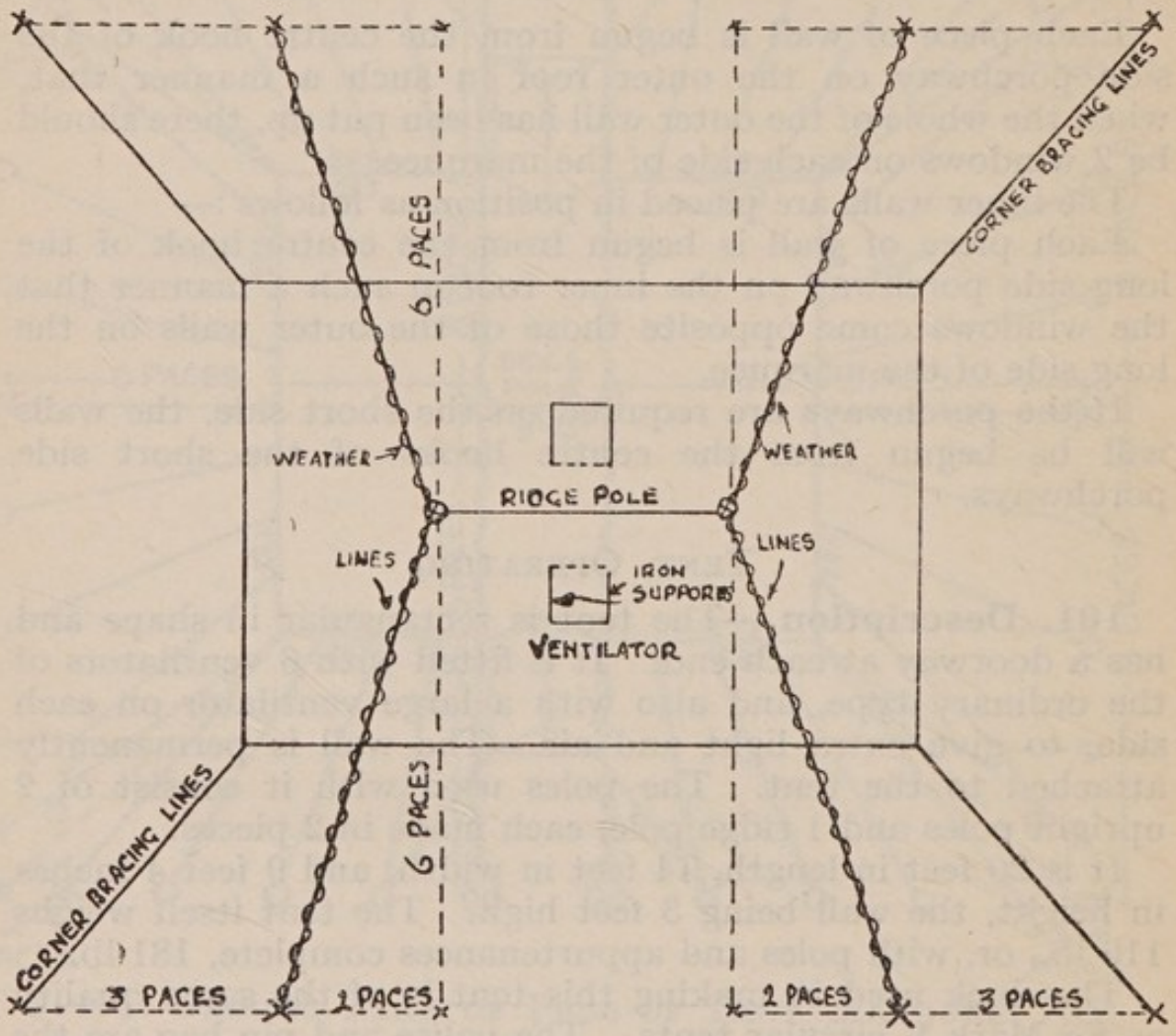


FIG. 17.—GROUND PLAN OF PEGS OF TENT, OPERATING

the notch of the peg pointing away from the ridge pole; these are the weather line pegs.

The tent men then continue forward 3 paces, halt and turn inwards so as to face the ends of the ridge pole. The pole men then drive in a large peg between the heels of these men with the notch of the peg pointing away from the ends of the ridge pole; these are for the corner bracing lines.

103. Erecting the tent.—The tent men unpack the tent, spread it flat on the ground, the lower edge touching the ridge pole and the top to windward, and then roll up the upper side of the tent until the top is exposed. While this is being done, the pole men fix the ridge pole and uprights together, and then place them in position on the top of the lower side of the tent.

The small iron spikes at the top of the uprights are pushed through the holes for them at the top corners of the tent, care being taken that each ventilating cord is on its own side of the ridge pole. The upper side of the tent is now pulled down over the lower side, the vases with weather lines on them fixed to the projecting spikes, and the whole tent carefully lifted towards the pegs marking the ridge pole until the bottoms of the uprights rest against them. Each tent man uncoils a weather line and moves towards his allotted weather line peg. The pole men remaining at the uprights and working with them, the tent is gradually raised and the lines fastened to the pegs. The lines must not be crossed. The 4 tent men each take an upper corner rope (distinguished by being fastened to a ring through which another line passes) and adjust it to the large pegs first driven in. The doors are now laced and hooked. The tent men take the 4 lower corner ropes, and fasten them to the small pegs driven in a line with, but 2 paces nearer the tent than, the upper corner pegs. The pole men adjust the windows, the tent men drive pegs and adjust the front and side lines of the roof, drawing them square with the tent, and fasten down the curtain.

Note.—In fixing the upper corner bracing lines, it may be necessary to apply bowlines or sheepshanks to shorten them.

104. Striking an operating tent.—The pole men pull up the curtain pegs and let down the windows. The tent men cast off all ends and side lines and coil them, and draw pegs. They then take post at the lower corner pegs. The pole men stand to the poles ; the tent men cast off first the lower corner, then the upper corner ropes, and coil down ; stand to the weather line pegs, cast them off and hold them in the hand ; then, working with the pole men, lower the tent to windward, coil the weather lines and remove the vases. The pole men withdraw the poles and lash them together. The tent men fold up the tent as follows :—the underside is first spread out flat, and the upperside drawn over it ; the ends are folded over so as to form a square. The lower end of the square is folded over to the middle ; the top end is folded over towards the middle as far as the ventilator irons allow, and then folded over the lower half. The whole is then rolled from end to end and placed in the valise.

Tent, Store

105. Description.—A large tent with wall attached to roof : inside dimensions, 50 feet by 20 feet with round ends, weighing about 670 lb. complete, consisting of : roof with

walls attached, 1 pin bag, 2 mallets, 18 large and 131 small pins, 1 ridge pole, 3 uprights, 22 wall poles, 1 valise, 5 weather lines and tying-up cords, 3 vases.

106. Pitching and striking.—On general principles, as for other marquees.

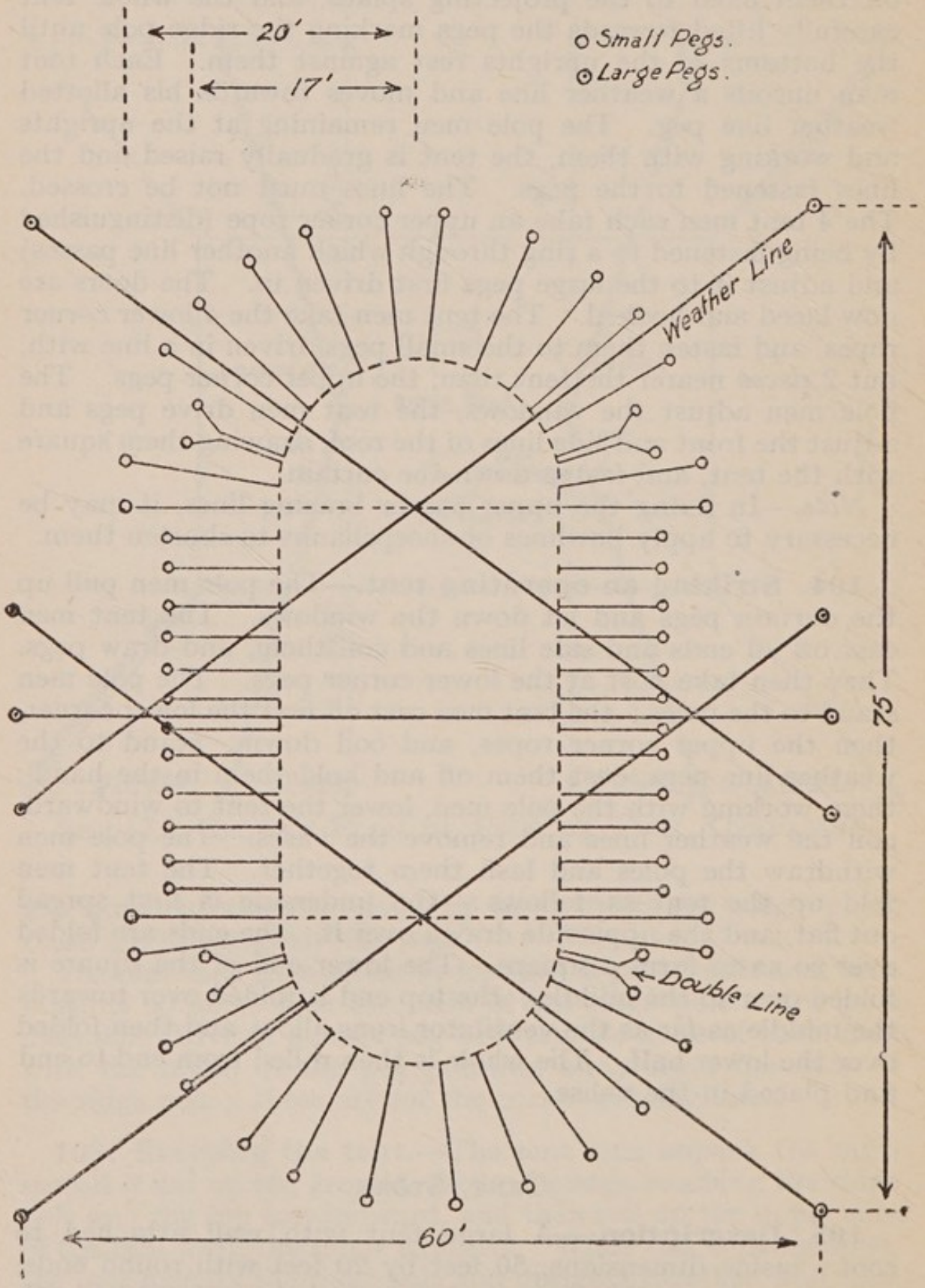


FIG. 18.—GROUND PLAN OF PEGS OF TENT, STORE

Tent, Marquee, G.S., Double

107. This tent is not shown as being issued to any units on mobilization but is shown in the Vocabulary of Stores as being for general purposes in hot climates. In such circumstances it would probably be issued in priority to medical units.

108. Description.—A marquee, inside dimensions, 29 feet long and 14 feet wide, weighing 512 lb. complete, consists of: 1 inside linen roof, 1 outside linen roof, 8 walls (4 inside and 4 outside), 82 bracing lines (40 inside and 42 outside), with wooden runner and button to each, 2 wooden vases painted red, and 6 weather lines (30 feet each), with large runners, all packed in a canvas valise, laced up in the centre, and marked on the outside "Marquee, G.S., double"; 180 small tent pegs, 6 large tent pegs (for weather lines) and 2 mallets, all contained in one peg bag, marked on the outside with contents and marquee to which it belongs; 1 set of poles, consisting of 8 pieces, viz., 1 ridge in 2 pieces, and 3 standards or uprights in 2 pieces, and lashed together in one bundle by two box cords; 1 waterproof bottom, made of painted canvas, in 4 pieces, each piece measuring 15 feet 2 inches by 8 feet 10 inches, rolled in a bundle round a thin pole, and tied by three box cords.

109. Pitching and striking.—On general principles, as for other marquees.

SECTION 3—MISCELLANEOUS

CHAPTER IX

CAMPS, BIVOUACS AND BILLETS

110. Camps.—General instructions as to the selection and layout of camp sites will be found in F.S.R., Vol. I, and the F.S. Pocket Book. Tactical and administrative interests have to be carefully weighed in siting a camp, but field medical units should be near a road for easy access of ambulance cars.

Camps should be compact, but the area allotted for the sick and wounded must not be too cramped and the possibility of attack from the air or other sources—from which field medical units cannot be considered immune—may require irregularity of layout and some measure of dispersion.

For sanitation, watering arrangements, picketing of animals and parking of vehicles, the instructions contained in F.S.R., Vol. I, and the F.S. Pocket Book will be followed.

Marking out of camp.—The site having been chosen and the line decided upon, the camp will be marked out as follows :— Mark the base point with a tent peg or flag ; measure off the distance required for the front of the camp, for a field ambulance (if companies are pitched together), 120 yards ; mark this with a second tent peg or flag.

The front of the camp having been fixed, the rear boundary will be marked out as follows : Place a tent peg or flag on the front alignment 6 feet from the base point, another tent peg or flag 8 feet from the base point towards the rear, and 10 feet diagonally from the other tent peg or flag ; the angle thus formed will be a right angle. Place a third tent peg or flag in the same straight line as the 8-feet side of the triangle, and distant from the base point 200 yards. The rear line of the camp will be equal in length and parallel to the base line, and will be marked with a fourth flag.

The attached plan (Fig. 19) is given as a rough guide for laying out a camp for a field ambulance. It can also be adapted to the requirements of a cavalry field ambulance.

111. Extra tents.—If it is considered that a mobilized force, on taking the field, requires additional tents for the accommodation of sick, 24 extra tents for a field ambulance are carried, the transport for which must be supplied.

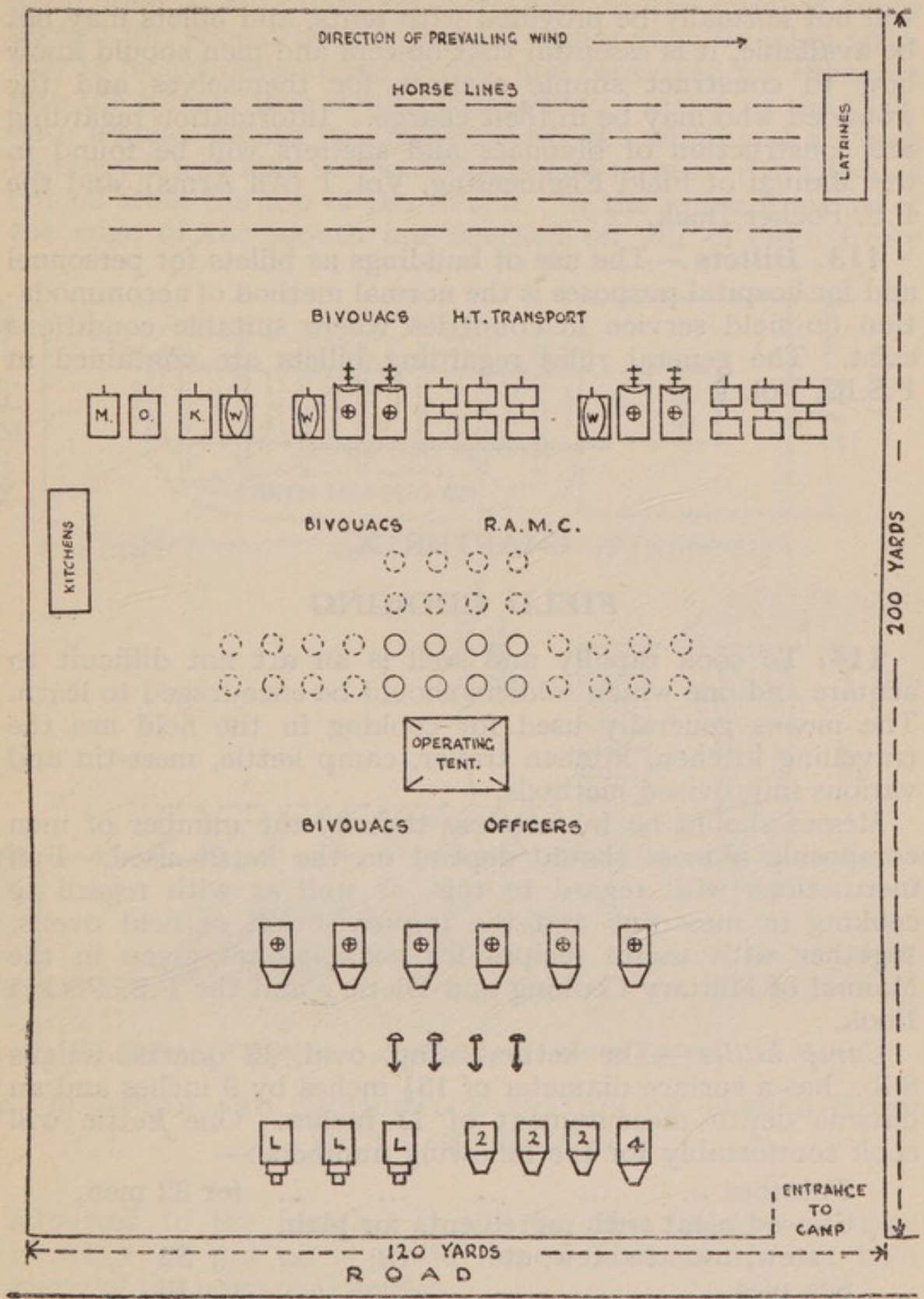


FIG. 19.—FIELD AMBULANCE CAMP

Showing full tentage for sick. Tents shown by dotted lines are not normally carried.

112. Bivouacs.—As the personnel of field medical units will not normally be provided with tents, and billets may not be available, it is essential that officers and men should know how to construct simple shelters for themselves and the wounded who may be in their charge. Information regarding the construction of bivouacs and shelters will be found in the Manual of Field Engineering, Vol. I (All Arms), and the F.S. Pocket Book.

113. Billets.—The use of buildings as billets for personnel and for hospital purposes is the normal method of accommodation on field service in countries where suitable conditions exist. The general rules regarding billets are contained in F.S.R., Vol. I.

CHAPTER X

FIELD COOKING

114. To cook rapidly and well is an art not difficult to acquire and one which soldiers should be encouraged to learn. The means generally used for cooking in the field are the travelling kitchen, kitchen trailer, camp kettle, mess-tin and various improvised methods.

Messes should be by kettles—that is, the number of men composing a mess should depend on the kettle used. Full instructions with regard to this, as well as with regard to cooking in mess-tins and the improvisation of field ovens, together with useful recipes for cooking, are given in the Manual of Military Cooking and Dietary and the F.S. Pocket Book.

Camp kettles.—The kettle, camp, oval, 12 quarts, weighs 8 lb., has a surface diameter of 13½ inches by 9 inches and an outside depth measurement of 11 inches. One kettle will cook comfortably for the following numbers :—

Potatoes	for 32 men.
Stewed meat with ingredients for plain stew, tomato stew, etc.	,, 32 ,,
Sea pies	,, 16 ,,
Meat puddings	,, 16 ,,
Plain stew and dumplings	,, 16 ,,
Green vegetables	,, 16 ,,

115. Field kitchens.—On a unit's arrival in camp, the cooks will at once proceed to make the kitchen. This can either be a trench-kitchen or one without a trench.

The trench-kitchen.—If the encampment is only for one night, one or two trenches, according to the number to be cooked for, should be dug 7 feet 6 inches long, 9 inches wide, and 18 inches deep at the mouth, and continued for 18 inches into the trench, then sloping upwards to 4 inches at the back, with a splay mouth pointing towards the wind, and a rough chimney 2 feet high at the opposite end formed with the sods cut off from the top of the trench. If the upper 6 inches of the edge of the mouth are bevelled off, air is more freely

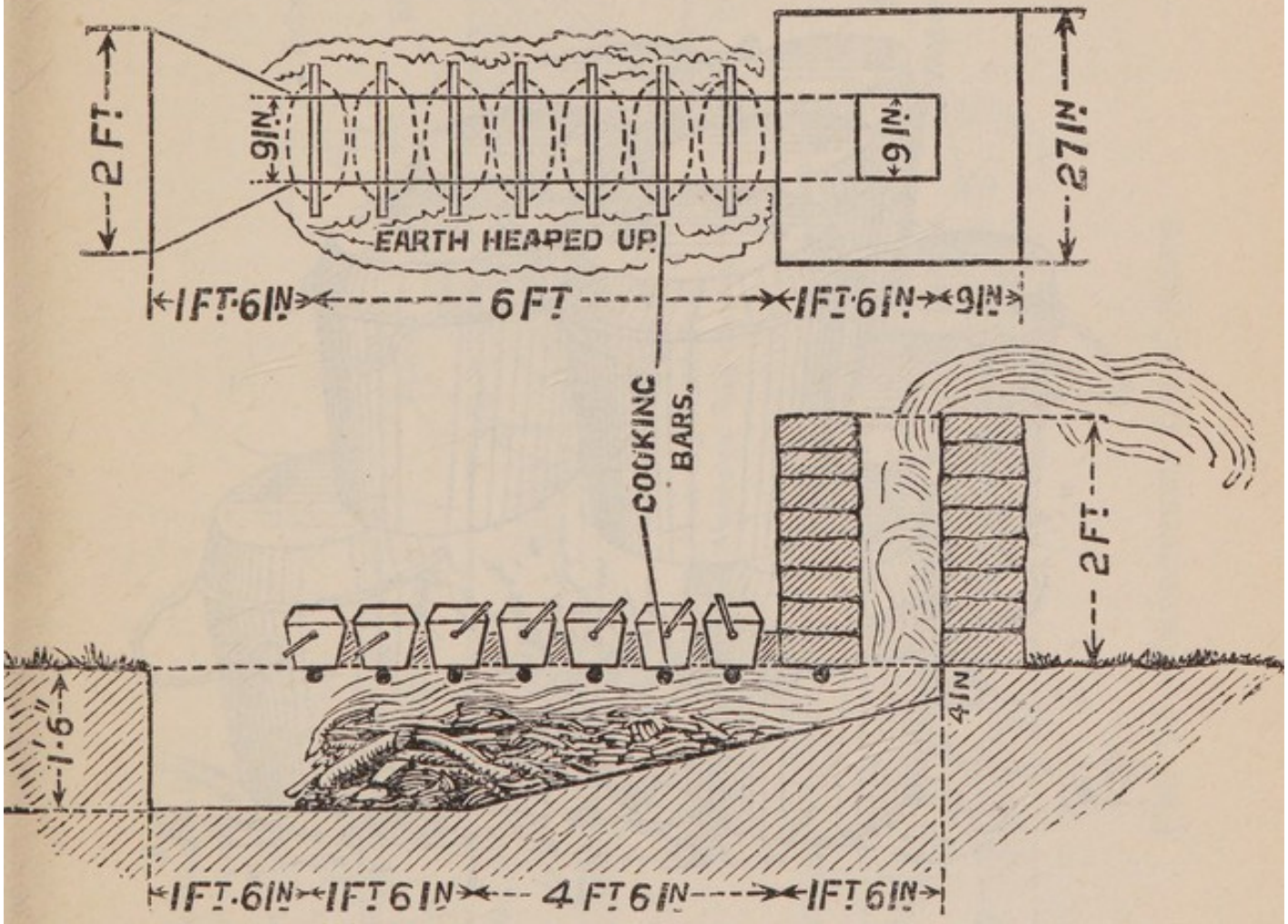


FIG. 20.—PLAN AND SECTIONAL ELEVATION OF TRENCH-KITCHEN WITH CAMP-KETTLES

admitted to the trench. It will be advantageous if these trenches are cut on a gentle slope. This trench will hold seven of the large oval kettles.

Iron bars are placed across the trench to support the kettles. The kettles are placed side by side with their bottoms resting on the ridges of the trench. The spaces between them are packed with wet earth or clay, which should reach as high as the loops of the handles. The fuel, generally wood, is fed into the trench from the splay mouth (*see* Fig. 20).

Without a trench.—The simplest and best arrangements for cooking in the field for any party over 20, if the stay in camp is for a night only, is to place a proportion of the kettles on the ground in two parallel rows about 9 inches apart, handles outwards ; block the leeward end of the channel so formed with another kettle, lay the fire and place over it one or two rows of kettles resting on those already placed in position (*see* Fig. 21).

Mess tins can be arranged similarly, but of these not more than eight should be used together.



FIG. 21.—KITCHEN WITHOUT A TRENCH, WITH CAMP-KETTLES

116. Cooking by means of waste oil and water.—This form of cooking is most suitable when other types of fuel are unavailable. Any kind of crude oil or waste oil from lorry sumps may be used.

Equipment required :—

(i) A kettle trench (*see* para. **115**).

(ii) Two containers, one for oil and one for water. They should be fitted with taps and hold at least one gallon.

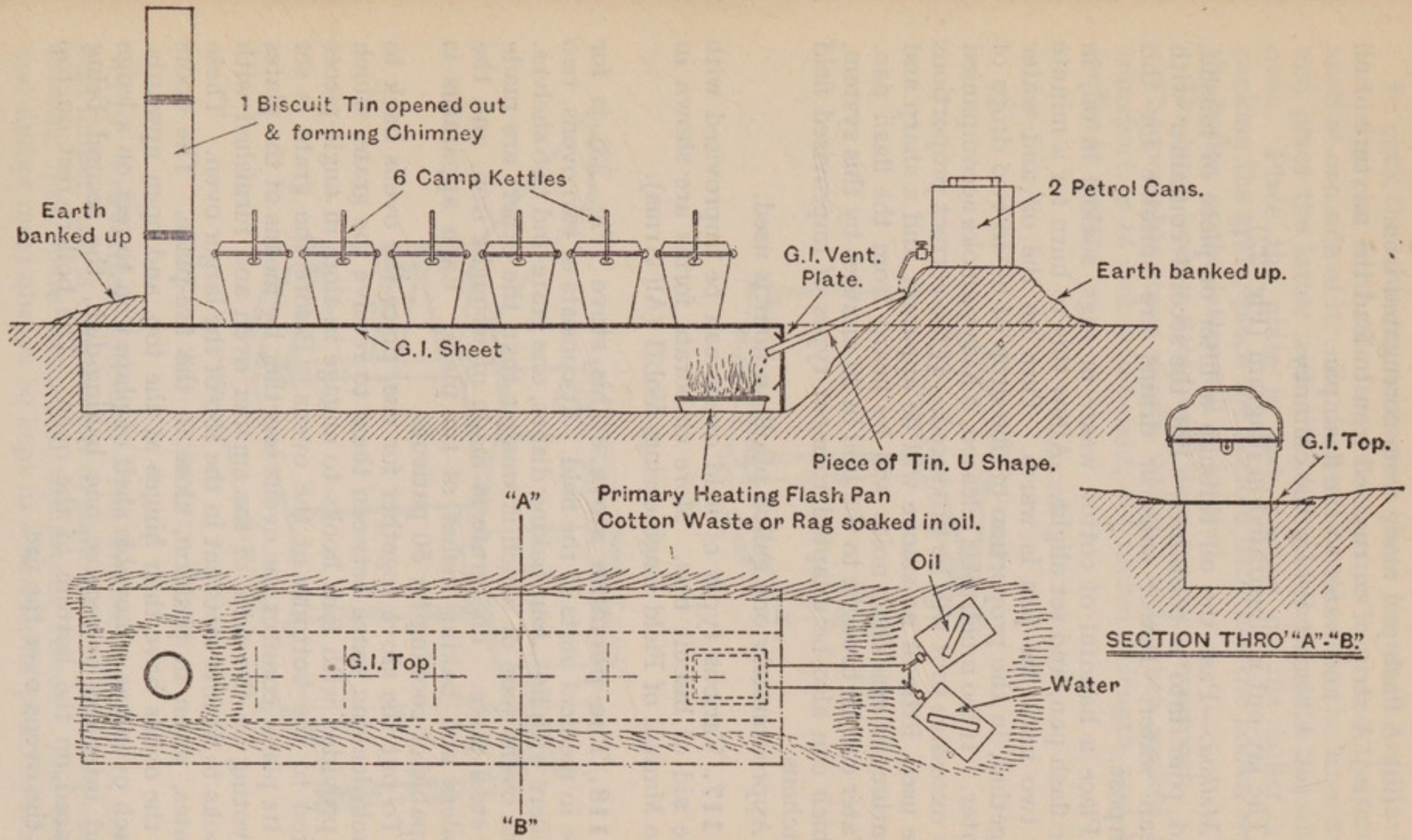


FIG. 22.—IMPROVISED OIL COOKER

(iii) A flash pan made from corrugated iron.
(iv) A strip of corrugated iron to lead the mixture of oil and water to the flash pan.
(v) A biscuit tin for the chimney.

The lay-out is illustrated in diagram (Fig. 22).

Method.—Pass the oil through a filter or piece of muslin, and pour into a container. Fill the second container with clean water. Petrol cans or drums are suitable for this purpose.

Place a handful of cotton waste or rags, soaked in oil, in the flash pan, and set alight. Allow this to burn for a minute or two until the pan is warm. Turn on the oil and water together, in the proportion of one drop of oil to two drops of water. If too much oil is released, a heavy smoke accompanied by excessive soot will be produced. If the correct proportions are used, little or no smoke will be apparent and a sharp and continuous crackling noise will be heard from the flash pan. Water can be brought to the boil in 20 minutes by this system, which can also be adapted to most types of improvised field kitchens.

Approximately one gallon of oil an hour is used.

117. Various types of field ovens can be improvised with the aid of biscuit tins. More elaborate forms are shown in the Manual of Field Engineering, Vol. I (All Arms).

118. The portable stove.—This stove (Fig. 23) is for use in medical units in the field. It consists of two ovens, two boilers with lids, four baking dishes, one grate and two shelves. The ovens (one of which is smaller than the other) are made of steel plate. The grate is made of wrought iron, and the boilers and baking dishes of tin plate. Each apparatus is capable of cooking for 50 patients.

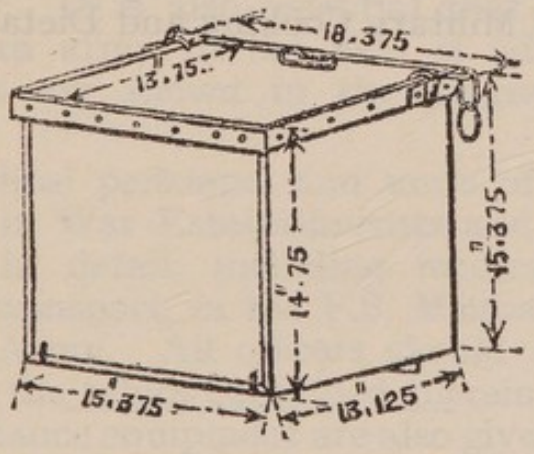
To put the stove together for use, place the ovens back to back, leaving space between them to receive the grate, which is provided with four hooks to engage in slots in angle-pieces fixed to the bottoms of the ovens. Before the grate is set in its place, connect the ovens together by means of the plates pivoting on the sides of the smaller oven and furnished with hooks to fit into slots cut in the top of the larger oven. These plates, when in position, close in the fire-place. The doors of the ovens have their hinges at the top, and open upwards. Each oven has a movable shelf of plate iron to rest on a ledge and intended to receive one baking-dish, the second being placed on the bottom of the oven. The boilers rest on top of the ovens over the fire.

To pack the stove for transport, place the small oven inside the large one, with the large shelf on its top, and the small shelf at one side of it. Put the small boiler into the large one, and place the latter with the baking dishes inside the small oven. Place the grate in last, resting on the boiler. In packing the grate, place the bottom bars, not the hooks, next the boiler, or the latter will be injured.

The large oven is fitted with links for pack transport.

The portable stove weighs 90½ lb., and, when packed for transport, is 14 inches in height, 18¾ inches in length, and 16¾ inches in depth.

PACKED



READY FOR USE

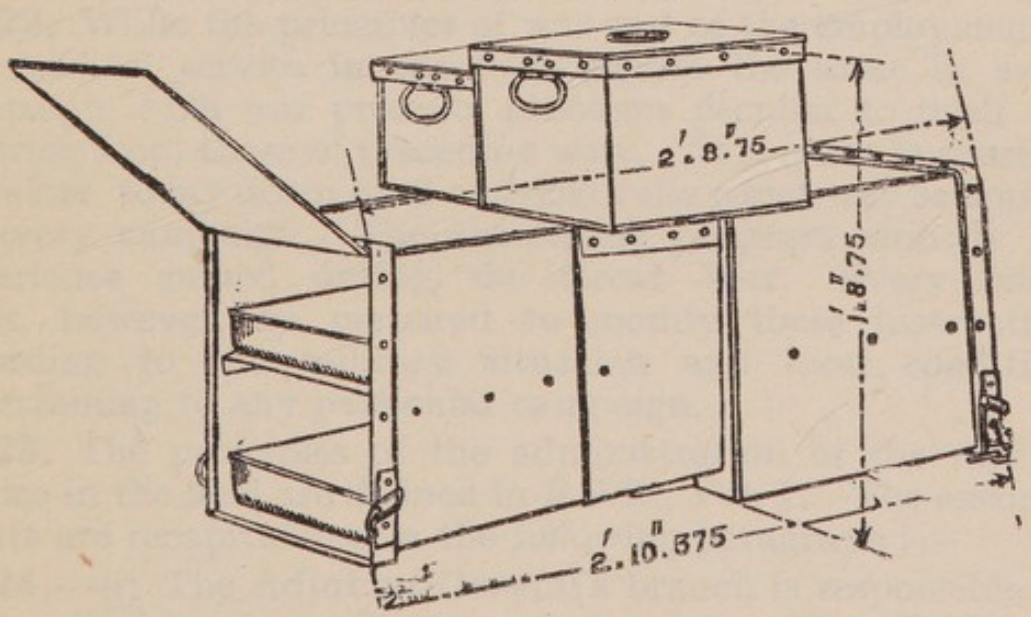


FIG. 23.—PORTABLE STOVE

119. Travelling kitchen.—The kitchen consists of body and limber, and is constructed to cook for 250 men and carry rations, fuel, spare parts and equipment stores. The body and limber must always be kept in a horizontal position when

in use. The limber can be used separately for distributory purposes.

The body consists of seven open compartments, five for boilers and two (one on either side of the rear boiler) for fuel, a fire-box and perch.

The limber consists of four boiler compartments at the front, which are lined with asbestos fibre, where the contents of the boilers may be kept at a high temperature when transferred from the body, and compartments at the rear to carry cooks' implements and rations of jam, sugar, salt and tea. The rear compartments are closed by a lid to which is attached a cutting board.

Fuller particulars of the travelling kitchen are contained in the Manual of Military Cooking and Dietary.

SECTION 4.—MEDICAL SERVICES IN THE FIELD

CHAPTER XI

ADMINISTRATION OF THE MEDICAL SERVICES

120. The duties of the medical service in the field are laid down in F.S.R., Vol. I, and should be studied by every R.A.M.C. officer. It is also essential that he should know generally how an army in the field is administered. The broad principles are shown in the diagrammatic scheme, Fig. 24.

121. The medical personnel and units of an army in the field are shown in War Establishments and the composition of these units in detail, including medical and ordnance equipment and transport, in the F.S. Manual for the Medical Services of the Army. All officers should make themselves acquainted with the tables contained therein. The details of medical and ordnance equipment are also given in A.Fs. I 1248 (series), Medical Mobilization Equipment Scales, and A.Fs. G 1098 (series), War Equipment Tables, respectively.

122. While the principles of war and of the employment of the medical service in the field remain the same in every campaign, each war presents problems peculiar to itself and differing from those of preceding wars. It is quite impossible, therefore, to lay down hard-and-fast rules which can be applied to every campaign. The succeeding chapters embody the experience gained during the Great War. Every officer must, however, be prepared to modify these instructions according to the military situation and local conditions appertaining to any particular campaign.

123. The principles of the administration of the medical service in the field are defined in F.S.R., Vol. I. The essential points are recapitulated in the following paragraph :—

124.—(i) The Adjutant-General's branch is responsible for all medical and sanitary arrangements. The D.M.S. is attached to the Adjutant-General's branch, and receives information as to moves, operations, etc., from it.

(ii) The Staff is charged with the issue to the services of such instructions and information as to the requirements and movements of the troops as will enable the services concerned to carry out their functions.

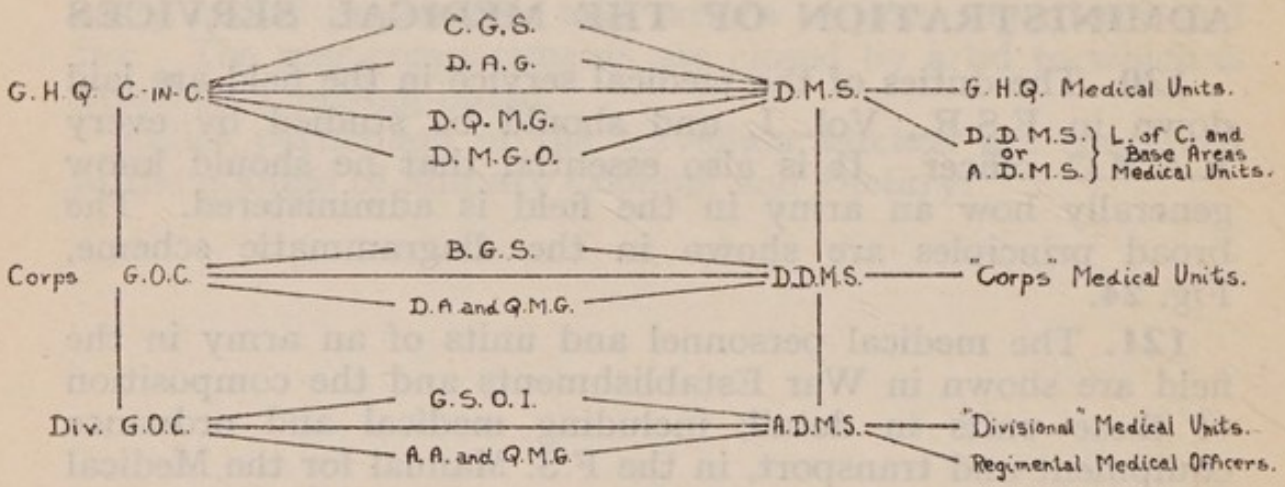


FIG. 24.—DIAGRAM ILLUSTRATING ADMINISTRATION IN THE FIELD AND CHANNELS OF COMMUNICATION BETWEEN STAFFS OF FORMATIONS

The duties of each branch of the staff are fully laid down in F.S.R., Vol. I. They may be summarized as follows :—

The General Staff branch deals with operations, intelligence, survey and signals service.

The Adjutant-General's branch is responsible for the provision of personnel, discipline, medical and sanitary services, personal services, casualty returns and burial of the dead.

The Quarter-Master-General's branch and the branch of the Master-General of the Ordnance provide for maintenance and movement, which includes arrangements for supply and transport.

The directors of services receive their orders from the appropriate branch of the staff.

(iii) It is the duty of the General Staff to obtain and communicate to the services information about our own troops, the enemy, and the theatre of operations—to furnish timely information as to future plans and the probable requirements of the troops and to supply any maps required.

125. The Director of Medical Services is the head of the medical services of the forces in the field ; he administers them and is responsible for their efficiency. In purely technical matters he issues instructions to his representatives with subordinate formations and in areas. Moves of personnel are ordered through the Adjutant-General's branch of the staff.

126. The D.M.S. is the responsible adviser of the G.O.C.-in-C. on all medical and sanitary matters. Similarly, his representatives with subordinate formations are the advisers of their commanders, and are the channel of communication between the Adjutant-General's branch and the medical units and services with such formations.

127. The D.M.S. and his representatives deal directly with the Quarter-Master-General's branch of the staff on questions in connection with the siting and construction of hospitals, ambulance trains and hospital ships, and dieting in hospitals.

128. They are responsible for the administration of the medical services and, subject to the policy formulated by the staff, for the provision of the requirements of the troops in so far as the medical service is concerned, and also for the financial methods employed in carrying out the work. They should maintain close personal touch with the staff and with commanders ; the value of this can hardly be over-estimated.

The head of a service and his representatives at headquarters of formations have direct access to commanders and principal staff officers.

129. The D.M.S. communicates directly with his representatives with formations and in areas, and issues instructions to them on all matters of technical and financial detail connected with the medical service. In these matters he will exercise control over them and will define the extent to which they may incur expenditure without reference to superior authority.

His representatives will keep their commanders informed of all important instructions on technical matters received from the D.M.S.

130. The D.M.S. has certain assistants as laid down in War Establishments ; he details one or more of these as D.D.M.S. or A.D.M.S. to administer the medical services on the L. of C.

131. The following are G.H.Q. troops and, with the exception of the last, are under the direct control of the D.M.S. :—

Casualty clearing stations.
General hospitals.
Convalescent depots.
Motor ambulance convoys.
Ambulance trains and barges.
Field hygiene sections (other than divisional).
Mobile hygiene and bacteriological laboratories.
Depots of medical stores.
Ambulance car companies (R.A.S.C.).

To facilitate administration, the D.M.S. may decide to place any of these units temporarily under the direct control of his representative with a subordinate formation or in an area. Thus one motor ambulance convoy is usually allotted to each corps, or a group of casualty clearing stations or general hospitals may be placed under the administration of a D.D.M.S. or an A.D.M.S. The D.M.S. may allot divisional field hygiene sections to areas under the technical control of the A.D.H. at G.H.Q. ; all such transfers should be notified to commanders of formations through the Adjutant-General's branch of the staff.

132. Orders for the distribution of medical units allotted as G.H.Q. troops are, on the advice of the D.M.S., issued by the Adjutant-General's branch of the staff, after consultation with the General Staff. Before recommending a site for the location of a medical unit, the D.M.S. should assure himself that the locality chosen is the most suitable ; as far as possible, frequent change of location should be avoided, as this puts the unit out of action for a time, besides making large demands on labour and transport.

The general principles regarding the location of casualty clearing stations, general hospitals and convalescent depots are laid down in F.S.R., Vol. I.

133. The D.M.S., as the expert adviser of the G.O.C.-in-C., should foresee and bring to his notice all matters which may affect the health and so the fighting efficiency of the forces.

134. One of the most important of these is the influence of climatic conditions likely to be experienced in a theatre of war. Thus extreme cold demands considerable thought as to how its adverse influence may be mitigated by the issue of warm clothing, by warming billets, by the provision of hot food and shelter, and by reducing the period of duty, etc., for men in exposed positions. Wet weather, especially if the

men have to occupy trenches, is a fruitful source of inefficiency and demands the exercise of considerable ingenuity to prevent the occurrence of avoidable sickness. The prevalence of endemic diseases, such as malaria, requires much prevision in devising protective measures and in demanding extra hospital accommodation.

135. The D.M.S. will arrange through the Adjutant-General's branch of the staff that medical supplies and reinforcements are forthcoming when required. On matters of technical detail not involving policy, he is authorized to correspond direct with the D.G.A.M.S., War Office. Copies of important communications will be sent to the principal staff officer concerned.

136. He must satisfy himself that adequate arrangements have been made for the evacuation, treatment and accommodation of casualties.

137. He will also arrange for the medical inspection and categorization of men sent down from the front on account of physical unfitness and of those in convalescent depots before being returned to duty. A standing medical board may be appointed to deal with these matters, as also with recommendations for periods of sick leave or furlough (*see* para. **271**).

138. The numbers evacuated and the nature of their disabilities require constant supervision to ensure that transport is not needlessly taken up for this service and that the forces are not unnecessarily depleted.

139. The D.M.S. should by frequent personal observation assure himself that his service is functioning satisfactorily; such visits afford him an opportunity of judging the capacity of his officers and of estimating the value of suggestions made by them as a result of their practical experience.

140. Deputy Director of Medical Services.—The D.D.M.S. is the representative of the D.M.S. and is attached to the Adjutant-General's branch of the staff at corps H.Q. His duties in the corps are, in general, similar to those of the D.M.S. at army H.Q. He is assisted by a D.A.D.M.S. and a D.A.D.H. The D.A.D.M.S. acts as M.O. at corps H.Q.

141. In addition to such medical units as the D.M.S. may have placed under his orders, he controls the corps field ambulance but does not possess any power of command over the R.A.M.C. personnel in the divisions forming the corps. If he wishes to make any changes in the distribution of medical personnel in divisional units, the orders for such moves should be issued by " A " branch of the staff.

142. The D.D.M.S. receives instructions on technical matters from the D.M.S. and is responsible for ensuring that all necessary matters are communicated to the A.Ds.M.S. of divisions and to any Os.C. corps medical units in his area. Similarly, communications on technical questions emanating from subordinate formations are sent to him for action.

143. In addition to the above duties, the D.D.M.S. co-ordinates the medical and sanitary work in his area. Thus, to economize transport he arranges for the systematic evacuation by the M.A.C. of all casualties from divisional M.D.Ss. and in the event of active operations on a large scale, he may, in order to economize personnel, establish a corps M.D.S. and walking wounded collecting post. In regard to sanitation, he should draw up a scheme for the area so that all field hygiene sections may work on a uniform general plan ; this facilitates the supply of materials, which can often be obtained more easily in bulk and then be distributed under corps arrangements to field hygiene sections.

144. He should hold periodical conferences with the A.Ds.M.S. in his corps and always, if time permits, when active operations are being planned. Free discussion of plans and requirements is infinitely preferable and more speedy than any attempt to settle difficulties by correspondence.

145. The D.D.M.S. should also frequently visit all parts of the corps area and medical units, to satisfy himself that a high standard of sanitation is being maintained and that the sick and wounded are being properly cared for, with a due observance of economy in the use of supplies and ambulance transport. He should also countersign all indents for medical stores for medical units under his control and check any excessive expenditure.

Should a division show a high sick rate, the D.D.M.S. should inquire into the cause and take any action he may consider necessary through the Adjutant-General's branch of the staff.

146. Assistant Director of Medical Services.—The A.D.M.S. is the representative of the D.M.S., and in this capacity is attached to the Adjutant-General's branch of the staff at divisional H.Q. He is the technical adviser of the divisional commander on all medical matters and on all matters of hygiene and sanitation affecting the division.

In addition to the above, he administers the medical services of the division and commands its medical units. He is assisted by a D.A.D.M.S. who is also the hygiene officer of the division and M.O. to divisional H.Q.

147. He receives instructions from the D.D.M.S. on technical matters and issues orders on these subjects to the medical units and R.A.M.C. personnel in the division. Orders for the moves of personnel attached to units other than medical should be issued by " A " branch of the staff.

148. He should keep in close touch with the divisional staff in order to obtain early information of expected hostilities and thus be prepared to deal with an influx of casualties. He should keep himself intimately acquainted with his area and with the capacity of his medical units and officers and know to what extent he can rely on them when pressure comes, and also what accommodation and transport he can obtain in an emergency. He must be able and willing to take responsibility and to make quick decisions without reference to higher authority..

149. The A.D.M.S. should frequently visit all units in the division to satisfy himself that the medical service is in every way satisfactory. He should discuss with C.Os. any medical or hygiene matters that specially concern their units. A personal interview saves time and correspondence and obviates possible friction.

150. He should also inspect any men whom the officer in medical charge of the unit has reported as unfit for further service at the front. If he concurs in the M.O's. opinion, he should countersign the nominal roll and pass it to " A " branch of the divisional staff.

151. He should also visit the R.A.P. with the officer in medical charge of the unit and satisfy himself that the latter understands fully and is carrying out all his duties. Points which require noting are :—

(i) The average number reporting sick daily and their ailments. A large number of imaginary diseases may indicate loss of morale in the unit and should be brought to the C.O's. notice. If skin diseases are prevalent, it usually means insufficient facilities for washing and bathing, or that the underclothing is not being changed as often as is desirable. Digestive troubles, not associated with bad teeth, should, if prevalent, lead the M.O. to inquire into the feeding of the unit. Monotony in diet or inferior cooking may be to blame.

The occurrence of sore throats should direct attention to the ventilation of billets. Cases of infectious disease will, of course, be followed up and the necessary precautionary measures put into force.

(ii) The state of the medical equipment of the unit. A useful procedure is to have it checked periodically by a quarter-master detailed from a medical unit.

(iii) The general sanitary conditions of the area.

152. Should the A.D.M.S. find any unsatisfactory conditions, he will point out to the officer in medical charge the steps that should be taken to remedy the defects.

153. When visiting *medical units*, he should see that the accommodation for and treatment of sick and wounded are as good in every way as local conditions permit, and that the sick and wounded are not kept waiting longer than is unavoidable before receiving food and treatment or being evacuated. He should see that due care is exercised to prevent waste of materials, that indents for supplies are kept within reasonable limits and that the equipment and a sufficient reserve of materials are available for use at the shortest notice. He will countersign all indents for medical supplies.

154. While bearing in mind that each man who is evacuated uses up transport and depletes for an uncertain time the strength of his unit, he should discourage the retention for more than a few days of patients in field ambulances. These units are not equipped to afford more than simple medical treatment, and they may have to be cleared of all patients at extremely short notice, possibly with only a limited amount of transport. The field ambulance must at all costs retain its mobility.

155. O.C. field ambulance.—The O.C. a field ambulance, in addition to performing the ordinary duties of an O.C. a medical unit, will, when active hostilities are about to take place, in all probability be assigned an area or formation from which he will have to collect the wounded. He should therefore cultivate the habit of carefully studying the ground both visually and from maps, so that the resources of the country as regards natural cover may be fully utilized for the collection and evacuation of wounded. He should also estimate his probable requirements as to personnel and material and make these known to his A.D.M.S., with whom he will work in close touch.

156. Returns.—Certain returns have to be made in accordance with F.S.R., Vol. I, but in addition to these the D.M.S. may wish to have special returns, *e.g.* a Daily State of Sick and Wounded (A.F. W 3185) or in regard to special matters such as the incidence of particular diseases or the expenditure of materials. The number of such returns should, however, be restricted to those that are essential, as their preparation throws much extra work on the limited clerical

staff of medical units. Any authorized special returns should be uniform throughout the force and the D.M.S. should forbid the introduction of any additional routine returns or reports in subordinate formations or areas without his special sanction (*see* Chapter XIV).

CHAPTER XII

REGIMENTAL MEDICAL ESTABLISHMENTS, MEDICAL UNITS AND THEIR DUTIES

157. Organization.—From front to rear the medical organization which deals with sick and wounded comprises regimental medical establishments and the following medical units :—

Field ambulances and cavalry field ambulances.
Motor ambulance convoys.
Casualty clearing stations.
Ambulance trains.
General hospitals.
Convalescent depots.
Hospital ships.

In addition there are the following medical units in the field :—

Divisional and cavalry divisional field hygiene sections.
Mobile (hygiene or bacteriological) laboratories.
Advanced depots and base depots of medical stores.

The personnel, transport and equipment of each of these are laid down in War Establishments and in the Field Service Manual for the Medical Services of the Army. The general principles of their employment and the zones (collecting, evacuating and distributing) on which the organization is based are laid down in F.S.R., Vol. I.

Regimental Medical Establishments

158. Each battalion and corresponding unit (*see* Field Service Manual for the Medical Services of the Army) has a medical establishment, which consists of :—

1 Medical officer. 1 Lance-corporal or bombardier as orderly. 1 Private as orderly. 1 Batman. In addition a chiropodist is authorized for dismounted units over 100 strong.	Normally provided by the unit.

There are also regimental stretcher bearers who are placed under the orders of the M.O. when an action is imminent and, in addition, certain personnel of the unit specially trained in water and sanitary duties for the efficiency of whose work as such the M.O. is responsible. The majority of smaller units to which no M.O. is attached have men trained in first-aid, water and sanitary duties.

159. Officer in medical charge.—In technical matters the officer in medical charge of the unit is directly under the A.D.M.S., but in all other respects he is under the orders of the O.C. unit. His duties are to take medical charge of the unit, for which purpose he has a limited medical equipment, to train the stretcher bearers and to give advice on all matters bearing on the hygiene and sanitation of the unit. He may be called upon to render medical assistance to any unit in his neighbourhood which has no M.O.

160. Should he be posted to a unit on mobilization, he will at once report in person to the O.C. unit, and in writing to the senior administrative medical officer. He will arrange for the medical examination of all officers and other ranks (including reservists) of the unit who have not already been examined, and, when necessary, carry out vaccination and inoculation.

161. He will ascertain that the medical and ordnance equipment, including stretchers and armlets for the unit stretcher bearers, are available and complete, and also that the unit sanitary and water personnel and stretcher bearers are detailed for, and are familiar with, their duties. He will make arrangements through the C.O. to give instruction to the unit on the use of the first field dressing, and on the application of the principles of hygiene to active service conditions. Subsequently, when on the march or in an area where hostilities are not being carried on, when making his health inspections, he should note the names of men who do not appear to be physically fit for service at the front and send a list of these to the A.D.M.S. He should carefully inspect all new drafts and report their condition to the O.C. unit and A.D.M.S.

162. A billet or tent will be provided as a medical inspection room. A small board with the letters "R.A.P." (Regimental Aid Post) and the distinctive mark of the unit should be fixed at the entrance so that men requiring medical attention may know where to apply for it (*see* para. **168**).

163. The examination of men who have reported sick requires, in addition to good professional knowledge, the exercise of skilled judgment and a knowledge of human

nature. Under the strain of war some men are sorely tempted to exaggerate their ailments in the hope of getting away from the front, while others from a high sense of duty will endeavour to carry on when they ought to be under treatment in a medical unit; the latter category may, if in the early stages of an infectious or contagious disease, be a source of danger to others. If the M.O. is too sympathetic with the first category, he will rapidly undermine the morale of the unit, while, if he succeeds in gaining their confidence, men will be less inclined to delay seeking his professional assistance and may thus earlier reveal the existence of unsuspected disease in the unit.

164. At sick parade, he will decide which men can be treated with the unit and which should be sent to the field ambulance. The latter must be accompanied by a sick report (A.F. B 256) signed by the M.O. and will be collected under arrangements made by the O.C. field ambulance detailed by the A.D.M.S. for that duty.

165. The M.O. must see that his medical equipment is constantly replenished. He should indent on the medical unit receiving the sick of his unit as soon as further supplies are required, as his unit may be moved at very short notice. He should endeavour always to replenish during quiet times and avoid indenting while on the move or during an engagement, when all are working at full pressure. It should be borne in mind that first field dressings and stretcher bearers' armlets are an ordnance issue, and are obtained direct therefrom by the unit concerned.

166. If men fall out on the line of march, the M.O. should see them, and, if he considers that they are unfit to complete the march, he should give them written authority to make use of ambulances or any other form of transport. If no transport is available, they should be left in shelter on the roadside in charge of an attendant, when necessary, to be picked up by the field ambulance. If he considers that they require admission to a field ambulance, he should attach a field medical card (A.F. W 3118) showing their disability.

167. During quiet periods, it is most important that the men should have the opportunity of bathing frequently. The N.C.Os. in charge of these parades should be instructed to report to the M.O. the names of any men showing signs of skin disease or of infestation with lice. The M.O. should, at intervals, inspect men of his unit while bathing. If steps are taken at once to deal with such men, the incidence of disease arising from these causes can be greatly curtailed.

The regimental aid post, during active operations

168. A field medical card (A.F. W. 3118) and envelope (A.F. W. 3118A) should, as far as possible, be made out by the M.O. for each patient passing through the R.A.P. When morphia has been administered, a conspicuous note of the dose and hour of administration must be entered for the information of other M.Os. Similarly, when a tourniquet has been applied, a note must be made to ensure that the case receives prior treatment on arrival at the advanced dressing station (*see* paras. **303** and **613**).

Mobile warfare.

169. A R.A.P. should afford protection from rifle and machine-gun fire and splinters and must be improvised, the provision of protection depending largely on the configuration of the ground, any natural cover being supplemented by improvised construction with any means available locally. A bank, the reverse side of a hill, a sunken road or a quarry will all give shelter from rifle and direct gunfire. If, however, at some previous time the enemy has occupied the ground or has made an air reconnaissance, he will have marked down the most sheltered spots for bombardment by indirect fire, while sunken roads, quarries and narrow wooded valleys invite gas shelling.

170. In a civilized country, the cellars of a house which is not too conspicuous and not too close to cross roads make an excellent aid post. An abandoned dug-out, if it allows the entrance of a stretcher, may be serviceable but, in the absence of any more suitable cover, a shell hole or disused trench may have to serve the purpose. When time permits, bays may be excavated in the side of a bank and roofed with tree trunks, etc.

171. In some regions, and especially in mountain warfare, large rocks form excellent shelter. If the country is quite flat and open, shelter from rifle fire can be improvised by digging a wide trench and throwing up the soil as a rampart on the side nearest to the enemy.

172. For protection against the weather, a roof may be improvised by fixing blankets, ground sheets or even branches of trees to poles, trees or rocks. Natives of tropical countries are generally expert at rapid thatching with grass or branches of trees.

173. During a retirement under pressure from an enemy, the M.O. can only carry out first aid treatment. His great object should be to prevent wounded men who are likely to become fit again for active service from becoming prisoners

of war. Those able to make their own way should be directed to the nearest field ambulance post; lying down cases should be handed over to the field ambulance bearers or evacuated in any form of suitable transport that can be found. If patients have to be abandoned, the field ambulance bearer officer should be informed of the exact location where they are left.

Position warfare.

174. If the unit is holding a position, whether trenches or an open front with piquets, the O.C., will, in conjunction with the M.O. of the unit, select a site for the R.A.P. This should be central and near the unit headquarters with easy access to and from all parts of the front held by the unit; the O.C. the field ambulance concerned should at once be informed as to its exact position with map reference, so that the field ambulance bearers will have no difficulty in finding it. The R.A.P. is the medical centre of the unit, and one of the two orderlies should therefore always be on duty.

175. When an attack is imminent, the M.O. will see that his equipment and supplies are fully replenished, that he has or can quickly obtain spare blankets, stretchers, hot-water bottles, Thomas splints, etc., and that some arrangements are made for providing hot drinks. He should also try to arrange for further resting space, sheltered from enemy fire, where lying cases can remain till they can be evacuated.

176. During the attack, the M.O. should, as a general rule, remain at or near his R.A.P. so that he can be found if wanted. If he accompanies the attacking troops, he cannot be everywhere at once and can do little more than a trained stretcher bearer, while, if he himself becomes a casualty, the whole medical arrangements of the unit are liable to become temporarily dislocated.

The Field Ambulance

177. The primary duty of a field ambulance is to collect the sick and wounded and to arrange for their proper disposal.

178. Each division has three field ambulances, each consisting of a H.Q. and two companies. The H.Q. holds the more elaborate medical and surgical equipment and the bulk of the ordnance equipment and forms the main dressing station (M.D.S.).

Each company has equipment, bearer squads and personnel for an advanced dressing station (A.D.S.), so that it may act, to a certain extent, independently of its H.Q. or may remain in reserve.

179. A field ambulance is essentially a mobile unit and is not equipped to provide other than the simplest accommodation and treatment; cases which require more than this must be evacuated to medical units organized and equipped to deal with serious medical and surgical cases. Before evacuating wounded, field ambulances should remember that (i) all fractures **must** be controlled by splints; (ii) hæmorrhage must be stopped; (iii) shock must be treated; (iv) anti-tetanic serum must be administered. A motor ambulance driver should be informed when any special case has been placed in his car, so that he may minimize jolting.

180. The personnel of a field ambulance should include, if possible, an experienced surgeon. A dental officer is attached.

The collection of sick and wounded from units.

181. The work involved in collecting the sick and wounded may be simple and easy or most difficult and strenuous, according to the military situation.

In areas away from the region of active hostilities.

182. The A.D.M.S. will detail one or more field ambulances, often allotting one to each brigade, to collect the sick of the division. If the force is stationary, slight cases may be retained for treatment, and as a rule a divisional rest station is established by one of the field ambulances for this purpose. The O.C. the selected field ambulance will arrange for the systematic collection of the sick from unit R.A.Ps. One or more vehicles should visit the R.A.Ps. daily at an hour previously notified to M.Os. in charge of units. The collection should be completed two hours before the time at which cases are usually evacuated from the field ambulance to the C.C.S. On arrival, emergency cases should be attended to at once, the sick should be seen by the M.O. on duty and sorted into those for retention at the field ambulance and those for evacuation.

183. Field medical cards must be carefully made out for each patient. This is most important, as his subsequent treatment and disability pension may be considerably affected by the actual entries on this card. A M.O. will superintend the loading of the vehicles and see that, as far as possible, the patients are made comfortable for the journey.

On the march.

184. It is usual for field ambulances to accompany brigades on the line of march, when orders will be given for field

ambulances to come under the orders of the brigade commander. The brigade will usually send a " warning order " of the proposed move at the earliest possible moment, with detailed orders to follow. This warning order allows the field ambulance commander the chance to pack up and dispose of any sick not likely to be fit for travel.

The detailed orders include (i) the time and place at which the billeting parties will meet the staff captain ; (ii) the time at which an officer will report to the brigade major to synchronize watches ; (iii) the time of passing the starting point ; (iv) the route and destination.

185. The field ambulance commander should remember the following points when drawing up his march orders :—

He should collect brigade sick one hour before starting ; he should calculate the distance from where his field ambulance is billeted to the starting point ; he should remember that he will march 100 yards a minute, and that the time of passing the starting point is the time at which the head of the unit passes that point.

186. The field ambulance should march in two parties, personnel and horsed transport on foot with brigade, mechanical transport following " in bounds " and should be prepared to deal with casualties occurring during the march.

187. One or two officers should be left with the mechanical transport and instructed to follow by the same route ; while waiting to start, these officers have ample time to clear any sick that may have been collected (*see* para. **185**). On other occasions the whole of the mechanized transport of the division marches together under the orders of the O.C., R.A.S.C., of the division.

188. An orderly M.O. and stretcher party should be detailed for the march to attend to men who have fallen out from their units or are wounded en route and a proportion of medical equipment should be *readily* available for this purpose.

189. If horsed ambulance wagons become full, sick should be left in charge of an orderly to be picked up by the motor ambulances following the same route.

190. If the march is at night, an officer should be detailed to see that each vehicle takes the correct turning at forked roads.

During hostilities.

(*i*) *Position warfare.*

191. According to the extent of the divisional front, one or more of the field ambulances are detailed for duty with

the front line ; the others are held in reserve or may be used to form temporary rest stations. The O.C. the forward field ambulance, having chosen and prepared the sites for the A.D.Ss., will get into touch with all R.A.Ps. in his area and will arrange that they shall be cleared of sick and wounded as often as the occasion demands. It is a good plan for him to detail one stretcher squad from his bearers to each R.A.P. to assist the M.O. and be ready to carry the first case down to the A.D.S. Os.C. should make known their own position and also those of the A.D.Ss. to all concerned. The M.D.S. may be established by another field ambulance.

192. In the absence of any other instructions, any unit that is without a M.O. should apply to the nearest medical unit or M.O. for such medical assistance as it may require.

193. All A.D.Ss. and M.D.Ss. should have a sufficient supply of medical and surgical stores, stretchers, etc., to enable them to deal with any influx of casualties that may arise from an unexpected attack.

194. The motor ambulance cars of the unit may be used to convey urgent cases from the A.D.S. after their proper entry and record, direct to the C.C.S. without being unloaded at the M.D.S. ; all other patients are evacuated from the M.D.S. by the M.A.C.

(*ii*) *Mobile warfare.*

195. In modern mobile warfare, one of the belligerents prepares and delivers an attack which, if successful, will generally mean an advance for a distance which varies according to the military situation, after which there is a halt of at least some days' duration to prepare for the next attack. The medical services will thus in all probability have short intervals in which to clear the units of all sick and wounded and to get ready for the next action. Evacuation may be difficult and slow because of the roads being very congested with troops, traffic and vehicles bringing up supplies, ammunition and stores.

196. It will rarely be feasible to establish a fully-organized A.D.S. There must, however, be a selected position from which the field ambulance bearers work forward to clear R.A.Ps. and to which spot they bring in wounded for transfer to field ambulance transport. The important points in selecting a site are to place it close to a road leading to the M.D.S. and at a spot which can be readily found by bearers, messengers and drivers.

Advanced dressing station.

197. This is the most advanced post in the field at which a casualty is taken over by a medical unit, and is intended to afford only the most urgent treatment.

198. It is formed by one or both of the companies of the field ambulance and possesses only a limited supply of medical and surgical equipment, but the quantity of dressings available should be sufficient to meet any demands.

199. Its function may be described as follows :—

(i) It is the centre from which the field ambulance officer, detailed to superintend the collection of wounded, works forward with his bearers to clear the R.A.Ps.

(ii) It is the spot where sick and wounded from units are collected and from which they are evacuated, generally by wheeled transport provided by the field ambulance.

(iii) In it casualties are retained in shelter until their evacuation becomes possible, which may not be until shelling has ceased or darkness has fallen.

(iv) In it very urgent surgical assistance can be given, collapsed cases can be revived and morphia administered. An arrangement for administering warmth to collapsed cases is essential. Hot drinks should always be available, the stimulation resulting from well-sweetened hot tea or from hot soup being of the greatest value in helping an exhausted patient to bear the journey to the M.D.S.

Note.—A word of warning is necessary as regards the administration of morphia to cases suffering from collapse. Such patients may have had injections of morphia previously, but owing to their condition the drug may have failed to produce any effect. It is wise to withhold further doses of morphia until some recovery from the collapse has taken place under the influence of warmth, when it will often be found that the dose previously administered will induce the desired sleep.

200. The injection of anti-tetanic serum (A.T.S.) and the recording of particulars will usually be postponed till the patient's arrival at the M.D.S. (or W.W.C.P. if one has been established), but delay of more than a few hours after the occurrence of the injury renders the injection of A.T.S. at the A.D.S. a necessity, the appropriate entry being made on the field medical card (A.F. W 3118).

201. The site of the A.D.S. is selected by the O.C. the field ambulance concerned, and its exact position is notified to the M.Os. of units in the vicinity and to the A.D.M.S.

It should be as far forward as possible, in order to reduce the work of the bearers, but it must be in such a position as to allow wheeled transport to get to it or its immediate neighbourhood, wheeled stretcher carriages or hand carriage being used to link up with the ambulance vehicles, if necessary. It will, therefore, be within the area liable to bombardment, and such means as are available should be used to provide protection from projectiles and gas. An ambulance car should be kept at or as near as possible to the A.D.S. (*see* para. **230**).

202. When an action is expected stretcher squads should be held ready for the collection of casualties. The number of bearers and personnel employed at the A.D.S. may have to be increased to meet the demands likely to arise and to permit continuous working for several days on end.

203. An A.D.S., being farther back than the R.A.P., is more liable to be subjected to howitzer fire or bombing, and should, therefore, as far as possible, be constructed to withstand direct hits.

204. An A.D.S. requires :—

(i) Accommodation for casualties pending their evacuation, the number to be provided for depending on the number of casualties likely to be brought in and the facilities for evacuating them.

(ii) Facilities for adjusting dressings or splints and arrest of hæmorrhage. Equipment panniers and trestles can be used to support the loaded stretcher, thus forming a fairly good substitute for an operating table.

(iii) A warming apparatus for the revival of collapsed patients (*see* para. **231**).

(iv) A tank for water or a sheltered spot for the water cart ; means of cooking meals for personnel and making hot drinks for patients ; warmth and ventilation ; latrines. Protection against gas may have to be provided.

(v) A reserve of blankets, hot-water bottles, stretchers, Thomas splints and shell dressings.

(vi) Living accommodation for the M.Os. and the bearers and for the personnel employed in the post, either within it or in its immediate vicinity.

(vii) A firm approach for wheeled vehicles, otherwise in case of heavy rainfall they may become embedded in the mud ; a stand for one ambulance car out of view and sheltered from enemy fire.

An A.D.S. should always be near a road to permit wheeled transport being used to evacuate the wounded.

205. In mobile warfare, it is not possible to put up shelter for the large numbers of wounded likely to arrive at the post. Buildings may be available, and, if suitable, make very convenient dressing stations ; failing these, an evacuated trench can be deepened and widened sufficiently to take stretcher cases while being attended to. One end should be reserved as an entrance and the other as an exit for the patients. Those waiting for transport or during periods of shelling may remain under cover in the trench. An improvised roof may be formed with blankets or ground sheets.

206. If there is no ready-made shelter, the A.D.S. must necessarily become merely a collecting post to which wounded, after receiving such attention as may be possible, are transferred for evacuation to the M.D.S.

Main dressing station.

207. The M.D.S. is formed by the H.Q. of a field ambulance. During position warfare it will be from three to five miles behind the A.D.S. When motor transport is available, the M.D.S. may be located further from the front, if by this means a much more suitable site is obtained. The site should be on or near a good road ; an ample supply of good water is essential. It may receive casualties from a division or corps as well as any occurring in its vicinity, and it should, therefore, be capable of dealing with a large number of sick and wounded daily. It must be in touch with the A.D.S., from which the ambulance vehicles of the field ambulance will be used to collect cases.

208. All cases on arrival at the M.D.S. are sorted out by a M.O. into those for evacuation and those for retention. Cases for evacuation must be carefully examined and any urgent treatment required applied. Splints and dressings should be inspected and readjusted if necessary ; hot drinks should be available. Collapsed cases should be retained until they have revived. Cases requiring immediate operative treatment may be evacuated forthwith to the C.C.S. by field ambulance transport, the remainder being evacuated in due course by M.A.C. Every wounded man must receive an injection of

anti-tetanic serum unless this has already been given at the A.D.S., as marked on his card (*see* para. **200**).

209. Particulars of all patients must be entered in the A. & D. book (A.B. 27) and the field medical card and envelope (A.Fs. W 3118 and W 3118A) completed.

210. Cases to be retained will be dealt with in accordance with instructions issued by the A.D.M.S. Thus, if the forces are stationary and not likely to move for some time, trivial cases likely to recover within, say, one week, may be retained at the headquarters of the field ambulance for treatment. With the approval of the divisional commander, a rest station may be established for cases suffering mainly from fatigue and strain. Special centres may be organized for the treatment of skin cases.

211. In the case of officers, special care must be taken immediately on their admission that their personal belongings, arms and equipment (which is private property, unlike that of a soldier) are collected, listed, packed, labelled and sealed by a N.C.O. detailed for this duty. Special attention must be given to money, valuables and articles of a sentimental nature.

212. In the case of other ranks, if circumstances permit, each patient's arms, equipment, clothing and personal possessions will be listed. Such a procedure is of great value should claims be made for losses stated to have occurred in medical units. During periods of pressure, it is seldom that this can be carried out fully, but special care should be taken of the patients' valuables and personal belongings.

213. In position warfare, buildings, huts or marquees should be used for the M.D.S. If exposed to bombing, each hut or marquee should be provided with sandbag protection to prevent splinters penetrating the walls.

214. Modern schools make good main dressing stations, as they are well ventilated and well lighted, the rooms are large and there is water laid on, very often central heating, ablution places, and a water carriage drainage system.

The following accommodation should be prepared :—

(i) A receiving section for patients on arrival, with arrangements for the supply of hot drinks, sandwiches, cigarettes, etc. Separate accommodation should be provided, if possible, for stretcher cases, and for walking and sitting cases ; this avoids congestion.

(ii) A recording section where each man's particulars are noted.

(iii) A dressing section where dressings and splints can be re-applied, minor surgical treatment carried out and injections of anti-tetanic serum or morphia given.

(iv) Lying down and sitting accommodation for a number of patients awaiting evacuation to a C.C.S.

(v) A section for dealing with gas casualties and contaminated clothing.

(vi) A mortuary.

(vii) Living accommodation for R.A.M.C. officers and other ranks.

(viii) A cookhouse, ablution stands and latrines.

(ix) Stabling or standings for horses and a park for vehicles.

In mobile warfare, if buildings are not available, tentage must be erected, supplemented, if necessary, by improvised shelters (*see* para. **227**).

215. When it is anticipated that an attack will result in an immediate advance, it may be considered advisable to construct a large A.D.S. close to the front, with a view to its becoming the M.D.S. as soon as the front line moves forward.

It should also be borne in mind that the M.D.S. may, as the advance takes place, become the site of a C.C.S. (*see* para. **240**).

Walking wounded collecting post.

216. When a very large number of casualties is anticipated, in order to avoid congestion in the M.D.S., it may be wise to establish a corps or divisional W.W.C.P. to deal with the less serious cases, which are sent to it direct from the A.D.S. or even direct from the units in the front, as may be found most convenient in the circumstances. The site should be easily accessible from the front line and the A.D.S. and on or close to a road leading to the C.C.S. Transport for sitting cases should be provided; motor charabancs are most useful for this purpose. It is also necessary to arrange for a limited amount of ambulance transport, as a certain number of cases which reach the W.W.C.P. on foot require onward despatch as lying cases.

217. During mobile warfare, separate arrangements for the collection of walking wounded will seldom, if ever, be made.

218. A W.W.C.P. should have the following accommodation :—

(i) A reception section provided with benches to seat a large number of patients ; a refreshment bar to supply tea, sandwiches and cigarettes.

(ii) A recording section, in which the A. & D. book and the field medical card must be completed as at a M.D.S.

(iii) A dressing section. In this section each man suffering from wounds or trench feet is given an injection of anti-tetanic serum, his dressings are examined and, if necessary, re-applied, and the nature of the wound is entered in his field medical card by the M.O.

(iv) An evacuation section, where patients can sit, or, if necessary, lie down until transport is ready to take them to the C.C.S. The name of each man evacuated must be noted for completing the A. & D. book and for the information of his C.O.

219. The A.P.M. should always be informed of the location of the W.W.C.P. in order that he may arrange for the collection of stragglers.

Rest stations.

220. When the military situation permits, rest stations may be formed by corps or divisional field ambulances close behind the front for the reception of men suffering from minor disabilities, but not requiring anything beyond simple medical treatment. They fulfil a useful purpose, as a soldier, while freed from the strain and exposure of fighting, still remains under divisional control.

They also relieve the C.C.Ss. of many trivial medical and surgical cases which may, through lack of accommodation there, have to be evacuated to the base forthwith. Rest stations are therefore quite important factors in the conservation of the man power of divisions and for this reason should always be established whenever the tactical situation permits. Should a patient on admission to a rest station be in possession of his arms and equipment, care must be taken to ensure that the rifle is unloaded and maintained in a clean condition.

Cavalry Field Ambulance

221. The cavalry field ambulance is a smaller unit than the field ambulance and serves a smaller formation. Its distinguishing feature is greater mobility to enable it to keep

up with cavalry. It is entirely mechanized and consists of a H.Q. and four sections; it has 12 motor ambulances and 13 motor lorries. The H.Q. is equipped to form a M.D.S. and each section to form a collecting post, comparable to an A.D.S.

222. Except when cavalry is dispersed or acting independently, the work of a cavalry field ambulance is much the same as that of the field ambulance; but, when it is dispersed, the collection of wounded is not easy.

If the country is fairly open, the cavalry field ambulance should be able to keep in touch with the fighting line. As a rule, the H.Q. of the cavalry field ambulance will remain with "B" echelon of the brigade and send forward the necessary number of sections to keep in touch with the various units.

223. It is often of assistance to place temporarily at the disposal of regimental M.Os. a motor ambulance to facilitate the evacuation of casualties to collecting posts.

224. A M.D.S. can rapidly be improvised by stretching large waterproof sheets, carried for the purpose, between two or more lorries.

Such a temporary M.D.S. can be erected in a few minutes, and as rapidly closed, thus preserving mobility, the essential feature of the cavalry field ambulance.

225. The O.C. the cavalry field ambulance must maintain liaison with the brigade, and especially with the M.Os. in charge of units.

226. If the wounded cannot be evacuated, *e.g.* in a retreat, they must be left in the care of the local authorities, and, if the G.O.C. approves, some of the cavalry field ambulance personnel should be left to look after them. Failing instructions from the A.D.M.S., the O.C. will use his own discretion in this matter.

Notes on the Construction and Equipment of Medical Posts

227. Before beginning the construction of a medical post, the officer concerned should ask his A.D.M.S. to find out from the divisional staff what material and labour are likely to be available; he should obtain technical advice from the R.E. and ascertain if any standard plan has been adopted for the construction of shelters and dug-outs in the corps (*see* Manual of Field Engineering, Vol. I (All Arms)). This will save much

time and labour, as the shelter can be constructed to suit the standard roofing, girders or timbers available.

228. The construction of a R.A.P. is the duty of the unit holding the line at the time, but the M.O. should be consulted as to its suitability (*see* para. **174**).

229. The construction of A.D.Ss. and M.D.Ss. is carried out by the field ambulance with such assistance as they may be able to obtain from the R.E. and other troops. Only one part of the personnel of a medical unit should be employed at any one time on such construction work, a sufficient reserve being kept to carry out their proper duties and to provide for unexpected demands.

230. In planning a R.A.P., A.D.S., M.D.S. or W.W.C.P., the following points should be kept in mind :—

(i) It should afford shelter from the weather—wet and cold in temperate zones and direct sunshine in the tropics.

(ii) It should give protection from enemy action. This may be rifle fire, gun fire, air bombing or gas attacks ; in uncivilized warfare, protection from direct rifle fire is usually sufficient.

(iii) It should be conveniently situated and easily accessible ; the entrance and exit should be separate and allow of a loaded stretcher being carried into or out of the post.

(iv) It should not be conspicuous to the enemy, yet should easily be found by stretcher bearers or by walking wounded. If the enemy is using aircraft, no lights should be visible at night.

(v) It should be capable of affording accommodation for the wounded until they can be evacuated.

(vi) It should provide separate accommodation for gas casualties.

231. Warming apparatus.—Severely wounded men are liable to suffer from collapse, especially if they have unavoidably been exposed for a time to the cold. Hot drinks help to counteract this condition, but in severe cases something more is required. Hence, whenever it is possible to do so, a warming apparatus should be constructed in each medical post, which will allow of the patient being surrounded by a layer of heated air. A simple way of doing this is as follows :—

Construct or improvise two trestles, or better a frame to take the patient on his stretcher. Fix blankets round the sides to reach from the level of the stretcher to the ground, thus forming a chamber which is nearly roofed in when

the stretcher is placed on the frame. Outside this chamber is placed a Primus stove or other source of heat with a pipe about four inches in diameter leading into the chamber. The patient is covered with blankets which fall over the sides of the apparatus but which are kept a few inches away from the body by bent twigs, wires or other means. The heated air is thus confined round his body. Care must be taken to minimize the risk of fire.

Motor Ambulance Convoy

232. A motor ambulance convoy (M.A.C.) is a medical transport unit commanded by an officer, R.A.M.C. It comprises a medical wing and a transport wing. It is organized as a H.Q. and three sections (each of 25 motor ambulances).

M.A.Cs. are utilized for clearing the sick and wounded from field ambulances to casualty clearing stations and from casualty clearing stations to ambulance trains. They are usually allotted for this purpose in the proportion of one to each corps. They are allotted as G.H.Q. troops under the direct orders of the D.M.S., but are, on occasion, placed under the orders of a D.D.M.S. corps, one or more being retained by the D.M.S. for allotment as necessary in emergency.

233. When a M.A.C. is being employed to convey patients from a M.D.S. to a C.C.S., the O.C., M.A.C., should ascertain from the O.C., M.D.S., the numbers of lying and sitting cases for which transport is required. During quiet periods, the evacuation should take place about the same time daily; this facilitates the routine work of the C.C.S. The M.A.C. may also be detailed to clear the C.C.S. to the ambulance train, if there is no railway siding at the C.C.S.

234. During an action, the O.C. should be ordered to detail sufficient cars to ply between each M.D.S. and the C.C.S., keeping a reserve in hand to meet reliefs and emergencies, but he should be given a free hand to vary these orders to meet unforeseen situations, merely reporting his action to higher authority for approval.

He, or one of his officers, should reconnoitre the routes to be followed by the cars and see that every driver is acquainted with the traffic control orders; if this is not done, the evacuation of the wounded will clash with other traffic. He should ascertain at intervals that every M.D.S. and C.C.S. served by his cars is adequately supplied with transport and that only a reasonable time is occupied in the double journey; if too long a time is being taken, he should find out and, if possible, rectify the cause of delay. He will arrange

that supplies of petrol, spare tyres, etc., are available in easily accessible points to obviate the necessity of returning to unit H.Q.

235. If heavy casualties are expected, the D.D.M.S. may be able to arrange for the loan of other motor vehicles to be attached temporarily to the M.A.C., as additional transport for conveying lightly wounded from the M.D.S. or W.W.C.P. to the C.C.S.

236. In order to maintain the supply of stretchers and surgical appliances in M.D.Ss., it is important that each car, on unloading its patients at a C.C.S., should receive the same number of stretchers, blankets, splints, hot-water bottles or other appliances as are handed in with patients.

237. Care must always be taken to see that drivers have sufficient rest and food and are not too fatigued to carry out their duties. A frequent cause of disability amongst drivers is conjunctivitis caused by dust or cold. This can largely be avoided by the provision of eye-lotions and insistence on the use of goggles.

Casualty Clearing Station

238. C.C.Ss. are allotted in the proportion of one for each division in the field as G.H.Q. troops. Their function is to receive sick and wounded from field ambulances and also direct from troops in the vicinity.

239. In a great war, their establishment may be altered to allow of the formation of surgical teams, one or more of which may be lent to other units or C.C.Ss. that require assistance.

Such surgical teams comprise :—

Surgical specialist	1
Anæsthetist	1
Sister	1
Operating room assistants	2
Theatre bearers	4
Batman	1

No sisters are included in the normal establishment.

Experience has shown that the largest number of teams that a C.C.S. can make use of at any one time is eight.

240. The establishment and equipment allow for a light section being formed which, in mobile warfare, may be sent forward to take over a M.D.S. or to open at a site suitable for the C.C.S. Hence it is advisable, in choosing a site for the M.D.S., to bear in mind that it may be taken over by a C.C.S. and its requirements in ground space, 300 yards by 200 yards, should not be lost sight of. The light section equipment may

be carried in ten 3-ton lorries. In case of a rapid advance, this light section may be ordered to take over from the field ambulances and thus enable them to advance with the troops. This procedure gives the heavy section of the C.C.S. time to evacuate its cases before re-joining the light section.

241. When it is necessary to move a C.C.S., transport will be provided under arrangements made by formation commanders. The approximate number of lorries required for the conveyance of ordnance and medical equipment is 22 3-ton lorries, and for the personnel three 3-ton lorries. If the unit is moved by rail, ten railway trucks, and two coaches for personnel, will be required. It must be borne in mind that this transport covers mobilization equipment only, and does not include any additional articles that may have been found necessary.

242. During position warfare, C.C.Ss. may be grouped to facilitate working, supplies, transport, etc., but one should always be kept ready to move at short notice. It must be remembered that a C.C.S. is a bulky unit and not readily rendered mobile. It is estimated that at least 48 hours must elapse before a C.C.S. in process of detrainment can be made ready to function even partially.

243. During a rapid advance, C.C.Ss. may be employed in echelon, that is to say, one C.C.S. may be working at the front, one in rear closing and packing up, and one may be on the move to take up a position in advance of the first. This arrangement economizes transport, which will thus only be required for one C.C.S. on the move at any one time.

244. In choosing a site for the C.C.S., the following conditions must be complied with :—

(i) A C.C.S. will be located at least 1,000 yards from any large railway junction, viaduct, depot, park or dump.

(ii) It will be at least 500 yards from a main line of railway, or waterway used as a main line of supply.

(iii) It should be connected, by a light railway or trolley line, to an ambulance siding on the main line. If, however, it is practicable to provide it with its own ambulance train sidings, in close proximity, connected with the main line by a special branch line, this should be done.

(iv) There must be a good road for incoming and outgoing motor ambulance transport.

(v) Ample water supply must be available.

245. During quiet periods, a certain number of patients who are likely to be fit for duty in a fortnight may be retained for treatment in the C.C.S., but, when active hostilities are in progress, wounded arrive in such large numbers that the bulk of them must be evacuated at the first opportunity. To deal with these expeditiously requires a well thought out plan.

246. Usually the D.M.S. will arrange that one C.C.S. receives patients for a certain period, varied according to the rate of influx. When the C.C.S. has taken in as many cases as it can deal with, the stream is switched on to another unit to give the first C.C.S. time to dispose of its cases and be ready to take in further patients. It is therefore advisable to locate C.C.Ss. in pairs or even in threes, if heavy casualties are expected.

247. Organization.—An unloading party will be ready to unload each motor ambulance car as it arrives. The driver should then be directed to the store, where he receives stretchers, blankets, splints, hot-water bottles, etc., in exchange for those given up with the patients.

248. Separate accommodation for stretcher cases and sitting or walking cases should be provided in the receiving section. Patients, on arrival, are examined by the M.O. on duty and marked for immediate operation, for resuscitation, for dressing or for evacuation, as the case may be, and removed to the appropriate section, those for evacuation being provided with food.

249. The designation of the C.C.S. and the treatment given there are entered on the F.M. card and the particulars of each case entered in the A. & D. book.

250. On the evacuation of patients by ambulance train, stretcher cases should be entrained first. Walking cases should then be paraded in groups opposite the entrance of the railway carriage. The entraining officer, with the O.C. ambulance train, checks the evacuation rolls and superintends the entrainment.

Ambulance Trains

251. Although primarily ambulance transport units, permanent ambulance trains are staffed and equipped to provide food and treatment during the journey. Normally trains are provided on the scale of one for each division in the field for small forces and two for every three divisions for large forces. The number of trains required will depend on the scale of operations and the distance of the seat of operation from the base ports.

252. When the number of organized ambulance trains is insufficient, temporary ambulance trains formed from available suitable rolling stock will be provided by the transportation service on the orders of the Movement Control (*see also* Manual of Movement (War)).

The movement of ambulance trains is carried out under the executive orders of the Director-General of Transportation.

253. Entraining.—To obviate confusion and delay, the O.C. train should draw up a scheme for entraining patients. In addition, an officer of the unit from which the patients are being transferred will be in possession of nominal rolls and ensure that no patient is entrained whose name is not contained in them.

254. General.—During a journey, patients must not be allowed to leave the train. Care must be exercised to safeguard the private belongings of patients and to see that they are sent to the same destination as their owners on detraining.

Note.—For alternative methods of transport, *i.e.* by barge and steamer, *see* para. **480.**

General Hospitals

255. These units are of 600 and 1,200 beds and are mobilized in sufficient numbers to provide accommodation normally for about ten per cent. of the force. The percentage may be varied according to the nature of the campaign and climatic conditions. They are fully equipped hospitals and can afford treatment for any kind of disability.

256. General hospitals are located in base and L. of C. areas. One or more may be located near, or even in advance of, ambulance railhead for the reception of serious cases which it would be inadvisable to evacuate. When the L. of C. is long or for any reason an advanced base is established, it may be advisable to group a proportion of general hospitals in the advanced base area for the reception of cases not likely to require evacuation from the theatre of operations.

257. A general hospital has medical and surgical divisions, each under the charge of an officer specially selected for his professional ability.

258. The principles laid down in para. **244** for the location of C.C.Ss. will be applied generally to that of general hospitals.

In planning a general hospital, the following points require attention :—

(i) The C.O.'s office and administrative block should be centrally situated, preferably alongside the reception section.

(ii) The entrance should lead into a reception section, having adjoining it a clerks' office for recording admissions and discharges and answering queries in reference to patients.

(iii) The reception section should be connected by covered passages with the wards for serious cases and with the operation room.

(iv) The kitchen should be close to the dining-room and connected with it and the wards by covered ways.

Note.—Much useful information on this subject is given in the Official History of the Great War, Medical Services, General History, Vol. II, Chapter III.

259. On the admission, evacuation and discharge of patients, the procedure indicated in the following paragraphs should be adopted.

260. *Admission.*—When notification is received that a convoy of patients is arriving, the reception staff will be held in readiness. This staff should consist of a M.O., one or more clerks according to the numbers to be dealt with, a representative of the quarter-master's department to take over kits and private property, a suitable number of stretcher squads and a few men to conduct and assist walking patients.

On arrival, the patients are taken into the reception section, where they are inspected by the M.O. and assigned to particular wards according to the nature of the disability. Their particulars are taken by one of the clerks. Stretcher cases, on arrival in their wards, are examined by the officers in charge of divisions or their representatives to decide as to the treatment required. Walking cases, unless requiring urgent treatment, normally proceed to a special section where they are bathed and receive clean clothing.

261. *Evacuation.*—The C.O. should maintain a list of patients for evacuation by categories which should be checked at least once a day. On receiving information from the D.M.S. of a convoy of patients to be dispatched to home hospitals and the number of places allotted to his hospital, the C.O. orders officers in charge of divisions to select patients and submit lists of their names. He then inspects the patients selected and satisfies himself that they are suitable for transfer. Having decided which patients are to be transferred, he ensures that A.Fs. W 3083 (ship's label) and W 3118 and 3118A are completed for each patient and that a nominal roll is prepared in quadruplicate. One copy of the latter is forwarded to D.M.S., one to O.i/c, 2nd Echelon, one is retained as a record and one is handed to the officer proceeding in charge of the

invalids, who checks the names on it with the ship's label attached to each patient and, on arrival at the ship, hands it to the E.M.O.

262. *Discharge.*—Patients who are considered by officers in charge of divisions as not requiring further hospital treatment will be notified to the O.C. hospital, who will inspect them and, if he concurs, mark their diet sheets for discharge to duty or to a convalescent depot.

Convalescent Depots

263. Convalescent depots are medical units. Their establishment consists of a very small nucleus of R.A.M.C. officers and other ranks and a larger complement of officers and other ranks detailed from combatant units and usually selected from those who are considered unfit through wounds, etc., for further front line work. Their organization is based on a H.Q. and two divisions, each being capable of dealing with 1,000 men.

264. Convalescent depots are of two classes :—

(i) Advanced convalescent depots—located near railheads to receive cases from C.C.Ss.

(ii) Convalescent depots—established to receive cases from general hospitals. By this procedure, many cases are retained in the theatre of operations which would otherwise have to be sent home, accommodation is more quickly made available at general hospitals and much economy in transport is effected.

265. They will be sited on the principles laid down for a C.C.S. or general hospital. The following amenities are necessary :—

(i) A large parade ground.

(ii) Large dining halls for the accommodation of 1,000 men.

(iii) A gymnasium, lecture rooms, theatre, Y.M.C.A. and similar institutes.

(iv) Laundry and bathing facilities.

266. When a soldier has recovered from a wound or illness, he is better out of hospital, but he is not likely to be fit for duty with his unit until he has had an opportunity of regaining his physical and mental strength. To meet these cases convalescent depots are instituted. The important

points in connection with the training carried out in these depots are :—

(i) Graduated exercises to restore physical fitness.
(ii) Recreation and amusement.
(iii) The elimination of irksome discipline.

267. The first object is attained by grading the men into three categories. On admission, they are placed in the lowest category and put through a short course of physical exercises of a light and interesting character, but calculated to bring all the muscles of the body into play.

268. In the next category, the exercises last longer and make a greater demand on the soldier's physical energy, while in the highest category, more strenuous exercises and games and route marches are carried out until the soldier has become fully fit for duty.

269. All possible means of recreation, both outdoor and indoor, should be provided and, if possible, a cinema and concerts. Particular attention should be paid to food and cooking, which should be as far as possible varied, and in contrast to the necessarily limited range of cooking in a unit in the field. Well-cooked and attractive meals exercise a most beneficial influence in hastening the restoration of physical fitness.

270.—In regard to discipline, men should be informed that they must conform to orders of the camp and that breaches of the rules will necessitate the introduction of disciplinary measures which must necessarily entail more or less discomfort to all.

271. Before a man is discharged from a convalescent depot, he should be most carefully inspected by the O.C., who should satisfy himself that the man is fit for duty (*see* para. **137**).

272. If patients fail to regain their fitness within a reasonable time, they should be brought before the standing medical board for further consideration.

Hospital Ships

273. Hospital ships convey sick and wounded from base ports to military hospitals outside the theatre of operations. Their numerical allocation to a force will depend on various factors such as the size of the force, the estimated number of evacuations and the distance of the theatre of operations from home ports. Details of the categories of hospital ships and other information will be found in Chapter XX, also in F.S.R., Vol. I., and the Manual of Movement (War).

ADDITIONAL MEDICAL UNITS

274. Field hygiene sections.—These sections are allotted to a force as divisional, cavalry divisional, corps or L. of C. troops.

The details of the sanitary organization in the field and the duties of field hygiene sections are contained in the Army Manual of Hygiene and Sanitation and F.S.R., Vol. I.

275. Mobile hygiene or bacteriological laboratories.—These are provided for each army in the field in the proportion oi one hygiene to two bacteriological laboratories. They will normally be located in proximity to a C.C.S. or group of C.C.Ss., but may be despatched to any area of the field of operations where an outbreak of disease requires investigation.

276. Depots of medical stores.—These are classified into advanced and base depots.

Advanced depots.—These are provided normally on the basis of one to every corps and are located in the forward areas, preferably at ambulance railhead or in the neighbourhood of a C.C.S. or group of C.C.Ss. They supply medical equipment on requisition to all medical units in the divisional and corps areas.

Base depots.—These are provided, if necessary, on the scale of one to every base port organized for disembarkation in a theatre of war and supply medical equipment to advanced depots of medical stores and to all units behind corps areas. They are located where they can most easily receive stores in bulk from home and distribute them.

CHAPTER XIII

EVACUATION OF CASUALTIES

277. General.—The medical service in the field is organized to effect rapid evacuation of the sick and wounded. The efficiency with which this system is organized and administered greatly affects the mobility and morale of the army. (F.S.R., Vol. I.)

278. Anyone who for any reason becomes unfit to perform his duty in the field is a hindrance to the efficiency of the force, and his presence among fighting troops tends to lower their morale. He must, therefore, be removed as speedily as

possible to some place where he can be properly treated and restored to physical efficiency, or otherwise disposed of according to the nature of his wound or disability. This procedure is known as evacuation.

279. In making arrangements for the evacuation of sick and wounded from a force in the field two categories have to be considered, viz., the daily sick and wounded from casual encounters, and the wounded from an engagement.

280. The daily admissions to medical units of sick and casual wounded are usually assumed to amount to 0·3 per cent. of the force. This figure is, in the absence of any epidemic, *e.g.* influenza, or of very unfavourable climatic conditions, quite a liberal estimate for a campaign in a temperate zone. In the tropics endemic diseases, especially malaria, may easily cause a great increase in the daily sick rate.

281. In ordinary circumstances about 40 per cent. of the daily sick can, if the military situation permits, be treated in divisional medical units and should be fit to return to duty in a week. The remainder will have to be evacuated, but about 80 per cent. of them should be fit to rejoin their units within a month.

282. Cases of infectious disease are almost certain to occur and must be evacuated as quickly as possible by transport reserved for this purpose, to a hospital specially arranged for their treatment. Mental cases require an escort to their destination.

283. When a general engagement takes place, a large number of wounded will have to be collected and evacuated. Fig. 25 shows the chain of evacuation in diagrammatic form.

284. Procedure.—The normal procedure is described in the following paragraphs, but modifications in detail may be necessary to meet local requirements.

285. When a man in a unit is wounded, the regimental stretcher bearers or his comrades should apply his first field dressing. He then makes his way, or, if unable to do so, is carried by the *regimental* stretcher bearers to the R.A.P. Here the M.O. gives such attention as may be possible, affixes a field medical card, A.F. W 3118, with his diagnosis, noting if morphia has been given, and directs him to the A.D.S. If unable to walk, he is carried by the *field ambulance* stretcher bearers to the A.D.S.

286. Any unwounded prisoners of war who are being sent to the rear should be made use of to assist in carrying wounded.

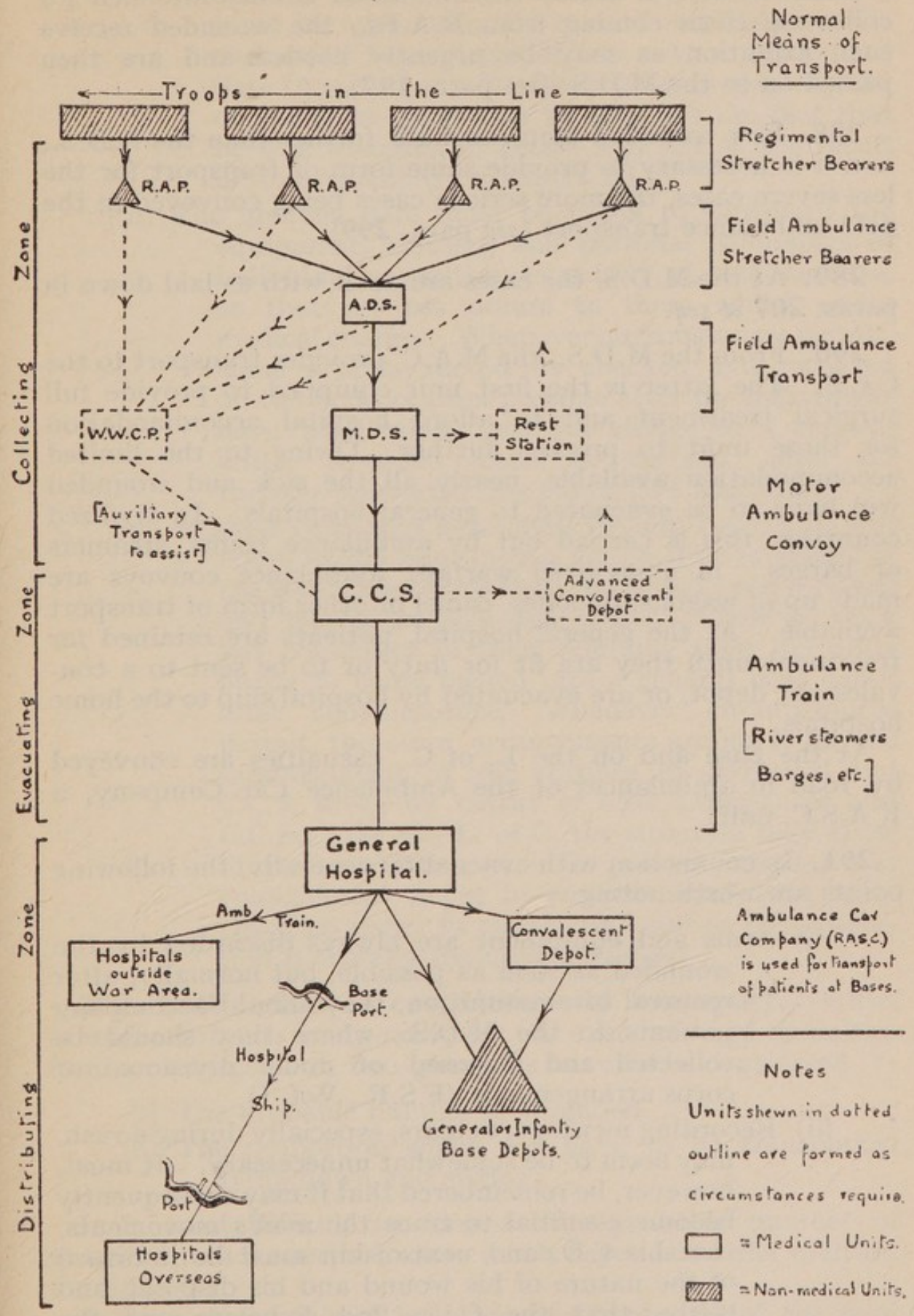


FIG. 25.—DIAGRAM TO SHOW CHAIN OF EVACUATION

287. On arrival at the A.D.S., which is only intended for collecting cases coming from R.A.Ps., the wounded receive such attention as may be urgently needed and are then passed on to the M.D.S. (*see* para. **197**).

288. Few wounded men can walk further than the A.D.S., and it is necessary to provide some form of transport for the less severe cases, the more serious cases being conveyed in the field ambulance transport (*see* para. **299**).

289. At the M.D.S. the cases are dealt with as laid down in paras. **207** *et seq.*

290. From the M.D.S., the M.A.C. provides transport to the C.C.S. The latter is the first unit equipped to provide full surgical treatment and to afford hospital accommodation for those unfit to proceed further. Owing to the limited accommodation available, nearly all the sick and wounded will have to be evacuated to general hospitals. In civilized countries, this is carried out by ambulance trains, steamers or barges; in uncivilized warfare, ambulance convoys are made up of wagons, dhoolies, camel or other form of transport available. At the general hospital, patients are retained for treatment until they are fit for duty or to be sent to a convalescent depot, or are evacuated by hospital ship to the home hospitals.

At the base and on the L. of C., casualties are conveyed by road in ambulances of the Ambulance Car Company, a R.A.S.C. unit.

291. In connection with evacuation generally, the following points are worth noting :—

(i) Arms and equipment are always discarded by the wounded as soon as possible, but normally, after removal of ammunition, they should accompany patients to the M.D.S., where they should be collected and disposed of under divisional or corps arrangements (F.S.R., Vol. I).

(ii) Recording men's particulars, especially during a rush, may seem to be somewhat unnecessary. It must, however, be remembered that it may subsequently become essential to trace the man's movements, that his C.O. and next-of-kin must be informed of the nature of his wound and his disposal, and lastly, that the O.i/c, 2nd Echelon, and the A.D.M.S. have to render returns showing the number of casualties. However irksome it may be at the time, the recording of a man's particulars

and the nature of his wound or other disability must be systematically carried out before he is evacuated beyond the M.D.S. At a much later date the grant of a disability pension may depend on the man being able to establish the fact that he was wounded in action and not as the result of an accident (*see* Chapter XIV).

(iii) The greatest care must be taken to safeguard the equipment, clothing and personal belongings of individual casualties, especially of helpless ones, so that no loss occurs to them whilst under medical charge. Whenever circumstances permit, these articles should be checked and recorded on the first occasion possible after the individuals have been taken into the charge of a medical unit. So-called losses in medical units are thereby prevented (*see* paras. **211** and **212**).

(iv) Slighter casualties evacuated beyond the C.C.S. and down to the base take a longer time in rejoining the front line troops than do similar ones retained and treated in divisional areas. There is much less possibility of their rejoining their old units owing to being passed into a general base depot after convalescence. Whenever circumstances permit, therefore, arrangements are made for the establishment of rest stations in divisional and C.C.S. areas by means of field ambulances and C.C.Ss. On the L. of C. the situation may allow of the establishment of a general hospital and convalescent depot in the advanced base area. Great economy in man-power and in transportation is thereby frequently effected.

292. Estimation of casualties and transport.—When arrangements are being made for the evacuation of casualties from an engagement, two questions have to be considered :—

(i) The probable number of wounded.

(ii) The proportion which will have to be transported lying down and sitting.

It is most difficult to forecast the probable number of wounded in a formation, as so much depends on the military conditions.

A close study should be made of Chapter II of the final volume of the Medical History of the War (Casualties and Medical Statistics), which gives a survey of casualties that occurred in the Great War. In that chapter are to be found

many tables and comments thereon which should prove of practical value to officers administering the medical services.

293. The General Staff must for their own purposes make a forecast of the casualties to be expected, and they should be consulted.

294. An attack on an enemy possessing little or no artillery should not result in more than 5 per cent. of casualties of the troops engaged, many of which would not be serious, while an attack on a highly trained force, equipped with the latest modern weapons and holding a fortified position, may cost the attacking force 40 to 50 per cent. of its strength. The casualties occur in waves as each forward movement takes place, with intervals of quiescence lasting a few hours or even a whole day.

295. Experience in one of the great battles in France during the Great War showed that in the first 48 hours the wounded who had to be evacuated approximated to 20 per cent. of the troops engaged, while at the end of the first week of the battle the wounded evacuated totalled 40 per cent. of the troops actually engaged. Individual formations, if caught in a disadvantageous situation, may lose more heavily, up to nearly 50 per cent. in a few hours.

296. Future developments in offensive weapons, especially those of a chemical nature, may necessitate an entire revision of these rough estimates.

297. As regards the number of killed, the generally accepted ratio is 1 killed to 5 wounded, but effective enemy artillery fire will increase the ratio of killed as also of seriously wounded who require lying-down transport.

298. In calculating the transport required, the area should be divided as follows :—

(i) In the region between the front line and the A.D.S. it may be assumed that 25 per cent. of the wounded will require lying-down transport, and the remainder, with the assistance of wounded comrades and casual means of transport, will make their own way back for one to two miles. Immediately before an attack, most men are in a state of high nervous tension. For a variable time after being wounded, this state of excitement enables a man to make his own way towards an A.D.S. A reaction, mainly due to nervous exhaustion and, to a certain extent, to the shock of being wounded, then makes itself felt, and the wounded man is unable to proceed further without the aid of some form of transport (F.S.R., Vol. I).

(ii) Between the A.D.S. and the M.D.S. the proportion of lying-down cases will increase slightly, say, to 30 per cent. of the total wounded. Transport for sitting cases will be required for the remainder.

(iii) From the M.D.S. to the casualty clearing station all wounded must be provided with transport, say, 50 per cent. lying and 50 per cent. sitting. If a W.W.C.P. has been established, 5 per cent. of the wounded admitted to it will require lying-down transport, while the remaining 95 per cent. should be provided with sitting transport.

(iv) From the casualty clearing station to the general hospitals, during active operations, 50 per cent. of cases evacuated will require lying-down and 50 per cent. sitting accommodation.

299. Should transport, additional to that allotted to the medical service, be considered necessary in order to evacuate the wounded, application should be made to the Quarter-Master-General's branch of the staff.

CHAPTER XIV

RECORDS, REPORTS AND RETURNS OF CASUALTIES BY FIELD MEDICAL UNITS

300. General remarks.—The first place on the line of evacuation where a permanent record can normally be made is at the M.D.S. and W.W.C.P., if the latter is formed. Whenever circumstances permit, a manuscript record will be kept in A.D.Ss. so that enquiries from regimental units as to the disposal of particular personnel may readily be answered. This may take the form of a duplicate copy of nominal rolls of casualties which are sent to the M.D.S.

301. In quiet times, recording can easily be carried out by the normal staff of clerks of the medical unit forming the M.D.S., but, when large numbers of wounded have to be recorded, as during an action, it will be found necessary to increase the staff of clerks by assistance from other field ambulances. If a corps M.D.S. or W.W.C.P. is formed, the D.D.M.S. will arrange that each division engaged sends two or more clerks to assist there. The clerks of each

formation should have separate tables clearly marked with the formation sign so that all casualties in each formation may be recorded by its own clerks.

302. The importance of the most careful recording and reporting of all casualties by medical units cannot be over-emphasized. Apart from their being the source from which the general medical statistics of a campaign are compiled, they should contain that complete medical history and record which will be a deciding factor in the event of an individual subsequently making a claim to a gratuity or pension for a disability received.

Field Ambulances

303. In addition to the returns to be rendered by Os.C. units in accordance with F.S.R., Vol. I, the following records will be kept and returns rendered by field ambulances :—

(i) **Records.**—A.F. W 3118 (field medical card) and A.F. W 3118A (envelope), if not already initiated before admission, will be completed for every patient admitted or transferred to a field ambulance. They must be most carefully completed for the reason given in para. **302.** As it is important to standardize the entries, the following abbreviations will be adopted :—

$\frac{\text{A.T.S}}{1000}$ =Anti-tetanic serum 1,000 units.

$\frac{\text{M. } \frac{1}{4}}{1800}$ =Morphia gr. $\frac{1}{4}$, given at 1800 hours.

$\frac{\text{T.}}{1820}$ =Tourniquet applied at 1820 hours.

U. =Urgent case—should be marked with red pencil or ink.

Particulars of every case admitted or transferred will be entered in the A. and D. book (A.B. 27A).

(ii) **Reports and returns.**—(*a*) All deaths occurring will be reported as follows :—

(i) *Officers.*—By telegram to the O.i/c 2nd Echelon at once, with confirmation by post the same day. (Deaths of R.A.F. officers are reported to the base personnel staff officer.)

(ii) *Other ranks.*—By post to O.i/c 2nd Echelon as they occur.

(*b*) A weekly report on A.F. A 36 (nominal roll of patients in field ambulances) of all admissions, discharges, transfers and deaths of officers and other ranks, will be sent to the O.i/c 2nd Echelon. In such reports, the nomenclature for the classification of battle casualties laid down in F.S.R., Vol. I, will be adhered to, as also the action to be taken in regard to accidental or self-inflicted injuries.

(*c*) During active hostilities, divisional commanders may require to be kept informed frequently of the number of casualties occurring and evacuated. To enable the data for the completion of this information to be available without delaying the evacuation of casualties, the following system should be adopted. At the door of the receiving room of the M.D.S. a clerk is stationed who notes the number of cases by units, walking or stretcher, as they pass and so at any moment the number admitted can be checked. A supply of buff slips with counterfoils is kept ready so that a slip can be gummed by one corner of the counterfoil to the A.F. W 3118A (envelope) of each patient. While each case is being dressed, the buff slip and counterfoil are filled in with the number, name, unit and diagnosis of the patient, in addition to the necessary entries in A.F. W 3118.

When the case is passed into the evacuating section, the buff slip is torn off, leaving the counterfoil, and passed to the clerk in charge of the A. and D. book (A.B. 27A), who enters the particulars at his convenience.

When the case is loaded on an ambulance for evacuation, the counterfoil is torn off and passed to the A. and D. clerk as a notification that the case has been evacuated.

The following examples illustrate the above method :—

Case 1.—If the clerk at the receiving room has recorded 200 cases, and the A. and D. clerk has 200 buff slips, this will indicate that 200 cases have been admitted, are dressed and await evacuation.

Case 2.—If the clerk at the receiving room has recorded 200 cases, and the A. and D. clerk has 200 buff slips plus 180 counterfoils, this will indicate that 200 cases have been admitted and dressed, 180 evacuated and 20 await evacuation.

The A. and D. clerk should arrange the buff slips by units, thus enabling the telegrams, recording casualties by units, to be made out easily.

Further, classification for evacuation may be simplified by a system of agreed signs on the buff slip, *e.g.* a circle for lying-down cases, a square for walking cases and additional signs, as necessary, to avoid a mixed load being despatched when C.C.Ss. are reserved for particular classes of casualties.

Casualty Clearing Stations

304. (i) **Records.**—These will be maintained as for a field ambulance.

(ii) **Reports and returns.**—In addition to those required for a field ambulance, the personal numbers and names of officers and army numbers, names and corps of other ranks who are on the dangerously ill list, together with the nature and degree of disability and any changes in their condition, will be telegraphed daily to the Casualty Section, The War Office, and repeated to the O.i/c 2nd Echelon.

General Hospitals

305. (i) **Records.**—A.F. I 1220 (hospital record or sick list card) will be prepared for every patient admitted or transferred to a general hospital and particulars of each case will be entered in the A. and D. book. The former will be compiled and disposed of in accordance with the instructions contained in Regulations for the Medical Services of the Army and Field Service Manual, Medical Services.

(ii) **Reports and returns.**—In addition to those required from a C.C.S., with the exception of A.F. A 36, the following reports will be rendered :—

(*a*) A daily report on A.F. W 3034 (nominal roll of patients in hospital) showing particulars of all admissions, discharges, transfers and deaths of officers and other ranks, will be sent to the O.i/c 2nd Echelon and a copy forwarded direct to the Casualty Section, The War Office.

(*b*) A weekly progress report on A.F. W 3034A of dangerous and serious cases (officers and other ranks) will be sent to the Casualty Section, The War Office, with a copy to the O.i/c 2nd Echelon.

306. *Invalids.*—The O.C. the medical unit concerned will prepare and forward to the O.i/c 2nd Echelon a nominal roll on A.F. W 3034 of all invalids proposed for embarkation, classified in accordance with the categories defined in F.S.R., Vol. I.

307. *Special returns.*—These may be called for by the D.M.S. or other administrative medical officers, subject to the restrictions laid down in para. **156.**

CHAPTER XV

THE EMPLOYMENT OF THE MEDICAL SERVICES IN THE FIELD

308. The term employment of the medical services in the field is here used to cover :—

(i) The scheme of medical arrangements for a force, including the arrangements for dealing with special categories, *e.g.* infectious, mental, venereal cases, the location of medical units allotted as G.H.Q. troops (*see* para. **131**), and the general policy as to retaining sick and wounded in the theatre of operations.

(ii) The work of an administrative medical officer at the H.Q. of a formation engaged in active operations, the nature of the work varying according to the military situation.

309. The D.M.S. will submit a scheme dealing with (i) above to the G.O.C.-in-C. for his approval.

310. Before formulating his scheme, the D.M.S. should make an appreciation of the situation from the point of view of his service (*see* Chapter XVI).

311. From the General Staff he will obtain information as to the topography of the area, the local resources and water supply, also some idea of the nature of the operations about to be undertaken and the anticipated number and nature of the casualties from enemy action. From the Quarter-Master-General's branch of the staff he will ascertain the line of supply for the force, which must necessarily also be the line of evacuation for casualties, the means of transport to be employed, the position of railheads (ambulance, supply and ammunition), and of the advanced base and the most suitable sites from the Quarter-Master-General's point of view (transport and supplies) for C.C.Ss. and general hospitals. The A.D.H. and A.D.P. should be able to furnish information as to the likelihood of adverse climatic conditions and of endemic or epidemic diseases.

Certain general principles should be borne in mind.

(i) All casualties must be evacuated from the area of active operations as speedily as possible.

(ii) The effective strength of the force must not be depleted by evacuating casualties to a greater distance than is necessary.

(iii) Economy in the use of all forms of transport is essential.

(iv) Stationary medical units should be located in easily accessible places, but must not hamper the distribution or supply of the force.

312. The D.M.S. has first to decide whether the hospital accommodation and means of transport provided in War Establishments will meet his expected requirements. For the purpose of estimating the accommodation required in general hospitals, he may assume that the daily sick and wounded from casual encounters will amount to 3 to every 1,000 of the force. Nearly one-half of these can be cared for in medical units at the front; the remainder will require hospital accommodation in general hospitals. If he is of opinion that further provision is necessary, he must draw up a statement of his requirements and submit it to the Adjutant-General.

313. In addition to the requirements of the ordinary sick and wounded, arrangements have to be made for the treatment of special categories, *e.g.* officers, sisters, infectious cases, mental, venereal, gassed, prisoners of war, and possibly civilian employees and inhabitants; also separate hospitals for coloured troops or labourers, if these are included in the force. Accommodation for these special categories will be provided out of the total beds allowed for the force (*see* para. **255**).

314. Location of units.—The next point to be decided is the location of medical units allotted as G.H.Q. troops, more especially the C.C.Ss. and the general hospitals. These units must be able to obtain supplies easily and to evacuate casualties in large convoys. They must therefore be located on or very close to the line of evacuation.

315. The Casualty clearing station is the first unit behind the front line which can provide full surgical treatment and hospital accommodation for seriously wounded. It is highly desirable, therefore, that this unit should be located near the M.D.Ss. which it serves, as this permits of considerable economy in the number of transport vehicles required to bring in the casualties and further reduces the length of road journey and the time that must elapse between the infliction of the wound and the provision of treatment in a hospital.

At the same time it must be borne in mind that during active hostilities nearly all the cases must be evacuated within a very short time of their admission. The C.C.S. must

therefore be on or near a railway or some other means of transport that will permit of the evacuation of large batches of casualties.

It may be possible to effect a compromise by pushing up the light section alone and retaining the heavy section further back.

316. General hospitals.—Before a general hospital is ordered to be opened in any locality, every endeavour should be made to ensure that the selected place is suitable, as much labour and transport and some time are required to close it and re-open in another situation. The Quarter-Master-General's approval must also be obtained.

One or more general hospitals will always be required at the base to receive convoys of casualties and to afford the necessary treatment till their further disposal has been decided.

If the line of communications is a long one, and military conditions permit, one or more general hospitals should be located at convenient sites between the front and the base, along the L. of C. This effects great economy in the use of transport and facilitates the early return to their units of men who again become fit.

Special hospitals for the treatment of infectious cases, skin and venereal diseases should be located as near the front as the military situation permits in order to economize transport and man power.

317. Convalescent depots.—Whenever possible, a convalescent depot should be established in connection with each group of general hospitals. These depots require little medical personnel or equipment, and in them patients who no longer require hospital treatment can by graduated exercises be made fit again for active service.

318. Motor ambulance convoys.—It is usual to allot one motor ambulance convoy to each corps, a certain proportion being retained in reserve by G.H.Q. at some convenient centre (*see* para. **290**).

319. Depots of medical stores.—The base depot of medical stores is usually at the port of disembarkation, where it can most easily receive its stores in bulk from home and distribute them as required to the advanced depots of medical stores, which should be located near the C.C.Ss.

320. Field hygiene sections and laboratories.—The D.M.S. will also decide where the non-divisional field hygiene

sections and mobile hygiene and bacteriological laboratories are to be located.

321. Consultants.—He will post consultants in medicine and surgery for duty in certain areas or to groups of general hospitals and define their duties.

322. Lines of communication.—He will also have to consider whether any medical staff should be detailed to take administrative charge of the medical services in a L. of C. area.

323. Hygiene precautions.—As regards hygiene precautions, he will, after consultation with his A.D.H., submit to the Adjutant-General any measures that he thinks should be put into force to prevent the occurrence of avoidable disease.

324. Combined operations.—The medical problems of disembarkation on a hostile coast will be dealt with when applicable, and special requirements connected with them will be included in the recommendations.

325. The scheme of medical arrangements for the campaign having been approved, the D.M.S. will keep in close touch with the development of the military situation and will be prepared to recast his plans to meet any altered conditions.

326. As regards the policy of treating sick and wounded in the theatre of war, a decision can only be formed after a careful review of local conditions. If adequate accommodation and treatment can be provided for sick and wounded likely to become fit again in, say, three months, their retention overseas saves much expense in transportation and ensures return to their units with the least loss of time.

327. If active hostilities are contemplated, the D.M.S. has to consider whether the medical units of the force will be able to deal with the expected casualties, and, if not, what additional assistance will be required. This problem requires careful study, and as time is necessary to bring up supplies, to erect temporary hospitals and to arrange for additional labour and transport, early notice of any requirements should be given to the Adjutant-General's branch of the staff.

328. As soon as the D.M.S. has determined his line of action, he should call his representatives to a conference. He can then, after telling them in strict confidence as much of the proposed operations as it is necessary for them to know, discuss his scheme of medical arrangements and ascertain whether they can carry out his wishes, and, if not, what additional means will be required. The D.M.S. is then in

a position to submit his scheme and requirements to the G.O.C.-in-C.

329. The D.D.M.S. of a corps exercises general supervision over the medical services in his area. He arranges for the systematic evacuation of casualties from M.D.Ss. of divisions, and co-ordinates the work of field hygiene sections. He has a field ambulance at his disposal, which may, in addition to caring for corps troops, be used to supplement divisional medical units in an emergency (*see* Chapter XI).

A Division Holding a Position

330. It is the duty of the A.D.M.S. to detail field ambulances to establish A.D.Ss. and M.D.Ss., and to collect and dispose of the sick and wounded.

In position warfare, one field ambulance may be sufficient to deal with the casualties from the whole of the divisional front; the other two should be held in reserve ready to meet any emergency.

If there is no likelihood of hostilities beginning suddenly, a portion of one of the reserve field ambulances may, with the approval of the divisional commander, be employed to establish a divisional rest station.

331. The A.D.M.S. should frequently inspect all R.A.Ps., regimental areas, the A.D.S. and the M.D.S., as well as the sanitary arrangements, which at first are of necessity of a somewhat improvised nature, while many of the regimental medical officers may be without experience of work in the field. When noting faults or irregularities, the A.D.M.S. should at the same time give advice and instruction as to how these are to be remedied (*see* Chapter XI).

A Division Preparing to Attack

332. The A.D.M.S. must first ascertain from the General Staff the scope of the operation, *i.e.* whether the whole of the division will be employed, the expected duration of the engagement, the probable number of casualties and the objective. Having obtained this information, the A.D.M.S. decides whether the bearers and material at his disposal will suffice to collect the wounded. If heavy casualties are expected, and the fighting is likely to be continuous for several days, the R.A.M.C. stretcher bearers will have to be augmented by men from units in reserve who will be detailed on application by the A.D.M.S. to "A" branch of the divisional staff; this is especially necessary if an advance is expected, as this

usually means a long carry for stretcher cases, because only the very lightest form of wheeled traffic can be brought across recently captured ground until the roads have been restored.

333. Auxiliary bearers must be accompanied by officers and N.C.Os. of their own unit for the maintenance of discipline, and by R.A.M.C. personnel in order to ensure that men trained in ambulance and first aid work are on the spot to deal with the wounded.

334. The A.D.M.S. should arrange for a reserve of stretchers, blankets, dressings and extra Thomas splints, dumps being formed at the A.D.S., or further forward if possible.

335. He has also to see that the routes to the A.D.S. and M.D.S. are clearly indicated by directing signs and that these posts are clearly marked, for wounded seeking assistance.

336. He then has to determine, so far as is possible, provisional sites for the new A.D.S. and M.D.S.

337. Finally he has to submit to the Adjutant-General's branch of the staff, for insertion in the divisional operation order, so much of his scheme as should be known to all the troops. As a general rule, all that need be inserted in the formation order is the position of the A.D.S. and M.D.S. and of the W.W.C.P., if one is to be formed.

338. He then draws up his R.A.M.C. operation order, *i.e.* the detailed instructions for the divisional medical units, which should be approved by the Adjutant-General's branch of the staff before being issued. The recognized form and sequence to be adopted in writing the operation order are laid down in F.S.R., Vol. II. He will give only such information as to the scope of the operation as the field ambulance commanders must know to enable them to carry out their instructions (*see* Chapter XVI).

The disposal of each of the divisional units must be indicated.

The divisional front may be subdivided into areas and one field ambulance assigned to each to collect wounded from that area. If it is uncertain where most of the casualties will occur, one field ambulance may be detailed to clear the whole front, the other two being kept in reserve till required. If the attack is on a wide front and includes a flank movement, it may be more convenient to detail each field ambulance to a brigade and make the O.C. field ambulance responsible for collecting the wounded of that formation.

339. The A.D.M.S. should also, in the case of an advance, detail a field ambulance to open the new A.D.S. and, if suitable, to convert the former A.D.S. into the new M.D.S.

340. The system of pooling the motor ambulance cars of the field ambulances of a division is one that is frequently adopted by A.Ds.M.S. This entails placing the cars under the charge of a field ambulance medical officer to act as a divisional ambulance convoy between the A.D.S. and M.D.S. This system ensures that motor transport is not lying idle with the H.Q. of any of the field ambulances that may not be functioning, and also that transport is available to be despatched to evacuate from any particular area on the divisional front where casualties may suddenly become very heavy.

341. The R.A.M.C. operation order should state the location contemplated for the new A.D.S. if this has already been decided upon ; otherwise the order should leave the O.C. the unit detailed for the purpose to site the new A.D.S. (in which case the location should be reported to the A.D.M.S. as soon as possible). The position of dumps of reserve stretchers, blankets, etc., should be indicated.

342. The location of the A.D.M.S's. office together with the times at which progress reports are to be rendered must also be made known. Either the A.D.M.S. or the D.A.D.M.S. will remain in the office to receive messages and to take any necessary action ; the other should be at the front to see that all arrangements are working smoothly.

343. The **D.D.M.S.** of a corps has to decide whether a W.W.C.P. is required or not. If the casualties are likely to be heavy, one may be established for the corps. He must also arrange for auxiliary or ambulance transport for sitting cases from this station to the C.C.S. ; lorries fitted with benches or charabancs will meet the purpose.

344. He must also arrange to distribute the M.A.C. cars to clear each of the divisional M.D.Ss. to the C.C.Ss. To avoid congestion at the M.D.S. a car stand may be established close to it, an empty car being sent forward as soon as a loaded car arrives. A proportion of the M.A.C. cars should be kept in reserve to meet extra demands from any M.D.S.

345. When heavy casualties are expected, the D.D.M.S. should form a corps reserve dump of stretchers, blankets, Thomas splints, hot-water bottles and dressings at some central spot as far forward as possible. Articles should only be issued on the written application of an A.D.M.S. or his D.A.D.M.S.

A Division Retiring under Hostile Pressure

346. This situation makes the collection of wounded most difficult, as the means of communication are usually dislocated and the A.D.M.S. may not be able to keep in touch with the medical units.

347. It is impossible to establish proper A.D.Ss. or M.D.Ss. as these must frequently and hurriedly be closed to be re opened at a new site on the line of retirement.

348. When the retirement is continuous, the A.D.M.S may attach temporarily one field ambulance to each brigade ; the O.C. field ambulance is thus kept in touch with the changes in the military situation and he can more easily be found by messengers. Each O.C. field ambulance should be informed as to the line of evacuation and the location of the C.C.S. which is receiving casualties. He must also be ordered to accelerate evacuation by any and every means ; wounded for whom transport is not at the moment available should be collected in groups on the line of evacuation and, if possible, at some spot which can be clearly indicated in a message by stating its position in relation to some prominent feature in the landscape, with a map reference. The A.D.M.S. may prefer to place the evacuation under the control of one O.C. field ambulance, using the other two to establish M.D.Ss. alternately as the retirement proceeds.

349. If the retirement is not a rapid one and especially if buildings are available, it may be feasible to open M.D.Ss. This should be done if possible, as it greatly facilitates the systematic handling of wounded, even if the arrangements are somewhat primitive. Should the retirement be continued, the M.D.S. will be closed as such and opened at a new site further back ; the staff of the A.D.S. may take over the site of the M.D.S. and open an A.D.S. This system is commonly known as " leapfrogging."

350. During a rapid retirement, the D.D.M.S. of a corps should keep himself informed as to the needs, especially in transport, of divisions. He should also endeavour to keep in touch with A.Ds.M.S. and to give them early indication of any change in the commander's plans or in the destination of the casualties. If, as is possible, there is difficulty in communicating with his representatives, it is not, except in matters of extreme importance, advisable to attempt to issue any orders, as these may never reach the officer to whom they are addressed or only too late for him to act on them, and so lead to confusion and delay.

The Encounter Battle

351. With modern means of obtaining intelligence as to the enemy's movements, unexpected collisions are not likely to happen. The G.O.C.-in-C. may, however, order a formation to carry out a reconnaissance in force, which may lead to a collision.

352. When such an operation is about to be undertaken, the A.D.M.S., after obtaining the necessary information from the General Staff, will arrange that one or more companies from his field ambulances accompany the force and keep in close touch with it. Should there be casualties, a temporary A.D.S. will be formed and the wounded collected there by horsed or other form of ambulance transport, according to the nature of the country. If the force is to remain in occupation of any ground seized, a new M.D.S. may be required, but if the troops are to rejoin the main body, the wounded will have to be evacuated quickly to the existing M.D.S.

353. The conditions may vary enormously, and the A.D.M.S. must formulate his plans accordingly, being guided by the general principles, viz., to provide for the collection and evacuation of the wounded, while not opening up more medical units than are essential to cope with the work.

A Cavalry Division

354. When a cavalry division is employed as dismounted troops, the A.D.M.S. should be guided by the principles laid down for an A.D.M.S. of a division. The cavalry may be detached as an independent force to act at a distance from the main body of the army. Such a situation makes the collection and evacuation of casualties extremely difficult, especially if the country is a hostile one and without roads fit for motor transport. The difficulties are further increased if the independent force proceeds without any wheeled transport. In such cases it has been possible in the past to organize a small mounted R.A.M.C. detachment on a pack basis to accompany the force in all its movements. This, however, requires time for its organization and the provision of horses from divisional resources. With the advent of the mechanized cavalry field ambulance, the difficulties of such provision are greatly enhanced.

355. There are two courses open to the A.D.M.S. The first is to obtain sufficient transport to carry all casualties with the division until they can be evacuated to the main

army. If the country is hostile and uncivilized, this plan must be adopted, as sick and wounded cannot in any circumstances be left behind. If the force is absent for more than a few days, supplies will have to be sent to it under armed escort and the sick and wounded can be evacuated with the returning convoy.

356. Secondly, if the inhabitants are civilized and not actively hostile and the country has good roads, sick and wounded may be left at centres in charge of the local authorities, and if the divisional commander approves, some medical personnel may be detailed to take charge of them. Any such centres will be cleared subsequently by motor transport.

357. A cavalry division may be extended over a wide front to carry out a sweeping movement. In this case the regimental M.Os. should be directed to form collecting posts for wounded, if possible on a main road ; these should be cleared by the cavalry field ambulance, which should be ordered to follow the advance of the cavalry brigade (or precede it in case of a retirement) along some centrally situated road in order to clear the collecting posts. The casualties requiring ambulance transport are not likely to be very numerous ; the difficulty lies in getting them to an easily identified spot and in informing the O.C. cavalry field ambulance of its location.

Communication

358. At all times, but especially during active hostilities, it is most important that the A.D.M.S. should keep in touch with his Os.C. field ambulances, and with the O.C., M.A.C., which is clearing his area, and keep himself informed of the rate at which casualties are arriving at the A.D.S., and of its probable requirements in stretchers, dressings, etc. ; he should also give timely notice to the O.C., M.A.C., when additional transport is likely to be required. Os.C. should make frequent reports to the A.D.M.S. for the information of the divisional staff. Telephone communication may be available, but, failing this, the motor cyclists will be found invaluable in carrying out these duties.

Tank Units and Formations

359. A tank battalion may be used in co-operation with cavalry or infantry, in which case the general arrangements for the collection and evacuation of casualties will conform to those of the formation concerned.

Tank battalions may be organized into a tank brigade which

may co-operate with cavalry or infantry or may operate as an independent formation.

360. A tank brigade moves rapidly, and it is essential that the medical unit serving it should be able to conform with its movements. The cavalry field ambulance is suitable for this purpose, being a wholly mechanized unit. This unit is so organized that it can form four small advanced dressing stations and a main dressing station. Stretcher bearers and motor ambulances, which are part of the headquarters of the cavalry field ambulance, can be distributed wherever they are most required. All vehicles are capable of cross-country movement.

The main dressing station, formed by the H.Q. of the cavalry field ambulance, should normally be located at the " B " echelon of the brigade, which is in wireless communication with brigade H.Q., and where it will obtain protection if in hostile country.

361. Where armoured brigades are co-operating with cavalry or infantry, the collection, early treatment and evacuation of casualties will follow the usual practice for evacuation from these arms. Some of the bearers and motor ambulances may be placed at the disposal of the field ambulance clearing the battlefield, but the H.Q. of the cavalry field ambulances, with the remainder of the bearers and motor ambulances, should be kept ready to follow the brigades in the event of the latter making a big advance ahead of the infantry.

In fighting periods, the tank battalion M.O. will normally be at " B " echelon and it is not anticipated that skilled attention can be given to the wounded in armoured fighting vehicles until fighting has ceased or until the vehicle has come out of action. Every armoured fighting vehicle carries a first aid outfit.

362. If a tank brigade goes into action a long distance ahead of the other arms, a cavalry field ambulance, working from " B " echelon with its motor ambulances, will assist the M.O. to collect the wounded. Special attention will be given to clearing the wounded from all derelict fighting vehicles. Whenever possible, armoured fighting vehicles leaving the scene of action will bring back the wounded with them.

It may happen that, owing to the rapid movement of the force, dressing stations cannot be opened at once. Casualties may then have to be attended to in the ambulance cars and retained with the force until they can be evacuated.

Definite periods are required each day for the maintenance and repair of the armoured fighting vehicles, and full advantage of this respite should be taken for attention to the wounded.

363. The rapidity of the advance and the range of action may result in the wounded having to be transported long distances from the battlefield to the C.C.S. Special arrangements will have to be made for their care and treatment during the road journey.

Much difficulty will probably be experienced in keeping in touch with a tank brigade as it advances. One of the field ambulance officers should be with brigade H.Q. and, so far as practicable, full use should be made of R/T and W/T for reporting the location of casualties.

364. In certain circumstances aeroplanes should be made available for the evacuation of seriously wounded, but it is probable that, in the early stages of a war, it would only be in very exceptional circumstances that any could be provided for medical use.

MEDICAL ARRANGEMENTS FOR WAR IN INDIA

365. The medical arrangements for a force of one or more divisions, in areas where roads and railways exist, will be on the lines already indicated. The numbers of battle casualties will usually be relatively small; but conditions of climate and country will often cause heavy casualties from sickness, and, where roads and railways do not exist, the length of the L. of C. will necessitate halts. Special units are therefore available to deal with these conditions. These are enumerated in the following paragraphs.

366. Field ambulances.—These units are very similar to those of the British service and are allotted on the same scale, *i.e.* three to a division. They are divisional troops under the orders of the A.D.M.S., and may be utilized on the lines already indicated. Each is composed of a H.Q. and two companies. The former, provided with M.T. for the carriage of casualties and equipment, forms the M.D.S.; the companies are complete on mule pack for the formation of an A.D.S.

Riding animals for the sick are provided in roadless areas. Camel pack transport for equipment and patients may replace M.T. Each unit is organized for the reception of British and all classes of Indian patients.

367. Bearer units.—These are composed of stretcher bearers and are used to supplement the M.A.C., or replace it in areas not suitable for motor transport. One bearer unit may be allotted to the line of evacuation from one or two divisions. Its function is to act as a link of evacuation between the M.D.S. and C.C.S.

368. Staging sections.—These are non-mobile units equipped for 25 beds expansible to 50. Separate sections are provided for British and Indians. Their function is to establish places of refreshment and rest or even a halt for one or two nights on the line of evacuation ; they also form post hospitals on the L. of C. for local troops, labour units and railway companies, but are not equipped for extensive medical or surgical treatment.

369. Conditions of climate and terrain necessitate special measures in all areas of operations for the prevention of diseases, which may cripple the units engaged. In fact the success of the operations is very often dependent on the efficiency of these special measures. Such measures include the prevention of the effects of heat—the adequate protection and purification of water supplies—the prevention of malaria or a temporary check on its effects—and the sanitary control of large numbers of irregular labour personnel and transport animals.

370. Sanitary sections.—These are provided on a scale of one to a division with additional sections for the L. of C. They are divisible into three sub-sections. They act as sanitary police and perform the duties of sanitary inspectors. They carry out disinfection, instruct the sanitary personnel of units and construct appliances beyond the scope of regimental personnel. Each sanitary section can also provide labour and sweeper personnel to give assistance in the normal labour of maintaining cleanliness in camps.

371. Casualty clearing stations.—In India these are equipped on a lighter scale than at home. They have no transport of their own, but are more easily moved. They will usually be sited at some existing hospital or buildings on the L. of C. on the scale of one to a division. When several are mobilized, they may be worked in echelon for economy of transport.

The C.C.S. is organized on a four-section basis—one British and three Indian.

372. General hospitals.—These are of two kinds, those for British having 520 beds (20 for officers), those for Indians 500 beds. They are organized on 100-bed-section basis, and are expansible as required.

Mobile Column

373. This is a common formation and consists usually of a force of all arms of about one brigade strength. The medical arrangements normally consist of regimental M.Os. and

personnel and an improvised field ambulance. Special features are that the force may move fast and far. Casualties must be evacuated according to circumstances, and may have to be carried with the force for a number of days.

Mountain Warfare

374. On the frontier of India there are very few first-class roads. The country consists generally of a succession of mountain ranges intersected by deep narrow valleys. The only possible routes for formed bodies of troops and transport lie along the valleys with an occasional steep pass over some intervening ridge. These routes are mere mule tracks and considerable work is usually required to make them passable even for camels.

Stores and equipment have therefore to be carried by mule pack transport. Casualties are conveyed by hand carriage —camel kajawah (*see* para. **457**), or by riding ponies or mules.

375. The great difficulty in mountain warfare lies in the evacuation of the wounded from piquets which are posted on the tops of the ridges on either side of the valley. Stretchers require expert handling on the steep hillsides, and often cannot be used. Casualties will usually be brought down pick-a-back, by the puttee method or in a blanket. The essential point is to get casualties down from piquets as fast as possible, to avoid hampering the action of the piquet, particularly during retirement. Delay often means further casualties. Riding ponies or mules are useful in the more sheltered parts of the journey. Carries are often long and very difficult.

376. Casualties may have to be carried with the field ambulance for several days. Convoys of sick and wounded can only be evacuated when the route has been opened and declared safe by the General Staff. Such convoys may have to be evacuated, as in para. **374** above, to road-head. Measures for the prevention of cold, thirst and hunger on the journey are essential. The return of blankets and stretchers used for evacuation should be arranged ; otherwise a shortage is sure to occur.

377. In action.—Close communication must be maintained between the field ambulance and unit medical officers. Brigade or regimental signallers or personnel, busy with other work, cannot be relied on for this. Field ambulance personnel and stretcher squads should be used, and the latter detailed to keep touch with unit M.Os. and replaced as casualties are brought in. Close liaison with brigade H.Q. is essential. The A.D.S. should be close to the forward R.A.Ps. They will usually be sited in shelter at the bottom of the valley.

378. On the march.—The column is often long, and intercommunication or separate movement of stretcher squads is very difficult. Bearer parties, stretcher squads with equipment and riding animals, will be detailed as travelling A.D.Ss. to keep close touch with the M.Os. of the advance guard and the rear guard.

The M.O. i/c water purification accompanies the engineer water party with the advanced guard.

If a suitable road exists, M.T. moves by bounds within the length of the column.

379. In camp.—Protection against sniping must be provided for the dressing station and patients. Lights draw fire at night and must not be visible from outside. Owing to the nature of the country and types of perimeter camp, attention to all camp sanitation must be strictly enforced.

CHAPTER XVI

APPRECIATIONS, ORDERS AND INSTRUCTIONS IN THE FIELD

Appreciations

380. Medical appreciations may be required by commanders to assist them in formulating their own plans of action.

The general principles to be followed in appreciating a situation are laid down in Training Regulations and should be carefully studied. With certain modifications in detail, they are applicable to the medical services.

381. It is seldom that a written medical appreciation will be called for before any particular operation in the course of a campaign, but certain factors affecting the health, etc., of the troops may have to be reviewed and reported upon.

Whether appreciations are written or delivered verbally, they should as far as possible follow the logical and accepted sequence given in Training Regulations, even though all the headings are not particularly well adapted to medical usage.

382. To consider the various headings :—

(i) *The object.*—From the point of view of the medical services, the object must always be within obvious and well-defined limits, namely :—

(*a*) The maintenance of the strength of the forces in the field by the prevention of disease and the minimizing of daily wastage.

(*b*) The efficient collection and evacuation of casualties.

(*c*) The provision of adequate accommodation for the efficient treatment of the sick and wounded.

The relative importance of these considerations will vary according to the nature and magnitude of the task which forms the subject of the appreciation.

(ii) *Considerations which affect the attainment of this object.*—These are indicated in Training Regulations and, from the medical point of view, at the beginning of Chapter XV of this manual.

(iii) *Courses open to the two sides.*—This heading is seldom applicable as such to a medical appreciation. More usually, the heading " Courses open " is used and under it may be considered different ways of dealing with the medical aspect of the proposed operation or campaign. Controlling factors which compel the choice of a particular course are frequently provided by " G " or " Q," but if it is considered that such factors are likely to prove inimical medically, the ill effects that may ensue from following that course should be pointed out.

If there are no special or alternative considerations of outstanding importance to review, discussion under this heading is often omitted in a medical appreciation.

(iv) *The plan.*—In the plan should be stated, in as definite, simple and practical manner as possible :—

(*a*) Recommendations for the prevention of disease, particular to the operation or campaign.

(*b*) A detailed scheme for the collection, evacuation and distribution of sick and wounded.

383. An appreciation should be as clear and concise as possible. If it is necessary to include lengthy considerations, calculations and details for the information of the commander and his staff, they should be given in appendices, reference only being made to them in the appreciation proper.

Orders and Instructions

384. Full information as to the various kinds of Orders and Instructions by means of which command is exercised is given in F.S.R., Vol. II.

F.S.R., Vol. I, provides that the representative of the D.M.S. with a formation commands the medical units in that formation, *e.g.* the A.D.M.S. of a division commands the divisional R.A.M.C. units, the D.D.M.S. of a corps commands the " corps troops " R.A.M.C. units (but not, of course, those in the divisions comprising the corps). It follows, therefore, that such representatives should issue orders to the units which they command as necessary—standing, routine, operation or administrative orders as circumstances may require.

385. R.A.M.C. operation orders should be framed in accordance with the recognized form and sequence laid down in F.S.R., Vol. II, for the writing of operation orders. In conjunction with these instructions, the following details under various headings may be mentioned :—

(i) *Heading.*—An order issued by the A.D.M.S. of a division should be headed :—

. . . Division R.A.M.C. Operation Order No. . . .

Under the map reference should be given the reference to any General Staff order or instruction issued to the recipient to which the present order is supplementary.

(ii) *Administrative arrangements.*—These will contain any special details as regards supplies of stretchers, blankets, medical stores, food, transport, evacuation, traffic direction, prisoners of war, etc., that it is necessary for all recipients of the order to know. It may be convenient to issue details of these administrative arrangements either as an appendix or in administrative orders.

(iii) *Distribution.*—A divisional R.A.M.C. operation order will normally require to be distributed to the

three divisional field ambulances, the divisional field hygiene section, " A " and " Q," D.A.P.M., M.A.C., War Diary (two copies), and file. A copy is usually required by the D.D.M.S. of the corps. Copies should also be sent to the A.Ds.M.S. of the divisions on either flank if circumstances so require.

386. Orders on medical matters which it is necessary for units of other branches of the service to know will not be issued by the representative of the D.M.S. direct, but will be included in the orders—standing, routine or operation—of the formation to the staff of which the representative is attached.

SECTION 5.—MEDICAL ORGANIZATION IN ANTI-GAS MEASURES

CHAPTER XVII

CHEMICAL WEAPONS AND THEIR EFFECTS

387. To deal successfully with casualties when chemical weapons are used by an enemy, it is necessary to possess a general knowledge of the uses of such weapons and an accurate knowledge of the injuries which may thereby be produced.

388. The peculiar feature of this type of warfare is the ever-present possibility of surprise, which in itself is a most effective and powerful weapon. The knowledge that an enemy may make use of any of the varied ways in which chemical agents can be released, *e.g.* from shells, bombs, air sprays, etc., and so produce casualties, in some cases even among troops who are unaware that they have been exposed to gas, must always induce a sense of uncertainty injurious to morale, more especially among soldiers whose training in anti-gas measures has been neglected.

389. Classification of chemical weapons.—The classes of chemical compounds which have been used as offensive agents are four in number, and although new members of each class are from time to time being discovered, it is unlikely that any compound of a more alarming nature than is known already will be produced in the immediate future.

Though many of these substances are gases at ordinary temperatures, some are dispersed as liquids which vaporize on release; others form minute particles such as occur in smoke.

390. All these substances may be broadly classified according to their action on human beings and grouped in the following way :—

i. (*a*) Choking.
   (*b*) Nose.
   (*c*) Tear.
ii. Blister.

391. Two other gases are known which might be met with on service, but not as chemical offensive agents.

(i) Hydrocyanic acid (prussic acid).
(ii) Carbon monoxide.

Of these (i) has little effect in the open owing to the lightness of its vapour ; (ii) is more likely to be met with as the result of an accident (*see* para. **411**).

392. It should be realized that, apart from chemical agents intended to produce casualties, the bursting of high explosive shell, the firing of machine guns in enclosed spaces and the explosion of mines all produce noxious gases, such as nitrous fumes and carbon monoxide, which may cause serious casualties amongst those exposed to them. Moreover, charcoal fires in braziers and the exhaust gases from the engines of motor vehicles, especially of armoured cars and tanks, may both become a source of danger unless adequate ventilation is assured, as they also produce or contain carbon monoxide. Carbon monoxide in dangerous concentration may also be encountered in burning buildings and particularly in fires underground, *e.g.* when the timbering of mine galleries, dugout systems, etc., catches fire.

393. The effects of chemical weapons ; their signs, symptoms, and treatment.

The injuries caused by each of the above classes with their signs, symptoms and treatment, are as follows :—

Choking gases.—These, when inhaled, cause severe irritation of the air cells in the lungs. In consequence, an intense congestion sets in and fluid is poured out from the capillary blood vessels into the air cells, bringing about œdema of the lungs so that the normal exchange of gases in the lungs (absorption of oxygen and excretion of carbonic acid gas) is interfered with ; in addition, the loss of fluid brings about a concentration of the blood. The patient thus suffers from an insufficient supply of oxygen to his organs and tissues. In severe cases so great an area of lung is thrown out of action that patients die of suffocation.

In addition to damaging the lungs, many of these substances cause injury to the lining membrane of the air passages, and, by causing an intense congestion of the trachea, bronchi and bronchioles, add to the difficulty in breathing.

In mild cases, the patient suffers from headache, pain in the chest, cough, frothy expectoration and some difficulty in breathing, but none of the signs or symptoms are severe.

In more severe cases, in addition to the above, he looks

seriously ill, his face is deeply engorged and red, or even plum-coloured, and he has a full pulse and rapid breathing.

In the most serious cases, the patient has a grey pallor with purple or lilac coloured lips, weak pulse and rapid shallow breathing, and sometimes is delirious or even unconscious.

394. In certain cases the onset of symptoms may be delayed for some hours after exposure. In all cases, therefore, when men have inhaled such gases, they should be kept under observation and made to rest for 24 hours.

In the majority of cases the symptoms are well established by the time the patients reach the field ambulance, and in fatal cases of poisoning from these substances death occurs within the first 24 to 48 hours after exposure.

Treatment.—The essentials of treatment are rest, warmth and oxygen.

395. Oxygen should be administered, under the orders of a M.O., if the patient's colour becomes of a blue tinge. If the patient's colour changes either to the plum-coloured or pallid variety, it should be given continuously (except for five minutes in every half-hour), by means of a Haldane or other suitable apparatus until the colour returns to normal, and no relapse occurs when the administration is stopped (*see* para. **749**).

In early cases in which severe symptoms are developing, bleeding (up to 20 ounces) will do good; when the blood becomes concentrated and tarry in appearance, the infusion or intravenous injection of one to two pints of normal saline solution may be of value.

396. *Nose gases.*—When inhaled in weak concentrations, such as are met with in the field, these substances give rise to intense irritation in the nose and throat and a burning pain along the windpipe, also to pain in the teeth and gums, headache and mental dullness and depression. More rarely, temporary paralysis of the limbs is seen. All these symptoms disappear fairly rapidly and the sufferers very rarely become seriously ill, though they may be unfit for work for a period varying from a few hours to a few days.

397. Inhalations of chloroform and the washing out of the nose and mouth with a solution of borax, bicarbonate of soda and salt (1 part of each to 100 parts of water), often relieve the pain. In the majority of cases, removal from the poisonous atmosphere and rest are all the treatment that is necessary.

398. *Tear gases.*—These cause immediately an intense burning pain in the eyes, with much watering and spasm of the eyelids.

In the majority of cases, removal from the poisonous atmosphere will bring rapid relief. Casualties should, therefore, be fit to return to duty within a few hours. A few may develop inflammation of the conjunctiva. In such cases, washing the eyes with normal saline solution or weak boric lotion will bring about a rapid cure.

399. *Blister gases.*—Mustard gas is the best known of this group, but lewisite, which contains arsenic, may also be met with. These substances are liquid at ordinary temperatures and under ordinary weather conditions and may be used in shells or bombs, or as a spray from aeroplanes. When the shells or bombs burst, the liquid is sprayed about and gives off vapour. Casualties may thus be produced either by splashing with the actual liquid or by the vapour which is given off for a long time from the liquid. An aerial spray may be delivered from a considerable height, and from a point well up wind of its target. The spraying aeroplane may be out of sight behind clouds, and the drops, even when they fall on the bare skin, may pass unnoticed by the men sprayed, especially if their minds and bodies are fully occupied in other directions, *e.g.* digging, marching, etc. (*see* para. **423**).

On first contact a faint odour as of horse radish or mustard is noticed, or a smell like geraniums in the case of lewisite, but the sense of smell in a contaminated atmosphere quickly becomes dulled unless the respirator is worn, and after some time men may not notice any smell and so fail to recognize that dangerous vapour is still present. Even a small amount of the vapour in the air will produce subsequent conjunctivitis in persons exposed to it for more than a few minutes.

400. Symptoms begin to appear from one to six hours after exposure. Generally, the first to be noticed is a burning pain in the eyes with profuse watering ; this may be associated with marked spasm of the eyelids so that the patient may be unable to open his eyes. Later, inflammation of the conjunctiva sets in, and sometimes an ulcer forms on the cornea. Rarely, the deeper parts of the eye are affected. It must be remembered that the wearing of the respirator affords complete protection from this type of casualty.

401. Skin injuries are the result of contamination of the skin by the liquid itself, or exposure for some time to the vapour given off by the liquid. Skin injuries from the liquid begin to show in four to 12 hours (rarely, one to two days), after exposure, and vary from slight redness to severe burns in which blebs containing a watery fluid appear towards the end of the second day.

Although painless in the early stages, such injuries are painful if blisters have developed. They tend to become easily infected and are slow in healing.

The vapour is particularly liable to attack those parts of the skin that are normally moist, such as the armpits, groin, scrotum, etc. Burns in these situations are always painful.

In dealing with mustard gas, it must be clearly understood that no time should be lost between contamination and treatment if a satisfactory result is to be obtained.

No definite times can be laid down as a safety period for wearing contaminated clothes, as the amount of liquid, the temperature of the body, etc., determine the time of penetration. An individual whose clothing is heavily contaminated with liquid mustard gas will become a casualty unless such clothing is removed within a few minutes.

402. If the vapour is inhaled, severe inflammation of the air passages may develop, and secondary infection with bacteria may give rise to broncho-pneumonia which often proves fatal. The severe œdema and congestion of the lungs which occur in poisoning from choking gas are not seen in those suffering from the effects of mustard gas.

403. Preventive treatment.—The treatment, which should be carried out at the earliest possible moment, should consist of the following :—

(i) The speedy removal of all contaminated garments.

(ii) The application of bleaching powder ointment to those parts of the body which might be expected to show burns at a later period. This should be thoroughly wiped off after two or three minutes, and the parts washed with soap and water, as bleaching powder ointment is irritating to the normal skin.

(iii) (Alternative to (ii), if bleach is not available)—Thorough cleansing of the skin with soap and water.

It must be realized that once mustard gas in the form of liquid has been in contact with the skin for more than a very few minutes, penetration to a greater or less extent has already occurred, and that no treatment will neutralize the resulting damage, but efforts must be directed towards preventing the greater severity of the burns by the removal of mustard gas which still remains on the skin or clothing. The same applies to the vapour when it is in a strong enough concentration, and the time of exposure to it sufficiently long. It must therefore be apparent that those men who arrive at a dressing station still wearing contaminated garments are in any case going to be badly blistered.

404. By far the most important of the above is the preventive treatment laid down under (i), as the continued wearing of contaminated clothing is bound to result in severe burning of the individual, and will render him also a danger to his fellows. The application of bleaching powder ointment or cleansing with soap and water, is essential to prevent burns of exposed parts such as the hands and face which have been contaminated, but to endeavour to save the remaining and larger area of the body from burns, the clothing must be rapidly removed. It will be realized that this is often impossible while active hostilities are in progress, but men whose clothing has been contaminated must get a change of some kind or they will certainly be casualties.

405. Treatment of burns from mustard gas.—Skin burns, consisting as they do at first of mere redness of the skin, can be treated by ointments or dusting powders. These early burns are often painful. Blisters should be pricked under aseptic conditions and the dead skin removed. The area should then be treated by the application of fresh 2 per cent. tannic acid solution by a fine spray or by what is known as the compress method. As mustard gas burns are liable to become septic, great care should be taken to prevent infection (*see* paras. **645–647**).

406. Eye cases should be irrigated with saline or weak boracic lotion. It is never easy to assess the possible damage from contamination of the eye, and therefore treatment of all eye cases is an urgent matter and must be thorough.

The effect of a drop of mustard gas in the eye is to cause irritation which may pass off in a few minutes. Within an hour, however, the eye becomes red and swollen. The inflammation progresses until the eye is greatly swollen, and, in the case of contamination by anything larger than a very small drop of mustard gas, severe ulceration will result with partial or complete loss of vision.

The treatment should consist of *immediate* and thorough irrigation with water, even from a water-bottle, repeated at frequent intervals. By this means the ultimate severity of the injury may be reduced, although serious damage to the eye is inevitable if the contamination has been caused by more than a minute drop.

In view of the serious effects of contamination of the eye, the importance of protecting the eyes by means of the respirator or goggles cannot be overstressed.

407. Nausea and vomiting, which often occur in the early stages of poisoning, may be relieved by drinking warm

water containing 2 per cent. bicarbonate of soda ; hoarseness and cough, by inhalation of steam from boiling water to which Friar's Balsam (Tincture Benzoin Co.), half a drachm to a pint, has been added, or by chloretone and camphor in liquid vaseline, used as a throat spray.

408. It should be impressed on all casualties from mustard gas that a complete recovery is the rule. It is only in those who have been exposed to the vapour for long periods without a respirator, in grave eye cases, or in those with very extensive burns, that serious results are to be expected.

409. Hydrocyanic acid (prussic acid gas).—When the quantity of this gas in the air is small, it may be borne for a considerable time without ill effects, but once the poisonous concentration is reached, its action is rapid.

Symptoms follow each other in rapid succession—giddiness, mental confusion, headache, indistinct sight, pain in the chest, laboured breathing, convulsions and finally failure of respiration and of the heart. In the case of large doses death is almost immediate (*see* para. **391**).

410. Immediate treatment is necessary. The patient must at once be brought into fresh air, and, if the breathing is failing, artificial respiration by Schafer's method should be begun without delay. This, which is by far the most important measure in treatment, may be followed or accompanied by other methods of resuscitation, such as the giving of heart stimulants.

411. Carbon monoxide gas.—Though not used directly as an offensive agent, it is often present in considerable quantity when mines are exploded ; when shells containing high explosives burst in a confined space ; when machine guns are fired in ill-ventilated structures, such as " pill-boxes " ; and when charcoal braziers are used in dug-outs, small rooms or lorries. It is present in the exhaust gases of motor engines, especially of armoured cars and tanks. It may be encountered also in burning buildings, especially in fires underground, *e.g.* when the timbering of mine galleries, dug-out systems, etc., catches fire. The symptoms to which it gives rise depend upon the degree of the saturation of the blood with the gas, and vary from giddiness and headache to loss of consciousness, failure of the heart and death (*see* para. **391**).

412. *Treatment.*—The patient suffering from its effects should at once be removed into the fresh air and oxygen should be administered. When the apparatus is available, the administration of oxygen containing 5–7 per cent. of carbon

dioxide is still more effective. If serious symptoms are present, care should be taken that the patient is not allowed to rebreathe the air that is exhaled. If the breathing is failing, artificial respiration should be begun at once.

Note.—It should be remembered that the box respirator does not protect against this gas, and, when entering any place where it is likely to be present, men should wear a self-contained oxygen breathing apparatus.

CHAPTER XVIII

DEFENSIVE MEASURES AGAINST CHEMICAL WEAPONS

These may be classified as individual and collective.

A. Individual Measures

413. Respirator.—Protection against all gases that affect the eyes, air passages and lungs is secured by wearing the respirator. This apparatus is issued as personal equipment to each soldier, who should be trained to adjust it quickly (in ten seconds from the slung position), to keep it clean and intact and to disinfect the mask at regular intervals of six months. For the purpose of disinfection a special solution (3 per cent. Izal) is issued.

414. It is difficult to obtain complete protection against substances which may cause burns on any part of the body (*e.g.* mustard gas and lewisite).

Fully protective clothing has been designed, but it is too cumbersome to be used except for special purposes, and its protection against mustard gas vapour is strictly limited, owing to the suction effect produced by movements of the body.

Reliance must, therefore, be placed on the removal of contaminated clothing and equipment, and the cleansing of the patient at the earliest possible moment, so that he may not further infect himself. Also, as contaminated clothing continues to give off mustard gas vapour for a considerable time, the wearer may be a source of danger to others.

415. Decontamination.—The cleansing of the patient is dealt with in paras. **403** and **404.**

Clothing can be decontaminated by the following methods :—

(i) *Vapour contamination.*

Clothing contaminated by mustard gas or lewisite vapour may be dealt with by hanging in the open for 12 to 24 hours, or by treatment in the steam disinfector for 15 minutes.

(ii) *Liquid contamination.*

(*a*) *Boiling.*—All clothing can be decontaminated by boiling. This method should not be used in dealing with woollens or leather because of the shrinkage which results. When practicable, it is the method of choice for cotton and linen fabrics and for rubber. Cotton and linen fabrics should be boiled for half an hour, rubber boots for two hours and respirator facepieces for three hours. The eyepieces of the respirators should be removed before the facepieces are boiled.

The addition of two ounces of washing soda to each gallon of water used in boiling cotton and linen materials is advantageous, as it helps to diminish deterioration of the fabric.

Water used for the boiling of contaminated articles should be changed frequently.

As the fumes given off in boiling contaminated clothing are dangerous, they must be removed by suitable ventilation and precautions taken to protect personnel from them.

All personnel engaged in this work should wear protective clothing and respirators.

(*b*) *Baking.*—This method is recommended for leather and such other articles as would be damaged by steam. If wet, they must first be slowly and thoroughly dried ; otherwise the subsequent baking will render them completely unserviceable.

When dry, these articles are baked for a period of eight hours. It is important that at no time should a temperature of 180° F. be exceeded.

(*c*) *Steam.*—(i) Dry woollen clothing. Treatment in a high pressure steam disinfector is recommended for the decontamination of all *dry* clothing of a woollen nature and the process takes approximately one hour.

(ii) Wet woollen clothing.

When the contaminated clothing is wet, the above process alone not only frequently fails to achieve decontamination,

but may also cause rotting of the clothing. It is, therefore, necessary, in dealing with wet clothing, to use a two-stage process, first drying the clothing in a drying room, and then using the steam disinfector.

Summary

Contaminated article	Method of decontamination
i. Articles contaminated by vapour.	Air in the open or treat in a steam disinfector.
ii. Articles contaminated by liquid.	
Cottons, Linens, Webbing, Haversacks	Boil in water containing washing soda.
Oilskins, Waterproofs, Rubber articles, Respirator facepieces and tubes (less eyepieces)	Boil in plain water.
Leather articles, Sun helmets.	Bake.
Woollens (dry).	Treat in a steam disinfector.
Woollens (wet).	First dry the clothing and then treat in a steam disinfector.

B. Collective Measures

416. Measures specially designed for collective protection include (i) the neutralization of the poisonous substances, or (ii) their removal from dug-outs, trenches, etc., and (iii) protective devices for keeping the gases from entering such places as dug-outs used as aid posts, dressing stations, etc.

417. To make ground safe, after it has been contaminated with mustard gas, it should be covered with a mixture of bleaching powder (chloride of lime) and earth in the proportion of one of bleaching powder to three of earth. If bleaching powder is not available, the area should be covered with three inches of fresh earth or other inert material. This, while not as efficient as the former, will prevent the escape of vapour in a dangerous concentration. If pure chloride of lime is brought into contact with liquid mustard gas, the resulting chemical action is so violent that a fire will result and dangerous fumes are given off.

418. Gas present in the air can be removed by ventilation. Dug-outs and confined spaces are cleared rapidly and effectively by means of a fire, but care must be taken that the air and ground outside such places are free from gas before the fire is lighted; otherwise the fire will merely serve to draw gas into the dug-out. For the same reason it is essential, while a gas attack is in progress, to extinguish all fires in dug-outs and shelters. If this is not done, gas will be drawn into them from the outside air.

419. In shallow trenches and dug-outs, anti-gas fans or fans improvised from sandbags or ground sheets, will produce sufficient draught to clear away the gas.

420. Selected places, such as dressing stations and aid posts, can be rendered "gas-proof" by the provision of doors made of special material.

421. The following methods of "gas-proofing" have been successful:—

Method 1.

A frame of 4-inch by 1-inch timber, covered with blanket material, is fixed in the entrance flush with the wall, sloping outwards at an angle of 20 degrees from the vertical.

Anti-gas material is cut to the required size so that, when fastened at the top of the frame, it will close the entrance completely and leave about nine inches on the ground. Three pairs of laths are nailed horizontally to the curtain, to keep it stretched. The laths on the inside must be one foot shorter than those on the outside so as to clear the frame. The lowest of the laths should be four inches from the ground. In no circumstances must it touch the ground.

All wires and piping must pass through the frame, which may be widened on one side to allow of this, and the hole through which they pass must be made gas-tight. They must not interfere in any way with the adjustment of the curtain.

422. *Method* 2. (*See Figs.* 26 *and* 27.)

It is sometimes convenient, as, for instance, in the case of an aid post, to place the gas-proof curtains outside the entrance to avoid narrowing the passage. In this case two sloping frames covered with anti-gas material are fitted to the outside and the inside of an entrance. The anti-gas material is nailed to the top of the frame with a lath, to prevent tearing. In the absence of anti-gas material, wet blankets will be of use.

The curtains should not be less than three feet apart, so as to allow a man to stand between them and to adjust one

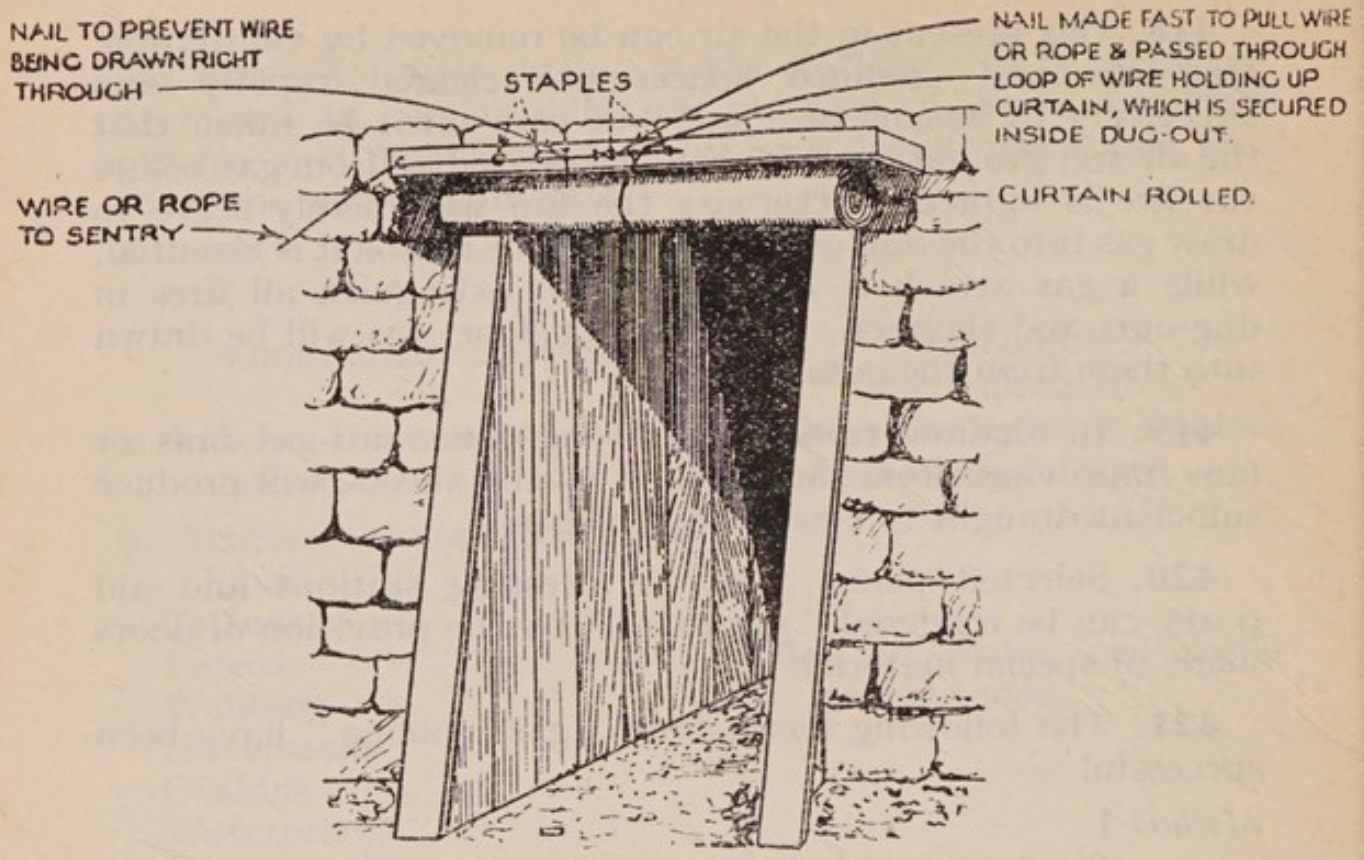


FIG. 26.—GAS-PROOF CURTAIN, OPEN

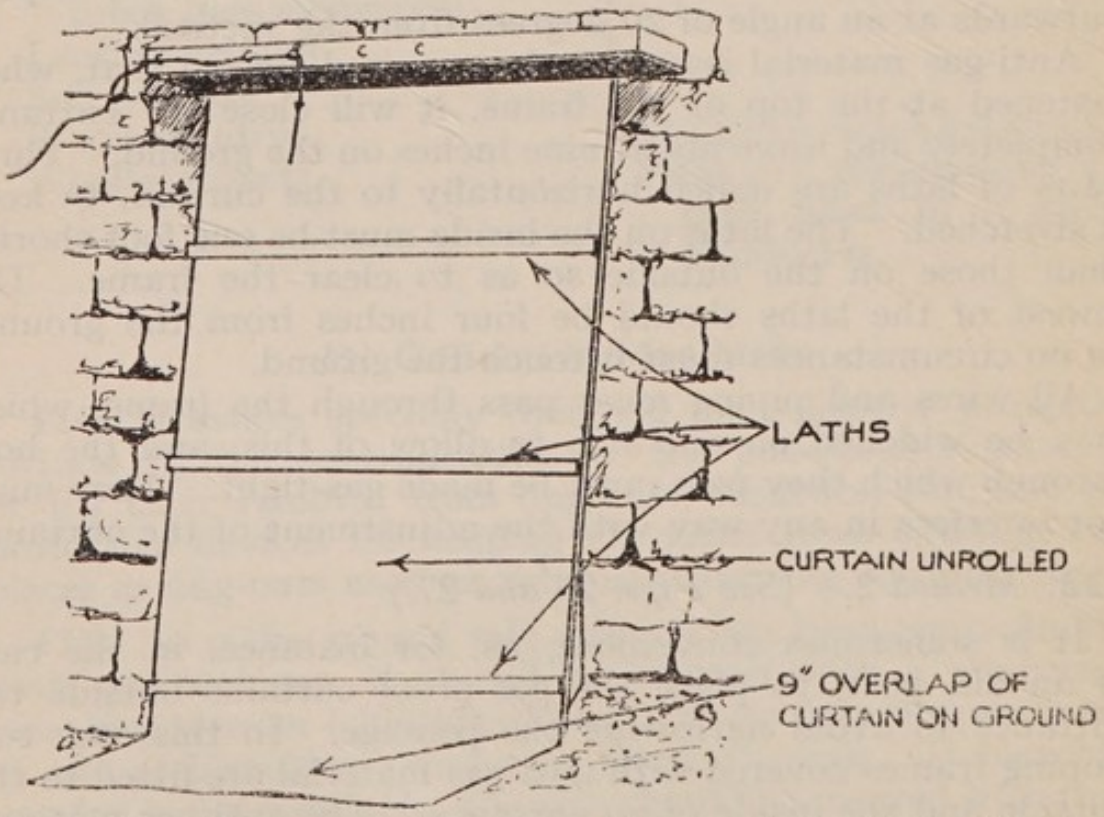


FIG. 27.—GAS-PROOF CURTAIN, CLOSED AFTER THE SENTRY HAS PULLED THE WIRE OR ROPE.

NOTE.—The laths should be fastened in pairs, one on the front and one on the back of the curtain. Those on the back should be shorter than those on the front to allow for the curtain lying close against the wooden frame.

before raising the other. This distance must be increased for dressing stations to allow stretcher cases to be carried in.

Openings in the side or in the roofs of shelters and cellars must be provided with curtains or closed with sandbags so that no gas can enter. Care must be taken to provide means for closing ventilating shafts and flues.

When not in use, curtains must be kept rolled up and held with a loop of string over a nail, so that they can be readily released. Curtains must in no circumstances be let down, except for their proper use or for inspection.

Screens for keeping out wind and sunshine must be contrived of other material and hung so as not to interfere with the rapid and correct adjustment of the gas curtain.

The construction and maintenance of gas-proof doorways are normally carried out by the Royal Engineers working in conjunction with the gas officer of the unit. C.Os. are responsible for seeing that defects in the gas protection of dug-outs are brought to the notice of the C.R.E. concerned.

Anti-gas cloth is treated with a special solution before issue and units are responsible for keeping gas-proof curtains moist with it or with water.

CHAPTER XIX

CLASSIFICATION AND DISPOSAL OF GAS CASUALTIES

423. The efficient sorting and disposal of casualties, when chemical weapons are used, will depend both on the type of casualty that has occurred and on the manner in which it has been produced.

In the Great War, particularly in the earlier periods, new chemical compounds were constantly being employed against us, with a result that a considerable element of surprise was effected. Chlorine and phosgene, and later the arsenicals and blistering gases (mustard gas) caused many casualties because of the very imperfect means of defence at our disposal at that time. Conditions have now altered. We have in the present respirator a very effective means of defence against all these compounds, but the respirator will not, of

course, protect the limbs and trunk from contamination by vesicants, *i.e.* blistering agents.

A difficult problem will arise in the sorting and disposal of casualties in the event of mustard gas or other blistering agent being sprayed from the air.

In such circumstances troops, if caught in the open, will be liable to get drops of liquid on their skin, clothing or equipment, and within a period varying from one to 12 hours they will be rendered casualties through burns occurring where the liquid and vapour have penetrated.

424. Contaminated personnel.—These may be divided into three classes :—

(i) Contaminated with gas, but not yet actually gas casualties.

(ii) Contaminated with gas, and already gas casualties.

(iii) Gas casualties and also wounded.

Under (i) the case would not primarily come under the R.A.M.C., but would be dealt with by unit or other arrangements. Cleansing of the body and a change of clothing, with the least possible delay, are ideals to be aimed at, as these are the only measures that will certainly prevent casualties.

Under (ii) the case is dealt with in a gas treatment centre.

Under (iii) the case would also go to the gas treatment centre, where its disposal would be decided on.

In this connection see para. **426,** where a scheme for the disposal of mustard gas casualties is shown.

425. Classification for evacuation.—For the purpose of evacuation, chemical warfare casualties in general may be divided into three classes :—

(i) *Slight.*—In the first place, the moral effect of chemical weapons is very great. In a gas bombardment many men, worried and shaken as they may be by the stress of war, will believe that they have been " gassed," and in that belief will report at a regimental aid post or field ambulance when in reality they have only smelt the fumes of ordinary high explosives, or gas in so low a concentration that it will do them no harm. A very careful examination and consideration of the evidence obtainable is therefore necessary before men are labelled as gas casualties. Casualties from the tear gases and nose gases are usually slight, and the majority of sufferers from them will be fit to return to duty within a few hours.

(ii) *Early acute cases.*—Active movement in cases of poisoning by suffocating agents should be reduced to a minimum. All such patients must, therefore, be treated from the first as stretcher cases and should be evacuated as lying down cases, until convalescence is well established. If there is evidence of serious damage to the lungs, evacuation to a casualty clearing station will be necessary. Since, however, in the early stages rest is essential, and the danger to life is greatest in the first 24 to 48 hours, once the patient has reached a medical unit, where adequate treatment can be given, his further evacuation should, when circumstances permit, be delayed for 48 hours.

(iii) *Late acute cases.*—As the appearance of symptoms in these cases is delayed, there is more time to arrange for their disposal and treatment. In mustard gas poisoning, the lung trouble—broncho-pneumonia—does not, as a rule develop before the third day after exposure, so that a patient suffering from early injuries to the skin or eyes may be allowed to walk from the front line and afterwards be sent on as a sitting case.

426. Organization of gas treatment centres.—When the number of casualties from chemical weapons is large and the type of warfare permits, special field ambulances and C.C.Ss. should be organized to receive, sort and treat them. Such units require special equipment and specially trained personnel.

In these units special arrangements are required for the reception and disposal of mustard gas cases. Such an arrangement is shown in Fig. 28. In any such scheme the essential point is to avoid the congregating indoors of men who have traces of mustard gas in their clothing, as the concentration of vapour so produced may be a danger to others.

The particulars of cases arriving should be taken preferably in the open or at least in a well ventilated shelter.

A separate department should be equipped to deal with cases of lung irritant poisoning.

The disposal of clothing contaminated by mustard gas will require special arrangements, unless medical units are in close touch with divisional or corps cleansing stations.

A treatment centre for mustard gas casualties in a back area (Fig. 29) would be on the same lines as that suggested for a C.C.S., but might be somewhat more elaborate. The centre would be part of a general hospital. An operating theatre should be provided in order that cases suffering from both mustard gas and wounds may be efficiently treated before proceeding to the surgical division of the hospital.

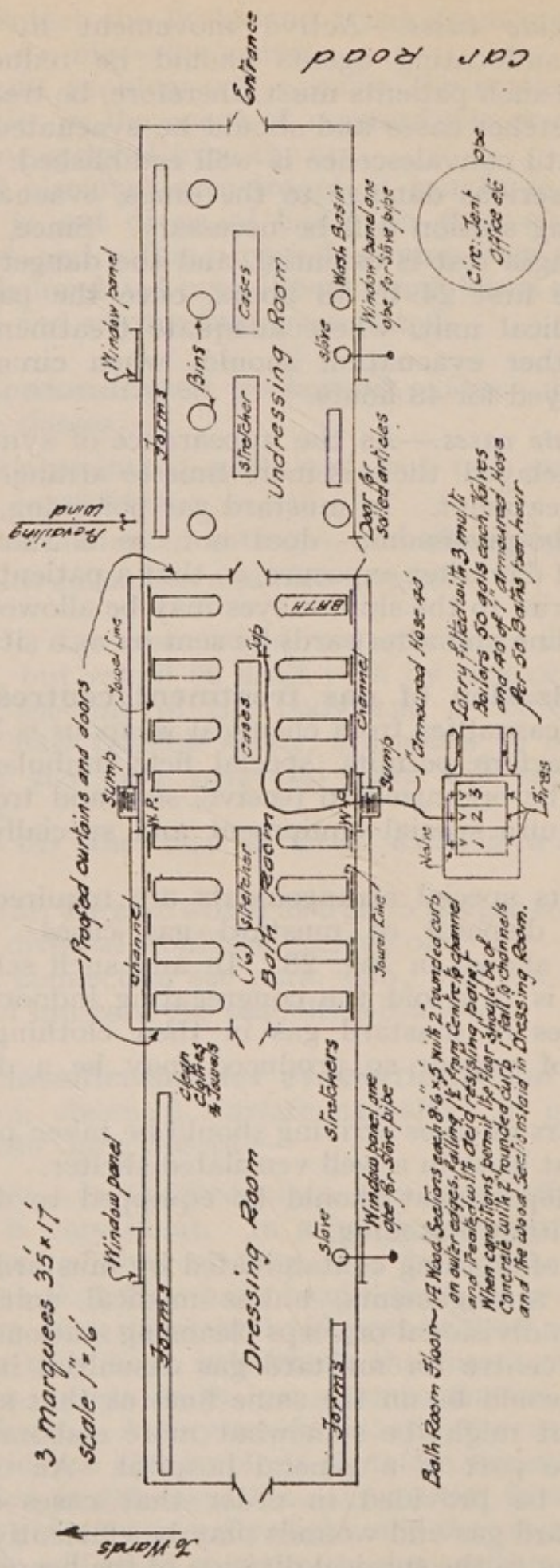


FIG. 28.—C.C.S. RECEPTION AND DISPOSAL CENTRE FOR MUSTARD GAS CASUALTIES

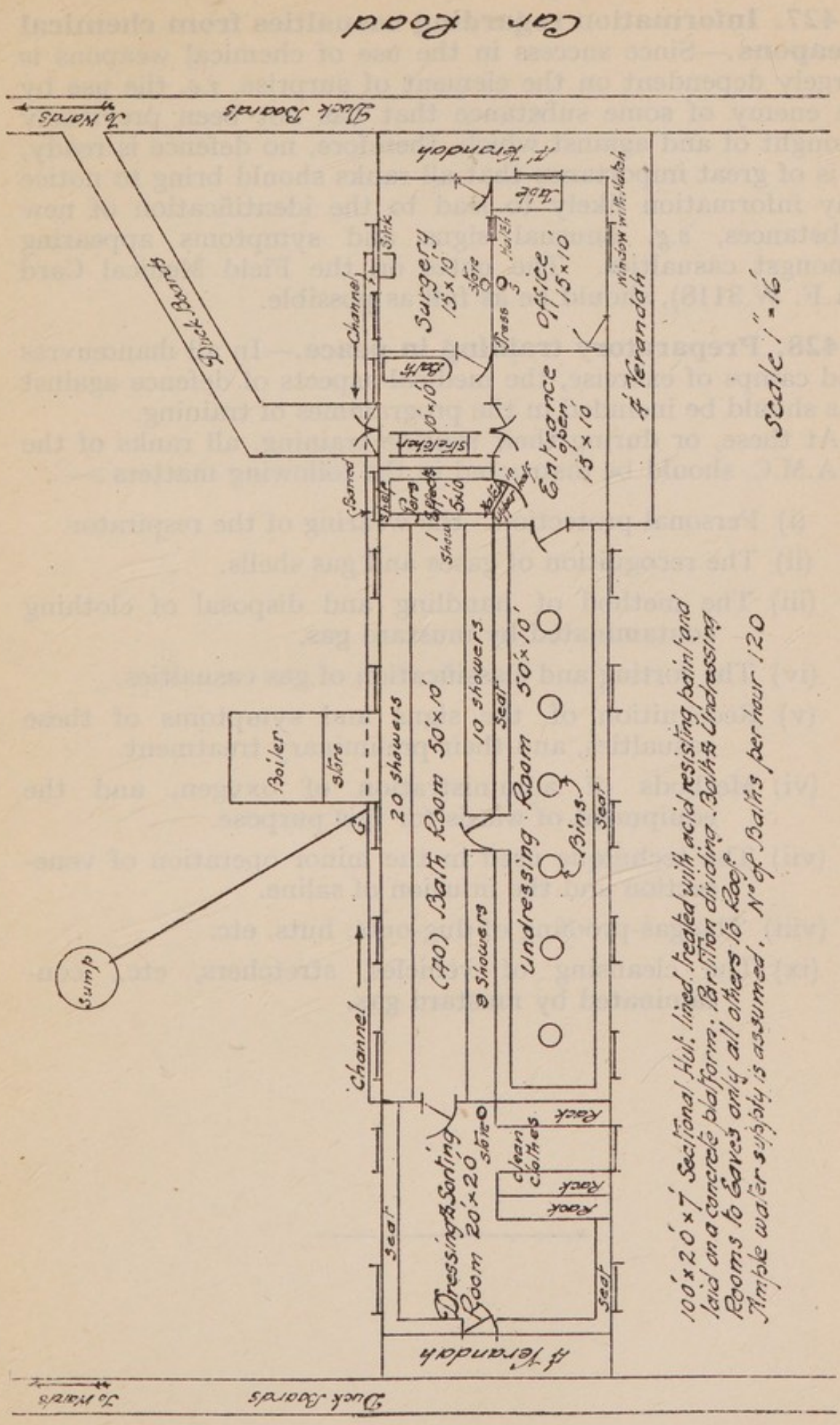


FIG. 29.—TREATMENT CENTRE FOR GAS CASUALTIES IN BACK AREAS

427. Information regarding casualties from chemical weapons.—Since success in the use of chemical weapons is largely dependent on the element of surprise, *i.e.* the use by an enemy of some substance that has not been previously thought of and against which, therefore, no defence is ready, it is of great importance that all ranks should bring to notice any information likely to lead to the identification of new substances, *e.g.* unusual signs and symptoms appearing amongst casualties. The notes on the Field Medical Card (A.F. W 3118), should be as full as possible.

428. Preparatory training in peace.—In all manœuvres and camps of exercise, the medical aspects of defence against gas should be included in the programmes of training.

At these, or during their routine training, all ranks of the R.A.M.C. should be instructed in the following matters :—

(i) Personal protection—the wearing of the respirator.

(ii) The recognition of gases and gas shells.

(iii) The method of handling and disposal of clothing contaminated by mustard gas.

(iv) The sorting and classification of gas casualties.

(v) Recognition of the signs and symptoms of these casualties, and their preliminary treatment.

(vi) Methods of administration of oxygen, and the equipment of wards for this purpose.

(vii) The technique used in the minor operation of venesection and the infusion of saline.

(viii) The gas-proofing of dug-outs, huts, etc.

(ix) The cleansing of vehicles, stretchers, etc., contaminated by mustard gas.

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FIG. 30.—THE BACK LIFT

SECTION 6

CHAPTER XX

METHODS OF TRANSPORT

429. Historical sketch.—From the beginning of history we know that the human race has been engaged in fighting battles, and, though we have full accounts of their victories and losses, little is recorded concerning their wounded. We do know, however, that the sick and wounded were carried in " litters " from the earliest times, and that at least two Roman generals transported their wounded in wagons, and also that the Roman legions were accompanied by surgeons. Digges, a writer in the sixteenth century, pointed out the need of a collecting station for the wounded. Barons Larrey and Percy, of Napoleon's Grand Army, inaugurated a great advance and effected far-reaching changes in the transport of the wounded in the field. The former was the first to introduce light horsed-ambulance wagons in the campaign against Austria, whilst to the latter we owe the organization of the first companies of stretcher bearers. A short account of the latter may be of interest here. The men were especially selected from volunteers from the different regiments, and these " brancardiers," as they are still named in the French army, were so equipped that any two could construct in a few minutes a stout, comfortable litter. It was composed of two poles of pinewood cut with the grain, two traverses or cross pieces, and a piece of cloth deeply hemmed on both edges. The weight hardly exceeded 4 lb., with a resistance of nearly 200 lb. without bending. The poles, which were painted, served also to form a kind of halberd or pike for defensive purposes. These companies became a recognized establishment of the Imperial Army in 1813.

430. Methods of transporting wounded.—The transport of the wounded is carried out by the following means :—By men ; by contrivances carried by men ; by contrivances wheeled by men ; by animals ; by contrivances carried by animals ; by conveyances drawn by animals ; by mechanical means (charabancs, cars, trains, aeroplanes) ; by water transport (barges, steamers, hospital ships).

The exact method to be adopted depends entirely on the local conditions, nature of the country and facilities available. The carriage of wounded by man-power imposes a heavy strain on the bearers. In order, therefore, to obviate their

early exhaustion, as well as to shorten the time of the journey to a dressing station, horsed or mechanical conveyance should be substituted for man-power at the earliest opportunity.

By Men

431. Wounded men may be carried out of action either pick-a-back, by the back-lift, fireman's lift, hand-seats or on stretchers.

432. Pick-a-back.—If conscious, and able to hold on, a man can be carried pick-a-back by another.

433. The back-lift.—If the patient is able to stand, place him with his back to yours, slightly stoop, place your hands over your shoulders and grasp him under the arm-pits, bring his weight well up into the small of the back, and stand up (Fig. 30). To lower the patient to the ground, sink down on the left knee, place him in a sitting posture and turn towards him.

434. The fireman's lift.—If a patient is helpless, he may be carried by means of "the fireman's lift" (Figs. 31, 32 and 33).

The Fireman's Lift



Fig. 31.

THE FIREMAN'S LIFT—*continued*



FIG. 32.



FIG. 33.

This method is well adapted for cases of insensibility, and is carried out as follows :—

(i) Roll the patient over on the face, the arms to the side.

(ii) Stand at the head, place your hands beneath the patient's shoulders, and raise him to the kneeling position (*see* Fig. 31).

(iii) Place your hands under his arm-pits, raise him up, stoop, place your head beneath his body, bring his right arm round your neck, put your right hand round his right thigh, bring his weight well on to the centre of your back (Fig. 32), grasp his right wrist with your right hand and rise to the erect position (Fig. 33).

435. Two-handed seat.—This seat is used to carry a patient who is unable to assist the bearers.

(i) Two bearers face each other and stoop, one on each side of the patient. Each bearer passes his forearm nearest to the patient's head under his back just below the shoulders, and, if possible, takes hold of his clothing. They slightly raise the patient's back, and then pass their forearms under the middle of his thighs (Fig. 34), and clasp their hands, the bearer on the left of the patient with his palm upwards, and holding a folded handkerchief to prevent hurting by the finger nails ; the bearer on the right of the patient with his palm downwards, as shown in Fig. 35.

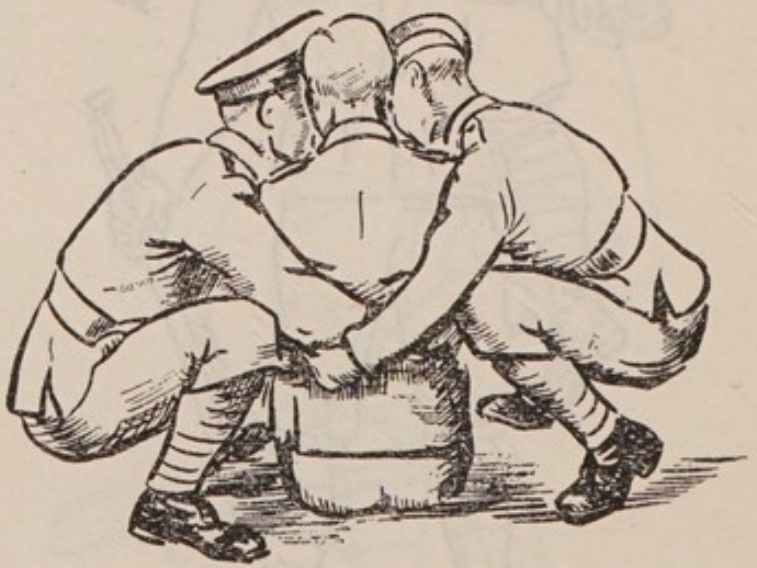


FIG. 34.—TWO-HANDED SEAT (1)

(ii) The bearers rise together and step off, the right-hand bearer with the right foot, and the left-hand bearer with the left foot (Fig. 36).



FIG. 35.—METHOD OF FORMING "HOOK-GRIP"

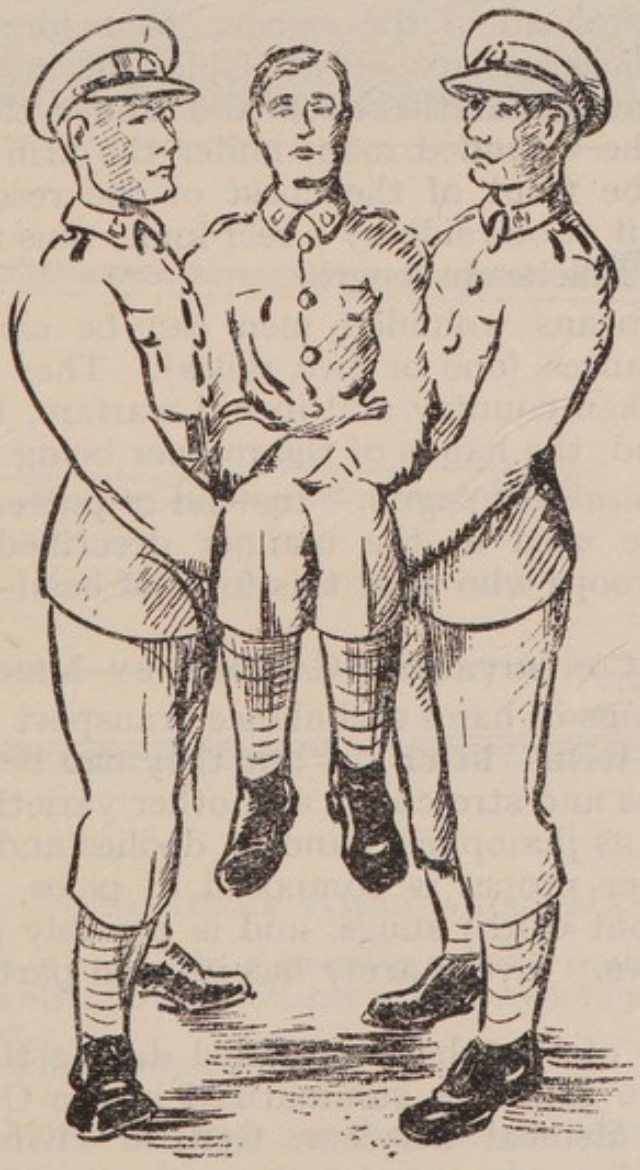


FIG. 36.—TWO-HANDED SEAT (2)

436. The fore and aft method.—If the patient is insensible, one bearer, kneeling behind him, passes his hands under his arm-pits and clasps them in front of his chest ; the second bearer carries him feet first with a leg on either side. If a lower limb is injured, both legs should be tied together.

437. By puttees or pagris.—Wounded men may be carried off the field by means of puttees or pagris :—

(i) *By means of one puttee.*—A puttee is unrolled and placed well forward under the buttocks of the wounded man, and tied by a reef-knot into a loop 84 to 88 inches in length. The rescuer then bends down, facing away from the injured man, applies the loop of the puttee over his own forehead and, rising, carries off the wounded man. The webbed stretcher-sling can be similarly used.

(ii) *By means of two puttees.*—One puttee is placed under the buttocks of the wounded man and over the forehead of the rescuer, as before. The second puttee is passed outside the first, round the middle of the back and under the arm-pits of the wounded man, under the arm-pits and over the front of the chest of the rescuer, and tied off at one side by a reef-knot, thus forming a loop 72 inches in length.

By these means wounded men can be carried for considerable distances (one or two miles). They are especially useful for broken country and in hill warfare, but equally so on level ground, the hands of the rescuer being free.

(iii) *By means of pagris.*—Instead of puttees, pagris may be used in the manner described above, with troops who wear this form of head-dress.

Contrivances Carried by Men

438. All forms of hand ambulance transport are comprised in the general term " litter " ; but they can be divided again into hammocks and stretchers, and other varieties confined to the East such as jhampans, dandies, doolies and palkis.

The stretcher proper is composed of poles, traverses and canvas (or stout cloth) slings, and is possibly provided with feet and pillows. Every army has its own particular pattern of stretcher.

Many types of stretcher were tried during the Great War. The experience gained is summarized in the Official History of the War, Medical Services, General History, Vol. IV, Chapter XXIII.

439. Doolies.—In India, from time immemorial, the doolie has been the general method of transporting the sick and wounded by litter. It consists of a canvas bed on which a man can lie full length with frame-work and cover carried on a bamboo pole.

440. Army pattern ambulance stretchers.—The stretcher in general use in the army is the Stretcher, Mark II.

A second pattern, the Stretcher, Special, is designed for use in tropical countries.

Another pattern, the Stretcher, C.C.S., is included in the war equipment of a C.C.S.

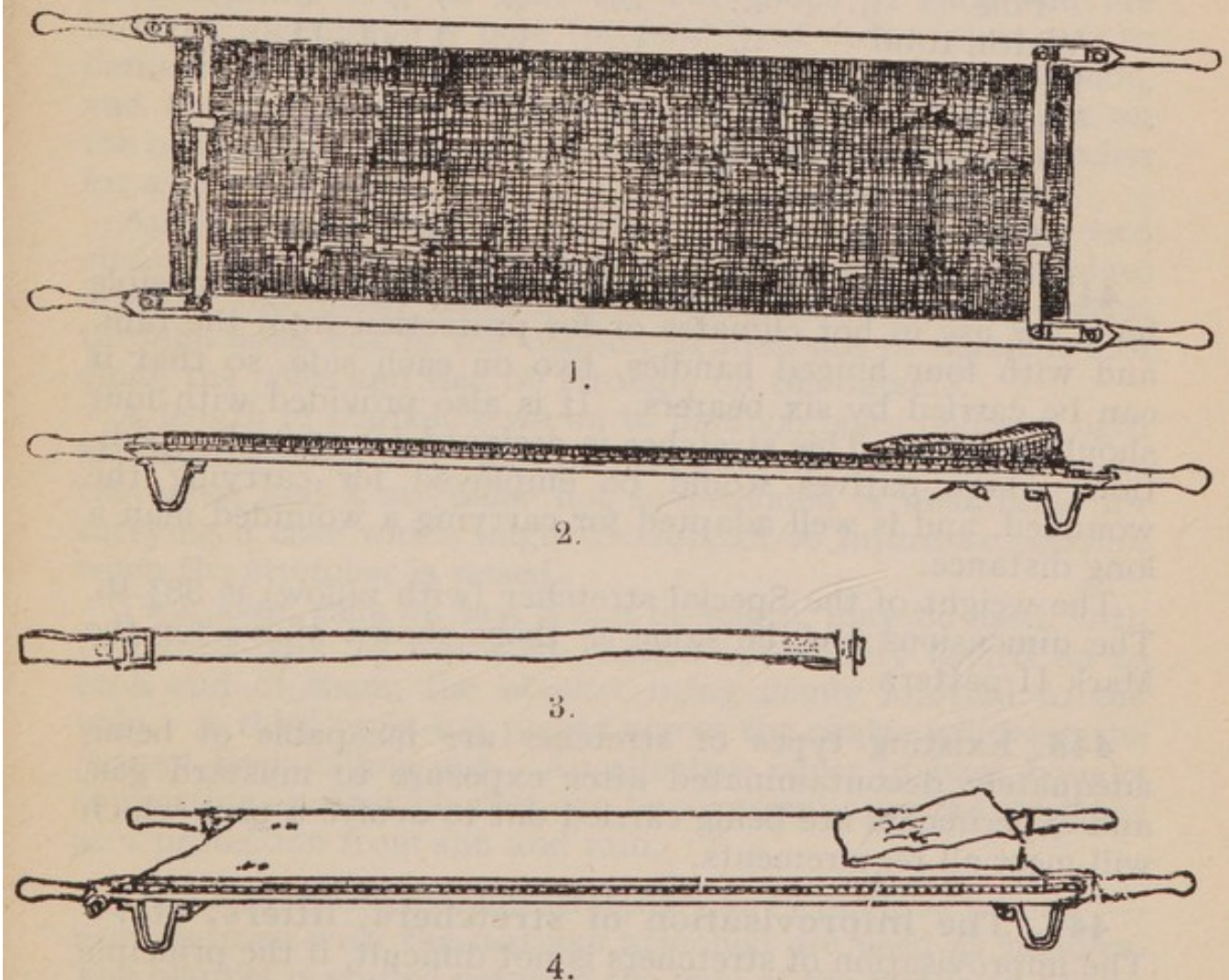


FIG. 37.—STRETCHER AMBULANCE, MARK II

1. Plan of underside of stretcher showing traverses.
2. Side elevation of stretcher with cushion in place.
3. Sling.
4. Stretcher ready for use.

441. In the Mark II stretcher the canvas, which is tanned, is fastened to the poles by copper nails ; the poles are squared and kept apart the required distance by two flat, wrought

iron, jointed bars called traverses, and are fitted on the under side with steel U-shaped runners. The pillow is wedge-shaped, varying from 1½ to 3½ inches in thickness. There are eyelet holes in the canvas of the stretcher at both ends for the attachment of the pillow by thin leather thongs, and it is fitted with two canvas straps, one at each end, to secure the stretcher when closed. Webbing slings are provided for assistance in carrying stretchers over long distances.

The following are the dimensions, etc., of the Mark II stretcher :—

Length—	
Canvas	6 feet 0 inches.
Pole	7 ,, 9 ,,
Width, total	1 foot 11 ,,
Height	0 ,, 6 ,,
Weight	30 lb.
Tonnage for freightage—	
Without pillow	·0364 ton.
Pillow only	·015 ton.

442. The Special stretcher is fitted with a collapsible hood for use in hot climates or for protection from the rain, and with four hinged handles, two on each side, so that it can be carried by six bearers. It is also provided with four shoulder pads. This stretcher is designed for special expeditions where natives would be employed for carrying the wounded, and is well adapted for carrying a wounded man a long distance.

The weight of the Special stretcher (with pillow) is 38¼ lb. The dimensions are the same as those shown above for the Mark II pattern.

443. Existing types of stretcher are incapable of being adequately decontaminated after exposure to mustard gas, and experiments are being carried out to evolve a type which will meet all requirements.

444. The improvisation of stretchers, litters, etc.— The improvisation of stretchers is not difficult, if the principle of their construction is borne in mind, *i.e.* to secure some material on which a patient can lie and be carried by men. Before any improvised apparatus is used for the conveyance of a wounded man, it must be tested practically by one of the party, in order to avoid the possibility of further injury to the patient from defective materials or construction. The materials necessary are generally to be found in the neighbourhood of operations, *i.e.* doors, gates, hurdles, shutters, shafts, saplings, broom-handles, corn-sacks, tarpaulins, old

tents, stout pieces of cloth, great-coats, hay, straw, ferns, leaves, etc., all of which have their uses.

A gate or door taken off its hinges, or a hurdle, are ready means of carriage, if at hand.

The hammock is the simplest special contrivance for carrying a sick or wounded man, and a soldier's blanket slung between two men, or tied to a pole carried on their shoulders, offers perhaps the most primitive form.

445. By means of blankets, canvas or sacks, an improvised stretcher can be formed with a couple of poles.

A loop may be sewn at each corner of a blanket, which is then doubled over so that the two loops at each end are brought together. A pole (preferably of cedar, pine, ash or bamboo) is then passed through the four loops on one side, and another passed within the doubling of the blanket on the other side. This forms a secure and comfortable stretcher for a short distance.

Again, a good temporary litter can be made by laying two stout poles on the edges of the blanket, rolling the edges inwards and finally making them fast by strong twine passed through holes cut in the blanket at intervals of about a foot along the poles and tied off strongly on the outside.

A length of blanket sewn on to bamboo poles makes a light serviceable stretcher ; but, like the preceding forms, it has no traverses, and a stretcher not so provided is unsuitable for carrying a case which might be subject to injurious pressure when the stretcher is raised.

Two poles, each of, say, 8 feet in length, may be used, with two cross-bars 2½ feet each, nailed or securely lashed on to each end of them, the blanket being firmly knotted to the pole. A third cross-bar placed across the centre will keep the patient from falling out. An effective cover of bent boughs supporting another blanket can be arranged over the stretcher as a protection from sun and rain.

446. A modified blanket stretcher can be made as follows :— Stirrup-irons with the leathers attached are used as handles. The blanket is stuffed between the bars of the treads and fixed there with a sword-knot, stone or other hard article of convenient size thrust into the pocket so formed. The stirrup-leathers are left attached, to be used as slings to assist in supporting the patient's weight. The irons are fixed on to the blanket in which the patient has been placed, two at the head-end and two at the feet-end, each pair being held by a bearer. One is also fixed to the blanket on either side of the patient, and grasped by an additional bearer. Stirrup-irons can be applied to any blanket, and should be placed

away from its edge and as near the patient's body as possible, leaving the free sides available for covering the patient. He can then be comfortably transported by four bearers with six stirrups, or by two bearers if poles are slipped through the irons on either side of the patient.

The irons and leathers may be used with two bearers (instead of four), one at either end, or used to suspend the patient in a wagon.

447. Stretchers can be improvised with rifles and puttees, pagris, etc., *e.g.* :—Two puttees are applied to two rifles, forming nine bands from muzzle to butt. The cartridges are withdrawn. The two rifles are placed with their trigger-guards uppermost, the two puttees being knotted to the rifles so as to form nine cross-bands uniting the rifles.

448. Trench stretchers.—In trenches, owing to their narrowness and the presence of traverses, the ordinary army stretcher fully opened out cannot be used by four bearers. To facilitate its passage round sharp turns, grooves may be cut in the walls of the trench, but their stability must not be endangered ; partially closing the traverses to reduce the width of the stretcher may be tried.

Often the only way possible is to carry the patient round traverses on a blanket or waterproof sheet until a portion of the trench is reached where a stretcher can be used. Various forms of special trench stretchers have been evolved, the principle being to reduce the length as much as possible to allow of its passage round traverses, the patient being carried in a sitting position as on a chair, with his back resting against the back of the leading bearer. For more detailed information, *see* History of the Great War, Medical Services General History, Vol. IV.

449. An appliance, known as the Universal Stretcher Sheet, has been devised which is easily attached to any standard stretcher. By its means the patient is held so securely on the stretcher that the latter can be carried in any position, greatly facilitating carriage along narrow trenches or corridors, or up and down steps. It is particularly adapted to use in aeroplanes, in trains or on board ship. It affords an extra splint in cases of fracture of the spine.

The appliance consists of a canvas sheet fitted on one side with three metal clips which fasten on to one pole of the stretcher. The sheet is further attached to each end of the stretcher by "runner straps," which buckle through the runners of the stretcher. The sheet is thrown over the patient and fastened in position by three body straps which are passed under the stretcher through loops in the canvas

sheet and buckled off by the clips. The upper two straps may be crossed diagonally to avoid undue pressure on the chest. Two " loop straps " are provided which pass round the nape of the neck and under the feet respectively, to prevent vertical movement in either direction.

Conveyances wheeled by Men

450. Wheeled stretcher carriers are extremely useful in the field, especially where the roads are good. They can also be used over open country if the surface is fairly firm. They must take the army pattern stretcher and admit of its being securely mounted. Of several varieties, the approved army pattern is the " Miller-James " Stretcher Carrier.

451. The **" Miller-James " Collapsible Stretcher Carrier** has a folding collapsible frame. The axles are jointed

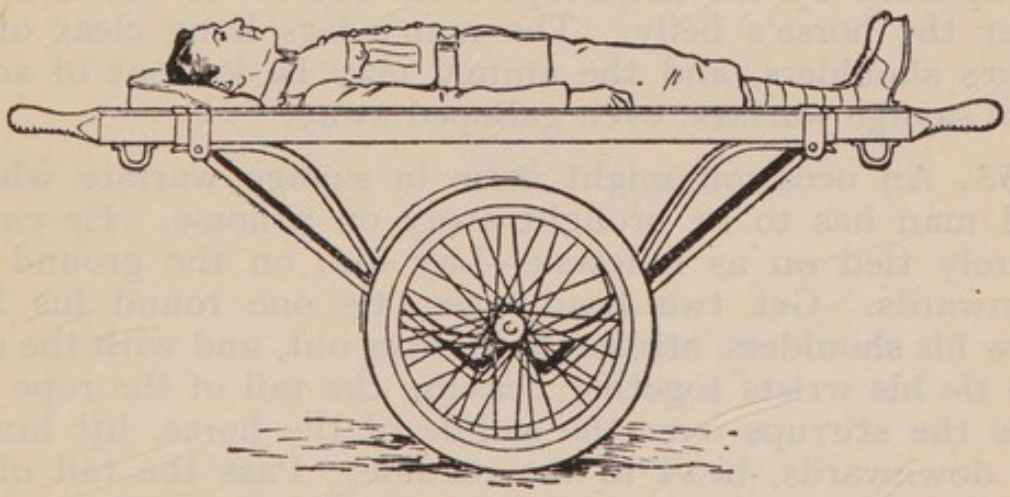


Fig. 38.—Miller-James Collapsible Stretcher Carrier

so that the two wheels can be brought close together and the apparatus easily transported. Running up from the axles at each side are two elliptical springs, on the top four corners of which the stretcher is supported. The tyres are pneumatic, of broad tread, and consequently do not sink deeply in firm mud, but offer great resistance when forced through liquid mud.

By Animals

452. The removal of a wounded comrade by mounted men is a useful practice in all mounted corps.

A man can be brought out of action on a horse without any special contrivance for carrying him, other than the saddle. If only slightly wounded, he may be able to ride off unaided,

or he may be assisted out of action by a comrade sitting behind him, or by one walking at the side of his horse. If dismounted, he may be given a stirrup and assisted to mount behind the rider; or, if unable to mount in this way and another horse is at hand, the comrade may dismount and help him up. If the wounded man is badly hit, the comrade should place him in front of him, facing the horse's tail, and hold him in his arms, the wounded man, if able to assist, holding on to the cantle of the saddle with both hands; or he may be laid across the saddle face downwards, supporting himself with one foot in a lengthened stirrup, while the horse is led by a comrade.

To carry an insensible man on a horse, make, if possible, a pad with a horse-blanket or sack on the saddle, place the man astride over the horse's withers, his body lying on the saddle face downwards, his head towards the horse's tail; cross the stirrup leathers over the man's back, and secure the stirrup-irons by the head-rope from the off to the near-side under the horse's belly. The man's legs hang clear of the horse's shoulders, and the animal may be led out of action or, in savage warfare, even galloped away.

453. An occasion might arise in savage warfare when a dead man has to be brought away on a horse. He can be securely tied on as follows:—Lay him on the ground face downwards. Get two head-ropes, tie one round his body below his shoulders, stretch both arms out, and with the same rope tie his wrists together, leaving the tail of the rope free. Cross the stirrups over the saddle of the horse, lift him on face downwards, head to the off-side. Pass the tail of the rope from the wrist under the horse's belly, and fasten it to the stirrup which hangs over the near-side; similarly, fasten the second rope round the legs, pass it under the belly and tie it to the stirrup on the off-side; the horse can then be galloped out of action.

454. Tying and coupling horses.—It is of importance in ambulance work with mounted troops to know how to tie up a horse so that he cannot move from the spot, and how to tie two horses together. The whole of the personnel of a cavalry field ambulance should possess this knowledge. The first can easily be done as follows:—Pass the bit-rein under the surcingle or girth on the near side of the horse, taking care to bring his head round quietly, without jerking, so as to shorten the rein; then pass the stirrup-iron and leather through the loop thus formed and draw taut.

Another method is to unbuckle the near stirrup-leather and pass one end of it through the ring of the bridoon on the

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FIG. 39.—CAMEL CACOLETS

near-side, and rebuckle. At the same time the stirrup-iron should be run up to the flap of the saddle.

Horses can be securely coupled by turning them head-to-tail and tying each with the bridoon-rein to the off back strap or arch of the saddle of the other, taking care that the rein when tied is not more than six to eight inches long.

455. To remove a wounded man from a horse.—Three bearers are sufficient but a fourth is useful to hold the horse. If the horse is restive, one foreleg should be held up with the knee bent. The patient's spurs should be removed.

In the case of an injury to a lower limb, the three bearers take up their position on the injured side. One bearer supports the injured limb and another the pelvis and uninjured leg, whilst the patient supports himself on the neck and shoulders of the third bearer. The patient is then gently lifted from the horse and laid on a stretcher, previously prepared.

In the case of an injury to an upper limb, the same procedure is adopted except that the patient is approached from the uninjured side.

Contrivances Carried by Animals

456. To these the name of Pack Ambulance Transport is given. The animals used are the camel and the mule, and their employment is restricted to countries with bad or insufficient roads and to mountain and desert warfare in Asia and Africa.

457. Camel kajawahs or cacolets.—In India up to the time of the Mutiny, the camel was one of the chief means of transporting the wounded, and it is still used on the N.W. Frontier, and in desert countries. Men were carried in what were called kajawahs, which were of various patterns to allow of patients lying or sitting. The framework was of wood with seats and backs of laced rope or canvas. Iron rings were fixed to the framework, through which ropes were passed to secure it firmly to the packsaddle of the camel. The load of a baggage camel is 400 lb. and his average pace is from 2½–3 miles an hour.

The modern modification of the kajawah, which is used on the N.W. Frontier at the present time, is a development of the above and of the Turkish cacolet, by which name it is also known (*see* Fig. 39).

The saddle is the ordinary heavy burden pack saddle adapted to kajawah or cacolet work by iron frame-work fittings, one near and one off interchangeable, each clamped to the side of the saddle near the arches and provided with

brackets into which the iron arms of the bed frame or chair fit. Thus either lying or sitting cases can be carried as required. The bed frames in the lying down type are steadied by girths passing beneath the camel's belly from outside to outside of the bed frame.

This pattern of saddle has the advantage of being available for ordinary transport work when not required for medical services, and of bringing the work of transporting casualties within the compass of the heaviest camels. The old pattern saddles were so small that only small or razor-backed animals could be used.

It is to be noted that although these camel kajawahs or cacolets entail certain disadvantages to the patients, actually inimical to the severely wounded, there may be times when they alone can be used for the evacuation of casualties in some phases of warfare.

Another form of cacolet is used in Egypt adapted to a mule. It consists of a pack saddle to which are attached by hooks folding chairs in which patients sit, one on either side, facing the direction of the animal's head. It is very tiring for the animals.

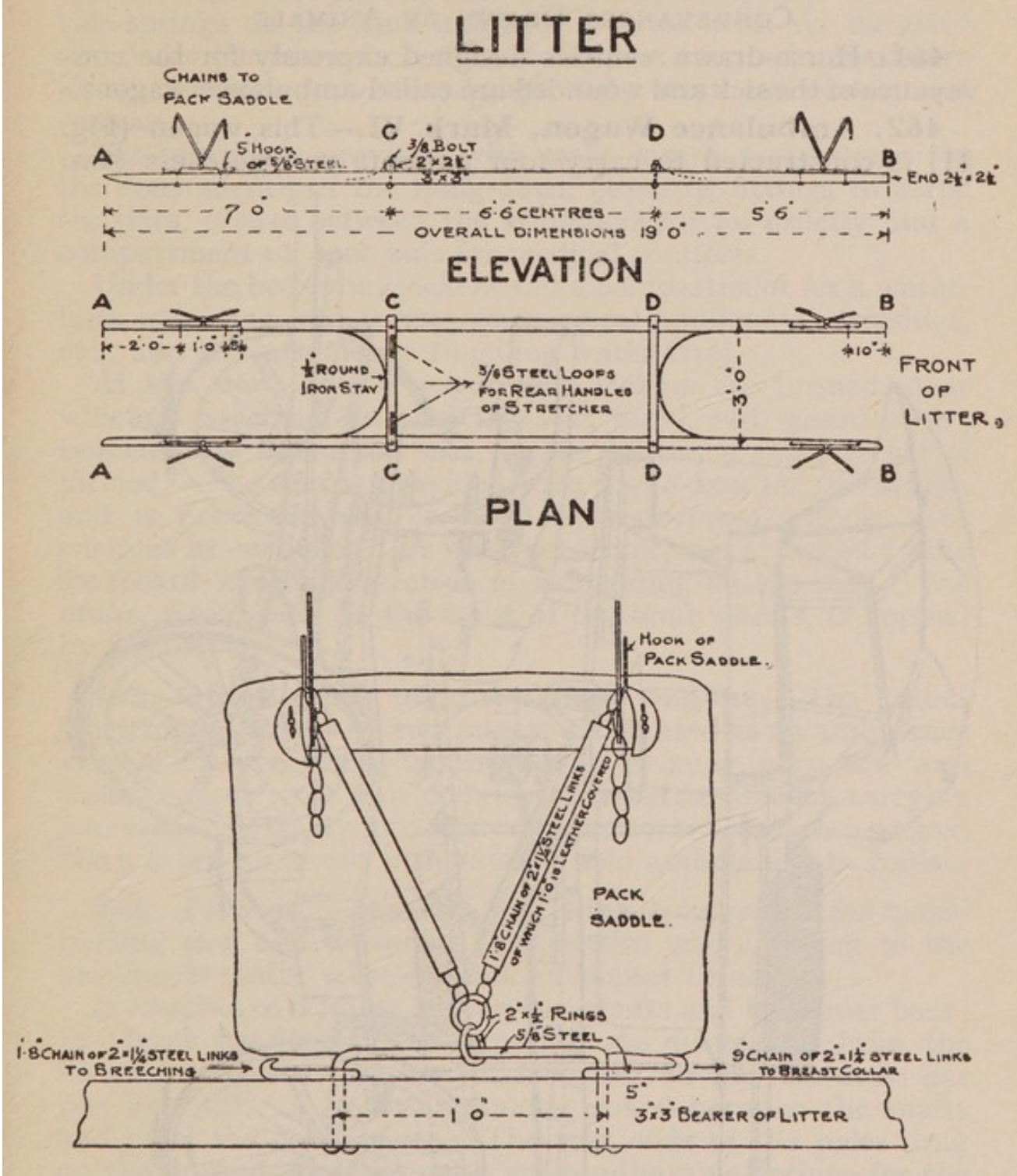
458. Camel litters.—A form of litter carried by two camels has been used successfully in Egypt and The Sudan. It consists of a bed supported on each side by a long pole (telegraph poles have been used), the poles forming a pair of shafts secured to the saddles of the camels. An important point to remember is that the shafts for the rear camel must be twice as long as those for the leader. The legs of the bed are prolonged upwards, forming supports for an awning formed by blankets folded double, the side away from the sun being rolled up to give plenty of air. Four blankets are sufficient to form the awning; two form the roof, meeting in the centre, and the ends are left hanging over to protect the head and feet from the sun, if necessary. A bar at each side of the litter above the poles prevents the patient rolling off; the sides are furnished with a "gate" in the centre for exit and entrance.

The camels must be made to rise or kneel together, so as not to cause inconvenience to the patient when loading or unloading. With carefully selected and trained camels, the man need never leave his bed and sound sleep can be procured. Each camel is led by its respective attendant.

459. Mule-litters.—These are carried by two mules and were found useful in Macedonia during the Great War.

The litters consist of two strong poles, each 19 ft. by 3 in. by 3 in., connected by two cross-pieces (*see* Fig. 40). The stretcher rests on the two cross-pieces. The cover is formed

of two arches of bent wood with cloth stretched over them, and covered with tarpaulins if necessary. The specification for the sealed pattern is held by the R.A.O.C.



DETAIL OF ATTACHMENT TO PACK SADDLE

FIG. 40.

460. Riding ponies.—For operations in roadless and mountainous country, provision may have to be made for the allotment to each field ambulance of a number of riding ponies, equipped with universal pattern saddles, for the

evacuation of sick and slightly wounded. It is essential that these animals be docile and well trained before they can be used for this purpose (*see* paras. **366, 374** and **378**).

Conveyances Drawn by Animals

461. Horse-drawn vehicles designed expressly for the conveyance of the sick and wounded are called ambulance wagons.

462. Ambulance Wagon, Mark VI.—This wagon (Fig. 41) is constructed to carry four patients on stretchers (two

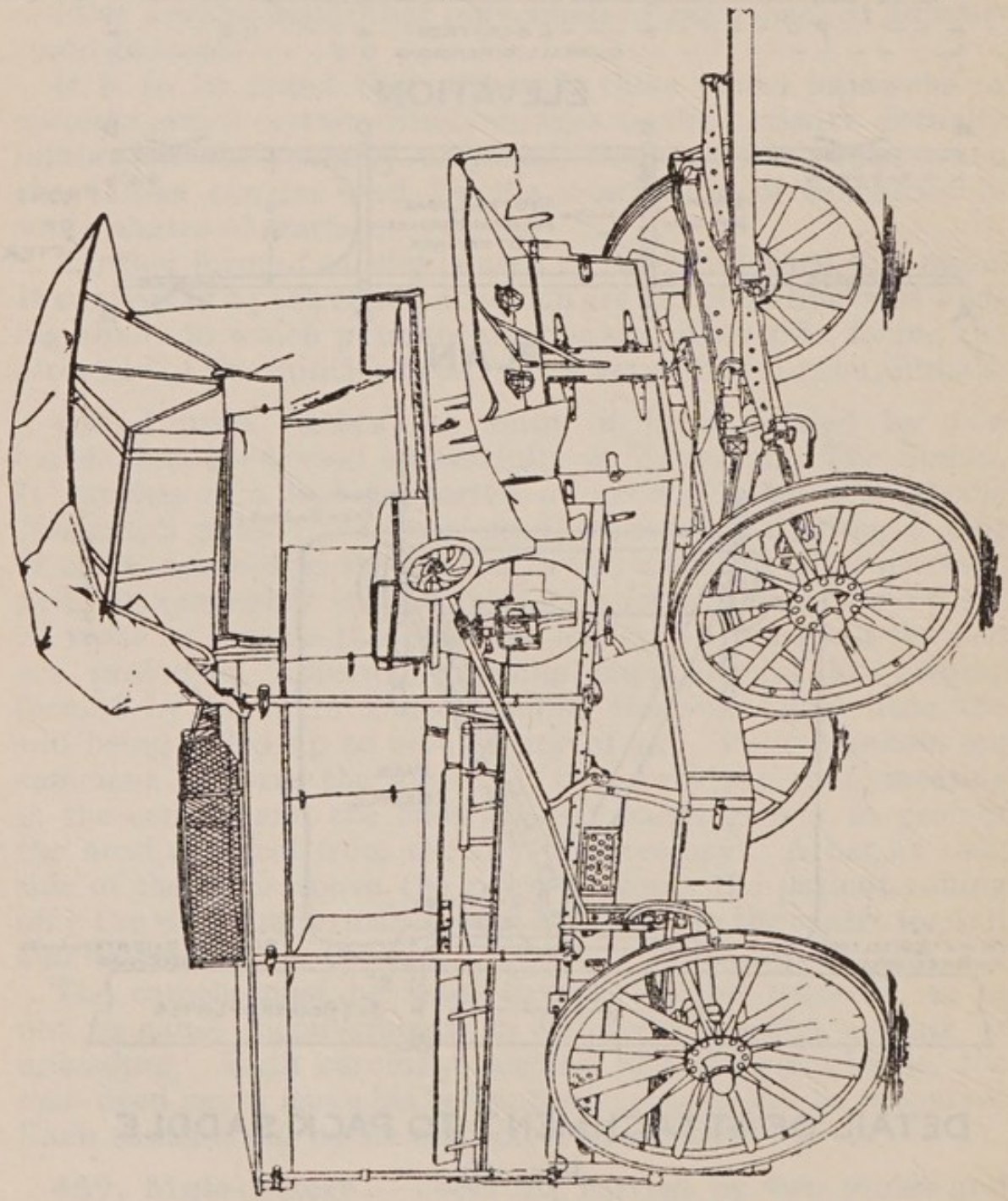


Fig. 41.—Wagon, Ambulance, Mark VI

stretchers on the floor and two on rails resting on the seats), or 12 sitting (on the seats), or six sitting at the rear end and two on stretchers on the rails.

The vehicle consists generally of a body, with a roof, fore-carriage, brake-gear, springs, axletrees and indiarubber-tyred wheels. The body, which is supported at the front by the fore-carriage, and at the rear by two cross-springs and two side-springs on the hind axletree, is fitted with six movable standards (three on each side) to support the roof, ventilators along the sides, travelling lamps and curtains of waterproof canvas.

The interior is provided with seats, lamps, hand-straps for the convenience of the lying-down patients, fittings to carry six rifles, a seat between the stretchers for an orderly and a compartment on each side for medical comforts.

Under the body four lockers and a compartment for a water-tank are fitted, the former for surgical appliances, dressings, etc., and the latter for a 10-gallon water-tank.

At the front of the wagon two lockers are formed, over which is constructed a driving seat fitted with guard-irons; immediately under the seat, in the centre, a small locker is formed. The seat is provided with a seat-box for the driver, and is protected with a hood of waterproof canvas with curtains at each side. A waterproof apron is attached to the footboard for the protection of men riding on the seat. The brake, which acts on the front of the hind wheels, is applied by the driver.

463. Other types of ambulance wagons.—The ambulance tonga, drawn by two mules, is still used as an ambulance vehicle by the army in India. It is hung very low and cannot upset over any country, and is capable of carrying four sitting or two lying cases. A light horse ambulance wagon, Mark I, is also in use with cavalry field ambulances in India.

464. Travois.—This is a wheel-less conveyance for transporting sick and wounded in countries where, owing to the absence of roads, wheeled vehicles cannot be used.

It consists of a frame having two shafts and two cross bars; the front handles of the stretcher are suspended from the forward cross bar, the rear handles rest on the rear cross bar (*see* Fig. 42). A horse or mule is yoked between the shafts and pulls the conveyance. The rear ends of the poles drag on the ground, and the poles make admirable springs for the litter, as any jar communicated to them is well distributed before it reaches the patient. One pole is always cut slightly shorter than the other, in order that, in passing over any obstacle, the shock may be received successively by each pole and thus reduced by about a half.

The most useful travois is fitted with a swingletree, which eases the pull on the mule and prevents lateral motion. In

North Russia travois were found extremely useful for the conveyance of patients along forest tracks.

Its main disadvantages are that it is unsuitable in rocky mountainous districts or in countries with much undergrowth,

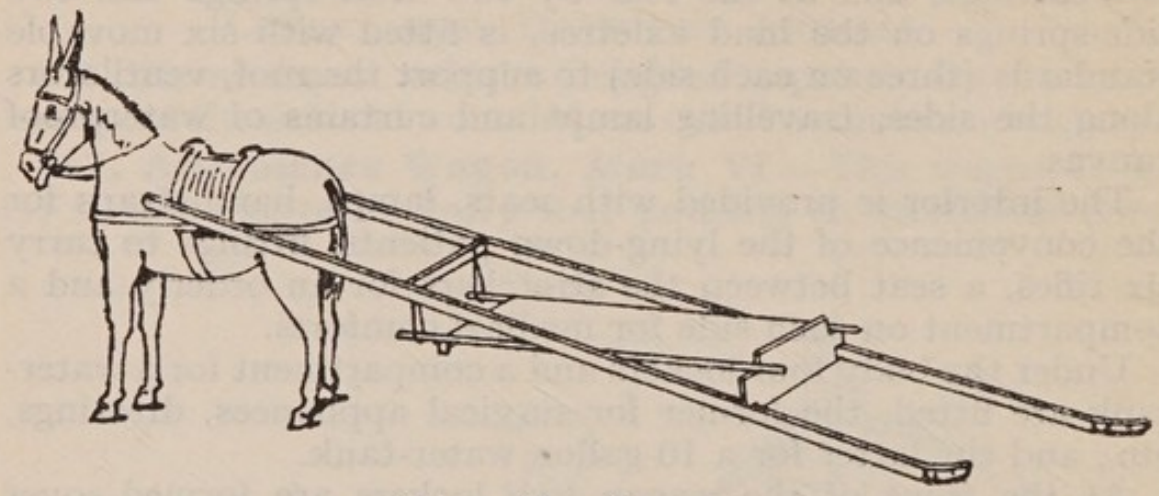


FIG. 42.—TRAVOIS

and that the steel shoes at the end of the poles are apt to damage telephone wires if laid along the ground as well as stirring up dust, while in soft ground they require wide wooden runners.

The specification for the sealed pattern is held by the R.A.O.C.

465. Sand sledges.—These have proved unsatisfactory, as they are easily overturned and can only be drawn by a mule.

466. Sleighs.—These proved most useful during the winter in North Russia. The patient must be well protected against cold.

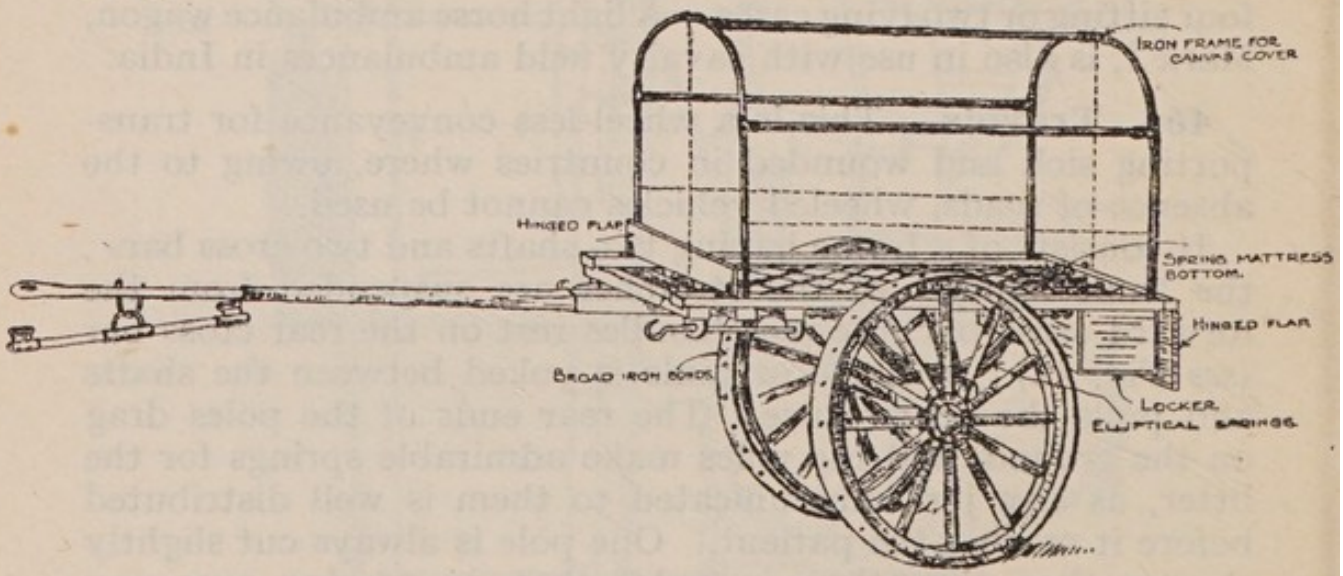


FIG. 43.—DESERT AMBULANCE CART

467. Desert ambulance cart.—This is a two-wheeled spring cart with a canvas hood, fitted with a spring bottom and drawn by four mules. The wheels are fitted with metal

tyres 9 to 12 inches in breadth to increase their surface and thus prevent their furrowing deeply into the sand.

468. Civilian horse transport.—Local transport from civilian sources may on occasion have to be used for the conveyance of sick and wounded.

469. Preparation and loading of wagons, country carts, etc.—Before vehicles from civilian sources are accepted for the conveyance of sick and wounded, they should be thoroughly overhauled, special attention being paid to the working of the brakes, and the condition of the axles and lynch pins.

When patients who are seriously wounded or dangerously ill have to be carried, heavy wagons are recommended for the purpose in preference to vehicles of light construction.

If possible, all wagons and carts, before being taken into use, should have covers fitted to them, to ensure at least a partial protection from the sun and weather.

470. Patients may be carried on stretchers in the vehicles or lying on some soft material on the floor. In the latter case a plentiful supply of straw, hay, dried leaves or bracken should be strewn over the floor and sides, about 15 lb. of the material being required for each lying-down case, some of the material being tied up in bundles as pillows. If mattresses and bedding are available they should be laid on the top of the straw.

Mechanical Transport

471. Ambulance cars (motor ambulances).—The modern ambulance car is a four- or six-wheeled vehicle, and attains on a good surface an average speed of 25 miles an hour.

Capacity.—Driver, attendant and ten sitting cases,
or
Driver, attendant and four stretcher cases.

The body is fitted with steps to facilitate entry into the car.

There is a communicating trap-door to the driver.

The interior is lit by electricity, is well ventilated, and is warmed by means of the exhaust pipes which are led overhead to prevent any fumes reaching the patients.

When not in use, the stretcher carrying apparatus is easily and rapidly folded away or lowered. Four stretchers, with three blankets each, are included in the normal equipment. A Thomas splint and first-aid equipment are included under local arrangements, when necessary.

At the present time, no motor vehicle fitted with a (caterpillar) track has been adapted for the conveyance of stretchers.

472. Motor Lorries.—In the event of motor lorries having to be used accommodation can be found for cases as follows :—

(i) *3-ton Lorry.*

(*a*) Sitting cases—14,

or,

(*b*) Lying cases without stretchers—eight.

Four on the centre of the floor of the lorry and two on each of the seats at the sides,

or,

(*c*) Stretcher cases—eight.

Five placed crosswise with the handles on the upper border of the side of the lorry, the runners being on the inside of the vehicle to prevent any likelihood of slipping. One on the floor and one on each seat. Care must be taken that the runners do not slip off the inner border of the seat,

or,

(*d*) Stretcher and sitting cases—nine.

Three stretcher cases as in (*c*) across the lorry and well to the front, and three sitting on each side.

(ii) *30-cwt. Lorry.*

(*a*) Sitting cases—ten,

or,

(*b*) Lying without stretchers—four,

or,

(*c*) Stretcher case—one.

Civilian motor vehicles such as cars and omnibuses can also be used for removing slightly wounded cases.

473. The Berridge conversion set.—A 30-cwt. six-wheeled supply lorry can be converted into an emergency motor ambulance by means of the Berridge conversion set (described in the " Journal of the R.A.M.C.," May, 1931).

The apparatus consists of a set of eight straps and eight hooks by means of which four stretchers can be suspended within the body of the lorry. The two top stretchers are suspended mainly from the canopy supporting angle iron, and the two lower stretchers are suspended partly from the top stretchers and partly by hooks from the sides of the lorry.

The arrangements of the straps and hooks reduces to a minimum all movement of the stretchers caused by centrifugal force.

[*To face p.* 166.

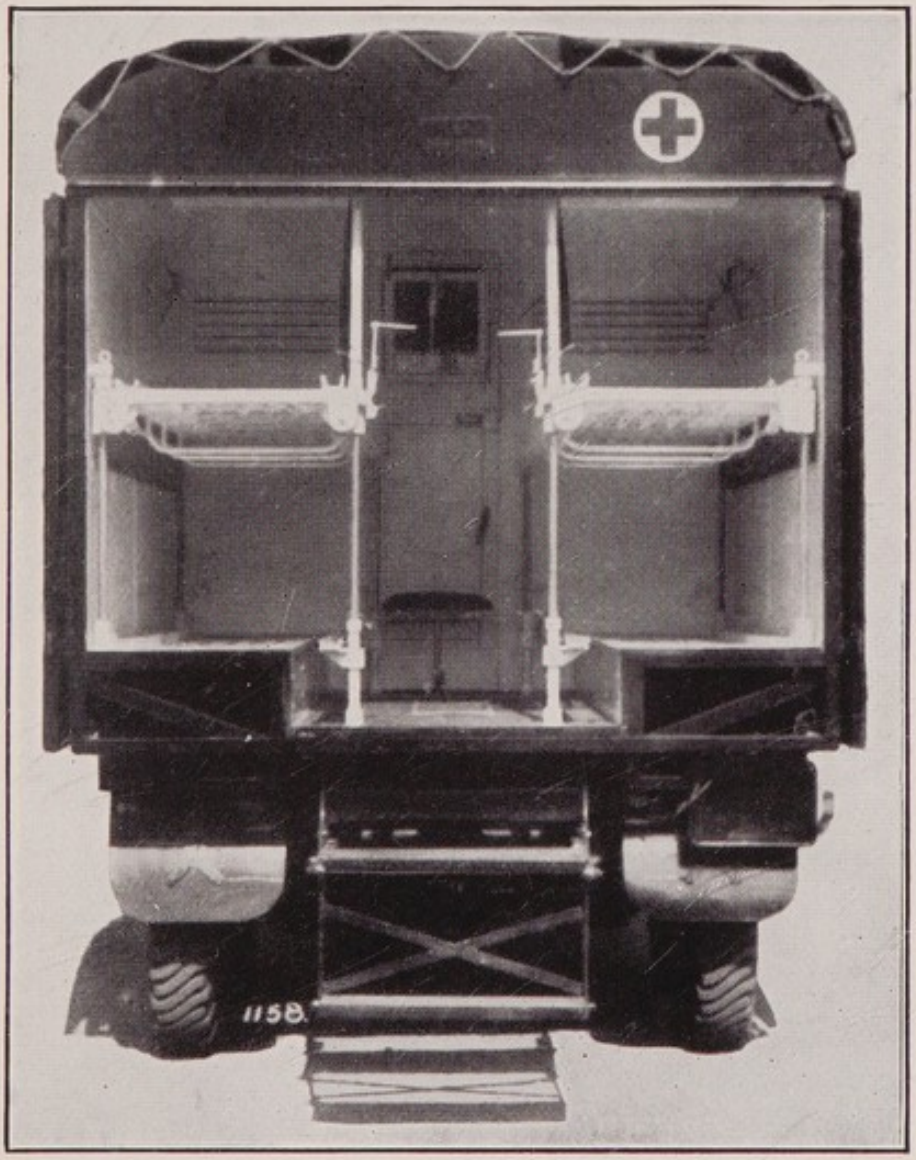


FIG. 44.—AMBULANCE CAR (MOTOR AMBULANCE)

It has been found by extensive trials in India that patients can travel in comparative comfort over rough country in a lorry so fitted.

The conversion set, when not in use, is kept in a small bag in the lorry in the charge of the driver with the rest of his tool kit.

474. Internal economy of M.T. vehicles.—The following details will be found useful in estimating the mileage, petrol and lubricant consumption, and circuit of action for M.T. vehicles in medical units.

Vehicles	Petrol consumption		Lubricant consumption to petrol consumption	Circuit of action in miles
	Miles to the gallon	Gallons on 50 miles		
Motor amb. cars... ...	10	5	6%	144 (*a*)
Lorries, 30-cwt.	7	7	6%	144 (*a*)
Lorries, 3-ton	5	10	6%	144 (*a*)
Motor vans	10	5	6%	144 (*a*)
Motor cars, 6-wheeled ...	8	6	6%	162 (*a*)
,, ,, 2-seater ...	25	2	6%	210 (*a*)
Motor cycles	50	1	12%	125 (*a*)

(*a*) Includes petrol carried in spare cans.

Railway Transport

475. Railway transport is the most rapid method of evacuating large number of patients from medical units and should be employed when possible.

(i) *Permanent ambulance trains* are designed solely for the carriage of sick and wounded and can carry 360 lying cases ; they have a permanent staff of M.Os., sisters and orderlies.

(ii) *Temporary ambulance trains* are made up when required of passenger coaches with a small staff of R.A.M.C. personnel and some medical equipment. They are suitable for the transport of sitting cases ; covered vans fitted with an apparatus to take stretchers may be used in an emergency, but they fall much below the desired standard of comfort.

These trains must halt for an hour or so at intervals of four to six hours to allow of an inspection of the patients and to permit them to leave the train to obtain hot meals. These halts should be at principal stations where there are facilities for preparing food and where there is hospital accommodation for cases unfit to continue the journey.

(iii) *Improvised ambulance trains* are usually composed of empty supply wagons returning to the base. They are only

suitable for the conveyance of slight cases who can stand the discomfort of the journey and can look after themselves. A M.O. with a few orderlies should be detailed for duty with the train. Such trains are only used when the evacuation service is working under great pressure. Owing to the stiff springs and loose couplings, goods wagons, even when liberally supplied with straw, entail much discomfort, while it is only possible for the train staff to visit the wagons during halts on the journey.

476. Methods of adapting railway vans for ambulance use.—Various methods have been devised for this purpose, the underlying idea being to increase the number of patients carried in each van by suspending or supporting the stretchers in tiers.

No method has been evolved up to the present time which is really comfortable for patients and they should only be used in an emergency.

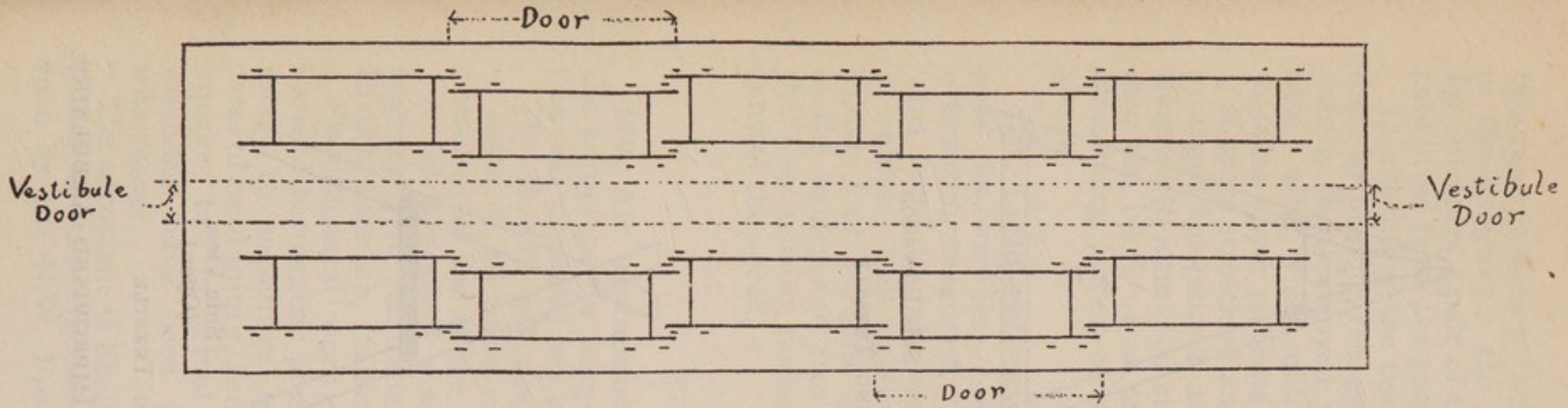
One method is by means of the " Brechot-Desprez-Ameline " apparatus. Another recently introduced and more elaborate apparatus is the " Tintner " stretcher stand which can also be used in lorries. Both methods allow of tiers of three stretchers being carried. The specification for each apparatus is held by the R.A.O.C.

A further method which has been successfully used on British railways in time of pressure, and which is highly recommended on account of its simplicity and the facilities afforded in loading and unloading, is the " trestle " method.

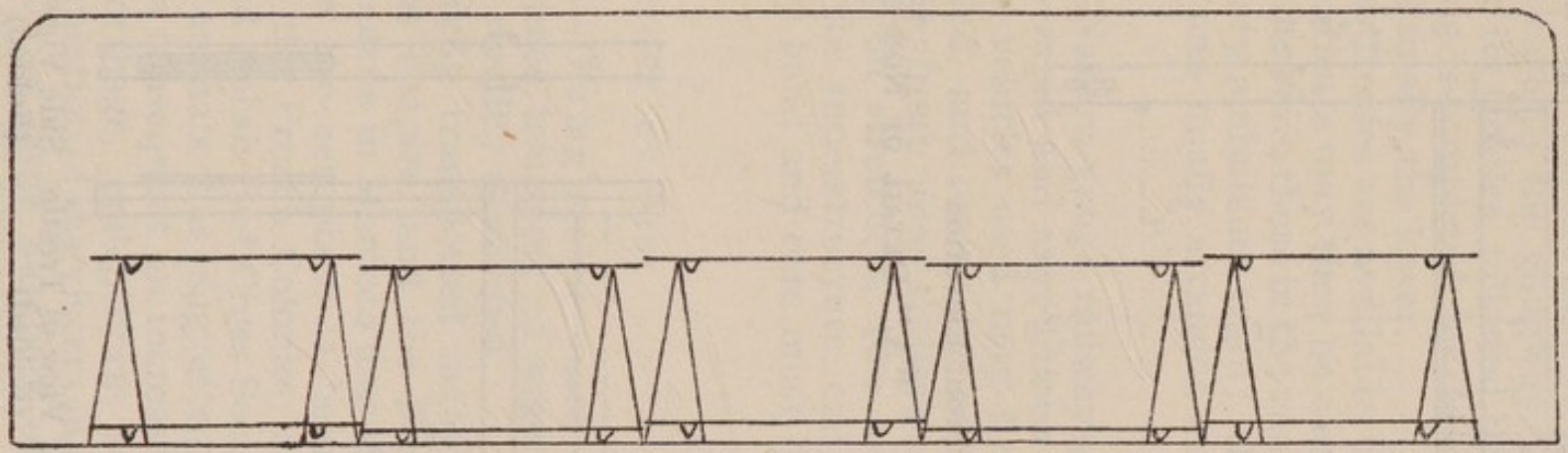
477. The trestle method.—A pair of wooden trestles is required for each pair of stretchers. The trestles may be made to fold or not (*see* Fig. 46), and should be light enough for a bearer to carry.

During the Great War ordinary railway luggage or milk vans were used for this method and it was found that the trestles remained steady at all speeds without any fixing beyond that afforded by the lower stretcher, which, as may be seen from Fig. 45, lies between each pair of trestles and acts as a " stop."

Loading by means of these trestles is comparatively simple. As many patients on stretchers as can be accommodated are placed end to end along the floor of a van, leaving a gangway in the centre and a space for entrance and exit : by dove-tailing the handles of the stretcher no room is lost (*see* Fig. 45A). Trestles are now carried into the van, and a pair placed over each of the patients on the floor. The upper patients are then brought in and placed on the trestles. The upper stretcher should be arranged so that the cross bars of the trestles support it just outside the feet (*see* Fig. 45B). The loading of the last



"A." PLAN

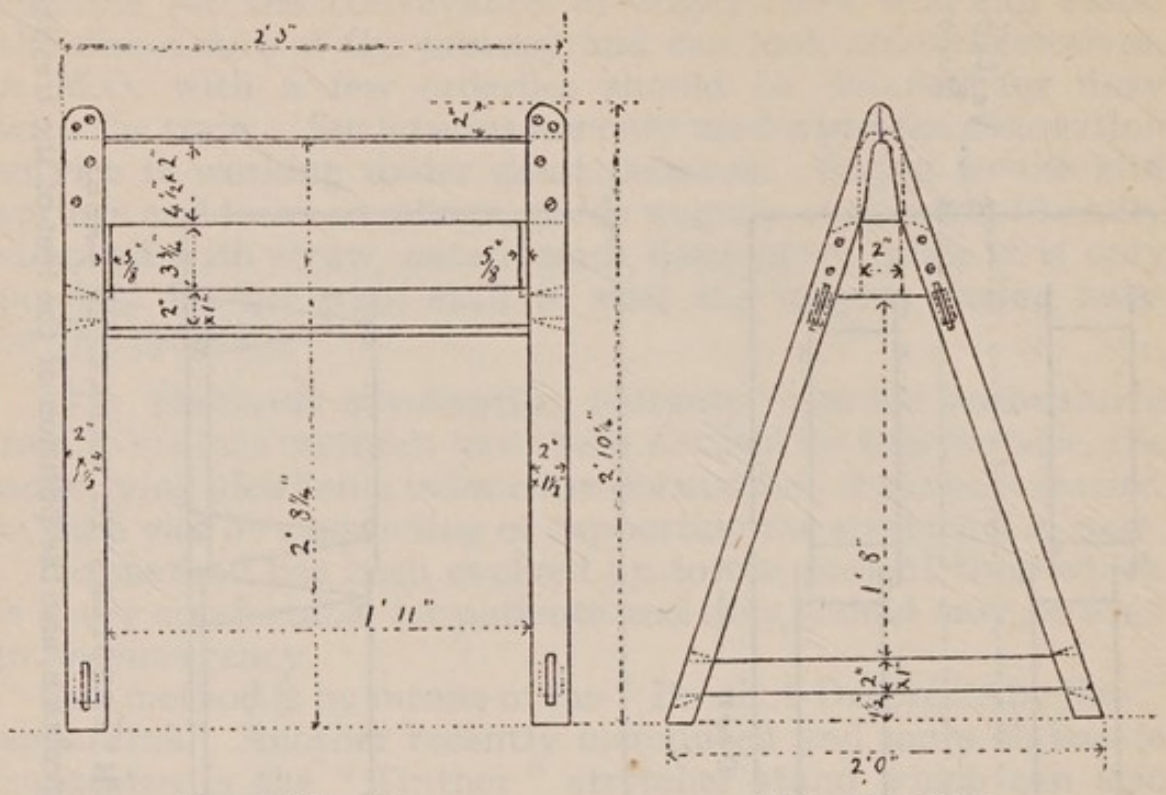


"B." ELEVATION

FIG. 45.—DIAGRAM OF RAILWAY VAN EQUIPPED WITH TRESTLES TO CARRY 20 CASES

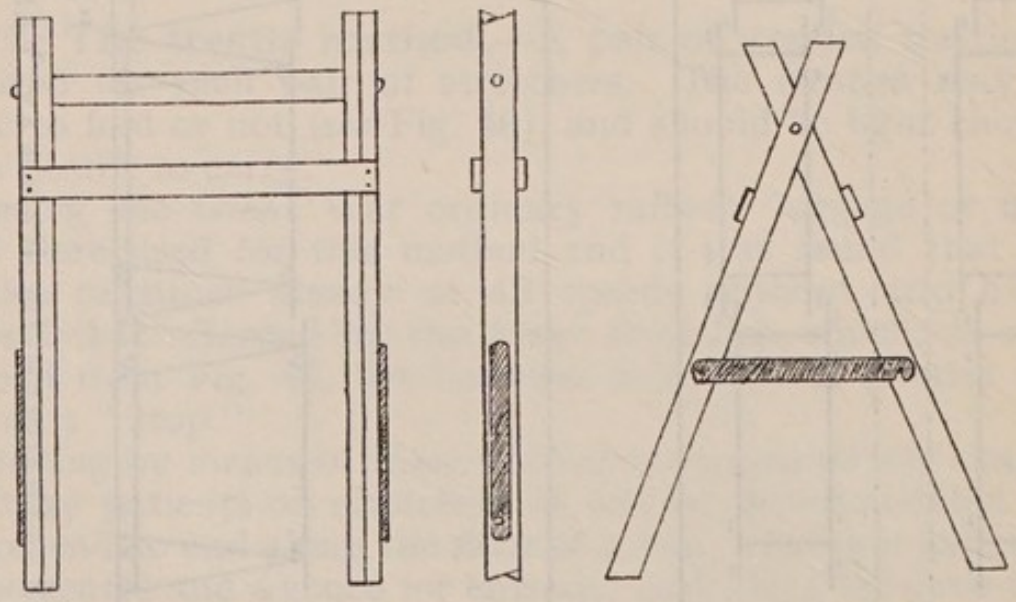
"A" Plan, with top stretcher removed, showing the bottom stretchers in position, also the position of the feet of the trestles, and dovetailing of the stretcher poles.

"B" Elevation, showing the arrangement of the trestles and stretchers at one side.



Front Elevation Side Elevation

"A." Detail of Non-folding Trestle



Front View of Trestle (Folded) Side View (Folded) Side View (Open)

"B." Detail of Folding Trestle

Fig. 46.—Details of Trestles for Improvised Ambulance Trains

two cases is done by bringing the upper in first and placing it in the gangway; the lower case is then put in the space left for entrance, a pair of trestles arranged over it, and the upper case lifted from the gangway into position on them.

In unloading, the two patients opposite the door are removed first, by placing the upper case in the gangway. The lower case is then removed with its trestles, followed by the upper case; after which unloading is completed by clearing the remaining upper patients and finally the lower.

If spare stretchers and mattresses are available, they can be arranged beforehand, and patients may then be carried in and transferred from their stretchers into those in the van, as though into the berth of an ordinary ambulance train; the last two cases being loaded outside and finally arranged as explained above.

478. Light railways.—Narrow-gauge railways, especially near the front line, offer a rapid and expeditious method of evacuating wounded. The vehicles used may be trucks or vans fitted to take wounded, and drawn by petrol engines or mules. Still nearer the front line, trolleys capable of taking four patients lying on stretchers, two on the floor of the trolley and two on the superstructure, can be used—these are usually pushed by hand and care must be taken to control the speed.

Transport by Air

479. Air ambulances.—During recent years the use of the aeroplane for long-distance transport of urgent cases of sick and wounded has been steadily developed.

The R.A.F. has successfully transported many hundreds of cases in all parts of the Empire, and the French made considerable use of the aeroplane in Morocco and the Levant.

In civil medical practice the aeroplane is being used in emergency in Australia, in the French Colonies, and by the British, Swedish, Italian and Polish Red Cross Societies.

Experimental work on animals has suggested that the lowered barometric pressure consequent on increased altitude tends to encourage hæmorrhage, epileptiform seizures in cases of head injury, and herniation of the viscera in abdominal injuries, but in actual practice large numbers of seriously wounded have been transported without any ill effects whatsoever.

The aeroplane is likely in the future to become of enormous utility in the evacuation of seriously wounded in regions such as the N.W. Frontier of India, where evacuation by

ordinary transport, if possible at all, may take days to complete. At present, the use of the aeroplane is frequently impracticable in these regions owing to a lack of suitable space for landing. This difficulty may be overcome by the development of the autogyro.

Many types of aeroplane can be adapted to take stretcher cases by various structural alterations. A special type of stretcher or special apparatus is necessary to retain the patient in position (*see* para. **449**).

Aircraft used in war for medical transport will be distinctively marked as laid down in the Geneva Convention and enjoy the protection of the Convention while so used.

Transport by Waterways

480. Ambulance barges and river steamers.—Where suitable waterways exist, ambulance barges specially fitted and equipped for the purpose are, owing to the absence of vibration and noise, ideal for the transport of the seriously wounded. On canals the rate of progress is usually slow; hence only a limited number can be evacuated by this means; a staff of one M.O., two orderlies and at least two nursing sisters is required for each ambulance barge. In Mesopotamia river steamers were fitted up as fully equipped hospitals and proved a most satisfactory means of evacuating sick and wounded. Protection from the weather by awnings, screens, etc., must be provided; also ventilation if lower decks are to be used.

Hospital Ships

481. Three categories of ships are used for the transport of sick and wounded.

(i) Hospital ship.
(ii) Hospital carrier.
(iii) Ambulance transport.

A hospital ship is a vessel fitted for the transport of sick and wounded. It is equipped to take 500 beds and the staff includes medical and surgical specialists and nursing sisters.

A hospital carrier is a passenger steamer temporarily adapted for the conveyance of sick and wounded during the period when hospital ships are being fitted out.

Both the above are protected by international conventions and therefore are neither available nor may be used for the transport of armed personnel or war material. They fly the Red Cross flag and the hulls are usually painted white with a green band, and one or more Red Cross emblems on each side.

An ambulance transport is a vessel which, used on the outward voyage for the transport of troops, is fitted for the homeward voyage either partly or wholly to carry sick and wounded. It has no distinguishing marks and can claim no protection under the international conventions. The medical equipment of an ambulance transport cannot be as complete as that of a hospital ship. It is used, therefore, for the less serious cases of sickness and wounds and is not used at all if accommodation in hospital ships can be made available.

482. Hospital ships are not maintained in peace time, but on mobilization have to be fitted out, which takes a considerable time. In order to avoid prolonged delay, a preliminary adaptation is made at once, and further alterations to improve and increase the accommodation for invalids are carried out as opportunity offers on return to the home port, where a stay of 10 to 14 days is usually made.

483. All ships are based on some port where there is a representative of the D.D.M.S., Embarkation, who should consult with the naval authorities as to any improvements that he wishes carried out.

484. The Admiralty provide the hospital fittings and equipment, also food during the voyage; hospital clothing, etc., are placed on board by the R.A.O.C. and the medical equipment by the O.C. Transports Medical Store, Royal Victoria Hospital, Netley, Hants. Every ship should be fitted with an operating theatre and an X-ray installation.

485. Embarkation of patients in roadsteads.—If patients have to be hoisted from lighters on to the deck of a hospital ship, a cradle is constructed to take a stretcher or four sitting cases; the stretcher must be securely fixed before the cradle is hoisted, and a mattress should be placed on the deck of the ship to prevent jolting when the cradle is lowered. While the cradle is being hoisted, the men on the lighter hold two of the guide ropes and steady the cradle; the other two are held by men on the deck of the ship; if the vessel is rolling at all, this precaution is essential.

SECTION 7

CHAPTER XXI

VOLUNTARY AID PERSONNEL

486. Military Hospitals Reserve.—Under Army Order 6 of 1926, a voluntary reserve has been formed called the Military Hospitals Reserve, the object of which is primarily to replace regular R.A.M.C. personnel in medical establishments at home on mobilization and secondly to provide reinforcements for medical units of the field force.

Membership of the reserve is entirely voluntary and limited to W.Os., N.C.Os. and privates only. The personnel is provided by the St. John Ambulance Brigade for England, Wales and Northern Ireland and by the St. Andrew's Ambulance Corps for Scotland. Members are trained in peace time by the bodies to which they belong and in addition receive training in military hospitals.

487. Voluntary Aid Detachments.—In addition to the above, an unlimited reserve of voluntary aid personnel has been made possible by a combined movement of the Order of St. John of Jerusalem, The British Red Cross Society and the St. Andrew's Ambulance Association, set out in the Scheme for Voluntary Aid Detachments, December, 1923, through a Joint V.A.D. Council formed under authority of the Army Council.

This Joint V.A.D. Council undertakes to supply trained categories of men or women to complete the requirements of the medical services of the Navy, Army and Air Force on mobilization. Personnel will be of two categories, mobile and immobile. Mobile personnel will be available for service both at home and abroad, immobile personnel only for such service as can be carried out within reach of their own homes ; voluntary aid personnel will therefore be available for service in general hospitals, auxiliary hospitals, hospital ships, ambulance trains, etc., and for entraining, detraining, embarking and disembarking sick and injured.

488. The rules affecting voluntary assistance to the sick and injured are laid down in F.S.R., Vol. I, the Scheme for Voluntary Aid Detachments and the Geneva Convention of 1929 (Chapter XXII).

SECTION 8

CHAPTER XXII

THE GENEVA CONVENTION, 1929

489. The chief points to be noted in the Convention are that the sick and wounded must be taken care of irrespective of nationality, that medical personnel must, as far as military exigencies permit, be left in charge of sick and wounded, and that, when they are captured by the enemy, they must continue their duty under his directions. They will be sent back to their own side only when the enemy can arrange to do this conveniently to himself and by the route which he shall determine. The personnel engaged exclusively in the collection, transport and treatment of the wounded and sick, and in the administration of medical formations and establishments, and chaplains attached to armies, will be respected and protected in all circumstances. If they fall into the hands of the enemy, they will not be treated as prisoners of war.

Sick and wounded who fall into the enemy's hands are, however, prisoners of war, and under the Convention are not entitled to any privilege different from those of unwounded and healthy prisoners, beyond that of proper medical attendance.

The commander who remains in possession of the field must cause a search to be made for wounded, and as far as possible prevent any acts of pillage to dead or wounded. Nominal rolls of all the enemy's wounded who have been received into any medical formation must be forwarded to the Prisoners of War Information Bureau together with any identification marks or articles of a personal nature taken from the dead.

As regimental stretcher bearers are not exclusively engaged in the care of the wounded, they are not entitled to wear the Red Cross brassard, but, if furnished with proof of identity, are entitled to enjoy the same treatment as the permanent medical personnel if they are taken prisoners whilst engaged in the care of the wounded.

The Geneva Convention of 1929 makes special provisions to cover the use of aircraft as a means of medical transport.

490. The protection afforded to the personnel of medical units is not forfeited by the fact that they carry weapons for

self-defence, or hold the arms and ammunition of the wounded who are under their care.

491. The Convention contains somewhat complicated provisions regarding the method of dealing with the material of medical units and convoys. Briefly they are as follows :—

i. Material of mobile units of the Army Medical Service is not prize of war and must be restored whenever this can be done. It can, however, be used by the enemy for the treatment of sick and wounded pending restoration.

ii. Material of fixed medical units is prize of war but must not be diverted from its purpose so long as there are cases to succour. In the case of a building, however, which the enemy wishes to use for purposes other than as a hospital, the Convention permits of this being done if the sick and wounded in it are properly provided for elsewhere.

iii. The medical material of convoys, including special ambulance and medical wagons along with their teams, ambulance trains, and river or lake ambulance boats, must be restored, but not the general service or other military vehicles of convoys.

iv. Material belonging to Voluntary Aid Societies is private property in all circumstances where it is found and can only be retained on requisition ; that is to say, a receipt must be given to the owner or representative of the owner if it is necessary to make use of it, so that the cost may be recovered subsequently.

v. Similarly, civilian vehicles belonging to convoys can only be retained by the enemy on requisition.

492. The distinctive emblem of the Red Cross on a white ground is the emblem and distinctive sign of the medical services of armed forces, and not as is popularly supposed of Voluntary Aid Societies.

The personnel of Voluntary Aid Societies duly recognized and authorized by their Government who are employed with medical units and establishments of armies are protected by the Convention, provided that they are subject to military law and regulations.

It is to be noted, however, that the Convention of 1929 permits recognized and authorized Voluntary Aid Societies to use the distinctive emblem in connexion with their humanitarian activities in time of peace subject to their national legislation.

GENEVA CONVENTION OF JULY 27TH, 1929

(Translation)

Chapter I.—*Wounded and Sick*

Article 1

Officers and soldiers and other persons officially attached to the armed forces who are wounded or sick shall be respected and protected in all circumstances ; they shall be treated with humanity and cared for medically, without distinction of nationality, by the belligerent in whose power they may be.

Nevertheless, the belligerent who is compelled to abandon wounded or sick to the enemy, shall, as far as military exigencies permit, leave with them a portion of his medical personnel and material to help with their treatment.

Article 2

Except as regards the treatment to be provided for them in virtue of the preceding article, the wounded and sick of an army who fall into the hands of the enemy shall be prisoners of war, and the general provisions of international law concerning prisoners of war shall be applicable to them.

Belligerents shall, however, be free to prescribe, for the benefit of wounded or sick prisoners, such arrangements as they may think fit beyond the limits of the existing obligations.

Article 3

After each engagement the occupant of the field of battle shall take measures to search for the wounded and dead, and to protect them against pillage and maltreatment.

Whenever circumstances permit, a local armistice or a suspension of fire shall be arranged to permit the removal of the wounded remaining between the lines.

Article 4

Belligerents shall communicate to each other reciprocally, as soon as possible, the names of the wounded, sick and dead, collected or discovered, together with any indications which may assist in their identification.

They shall establish and transmit to each other the certificates of death.

They shall likewise collect and transmit to each other all articles of a personal nature found on the field of battle or on the dead, especially one half of their identity discs, the other half to remain attached to the body.

They shall ensure that the burial or cremation of the dead is preceded by a careful, and if possible medical, examination of the bodies, with a view to confirming death, establishing identity and enabling a report to be made.

They shall further ensure that the dead are honourably interred, that their graves are respected and marked so that they may always be found.

To this end, at the commencement of hostilities, they shall organise officially a graves registration service, to render eventual exhumations possible and to ensure the identification of bodies whatever may be the subsequent site of the grave.

After the cessation of hostilities they shall exchange the list of graves and of dead interred in their cemeteries and elsewhere.

ARTICLE 5

The military authorities may appeal to the charitable zeal of the inhabitants to collect and afford medical assistance, under their direction, to the wounded or sick of armies, and may accord to persons who have responded to this appeal special protection and certain facilities.

Chapter II.—*Medical Formations and Establishments*

ARTICLE 6

Mobile medical formations, that is to say, those which are intended to accompany armies in the field, and the fixed establishments of the medical service shall be respected and protected by the belligerents.

ARTICLE 7

The protection to which medical formations and establishments are entitled shall cease if they are made use of to commit acts harmful to the enemy.

ARTICLE 8

The following conditions are not considered to be of such a nature as to deprive a medical formation or establishment of the protection guaranteed by article 6 :—

(1) that the personnel of the formation or establishment is armed, and that they use the arms in their own defence or in that of the sick and wounded in charge ;

(2) that in the absence of armed orderlies the formation or establishment is protected by a piquet or by sentries ;

(3) that small arms and ammunition taken from the wounded and sick, which have not yet been transferred to the proper service, are found in the formation or establishment ;

(4) that personnel and material of the veterinary service are found in the formation or establishment, without forming an integral part of the same.

Chapter III.—*Personnel*

Article 9

The personnel engaged exclusively in the collection, transport and treatment of the wounded and sick, and in the administration of medical formations and establishments, and chaplains attached to armies, shall be respected and protected under all circumstances. If they fall into the hands of the enemy they shall not be treated as prisoners of war.

Soldiers specially trained to be employed, in case of necessity, as auxiliary nurses or stretcher-bearers for the collection, transport and treatment of the wounded and sick, and furnished with a proof of identity, shall enjoy the same treatment as the permanent medical personnel if they are taken prisoners while carrying out these functions.

Article 10

The personnel of Voluntary Aid Societies, duly recognized and authorized by their Government, who may be employed on the same duties as those of the personnel mentioned in the first paragraph of Article 9, are placed on the same footing as the personnel contemplated in that paragraph, provided that the personnel of such societies are subject to military law and regulations.

Each High Contracting Party shall notify to the other, either in time of peace or at the commencement of, or during the course of, hostilities, but in every case before actually employing them, the names of the societies which it has authorized, under its responsibility, to render assistance to the regular medical service of its armed forces.

Article 11

A recognized society of a neutral country can only afford the assistance of its medical personnel and formations to a belligerent with the previous consent of its own Government and the authorization of the belligerent concerned.

The belligerent who accepts such assistance is bound to notify the enemy thereof before making any use of it.

Article 12

The persons designated in Articles 9, 10 and 11 may not be retained after they have fallen into the hands of the enemy.

In the absence of an agreement to the contrary, they shall be sent back to the belligerent to which they belong as soon as a route for their return shall be open and military considerations permit.

Pending their return they shall continue to carry out their duties under the direction of the enemy ; they shall preferably be engaged in the care of the wounded and sick of the belligerent to which they belong.

On their departure, they shall take with them the effects, instruments, arms and means of transport belonging to them.

Article 13

Belligerents shall secure to the personnel mentioned in Articles 9, 10 and 11, while in their hands, the same food, the same lodging, the same allowances and the same pay as are granted to the corresponding personnel of their own armed forces.

At the outbreak of hostilities the belligerents will notify one another of the grades of their respective medical personnel.

Chapter IV.—*Buildings and Material*

Article 14

Mobile medical formations, of whatsoever kind, shall retain, if they fall into the hands of the enemy, their equipment and stores, their means of transport and the drivers employed.

Nevertheless, the competent military authority shall be free to use the equipment and stores for the care of the wounded and sick ; it shall be restored under the conditions laid down for the medical personnel, and as far as possible at the same time.

Article 15

The buildings and material of the fixed medical establishments of the army shall be subject to the laws of war, but may not be diverted from their purpose so long as they are necessary for the wounded and the sick.

Nevertheless, the commanders of troops in the field may make use of them, in case of urgent military necessity, provided that they make previous arrangements for the welfare of the wounded and sick who are being treated therein.

ARTICLE 16

The buildings of aid societies which are admitted to the privileges of the Convention shall be regarded as private property.

The material of these societies, wherever it may be, shall similarly be considered as private property.

The right of requisition recognized for belligerents by the laws and customs of war, shall only be exercised in case of urgent necessity and only after the welfare of the wounded and sick has been secured.

Chapter V.—*Medical Transport*

ARTICLE 17

Vehicles equipped for the evacuation of wounded and sick, proceeding singly or in convoy, shall be treated as mobile medical formations, subject to the following special provisions :—

A belligerent intercepting vehicles of medical transport, singly or in convoy, may, if military exigencies demand, stop them, and break up the convoy, provided he takes charge in every case of the wounded and sick who are in it. He can only use the vehicles in the sector where they have been intercepted, and exclusively for medical requirements. These vehicles, as soon as they are no longer required for local use, shall be given up in accordance with the conditions laid down in Article 14.

The military personnel in charge of the transport and furnished for this purpose with authority in due form, shall be sent back in accordance with the conditions prescribed in Article 12 for medical personnel, subject to the condition of the last paragraph of Article 18.

All means of transport specially organized for evacuation and the material used in equipping these means of transport belonging to the medical service shall be restored in accordance with the provisions of Chapter IV. Military means of transport other than those of the medical service may be captured, with their teams.

The civilian personnel and all means of transport obtained by requisition shall be subject to the general rules of international law.

ARTICLE 18

Aircraft used as means of medical transport shall enjoy the protection of the Convention during the period in which they are reserved exclusively for the evacuation of wounded and sick and the transport of medical personnel and material.

They shall be painted white and shall bear, clearly marked, the distinctive emblem prescribed in Article 19, side by side with their national colours, on their lower and upper surfaces.

In the absence of special and express permission, flying over the firing line, and over the zone situated in front of clearing or dressing stations, and generally over all enemy territory or territory occupied by the enemy, is prohibited.

Medical aircraft shall obey every summons to land.

In the event of a landing thus imposed, or of an involuntary landing in enemy territory or territory occupied by the enemy, the wounded and sick, as well as the medical personnel and material, including the aircraft, shall enjoy the privileges of the present Convention.

The pilot, mechanics and wireless telegraph operators captured shall be sent back, on condition that they shall be employed until the close of hostilities in the medical service only.

Chapter VI.—*The Distinctive Emblem*

Article 19

As a compliment to Switzerland, the heraldic emblem of the red cross on a white ground, formed by reversing the Federal colours, is retained as the emblem and distinctive sign of the medical service of armed forces.

Nevertheless, in the case of countries which already use, in place of the Red Cross, the Red Crescent or the Red Lion and Sun on a white ground as a distinctive sign, these emblems are also recognized by the terms of the present Convention.

Article 20

The emblem shall figure on the flags, armlets, and on all material belonging to the medical service, with the permission of the competent military authority.

Article 21

The personnel protected in pursuance of Articles 9 (para. 1), 10 and 11, shall wear, affixed to the left arm, an armlet bearing the distinctive sign, issued and stamped by a military authority.

The personnel mentioned in Article 9, paras. 1 and 2, shall be provided with a certificate of identity, consisting either of an entry in their small book (paybook) or a special document.

The persons mentioned in articles 10 and 11 who have no military uniform shall be furnished by the competent military

authority with a certificate of identity, with photograph, certifying their status as medical personnel.

The certificates of identity shall be uniform and of the same pattern in each army.

In no case may the medical personnel be deprived of their armlets or the certificates of identity belonging to them.

In case of loss they have the right to obtain duplicates.

Article 22

The distinctive flag of the Convention shall be hoisted only over such medical formations and establishments as are entitled to be respected under the Convention, and with the consent of the military authorities. In fixed establishments it shall be, and in mobile formations it may be, accompanied by the national flag of the belligerent to whom the formation or establishment belongs.

Nevertheless, medical formations which have fallen into the hands of the enemy, so long as they are in that situation, shall not fly any other flag than that of the Convention.

Belligerents shall take the necessary steps, so far as military exigencies permit, to make clearly visible to the enemy forces, whether land, air, or sea, the distinctive emblems indicating medical formations and establishments, in order to avoid the possibility of any offensive action.

Article 23

The medical units belonging to neutral countries which shall have been authorized to lend their services under the conditions laid down in Article 11, shall fly, along with the flag of the Convention, the national flag of the belligerent to whose army they are attached.

They shall also have the right, so long as they shall lend their services to a belligerent, to fly their national flag.

The provisions of the second paragraph of the preceding article are applicable to them.

Article 24

The emblem of the red cross on a white ground and the words " Red Cross " or " Geneva Cross " shall not be used, either in time of peace or in time of war, except to protect or to indicate the medical formations and establishments and the personnel and material protected by the Convention.

The same shall apply, as regards the emblems mentioned in Article 19, para. 2, in respect of the countries which use them.

The Voluntary Aid Societies mentioned in Article 10, may, in accordance with their national legislation, use the distinctive emblem in connexion with their humanitarian activities in time of peace.

As an exceptional measure, and with the express authority of one of the national societies of the Red Cross (Red Crescent, Red Lion and Sun), use may be made of the emblem of the Convention in time of peace to mark the position of aid stations exclusively reserved for the purpose of giving free treatment to the wounded or the sick.

Chapter VII.—*Application and Execution of the Convention*

Article 25

The provisions of the present Convention shall be respected by the High Contracting Parties in all circumstances. If, in time of war, a belligerent is not a party to the Convention, its provisions shall, nevertheless, be binding as between all the belligerents who are parties thereto.

Article 26

The Commanders-in-Chief of belligerent armies shall arrange the details for carrying out the preceding articles, as well as for cases not provided for, in accordance with the instructions of their respective Governments and in conformity with the general principles of the present Convention.

Article 27

The High Contracting Parties shall take the necessary steps to instruct their troops, and in particular the personnel protected, in the provisions of the present Convention, and to bring them to the notice of the civil population.

Chapter VIII.—*Suppression of Abuses and Infractions*

Article 28

The Governments of the High Contracting Parties whose legislation is not at present adequate for the purpose, shall adopt or propose to their legislatures the measures necessary to prevent at all times :—

(*a*) the use of the emblem or designation " Red Cross " or " Geneva Cross " by private individuals or associations, firms or companies, other than those entitled thereto under the present Convention, as well as the use of any sign or designation constituting an imitation, for commercial or any other purposes ;

(*b*) by reason of the compliment paid to Switzerland by the adoption of the reversed federal colours, the use by private individuals or associations, firms or companies of the arms of the Swiss Confederation, or marks constituting an imitation, whether as trade-marks or as parts of such marks, for a purpose contrary to commercial honesty, or in circumstances capable of wounding Swiss national sentiment.

The prohibition indicated in (*a*) of the use of marks or designations constituting an imitation of the emblem or designation of " Red Cross " or " Geneva Cross," as well as the prohibition in (*b*) of the use of the arms of the Swiss Confederation or marks constituting an imitation, shall take effect as from the date fixed by each legislature, and not later than five years after the coming into force of the present Convention. From the date of such coming into force, it shall no longer be lawful to adopt a trade-mark in contravention of these rules.

ARTICLE 29

The Governments of the High Contracting Parties shall also propose to their legislatures, should their penal laws be inadequate, the necessary measures for the repression in time of war, of any act contrary to the provisions of the present Convention.

They shall communicate to one another, through the Swiss Federal Council, the provisions relative to such repression not later than five years from the ratification of the present Convention.

ARTICLE 30

On the request of a belligerent, an inquiry shall be instituted, in a manner to be decided between the interested parties, concerning any alleged violation of the Convention ; when such violation has been established the belligerents shall put an end to and repress it as promptly as possible.

Final Provisions

ARTICLE 31

The present Convention, which shall bear this day's date, may be signed, up to the 1st February, 1930, on behalf of all the countries represented at the Conference which opened at Geneva on the 1st July, 1929, as well as by countries not represented at that Conference but which were parties to the Geneva Conventions of 1864 and 1906.

ARTICLE 32

The present Convention shall be ratified as soon as possible.

The ratifications shall be deposited at Berne.

A *procès-verbal* of the deposit of each instrument of ratification shall be drawn up, one copy of which, certified to be correct, shall be transmitted by the Swiss Federal Council to the Governments of all countries on whose behalf the Convention has been signed, or whose accession has been notified.

ARTICLE 33

The present Convention shall come into force six months after not less than two instruments of ratification have been deposited.*

Thereafter, it shall enter into force for each High Contracting Party six months after the deposit of its instrument of ratification.

ARTICLE 34

The present Convention shall replace the Conventions of the 22nd August, 1864, and the 6th July, 1906, in relations between the High Contracting Parties.

ARTICLE 35

From the date of its coming into force, the present Convention shall be open to accession duly notified on behalf of any country on whose behalf this Convention has not been signed.

ARTICLE 36

Accessions shall be notified in writing to the Swiss Federal Council, and shall take effect six months after the date on which they are received.

The Swiss Federal Council shall communicate the accessions to the Governments of all the countries on whose behalf the Convention has been signed or whose accession has been notified.

ARTICLE 37

A state of war shall give immediate effect to ratifications deposited and accessions notified by the belligerent Powers before or after the outbreak of hostilities. The communication of ratifications or accessions received from Powers in a state of war shall be made by the Swiss Federal Council by the quickest method.

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* The Convention came into force on June 19, 1931.

ARTICLE 38

Each of the High Contracting Parties shall be at liberty to denounce the present Convention. The denunciation shall not take effect until one year after the notification thereof in writing has been made to the Swiss Federal Council. The latter shall communicate such notification to the Governments of all the High Contracting Parties.

The denunciation shall only have effect in respect of the High Contracting Party which has made notification thereof.

Moreover, this denunciation shall not take effect during a war in which the denouncing Power is involved. In such a case, the present Convention shall continue binding beyond the period of one year, until the conclusion of peace.

ARTICLE 39

A certified copy of the present Convention shall be deposited in the archives of the League of Nations by the Swiss Federal Council. Similarly, ratifications, accessions and denunciations which shall be notified to the Swiss Federal Council shall be communicated by them to the League of Nations.

In witness whereof, the above-named Plenipotentiaries have signed the present Convention.

Done at Geneva the twenty-seventh July, one thousand nine hundred and twenty-nine, in a single copy, which shall remain deposited in the archives of the Swiss Confederation, and of which copies, certified to be correct, shall be transmitted to the Governments of all the countries invited to the Conference.

PART B.—TECHNICAL TRAINING

SECTION 9.—ANATOMY, PHYSIOLOGY AND FIRST AID

CHAPTER XXIII

ANATOMICAL AND PHYSIOLOGICAL OUTLINES

493. Anatomy and **physiology** are branches of the science of **biology**—the science that treats of living things. While **anatomy** deals with the form or structure of living things, **physiology** treats of their functions, *i.e.* the manner in which their individual parts carry out the processes of life. The human body has been very aptly compared to a combustion engine. Just like an engine, it requires air or oxygen and fuel or food to keep it working. Similarly, it has to get rid of certain products of combustion, both solids and gases ; otherwise it would become clogged and cease to act.

The way in which these needs are met are explained in the paragraphs of this chapter dealing with the systems concerned.

494. Construction of the human body.—The human body is made up of :—

The bony system, consisting of the bones and joints. This is the framework of the body and is known as the SKELETON.

The muscular system, by which all movements are carried out.

The circulatory system, comprising the heart, the blood-vessels and the blood. The blood carries nourishment and oxygen to all parts of the body and carries off the waste products to the excretory system.

The lymphatic system, consisting of lymphatic glands and vessels and lymph spaces containing the fluid called lymph. The lymph vessels convey lymph from all parts of the body and return it to the blood vessels.

The respiratory system, consisting of the air passages and lungs. These take in air, give oxygen to the blood and at the same time extract from the blood certain waste products.

The digestive system, embracing the mouth, the stomach, the intestines and certain glands. These receive the food, digest it and then absorb it into the body.

The nervous system, consisting of the brain, spinal cord and nerves. These regulate movements and receive impressions.

The excretory system, which includes the kidneys, bowels, lungs and skin. These get rid of the waste products of the body.

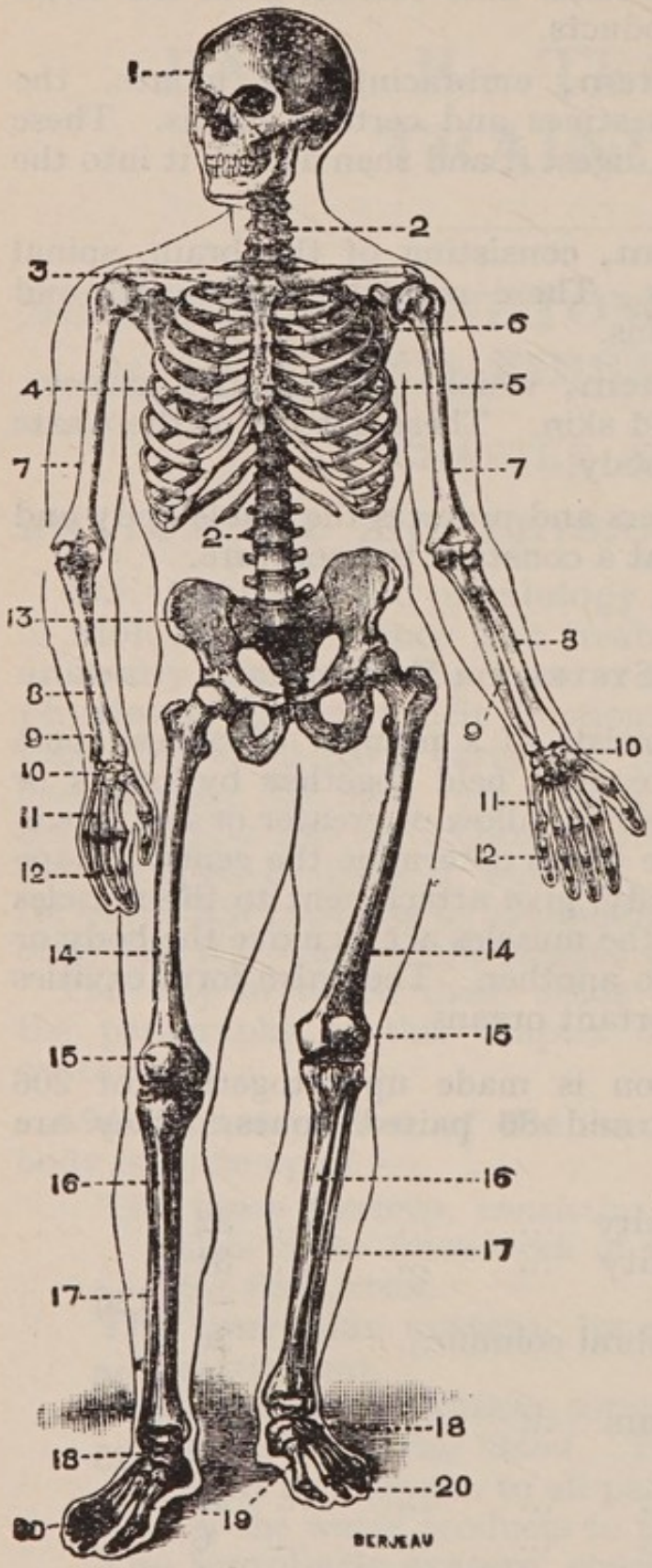
The skin, which covers and protects the whole body and helps to keep it at a constant temperature.

The Bony System or Skeleton

495. The skeleton consists of a number of bones, some long, some short and irregular, held together by bands or ligaments to form joints, which allow of greater or less movement between them. The bones determine the general shape and proportions of the body, give attachment to the muscles and form levers on which the muscles act to move the body or limbs from one position to another. They also form cavities for the protection of important organs.

496. The adult skeleton is made up altogether of 206 bones :—34 single bones and 86 paired bones. They are grouped as follows :—

In each upper extremity	32	
In each lower extremity	31	
	—	126
In the spinal or vertebral column... ...	26	
	—	26
In the ribs and sternum	25	
	—	25
In the skull	22	
Auditory ossicles	6	
Hyoid bone	1	
	—	29
Total		206



1. Cranium, or skull.
2. Spine formed of vertebræ.
3. Clavicle, or collar-bone.
4. Ribs.
5. Sternum, or breast-bone.
6. Scapula, or shoulder-blade.
7. Humerus, or arm bone.
8. Radius.
9. Ulna.
10. Carpus, or wrist bones.
11. Metacarpal bones.
12. Phalanges, or finger bones.
13. Pelvis.
14. Femur, or thigh bone.
15. Patella, or knee-cap.
16. Tibia, or shin bone.
17. Fibula.
18. Tarsus, or ankle bones.
19. Metatarsal bones.
20. Phalanges, or toe bones.

FIG. 47.—THE SKELETON

497. Classes of bones.—Bones are of different shapes and sizes and may be divided into four classes.

Long bones are made up of a long cylinder-shaped shaft with an enlargement at each end. The ends are covered with cartilage and form parts of the joints. When such a bone is sawn through longitudinally, the shaft is found to be hollow (the medullary cavity) and to be filled with yellow marrow. The shaft itself is formed of hard *compact* bone. The enlargements at each end consist of soft *cancellous* bone filled with red marrow, covered with a thin layer of hard *compact* bone.

Short bones are " square-shaped " (cuboidal) and consist of soft *cancellous* bone covered all over with a thin layer of *compact* bone.

Flat bones are thin plates and are composed of three layers —a thin outer layer and a thin inner layer of hard *compact* bone with a layer of thin *cancellous* bone in between.

Irregular bones are of varied shape and are not included in the three preceding classes.

498. Structure of bones.—Bones are composed of animal matter and lime, and are surrounded by a membrane, called the *periosteum*, from which blood-vessels pass into the bone to nourish it, and which is essential to its proper union in the case of fracture. The long bones have a cavity in their shaft called the *medullary* or marrow cavity, containing yellow marrow: in this, as well as in the periosteum, are found blood-vessels for the supply of the bone. The outer layers of the bones are hard and compact, but the inner portions are made of a kind of network of interlacing laths of bone, with spaces between them containing many blood-vessels and red marrow, which plays an important part in the formation of the blood corpuscles. This porous portion is the cancellous bone already mentioned.

499. Development of bone.—At birth many of the bones consist mainly of cartilage, which gradually becomes converted into bone by the deposit of lime salts.

This ossification of the bones is completed at the age of 25.

Some bones, such as the face bones, are developed in a fibrous membrane and are called membrane bones.

Growth of the long bones occurs mainly at the ends, where the cartilage persists during the growing period and constitutes in this situation what are known as epiphysial lines.

500. The bones of the upper extremity.—The upper extremity is divided into the shoulder, the arm, the fore-arm and the hand, and consists of the following bones :—

The clavicle or collar-bone and
The scapula or shoulder-blade, which together form the shoulder.
The humerus, the bone of the upper arm.
The ulna and
The radius, which are the bones of the forearm.
The carpal or wrist bones.
The metacarpal or hand bones.
The phalanges or finger bones.

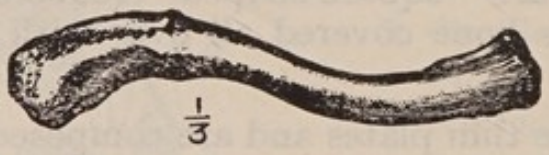


FIG. 48.—THE RIGHT COLLAR-BONE (seen from above)

The CLAVICLE is a long, curved bone, situated in front at the root of the neck, and connects the shoulder-blade to the breast bone.

The SCAPULA is a large flat, triangular bone lying upon the ribs behind, with a prominent ridge (or spine) at the back.

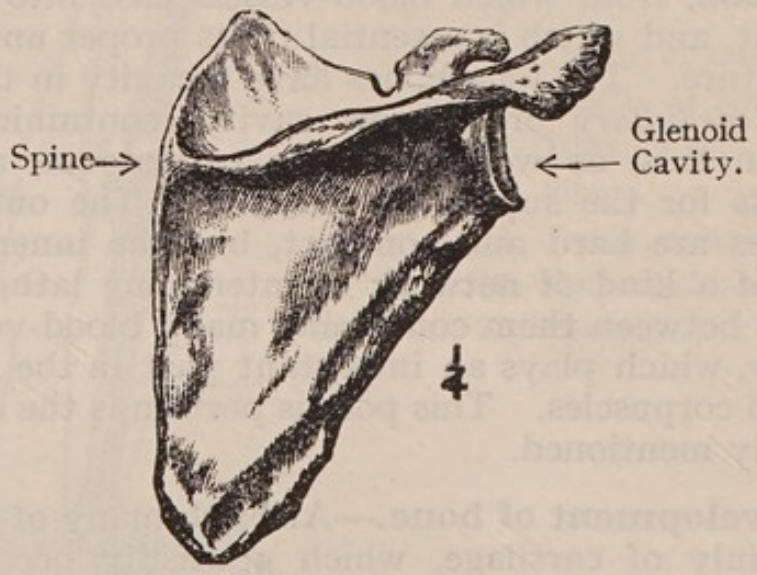


FIG. 49.—THE RIGHT SHOULDER-BLADE (seen from behind)

At the upper and outer part there is a large cavity (the glenoid cavity) which receives the rounded head of the bone of the upper arm.

The HUMERUS is the bone of the upper arm. It is a long bone, having at its upper end a rounded head which works in a socket in the scapula (the glenoid cavity), and at its

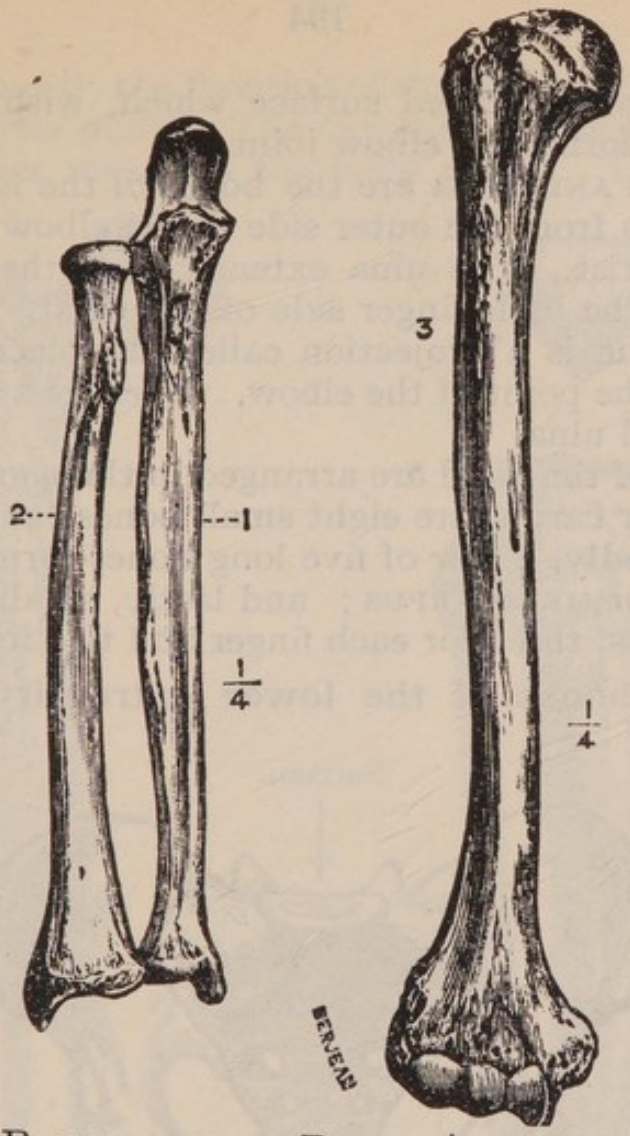


FIG. 50.—BONES OF THE RIGHT ARM AND FOREARM
(front view)

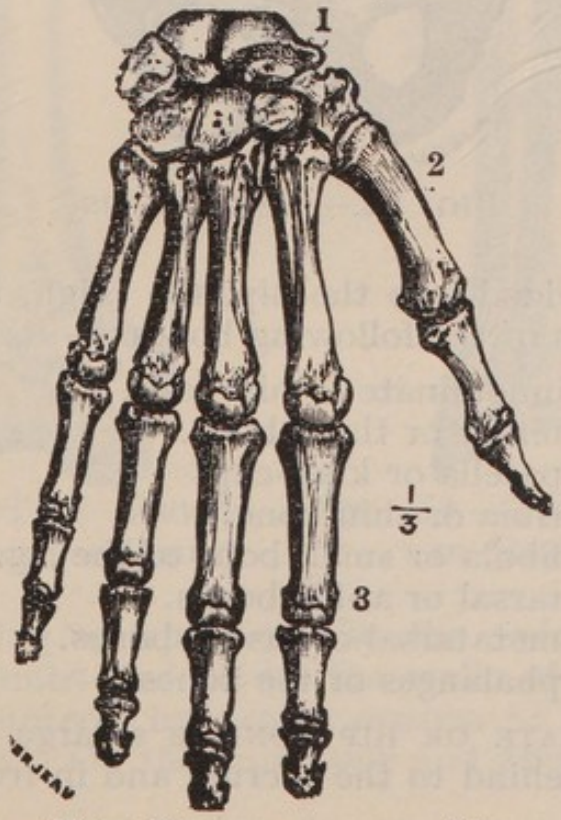


FIG. 51.—THE BONES OF THE RIGHT HAND
(seen from behind)

lower end a roller-shaped surface which, with the bones of the fore-arm, forms the elbow joint.

The RADIUS AND ULNA are the bones of the fore-arm. The radius extends from the outer side of the elbow to the thumb side of the wrist. The ulna extends from the inner side of the elbow to the little finger side of the wrist. At the upper end of the ulna is a projection called the olecranon process, which forms the point of the elbow. There is a space between the radius and ulna.

The bones of the hand are arranged in three groups : firstly, in the wrist or carpus are eight small bones called the CARPAL BONES ; secondly, a row of five long bones forming the palm of the hand or METACARPUS ; and lastly, small bones named the PHALANGES, three for each finger and two for the thumb.

501. The bones of the lower extremity.—The lower

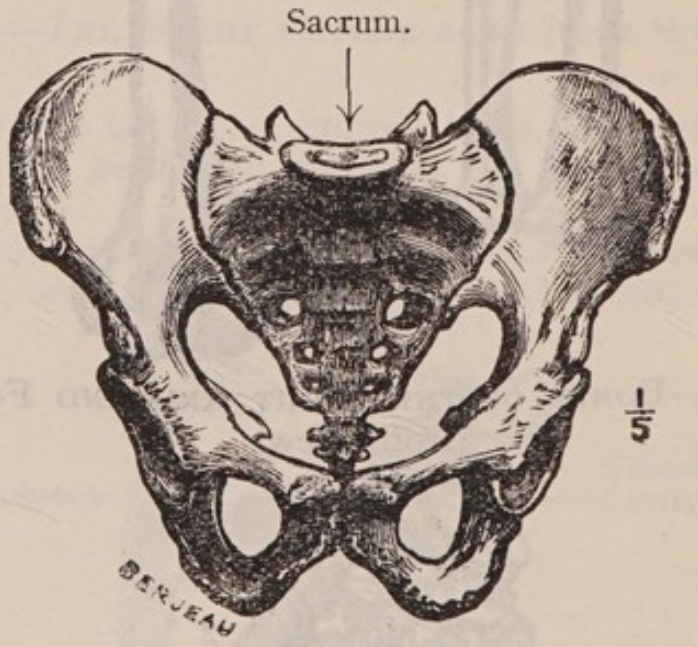


FIG. 52.—THE PELVIS

extremity is divided into the hip, the thigh, the leg and the foot ; it consists of the following bones :—

The innominate or hip bone.
The femur or thigh bone.
The patella or knee-cap.
The tibia or shin bone.
The fibula or small bone of the leg.
The tarsal or ankle bones.
The metatarsal or instep bones.
The phalanges or toe bones.

The INNOMINATE OR HIP BONE is a large irregular bone. It is attached behind to the sacrum and in front to its fellow

of the opposite side, the junction of the two bones being known as the symphysis pubis. The two innominate bones and the sacrum together make up the bony pelvis. The pelvis is a

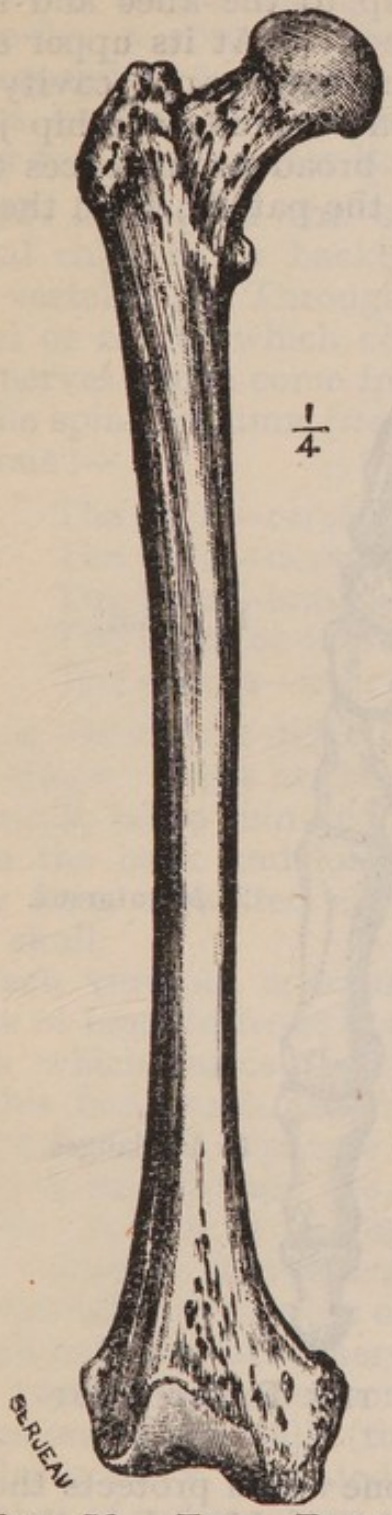


FIG. 53.—THE RIGHT THIGH BONE (or femur)

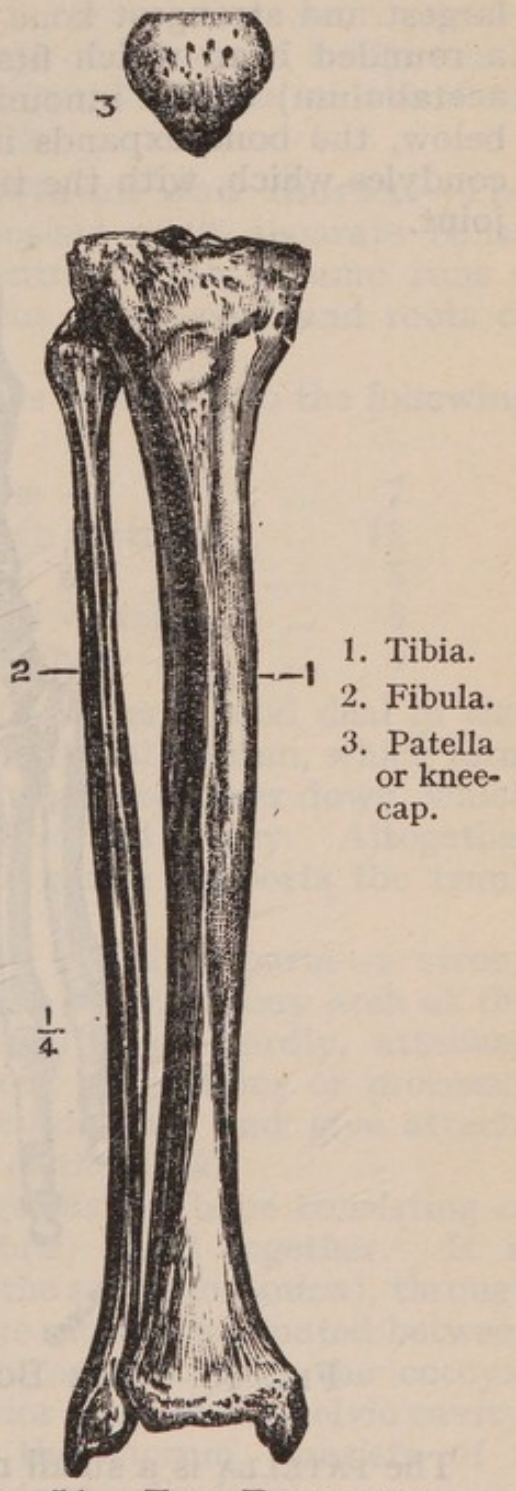


FIG. 54.—THE BONES OF THE RIGHT LEG

strong bony ring which transmits the weight of the body to the lower limbs and forms the walls of a cavity which contains and protects important organs, *i.e.* the rectum and urinary bladder. On the outer side and about the middle of

the innominate bone is a cup-shaped cavity known as the acetabulum, which receives the head of the femur and with it forms the hip joint.

The FEMUR extends from the hip to the knee and is the largest and strongest bone in the body. At its upper end is a rounded head which fits into the cup-shaped cavity (the acetabulum) of the innominate bone forming the hip joint; below, the bone expands into two broad prominences called condyles which, with the tibia and the patella, form the knee joint.

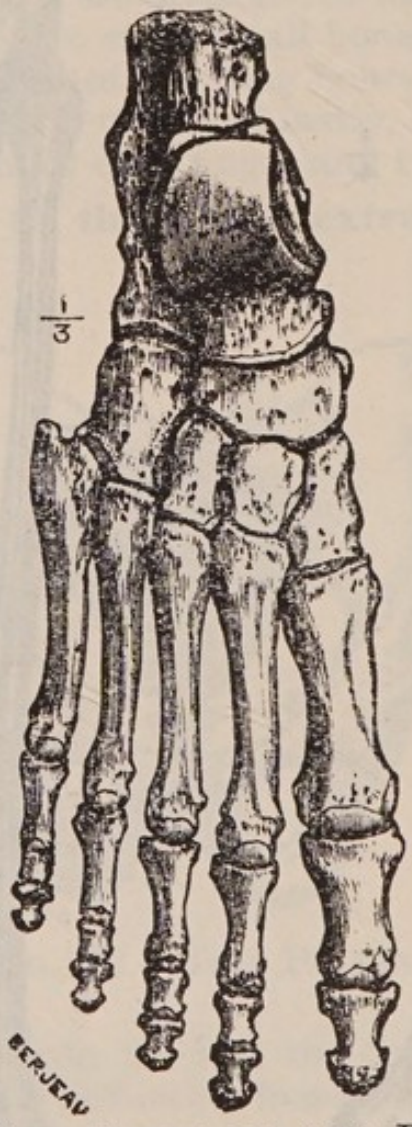


FIG. 55.—THE BONES OF THE RIGHT FOOT

The PATELLA is a small round bone which protects the knee joint in front and which is freely movable when the leg is straightened.

The leg, extending from the knee to the ankle, has two bones, a larger one lying on the inner or great toe side called the TIBIA, on the flat expanded head of which rests the lower end of the thigh bone, and a more slender bone on the outer side called the FIBULA.

The construction of the foot is like that of the hand; it has three groups of bones: the hinder part or tarsus, formed of seven short, strong bones called the TARSAL BONES; secondly, a row of five longer bones, the METATARSUS, corresponding to the sole of the foot and instep; lastly, small bones named the PHALANGES, three for each of the four outer toes and two for the great toe.

502. Bones of the spinal column and thorax.—The spinal column (or backbone) consists of 26 separate bones (33 vertebræ). Through the centre of this column runs a canal or cavity which contains the spinal cord and roots of the nerves which come from it.

The spinal column (*see* Fig. 56) is divided into the following regions:—

The neck—cervical vertebræ	7
The back—dorsal or thoracic vertebræ ...	12
The loins—lumbar vertebræ	5
The rump or sacrum—sacral vertebræ ...	5
The coccyx—coccygeal vertebræ	4

The VERTEBRÆ differ from one another a good deal in size and shape: those at the top of the spinal column, which form the neck, being thin and light, while those lower down, which form the back and loins, are thick and heavy. Altogether they form a jointed elastic pillar which supports the trunk and skull.

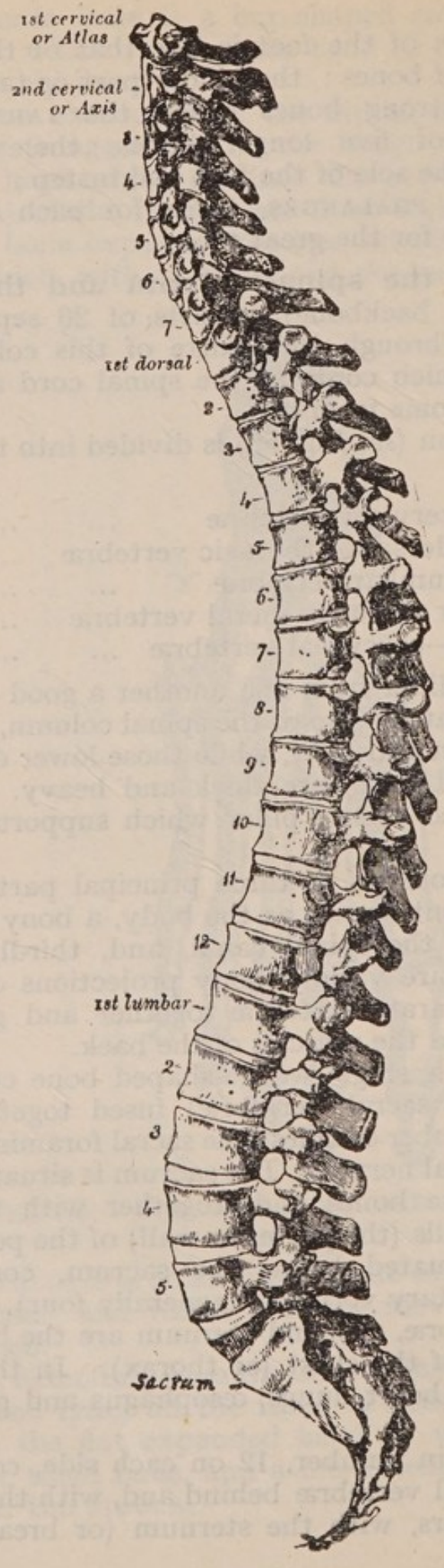
Each vertebra consists of three principal parts—a strong mass of bone in front known as the body, a bony arch at the back which forms the spinal canal, and, thirdly, attached to this bony arch are various bony projections or processes which lock the separate vertebræ together and give attachment to the ribs and the muscles of the back.

The SACRUM is a single wedge-shaped bone consisting of five vertebræ (the sacral vertebræ) fused together. It is perforated by a number of holes (the sacral foramina), through which pass the sacral nerves. The sacrum is situated between the two innominate bones and, together with the coccyx, forms one of the walls (the posterior wall) of the pelvic cavity.

The COCCYX, situated below the sacrum, consists of a number of rudimentary vertebræ (generally four).

The dorsal vertebræ, ribs and sternum are the bony framework of the walls of the chest (or thorax). In the cavity of the thorax are the heart, lungs, œsophagus and great blood-vessels.

The RIBS are 24 in number, 12 on each side, connected in pairs with the dorsal vertebræ behind and, with the exception of the last two pairs, with the sternum (or breast-bone) in



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FIG. 56.—LEFT LATERAL VIEW OF SPINAL COLUMN

front. Each of these pairs of ribs forms a circular arch called a costal arch.

The STERNUM is a long, flat, soft bone, the lower portion of which is composed of cartilage and is flexible.

The first seven pairs of ribs are known as the *true ribs* and are connected directly with the sternum, each by its own costal cartilage.

The last five pairs of ribs are known as the *false ribs*, as their costal cartilages do not join directly to the sternum. The 8th, 9th and 10th pairs are joined by their costal cartilages to those immediately above them, but the 11th and 12th pairs are, in addition, known as *floating ribs*, as their costal cartilages are not joined to any other, but are free.

503. The skull.—The skull is made up of the bones of the head and face. It contains many cavities for the protection of the brain and delicate organs of special sense (eye, ear and nose), and other air cavities, which add lightness to its structure and give resonance to the voice. It consists of two portions :—

(i) The cranium or brain case.
(ii) The face with its air cells and cavities.

The cranium.—This is a large bony case which contains the brain. It consists of the following bones :—

Occipital	1
Sphenoid	1
Frontal	1
Ethmoid	1
Temporal	2
Parietal	2

(i) The OCCIPITAL bone forms the back part of the base of the skull. Its lower portion has a large opening, the " Foramen Magnum," by which the cranium communicates with the spinal canal. On either side of the foramen are the condyles, rounded pieces of bone which rest and move upon two corresponding depressions in the topmost vertebra. In front, the occipital bone is permanently united to the sphenoid bone.

(ii) The SPHENOID (in appearance somewhat like a bat) forms a sort of keystone to the cavity of the cranium and has wing-like extensions passing upwards and outwards, supporting a great part of the base of the brain. It has other extensions passing downwards, which form the back part of the hinder nostrils and give attachment to some of the muscles of the lower jaw.

The great blood-vessels for the brain enter through holes in the base of the skull near the sphenoid bone.

The eye-socket (or orbit) is partly formed by the wing of the sphenoid, which also appears on the outside of the skull.

(iii) The FRONTAL bone is attached to the front part of the sphenoid bone. It consists of a horizontal part forming the front portion of the floor of the cranium and the roof of both orbits, and a rounded ascending plate which forms the whole of the forehead and the front of the cranium.

(iv) The ETHMOID is a small bone placed in the front part of the base of the cranium, between the frontal and sphenoid bones, and forms part of the roof of the nasal cavity.

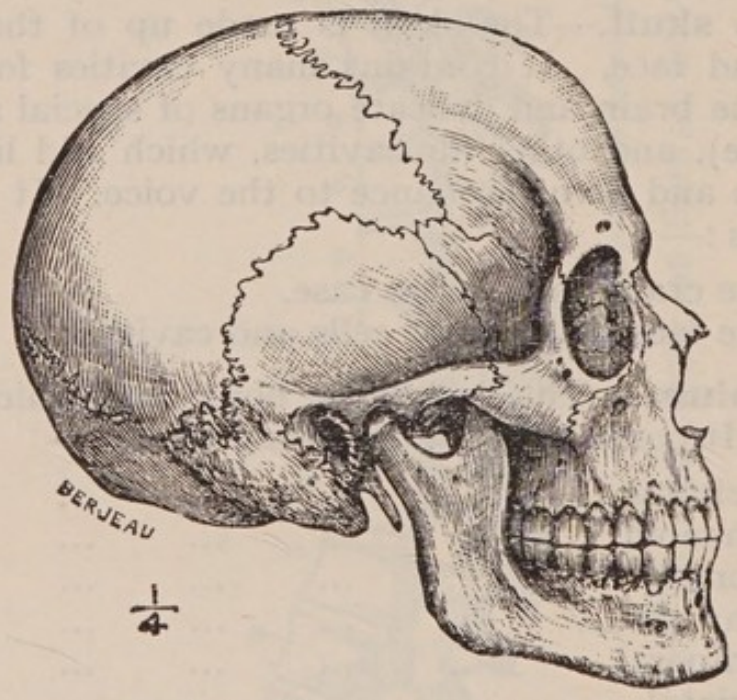


FIG. 57.—THE SKULL

(v) The TEMPORAL bones lie on each side of the skull, wedged in between the occipital and sphenoid, but do not meet in the central portion of the base of the skull. In each temporal bone are contained the bony part of the external ear, the middle ear and the internal ear.

(vi) The PARIETAL bones form the side wall and portion of the roof of the cranium.

The base of the skull is very thin in certain spots, such as the roof of the orbit and roof of the nasal cavity; these spots are, however, generally protected from injury by their deep position. The central portions of the base are very strong, as must be the case to withstand the shock of the weight of the head in jumping from a height.

The cranium contains the brain, from which the nerves of special sense pass through the holes in its base. The brain is covered by a strong membrane called the *dura mater*. The *dura mater* supports nerves and vessels, and forms partitions to hold the brain in its place. It also contains blood-vessels to nourish the inner layers of the bones of the skull, in the same way as the periosteum does in the case of other bones.

The muscles which move the head and form the flesh of the neck are attached to the base of the skull.

504. Cartilage is a tough, smooth, flexible and elastic non-vascular substance which occurs in the body in several forms :—

(i) *Hyaline cartilage.*

(*a*) The substance of which bones are composed before ossification (temporary cartilage).

(*b*) A thin layer covering the ends of bones where they form a joint (articular cartilage).

(ii) *White fibro-cartilage,* which exists as flattened plates and discs acting as buffers between bones forming certain joints, notably between the vertebræ of the spinal column.

(iii) *Yellow elastic fibro-cartilage,* which is found in the ears, epiglottis and eustachian tubes.

505. Ligaments are strong white fibrous bands which bind the bones together, but allow movement in certain directions while keeping them close together and preventing them from slipping out of place.

506. Joints.—A joint (or articulation) is the meeting point of two or more bones. Joints are either movable, as in the limbs, or immovable, as in the skull.

The inside of a movable joint contains an oily material like the white of an egg, called SYNOVIA, which allows the ends of bones to glide smoothly over one another. The membrane which lines the joint and provides this material is called the SYNOVIAL MEMBRANE and forms a closed sac round the joint.

There are three principal kinds of movable joints :—

(i) The ball-and-socket joint.
(ii) The hinge joint.
(iii) The pivot-joint.

(i) The BALL-AND-SOCKET JOINT allows one of the bones to move freely in all directions. The shoulder and hip are joints of this description, the scapula and innominate bones

each having a cup-like hollow, into which fit the rounded ball-shaped ends of the long bones of the upper arm and the thigh.

(ii) The HINGE JOINT is so called from its working like the hinge of a door, allowing of movement up and down, or backwards or forwards only, as seen in the elbow and knee.

(iii) The PIVOT-JOINT allows rotation as in the joint between the first and second cervical vertebræ (known as the atlas and axis) in the spine and the upper end of the radius in the fore-arm.

THE MUSCULAR SYSTEM

507. Structure of muscles.—The muscles form the red flesh of the body. They are made up of bundles of threads or fibres, which lie side by side, enclosed in a sheath. Muscles are arranged in bands which pass from one bone to another and are attached to the bones or other parts very commonly by means of leaders or tendons.

508. Functions of muscles.—The movement of the bones or other parts is caused by the power which these muscles have of contracting or shrinking themselves in answer to the impulse sent along the nerve, whereby their points of attachment are brought nearer together and so move the part, *e.g.* bending or straightening a limb.

These muscles are responsible for all movement of the body, whether under the control of the will or not.

Each muscle has a nerve passing into its substance and each nerve gives off a branch to each muscle fibre.

Muscles are of two kinds :—

(i) Voluntary, as in the head, trunk and limb.
(ii) Involuntary, as in the heart, intestines and blood-vessels.

(i) Voluntary muscles are under the control of the will, have striated fibres striped transversely, and are capable of rapid and complicated movement.

(ii) Involuntary muscles are *not* under the control of the will, the muscle fibres are not striated (except in the heart) and they are only capable of slow and mechanical movement. They are controlled by the sympathetic nervous system.

509. Blood supply.—Muscles are very freely supplied with blood, as every movement causes the production of waste materials, which must be removed ; otherwise the muscles would soon be clogged and so prevented from doing more work. The well-known feeling of stiffness after severe exercise is due to the accumulation of waste products in the muscles.

510. Muscular development.—Moderate exercise, together with good feeding, develops the muscles ; disuse and poor feeding cause them to dwindle. Great development of muscles is seen in persons who systematically exercise every muscle.

The effect of disuse in causing the dwindling or atrophy of the muscles is particularly striking in the case of a stiff joint, where the limb affected may decrease to half its proper size. When the nerves supplying muscles are damaged, the condition of the muscles which become powerless and would otherwise atrophy can be preserved to a certain extent by massage and passive movement. Muscles can be made to contract by the electric current, which is often used to keep up their activity in cases of paralysis.

511. Expenditure of energy.—Energy is expended by the body in two ways :—

(i) *Internal work.*—By this is meant the work which is always going on in the body, even during sleep, which is necessary to maintain life.

Examples of this are seen in the beating of the heart, the movements of the muscles of respiration and the movements of the alimentary canal, whereby the food is continually kept in motion.

This expenditure of work, which is essential for the continuance of life, constitutes the " basal metabolism " of the body. It is fairly constant for the individual, and in 24 hours corresponds to the amount of energy that would be required to raise 240 tons to a height of one foot. The body tissues, particularly the muscles, also produce by their slow combustion a great quantity of heat, enough in 24 hours to raise the temperature of 40 pints of water from freezing to boiling point.

(ii) *External work.*—By this is meant the expenditure of energy which takes place when an individual performs any muscular exertion, such as walking, playing games or performing manual labour. The amount of energy expended in this way depends on the amount of physical work performed.

The total daily loss of energy by the body is made good by the energy derived from burning up or oxidation of the food. An individual who performs heavy muscular work will require a more generous diet than an individual who leads a sedentary life, and if this is not supplied, the food stored in the body is broken down to supply the extra energy, with the result that weight is lost.

512. Necessity for oxygen.—Just as a fire uses up oxygen from the air and produces carbonic acid gas rapidly, so in the body the tissues are subject to slow combustion, using up

oxygen and producing carbonic acid gas. In making great exertion, the rate of the breathing is much increased, because more oxygen is wanted to supply the muscles in action.

The Trunk

513. Before any other systems are dealt with, this is a convenient place to describe the trunk.

The trunk is divided into two large cavities by means of a large dome-shaped muscle, the diaphragm. The thorax or chest is the upper of these two cavities, the belly or abdomen the lower.

514. The thorax or chest (*see* Fig. 58).—The thorax or chest is a cone-shaped chamber, the base of which is below. The walls are made of a framework of bone, namely, the backbone, the ribs and the breast-bone or sternum, and the costal cartilages, the spaces between the ribs being filled in by muscle and fibrous tissue.

It contains :—

(i) The heart and great blood-vessels (the organs of circulation).
(ii) Part of the trachea or windpipe, and the lungs (the organs of respiration).
(iii) Part of the gullet.

Above, the thorax communicates with the neck by an opening through which pass the windpipe, gullet and blood-vessels of the head and neck. Below it is shut off from the abdomen by the diaphragm—through which pass the gullet, leading to the stomach, and the main artery and vein of the body, *i.e.* the aorta and the inferior vena cava.

515. The abdominal cavity (*see* Figs. 58 and 59).—This cavity lies immediately below the chest, being roofed in by the diaphragm. The walls are formed by layers of muscle, except behind where the backbone runs. The floor is formed by the pelvis. The lower part of the abdominal cavity is known as the pelvic cavity.

The abdomen contains the following important organs, the position of which in the body is shown below.

Name of Organ.	Position.
(i) Liver and Gall Bladder.	On the right below the diaphragm and under the ribs.
(ii) Pancreas ...	In the centre across the spine above the level of the navel.

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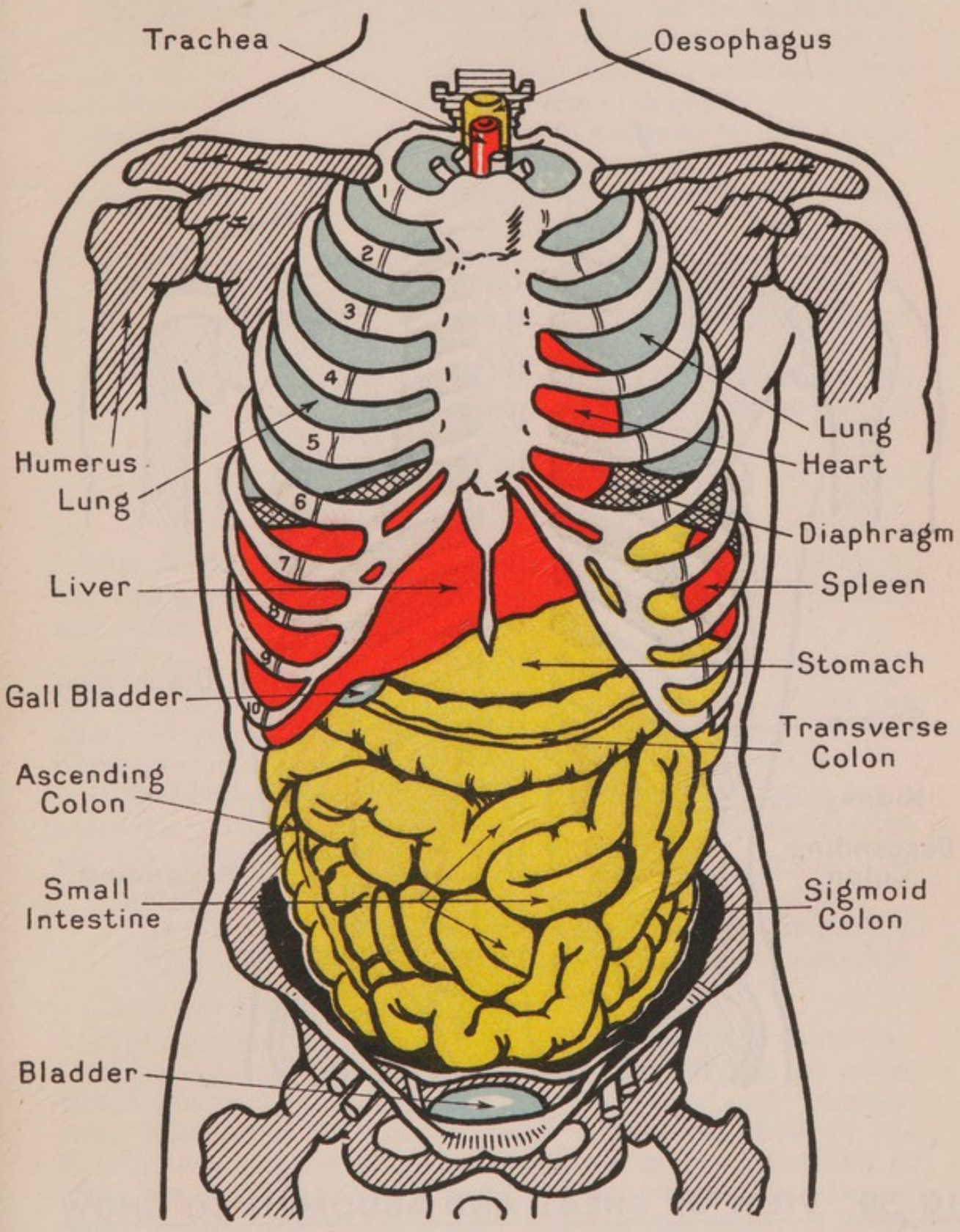


FIG. 58. VIEW OF CHEST AND ABDOMEN TO SHOW ORGANS FROM IN FRONT.

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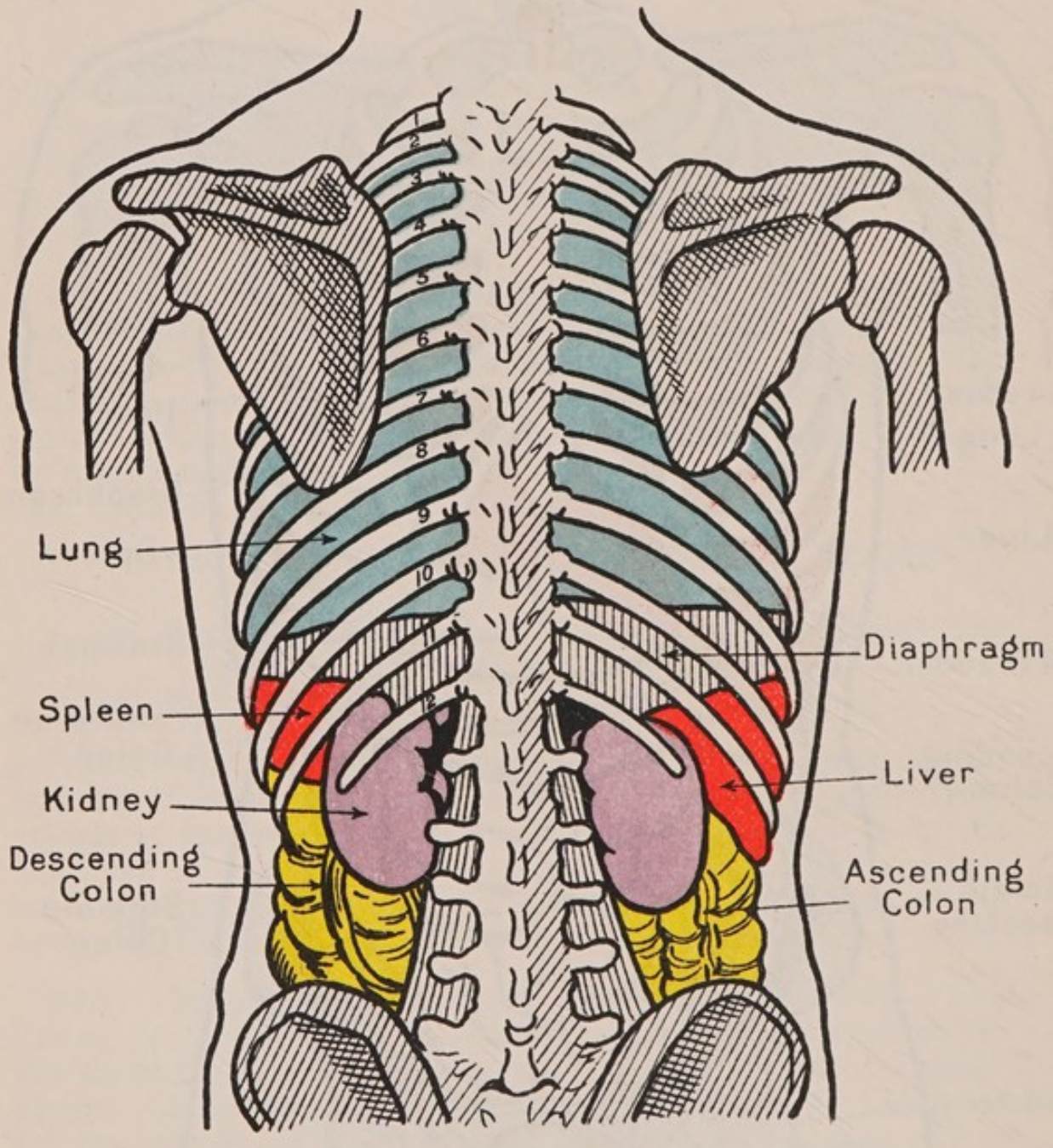


FIG. 59. VIEW OF CHEST AND ABDOMEN TO SHOW ORGANS FROM BEHIND.

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Name of Organ.		Position.
(iii) Kidneys	...	Deep in the loins at the back of the abdomen. One on each side of the spine, reaching as high as the level of the 11th rib.
(iv) Bladder	...	Low down in the middle of the front of the pelvis.
(v) Spleen	...	On the left side under the ribs behind the stomach close under the diaphragm.
(vi) Stomach	...	On the left side partly under the ribs, varying in size according as it is full or empty.
(vii) Bowels	...	Filling the rest of the space of the abdomen, divided into large and small intestines.

Circulatory System

516. The organs concerned in the circulation of the blood are the heart and the blood-vessels, *i.e.* arteries, capillaries and veins.

517. The **heart** is a hollow muscular organ, about the size of a closed fist, situated on the left of the middle of the chest between the two lungs. It is conical in shape, its base uppermost, its apex downward and towards the left side.

It is divided into a right and left side, separated by a muscular partition so that nothing can pass directly from its right to its left side.

Each half is again divided into—

(i) An upper thin-walled receiving chamber, the auricle.
(ii) A lower thick-walled pumping chamber, the ventricle.

There are thus in the heart four chambers :—

Right auricle, left auricle. Right ventricle, left ventricle.

There is a flap or valve between each auricle and ventricle, which allows the blood to pass in one direction only, namely, from the auricle to the ventricle. These chambers of the heart contract between 70 and 80 times in a minute, and so force the blood into the arteries, which are described below, and through them to the body. The blood is returned to the heart by means of the veins. A continuous circulation is thus kept up.

518. The **blood-vessels** are tubes extending from the heart to every part of the body, and with the heart, contain the blood.

There are three kinds of blood-vessels, viz., ARTERIES, CAPILLARIES and VEINS. The blood passes along these tubes, which open into one another, and does not escape from them.

ARTERIES are thick walled, strong elastic tubes leading from the pumping chamber of the heart (the ventricles); branching and getting smaller as they get farther from the heart, finally dividing into very small vessels with very thin walls, which are so small as to be invisible to the eye. These are called CAPILLARIES.

The walls of the capillaries are so thin that the dissolved nourishment which comes from the digestive system, and the oxygen which comes from the lungs and is contained in the blood, can pass through them into the tissues of the body and so nourish it; while the impurities from the tissues are taken up by the capillaries and are carried away in the blood. The capillaries form a close net-work all over the body, and, gradually joining together and getting larger, they become VEINS.

The veins, thin-walled tubes, beginning thus in the capillaries, become fewer in number and larger in size as they get nearer the heart, until they end in the large veins which open into its upper chambers (the auricles).

The arteries carry the blood from the heart to the capillaries, the veins from the capillaries to the heart. The blood travels rapidly in the arteries and veins, and very slowly in the capillaries, so as to allow the work above described to be done.

519. Main blood-vessels connected with the heart.—The names of the vessels connected with the various chambers of the heart are as follows :—

(i) The aorta, carrying blood from the left ventricle.

(ii) The superior vena cava and inferior vena cava, carrying blood from the body to the right auricle.

(iii) The pulmonary artery, carrying blood from the right ventricle to the lungs.

(iv) The pulmonary veins, carrying blood from the lungs to the left auricle.

520. The blood passes through the blood-vessels and heart in the following stages, comprising the **pulmonary and systemic circulations** (*see* Fig. 60).

(i) The superior vena cava and inferior vena cava pour their *impure* blood into—

(ii) The right auricle of the heart, which contracts, driving the blood through—

(iii) The tricuspid valve into—

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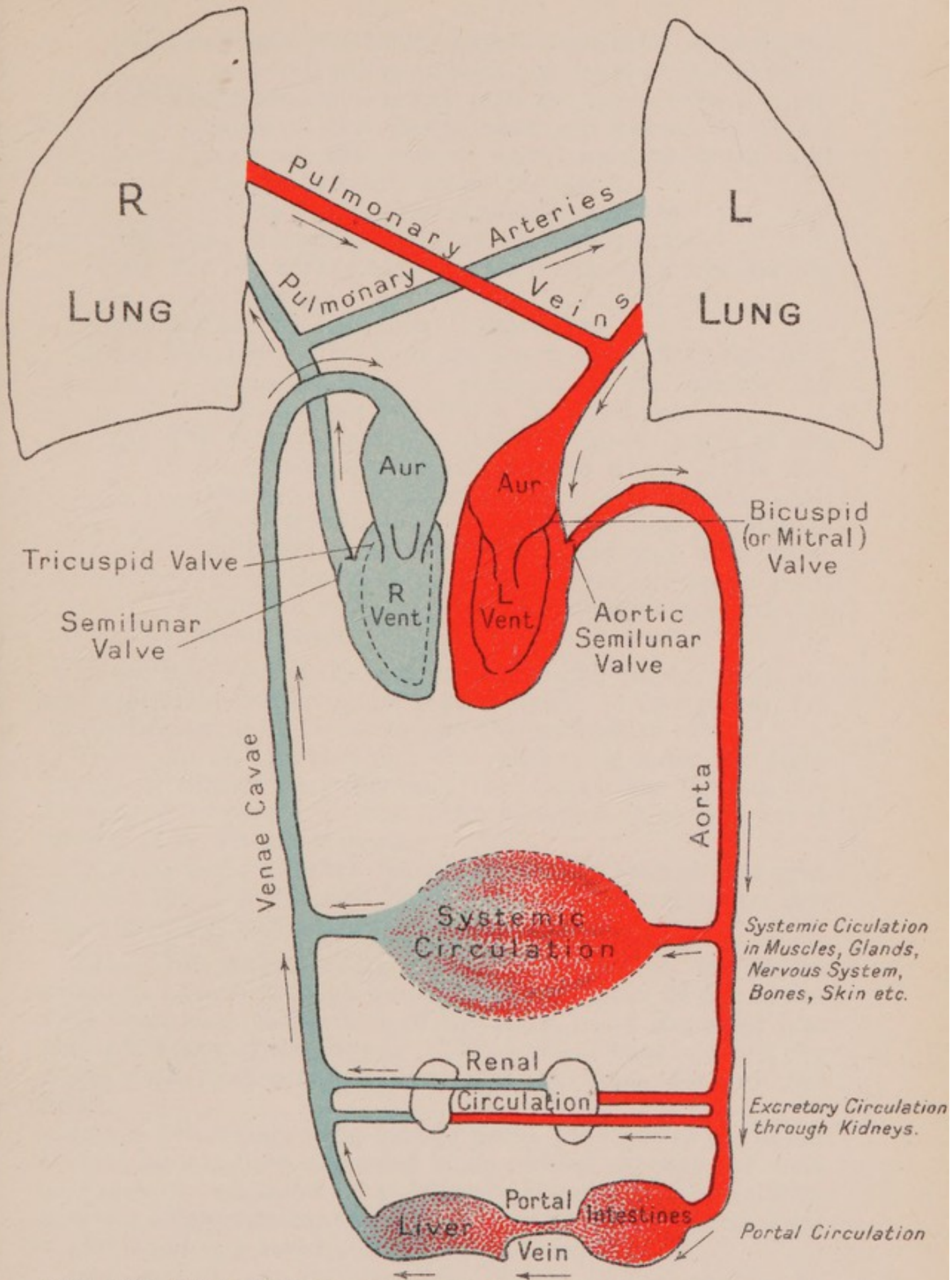


FIG. 60. DIAGRAM OF THE CIRCULATION OF BLOOD.

The ventricles are seen in section to show the valves.
The right and left side of the heart are shown separated.

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(iv) The right ventricle, which contracts, closing the tricuspid valve, and driving the blood through—

(v) The pulmonary artery into the lungs, where capillaries of this blood-vessel are formed round air sacs at the end of the bronchial tubes and oxygen is taken up by the blood.

The *purified* blood then passes into

(vi) The pulmonary veins, which convey it to—

(vii) The left auricle of the heart, which contracts, driving it through—

(viii) the bicuspid (or mitral) valve into—

(ix) The left ventricle of the heart, the extremely thick muscular wall of which contracts, closing the mitral valve, and drives the blood into—

(x) The aorta, which distributes it to all parts of the body through branch arteries which divide and subdivide, becoming smaller and smaller until they terminate in capillaries. The capillaries unite to form small veins which join with other veins, becoming gradually larger and larger until they all unite to form the superior and inferior venæ cavæ.

In addition to the tricuspid and bicuspid valves, there are also *semilunar* or half-moon shaped valves in two places, *i.e.* at the beginning of the aorta and the pulmonary artery.

There are no valves where the venæ cavæ enter the right auricle or where the pulmonary veins enter the left auricle, because the pressure of the blood is sufficient to prevent it flowing back whence it came.

In some kinds of heart disease, the valves become damaged and the blood is dammed back in the body, causing swollen limbs (dropsy) and possibly fainting attacks.

521. The pulse.—The pumping action of the heart produces a wave through the arteries, which can be felt where they come near the surface of the body, as at the wrist just above the root of the thumb. This wave or beat is called the *pulse*, each beat corresponding with the contraction of the heart.

In the veins there is no beat or pulse, the force of the blood current having been expended while passing through the wide net-work of capillaries lying between the ends of the arteries and the commencement of the veins, so that the blood flows in the latter in a steady, even stream.

522. Blood-vessels.—All the blood-vessels contain in their walls muscle-fibres, which, however, are more numerous in the arteries than in the veins; and these fibres by their

contraction regulate the calibre of the vessels and admit more or less blood to the parts they supply.

It must be borne in mind that all the work of the blood is done while it is moving slowly in the capillaries, and that there is far more blood in the venous system than in the arterial. The vessel-muscles are under the control of the sympathetic system of nerves. Flushing and pallor are caused by the dilation and contraction, respectively, of the capillaries of the skin, and are caused by emotion, heat, cold, pressure, etc.

523. The blood-supply of vital organs.—It is important that the supply of blood to all parts of the body should be uninterrupted, and that the vital organs should receive a copious supply. The vital organs, therefore, are placed in the chest and abdomen near the heart, which is the source of supply. The brain which is a little farther off, has a very full supply, being fed by four large arteries :—

(i) The carotid arteries, one on each side of the neck.
(ii) The vertebral arteries, branches of the sub-clavian arteries, which themselves come from the arch of the aorta.

524. The arrangement of the main arteries of the body.—The aorta is the main artery of the body. It is about one inch in diameter at its origin from the left ventricle. It forms an arch just above the heart, from which spring the great vessels to the head and upper limbs, namely, the innominate artery on the right side, and the common carotid and sub-clavian arteries on the left. It then proceeds downwards along the left side of the vertebral column, passes through the diaphragm out of the thorax into the abdomen, where it divides into the right and left common iliac arteries, each of which again divides into the internal iliac, which supplies the organs of the pelvis, and the external iliac, which is continued down into the lower limb as the femoral artery.

The sub-clavian artery springs on the right side from the innominate artery and on the left side from the arch of the aorta. It passes out of the thorax beneath the clavicle into the axilla or arm-pit, where it becomes the axillary artery and continues down the inner side of the arm as the brachial artery. At the bend of the elbow the brachial artery divides into the radial and ulnar arteries, which run down on the outer and inner sides of the fore-arm respectively. Having passed over the wrist (where the pulse is usually felt), they sink deep into the palm of the hand, where they unite to form the palmar arch.

The femoral artery is the continuation of the external iliac artery. At the junction of the limb with the trunk,

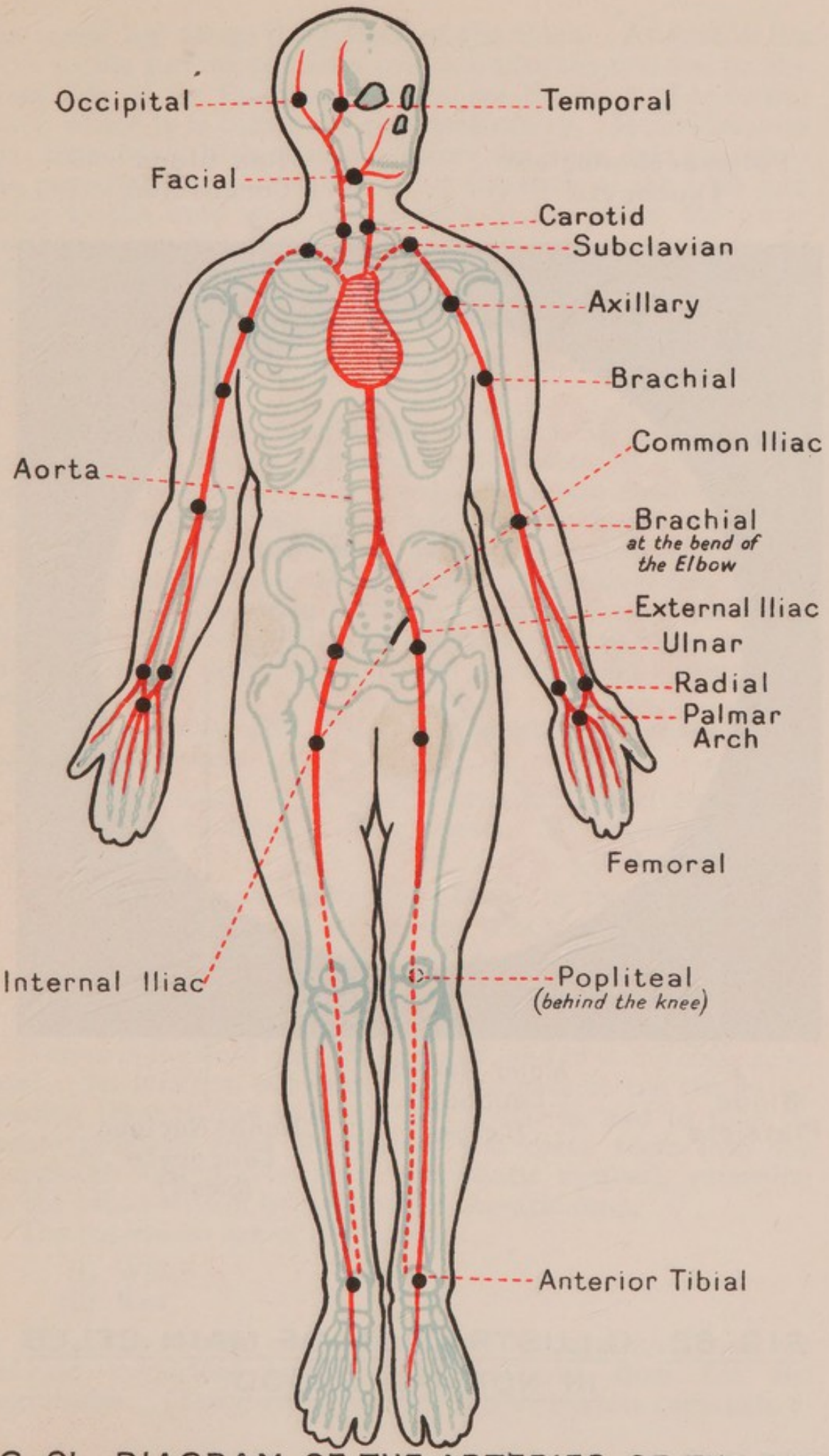


FIG. 61. DIAGRAM OF THE ARTERIES OF THE BODY.

The black dots indicate the point where to apply compression.

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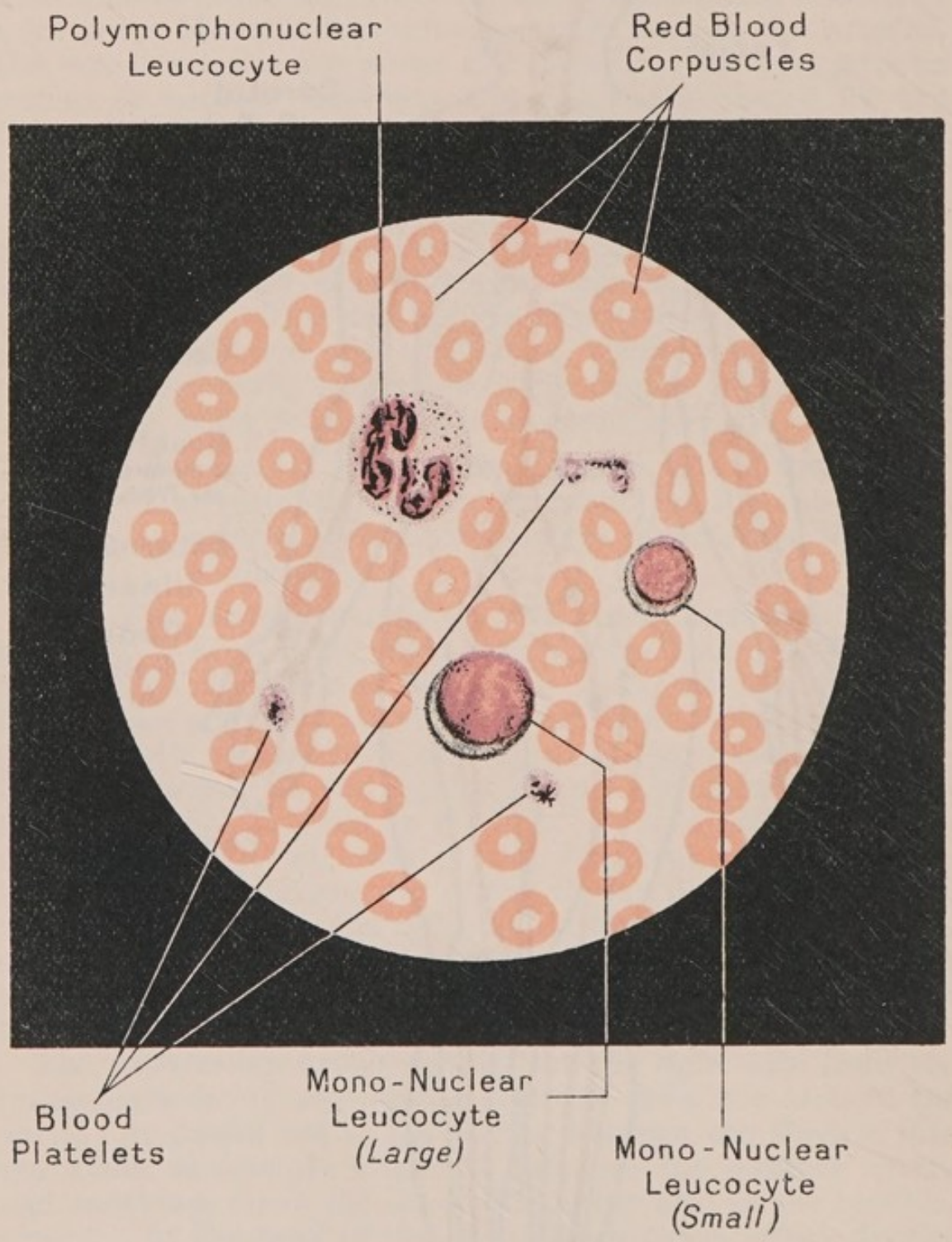


FIG. 62. ILLUSTRATION OF MAIN CELLS IN NORMAL BLOOD.

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the vessel lies about the middle of the thigh. At first it lies close to the surface but soon passes under the muscles on the inner side of the thigh until it reaches the back of the knee joint, where it is called the popliteal artery. It divides into two branches a little distance below the knee, one branch—the posterior tibial—keeping along the back of the tibia and going to the inner side of the back of the ankle, the other running down the front of the leg between the muscles to reach the front of the ankle. These two arteries meet in the sole of the foot, where they form the plantar arch, which is placed in such a position under the arch of the instep that it cannot be compressed by the weight of the body in the standing position.

525. The Portal circulation.—In para. **518** it was stated that the blood in the systemic capillaries takes up nourishment from the stomach and bowels, but it was not mentioned that the whole of the veins which carry blood from the alimentary canal pass into a large vein called the portal vein, which splits up in the substance of the liver into which it enters. After passing through the interstices of the liver, the blood is gathered into the hepatic or liver-veins and so into the main vein (inferior vena cava), which enters the heart.

In the kidneys, also, there is a secondary circulation of similar description.

526. The blood.—The blood is a red fluid, which coagulates when it escapes from a blood-vessel. It consists of two parts :—

(i) A colourless fluid called *plasma*, or serum.
(ii) Many millions of minute coin-shaped bodies—too small to be seen by the naked eye—which give to the blood its colour and substance, the *corpuscles*.

Plasma is the fluid part of the blood, and in it the corpuscles float. Its function is to carry nourishment to the tissues by passing through the walls of the capillaries, and to take up waste products from the tissues and carry them into the lymphatic system (*see* under lymphatic system), returning to the blood stream by way of the thoracic duct.

The corpuscles are of two kinds :—

(i) White.
(ii) Red.

527. The white corpuscles or leucocytes.—These are minute colourless bodies—less numerous than the red corpuscles. (There are about 500 red to 1 white corpuscle.)

They have the power of altering their shape, and of passing through the walls of the capillaries ; and they also seize and destroy germs of disease which gain access to the blood, thus protecting the body from infection ; when an injury has been done to some part of the body and it has become inflamed, the white corpuscles flock there in great numbers to deal with the cause of the inflammation, and, if they are successful in removing it, they return into the circulation ; if not, they themselves are destroyed and become pus-corpuscles, collections of which are found in abscesses.

528. The red corpuscles.—These are microscopic disc-like bodies, concave on both sides—so small that several thousands placed against each other would be required to make up one inch.

They are coloured by a compound of iron which is called *hæmoglobin*, and the red colour of the blood is entirely due to them. Their duty is to absorb oxygen from the air taken into the lungs (para. **520**).

529. It must always be remembered that every movement causes firstly, the combustion or using up of some of the body tissues, secondly, the production of heat, and thirdly, the formation of carbonic acid gas, which is the gas produced by burning (*i.e.* the rapid oxidation of) organic matter. Combustion can only take place if oxygen is present. Hence the necessity for a continuous supply of oxygen to every part of the body.

530. The spleen.—The spleen belongs to what are known as the ductless glands and its functions are connected with the production of white blood corpuscles and probably the destruction of red blood corpuscles.

It is a soft elastic organ, weighing about 7 ounces and is on the average 5 inches long, 3 inches broad and 1 inch thick. It lies in the left upper side of the abdominal cavity towards the back and close to the 9th, 10th and 11th ribs (*see* Figs. 58 and 59).

The spleen becomes enlarged in malaria and many infective diseases, such as typhoid fever. It is also at times very large in certain blood diseases, such as splenic anæmia. It is very soft and easily ruptured by violence ; this is common in the enlarged spleen of patients who have suffered from malaria.

The Lymphatic System

531. The lymphatic system consists of :—

(i) Lymph.
(ii) Lymph spaces.
(iii) Lymphatic vessels.
(iv) Lymphatic glands.

Though the blood is the nutritive fluid of the body, it must be borne in mind that, except in the liver and spleen, the blood does not come in direct contact with the tissues of the body. It is separated from them by the walls of the capillaries and the lymph.

532. The lymph is a clear, colourless or slightly yellow fluid such as is seen in a blister. The lymph which passes from the intestines during digestion, however, becomes milky from being charged with fat.

The lymph acts as a middle-man :—

(i) It receives from the blood oxygen and nutrient matter, which it delivers to the tissues.
(ii) It receives from the tissues carbonic acid and other waste products, which it delivers to the blood.

It lies in spaces known as lymph spaces, which are found in all the tissues of the body. From them pass numerous channels known as lymphatic vessels, which themselves unite and form the *thoracic and right lymphatic duct.*

533. The thoracic duct is a long narrow tube which begins in front of the spinal column in the upper part of the abdomen, runs up through the chest cavity, and eventually discharges the lymph that it receives into the large veins on the left side of the root of the neck. The right side of the upper part of the body is drained by the right lymphatic duct. All lymph is thus poured into the blood.

534. Lymphatic glands.—In its course through the body the lymph passes through the lymphatic glands, which act as filters and keep back any poisonous material, such as germs, that has been brought to them in the lymph. This is seen, for instance, with a septic or festering sore on the foot, when the glands below the groin become inflamed from the poisoned lymph that they have intercepted, and red lines can often be seen in the position of the lymphatic channels.

Certain forms of malignant growths, *e.g.* "cancer," also spread by means of the lymphatics and secondary deposits of the growth occur in the glands.

The Respiratory System

535. The organs of respiration are :—

(i) The larynx and trachea.
(ii) Two bronchi.
(iii) The lungs.

Air is drawn in through the nasal cavities, or the mouth if the latter is open, and then traverses the pharynx, which

is a cavity which passes not only air to the lungs, but food to the œsophagus.

The pharynx opens into the larynx, in which is situated the organ of voice and the larynx is continued down into the trachea, which finally divides into the right bronchus and left bronchus going to the two lungs.

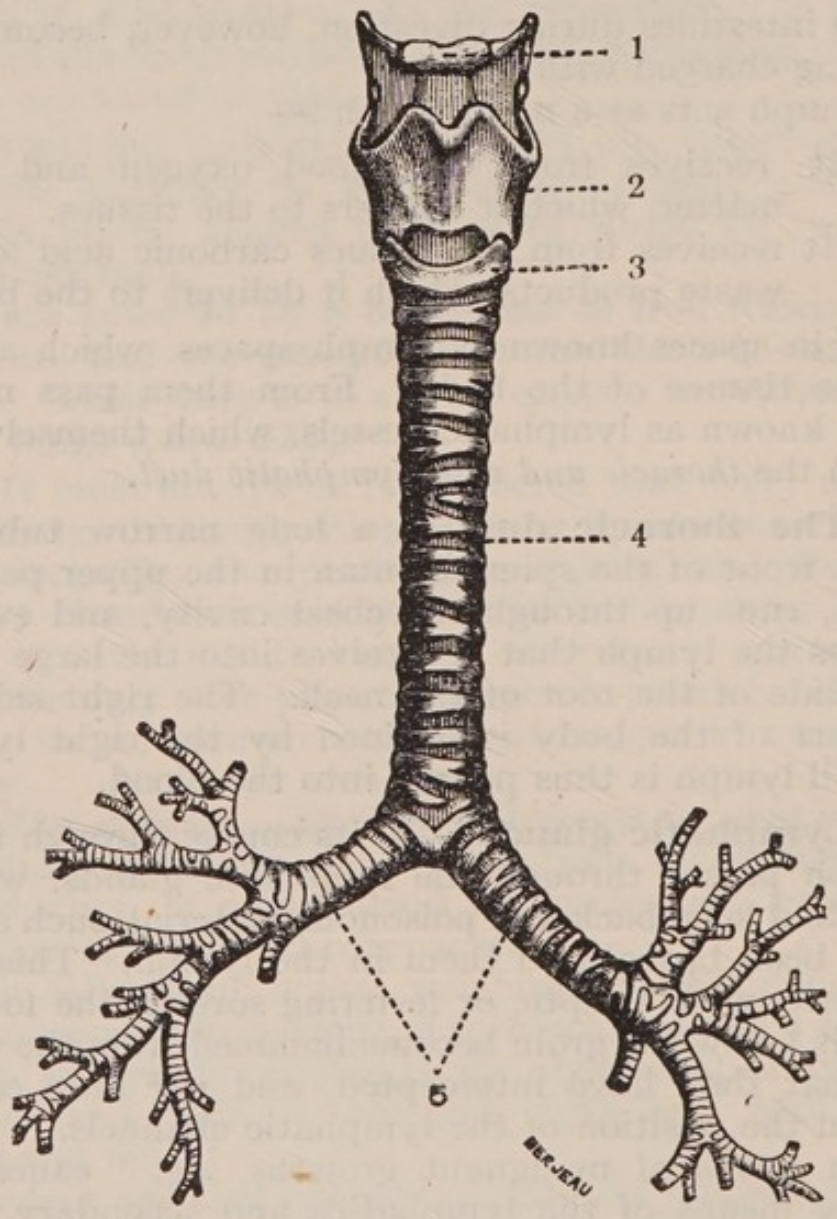


FIG. 63.—THE LARYNX, TRACHEA AND BRONCHI

1. Hyoid bone; 2. Thyroid cartilage and 3. Cricoid cartilage, forming the larynx. 4. Trachea or windpipe. 5. Bronchi.

There is a flap, called the epiglottis, at the upper opening of the larynx, which covers it and prevents food from passing into the windpipe during swallowing.

The bronchi are stout tubes leading from the windpipe to the lungs. In the lungs the bronchi branch out in all direc-

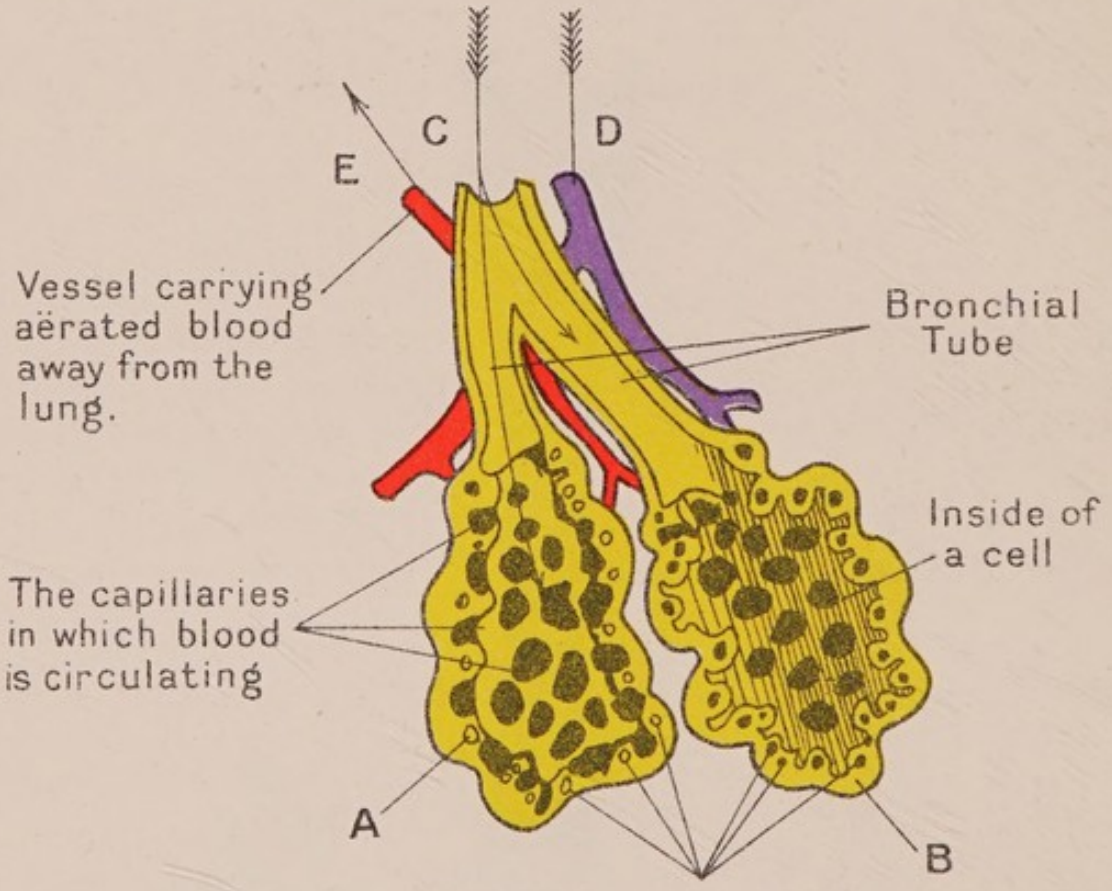


FIG. 64. TWO AIR-CELLS OF THE LUNG CUT ACROSS (MAGNIFIED).

A, *showing the arrangement of the capillaries around the air-cells.*
B, *showing the appearance of the inside of an air-cell.*
C, *is a bronchial tube. The arrow in it shows the direction of the air in inspiration.*
D, *a blood-vessel taking the dark blood to be aërated in the cell.*
E, *a blood-vessel returning the bright aërated blood to the left auricle.*

954. Malby & Sons, Lith.

tions, becoming smaller and their walls thinner as they proceed to their closed endings, the air-cells.

The lungs, two in number, are large sponge-like organs, which lie in the chest cavity, one on each side. Each consists of a mass of minute, extremely thin walled cells, the air-cells, which are the blind endings of the bronchial tubes.

In the extremely thin walls of the air-cells are spread net-works of capillaries.

It is by means of the organs of respiration that air is taken into the lungs and oxygen given to the blood. While oxygen is being taken into the blood, carbonic acid gas or carbon dioxide and watery vapour pass from the blood into the lungs and are breathed out.

536. Description of respiration.—Respiration or breathing is produced by the alternate expansion and contraction of the chest walls, by means of which air is drawn into and expelled from the lungs.

A complete respiration consists of :—Inspiration or drawing in of air to the lungs, immediately followed by expiration or breathing out of air from the lungs, followed by a pause.

In health, a complete respiration occurs 15 to 18 times a minute. The rate is increased during exertion and also in many diseases. The act of respiration is carried out in the following way.

537. Inspiration.—In inspiration the chest is enlarged by the action of various muscles.

One of these, the diaphragm or midriff, is situated between the chest and abdomen. The diaphragm, when not in action, is arched upwards. It is attached to the lower end of the breast bone, the lower ribs and the backbone, forming the floor of the chest and separating it from the abdomen. On inspiration, it contracts and becomes flatter, pushing the belly outwards, and enlarging the cavity of the chest from above downwards.

The ribs pass slanting downwards from the backbone to the breast bone, and their arches are wider below than above. Various muscles are attached to the ribs, which raise them and at the same time carry the breast bone upwards and forwards, thus increasing the size of the chest, making it broader from side to side and deeper from front to back. As the chest cavity enlarges, air is drawn in through the mouth and nostrils, and, passing down the windpipe and bronchial tubes into the air-cells, expands the lungs, where it remains long enough to allow the oxygen to pass through the

capillaries into the blood, and some watery vapour and carbonic acid gas to pass out. The chest is not completely emptied or filled at each breath.

538. Expiration.—At the end of inspiration, the diaphragm relaxes and becomes more arched upwards; the muscles which raised the ribs and breast bone cease to act, and the chest-walls fall. Thus, by its natural elasticity, and that of the lungs, the cavity of the chest is reduced in size, and the air is, consequently, expelled from the lungs.

539. The air is made up mainly of two gases—oxygen and nitrogen, with a small quantity of carbonic acid gas. Oxygen is necessary to maintain life and is absorbed by the blood; the nitrogen merely passes into and out of the lungs. Oxygen has the effect of making the corpuscles bright scarlet, as in the systemic arteries. As the oxygen passes out of the corpuscles, the blood becomes darker in colour, as in the systemic veins.

The Digestive System

540. The process of digestion is the preparation of foods by the digestive organs so that the nutritive substances can be absorbed into the blood.

The process is carried out by the digestive system, which consists of two portions :—

(i) A long tube called the alimentary canal.
(ii) Glands which prepare juices to be mixed with the food in order to dissolve it.

541. The **alimentary canal** begins at the mouth and ends at the anus or lower opening of the bowel; it is about 30 feet long. It consists of :—

The mouth.
The gullet or œsophagus.
The stomach.
The intestines (small and large).

542. The **glands** or organs which pour juices or secretion into the alimentary canal are :—

(i) The salivary glands, which secrete saliva, which is alkaline, into the mouth, where the digestion of the starchy parts of the food begins.
(ii) The gastric glands in the stomach, which secrete gastric juice, which is acid and acts on meats.
(iii) The liver, which excretes about two pints of bile a day, which helps in the emulsification or breaking up of fats.
(iv) The pancreas, which secretes pancreatic juice, which

acts on all classes of food, continuing the action of the saliva and gastric juice.

(v) The glands in the small intestines, which secrete the intestinal juice, which completes the digestion of the meat foods in the intestines.

543. The teeth are hard, specialized bony structures consisting of three parts, the *crown*, the *root* and the *neck*. The crown is the *enamel*-covered portion of the tooth projecting above the gum, the root is the portion embedded in the jaw bone and the neck is the constricted portion between the crown and the root. A central cavity contains the tooth *pulp*, which is a highly-sensitive soft structure containing blood-vessels, lymph-vessels and nerves, which enter the tooth through a small opening at the end of each root (*see* Fig. 65).

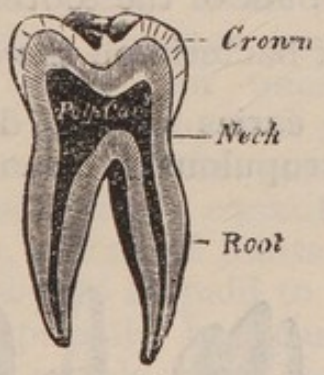


FIG. 65.—SECTION THROUGH A MOLAR TOOTH

544. The teeth appear in two sets by the process called *eruption* :—

(i) The *temporary* or *milk* teeth, 20 in number, which begin to make their appearance about the seventh month after birth, are usually all fully erupted by the end of $2\frac{1}{2}$ or 3 years, and are eventually replaced by permanent teeth.

(ii) The *permanent* teeth, 32 in number, which comprise from front to back in each half of each jaw two *incisors* or cutting teeth, one *canine* with a single point or *cusp* to its crown, two *premolars* (bicuspids), each with two cusps, and three *molars* with square crown surfaces usually having four cusps in the upper teeth and five cusps in the lower teeth. The upper molars usually have three roots and the lower molars two roots. The first upper premolars frequently have two roots and the remainder of the teeth usually have single roots (*see* Fig. 66).

The approximate order and dates of eruption of the permanent teeth are as follows :—

First molars and incisors, 6–8 years ; first premolars, upper second premolars and lower canines, 10–12 years ; lower second premolars, upper canines and second molars, 12–13 years ; third molars, 20–25 years.

545. Dental caries (dental decay) is the destructive change which frequently takes place in tooth tissues. It usually occurs in two stages :—

(i) The destruction of enamel by acid formed in the fermentation of food particles on and between the tooth surfaces. This lays bare a portion of the specialized bony part (dentine) which forms the great bulk of the tooth.

(ii) The action of bacteria on the exposed dentine.

The prevention of caries chiefly depends, therefore, on keeping the teeth scrupulously clean by the regular and

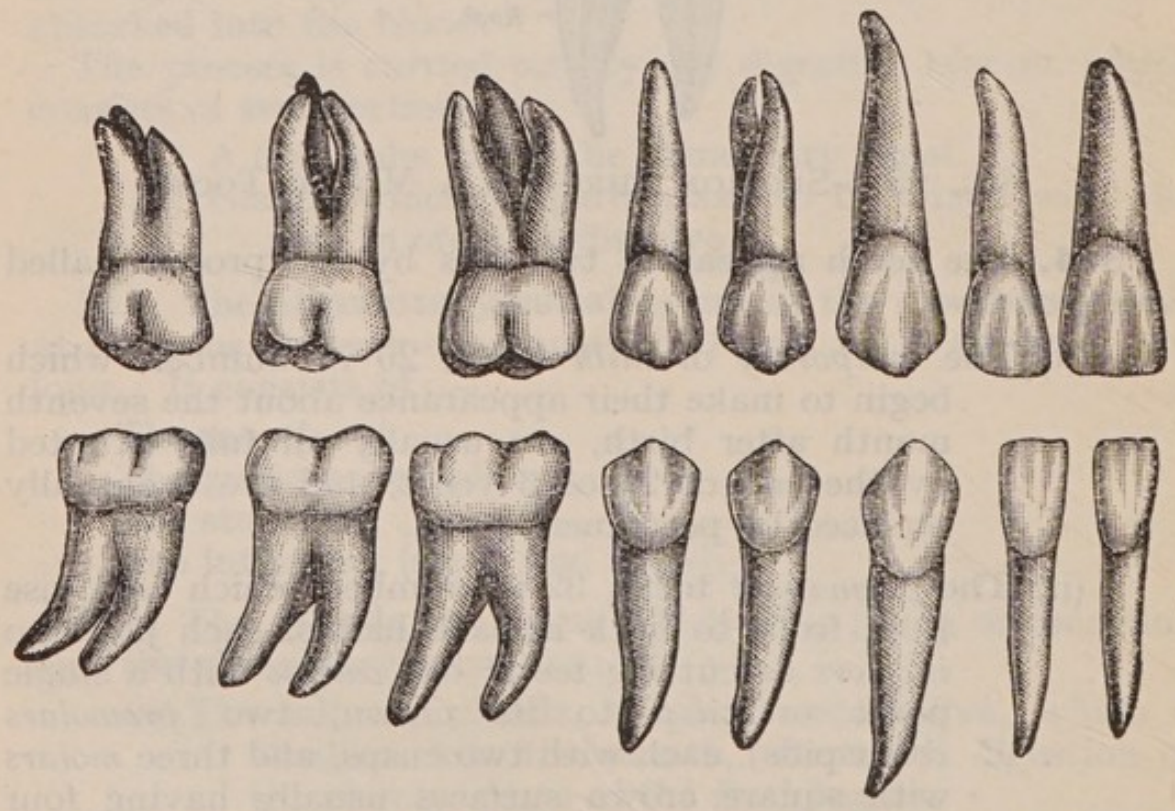


FIG. 66.—THE PERMANENT TEETH OF THE RIGHT SIDE

intelligent use of the tooth brush. They should be well brushed after every meal, evening brushing being particularly important, as food particles have a much greater chance of

fermenting during the night when not disturbed by the movements of the tongue, lips and cheeks.

In cleaning the teeth an "up-and-down" and slightly rocking action will work the bristles between the teeth and tend to dislodge particles of food. A slightly circular action will clean the surfaces of the teeth and remove particles from the gum margins. After brushing, the mouth should be rinsed with clean water.

The tooth brush, which should be of medium hardness, not too large, and with the tufts of bristles set not too closely together, should be rinsed after use and hung up to dry.

Should a tooth or the gum become painful or should a hole be discovered in a tooth, the dental officer should immediately be consulted.

A clean mouth is of the greatest importance to the general health. Without good teeth food cannot be properly masticated, the digestion becomes impaired and ill-health frequently follows. Further, an unclean mouth, besides causing inflammation of the gums and pyorrhœa, is an ideal breeding ground for bacteria, the poisons from which are absorbed and often cause serious constitutional disturbances, *e.g.* chronic rheumatism, deformed joints and dyspepsia.

Particular attention should be paid to the dental hygiene of patients in hospital, especially bed cases, and all facilities should be provided to enable them to keep their mouths clean.

It is of equal importance that all men dealing with the sick, cooks and all men handling food should pay the greatest attention to the cleanliness of their mouths.

546. In the mouth the food, by the movements of the tongue and cheeks, is turned about and chewed or crushed between the teeth, *i.e.* is masticated, while at the same time saliva flows into the mouth and is thoroughly mixed with the food to form a thick paste, which can then be swallowed. This is done by the tongue pushing it into the upper part of the pharynx or throat, whose muscles seize it and pass it quickly over the top of the larynx and down through the œsophagus into the stomach.

547. In the stomach (which can be looked upon as a bag or receptacle for food) much of the process of digestion occurs. Although the stomach begins to pass on its contents to the small intestine almost directly food is swallowed, a considerable time elapses—usually about four hours after a meal—before it is completely empty, thus allowing time for digestion by means of the gastric juices to take place.

Different sorts of glands are found at the opposite ends of the stomach, producing two different kinds of juices. Glands producing pepsin (the peptic glands) are situated in the first part of the stomach (the left or cardiac end) and those producing acid at the right or pyloric end, *on the way to the intestines*. Meat is very largely digested in the stomach.

548. In the intestines.—From the stomach the food is passed into the upper end of the small intestine or duodenum in an acid condition.

A short distance down the duodenum, ducts open into it by a common channel carrying bile produced in the liver and digestive juice secreted by the pancreas. The *pancreas* is an elongated gland which lies across the back of the upper part of the abdominal cavity with a structure resembling that of the salivary glands. The bile and pancreatic juice render the contents of the duodenum alkaline.

Whilst the food is passing down the small intestine, the dissolved nutritious part is absorbed into the blood through the thin walls of the capillaries on the inside of the bowels and passed into the veins of the portal circulation, through the liver, into the general circulation for the nourishment of the body.

The undigested parts of the food and unused or excess bile are passed out of the body.

To prevent the liquid food passing too rapidly and to offer a large surface for digestion and absorption, the interior of the upper part of the small intestine has its lining raised into transverse ridges called *valvulae conniventes*. Further, the inner lining throughout its whole length is covered with small projections called *villi*, which have inside them blood-vessels and lymphatics (lacteals). These *villi* are bathed in the digested food and absorb it as it passes along.

549. The small intestine.—The small intestine is about 22 feet long. It is attached to the back wall of the abdominal cavity by a double layer of membrane called the *mesentery*, which allows of free movement of the coils of intestine within the cavity and between the folds of which pass blood-vessels, lymphatics and nerves. The small intestine is divided into three parts, duodenum, jejunum and ileum. The duodenum constitutes the upper 10–12 inches and is more firmly fixed in position than the other parts. There is no sharp demarcation between the jejunum and ileum apparent externally; the former constitutes roughly two-fifths and the latter three-fifths of the small intestine, excluding the duodenum.

The intestinal wall contains circular and longitudinal layers of involuntary muscle fibres. These contract slowly at

intervals, producing waves of contraction from the upper towards the lower end of the tube, and squeeze the food onwards ; these movements are called peristaltic movements or *peristalsis*.

In the small intestine the fæces begin to acquire their characteristic smell.

550. The large intestine.—The contents of the small intestine pass into the large intestine, which begins in the right iliac fossa. The large intestine, which is about five feet long, begins in a pouch called the cæcum, into the side of which the small intestine opens. Attached to the cæcum is the vermiform appendix, and it is this small, worm-like appendix which is affected in the disease called appendicitis.

From the cæcum the large intestine passes upwards in the right flank as the ascending colon, across the abdomen as the transverse colon, then downward through the left flank as the descending colon, into the left iliac fossa, where it makes a double bend called the sigmoid flexure, and finally, the last part of it, called the rectum, goes downwards in front of the sacrum and coccyx and ends in the anus.

The large intestine is attached in the greater part of its length to the back of the abdominal cavity by a mesentery in a similar manner to the small intestine.

The process of digestion is completed in the large intestine by the absorption of water, and the contents become solid and formed in the lower end, where they are retained till voided.

The large intestine is principally lined with mucous glands whose secretion lubricates the passage of the fæces. In the lower part of the small intestines are masses of lymphoid glands, called Peyer's patches, and single lymphoid glands. Lymphoid tissue also occurs in the large intestine.

551. The anus is kept closed by means of the sphincter muscles (of which there is an inner and an outer one) until it is desired to defæcate. The fæces are the undigested remains of food, mixed with the useless remains of the digesting fluids, and some substances excreted from the system ; the whole mass is coloured by the bile and contains very large numbers of bacteria.

Note.—Though it has been stated that the small intestine alone is concerned in the absorption of nourishment, it must be borne in mind that the large intestine has the power of absorbing harmful products—known as toxins or poisons—such as result from constipation.

The Nervous System

552. The nervous system is the system which controls every voluntary and involuntary movement of the body.

It consists of: (i) nerve centres; (ii) nerve cords; (iii) nerve endings.

The nervous system is divided into two distinct parts :—

(i) A voluntary system—the cerebro-spinal, or central nervous system.

(ii) An involuntary system—the sympathetic system.

553. The cerebro-spinal system consists of the brain, spinal cord and nerves.

554. The brain is the great nerve centre of the body, and is contained in and protected by the skull. It is enclosed in three distinct membranes: an outer known as the dura

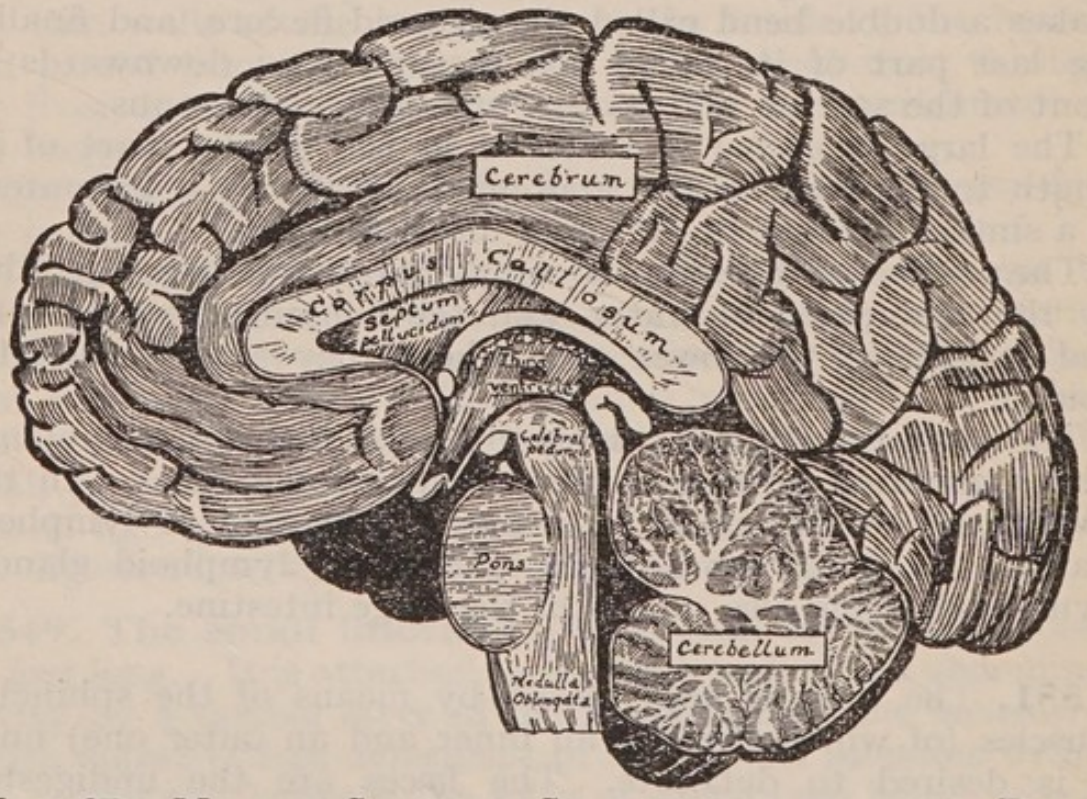


Fig. 67.—Median Sagittal Section through the Brain

mater; a middle called the arachnoid; and an inner called the pia mater, and is surrounded by fluid (the cerebro-spinal fluid). It receives all messages from the skin and organs of sense, sending out orders to the muscles to make them move in any desired way. It consists of countless numbers of nerve cells and nerve fibres contained in the brain substance.

The chief parts of the brain are: (i) the cerebrum; (ii) the cerebellum; (iii) the medulla (*see* Fig. 67).

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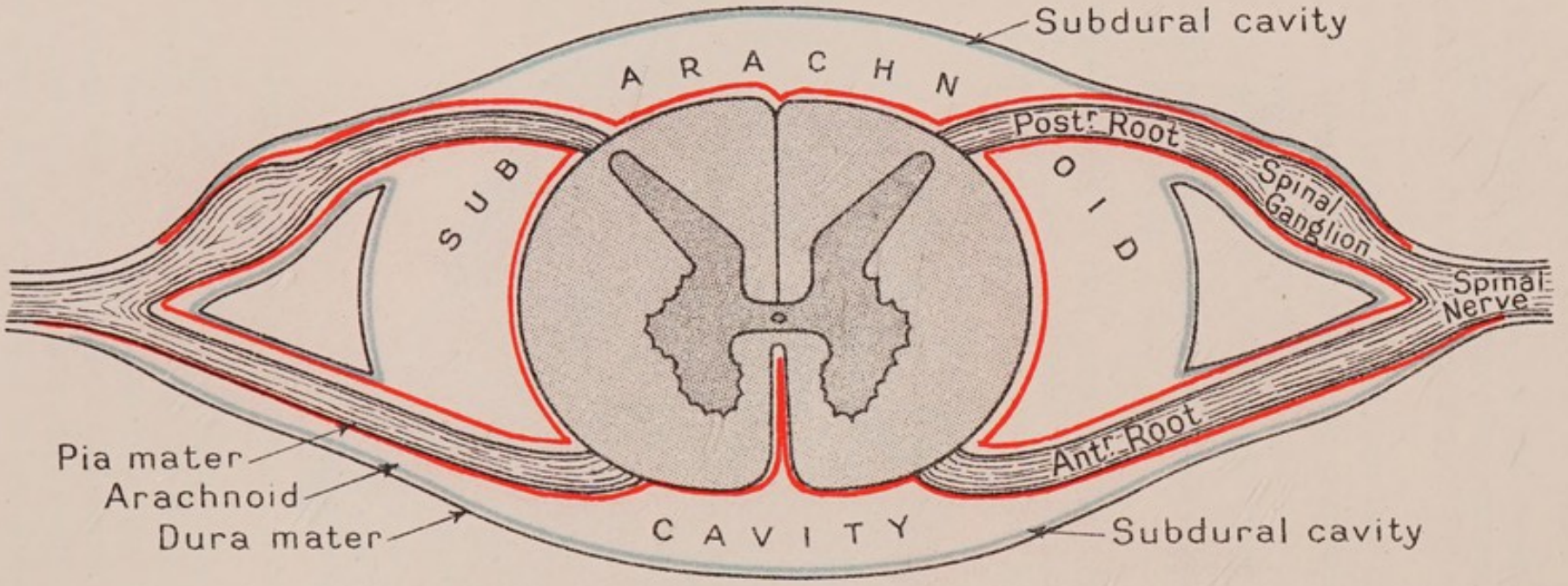


FIG. 68. DIAGRAM OF A SECTION THROUGH THE SPINAL CORD.

(i) The *cerebrum* lies uppermost in the skull and consists of two halves or hemispheres, which are to all intents duplicates of one another. The halves are joined together and to the cerebellum below ; above they are separated by a deep furrow from front to back, into which a partition of the dura mater fits. The outer surface of the brain is covered with rounded ridges and furrows, and is plentifully supplied with blood-vessels which run into these furrows. The main blood supply of the brain passes into its base.

Springing from the base of the brain are nerve-cords, *e.g.* the nerves of smell, sight, hearing and taste, and for the movements of the eyes, tongue, jaw and the muscles of the face.

(ii) The *cerebellum* lies below the cerebrum. It is much smaller and, like it, is divided into two parts.

(iii) The *medulla* is a mass of brain substance which connects the brain with the spinal cord.

555. The spinal cord is a long cylinder of nerve matter which runs from the base of the brain down the spinal column. It goes as far as the first lumbar vertebra, and is about 18 inches long. Successive pairs of nerve-cords pass outward from it in between every two vertebræ ; each nerve cord consists of :—

(i) a motor nerve trunk carrying impulses to the muscles ;

(ii) a sensory nerve trunk carrying impulses from the skin, muscles, etc., to the brain.

These unite to form a compound nerve.

556. Nerve cords or nerves are the connecting threads between the nerve centres and nerve endings. They are, therefore, attached at one end to the brain or spinal cord and at the other terminate in the nerve endings, whether in the skin, organs of sense or muscles.

Nerve cords are of two kinds :—

(i) Motor or efferent nerves—those carrying impulses *from* the brain to the muscles of the body.

(ii) Sensory or afferent nerves—those of special senses, *e.g.* sight, taste, smell and hearing, and those of common sensation, carrying impressions of heat, cold, touch and pain from the body *to* the brain.

557. Nerve endings are to be found in every part of the body. They are able to communicate to the brain by an afferent or sensory impulse information of what is taking place in the part to which they are distributed. For instance,

with the end of the finger we can tell whether anything we touch is rough or smooth, hot or cold. Other nerve-endings in the ear, eye, tongue or nose send to the brain information as to hearing, sight, taste and smell. Acting on this information, the brain can send an order by an efferent or motor impulse to any muscle or set of muscles, by the nerves which pass into them, and so make the desired movement.

558. Functions of the various parts of the cerebro-spinal system.—(i) The cerebrum is the seat of thought, will, sensation and emotions. It is possible for life to continue for a time without the higher brain, as the centres for the mere vital and non-intellectual functions are in its base and in the medulla and spinal cord. Breathing and swallowing can go on even when sensibility is quite absent, as in concussion of the brain, but if the nerve-centres which govern the vital functions are in any way interfered with, instant death is the consequence.

(ii) The main function of the cerebellum is to co-ordinate the action of various muscle groups, which usually work together, in any complicated combination of movements, such as walking or running.

(iii) The functions of the medulla are most important, as it contains the centres which regulate the heart, respiration, swallowing, etc. Any injury interfering with these nerve-centres is usually instantly fatal.

(iv) The spinal cord is the channel by which motor and sensory impulses or messages are carried to and from the brain ; it also contains the centres for reflex actions.

559. Reflex actions.—In the case of the so-called reflex action, the message, when it reaches the spinal cord by means of the sensory nerve, instead of being sent upwards into the brain, passes directly across to the motor nerve and the movement required takes place ; whereas in the case where the will is required to play a part, the message comes in as usual by the sensory nerves, but it then travels up to the brain, consciousness is awakened and the necessary order is sent out by way of the motor nerves to the appropriate set of muscles, which will bring about the movement desired. The great difference, then, between voluntary and reflex action is that in the one case the subject is conscious of the desire to perform voluntary movement, whereas in the other case the action takes place spontaneously.

560. Sympathetic nervous system.—This system consists of a chain of nerve ganglia or knots mainly lying upon the side of the vertebral column and intimately connected

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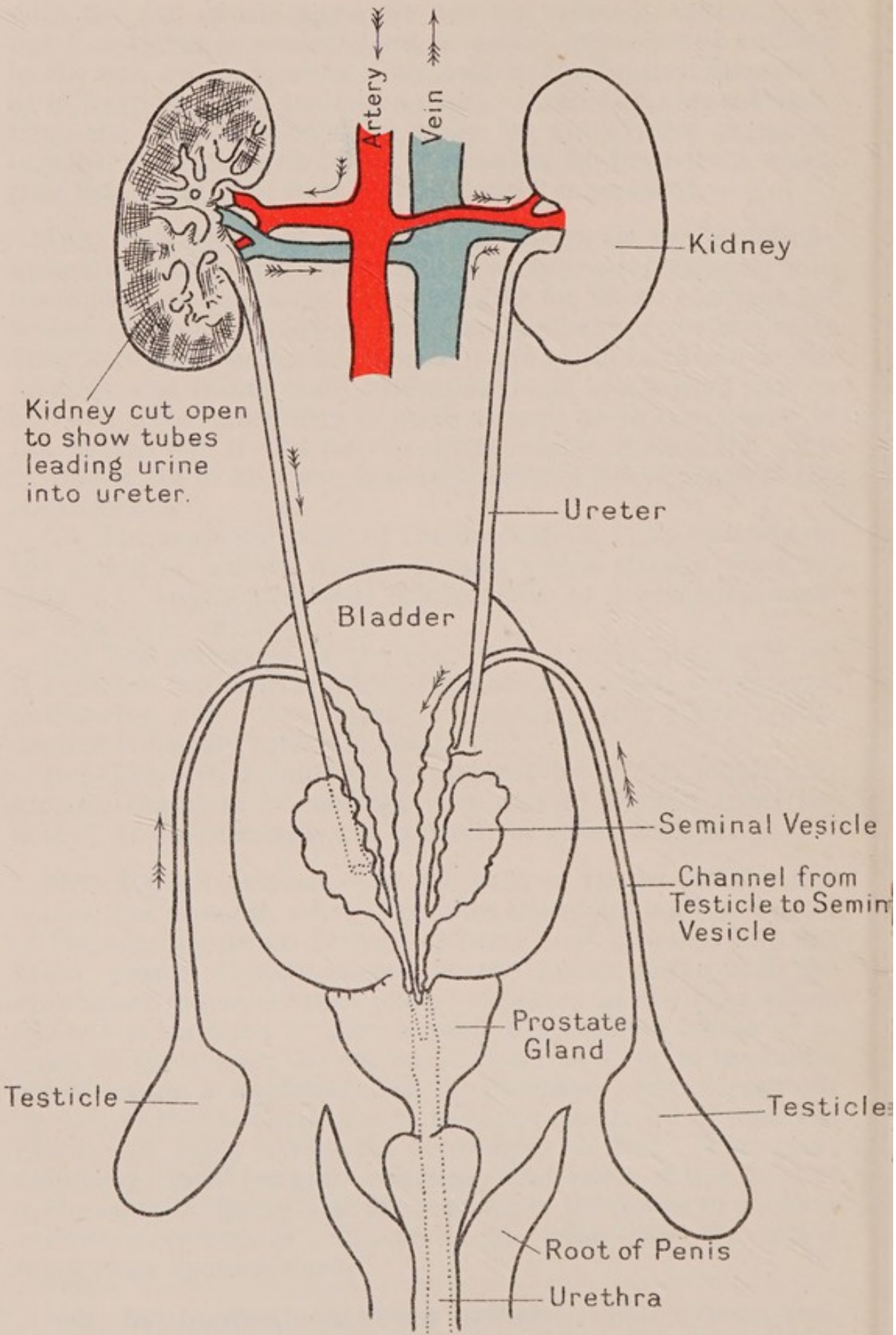


FIG. 69. THE URINARY SYSTEM.

Diagrammatic sketch of the genito-urinary organs.

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with the spinal nerves. This system controls the functions of the body which may be considered as automatic, such as the contraction and dilatation of the blood-vessels, peristaltic movements of the intestine, etc.

561. Injury to nerves.—Injury to nerves causes paralysis of the parts which they supply, *i.e.* loss of sensation and of the power of movement, and the nourishment of the paralysed part also suffers. Bed sores are especially likely to occur in cases of paralysis.

The spinal cord consists of large nerve cells, and nerve-fibres coming from the brain to supply the trunk and limbs ; when it is torn through or badly crushed, the result is paralysis of both sides of the body below the point of injury.

When a nerve is completely severed, it may be repaired, but this takes a long time, and sensation and power are only gradually recovered.

The Excretory System

562. It is necessary to life to get rid of impurities and waste matters which accumulate in the blood ; this is carried out by the kidneys, bowels, lungs and skin.

The kidneys excrete daily about two and a half pints of urine, which consists of water and waste matter from the blood.

In the expired air the lungs get rid of gases resulting from oxidation of the tissues.

The bowels assist in casting out certain impurities with the remains of the food.

The skin is continually passing off sweat, which consists of water and impurities from the blood.

In order to keep the skin healthy, great attention should be paid to cleanliness.

563. The urinary system.—The urinary system is the system which excretes or gets rid of the largest share of the waste products of the body. If these waste products were not got rid of, the body would be poisoned and life would cease. This actually happens when the kidneys are destroyed by disease.

The urinary system consists of :—

(i) The kidneys—right and left.
(ii) The ureters—a tube from each kidney which conveys the urine from the kidneys to the bladder.
(iii) The bladder.
(iv) The urethra—a tube leading from the bladder along which urine is passed out of the body.

564. The kidneys.—The kidneys, two in number, are situated in the abdominal cavity, one on each side of the spinal column. They lie behind all the other contents of the abdomen and their upper borders are as high as the eleventh rib. They have each a very large artery passing in and a vein passing out of them, on their inner and front edge ; the ureter comes out behind the vein and artery and goes down to enter the lower and rear part of the bladder.

565. Structure of the kidneys.—Each kidney consists of a very large number of minute (folded and twisted) tubes which end in small blind ends, each of which receives a tuft of capillary blood-vessels called vascular tufts. At their other ends the tubes open into the ends of the ureters in the " pelvis " on the concave side of the kidney.

The renal artery and vein are very large, and the blood passes through the kidneys rapidly.

566. Action of the kidneys.—The kidneys may be regarded as filters through which the whole blood of the body passes, and which remove from the blood a substance called urea, together with other impurities, dissolved in water, which together constitute the urine. The water of the urine passes from the blood through the tuft of capillaries into the ends of the tubes, and, as it runs down the tubes it mixes with the urea and other substances secreted by the cells lining the tube walls, forming the urine. The cleansed blood passes on in its vessels, and the urine drains into the ureters and finally into the bladder. The amount of urine passed in a day is about 50 oz., or 2½ pints. This quantity of water contains about 2½ oz. of solid matter. The urine is more watery and abundant in cold weather, as less water is then passed off by the skin than in hot weather. If the kidneys cease to work from any cause, the blood soon becomes poisoned by the accumulation of these matters in it, and " uræmia " with convulsions, and insensibility results.

567. Retention of urine.—Urine is passed from the bladder as convenient or when the bladder is full. When from any cause the water cannot be passed, retention of urine occurs.

To draw the water from the bladder an instrument called a catheter is used. It is a tube with a hole in the side near the end of it and is inserted at the orifice of the urethra and passed along it until it reaches the bladder.

568. The bladder.—The bladder is situated in the pelvis. It is a bag, which is fixed at its base and free to expand upward. It lies below all the intestines and only rises into the

abdomen when very full. It will hold comfortably about one pint. It opens into the urethra at its lower part, and in the male, at its neck has a gland called the prostate gland, through the middle of which the urethra passes. The receptacles for the semen lie behind the bladder at its base, and the tubes which conduct the semen from the testicles to the receptacles lie against its side (*see* Figs. 69 and 90).

The wall of the bladder contains strong layers of involuntary muscle-fibres, which help the abdominal muscle to squeeze the urine out into the urethra.

569. The male urethra.—The urethra in the male (to which sex alone these remarks refer) is about 8½ inches long and ¼ inch in diameter. It passes out from the base of the bladder through the prostate gland in a downward direction, then curves forward to pass beneath the junction of the two pubic bones, joining with the two lateral roots of the penis along whose under-surface it runs, ending in the orifice at its tip. As it passes through the prostate gland, seminal receptacles open into the urethra. The rectum (the lower end of the bowel) lies behind it as it passes the prostate gland. It is essential to know the position of these parts, so as to understand how the nozzle of an enema syringe should be introduced and how a catheter should be passed.

The Skin

570. The skin forms the protective covering of the body. It consists of two layers :—

(i) The epidermis or cuticle on the outside.
(ii) The dermis or true skin.

(i) The epidermis is hard and horny, composed of thin scales which are always being worn away. It is impermeable to fluids.

It is full of small openings known as pores which are merely the openings of the ducts of the sweat glands.

There are no blood-vessels in the epidermis.

(ii) The dermis or true skin consists of fibrous and elastic tissue. It contains the sweat glands, which are themselves surrounded by small capillaries from which the glands excrete sweat, which consists of water and impurities from the blood.

By the evaporation of the sweat, heat is withdrawn from the body, thus cooling it and so helping to keep its temperature constant.

The true skin also contains fat, which assists in preventing

the loss of heat from the body, while embedded in it are delicate nerve endings which give us the sense of feeling and touch.

The nails and hair are outgrowths of the epidermis.

The Eye

571. The eye is shaped like a globe, as shown in the diagram, and it is set in a bony socket called the *orbit*.

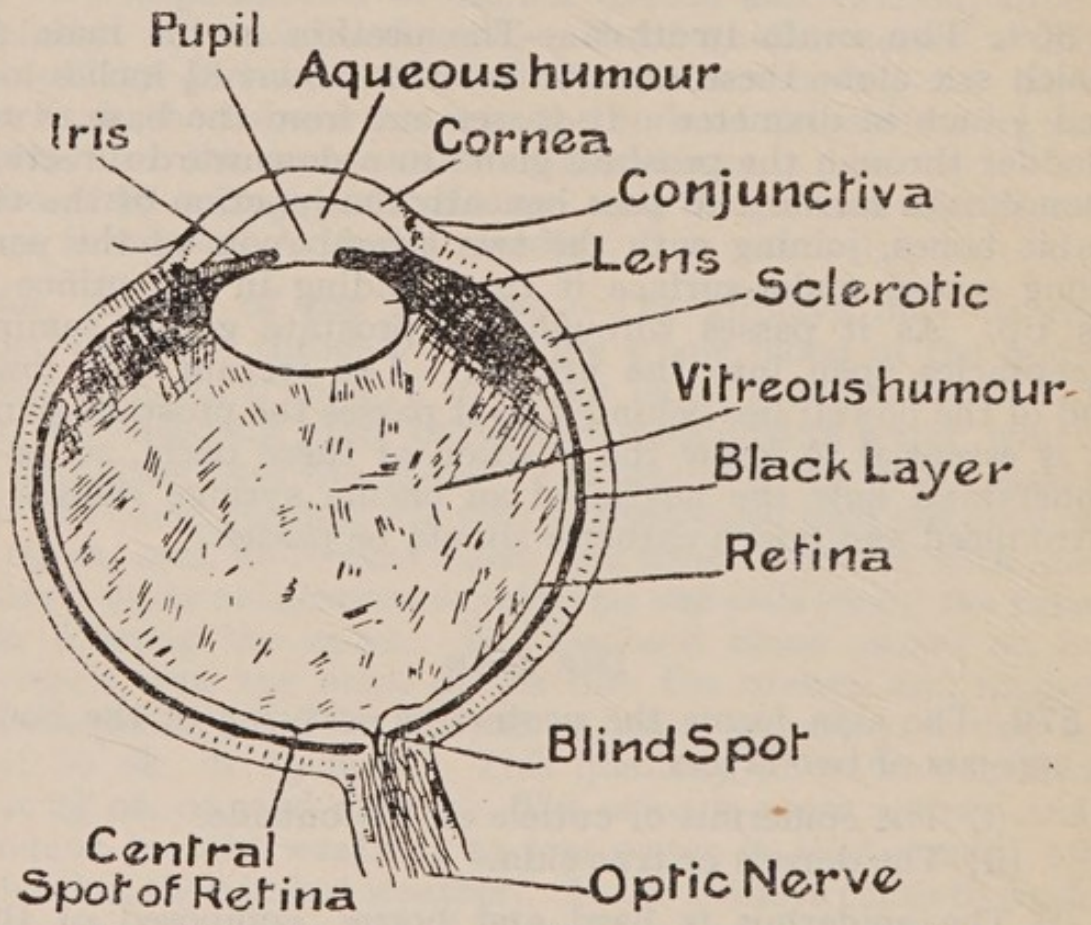


Fig. 70.—Diagram of Section through Eye (Horizontal)

It is partly covered by the eyelids for protection, so that only a small portion of the front of the eye is visible.

The visible portion of the eye is covered by a thin transparent membrane, the *conjunctiva*, which also covers the inner surface of the eyelids.

It is the conjunctiva which becomes red in inflammation, due to dilatation of the blood-vessels contained in it.

572. The important parts of the eye are :—

(i) The *cornea*, the circular clear window of the eye in front.

(ii) The *iris*, the coloured part of the eye, covering the edges of the lens.

It is a diaphragm, having a black hole in the centre called the *pupil*. The colour of eyes depends on the amount of pigment (black colouring matter) in the iris. Brown eyes have more pigment than grey or blue eyes.

(iii) The *lens*, placed just behind the iris, about the size of a pea, shaped like a magnifying glass.

(iv) The *vitreous*, a clear jelly-like substance which fills the main body of the eye, and serves to keep its shape.

(v) The *retina*, a sensitive screen, which covers the inner surface of the eyeball. It is composed of nerve endings, and nerve fibres leading to the *optic nerve*, or nerve of sight.

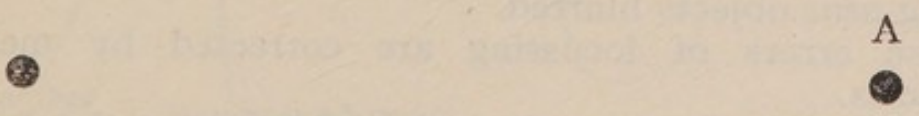
(vi) The *sclerotic*, continuous with the cornea in front, a tough outer coat, covering the whole eyeball.

(vii) The *optic nerve*, from the back of each eye, carrying the nerve fibres from the retina to the brain.

It passes through a hole at the back of the orbit called the *optic foramen*.

The point at which the optic nerve leaves the eye is a blind spot, and any object in the direction of the blind spot is invisible. This spot is slightly to the inner side of the back of the eye, so that no object is in line with the blind spot of each eye at the same time.

To demonstrate the blind spot, hold this page at arm's length so that a line joining the two black spots would be horizontal.



Close the right eye, and keep looking steadily at the spot A with the left eye, and bring the page towards the eye. At about 10 inches' distance the left spot disappears, as the image falls on the head of the optic nerve of the left eye.

573. Movements of the eyes.—Six muscles are attached to the sclerotic of each eye so that the eyes may be moved in any direction.

Squint is caused by a loss of balance between the muscles of the two eyes.

The eyeball moves in a layer of fat in the orbit and the tear gland secretes tears to keep the exposed part of the eye moist.

574. Function of the different parts.—The *cornea* and *lens* reduce the size of an object seen and focus the image on the retina.

The lens is elastic and is capable of altering its shape rapidly so that objects at different distances can be focussed clearly on the retina. The change of focus from a distant to a near object is called accommodation.

The *iris* acts like a diaphragm of a camera. It contracts or expands to alter the size of the pupil and thus regulates the amount of light entering the eye.

The pupil is small in bright light, and large in dim light.

A small pupil prevents dazzle from too much light.

The *retina* is the sensitive part of the eye, like the film in a camera. The image of an object looked at is focussed on the retina.

The *optic nerve*.—The image on the retina is a stimulus which is conveyed to the brain in the fibres of the nerve.

It is by means of the eyes that the brain can appreciate the shape, colour, size and position of objects within the range of vision.

Each eye sees an object from a slightly different angle: this gives stereoscopic or binocular vision, which makes judgment of distance much easier.

575. Errors of refraction.—In short sight, the image of an object is focussed in front of the retina, making distant objects blurred.

In long sight, the image is focussed behind the retina, making near objects blurred.

These errors of focussing are corrected by means of spectacles.

The use of spectacles is to focus the image on the retina.

Apart from these errors, spectacles are required for near vision as age advances, because the lens become less elastic and accommodation is therefore more difficult.

The Ear

The ear is divided into external ear, middle ear and internal ear.

576. External ear.—This consists of the external flap and the passage leading to the drum. The external flap is made of cartilage covered with skin and shaped in ridges and

depressions. It leads into the opening of the external meatus or ear-hole, a channel which can be described in two parts.

The outer half is a prolongation of the skin-covered cartilage of the external flap. It is in this outer half that boils in the ear occur. These may be so painful that a wrong diagnosis is often made, the severe pain being thought to be due to mastoid involvement (*see* para. **577**).

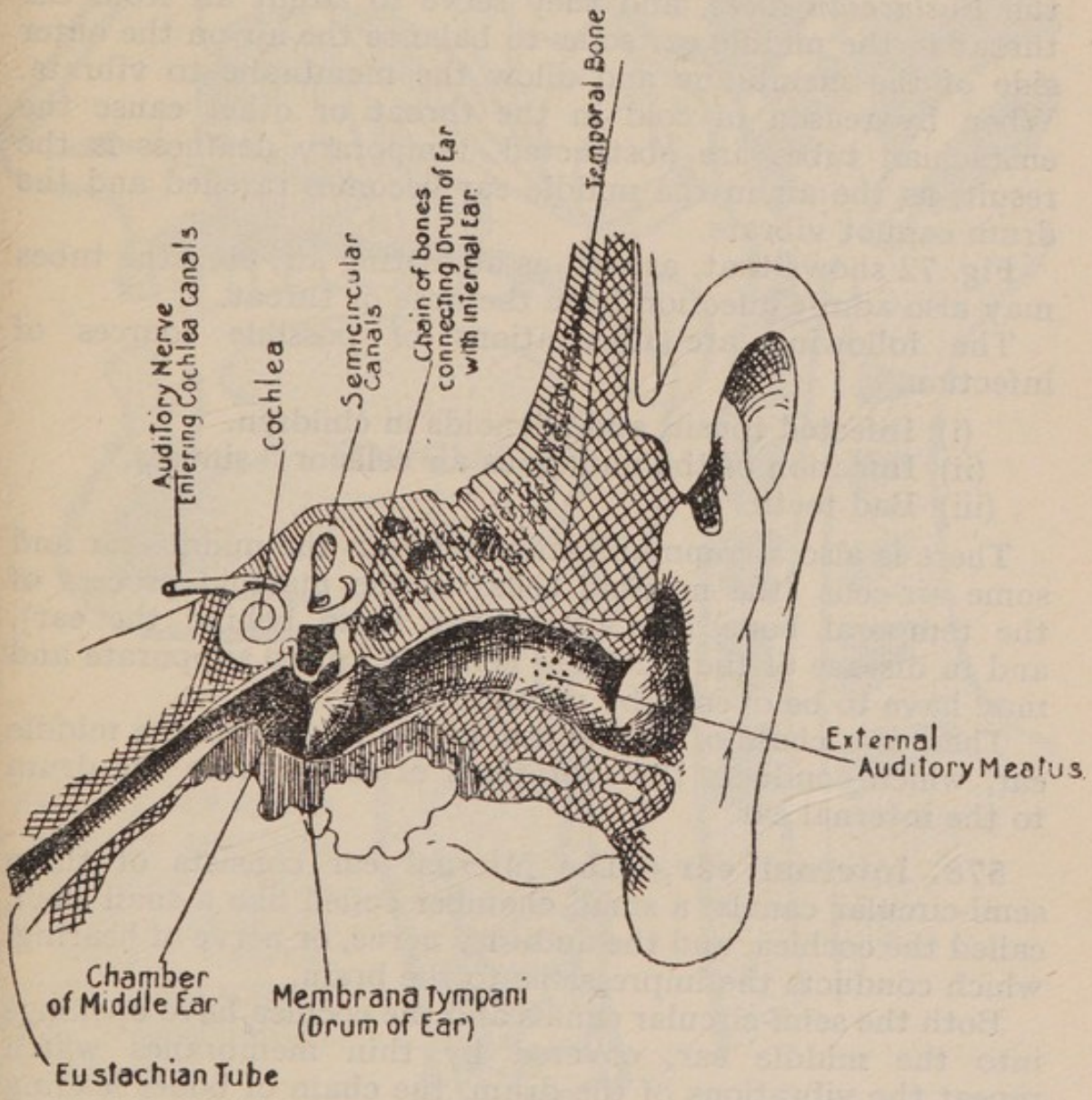


FIG. 71.—DIAGRAM OF SECTION THROUGH EAR

The inner half is a bony tunnel lined with skin. Hairs and wax-producing glands are found in the passage, which prevent small foreign bodies from reaching the delicate drum of the ear, placed obliquely at the inner end of the meatus. The passage is about one inch long and slightly curved. The drum of the ear, or membrana tympani, is a thin membrane stretched across the inner end of the meatus, and

kept in tension by a thin piece of bone, so as to cause it to vibrate.

577. Middle ear.—The middle ear lies on the inner side of the membrana tympani and in a small cavity hollowed out of the thickness of the temporal bone. A tube passes from it to the back of the throat, opening on a level with the hinder opening of the nasal passages. These tubes are called the *Eustachian tubes*, and they serve to admit air from the throat to the middle ear so as to balance the air on the outer side of the membrane and allow the membrane to vibrate. When by reason of cold in the throat or other cause the eustachian tubes are obstructed, temporary deafness is the result, as the air in the middle ear becomes rarefied and the drum cannot vibrate.

Fig. 72 shows that, as well as admitting air, etc., the tubes may also admit infection from the nose or throat.

The following are illustrations of possible sources of infection.

(i) Infected tonsils and adenoids in children.
(ii) Infection of the numerous air cells or " sinuses."
(iii) Bad teeth.

There is also a communication between the middle ear and some air-cells (the mastoid cells) in the mastoid process of the temporal bone (the hard bony lump behind the ear), and in disease of the ear these cells are apt to suppurate and may have to be opened by operation.

There is a chain of tiny bones, extending across the middle ear, which conducts the vibrations of sound from the drum to the internal ear.

578. Internal ear.—The internal ear consists of three semi-circular canals, a small chamber coiled like a snail shell, called the cochlea, and the auditory nerve, or nerve of hearing, which conducts the impressions to the brain.

Both the semi-circular canals and the cochlea have openings into the middle ear, covered by thin membranes which repeat the vibrations of the drum, the chain of bones leading from the drum being fixed to one of the membranes. The semi-circular canals and cochlea have fluid in their interior.

579. Functions of various parts.—The semi-circular canals are believed to give knowledge of the position of the head, and of direction, and to hear the coarser sounds ; while the cochlea, in which the nerve endings are arranged along a spiral membrane, distinguishes between the tones and appreciates the more delicate notes, and can judge of the pitch of sounds.

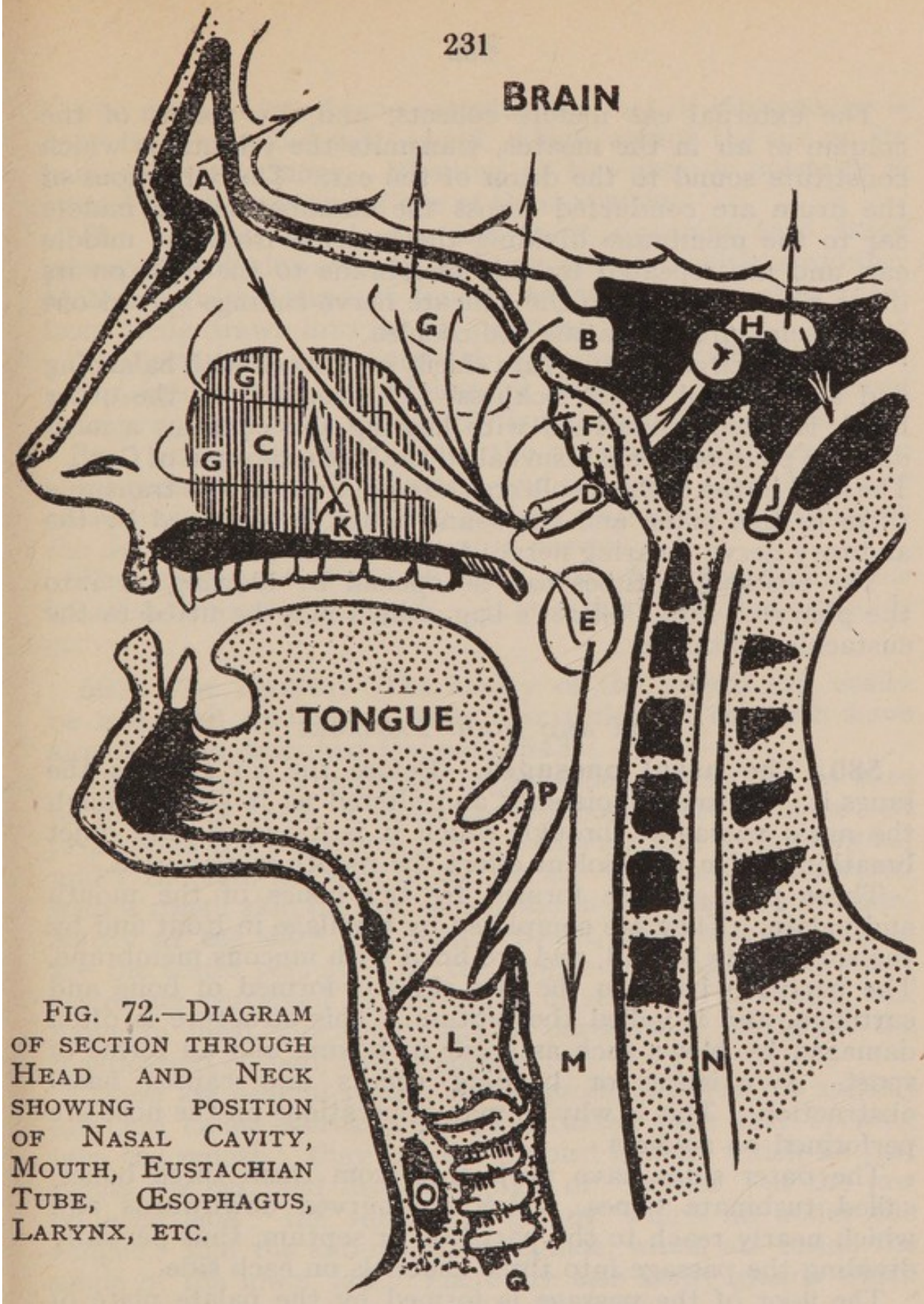


FIG. 72.—DIAGRAM OF SECTION THROUGH HEAD AND NECK SHOWING POSITION OF NASAL CAVITY, MOUTH, EUSTACHIAN TUBE, ŒSOPHAGUS, LARYNX, ETC.

KEY

A,B,C. Nasal air cells, termed sinuses.

D. Eustachian tube. This is a channel leading from the space behind the nose to the middle ear. The function of this tube in health is to admit air into the middle ear. It may also, unfortunately, admit infection and the diagram shows that infection coming from the nasal air cells (A,B,C), adenoids (F), tonsils (E) and teeth (K) by their close relationship with this tube may largely infect the ear and cause a "running ear" with all its dangerous consequences, such as inflammation of the mastoid bone, lateral venous sinus (J) or brain.

E. Tonsil. F. Adenoids.

G,G,G. Turbinate bones which warm and moisten the inspired air.

H. Mastoid antrum. J. Lateral venous sinus.

K. Bad teeth infecting the largest nasal air cell or maxillary antrum.

L. Larynx or voice-box. M. Œsophagus or gullet. N. Spinal canal,

O. Thyroid gland. P. Epiglottis. Q. Trachea or windpipe,

The external ear merely collects, and, by means of the column of air in the meatus, transmits the vibrations which constitute sound to the drum of the ear. The vibrations of the drum are conducted across the chamber of the middle ear to the membrane dividing the internal from the middle ear, and are repeated by this membrane to the fluid on its other side, and thus to the delicate nerve-endings spread out in the semi-circular canals and cochlea.

The semi-circular canals are chiefly concerned with balancing and are affected in sea-sickness. The cochlea, on the other hand, is chiefly concerned with hearing and contains a most delicate piece of mechanism called the " piano-organ of Corti." The fluid in the cochlea collects the sound waves and transmits them to this piano and the sound heard is conveyed by the auditory nerve (hearing nerve) to the brain.

The eustachian tubes can be opened by blowing air into the pharynx with Politzer's bag, which may be fitted to the eustachian catheter.

Air and Food Passages

580. The nasal passages.—Before the air reaches the lungs it is warmed, moistened and filtered as it goes through the nasal passages, through which it is drawn during quiet breathing. During violent effort the mouth is also used.

These passages are formed by the bones of the mouth and palate. They are completed by cartilage in front and by the soft palate behind, and are lined with mucous membrane. The partition between the two sides is formed of bone and cartilage, and is called the septum. This structure is often damaged by blows such as occur in boxing and all forms of sport. A twisting or bending occurs and causes nasal obstruction. This is why so many operations on the nose are performed on soldiers.

The outer sides have projecting from them three bones, called turbinate bones, which are curved downwards and which nearly reach to the partition or septum, thus partially dividing the passage into three channels on each side.

The floor of the passage is formed by the palate plate of the upper jaw and by the palate bone.

Several sets of air-cells (called sinuses) communicate with the nasal cavities, and the tear-duct opens into the inferior meatus of the nose.

The upper division of the passage and the upper pair of turbinate bones are the seat of the sense of smell, the branches of the olfactory nerves or nerves of smell being spread in the mucous membrane covering them.

The mucous membrane covering the rest of the passage is very fully supplied with blood, which warms the air on its passage to the lungs. Bleeding at the nose or epistaxis is caused by the rupture of one of these vessels.

The nostrils, which are the front openings into these passages, look downwards, and are provided with a number of hairs which intercept foreign substances and stop them from being drawn into the air passages.

The posterior nares are the openings by which the air passes into the throat or pharynx after traversing the nasal passages ; they are considerably larger than the nostrils.

In " cold in the head," it is the mucous membrane of the nasal passages that is inflamed, and the sense of smell is lost on account of the swelling up of the membrane which contains the nerve-endings of the olfactory nerves.

The upper part of the pharynx into which the nose opens is called the post-nasal space. It is in this space that adenoids grow.

581. The mouth.—The cavity of the mouth can easily be inspected and needs little description. The teeth have already been described (*see* para. **543**).

The tongue is a muscular organ which is fixed at its base to the hyoid bone, a small curved bone which can be felt just above the prominence of " Adam's apple " (the larynx) under the skin in front of the neck. The tongue is covered with a rough skin on top, which has in it the nerves of taste, chiefly at the sides and back. Sweet, acid, salt and bitter are the tastes perceived by the tongue and palate ; all other tastes are perceived by the organ of smell. The tongue can move in most directions, and is particularly active in the mastication of food, and in speech.

There are several glands which produce saliva (or spittle) and are called salivary glands, situated near and opening into the mouth ; they are the parotid glands, which lie just below the ear, and near the angle or " corner " of the jaw on each side ; the sublingual glands, which lie under the tongue ; and the sub-maxillary glands, which are inside the angle of the lower jaw. There are also many glands which pour out mucus and keep the mouth moist.

582. The fauces.—Near the back of the tongue on each side of the pharynx are seen the two pillars of the fauces enclosing the tonsils between them.

The tonsils are in reality lymphatic glands of which there are many in the neck and elsewhere. They are, however, peculiar in that their inner or throat surfaces are devoid of capsule (or covering). This provision of nature is meant for

a special purpose, *i.e.* the exposed surfaces of the tonsils act as a filter to protect the lungs and gastro-intestinal tract from the entrance of germs. It is only when these filters themselves become choked, *i.e.* diseased, that they are removed by the surgeon to prevent disease of the ears, etc. (*see* Fig. 72).

It will be seen from the foregoing that, if *diseased* tonsils and air sinuses are not treated, many septic complications may be caused.

The roof of the fauces is formed by the soft palate, attached to the back of which is the pendulous part or uvula.

583. The pharynx.—The pharynx is the cavity into which the mouth, and above it, the posterior nares, open. It is like a " hopper " or funnel suspended from the base of the skull ; it is continued down to the œsophagus behind and joined to the larynx in front. It has at its back the spinal column covered by muscle, and it is formed of muscles lined with mucous membrane ; the eustachian tubes (*see also* para. **577**) open into it above the soft palate.

The epiglottis is a cartilaginous flap covered with mucous membrane, situated at the back of the tongue and immediately above the entrance to the larynx ; it is attached by ligaments to the back of the tongue, the side-wall of the pharynx and the hyoid bone and thyroid cartilage.

In swallowing, the larynx is drawn up by various muscles, the opening of the larynx being closed by the epiglottis ; the bolus or mass of masticated food is at the same time gripped by the muscles of the pharynx and gullet and so passed on to the stomach.

CHAPTER XXIV

BANDAGES AND BANDAGING

584. Method of instruction.—In imparting instruction in bandaging, great economy of time and labour will be effected by practising one half of the members of a class in bandaging the other half. The class should be formed up in two ranks, the front rank bandaging the rear rank, and *vice versa*.

585. To secure the ends of bandages.

(i) *By pinning.*—It is sometimes impossible to tie the *ends* of a triangular bandage. To fix the *point* by tying is usually impossible (though it may sometimes be included in a knot between the ends). In these cases it must be fixed by a safety-pin.

(ii) *By tying.*—A reef knot should always be used. The granny knot is apt to slip and is much more difficult to untie. The diagrams show better than any description in words the difference between these knots. Fig. 73 shows how to make a knot, and Fig. 74 how *not* to make it. Starting from position I of Fig. 73, it may be said shortly that the reef knot consists of two movements, *Right over Left* (II and III of Fig. 73) and then *Left over Right* (IV and V of Fig. 73).

586. Bandages.

(i) *Objects and uses :—*

(*a*) To fix splints and dressings.
(*b*) To apply pressure to a part.
(*c*) To support or control the circulation of a part.

(ii) *Varieties :—*

(*a*) Triangular.
(*b*) Roller.
(*c*) Special.

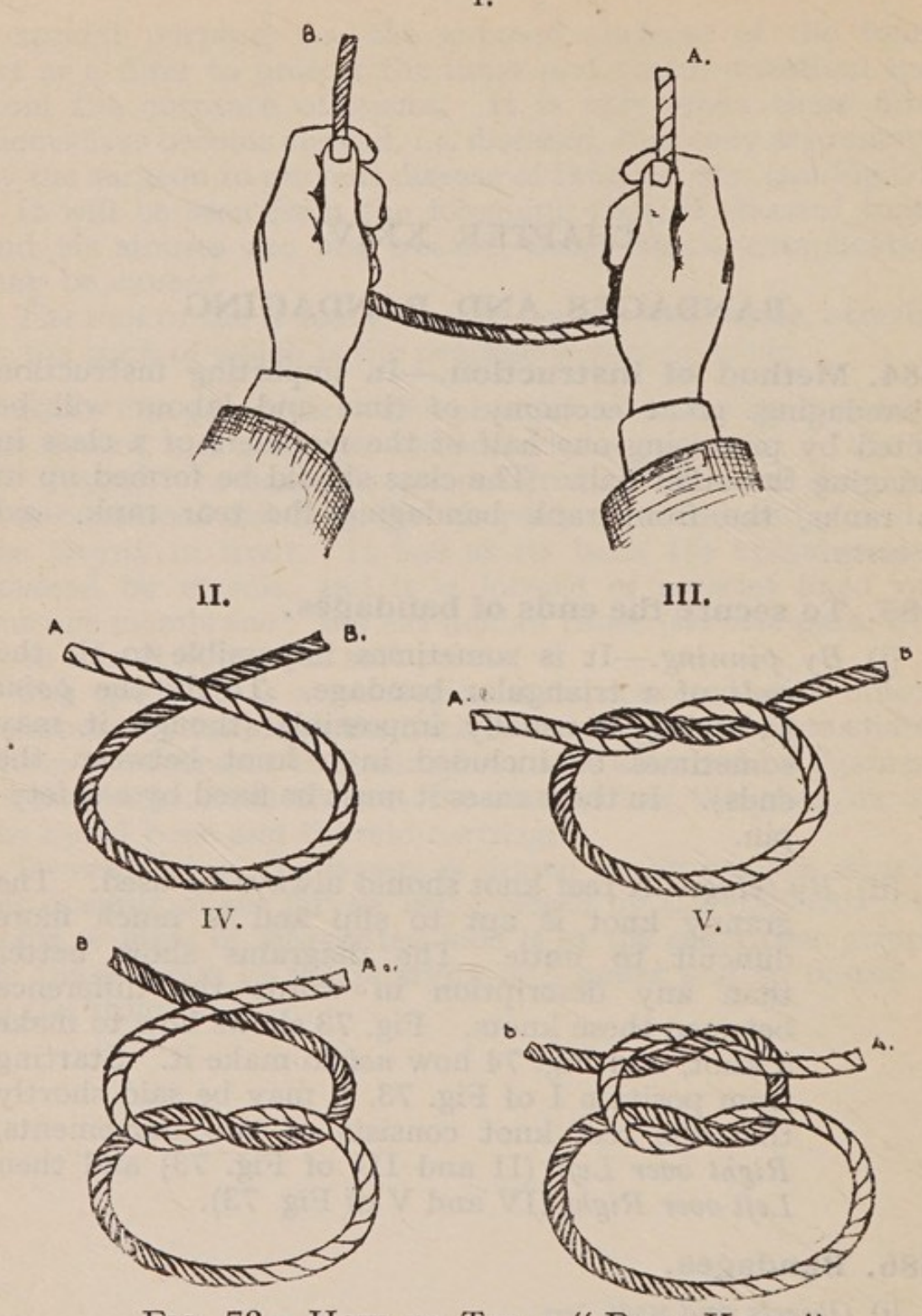


FIG. 73.—HOW TO TIE A "REEF-KNOT"

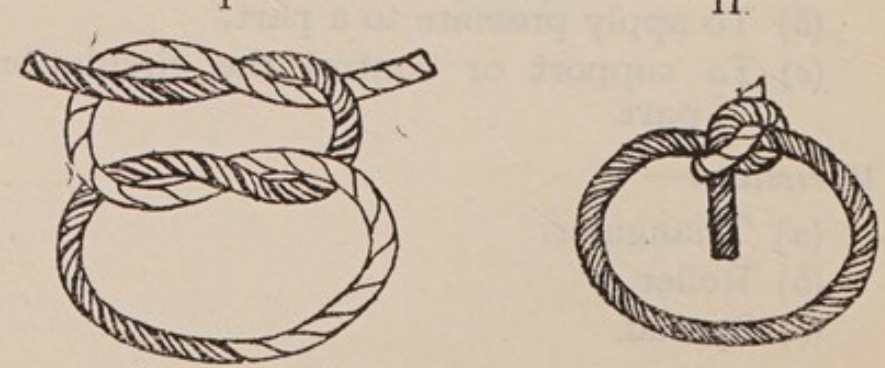


FIG. 74.—THE "GRANNY" KNOT

Triangular Bandages

587. Description.—Pieces of calico or linen, 38 inches square, are cut diagonally into halves. Each half then forms a triangular bandage. Of the three borders of the bandage, the longest is called the lower border and the two others the side borders. Of the three corners, the upper one opposite the lower border is called the point and the remaining corners the ends.

Packing.—To fold the bandage for packing, it should be folded perpendicularly down the centre, by placing the ends together, the right end on the left. If the ends, and the point, are then brought to the centre of the lower border, a square will be formed. Fold this square in half from right to left and in half again from above downwards, twice.

Modes of application.

(i) *As a whole-cloth, i.e.* as the bandage spread out to its full extent.

(ii) *As a broad-fold,* made from the whole cloth by carrying the point to the centre of the lower border and then folding the bandage again in the same direction.

(iii) *As a narrow-fold,* made by folding the broad fold once lengthwise.

Application to special regions. (i) *Top of head.*—Take a whole-cloth and lay the centre on the top of the head with the point towards the back of the head, and the lower border lying along the forehead, just above the eyebrows. Make a short fold in the lower border, and pass the ends round to the back of the head above the ears. Cross the ends over the point of the bandage, which should here be lying vertically over the occipital protuberance, bring the ends to the front again, and knot off on the centre of the forehead. Place the hand on the top of head to steady the dressing, and draw down the point until the bandage is taut over the top of the head. Then turn up the point and pin off on the top of the head.

(ii) *Side of head.*—Place the centre of a narrow-fold over the dressing, pass the ends horizontally round the head, cross and knot off over the dressing.

(iii) *Both eyes.*—Place the centre of a broad-fold between the eyes, carry the ends backwards, cross and knot off in front.

(iv) *One eye.*—Place the centre of a narrow fold over the injured eye, with one end passing obliquely upwards over the opposite side of the forehead, and the other downwards over the ear of the same side. Cross the ends below the bump at the back of the head, bring them forwards and knot off above the eyebrow on the injured side.

(v) *Chin and side of face.*—Place the centre of a narrow-fold under the chin, pass the ends upwards and knot off over the top of head, tucking in the ends.

(vi) *Neck.*—Place the centre of a narrow-fold over the dressing, cross the ends, bring back and knot off over the wound.

(vii) *Chest.*—Apply the centre of a broad-fold over the dressing, pass the ends round and knot off on the other side, leaving a long end ; take a narrow-fold, tie to the long end, bring it over the shoulder, and pin off to the broad-fold over the dressing.

(viii) *Abdomen.*—Place the centre of a broad-fold over the dressing and knot off on the side.

(ix) *The greater arm-sling.*—Place the patient facing you with his arms to his sides. Take a whole-cloth, throw *one end* over the shoulder on the sound side. Carry this end round the back of the neck and then forwards over the opposite shoulder. Let the *other end* fall down in front of the patient. Place *the point* behind the elbow of the injured arm. Bend the injured arm carefully at the elbow and bring the forearm across the chest on the middle of the bandage, with the thumb pointing towards the chin. Pick up the lower end and bring it upwards in front of the injured forearm, and knot off with the upper end which is lying in front of the shoulder on the injured side. Draw the point forwards round the arm and elbow and pin off.

(x) *Shoulder with broken collar-bone.*—There is one exception to the above method of applying the greater arm-sling, viz., in fractures of the clavicle, where it is not advisable to allow anything to press on the injured bone. To avoid this, the lower end, which is brought up in front of the forearm, should be passed between the arm and the side of the injured shoulder, and knotted off to the upper end behind the neck.

The triangular bandage may also be used to secure the arm temporarily in cases of a fractured clavicle. Having placed a small pad in the arm pit, apply the centre of a narrow-fold bandage to the outer surface of the arm of the

injured side, and carry the front end horizontally across the chest; bring the back-end forwards between the arm and chest (on the injured side), over the upper margin and front of the horizontal end, then pass it upwards and backwards through the loop thus formed to the back of the chest, and exercise steady traction, so as to draw the arm backwards; then secure the two ends on the opposite side of the chest. Instead of triangular bandages an ordinary roller bandage may be used, care being taken to place a pad between the upper arm and the chest, to draw the upper arm well back, and to support the elbow.

(xi) *The lesser arm-sling.*—Take a broad-fold, place one end over the shoulder on the sound side, carry it round the back of the neck so as to lie over the opposite shoulder, allowing the other end to fall down; bend the arm carefully and place the wrist across the middle of the bandage with the hand a little higher than the elbow, bring up the lower end and knot off to the upper end over the shoulder on the injured side.

(xii) *Shoulder.*—Lay the centre of a whole-cloth on the top of the shoulder, point upwards, the lower border lying across the middle of the arm. Fold in the lower border, carry the ends round the arm, cross them and knot off on the outer side. Apply the lesser arm-sling, draw the point of the first bandage under the arm-sling, fold it back on itself and pin off over the shoulder.

(xiii) *Elbow.*—Place the centre of a whole-cloth over the back of the bent elbow, point upwards, turn in the lower border, pass the ends round the forearm, cross them in front, pass up round the arm, cross behind and knot off in front. Tighten the bandage by drawing on the point, which is then brought down and pinned off. Apply the greater arm-sling.

(xiv) *Hand.*—Take a whole-cloth, place the hand, palm downward, on the centre of the bandage, fingers towards the point, bring the point over the back of the hand to the wrist, pass the ends round the wrist, crossing them over the point, which is then folded towards the fingers and covered by another turn of the bandage round the wrist. Knot off the ends in front of the wrist.

Or a figure-of-eight bandage (narrow-fold) may be used. Place the centre of the bandage over the dressing, bring the ends to the opposite side of the hand, cross and take two or three turns round the wrist, and knot off. Apply the greater arm-sling.

(xv) *Hip.*—Take a narrow-fold, apply it round the waist, and knot off in front; then take a whole-cloth, place the centre over the hip, point upwards, the lower border, which should be folded in, lying across the thigh; pass the ends round the thigh, and knot off on the outer side. Draw the point upwards beneath the bandage round the waist, turn it down and pin off.

(xvi) *Knee.*—Keep the leg straight, apply a broad-fold, cross behind and knot off in front below the knee-cap.

(xvii) *Foot.*—Place the sole of the foot on the centre of a whole-cloth, toes towards the point; turn the point upwards over the instep, take one of the ends in each hand close up to the foot, bring them forward and cross them over the instep covering the point. Draw the point upwards to tighten the bandage and fold it towards the toes. Carry the ends back round the ankle, cross them behind, catching the lower border of the bandage. Bring the ends forward, cross them again over the instep, covering the point, carry them beneath the foot and knot off on the inner side.

(xviii) *Other part of limbs.*—When applied to any other part of the limbs, a broad-fold is used, the centre of the bandage being placed over the dressing, the ends passed round the limb and knotted off over the wound.

(xix) *Perinæum and lower part of abdomen.*—Take a whole-cloth, lower border uppermost, pass the ends round the waist immediately above the hips and knot off behind, leaving one long end, pass the point between the legs, draw it upwards and knot off to the long end behind.

Another method: Apply a narrow-fold bandage round the waist, pass the end of a second bandage similarly folded beneath the waist bandage at the centre of the back, fold over and secure with a safety-pin; bring the other end forward between the thighs up to the waist bandage in front, pass beneath, turn over and secure with a safety-pin. This forms a modified T-bandage.

(xx) *To fix splints.*—Take a narrow-fold bandage, double it upon itself and place the loop thus formed upon the splint on the outer side of the limb; pass the free ends round the limb from without inwards and one of them through the loop; tighten the bandage by steadily drawing on the two ends and then knot them in the usual way.

Roller Bandages

588. Description.—Roller bandages consist of long strips of material varying in length and width according to the part to which they are to be applied.

(i) For head and upper limbs, 2 to 3 inches wide and 4 to 6 yards long.
(ii) For fingers, 1 inch wide and 2 yards long.
(iii) For trunk and lower limbs, 3 inches or more wide and 6 yards long.

Instructions in rolling.—They are lightly rolled on themselves in a compact cylindrical shape ready for use. A bandage class should be instructed in the proper method of rolling a bandage; at the conclusion of the exercises, roller bandages should always be inspected to see that each man hands in his bandage properly rolled.

Varieties.—Roller bandages are made of calico, flannelette, loose-woven material or crepe.

(i) Ordinary roller bandages are made of loose-woven material.
(ii) Flannelette bandages are used for warmth or sometimes because of their elasticity.
(iii) Muslin bandages are used with plaster of Paris.
(iv) Crepe bandages are used to support the circulation or to exercise pressure on a limb.

Rules for bandaging:—

(i) Fix the bandage with two or three turns.
(ii) Bandage from below upwards and from within outwards over the front of the limb.
(iii) Use uniform pressure throughout.
(iv) Let each succeeding turn overlap two-thirds of the preceding one.
(v) Keep all margins parallel and let the crossings and reverses be in one line and rather towards the outer aspect of the limb.
(vi) Secure the bandage with a safety-pin.

Application of bandages.—(i) The operator stands or sits opposite the patient.

(ii) The limb is placed in the position that it is to occupy when bandaged.

(iii) The bandage must not be put on so tightly as to cause discomfort, or swelling of the limb below. A bandage too tightly applied may, by cutting off blood supply, cause gangrene of a limb. Observe the toes or fingers of a bandaged

limb. If, after squeezing them, it is observed that the colour returns more slowly in them than in the unbandaged limb, it may be assumed that the bandage is too tight.

(iv) Take the roller in the right hand when bandaging left limbs, in the left hand when bandaging right limbs.

(v) The outer surface of the bandage is applied to the skin; not more than four inches of the bandage should be unrolled at a time :—

(*a*) *Simple spirals.*—From the wrist or ankle the bandage may be taken up the limb in simple spirals; that is, evenly put on turns of the bandage, each overlapping for two-thirds of the width of the bandage below, care being taken to have the lower edges of the turns of bandage parallel with each other (*see* Fig. 75).

(*b*) *Reverse spirals.*—When the swell of the limb is reached, the bandage will no longer lie evenly, and it therefore becomes necessary to use the reverse spiral.

To make the reverse, the thumb of the disengaged hand is placed on the lower border of the bandage on the outer side of the limb, the bandage is slackened and turned over, reversed downwards and passed round the limb to the opposite side, its lower edge parallel with that of the turn below. On reaching the outer side, the reverse is again made, and so on up to the joint. The angles formed by the successive reverses must be kept in a straight line (*see* Fig. 76).

(*c*) *Figure-of-*8.—On reaching the joint, neither the spiral nor reverse will lie evenly, so that the figure-of-8 has to be resorted to. This, as its name implies, is applied by passing the roller obliquely round, alternately upwards and downwards, the turns resembling the figure 8, each figure overlapping the one below by two-thirds of the width of the bandage. The crossings of the figures should be kept in the same line as the reverses below.

Removal of bandage.—Unroll from the top and gather the slack up into a ball, and pass from hand-to-hand round the limb.

Roller bandages for special regions. (i) *A finger.*—With the one-inch finger bandage, take two turns round the wrist, carry the bandage across the back of the hand to the root of the injured finger, up the finger by an open spiral to the top and by an evenly-laid close spiral back to the root;

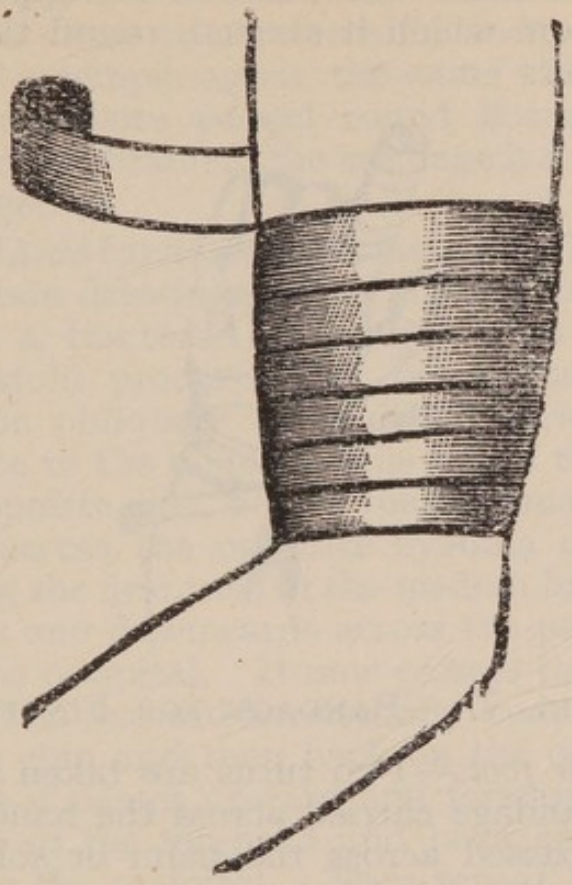


FIG. 75.—SIMPLE SPIRAL BANDAGE

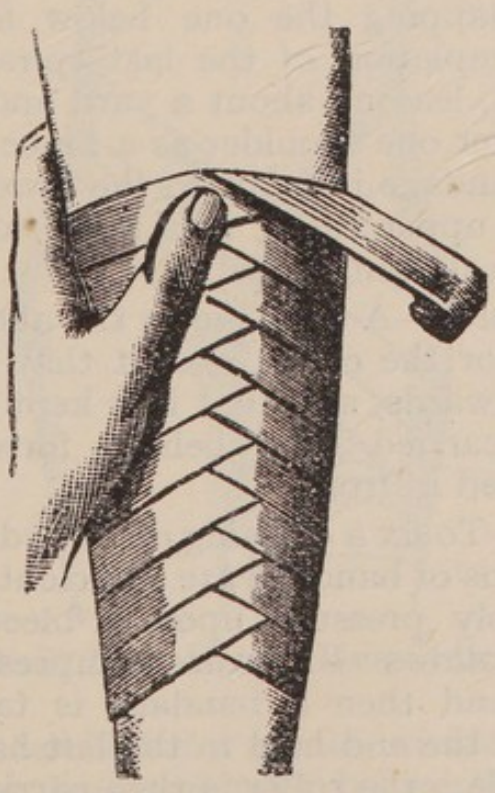


FIG. 76.—REVERSE SPIRAL BANDAGE

then across the back of the hand to the opposite side of the wrist to that from which it started, round the wrist once or twice, and pin off.



FIG. 77.—BANDAGE FOR FINGER

(ii) *A hand or foot.*—Two turns are taken round the wrist or ankle, the bandage carried across the hand or foot to the opposite side, passed across the palm or sole, and brought back to the opposite side of the wrist or ankle, over the back of the hand or foot, thus forming a figure-of-8, which may be repeated as often as required.

(iii) *The chest.*—A roller 6 inches wide and 6 yards long is used. It is applied from below upwards, in a single spiral, each spiral overlapping the one below for *one-half* of its breadth. On completion of the last spiral, the bandage is pinned off behind, leaving about a yard and a half free ; this end is brought over one shoulder as a brace, carried obliquely down over the bandage in front to the lowest turn, to which, as well as to the upper turns, it is fastened, thus preventing the bandage from slipping down.

(iv) *The abdomen.*—A bandage to the abdomen is similarly applied to that for the chest, except that it may be put on from above downwards, and that it is kept in position by the free end being carried from behind forward between the thighs and fastened in front.

(v) *The head.*—To fix a dressing on an ordinary head wound, a few circular turns of bandage are sufficient. It is sometimes necessary to apply pressure upon a bleeding point. This may be done as follows :—A gauze compress is applied to the bleeding point, and then a bandage is taken, unrolled for about a foot, and the end held in the left hand, which is kept close to the temple ; the roller is then carried round the forehead and occiput so that it comes back to the unrolled end

at the wound. At this point the roller is twisted round sharply and then carried down below the chin and over the vertex. On coming to the temple again, the same twist is made and the roller is once more passed round horizontally; when sufficient pressure is obtained, the bandage is fixed by knotting the two ends together.

(vi) *Universal head bandage.*—A 2-inch roller bandage applied as under will retain dressings on the scalp, face and lower jaw and immobilize a fractured jaw. Begin on the scalp just behind the mastoid process—pass below the occipital protuberance. Then obliquely upward and forward across the parietal eminence to the middle of the top of the head. Then down on the opposite side, across the zygoma and under the chin—then up across the opposite zygoma over the top of the head crossing the first turn at the median line of the vertex. Then backwards and downwards across the parietal eminence or below it to the occipital. It now crosses the starting point and holds it. Then forward horizontally under the ear, across the front of the chin and then back on the other side to the occipital. Then it passes upward and forward above the ear across the front of the forehead and back on the other side above the ear to the occipital. Then repeat layer over layer —the last turn should be about the forehead and the last jaw turn should be vertical.

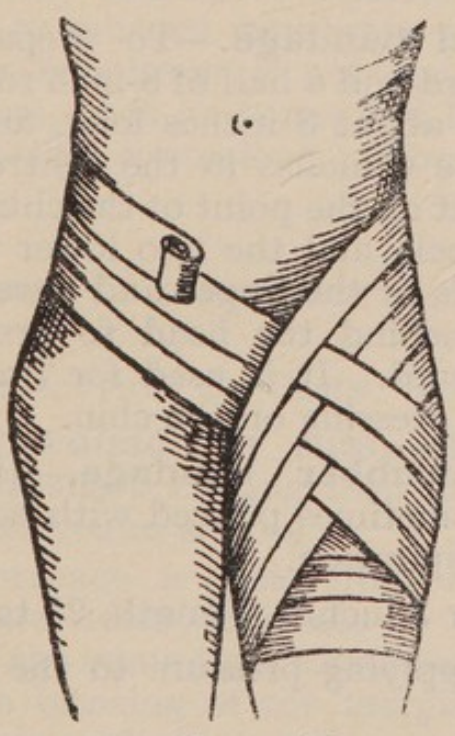


FIG. 78.—SPICA BANDAGE

(vii) *The spica bandage for groin, shoulder or thumb* (*see* Fig. 78).—A roller bandage may be applied to the groin, shoulder or thumb in the following manner, which is known

as the spica bandage. It is made by applying the bandage in a series of figure-of-8 turns, overlapping from below up Take two turns of a single-headed roller round the thigh from within outwards as a point of attachment; carry the bandage upwards over the groin above the hip, and round the back to the opposite hip, then across in front of the abdomen, passing round the other side of the thigh and upwards between the thighs to complete the figure-of-8. The turns should be repeated as often as necessary.

Special Bandages

589. The T-Bandage.—(i) Prepared by taking a piece of roller bandage 3 inches wide and 1½ yards long, and sewing to it at its middle another similar strip 1 yard long, so as to form a T.

The free end of the shorter portion of the T is split sufficiently to allow one-half to be brought up on each side of the scrotum.

(ii) Applied by placing the junction of the two pieces over the upper part of the sacrum behind and bringing forward the long ends and tying them off in front. The short piece is then passed between the thighs and its two ends fastened to the long piece in front. It is used to keep a dressing on the perinæum.

The four-tailed bandage.—To prepare the four-tailed bandage, take a yard and a half of 3-inch roller bandage, make a slit in its centre about 3 inches long, and then slit up the ends so as to leave 6 inches in the centre. In applying it, place the central slit on the point of the chin, tie the two upper tails behind the neck, and the two lower tails on the top of the head; the ends of the upper and lower tails should then be tied together behind the head to prevent the bandage from slipping forward. It is used for fracture of the lower jaw, or to retain a dressing on the chin.

Martin's indiarubber bandage.—(i) Made of pure indiarubber and sometimes pierced with holes to allow of the evaporation of perspiration.

(ii) Width, 2½ or 3 inches; length, 2½ to 7 yards.

(iii) Used for applying pressure to the limbs, usually the lower limb.

(iv) Applied as a rule in simple spirals.

Many-tailed bandage.—(i) For retaining dressings on the abdomen, chest or thigh, when it is desired to change dressings without moving the patient.

(ii) Made of lengths of flanellette, laid parallel with each other and overlapping to the extent of one-third of their width. When the required number of strips have been laid down, they are stitched together for a short distance near their centres, the ends being left free.

(iii) A many-tailed bandage should be long enough to go round the part to be bandaged, and one-quarter more.

(iv) In the application of the bandage to the chest and abdomen, the lowest ends should first be crossed over each other in front. The next lowest secure the first, the third the second and so on. The last should be fixed with a safety-pin.

(v) These bandages are supplied ready made.

CHAPTER XXV

WOUNDS AND THEIR TREATMENT

590. Definition.—A *wound* may be defined as the forcible solution of continuity of any of the tissues of the body, but the term is commonly limited to injuries of the soft parts, involving the skin or mucous membrane. Injuries in which the skin or mucous membrane is not divided, and in which the deeper structures, such as bones and ligaments, etc., are not involved, are called contusions. Wounds may therefore be classified into :—

(i) Open.
(ii) Subcutaneous, *i.e.* contusions.

Classification of Open Wounds

591. (i) **Incised wounds or cuts.**—An incised wound is one made by any sharp cutting instrument. The *special features* of an incised wound are :—

(*a*) The hæmorrhage is free, from the fact that the vessels are cleanly divided.
(*b*) The lips of the wound are separated.
(*c*) There is no bruising of the margins of the incision, so that in ordinary circumstances rapid healing occurs.

The *chief dangers* of an incised wound are (*a*) hæmorrhage; (*b*) injuries to the deeper structures; (*c*) the risk of infection by germs.

(ii) **Lacerated or contused wounds.**—These injuries are caused by blunt instruments, by machinery, the wheels of a vehicle, etc. The signs are :—

(*a*) *Hæmorrhage*, as a rule slight, since the vessels are torn irregularly and not cut cleanly.

(*b*) The amount of *damage* varies with the type of injury and may vary from tearing of muscles, tendons and nerves to severe injury and even rupture of internal organs.

They do not heal so rapidly as incised wounds, and as they are usually infected, steps must be taken to clean and sterilize them thoroughly.

(iii) **Punctured wounds and stabs.**—These may be produced by any form of penetrating weapon, from a needle or hatpin to a sword or bayonet.

The wound is deep and narrow. The skin wound may in itself be insignificant, the chief dangers being (*a*) the possibility of injury to the deeper structures ; blood-vessels and nerves may be divided, or the abdominal or thoracic contents injured ; (*b*) the liability to septic poisoning (*see* Poisoned wounds). Punctured wounds do not usually bleed much externally, but may give rise to serious internal hæmorrhage. When, however, no serious damage is done to the deeper parts and the instrument inflicting the injury is fairly clean, they frequently heal without trouble.

(iv) **Gunshot wounds.**—These include all varieties of injury caused by shells, rifle bullets, bombs and grenades and give rise to lacerated, punctured or contused wounds.

(*a*) *Small-bore bullet wounds.*—If the bullet has not struck anything before inflicting the wound, it usually causes a clean wound of the punctured variety. Accordingly, two skin wounds will usually be observed, one where the bullet entered (called the wound of entry) and a second where the bullet left the body (called the wound of exit). Occasionally the bullet comes to rest in the body, in which case only the wound of entry will be seen. It sometimes happens that adjacent portions of the body, such as the arm and chest or both thighs, may be pierced by one bullet, in which case, three, four or more skin wounds may be seen. The wound of entry is usually circular, slightly smaller than the bullet in diameter, and the edges of the skin may be slightly inverted or tucked in. The wound of exit may be very similar to the wound of entry but is usually larger with the skin edges slightly turned outwards. Sometimes, however, it may be very large and irregular in shape, with portions of destroyed tissue protruding from it, and large portions of skin blown away.

Injuries to the tissues occur in the track of the bullet between the wound of entry and the wound of exit.

The bullet track (taking into consideration the position of the body when struck) is usually a straight line from entry to exit, so that in order to ascertain accurately the parts injured and the course of the bullet, the patient should, if possible, be placed in the position in which he was when struck.

A bullet may strike some hard body before entering the patient, and become altered in shape. The resulting wound may then be lacerated as well as punctured. Or a bullet may strike the body superficially, causing a grooved wound with loss of tissue instead of a punctured wound.

(*b*) *Shell wounds.*—Shell wounds and those caused by bombs and grenades are much more variable in character. The small fragments of a high explosive shell may cause ordinary punctured wounds. On the other hand large irregular slow moving shell fragments cause severe lacerated and contused wounds, and may even carry off an entire limb. The peculiarities of shell wounds, besides their severity, are that :—

(i) fragments usually lodge in the body ;
(ii) they often carry pieces of clothing into the wound with them ;
(iii) they are nearly always septic.

592. Poisoned wounds.—Any wound, if exposed to infection by germs, may not only discharge pus, fail to heal, and tend to increase in size, but may produce severe constitutional symptoms, such as fever, etc. By their growth in wounds germs produce poisonous substances which are absorbed into the blood, and may cause blood poisoning and death. It is of the greatest importance, therefore, to keep wounds aseptic or germ-free.

Poisoned wounds may also result from the bites of insects.

593. Treatment of wounds.—(i) *The arrest of hæmorrhage.*—General oozing may be controlled by a pad and bandage but arteries and veins will require to be ligatured.

(ii) *Sterilization* of the wound and its surroundings.

(iii) *The bringing together of the cut surfaces.*—In slight cases this may be accomplished by properly applied bandages, though in severer injuries sutures may be required.

(iv) *Drainage* is only required in the more serious cases where there is general oozing from the deeper parts.

(v) *Infection* must be guarded against by the use of some form of antiseptic or aseptic dressing.

(vi) *Rest,* to allow the parts to unite.

(vii) *Attention to the general health.*

CHAPTER XXVI

ANTISEPSIS AND ASEPSIS

594. Germs.—Germs or bacteria are minute organisms of the lowest form of vegetable life, so small as only to be visible under a powerful microscope, which multiply by a process of division and reach maturity so rapidly that a wound which has been infected by one or two bacteria may in a few hours contain many millions, resulting in suppuration or sepsis.

Conditions of life.—(i) All bacteria require moisture and a suitable temperature, the majority growing best at the body temperature. Light is injurious to their growth, but many require air.

(ii) In their growth they give off *toxins* or poisons which give rise to the symptoms of *fever*. They are killed by being subjected to high temperature or the action of certain chemicals known as antiseptics, *e.g.* carbolic acid, perchloride and biniodide of mercury (*see* para. **596**).

Distribution.—Bacteria are very widely distributed in the air, being attached to particles of dirt and dust, and in water. Vast numbers exist in earth, more especially those causing tetanus and gas gangrene. The human skin (like anything else exposed to dust and dirt) teems with bacteria, as also does the intestine, the mouth, the nose and the external ear.

To prevent the introduction of these germs into a wound where there would be the heat and moisture necessary for their growth and where they would multiply very rapidly, the greatest precautions must be taken to ensure that everything used during an operation and during the dressing of wounds is completely free from living germs.

Antisepsis

595. General principles.—The antiseptic method of treating wounds is the result of our knowledge that all suppuration is caused by germs; its object is the prevention of bacterial development, or their destruction in wounds by the use of agents known as antiseptics which either destroy or prevent the growth of these bacteria. There are both liquid

and solid antiseptics, most of which are dangerous poisons. For dressing wounds and cleansing the hands, etc., they are commonly employed in the form of "lotions," made by dissolving in a suitable medium some of the substance selected. The strength of the lotion is always known, for instance, 1 in 20, 1 in 40, 1 in 1,000, which means that 1 part of the antiseptic is contained in 20, 40 or 1,000 parts of the lotion.

596. The following are the antiseptics most commonly employed :—

(i) *Acriflavine.*—This is one of the most valuable antiseptics, as it destroys germs in a wound without producing any injurious effects on the tissues and has, with eusol, almost entirely replaced carbolic acid lotions and solutions of perchloride of mercury for wound treatment. It is usually used in a strength of 1 in 1,000. A solution in sterile liquid paraffin is used as a first-aid dressing for burns, when tannic acid is not available.

(ii) *Boric or boracic acid.*—This is generally seen as colourless crystals or white powder. It is a mild and weak antiseptic, mostly employed in saturated solution or powder when stronger remedies might prove harmful. It is most commonly employed for the eye and as a mouth wash or for washing out the bladder.

(iii) *Carbolic acid.*—This is now very rarely used for application to the skin or for treatment of a wound, but is valuable for disinfecting purposes and is sometimes used for the sterilization of instruments.

(iv) *Eusol.*—This is a solution of hypochlorous acid in water and has a sweet, pungent odour. It is used extensively in the treatment of septic wounds. It is best used cold. Instruments must not be placed in this solution or they will tarnish.

(v) *Iodine.*—This is a most valuable antiseptic and is largely employed in alcoholic solutions varying from 2 to 5 per cent. (1 in 50 to 1 in 20) to sterilize the skin before operations. If it is to be effective, the skin must be freed from moisture or grease and, therefore, in emergency cases should previously be washed over with ether.

In weaker solutions, 1 drachm of weak solution of iodine to the pint, is used for irrigating suppurating cavities, or as a bath in which to immerse inflamed parts.

(vi) *Iodoform.*—This is a yellow powder of characteristic and unpleasant odour and is mainly used in foul or tuberculous wounds.

It is much employed in the form of bismuth, iodoform and paraffin paste (B.I.P.P.), which consists of bismuth subnitrate (1 part), iodoform (2 parts) and liquid paraffin (1 part), and has proved a valuable application to infected war wounds.

(vii) *Lysol.*—This is a tar derivative containing 50 per cent. cresol. It is an amber or reddish-brown coloured liquid, soapy to the touch, with a tar-like odour.

Instruments which have been previously sterilized may be placed in a 1 in 100 solution. It is now very rarely used for application to the skin or wounds, and then only in a very dilute solution.

(viii) *Perchloride and biniodide of mercury.*—Solutions of these are employed by many surgeons for disinfecting the hands before operating. The usual strength is 1 in 1,000.

(ix) *Permanganate of potash.*—This occurs as dark purple crystals and is used in solutions of varying strength, mainly for the disinfection of wounds or cavities already infected.

(x) *Peroxide of hydrogen.*—This is a colourless fluid, odourless and with a slightly acid taste used for disinfecting infected cavities. It contains 10 or 20 times its volume of free oxygen (known as 10 or 20 volume strength).

(xi) *Picric acid.*—A solution of this in spirit is a valuable solution employed for sterilizing the skin before operation.

In a one per cent. watery solution it is also a useful dressing for burns.

597. Antiseptic baths and fomentations.—When a wound has become infected with germs and is inflamed and suppurating, it is usual to treat it with antiseptic baths or antiseptic fomentations. Boric acid, a solution of iodine or eusol is the usual antiseptic in such cases, the limb or other part being suspended in one of these solutions in a specially constructed bath.

Boric acid is used for this purpose in a strength of five grains to one ounce of water and iodine in a strength of one drachm of weak solution of iodine to one pint of water.

An antiseptic fomentation is made in exactly the same way

as any other fomentation, except that several folds of lint are used instead of the ordinary fomentation-flannel.

A saturated solution of magnesium sulphate—commonly known as Epsom salts—is very effective as a warm compress to septic wounds.

Asepsis

598. Aseptic treatment.—Means the prevention of sepsis in a clean wound, such as an operation wound, by means other than the application of antiseptics. The principle of aseptic treatment is that everything brought into contact with a wound should previously have been freed from germs by one of the methods of sterilization. Sterilization is fully dealt with in Chapter L (*see* also Chapter XXVII).

CHAPTER XXVII

DRESSING AND HEALING OF WOUNDS

599. General remarks.—In the dressing of wounds, absolute cleanliness, by which is meant *surgical cleanliness*, is imperative. This means more than just washing the hands in soap and water; it means prolonged scrubbing with a sterilized nailbrush and ether soap, followed by the application of a suitable antiseptic solution. The hands, being carriers of germs, may easily infect a clean wound. A dresser should, therefore, take the greatest possible care of his hands, especially the nails and the folds of skin surrounding them (*see* Chapter L).

600. Rules to be followed in applying dressings.—(i) Never begin changing a dressing until everything likely to be required for the new dressing is in readiness.

(ii) Arrange the bed-clothes so that no part of them can touch the wound area, and protect the bed-clothes from being soiled by means of jaconet or waterproof sheeting.

(iii) Remove the bandages, but do not touch the actual dressing.

(iv) Next scrub your hands most thoroughly with soap and a stiff nailbrush which has, after boiling, been soaked in antiseptic solution.

(v) Rinse the soap off your hands without drying and soak them for some minutes in antiseptic solution. From now

onwards until the dressing is completed, take care that your hands come in contact with nothing that has not been sterilized.

(vi) Never handle old dressings after the hands have been rendered aseptic, but use a pair of sterilized forceps.

(vii) Now shut off the wound area with sterilized towels suitable arranged.

(viii) Remove the old dressing, having first loosened it, if necessary, with warm antiseptic solution, protect the wound with a swab, then clean the surrounding skin, wiping from the wound outwards to avoid carrying germs from the surrounding skin into the wound.

(ix) Place the fresh sterilized dressing gently in position with sterilized forceps and apply a bandage.

(x) Before dressing any wound or assisting at an operation which is infected, it is advisable to protect any cuts or scratches on your own hands by covering them with a couple of layers of gauze and painting that over with collodion, to make a waterproof coating. Sterilized rubber gloves should be worn.

(xi) If the necessary means of purifying the wound are not at hand, do not attempt to clean it up ; simply apply a dry, antiseptic dressing.

(xii) Destroy all old dressings, preferably by burning.

601. Order in which dressings should be done.—If a dresser has in his wards various kinds of wounds, some that are clean, such as operation wounds, and others that are suppurating, the clean, aseptic wounds should be first attended to, and only after all these have been dealt with should the dressing of suppurating wounds be carried out. Any other course will lead to infection of the clean wounds from the dirty ones.

An aseptic wound must be kept aseptic by exercising the strictest cleanliness, and a septic wound may, by antiseptic measures, be brought into a healthier condition. These two points should be the aim of every dresser.

The hands must be thoroughly cleansed between each dressing ; if this is not done, one wound may be infected from another, of the dresser may infect his own hands through small scratches or abrasions.

602. Healing of wounds.—The method of healing of wounds is as follows :—

(i) The margins of the wound are inflamed.

(ii) The ends of the divided vessels are blocked by blood clots.

(iii) The surface of the wound is bathed in lymph or blood clot.

(iv) There is an exudation of leucocytes, whose function is to remove all dead or damaged tissue and to break up and remove blood clots. Leucocytes are the scavengers of the blood. After their work is complete, they either die or find their way into the circulation.

(v) The fluid part of the blood continues to ooze out, finally becomes jelly-like and sets, glueing the edges of the wound together, a little of the fluid part of the blood which escapes forming a scab or crust on the surface. In a clean wound at no time is there any discharge beyond a small quantity of blood-stained serum in the first twenty-four hours.

(vi) New blood-vessels gradually make their way from side to side of the wound, and the circulation is thus restored; new tissue is produced and firmly unites the cut surfaces. At the end of ten days or a fortnight, the wound has completely healed, a thin red scar being all that remains of it. This is what happens in a cut when the surfaces of the wound are close to one another, and is called "healing by first intention."

When the wound is large and the raw surfaces cannot touch one another, small, red, rounded projections, called granulations, grow from the bottom and sides of the wound until it is filled up, and a new skin is gradually formed over them. In the end a scar forms, which, when the wound is quite healed, is slightly drawn in; this is called "healing by granulation." Wounds which heal by granulation are much more difficult to keep free from infection than those which heal by first intention.

The main object in the dressing of a wound is to protect it from the entry of germs. These not only prevent healing, but lead to the formation of pus, and sometimes to blood-poisoning. A wound into which these germs have entered is called a *septic wound*, and the treatment which is directed against these germs is called *antiseptic treatment*. A wound free from germs is called an *aseptic wound*.

CHAPTER XXVIII

THE FIRST FIELD DRESSING

603. A field dressing forms a part of every British soldier's kit on active service and is therefore available at all times and in all places as a first dressing for wounds. When officers and men proceed on active service, the first field dressing will be carried in the inside pocket of the skirt of the frock on the right side, and should never be carried in the trouser pocket.

604. The first field dressing, pattern 1928, consists of an outer packet of khaki cotton cloth containing two dressings each complete in itself. Each dressing consists of :—

(i) A loose-woven khaki bandage 2½ yards long by 2½ inches wide.

(ii) A piece of bleached cotton gauze 36 inches by 23 inches which has been impregnated with acriflavine to the extent of 0·1 per cent. This is folded into a pad 4 inches by 3⅛ inches and stitched to the bandage 18 inches from one end.

(iii) One safety-pin wrapped in wax paper and loosely stitched to the inner cover.

First, the gauze is folded into a pad and stitched to the bandage as detailed above. It is then folded once on itself so as to reduce its size by one half and so that the bandage lies outside the folded pad.

The short end of the bandage is folded into pleats and the long end loosely rolled on itself up to a point 18 inches from the pad and secured by a tight stitch to prevent unrolling. The stitch is easily broken without tearing the bandage.

The remaining 18 inches of bandage between the roll and gauze pad is folded into pleats.

The gauze pad and bandage are enclosed in a parchment paper with the ends left open and sterilized by steam for 30 minutes at a temperature of 265° F.

After sterilization, the parchment paper is closed aseptically at the ends before being enclosed in the inner waterproof cover. This inner cover, which is of jaconet, is efficiently sealed so as to render the package air tight. At one corner, indicated by an arrow, the fabric is turned inwards to facilitate opening.

It will be seen that the first field dressing is a sterile dressing which is impregnated with an antiseptic to diminish the liability of contamination by germs.

605. Printed directions.

(i) *On outer cover.*

FIRST FIELD DRESSING

To open { *Outer cover.*—Break the thread holding the flap. *Inner waterproof cover.*—Tear apart at the uncemented corner where indicated by the arrow.

Contents { Two dressings in waterproof covers, each consisting of a gauze pad stitched to a bandage, and a safety-pin.

Directions for use.—Take the folded ends of the bandage in each hand, and keeping the bandage taut, apply the gauze pad to the wound and fix the bandage. One dressing to be used for each wound.

DO NOT HANDLE THE GAUZE OR WOUND.

(ii) *On inner covers.*

FIRST FIELD DRESSING

Tear apart the uncemented corner, as indicated by the arrow, and remove the paper. Take the folded ends of the bandage in each hand and, keeping the bandage taut, apply the gauze pad to the wound and fix the bandage.

DO NOT HANDLE THE GAUZE OR WOUND

606. How to apply a first field dressing.—In applying a first field dressing attention should be paid to the following points :—(i) Expose the wound by carefully cutting open the clothing ; (ii) never wipe the wound or attempt to clean it on the field ; (iii) open the packet, taking care not to drop the contents on the ground and not to handle the gauze that will touch the wound ; (iv) apply the dressing as directed on the covers, putting the gauze directly on to the wound. The first field dressing should be applied as soon as possible after the infliction of the injury and the injured part placed at rest on a splint if necessary. In carrying this out, the wound, being handled as little as possible, should first be exposed. The dressing is then removed from its outer cover, every precaution being taken to prevent it from becoming contaminated by the soil on the hands, and immediately applied and bandaged with an even, firm pressure ; this pressure helps to control bleeding and also prevents infection

from getting into the wound from the surrounding skin or outside air.

The patient is then removed to a place of safety until he can be got back to the advanced dressing station or casualty clearing station. As almost all gunshot wounds are infected with germs, the patient must be seen by the surgeon as soon as possible after the receipt of the injury.

607. Shell dressing.—This is a large form of first field dressing for extensive wounds. It is not carried by the individual soldier but haversacks are supplied each containing 12 shell dressings.

Each packet measures 6 inches by 4 inches and contains a pad consisting of three layers, namely, unbleached wool, absorbent wool and gauze.

A bandage 3 yards long and 4 inches wide is stitched to the unbleached side of the pad 24 inches from one end. A safety-pin is enclosed in waxed paper.

The pad is folded once on itself so that the bandage lies outside and is enclosed in three layers in a similar way to the first field dressing by parchment paper, a jaconet covering and an outer cover of khaki cotton cloth.

The shell dressing is treated in the same way as the first field dressing by being impregnated with neutral acriflavine and then enclosed in the parchment paper. The ends of the paper are left open and the dressing sterilized by high pressure steam. The paper is then closed aseptically, and the water-proof covering of jaconet applied and sealed.

Directions for its use, which are on similar lines to those for the first field dressing, are printed on the outer khaki cotton cloth.

CHAPTER XXIX

BLEEDING OR HÆMORRHAGE

608. By the term hæmorrhage is meant any escape of blood from the vessels, whether slight and immediately arrested by natural means or more severe and requiring treatment to prevent its continuance.

609. Varieties of hæmorrhage.—The character of the bleeding differs according to the vessel from which the blood escapes.

(i) *Arterial hæmorrhage* consists of a flow of bright red blood which escapes in jets to correspond with the heart's beats. If, however, it comes from a deep artery, the blood may well up instead of escaping in gushes. Arterial hæmorrhage may be controlled by applying pressure between the bleeding vessel and the heart.

(ii) In *venous hæmorrhage* the flow is usually continuous and the blood of a dark red or almost black colour. To control the hæmorrhage, pressure must be applied on the side of the wound away from the heart.

(iii) *Capillary hæmorrhage* is marked by general oozing from a raw surface.

610. Hæmorrhage may be either (i) external or (ii) internal.

(i) **External hæmorrhage** may be :—

(*a*) Primary, occurring at the time the vessel is injured.
(*b*) Reactionary, *i.e.* bleeding which recurs within 24 hours of an accident or injury.
(*c*) Secondary, occurring any time after 24 hours have lapsed, following a wound or operation, but seldom before ten days or a fortnight. Its chief cause is septic infection, which breaks down the blood clot closing the end of the wounded vessel, or a vessel itself may be opened up by the action of the suppuration.

(ii) **Internal or concealed hæmorrhage,** as its name implies, is bleeding from a vessel or vessels into the tissues (extravasation), or into one of the cavities of the body, *e.g.* chest, abdomen, stomach, skull, etc. As in external hæmorrhage, it may be primary, reactionary or secondary. Internal hæmorrhage occurs as the result of injury or disease, and can only be recognized by the signs and symptoms presented by the sufferer, as no blood is visible as in the case of external hæmorrhage, except in extravasation (*q.v.*).

If the bleeding continues and a large quantity of blood escapes from the vessels, the following symptoms appear :—

(*a*) Great prostration and weakness.
(*b*) The surface of the body cold and blanched.
(*c*) The lips ashy-grey and face drawn and shrunken.
(*d*) The forehead covered with a cold clammy sweat.
(*e*) Great thirst.
(*f*) The breathing shallow, hurried and laboured ; sometimes yawning and sighing.
(*g*) The pulse weak and even imperceptible ; subnormal temperature.

(*h*) Great restlessness; patients gasping and struggling for air and showing great anxiety.
(*i*) Noises in the ears.
(*j*) Blurring of vision, with dilated pupils.
(*k*) Giddiness on sitting or standing.
(*l*) Gradual increase of weakness and final unconsciousness.

Treatment.

(*a*) At once send for a M.O.
(*b*) Ascertain if possible the cause of the bleeding, apply ice locally and give small pieces of ice to suck.
(*c*) Loosen the clothing round the neck, chest and abdomen.
(*d*) Raise the foot of the bed three or four inches from the ground.
(*e*) *On no account give stimulants.*
(*f*) Apply hot-water bottles to the feet.
(*g*) Bandage the limbs from toes to thighs and from fingers to shoulders.
(*h*) Keep the patient *absolutely quiet,* avoiding all conversation.
(*i*) Restrain him if restless and try to allay his anxiety.

Extravasation.—This is generally seen in the form of a bruise or black eye, etc. The treatment consists simply of rest and the application of soothing lotions.

611. Arrest of external hæmorrhage.—The arrest of external hæmorrhage is of great importance, especially on the field of battle, for, although bleeding has often ceased from the wound by the time the wounded man reaches a M.O., a severe initial loss of blood may occur rapidly and render the man more liable to serious shock, and make necessary life-saving operations impossible when he reaches the C.C.S. Apart from arterial and venous bleeding, the slow steady oozing of blood from a large wound may have very serious effect on the patient.

(i) *Natural arrest.*—When a vessel is wounded, bleeding may be arrested by contraction of the vessel or by the clotting of the blood.

(ii) *Artificial arrest.*—The means of temporarily arresting external hæmorrhage until more permanent means can be resorted to by the surgeon are :—

(*a*) Pressure.
(*b*) Application of heat or cold.
(*c*) Position of the patient.

Chemical agents are used to control hæmorrhage from the nose and mouth after the extraction of teeth or following an injury, but should only be used by the M.O. The drugs generally used are adrenalin, liquor ferri perchloridi, tannic acid, permanganate of potash and alum. Other methods of permanently arresting hæmorrhage, such as tying the vessels, can also only be carried out by the M.O.

(*a*) *Pressure.*—If the bleeding point is within reach, hæmorrhage need cause no alarm, as pressure will control it, however big the vessel may be. It can be applied:—

(i) Directly on the bleeding point, by means of the finger or thumb (digital compression); but preferably by plugging the wound with a piece of antiseptic gauze.

On the field of battle, the first field dressing should rapidly be placed over the wound and digital pressure applied over the dressing, but in very serious bleeding it is permissible to apply the fingers direct until the first field dressing is ready.

(ii) Close to the wound, between the wound and the heart, if the bleeding is from an artery, or below the wound, that is, on the side away from the heart, if from a vein.

Pressure is best applied by the fingers and, where possible, should be made in such a direction as to press the vessel against a bone. It is only in the rare instances when this does not succeed that recourse should be had to the *tourniquet*, which is always a painful and dangerous instrument if applied too tightly or left on for more than a brief period. Further, the danger of serious infection of a wound is much greater when it has been deprived of its blood supply.

(iii) In bleeding below the knee or elbow, by placing a pad in the bend of the joint and flexing the limb.

(*b*) *Heat and cold.*—The application of heat and cold will only control bleeding from the smaller vessels which are situated superficially, and is at times useful at operations, but it is not normally practicable when wounds are treated on the field of battle.

Of the two, heat is the more effective, but neither is as certain as pressure properly applied. Heat may be applied by means of hot water at a temperature of from 140° to 160° F.,

that is to say, rather hotter than the hand can comfortably bear. Warm water is worse than useless, as it tends to increase, rather than diminish, the bleeding. Cold is not so effectual as heat, and is liable to increase shock. It should be applied in the form of ice.

(*c*) *Position of the patient.*—This is often of great importance. Absolute rest is essential. Lay the patient down and keep him as quiet as possible and allay his anxiety. While keeping the patient lying perfectly still, when the bleeding is from a limb, raise it and keep it elevated. As a rule, in the case of a limb, pressure combined with elevation will always check the bleeding until steps can be carried out for permanently arresting it.

612. Compression by tourniquet.—Compression by means of a tourniquet is only applicable in the case of the arteries of the limbs where the pad takes the place of the thumb and finger described in digital compression.

On active service, whenever a tourniquet is applied, a note to this effect must be made on the patient's field medical card (A.F. W 3118).

Tourniquet.—The only tourniquet in use in the army at the present time is the Samway Anchor pattern. It is easy to apply and has none of the grave disadvantages of the improvised tourniquet or of the screw tourniquet. All that is necessary is to pass the rubber tube twice around the limb above the bleeding point, exerting sufficient pressure to control the hæmorrhage, and to fix with the anchor clasp.

This must only be used when other methods fail to stop the hæmorrhage. The bleeding should be controlled by direct pressure on the bleeding point until the tourniquet is ready. The tourniquet should be applied over a thick pad of wool, if available, or over the sleeve of the coat or leg of the trousers, to avoid damage to the skin. It should not be applied more tightly than is necessary to stop the bleeding.

Improvised tourniquet.—The method of applying is as follows :—

(i) Apply a small firm pad over the line of the bleeding vessel on the heart side of the wound.

(ii) Encircle the limb by a broad bandage, or a puttee, or a rifle sling (narrow cords and tape should be avoided), which should be kept flat, with no kinks, or it may cause damage. A pad is placed over the wound and the ends of the bandage tied in a half knot on the side opposite the pad.

It is well, if possible, to apply a short padded splint on the side of the limb opposite the wound and to apply the improvised tourniquet over this so as to avoid circular constriction of the limb when the tourniquet is tightened by twisting.

(iii) Lay a short stick, pencil or similar object on the half knot and over it tie a reef knot.

(iv) Twist the stick to tighten the bandage, thereby causing the pad to press upon the artery and thus arrest the flow of blood.

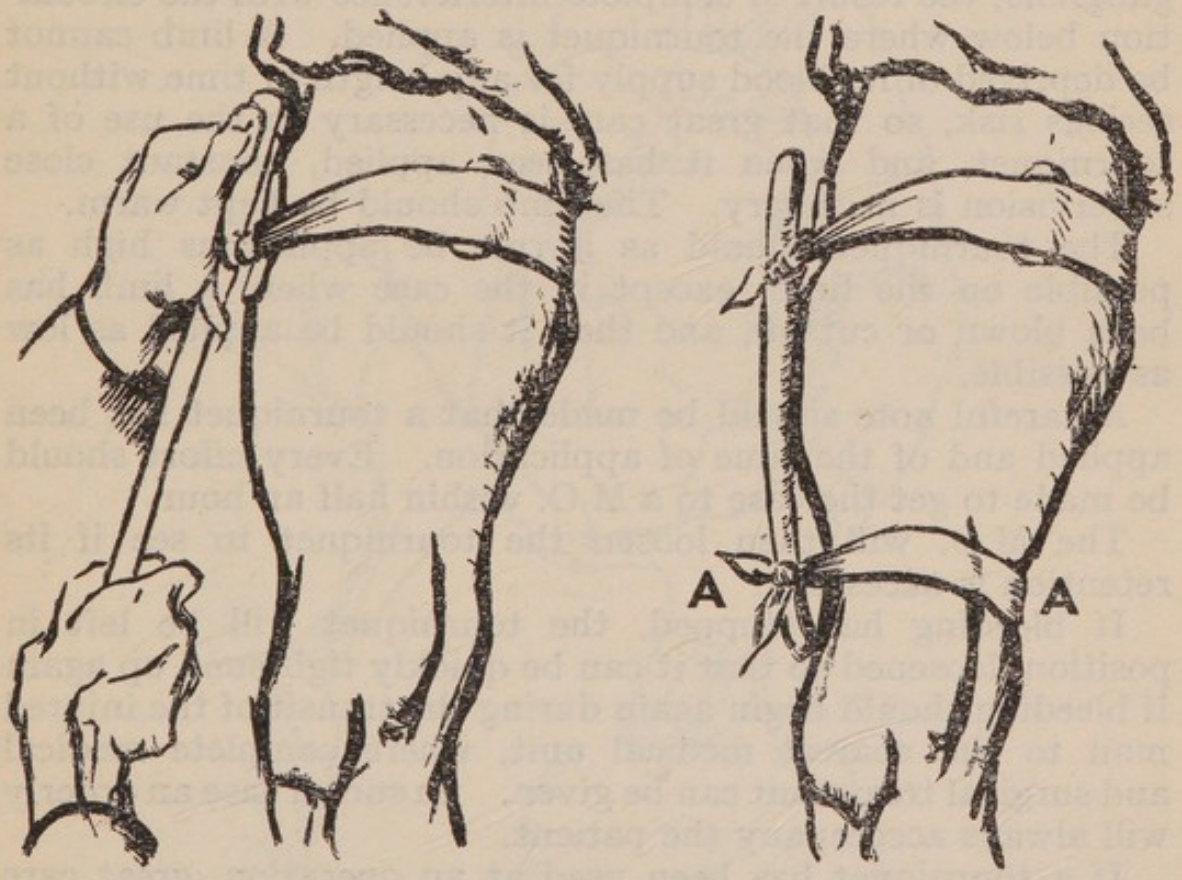


FIG. 79.—1. IMPROVISED TOURNIQUET FOR COMPRESSION OF THE FEMORAL ARTERY.
2. THE SAME TOURNIQUET FIXED BY A BANDAGE AT "A."

Twisting should be stopped directly bleeding is controlled.

(v) Lock the stick in position by the ends of the bandage already applied, or by another bandage passed round the stick and limb.

Note.—The pad for an improvised tourniquet is easily made by tying a knot in the centre of a handkerchief or triangular bandage, using a piece of pagri or cloth or, in fact, any soft substance that can be compressed into a small uniform mass.

613. Caution in use of tourniquets.—Digital compression or compression through a pad of antiseptic material is greatly to be preferred to compression by tourniquets, and will usually be all that is required. As it is a mechanical contrivance, it is very difficult to estimate the amount of pressure exerted by a tourniquet, and it is a good rule only to exert *sufficient pressure to check the hæmorrhage.* If great care is not taken, serious injury to other structures lying close to the artery (such as nerves and veins) may be done and may easily lead to the death of the limb, from mortification or gangrene, the result of complete interference with the circulation below where the tourniquet is applied. A limb cannot be deprived of its blood supply for any length of time without serious risk, so that great care is necessary in the use of a tourniquet, and when it has been applied, constant close supervision is necessary. The limb should be kept warm.

The tourniquet should as a rule be applied as high as possible on the limb, except in the case where a limb has been blown or cut off, and then it should be applied as low as possible.

A careful note should be made that a tourniquet has been applied and of the time of application. Every effort should be made to get the case to a M.O. within half an hour.

The M.O. will then loosen the tourniquet to see if its retention is necessary.

If bleeding has stopped, the tourniquet will be left in position, loosened so that it can be quickly tightened up again if bleeding should begin again during the transit of the injured man to the nearest medical unit, where complete medical and surgical treatment can be given. In such a case an orderly will always accompany the patient.

If a tourniquet has been used at an operation, great care will be exercised that it is removed at the end of the operation when no longer required. Serious results have followed the leaving of such a tourniquet in position when the patient is returned to bed.

614. Arrest of hæmorrhage in special situations by digital compression. (i) *Abdominal aorta.*—The abdominal aorta may be compressed by flexing the thighs on the abdomen, and pressing backwards against the vertebræ at the level of the navel, but slightly to its left.

(ii) *The common and external carotid artery.*—The common carotid (and the external carotid, which is a continuation of the former) lies on the side of the neck under the anterior border of the muscle running from behind the ear to the middle of the breast-bone, and may be compressed against

the spine by the thumb in a direction backwards and inwards anywhere along that line.

(iii) *Subclavian artery.*—The subclavian artery may be compressed at the base of the neck opposite the centre of the collar-bone. By drawing forward the shoulder, the artery will more easily be reached by the thumb pressing downwards



FIG. 80.—DIGITAL COMPRESSION OF THE SUB-CLAVIAN ARTERY AGAINST THE FIRST RIB

against the first rib behind the clavicle. Compression can also be effected with the handle of a key or similar article, wrapped in soft cloth, in the same position as with the fingers. (Fig. 80.)

(iv) *Axillary artery.*—To compress the axillary artery, raise the arm, place the fingers in the arm-pit and press upwards against the head of the humerus.

The vessels of the upper and lower limbs are those to which tourniquets and digital compression can best be applied.

(v) *Brachial artery.*—The brachial artery may be compressed with the fingers against the inner side of the middle of the humerus.

The inner margin of the biceps may be taken as a rough guide to the course of the artery.

Almost fully extend the arm at right angles to the body, pronating the forearm. Then standing on the outside of the limb, grasp the arm about its middle with the fingers under the edge of the biceps muscle, palm of the hand uppermost and thumb on the outer side of the limb (*see* Fig. 81). The artery is then compressed against the bone with sufficient pressure to arrest the hæmorrhage. In the practice of digital compression the absence of the pulse at the wrist indicates

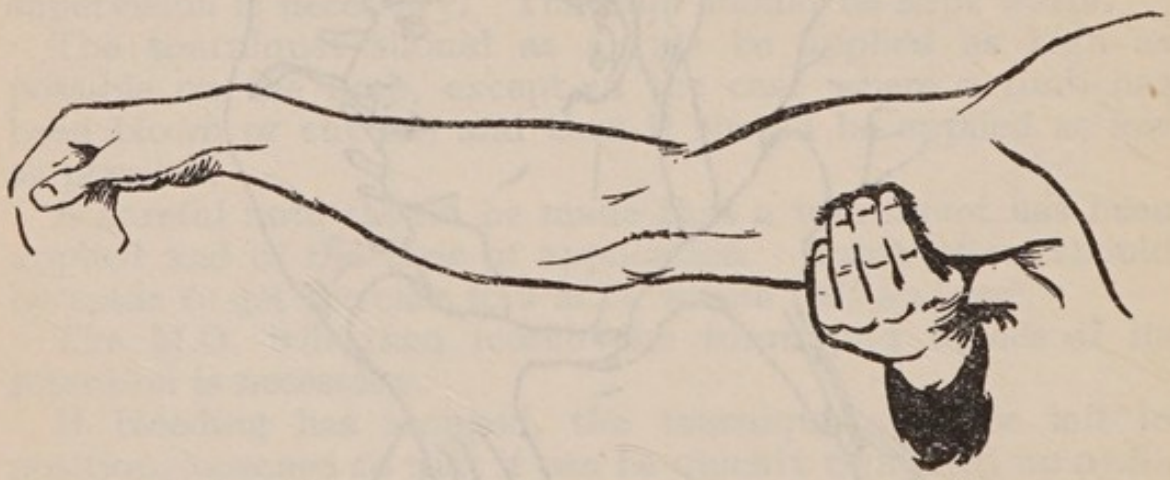


FIG. 81.—DIGITAL COMPRESSION OF THE BRACHIAL ARTERY AGAINST THE HUMERUS

that pressure is being properly applied. This artery can also be compressed by both thumbs, as in the case of the femoral artery (Fig. 82).

(vi) *Radial and ulnar arteries.*—Hæmorrhage from these vessels may be checked either by pressure on the bracial artery above or by the flexion-method, by placing a pad in the bend of the elbow, strongly flexing the forearm and keeping it in position by a bandage passed round the wrist and arm. The limb is then bandaged to the side of the chest.

(vii) *Palmar arch* or wound of the palm of the hand. The bleeding may be arrested as in the case of the radial and ulnar arteries. Or a thick pad composed of two clean rolled handkerchiefs may be applied to the wound, the patient's fingers closed over the pad, so as to grasp it firmly, and a bandage (narrow-fold triangular) applied over the clenched hand and the pad firmly pressed upon the wound.

(viii) *Femoral artery.*—The femoral artery runs from the centre of the groin down the inner side of the thigh to the centre of the back of the knee-joint. The artery may be compressed :—

(*a*) against the hip-bone, by pressing at the fold of the groin ; or

(*b*) against the upper end of the thigh-bone, by pressing backwards and outwards on the line of the artery, some four fingers' breadth below the fold of the groin (Fig. 82).



FIG. 82.—DIGITAL COMPRESSION OF THE FEMORAL ARTERY AGAINST THE FEMUR

(ix) *Arteries of leg and foot.*—Direct pressure on the bleeding point, or in the course of the artery above the wound, should first be tried. If unsuccessful, compress the femoral artery as above described or flex the knee on a pad.

(x) *Temporal artery.*—The temporal artery may be felt pulsating in front of the upper part of the ear and bleeding

may be arrested by pressure exerted along the course of the vessel at this point.

(xi) *Scalp.*—Hæmorrhage from wounds of the scalp and forehead can be controlled by an antiseptic pad and bandage firmly applied.

(xii) *Tongue.*—(*a*) If the wound is within reach, it may be grasped by the finger and thumb and firmly held for several minutes, the pressure being re-applied if the bleeding continues or recurs ; (*b*) a piece of ice allowed to melt in the mouth will often check severe bleeding from the tongue ; (*c*) pressure on the carotid artery may sometimes be necessary.

(xiii) *Lips.*—Hæmorrhage from the lips can be controlled by pressure with a pad of gauze, or by grasping the lip on each side of the wound.

(xiv) *Cheek.*—Hæmorrhage from the cheek may be controlled by compressing the wound between a pad of gauze placed on the wound and the forefinger, which is placed inside the mouth.

(xv) *Throat and palate.*—Hæmorrhage from the throat or palate can most readily be dealt with by giving ice to suck. Hæmorrhage from the cavity from which a tooth has recently been extracted may be arrested by pressing into it a small plug of antiseptic gauze or wool.

(xvi) *Nose.*—Hæmorrhage from the nose is called *epistaxis*, and may be treated in the following way :—

(*a*) Seat the patient in a chair.
(*b*) Raise the hands above the head with arms fully extended.
(*c*) Loosen all tight clothing.
(*d*) Apply a piece of ice, or a sponge wrung out in cold water to the bridge of the nose ; or make the patient sniff cold water up the nostrils.
(*e*) Apply cold (a piece of ice or cold sponge) to the nape of the neck.

If these methods are unsuccessful, a M.O. should be sent for, as the nasal passages may require to be plugged before the hæmorrhage can be controlled.

(xvii) *Varicose veins.*—This generally occurs as the result of an ulcer or injury. Place the patient lying down, elevate the limb, and fix an antiseptic pad over the bleeding point.

(xviii) *Hæmoptysis and hæmatemesis.*—Bleeding from the lungs is known as hæmoptysis. Bleeding from the stomach

is known as hæmatemesis. The following points will help to distinguish them :—

(*a*) *Hæmoptysis*	(*b*) *Hæmatemesis*
(i) The blood is usually bright-red in colour, but may be clotted.	(i) The blood is dark in colour, and may appear like coffee-grounds.
(ii) It is frothy from being mixed with air.	(ii) It is not frothy, but may be mixed with particles of food.
(iii) It is coughed up.	(iii) It is vomited up.
(iv) As a rule the patient does not feel sick beforehand.	(iv) A feeling of sickness is often felt beforehand.
(v) The patient is probably suffering from disease or wound of the chest.	(v) The patient is probably suffering from disease or wound of the stomach.
	(vi) Blood may be passed in motions subsequently.

It must be remembered that blood may first be swallowed and afterwards vomited, so that a patient may vomit blood which has really come from his nose or upper air passages.

(*a*) *Treatment of hæmoptysis.*

(i) Place the patient in a recumbent position unless breathlessness requires him to be propped up.
(ii) Remove tight clothing.
(iii) Give ice to suck and apply ice to the affected side of the chest.
(iv) If it is known from which side the blood is coming, incline the patient to the affected side.

(*b*) *Treatment of hæmatemesis.*

(i) Place the patient in a recumbent position.
(ii) Loosen tight clothing.
(iii) Apply an ice bag over the pit of the stomach.
(iv) Do not give *anything* by the mouth until the patient has been seen by a M.O.

CHAPTER XXX

FRACTURES AND THEIR TREATMENT

615. Definition and causes.—When a bone is broken, it is said to be fractured. A fracture may be caused by injury or disease.

The violence may be applied to the bone directly or indirectly, or it may be broken by muscular action. Disease of the bone itself may so weaken it that it breaks much more easily than it naturally would.

616. Fracture by direct violence.—The bone breaks at the spot struck or crushed, the injury being caused by a kick, a bullet, the passage of a wheel over the part, etc.

617. Fracture by indirect violence.—The bone does not give way at the point struck, but, owing to the shock being transmitted, it is broken at some distance from the actual site of violence.

As examples may be mentioned the frequency of fractures of the collar-bone from falls on the hand, and of fracture of the base of the skull from a fall from a height on to the feet. In the first instance, the violence is applied to the hand, and the shock travels up the arm to the clavicle and breaks it; in the second instance the shock is transmitted from the feet, through the legs and spine to the skull.

618. Fracture by muscular action.—This is caused by violent contraction of the muscles. It is not such a common cause of fracture as direct or indirect violence. Fractures of the patella or knee cap are not uncommonly caused in this way.

619. Varieties.—Fractures may be either: (i) Simple or closed; (ii) compound or open.

(i) *Simple or closed fracture.*—Where there is no wound of the skin and soft tissues leading down to the break in the bone, the fracture is said to be simple.

(ii) *Compound or open fracture.*—When a wound through the skin and soft parts leads down to the break in the bone, the fracture is said to be compound or open. Sometimes the bone protrudes through the skin. This rarely occurs in compound fractures due to bullets. Owing to risk of infection of the wound, compound or open fractures are much more serious injuries than simple fractures.

620. Complicated fracture.—A fracture (either closed or open) is said to be complicated when, in addition to the break in the bone, the arteries, veins or nerves of the limb are injured ; or when the lung or the brain is damaged by a broken rib or portion of the skull ; or a fracture may be complicated by a dislocation of the bone.

621. Fractures are further described as :—

(i) *Complete fractures,* when the bone is broken right across.

(ii) *Incomplete or greenstick fractures,* when the bone is partially broken or bent. This variety is most commonly seen in children, because their bones are softer than those of adults.

(iii) *Comminuted fractures,* when the bone is broken in several pieces or even pulverized.

(iv) *Impacted fractures,* when the bone is broken and one fragment is driven into and firmly fixed in the other fragment.

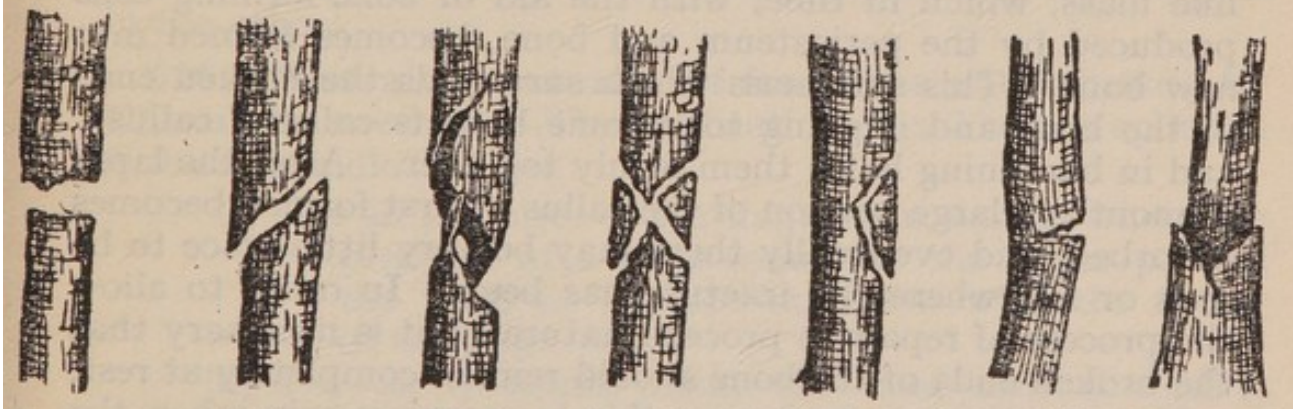


FIG. 83.—DIAGRAMS OF FRACTURES

622. Signs of fracture.—When a bone is broken, any of the following signs may be present :—

(i) The patient may have experienced the sensation of a sudden snap or giving way of the bone.

(ii) Pain, which is generally referred by the patient to the point at which the bone is broken.

(iii) Loss of power, *i.e.* the limb cannot be put to its proper use ; for instance, when a leg is broken a man cannot stand upon it ; when an arm is broken, the hand cannot be raised to the back of the head.

(iv) Alteration in shape ; the limb may be bent, twisted, or shortened, and, when compared with the sound limb, it appears of an unnatural shape.

(v) Unnatural mobility; *i.e.* when the limb is handled (which should not be done unnecessarily), it gives way where, if sound, it would not be movable.

(vi) When the limb is handled (*see* (v)) there is generally a grating sensation caused by the broken ends of the bone grating against one another. This is known as "crepitus." No attempt to elicit this should be made except by a M.O. who has to make a diagnosis.

(vii) Swelling of the limb is generally present.

623. Mode of repair.—The repair (or union, as it is called) of a fractured bone is a similar process to that already described under "Healing of wounds," but it is modified owing to the process taking place in a different kind of tissue. A bone has its blood-vessels just as any other portion of the body; it must not be looked upon as a hard bloodless structure, but as a portion of the living body which is itself alive. The blood which escapes at the time of the injury sets into a jelly-like mass, which in time, with the aid of bone-forming cells produced by the periosteum and bone, becomes formed into new bone. This soft mass which surrounds the broken ends of the bone and is going to become bone is called "callus," and in hardening holds them firmly together. After the lapse of months a large portion of the callus at first formed becomes absorbed, and eventually there may be very little trace to be seen or felt where the fracture has been. In order to allow the process of repair to proceed naturally, it is necessary that the broken ends of the bone should remain completely at rest.

Nature attempts to ensure this by causing pain when the limb is moved, and to assist nature and secure immobility the surgeon fixes the limb in splints or takes other steps to prevent the ends of the bones from moving.

624. Treatment of doubtful cases.—If there is any doubt as to whether the bone is really broken, the case must be treated as one of fracture. Always handle the limb with the greatest gentleness in order that there may be no risk of further injury to the part, bearing in mind that a simple or closed fracture may easily be converted into the much more serious compound or complicated fracture by rough handling.

625. Objects of treatment.—From the point of view of their treatment when fractured, the bones of the body may be divided into two rough classes :—

Class 1.—Includes the long bones of the limbs.

Class 2.—Comprises the skull, ribs, spine and pelvis.

Nature intended these two classes of bones to perform very different functions, and consequently the conditions produced when they are broken differ considerably.

The object of treatment of a fractured long bone is to replace the broken ends in accurate alignment at the earliest possible moment, and to keep them in this position until nature has joined them together firmly. This result can only be achieved by making the broken ends of bone retrace the unnatural path that they have taken, and the necessary manipulation to attain this end is effected by making one fragment a fixed point, and then by exerting a steady, even and continuous pull on the other to bring it into its proper place and keep it there. This is the fundamental principle that underlies the efficient treatment of all fractures of long bones, and it is in this way alone that the tragedy of shortened and otherwise deformed limbs, after fracture, can be avoided. The proper place to apply this extension to the limb is the spot where the wounded man falls on the battle field, or the street in which the civilian is run over, and not the first-aid post or field ambulance in the one case, or the city hospital in the other.

626. First-aid treatment of fractures and wounds by Thomas's method.—The application of a Thomas splint in first-aid is indicated :—

(i) For all fractures of the thigh bone, except where the presence of a large wound in the upper part of the thigh or buttock interferes with the fitting of the ring.

(ii) For all fractures about the knee-joint (including the patella) and the leg-bone.

(iii) For cases of extensive wounds of the fleshy part of the thigh or leg.

The Thomas splint consists of an oval iron ring, united obliquely to another length of round iron which forms the side bars and end of the splint; the ring is padded and covered with leather. The splint can be applied to either leg.

It can be carried conveniently by threading the closed stretcher through the ring, and tying the side bars to the stretcher. The bars should be kept lightly smeared with vaseline and the leather covering of the ring kept clean and soft by the occasional use of saddle-soap.

627. Directions for the application of the Thomas splint to a fractured femur.—Modification, as required, can be made for other injuries. For the application, three bearers are required, Number 1 being responsible for the application and Numbers 2 and 3 assisting him.

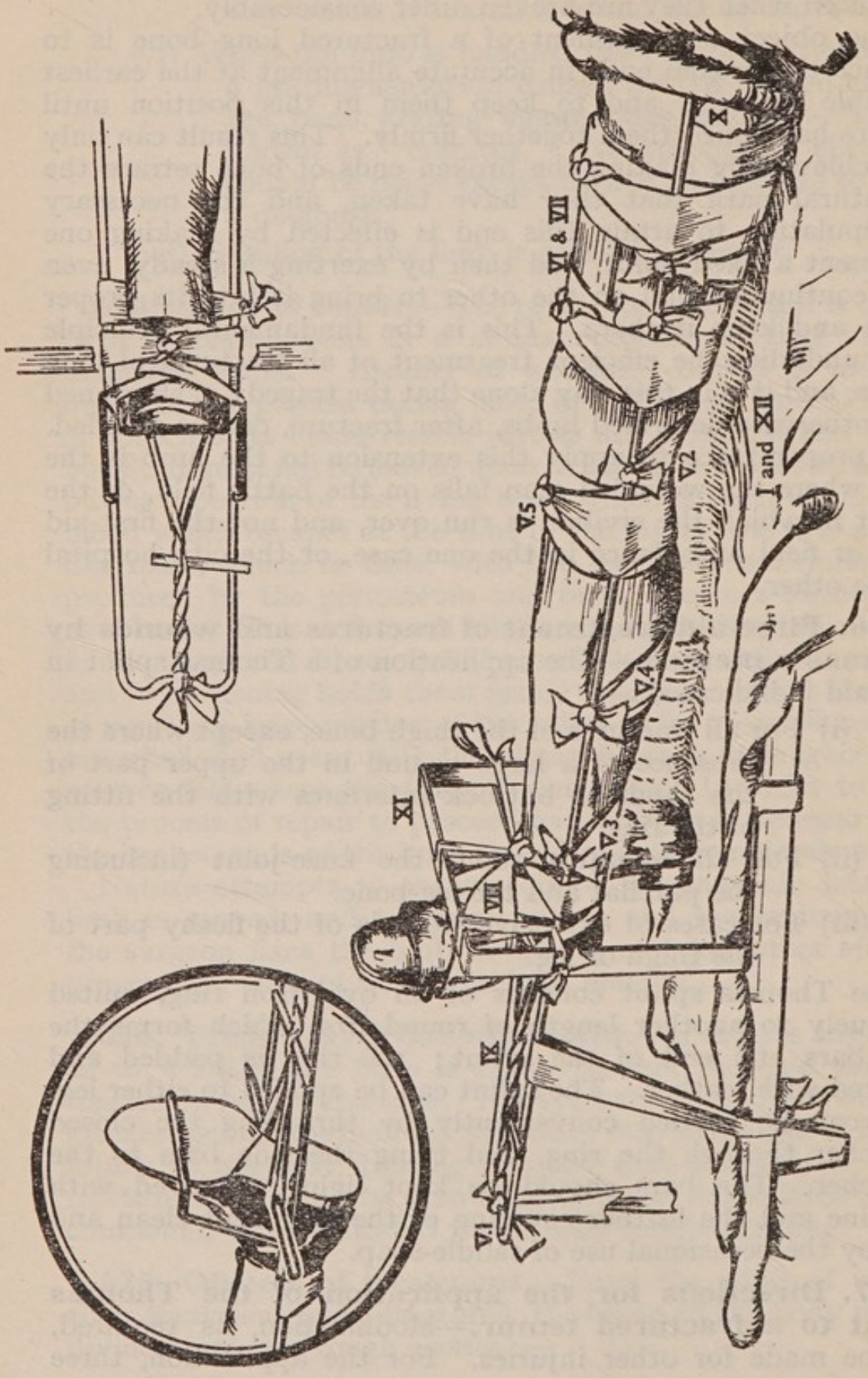


FIG. 84.—THOMAS SPLINT APPLIED TO FRACTURE OF LEFT FEMUR

In accordance with description in para. **627.**

Apparatus required.

(i) Thomas splint (as this splint is applied over the trousers in first-aid treatment, the ring must be a large one).
(ii) Stretcher suspension bar.
(iii) Reversible stirrup (Sinclair's).
(iv) A metal skewer about 12 inches long or, if this is not available, flannelette bandage 3 yards in length to form the clove hitch.
(v) Five flannelette bandage slings and five safety-pins.
(vi) Five triangular bandages.
(vii) Some loose woven bandages and wool.
(viii) Two pieces of Gooch splinting about 8 inches by 6 inches.

To form the slings mentioned above, five pieces of flannelette bandage approximately 30–36 inches in length are taken and folded into two. The loop ends are pinned over the inner bar of the splint, rolled up and secured in position by short ties of loose woven bandage.

Note.—In practising the application, the patient may be splinted lying on a stretcher, which should rest on trestles, but, with an actual casualty, he should be splinted where he lies unless it is absolutely necessary to remove him to a place of shelter. Application of the Thomas splint should be practised in the dark and wearing anti-gas respirators.

I. *Preparation of stretcher.*—The stretcher is prepared as described in para. **74.**

II. *Extension.*—No. 2 bearer stands at the foot of the stretcher facing the patient and opposite the injured limb. Grasping the heel of the boot with his right hand, and the toe with his left, keeping the arms straight, he exerts a steady pull, thereby producing the necessary extension.

No. 3 supports the limb at the site of the fracture until the dressing and Gooch splinting have been applied.

III. *Maintaining extension.*—(i) To maintain extension, take a pointed metal pin or skewer about 12 inches long, pass it obliquely through the boot just in front of the heel and close to the sole, so that it lies between the sole of the foot and that of the boot.

The outside end will then be about 1½ inches nearer the toes than the inner end, so that, when the extension pin rests on the side bars of the splint, the limb and foot are in external rotation. A piece of bandage or tape is attached to each end of the pin and tied off to the splint as described under fixation of the leg (V, (i)).

(ii) Another method of maintaining extension is by means of the clove hitch halter.

To form the clove hitch, No. 1 bearer takes a 9-foot length of flannelette bandage, and holds it in the left hand, back uppermost, by its mid point, thus forming a right and left half. With the right hand, back towards himself, thumb pointing down, he grasps the middle of the left half, raises the right hand to the level of the left hand to the right of it, thumb touching thumb, thus forming two loops, a right and left. He now carries the right hand, without any further turning, to the back of the left, thus forming a clove hitch with a diameter of 10 inches. This is applied over the foot without relaxing extension, both ends on the outer side ; the long end is carried under the instep, up and through the loop round the ankle. This forms the halter, which should fit without being tight.

The two extension bands thus produced are ready to be attached to the splint later on.

IV. *Slipping on the splint.*—No. 1 bearer slips on the splint, No. 2 removing and re-applying the upper and lower bands alternately to allow the ring to be passed over the foot. The splint should be pushed up under the buttock as far as possible, care being taken to keep the traverse bar horizontal. No. 3, as before, steadies the limb.

V. *Fixation of the leg.*—(i) The extension bands of the skewer or clove hitch are tied round the notched bar at the end of the splint as follows :—

The outer band is passed over and under the bar at the notch, drawn taut and held over to the opposite side. The inner band is passed in the reverse direction—that is, under and over the notched bar, crossing the first band at the notch and preventing its slipping. The two bands are finally tied off by a half bow. As soon as the extension bands are tied, No. 2 bearer ceases to hold the foot and supports the lower end of the splint.

(ii) The middle sling is tied off over the outer bar behind the knee, No. 3 keeping the knee slightly bent.

(iii) and (iv) The slings behind the ankle and calf are tied off so that the leg is now supported in a shallow trough, with the long bars of the splint level with the centre of the leg.

(v) To prevent the leg rising off the splint, a narrow fold bandage is placed across the leg just below the knee ; the ends are carried down between the leg and the splint, crossed behind, brought up outside the bars and tied off on the front of the leg.

The lower limb is thus fixed in a position of extension, and it may be moved freely without causing pain to the patient or damage to the injured part.

VI. *Dressing the wound.*—The wound is exposed by cutting away the overlying portion of clothing, and the dressing applied.

Note.—If severe hæmorrhage is occurring, steps will be taken to control it before splinting is begun.

VII. *Gooch splinting and bandages.*—One piece of Gooch splinting is placed behind the limb and secured by tying off the remaining two slings. The other piece is placed in front of the limb, care being taken to prevent the lower edge pressing on the knee-cap. The dressing and splints are now kept firmly in position by two narrow fold bandages in the following manner :—

The centre of each bandage is placed on the front of and over the centre of the Gooch splinting. The ends are taken down between the limb and the side bars of the splint, crossed behind and then brought up on the outside of the bars and tied off in front of the limb.

VIII. *Stirrup and figure-of-*8.—The stirrup is sprung on to the splint so that the shaped part fits the sole of the boot, thus preventing lateral movement of the foot. A narrow fold bandage is applied in the following manner to form a figure-of-8. The centre of the bandage is placed under the sole of the boot. The ends are brought forward, crossed, taken down behind the ankle, crossed again, brought up outside the bars and tied off in front of the limb.

IX. *Spanish windlass.*—The extension bands are retied, if necessary, and a small piece of wood is inserted to twist up the bands as required.

X. *Pad in the ring.*—A pad is placed inside the ring on the outer side of the thigh to act as a wedge and prevent undue movement.

XI. *Suspension bar.*—The suspension bar is now fitted to the stretcher, grips away from the runners, with its horizontal part one hand's breadth in front of the foot. The splint is then slung by two long ties, a hand's breadth below the horizontal bar. To prevent lateral movement, the ends of these ties are secured round the uprights of the suspension bar.

To prevent vertical movements of the splint, a narrow fold bandage is passed round the outer bar of the splint below the foot and tied off to the runner of the stretcher.

XII. *Warmth.*—The blankets are adjusted as described in para. **74**, and the patient is ready for removal.

For work in the dark, in pinning the blankets, it is advisable to include a small piece of bandage or other white material under each pin.

628. Evacuation.—For the purpose of transport, it may be advisable to place pads of wool at the sides of the knee and ankles and bandage over the pads, limb and sidebars.

After the fracture has been splinted and dressed in the manner described, the patient should be evacuated with all possible speed through the A.D.S. and M.D.S. to the C.C.S. Provided that neither hæmorrhage nor severe shock has occurred, it should only be necessary to make a short stay at either dressing station for the patient to receive a dose of anti-tetanic serum and for his particulars to be taken. On the other hand, it is most important that shock, if present, should be treated.

629. How a Thomas splint acts.—In the first-aid stage, all that is aimed at is the fixation of the fracture and not necessarily its complete reduction, because, if a very strong pull is exerted on the foot through the boot, ulceration and perhaps gangrene may be produced. The ring pressing against the ischial tuberosity fixes the upper fragment of the fracture ; the side bars and end of the splint being in one rigid piece, it follows that traction exerted on the foot by the pull exerted between the extension skewer and the end of the splint must have the effect of pulling the lower fragment away from the upper in the long axis of the limb and make further shortening impossible. The pull required to reduce a fracture of the femur, and maintain it in position, is very great, especially in the case of a simple fracture, and is applied when the patient reaches the hospital, where he can receive permanent treatment.

630. Treatment while under transport.—The treatment of a fracture of a long bone during any form of transport from the point of view of the R.A.M.C. orderly consists in :—

(i) Watching for hæmorrhage.

(ii) Noticing the patient's general condition, especially with regard to shock, and if this occurs, carrying out the M.O.'s instruction to combat it.

(iii) Paying great attention to any complaint that the patient may make of being uncomfortable, or of a bandage being too tight, and informing the M.O. at once of such complaint.

It must be borne in mind that a limb may swell rapidly within a few hours of receipt of a compound fracture owing to the occurrence of gas gangrene or internal hæmorrhage in the limb.

631. Treatment at the casualty clearing station and base hospital.—The treatment of a fracture of a long bone in these units is entirely in the hands of the surgeon, but it may help the orderly to take a more intelligent interest in his work and to appreciate more fully the importance of following accurately the instructions given him for splinting the patient on the battlefield, if the principles of the treatment are outlined.

These are :—

(i) To relieve shock and arrest hæmorrhage, if present.

(ii) As soon as the patient is in a fit state, to X-ray the limb without removing the splint or the extension.

(iii) To remove the clothing from the limb with scissors, without interfering with the wound or the extension.

(iv) To apply a permanent extension to the limb below the fracture and, when this is secured, but not before, to remove the temporary extension and the boot.

(v) In the case of the lower limb, to re-splint the leg in a Thomas splint, the ring of which accurately fits the patient's thigh, if it seems probable that further swelling from gas gangrene or hæmorrhage will not occur.

(vi) To cleanse, and, if necessary, do a thorough surgical revision of the wound, removing any foreign bodies or pieces of clothing. To provide drainage on the under surface of the limb for pus to run away, unless it is thought possible that the wound may be sewn up after a day or two.

(vii) Guided by X-ray films, to endeavour to replace the fractured ends of the bone in accurate apposition by manipulation.

(viii) To remember that, in the case of a broken thigh, the femur is an arched bone, the convexity of which points upwards when the subject is lying down, and therefore to adjust the flannel band which immediately supports the site of the fracture more tightly than the others, so as to reproduce this arch at the point where the bone is broken.

If these adjustments have been carried out at the C.C.S., the patient should be transferred to the base, as soon as his general condition admits of his making the journey. Special attention should be paid to see that he travels on a stretcher with the splint attached to a suspension bar.

632. Additions to a Thomas splint.—Certain additions to the Thomas splint have been found useful, such as :—

(i) A wooden serrated foot piece, which gives accurate control of the foot, and through it of the lower fragment.

(ii) Some method of suspending the splint, to enable the patient to move freely in his bed without disturbing the position of the fracture.

633. Special fractures.—Under this heading only the more common fractures will be discussed.

(i) *Fracture of the spine.*—This injury may result from a shell or bullet wound, from falling from a height on the back across a bar or on to uneven ground, from a fall on the head, or from a mass of rock, earth, etc., falling on to the back. In this fracture the vertebræ are broken and may be displaced ; the spinal cord and nerves are damaged according to the amount of displacement present. The result may be complete or partial paralysis of the parts of the body below the seat of fracture.

Treatment.

(*a*) As a rule, no attempt should be made to move the patient until a M.O. arrives, but

(*b*) If no M.O. is available within a reasonable time, first aid must not be further delayed.

Note.—The position in which a patient who is suffering from a fracture of the spine should be placed for transport varies according to the position of the injury.

If the spine in the dorsal or lumbar region is injured, the safest position in which the patient can be placed and transported is lying face downwards.

If the cervical region is involved, the patient should be on his back.

Although a fracture may occur without damage to the spinal cord, and paralysis, in any case in which paralysis of the legs exists and the arms are not affected, the patient should be placed face downwards for transport.

If the arms are paralysed as well as the legs, the injury is in the cervical region of the spine, and the patient should be placed on his back.

(*c*) To raise the patient, some form of support such as a blanket, sheet or piece of canvas must be placed under him. This should be done by two, or if possible three, persons, the patient being carefully rolled on his side, his shoulders and back supported by one attendant, while another looks after his pelvis and lower limbs ; the third attendant should then roll the canvas or blanket under the patient.

If the damage to the spine is in the dorsal or lumbar region, the patient is then gently lowered on to his face with a good pad of rolled up clothing or some other material placed under the upper part of the chest. The head can be turned to one side or supported by a pad placed under the forehead so that the nose and mouth will not press against the stretcher.

If the case is one in which both arms and legs are paralysed, or injury to the cervical region of the spine is suspected, the patient should be very carefully placed on his back with a good pad under the shoulders to allow the head to fall well back and additional pads placed on each side of the head to prevent it rolling about.

Note.—It is of the utmost importance to avoid any undue movement of the body as a whole and to carry out all necessary movements very gently to prevent any jarring of the spine.

The face-down position for a fracture or suspected fracture of the dorsal or lumbar spine must always be adopted unless other injuries exist at the same time which make it impossible to place the patient in this position.

(*d*) After the patient has been placed on a blanket or similar support, poles should be fixed to each side of the support, if possible.

(*e*) The patient is then slowly and with the utmost care placed upon a stretcher, board, gate, etc., and carried, if possible by four persons, to the nearest place of shelter, where he is kept absolutely quiet until the arrival of a M.O.

(ii) *Fracture of the skull.*—The patient may be quite unconscious or only dazed, and there may be bleeding from the mouth, ears or nose.

Treatment.—Keep the patient absolutely quiet until he can be seen by a M.O. Do not give stimulants. Take special care of the ears, etc., so that no dirt or septic matter gets in. This is very important, as bleeding externally means that the

fracture is compound, and if septic matter gets in, it may lead to inflammation of the brain. If available, plug the ears and nostrils with a piece of gauze or wool moistened in antiseptic solution.

(iii) *Fracture of the pelvis.*—This is nearly always due to severe, direct violence, such as the passage of a wheel across the body.

As a rule there is little displacement of the bones ; and the treatment consists in keeping the parts at rest by means of a broad bandage.

As rupture of the urethra is a not uncommon complication of fracture of the pelvis, the patient should be warned not to attempt to pass urine until he has been seen by a M.O.

(iv) *Fracture of the lower jaw.*—In addition to the usual signs of fracture, the following are often present :—

(*a*) Inability to speak or move the jaw with any degree of freedom.
(*b*) Irregularity of the teeth, noticeable on looking into the mouth or passing the finger along them.
(*c*) Bleeding from the gums.
(*d*) Salivation.

Treatment.—Apply the four-tailed bandage as described under the heading of " special bandages " in Chapter XXIV and remove the case to hospital forthwith.

(v) *Fractures of the ribs.*—When a rib is broken, the patient complains of severe pain on taking a long breath, and crepitus may be detected on placing the hand over the injured part. In addition to these signs, when the lung is injured, as is often the case, blood may be coughed up.

Treatment.—Apply two broad-fold bandages firmly round the chest, in such a manner that the centre of one bandage is immediately above, and that of the other directly below, the seat of fracture ; the upper half of the lower bandage overlapping the lower half of the upper. The bandages should then be tied off on the opposite side of the body to the injury, knots slightly to the front. When the ribs are crushed in and the lung is severely injured, do not apply bandages to the chest, as great damage may be inflicted by the fragments being still further pushed into the lung.

In this case lay the patient down, slightly inclined towards the injured side, loosen all clothing, give small pieces of ice to suck and place an ice-bag over the injured area. Apply the greater arm-sling in either case and remove at once to hospital.

(vi) *Fracture of the collar-bone.*—This is caused either by a fall on the shoulder or outstretched hand, or by direct violence applied to the collar-bone itself. The arm on the injured side is helpless; the patient generally supports it at the elbow with his other hand, and the head is inclined towards the injured side. On the injured side being examined, a deformity in the line of the collar-bone will at once be apparent, and to this point the patient will refer most of the pain from which he suffers.

Treatment.—After having removed the coat and all necessary clothing, place a pad about the size and thickness of the palm of the hand in the axilla of the injured side, and apply bandages for fractured clavicle as described in Chapter XXIV.

(vii) *Fracture of the leg.*—First-aid treatment of all fractures of the lower limb is best carried out by means of a Thomas knee splint. The only case in which it cannot readily be used is when the ring of the splint comes into contact with a buttock wound. In the latter case, the injured limb can only be supported by the application of a long splint reaching from the armpit to below the level of the heel on the outer side of the body and leg. Liston's long splint or a rifle used as a splint provides such a support. In either case, short straight splints or preferably a piece of Gooch splinting must be applied at the actual site of the fracture. But this method of splinting should be looked upon as a temporary measure only.

(viii) *Fracture of the arm.*—The upper arm may be broken at the shoulder, the centre of the shaft or near the elbow joint. The usual signs of fracture are present.

Treatment.—If the fracture is at the shoulder, first put a pad along the inside from the armpit to the elbow; then bandage the affected arm to the side by means of a broad-fold bandage, the centre over the centre of the arm, and the ends passed round the body and tied on the opposite side. Apply the lesser arm-sling. For every other fracture of the arm, however, the best first-aid treatment is by the application of the Thomas arm splint.

This appliance (Fig. 85) only differs from the Thomas knee splint in that the ring is round not oval, it is set square to the side bars not obliquely, and is fitted with a swivel at the point of its attachment to the side bars, instead of being fixed. The application of this splint is similar to that of the Thomas knee splint described above. Temporary extension is taken from a double hitch of bandage placed over the well padded wrist, and the two ends of this are tied to the end of the

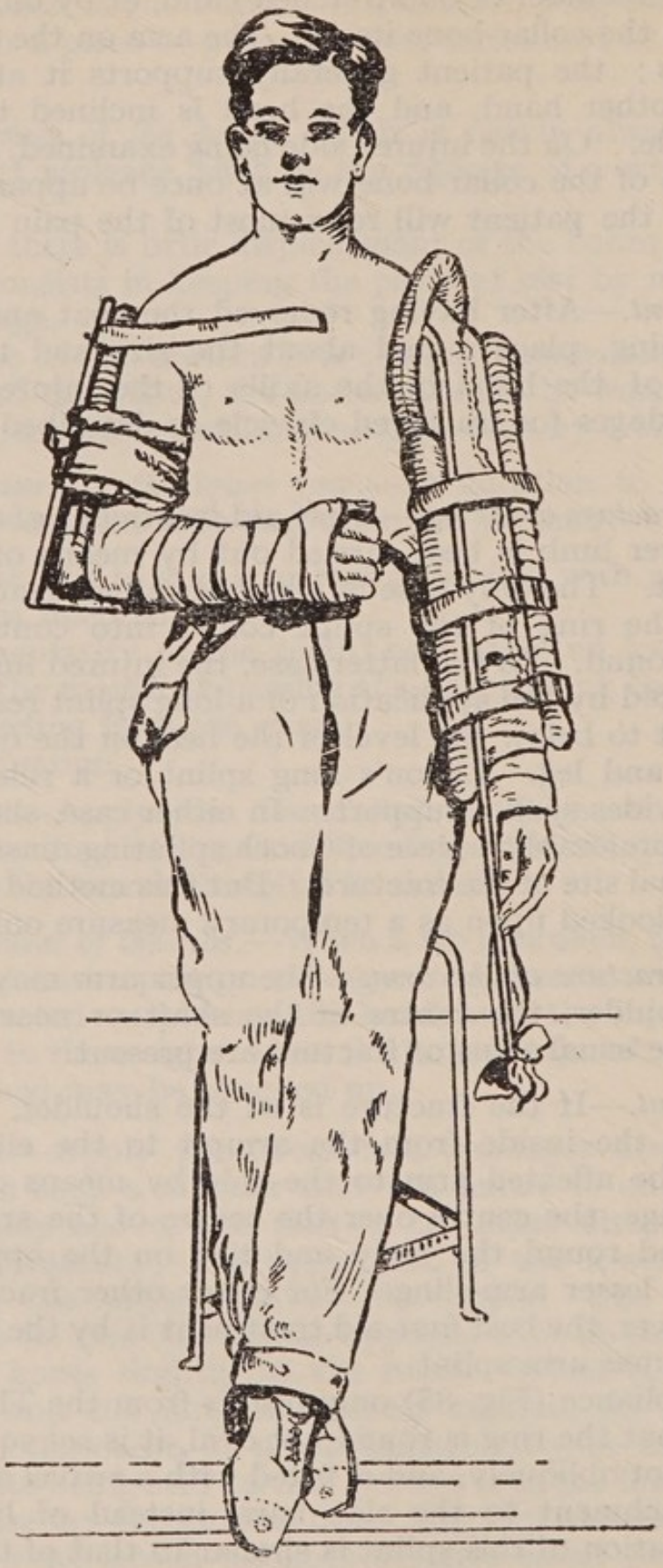


FIG. 85.—THOMAS ARM SPLINT

splint, counter extension being taken from the side wall of the chest in the region of the armpit.

The swivel ring allows the arm to be brought in to the side of the body to facilitate transport. The arm is suspended from the side bars of the splint, and the wound is dressed in the splint in the same way as has been described above in " Fracture of the femur."

This splint is suitable for the first-aid treatment of any fracture of the arm from the shoulder joint downwards, and it can be carried easily with the rolled up stretcher threaded through the ring, as described above in the case of the Thomas knee splint. If a swivel Thomas arm splint is not available, the site of fracture should be given some partial support by the application of padded pieces of wood bandaged round it and the arm bandaged to the side as described above for wounds near the shoulder.

(ix) *Fracture of fingers and toes.*—Fractures of the fingers and toes require extension, which is difficult to apply as a first-aid measure. A flat piece of wood may be padded and applied to the sole of the foot to steady it, and the hand may be bandaged over a rolled-up bandage, or a rubber ball held in the palm of the half-closed fist. But the support of the surrounding digits, particularly in the case of the middle three fingers and toes, will usually act as sufficient splinting to prevent the broken bone ends from doing further damage to the soft parts, until proper extension can be applied.

634. *Compound fractures.*—Any of the above fractures may be compound. They are much more serious injuries than the simple fractures because of the wound in the soft parts leading down to the bone. The greatest precautions must always be taken against septic infection of the wound, for, if this occurs, inflammation of the bone may arise followed by general blood poisoning and death.

635. Hæmorrhage.—When this occurs as a complication of a fracture, the treatment may be summarized as follows :—

(i) Severe hæmorrhage is the only condition that should receive priority of treatment to the splinting of a fracture.

(ii) Digital control of the vessel from above, when possible and effective, will cause less damage to the limb than the application of a tourniquet, which stops the entire blood supply to the limb instead of only arresting the flow in the injured vessel.

(iii) Every minute that a tourniquet is left on a limb increases the chance of gangrene, and consequently of subsequent amputation or death.

(iv) Immobilization of the limb by efficient splinting reduces the liability to bleeding from a vessel already injured, and prevents the possibility of an uninjured vessel being torn by a jagged end of bone.

(v) It is a good plan, if hæmorrhage has occurred and has been arrested, or if the position and character of the wound make it seem probable that there will be bleeding, to apply a tourniquet loosely in position, so that it can be tightened in a second, should occasion arise.

(vi) Remember that a fractured limb needs more circulation of blood for the process of repair than a sound one does.

636. First-aid treatment of fracture.—While the Thomas method, as previously described, is undoubtedly the best means of applying first-aid treatment for most fractures, yet there are certain cases, as for instance severe wounds of the buttock and axilla, to which it cannot be applied, as the ring of the splint would come in contact with the wound.

In other cases a Thomas splint may not be available and some extemporized splint must be applied.

In first-aid treatment of such, it must be realized that no real attempt is made to get accurate replacement of the broken bones, but that the object of the treatment is to relieve pain, and to prevent shock and further aggravation of the injury, which is very likely to occur unless something is done to prevent movement of the broken bone when the patient is moved.

The arm does not present such great difficulties as the leg and thigh, as in the former case the arm can always be carefully bandaged to the side, which will serve to prevent further injury.

Any unyielding material, such as wood, iron, pasteboard or the man's bayonet or rifle, can be employed. Before using the rifle, it is important to draw the bolt and empty the magazine. In the absence of any splint for the lower limb, the fracture can be steadied by carefully bandaging the injured to the sound leg. Improvised splints must be padded with soft material, to prevent injury to the limb. Tow and wool are best, but, if these are not available, grass, hay, straw or articles of clothing are useful. While bandages must be applied with sufficient firmness to prevent movement of the

broken bones, care must be taken to ensure that they are not too tight. The limb is likely to swell after injury; hence great damage and even death of the limb may be caused by tight bandaging.

The patient should never be moved from the spot where he has been injured until some sort of splint has been applied.

637. Other varieties of splints.—Although the Thomas splints can be used throughout the whole course of treatment in many cases, yet, certain other splints may be required for fractures in special positions, and the surgeon may ask for any of the following :—

Long Liston splint with interruption.—This is a stout board, about four inches wide, and long enough to extend from the axilla to beyond the foot of the patient. It may be interrupted at any part by iron bars, which maintain the rigidity of the splint but allow the wound to be dressed without the removal of the splint.

Hodgen's splint.—This is used for fractures of the thigh. It is made of light bar iron, and is applied in front of the limb, which is supported by flannel bands. The limb is fixed to the splint by a surface extension, applied with glue or adhesive strapping. The splint must be suspended; so some arrangement of overhead bars and cords and pulleys is necessary.

Jones's arm splint.—This is a very useful splint for fractures of the arm (*see* Fig. 86).

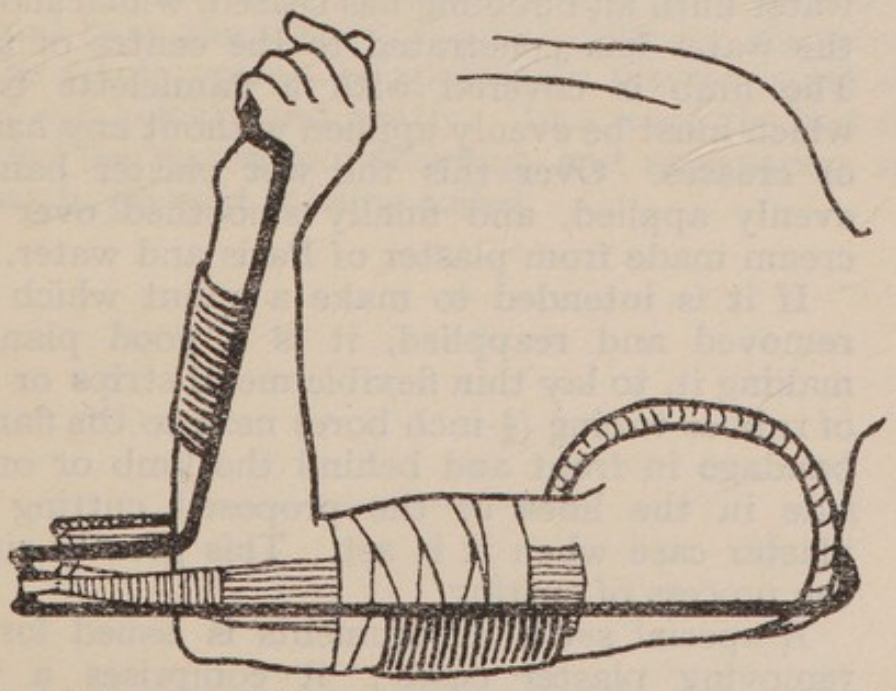


FIG. 86.—MODIFIED THOMAS SPLINT USED BY SIR ROBERT JONES IN CASES OF FRACTURE OF THE HUMERUS

Angular wooden or iron splints, hinged at the elbow, and applied to the inner or outer side of the arm or fore-arm, are also frequently asked for.

Special splints, consisting of poroplastic felt, which can be heated and moulded to any desired shape, are often used. A very useful type of splint material is known as Gooch splinting. This consists of strips of lath, glued to stout canvas. It is supplied in rolls, and can be cut as desired.

In fractures of the lower limb, unless the patient is treated in a splint which is slung up, the bed must be firm, and for this purpose fracture boards are used, which are introduced under the mattress.

Balkan beam.—This consists of a stout wooden beam, carried the whole length of the bed, and supported at either end by uprights. To this beam the splint can be hung, and the patient, by grasping it with his hands, can assist to move himself in bed.

Plaster of Paris.—For the later treatment of fractures, plaster of Paris is often required. This can be applied in several ways.

First, the limb must be thoroughly cleansed by soap and water or ether, and then dried and powdered with zinc and starch powder.

Bandages of some loose woven material are prepared by rubbing dry plaster into them, and before use, are placed in hot water; they are left in the water until all bubbling has ceased, which shows that the water has penetrated to the centre of the roll. The limb is covered with a flannelette bandage, which must be evenly applied without any hard folds or creases. Over this the wet plaster bandage is evenly applied, and finally smoothed over with a cream made from plaster of Paris and water.

If it is intended to make a splint which can be removed and reapplied, it is a good plan, when making it, to lay thin flexible metal strips or lengths of rubber tubing ($\frac{1}{4}$-inch bore) next to the flannelette bandage in front and behind the limb or on either side in the lines of the proposed cutting of the plaster case when it is set. This greatly simplifies the process of cutting.

A special set of instruments is issued for use in removing plaster cases; it comprises a pair of gypsum shears and a knife with a blade and a spike.

Another method is to dip strips of household flannel in plaster cream and bandage them to the limb with an ordinary loose woven bandage, which is not treated with plaster of Paris, and consequently can easily be cut with scissors, when the plaster has set. The splint is then removed, and its edges trimmed up and bound with adhesive strapping, and again applied to the limb with bandages. This is known as a Croft's splint.

The type known as a Bavarian splint is made as follows :—

Two layers of household flannel are cut so that they exactly fit the limb. The inner layer of flannel is fitted in position by pins or stitches, and its outer surface is then thoroughly rubbed over with plaster cream. The outer layer is dipped in the plaster cream and applied over the first layer. A loose woven bandage may be applied to keep it in position until set, but this is not always necessary. These splints can be made to open at a hinge, by applying a narrow strip of adhesive plaster to the flannel, where the hinge is desired. This prevents the plaster of Paris from entering the flannel at this spot, so that it remains flexible. As soon as the plaster is set, the splint is removed, and the edges are trimmed up and bound by adhesive strapping, which prevents them breaking away.

In order to ensure good setting of plaster of Paris, it should be kept in air-tight tins, and before use, it is well to open the tins and bake the plaster in a hot oven for about half an hour. The whole process of applying a plaster splint should be carried out quickly and neatly. In a ward the bed should be protected by waterproof sheeting, and newspapers spread on the floor to prevent it being soiled.

CHAPTER XXXI

SPRAINS AND DISLOCATIONS

638. Sprains or strains result from sudden violence applied to a joint and consist in the tearing or stretching of the ligaments, the bones of the joint, however, remaining in their normal position.

639. Signs of a sprain.

(i) Severe pain, increased on movement.

(ii) Swelling round the joint with loss of power.

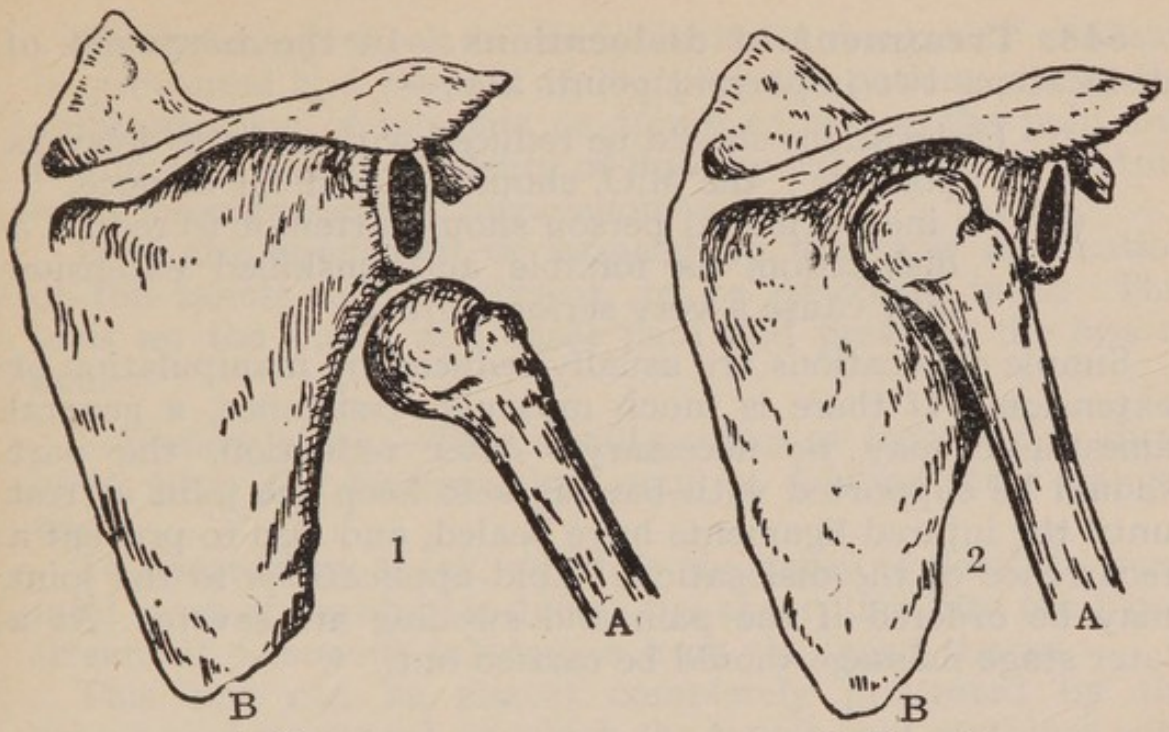
(iii) Deformity in severe cases.

(iv) The ligaments, and perhaps other parts of the joints, being torn, there is always some bleeding, which shows itself by discoloration or bruising round the joint.

640. Treatment of sprains.—Early treatment consists in putting the part at rest and supporting it firmly by a bandage over cotton wool ; in the more severe cases a splint may be applied. The application of heat or cold in the shape of fomentations is most soothing, and massage to reduce the swelling and to disperse the extravasated blood should be undertaken at the very earliest opportunity.

641. Dislocations are a further stage and occur when the bones of the joint are put out of their usual position, and are always accompanied by tearing or stretching of the ligaments (*see* Fig. 87).

Certain joints are much more liable to dislocation than others. What are known as " ball and socket " joints are, owing to their extensive range of movement, much more frequently dislocated than " hinge joints." For example, dislocation of the shoulder joint, which is a ball and socket joint, is common as compared with dislocation of the elbow joint. Again, joints which depend largely upon the support of surrounding muscles (such as the shoulder joint) are more frequently dislocated than joints in which the shape of the bones themselves, such as the hip joint, gives the main support.



A. Humerus B. Scapula

FIG. 87.—DISLOCATION OF THE SHOULDER-JOINT

1. Dislocation of the head of the humerus downwards into the arm-pit.
2. Dislocation of the head of the humerus backwards on to the scapula.

642. The signs of a dislocation are :—

(i) Pain and evidence of local injury at the site of a joint, *e.g.* bruising and swelling of the soft tissues.
(ii) Deformity of the limb when compared with the opposite side.
(iii) Restricted mobility of, and swelling round the joint, due in part to the abnormal position of the bones.

A dislocation may be distinguished from a fracture in the following way :—

(i) It always occurs in a joint.
(ii) Instead of increased mobility, there is entire loss of movement.
(iii) If the end of the bone can be felt, it is smooth and rounded in a dislocation, whilst in a fracture it is sharp and angular.
(iv) There is no grating.

It must be remembered, however, that a dislocation may be combined with a fracture as, for instance, fracture of the humerus with dislocation of the shoulder joint.

A dislocation may be compound. That is, the displaced end of the bone may protrude through the skin.

643. Treatment of dislocations.—In the treatment of dislocations two important points are :—

(i) Dislocations should be reduced with as little delay as possible ; the M.O. should be sent for at once.

(ii) No inexperienced person should attempt to reduce a dislocation, as forcible and unskilled extension may cause a very serious injury.

Simple dislocations are usually reduced by manipulation or extension. If there is much muscular resistance, a general anæsthetic may be necessary. After reduction, the part should be supported with bandages to keep the joint at rest until the injured ligaments have healed, and also to prevent a recurrence of the dislocation. Cold applications to the joint may be ordered if the pain and swelling are severe. At a later stage massage should be carried out.

CHAPTER XXXII

BURNS AND SCALDS

644. Burns and scalds may be considered as a special variety of wound brought about by the action of heat ; burns by direct contact with flames or heated solid bodies or an electric current ; scalds by the action of boiling water, superheated steam or other hot fluids or gases. (Burns caused by the action of compounds used in chemical warfare are dealt with in Chapter XVII.)

The course of a burn may be divided into three stages :—

(i) The stage of destruction or burning accompanied by shock, its severity depending on the extent and depth of the burn.

(ii) The stage of inflammation or sloughing accompanied by the usual symptoms of fever.

(iii) The stage of repair.

Burns and scalds, if extensive, produce serious shock which may rapidly prove fatal.

The shock produced is of two kinds :—

Primary shock and *secondary shock.*

Primary shock is due to pain conveyed to the brain from the sensitive nerve-endings in the skin and also to the loss of large quantities of fluid which ooze from the burned surface.

This primary shock is rarely in itself dangerous and can be prevented and relieved by keeping the patient warm, the administration of morphia or opium to relieve the pain and the administration of plenty of fluid by the mouth or rectum or by subcutaneous or intravenous infusion.

It is also prevented or lessened by the early application of the tannic acid treatment, to be described later. This seals up the burns and eases pain and prevents the loss of fluid.

Secondary shock.—This usually comes on from two or three hours after the burning, but may be delayed for a day or two.

This secondary shock, which is the cause of death in most fatal cases of burning, is due to the absorption into the blood stream of poisonous substances from the burnt tissues.

This also can be almost completely prevented by the tannic acid treatment, in which the tannic acid combines with the burnt tissues and produces an insoluble material which is not absorbed into the blood stream.

Treatment of Burns and Scalds

645. First aid.—First aid treatment should promptly be applied, the patient wrapped up warmly and conveyed to hospital as quickly as possible.

If admission to hospital can be rapid, it is best not to attempt to treat the burns, but, if a delay of two or three hours is likely to occur before admission, then the burns should be treated. In such a case, no attempt should be made to clean up the burnt area, but the clothing should gently be cut away, not dragged away.

The best first-aid application is a two per cent. solution of tannic acid to which a small quantity of antiseptic solution has been added. To ensure that the solution is fresh, it is convenient to keep the ingredients in powder form. A powder comprised of 35 grains of tannic acid and one grain of perchloride of mercury dissolved in four ounces of warm water will provide a two per cent. solution. Large quantities of solution can readily be prepared by using additional powders in similar proportion. The solution must always be used warm.

For first-aid purposes, the solution is best applied by means of compresses, as follows. Six layers of white gauze or three layers of lint are thoroughly soaked in the fresh warm solution and applied all over the burnt surface without wringing out. The dressings are then bandaged firmly and

evenly, wetting the outside of the bandage with the solution. The amount of solution required varies with the area to be treated. As a guide, it may be said that for treating the entire front or back of the trunk, about one pint of solution is required.

If the face is burnt, great care must be taken to prevent tannic acid entering the eyes. The lids should be closed and thickly covered with vaseline and a pad of cotton wool before the compresses are applied to the face.

If the tannic acid treatment is not available, a one per cent. watery solution of picric acid may be used. This does not prevent the use of tannic acid later.

The application of powders, formerly recommended, oily preparations or ointments is not advocated, but in the absence of tannic acid or picric acid a solution of acriflavine in liquid paraffin may be applied. Whilst giving some protection, powders make the necessary cleaning of the burnt area very difficult, and oily preparations are difficult to get rid of before tannic acid can be applied.

646. Treatment in hospital.—The first essential is thoroughly to clean up the burned area. As this is a very painful process, a sedative of some sort is necessary. In some cases, an appropriate dose of opium or morphia, as ordered by the M.O., will suffice, but in many others a general anæsthetic will be required when gas and oxygen is the best to employ.

All loose skin and dead or charred tissue is gently removed, blisters being punctured with a sterilized needle. The area is then cleaned with soap and water by means of a sterile swab and finally sponged over with ether to remove grease.

While this cleansing is in progress, the necessary quantity of fresh warm tannic acid solution can be prepared by the dispenser.

In hospital, the tannic acid solution can be applied by compresses, as already described, or by a spray method which is suitable for the less extensive burns.

If compresses are used, they can be left in position for 14 to 21 days but, if it is necessary to change them, some of the tannic acid solution should be used to soften the compress and make it separate easily.

If the spray method is used, the burnt area is cleaned as already described and the solution is then sprayed all over the affected area with a fine atomizer, the spraying being repeated hourly for 10 to 24 hours. No dressing is applied, as a coating of coagulum is formed which is adequate protection. A bed cradle may be necessary to prevent pressure from bedclothes and a radiant heat bath may be employed

to assist the drying process and to assist in the prevention of shock. Waterproof sheets to protect bed linen are essential.

It may be necessary to repeat the spraying from time to time on subseqûent days, and it is essential that the solution should be freshly prepared.

647. Value of the tannic acid treatment.—The great value of this method of treating burns is that it promptly relieves pain and forms a protective coating to the burnt or scalded area, which prevents the loss of fluid from the body and also prevents the poison from the damaged tissues being absorbed into the blood stream, the commonest cause of death from burns. Healing is hastened and contraction of the tissues during healing is less than with any other method, although splints may be necessary to prevent deformities of the joints.

648. Suffocation from swallowing very hot water or by inhaling steam.—This is a common accident among children and is always serious. It may be followed rapidly by extreme swelling of the throat, causing obstruction to respiration, and death.

Treatment in such cases must be prompt, and the sufferer should be watched constantly. Apply fomentations to the front of the neck, from the chin to the top of the breast-bone (sternum). Keep the patient sitting up and give ice to suck. It is desirable that the sufferer should be seen at once by a M.O., as surgical treatment may be required at any moment, and the instruments for performing tracheotomy should be ready.

CHAPTER XXXIII

SHOCK, LOSS OF CONSCIOUSNESS, FITS AND EFFECTS OF HEAT

Shock

649. Shock is a condition of collapse produced by any severe injury or emotional disturbance. It is usual after severe operations, as the result of pain or of extensive injuries.

Shock may be described as *primary* or *secondary*, according to whether it comes on at the same time as the cause or at a later period.

Primary shock.—The symptoms come on at once and vary with the injury inflicted from a slight momentary faintness or giddiness, closely resembling a fainting attack, to immediate and complete prostration, insensibility and even death. The pulse at first small and weak, soon becomes irregular, extremely rapid and almost imperceptible; the countenance is pallid and shrunken and the brow covered with cold sweat; the respirations are slow and shallow, whilst the temperature is subnormal. After an interval, under appropriate treatment, reaction sets in which shows itself by increased strength and frequency of respirations and a stronger and slower pulse; the surface of the skin becomes warmer whilst consciousness and muscular power are gradually restored. During this period vomiting may occur.

Secondary shock is the condition into which an individual passes unless the primary shock has received appropriate treatment, and is a far more serious condition. Thus it occurs in the later stages of operations, after very severe injuries, and is aggravated by loss of blood, exposure to cold, absence of food, fear, etc. The symptoms of secondary shock are those of the later stages of primary shock. The patient lies in bed in a state of collapse. The surface of the body is cold and covered with a cold, clammy sweat; the pulse is weak and very often so rapid that it cannot be counted; the finger-tips, ears, etc., become blue; the respirations rapid and shallow; the patient is unconscious and, unless rapidly treated, dies quickly.

650. Treatment of shock.—In slight cases, nothing is required beyond resting for a few minutes, keeping the head well down and the use of ammonia or smelling salts. In more severe cases, the patient is wrapped up and kept warm with hot blankets or electric lamps placed under the bedclothes, care being taken, however, to protect him from being burnt, and hot drinks given. In the severest cases, the patient is laid flat with the head low, and steps should be taken to maintain the bodily heat with blankets and hot-water bottles, and to arrest hæmorrhage. Pain must be relieved and hot saline solution given by the rectum; when the patient can swallow, hot coffee may be given.

In war, many lives can be saved if steps are taken, at the earliest possible moment after a man is wounded, to prevent the initial primary shock, which may occur after wounding, from passing into the dangerous condition of secondary wound shock.

These consist of :—

(i) Warmth. Waterproof sheets and blankets should be carried by all stretcher squads and the wounded man should be covered over to keep him warm (*see* para. **75**). At dressing stations, some form of warming apparatus should be improvised over which stretchers can be placed.
(ii) The provision of hot drinks, such as hot sweet tea.
(iii) The prompt arrest of all hæmorrhage.
(iv) The relief of pain by the administration of a sedative such as morphia and the efficient splinting of fractures.
(v) Rapid evacuation, care being taken, however, to prevent further exposure to cold and additional pain or discomfort.

At a C.C.S., more elaborate arrangements can be made to revive patients suffering from shock :—

(i) The removal of wet and dirty clothes, drying and change into warm pyjamas and blankets.
(ii) More efficient warming by special apparatus or even radiant heat baths.
(iii) The special detailing of orderlies in resuscitation wards to encourage patients to drink.
(iv) The giving of infusions or transfusions of blood. All orderlies working in resuscitation wards must be familiar with the details of giving intravenous infusions or transfusions.

651. Intravenous infusion.—Various solutions have been used, but the most useful and valuable is gum saline solution. Strict aseptic precautions must be taken.

652. Blood transfusion.—This is a most valuable life-saving measure for severe cases of shock, especially where bleeding has occurred.

There are several methods of carrying out a blood transfusion ; the most usual and convenient method for use in war is known as the citrate method. In this the blood of the donor is drawn into a solution of 3·8 per cent. of citrate of soda, which prevents clotting taking place.

It is not possible to give a full description of the actual operation of a blood transfusion, but it is important to remember that the operation must be carried out with strict aseptic precautions. Two complete sets of instruments are required, one for the donor who gives the blood, and one for the recipient to whom it is given.

It is of interest to know that patients cannot with safety receive blood from any donor and the M.O. will have had tests carried out so that only a suitable donor is used who is free from any disease that could be transmitted to the patient, and whose red blood cells will not be destroyed when introduced into another man.

When such a case is found, the bloods of patient and donor are known as compatible.

All mankind is divided into four groups as regards their blood.

No. 1 group is known as the universal recipient and can safely receive blood from any other group.

No. 4 group is known as the universal donor and his blood can be safely given to any other.

These are general rules and some exceptions occur which can be guarded against by cross-matching the blood of the prospective donor against that of the patient to whom blood is to be given.

Loss of Consciousness

653. Insensibility or loss of consciousness.—The causes of this condition may be arranged in three main groups :—

(i) Failure of the blood supply to the brain.
(ii) Concussion or compression due to damage to the skull or brain.
(iii) The effect of drugs, such as opium, upon the brain.

The varieties of unconsciousness commonly met with are :—

(i) Syncope or fainting.
(ii) Concussion of the brain.
(iii) Compression of the brain.
(iv) Coma.

654. Syncope.—Fainting may be caused by over-exertion in hot weather or heated rooms, or by getting into the upright position when weak from disease, or it may result from hæmorrhage or starvation, or it may follow fear or great grief. A fainting fit is distinguished by the patient falling down in a helpless condition, generally insensible, without convulsions. The face and lips are pale and the surface of the body cold, often covered with a clammy perspiration.

Treatment.—All that is necessary is to place the patient in the recumbent posture with the head low, administer a stimulant in the shape of aromatic spirit of ammonia or ho coffee and keep the patient warm.

655. Concussion of the brain or stunning, due to injury to the brain caused by a blow on the head or falling in a sitting posture, is evidenced by unconsciousness more or less complete, although the patient may be roused by shouting. He lies on his back with muscles relaxed ; the eyelids are closed and the conjunctivæ may be insensitive ; the pupils may be contracted or dilated, but are equal in size and usually react to light. The surface of the body is pale, cold and clammy, the breathing slow and shallow, the pulse rapid and weak and the temperature subnormal. He may pass both fæces and urine unconsciously.

The condition may pass into deeper unconsciousness and death, or the signs of *reaction* may set in by deeper breathing and a stronger pulse, and the patient answers any question put to him ; he may turn over on his side and pull the bed-clothes up over his head. Gradually recovery occurs and leaves nothing behind beyond a severe headache.

It is very important to bear in mind that all head injuries, no matter how slight they may appear, should be regarded as serious for the first 48 hours. The patient should be kept in bed with his head low and not allowed to read or exert himself in any way during this period. In these cases serious symptoms often develop some little time after the injury.

Treatment.—The treatment resembles that for shock, viz., the patient is at once put to bed with his head low and warmth applied. If he is able to swallow, hot tea may be given and also a purge. The diet must be restricted, all stimulants avoided and the room darkened.

656. *Cerebral irritation.*—This condition, which sometimes follows concussion, is shown by great irritability of mind and body. The patient lies on his side with all the limbs flexed, the back arched and the knees drawn up to the abdomen. He is restless and may toss about the bed, the eyes are closely shut, the pupils contracted and the temperature raised ; the pulse is quick but weak ; he is not unconscious but resents being spoken to or disturbed.

Treatment.—The patient must be kept quiet and free from noise, his diet light and nourishing, an ice bag placed to his head and the bowels kept open. He must be carefully watched, as such patients often attempt to get out of bed.

657. Compression is due to some pressure within the skull, such as depressed bone, hæmorrhage, pus, etc.

Symptoms.—The patient lies on his back in absolute unconsciousness. His breathing is slow and noisy, the lips and cheeks being puffed out each time ; the pulse is full and slow

at first, but later becomes rapid and irregular and the pupils are dilated. There may be bleeding from the ears and nose and paralysis of the limbs.

Treatment must be directed to removing the cause and usually necessitates an operation.

658. Coma from drugs or alcohol. This is a difficult condition to diagnose, and in arriving at a decision every care must be taken to exclude unconsciousness due to injury of the brain, sunstroke, etc.

The chief differences in unconsciousness due to opium and alcohol are :—

Opium	*Alcohol*
Drowsiness to complete coma.	Patient can be roused.
Pulse full and bounding or slow and weak.	Pulse bounding.
Face flushed or pale.	Face flushed.
Pupils contracted to " pin " points.	Pupils dilated.
Temperature normal or sub-normal.	Temperature always sub-normal.
Smell of opium.	Smell of alcohol, though this by itself is unimportant.

Treatment of opium and morphia coma.—(i) Begin treatment by washing out the stomach with the stomach tube, first with simple warm water and then with warm water to which 15 grains of permanganate of potash to the pint has been added. If a stomach tube is not available, an emetic must be administered. Vomited matter should be saved.

(ii) Give strong black coffee as a stimulant, keep the patient at walking exercise, provided that his pulse remains good.

(iii) When the heart's action appears to be failing, alcohol must be given by the rectum.

Treatment of alcoholic coma.—(i) At once empty the stomach by using the stomach tube or give an emetic, provided that there is no doubt as to the cause of the coma.

(ii) Turn the patient's head to one side if vomiting occurs.

(iii) Keep the body warm to prevent shock.

(iv) In all cases of suspected alcoholism a M.O. must see the case as soon as possible.

Fits

659. Fits.—A fit may be defined as an attack of unconsciousness with or without convulsions.

There are many causes of fits or convulsions. The common ones are :—Epilepsy, apoplexy and hysteria.

660. *Epilepsy* is the commonest form of fits and may be described in three stages:—

Tonic stage.—The head is drawn back and the jaws are fixed. The hands are clenched and the legs extended. Respiration is impeded and the initial pallor changes to a dusky or livid hue. The arms are flexed at the elbow, the hands at the wrists and the fingers tightly clenched into the palm. This stage lasts only a few seconds, to be followed by the

Clonic stage.—Muscular contractions give place to violent convulsive movements and the limbs are violently jerked about. The muscles of the face are in constant movement. The eyes are rolled and the eyelids are opened and shut. At this stage the tongue may be injured by being bitten. The dusky colour gives place to a pallor and a frothy blood-stained saliva escapes from the mouth. Fæces and urine may be passed. This stage lasts for two or three minutes and passes in to

Coma.—The breathing is noisy, the face flushed, the rigid condition of the limbs passes off and unconsciousness is complete. If left alone, the patient sleeps and awakes to complain of headache and dullness.

Treatment.—During the attack a piece of cork or rubber should be placed between the teeth and the clothes loosened, whilst the patient is kept lying down. The movements of his limbs should be restrained to prevent him from hurting himself, and in hospital the bedside table should be removed out of his reach.

661. *Apoplexy* is due to blocking or rupture of a blood-vessel in the brain.

The *symptoms* are those of compression of the brain which have already been given—

(i) Sudden onset.
(ii) Loss of consciousness.
(iii) Flushed face.
(iv) Respirations slow and noisy.
(v) Pulse slow.

Treatment.—(i) Rest in bed in a quiet room, in the recumbent position with the head raised.

(ii) An ice bag to the head.
(iii) Purgatives.
(iv) No alcohol or other stimulants.
(v) Hot-water bottles.
(vi) Milk diet, when the patient has recovered consciousness.

662. *Hysterical or functional fits.*—Very many fits are of this nature. These fits are characterized by the following points :—

(i) The patient falls carefully and never hurts himself.
(ii) There are no definite stages as in epilepsy.
(iii) The arms are waved mildly and the patient talks or shouts during the fit.
(iv) The patient is not wholly unconscious.
(v) There is no subsequent stupor or headache.

Treatment.—Leave the patient alone.

Effects of Heat

663. Heat prostration, sunstroke and heatstroke are caused by exposure to high temperatures, especially when associated with a moist atmosphere. A damp air checks evaporation from the skin and so lessens the amount of heat got rid of by the body. Where the dry bulb shows the temperature to be 120° F., or the wet bulb reads 85° F., heatstroke or sunstroke is likely to occur.

The symptoms of heat prostration are those of a fainting attack with giddiness or unconsciousness, weak pulse and a normal or subnormal temperature. The attack may end fatally and severe forms are often called " sunstroke."

True heatstroke begins with a high temperature, rapid pulse and dry burning skin, and the patient is usually delirious or comatose. He may have convulsions.

Treatment.—Remove the patient to the coolest available place. Loosen his clothing ; if the temperature is normal or subnormal, warm applications are necessary. Massage the limbs and body. In true heatstroke, lower the temperature by douching the head and body with the coldest water obtainable. The patient may be placed in a tub of water and rubbed vigorously with ice, if available. When the rectal temperature falls to 102°, stop all cold applications, wrap the patient in blankets and apply hot-water bottles to induce sweating. Watch carefully for any return of high temperature.

CHAPTER XXXIV

SUFFOCATION AND ELECTRIC SHOCK

Suffocation or Asphyxia

664. Asphyxia is the term used to indicate the conditions arising from interference with or stoppage of the respiratory act.

Causes.—Conditions within the air passages such as :— foreign bodies, scars from old burns, growths and abscesses, etc., cut throat, hanging, drowning, and certain diseases such as pneumonia, bronchitis and diphtheria, coal-gas poisoning, etc.

Symptoms.—The symptoms of asphyxia usually come on suddenly and require urgent and rapid treatment. The sufferer, who is unconscious, makes violent attempts to breathe, the eyeballs are staring, the veins in the neck are distended and prominent, the skin purple in colour owing to insufficient oxygenation of the blood, the pulse throbbing and in the final stages, if the condition is not relieved, convulsive movements of the limbs occur.

General treatment.—A rapid examination of the body should be made to discover, if possible, the cause. The chest and neck should be bared, the mouth opened, the tongue drawn forward and the back of the throat examined to exclude the presence of a foreign body and to see that the passages are clear. In making this examination, great care must be exercised, should such a foreign body be present, not to push it further down into the air passages, and steps should be taken to remove it at once. The patient must then be removed into the fresh air and artificial respiration applied at once. Breathing can sometimes be excited by dashing hot and cold water alternately over the patient's head and chest. Further aid in the shape of oxygen administration, the electric battery and venesection may be necessary.

Treatment of Special Conditions

665. Choking may be caused by pieces of meat, coins, false teeth, etc., lodging over the entrance to the windpipe and causing obstruction to respiration. The treatment consists in opening the patient's mouth and passing the forefinger carefully behind the foreign body in an endeavour

to hook it forward. In the case of children, hold them up by the legs and thump them between the shoulder blades. This suspended position may be adopted also in the case of adults.

666. Smoke or gas.—Remove the patient into the fresh air and apply artificial respiration, or in mild cases which show signs of returning consciousness, douching with cold water may be all that is necessary. Oxygen, if available, may be administered (*see* para. **749**).

667. Rescue from fire.—Before entering a burning building, whether to rescue inmates or not, put on a gas mask. If no gas mask is at hand, cover the nose and mouth with a wet handkerchief. Any individual entering a burning building should have water thrown over his clothes. In removing patients from the building, protect their heads and necks with wet handkerchiefs or blankets, if possible.

Electric Shock

668. Electric shock.—Contact with an electric circuit may produce very severe burns, shock, insensibility or death. The sufferer is unable to free himself, owing to the current depriving him of all power of movement.

It is imperative to act at once, but the rescuer must adopt certain precautions in order to protect himself.

Insulation.—He must stand on a non-conductor, *i.e.* a substance which resists the current; amongst such easily available substances are india-rubber shoes, linoleum, dry glass, dry bricks, dry sailcloth, and dry wood or straw.

Protection of the hands.—The hands must be protected both from the sufferer and the electric current by covering them with dry clothing, an india-rubber tobacco pouch, rubber hot-water bottle or folded newspaper. An attempt may be made to push or drag the patient away by a *dry* loop of rope, or a puttee, bandage or stick. All common metals and damp clothing are conductors of electricity and must therefore be avoided by persons attempting to rescue a patient. The treatment is the same as that for asphyxia.

Treatment of burns.—The local treatment of burns caused by electricity is exactly similar to that for ordinary burns or scalds described in Chapter XXXII.

CHAPTER XXXV

EFFECTS OF COLD

669. Frost-bite is the result of exposure to extreme cold. It comes on suddenly and requires prompt treatment. If it is neglected, gangrene and death of the part result. The parts most commonly affected are the fingers, toes, ears, hand, nose, and the parts over the cheek-bones.

How to recognize frost-bite.—If the part has been painfully cold and suddenly ceases to be so, suspect frost-bite. The part affected has a waxy-white appearance and is cold to the touch. There is loss of sensation and of power of movement in the part, but no pain, and so the patient may be unaware of the condition.

Prevention.—Encourage free circulation by regular exercise and avoidance of tight clothing such as tight puttees, knee-breeches; boots must be large enough to take two pairs of thick woollen socks easily, and for use in extreme cold must never be saturated with grease; otherwise the sweat is retained and the feet become wet. Ordinary trousers or "slacks" pulled down over the tops of the boots, with a half puttee wrapped round the ankle to keep the snow from getting between the boot and trouser, are recommended. Wind-proof clothes with leather, not metal, buttons, fingerless mits made of leather with a woollen lining, and fur caps with ear flaps make a suitable kit.

All officers and men should be taught to recognize and treat frost-bite. Daily inspections of the feet and socks should be made, and one pair of socks should be kept dry and carried inside the jacket. Do not grease the feet but keep them dry and rub them twice a day when the socks are changed.

Thawing frost-bitten parts by warming them in hot water or near a fire causes blood-filled blisters and gangrene. In the conditions where frost-bite is liable to occur, officers and men should get into the habit of scanning each other's faces, as by this means cases may be detected at an early stage.

Treatment.—In mild cases apply slight warmth by placing a warm hand over the part, or place the frost-bitten hand inside the shirt next the skin. Gentle rubbing with snow will

quickly relieve the condition. Rubbing should be continued until signs of circulation (*e.g.* the return of a normal colour of the skin) are re-established. Frost-bite recognized early and treated quickly passes off, but if it is neglected, death of the part follows.

670. Chilblains.—Parts of the skin in certain people, especially children and young persons, become inflamed as the result of exposure to cold and damp. The parts usually affected are the toes, heels, fingers and ears. A chilblain may amount to no more than a slight redness, but sometimes a blister forms which breaks, forming a "broken chilblain." The feet and hands should be kept warm and dry, and protected by suitable gloves and socks. Gentle rubbing in the early stages, and washing the parts with methylated spirit or menthol liniment is the best treatment. For a blister apply zinc or boric ointment and cover with lint and cotton-wool. Constitutional treatment is also necessary in the shape of regular exercise, good food and warm clothing.

671. Trench foot. *Causes.*—Anything which depresses the vigour of the circulation, *e.g.* fatigue, want of exercise, exposure to cold; prolonged standing in wet slushy mud when the weather is cold; constriction of the blood-vessels due to wearing tight puttees or tight boots or to pressure on the popliteal space from sitting or sleeping on the fire step of trenches.

Pathology.—The condition is primarily due to some damage to the walls of the blood-vessel caused by the effects of cold and a very reduced rate of flow of the blood. The vessel walls allow serum and even blood to escape into the tissues. This in turn affects the nerves supplying the blood-vessels, with the result that the feet may be flushed, sweat profusely and suffer loss of sensation or may become excessively painful. The lymphatics are unable to drain off this excess of fluid, and, if the foot is prevented from swelling by a hard boot, gangrene of the toes may occur.

Symptoms.—The condition comes on gradually and the early stage may escape notice. In the common form as seen at the aid-post the foot is swollen, sometimes enormously; it is usually painful, the skin is glazed and flushed or even of a purple colour; there may be blisters on the surface. In a few cases the foot is pale and cold but not swollen, and the patient suffers from severe neuralgic pains.

Treatment in mild cases.—The patient should have his feet thoroughly washed with a soap made up of soft soap, turpentine liniment and hot water, and afterwards with some

antiseptic lotion. He should be kept in bed with his feet elevated, the toes and feet being covered with some dry antiseptic dusting powder, such as a powder containing equal parts of boric acid and zinc oxide, and the toes should be separated by strands of aseptic gauze. If the feet are cold, they may be wrapped lightly in cotton-wool, and if hot, they should be exposed to the air and an evaporating lotion applied. A cradle may be required to take the weight of the bedclothes. As the pains and tenderness pass off, gentle massage with alcohol or boric powder, followed later by mild exercises, is indicated.

In the severer cases, a preliminary washing and disinfection should be carried out ; the blisters should be opened aseptically and the surface dressed with moist antiseptic dressings and then painted with a 1 per cent. picric acid solution in spirit.

If gangrene of the toes or foot sets in, strenuous efforts must be made to keep the affected parts absolutely dry by using some antiseptic powder.

General treatment.—In all cases a protective injection of anti-tetanic serum should be given. Aspirin, sodium salicylate or opium (1 grain) may be required for the relief of pain.

Prevention.—Trench foot begins as a painful swelling of the foot. It is likely to arise when the feet are continuously exposed to cold and wet in muddy trenches. Under these conditions the vitality of the tissues is lowered and the skin becomes soft, sodden and easily abraded. The germs of infection can then enter and produce a septic inflammation which may be very serious.

Trench foot can be prevented by carrying out the following precautions :—

General.—Keep the men as fit as possible under the military conditions prevailing by providing sufficient clothing and generous meals, which should be served hot whenever possible. To improve the circulation, men should have frequent short spells of work. Trenches should be kept as dry as possible by duckboards, drainage, etc. When off duty, the men should rest in a recumbent and not in a sitting position.

Local.—The essential thing is to keep the feet dry, warm and clean. Before going into the trenches, the feet should be well washed, dried and then dusted with powder, the composition of which is as given below.

Camphor	1 part
Borax	100 parts
Talc powder	900 ,,

Whilst in the trenches two pairs of clean, roomy socks should be worn, and these should be changed once or, if possible, twice daily, and the feet vigorously rubbed with camphor ointment, the composition of which is as follows :—

Camphor	1 part
Borax	16 parts
Soap	100 ,,

Care should be taken that the circulation through the feet is not impeded by tight boots, tight lacing, shrunken socks or tight puttees, and, if the trenches are very wet, long gum boots should be worn ; these should be dry when put on and sufficiently roomy to allow of two pairs of socks to be worn without squeezing the feet.

CHAPTER XXXVI

FOREIGN BODIES IN THE EYE AND EAR

672. In the eye.—*Foreign bodies*, which are usually small particles of coal dust, steel, etc., may lodge upon the eyeball or beneath the lid, causing severe discomfort, and, if not quickly removed, give rise to inflammation accompanied by considerable pain.

Removal of foreign bodies.—The patient should be placed facing a good light and careful search made. If on the eyeball itself and freely movable, the foreign body may be removed by means of the point of a handkerchief or a piece of lint. If it is not visible, systematic search must be carried out first in the interval between the lower lid and the eyeball. If it is under the upper eyelid, before attempting its eversion, pull the upper lid down over the lower lid and let it slowly slip back to its proper position ; this may wipe off the foreign body. If this fails, eversion of the upper lid, which is more difficult, should be tried. Place the patient on a chair facing a good light and stand behind him on the same side as the affected eye. Now with a probe or a match held in the left hand for the left eye, and in the right hand for the right eye, lay the probe or match horizontally along the eyelid

about half an inch from the free edge, having previously instructed the patient to close the eye lightly and look downwards. Then, maintaining a steady, gentle pressure backwards and upwards and at the same time grasping the free edge of the lid with the forefinger and thumb of the disengaged hand, quickly turn the lid up over the probe. Then withdraw the probe, still keeping the everted lid in position, when the foreign body can be gently removed.

Should the foreign body become embedded in the eyeball itself, nothing should be done before the arrival of the M.O. beyond putting in a few drops of sterilized oil; then, instructing the patient to shut the eye, place on the outside a piece of lint and lightly bandage.

673. *Burns and injuries by caustics.*—Burns by hot water, steam and hot ashes, and injuries by caustics such as lime, strong acids and alkalies, etc., are very serious and prompt action must be taken.

Treatment.—In the earliest stages of injury by caustics, as much as possible of the substance must be removed at once and with the greatest gentleness. Acids may be neutralized by dilute alkalies (bicarbonate of soda lotion, 3 per cent.), and alkalies by weak acids (boracic acid lotion) or milk. A few drops of castor oil or olive oil may be applied. In the case of hot water and steam, a soothing application should be applied and cold fomentations.

674. In the ear.—The external auditory meatus has often to be cleared of wax, and occasionally of some foreign body, which may be causing deafness, irritation or pain.

Such are usually dislodged and removed by syringing, only enough force being used to bring about the desired result, as the employment of excessive force may damage the drum.

The drum has occasionally been ruptured by syringing in cases where deafness has been assumed to be due to wax and where none existed; therefore, it is advisable always to examine the ear before syringing.

Instrumental delivery of a foreign body should only be undertaken by an expert. The drum of the ear has been known to rupture in artillery-men from gunfire. To prevent such accidents or possible deafness, suitable plugs are issued for occluding the ears.

CHAPTER XXXVII

ARTIFICIAL RESPIRATION AND DROWNING

675. Artificial respiration is a most valuable method of life-saving which may be required in cases of suffocation from fumes of charcoal, *choke-damp* in mining accidents or from hanging; also in cases of lightning stroke, severe electric shock or for failure of respiration during the administration of an anæsthetic.

It is, however, most commonly necessary in cases of apparent drowning.

Several appliances, on the principle of a see-saw, have been devised for keeping up artificial respiration for prolonged periods. They can be improvised by utilizing a service stretcher on a trestle.

676. Restoration of the apparently drowned.—Send immediately for medical assistance, blankets, stimulants and dry clothing, but proceed to treat the patient instantly on the spot, in the open air, whether ashore or afloat. The points to be aimed at are:—(i) The removal of all obstructions to the passage of air into the lungs; (ii) the restoration of the breathing; (iii) after breathing is restored, the promotion of warmth and circulation. The efforts to restore life must be persevered with for one or two hours, or until a doctor has pronounced life to be extinct. Efforts to promote warmth and circulation, beyond removing the wet clothes and drying the skin, must not be made until the first appearance of natural breathing; for, if the circulation of blood be induced before the breathing has begun again, the restoration of life will be endangered.

677. Schafer's method of resuscitation of the apparently drowned.—If breathing has ceased, immediately on removal from the water place the patient face downwards on the ground, with the arms drawn forward and the face turned to the side.

Then, without stopping to remove or loosen clothing, apply artificial respiration, as every instant of delay is serious.

To effect artificial respiration, put yourself astride, or on one side of, the patient's body, in a kneeling or squatting position, facing his head. Placing your hands flat on the small of his back, with the thumbs parallel and nearly touching,

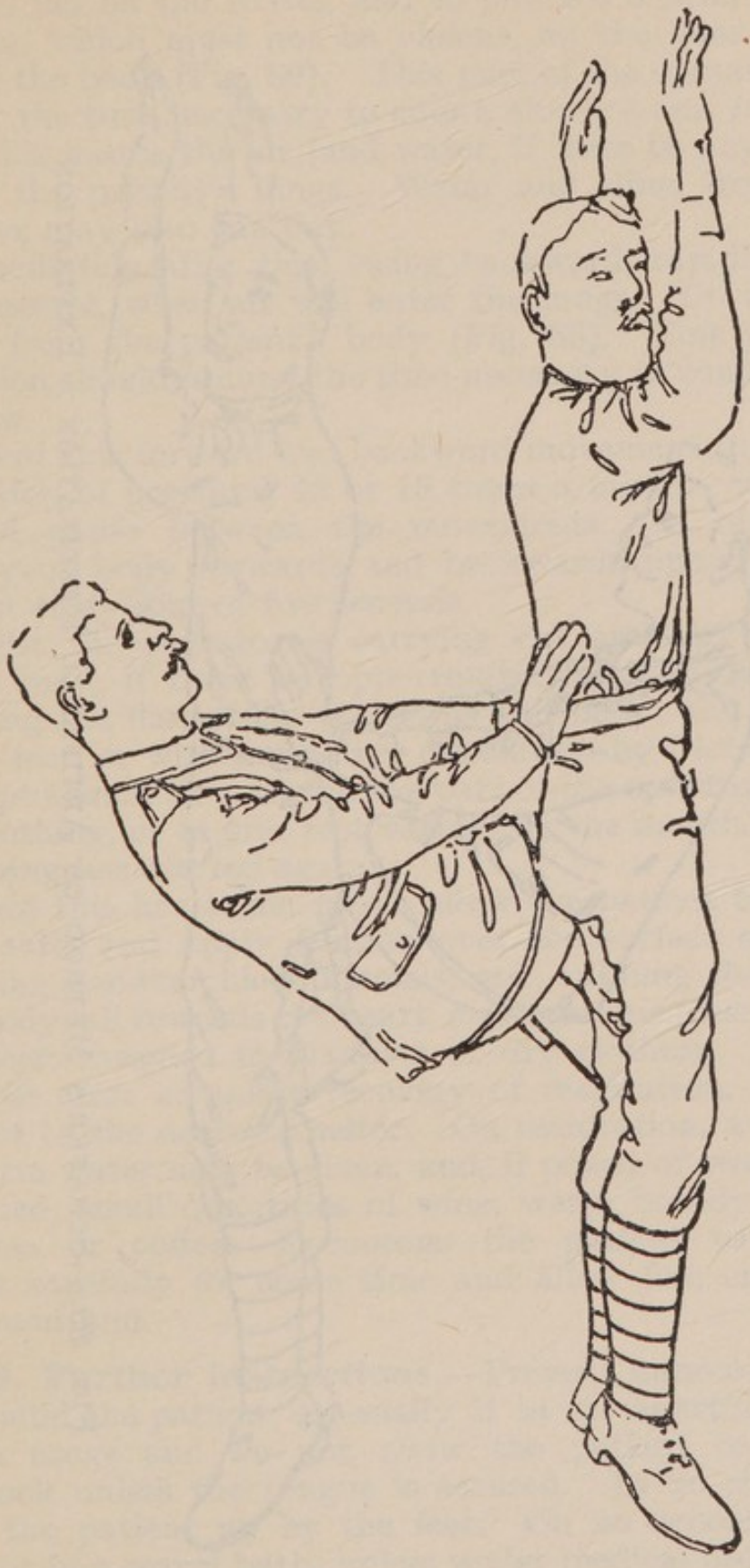


FIG. 88.—SCHAFER'S METHOD OF ARTIFICIAL RESPIRATION: INSPIRATION

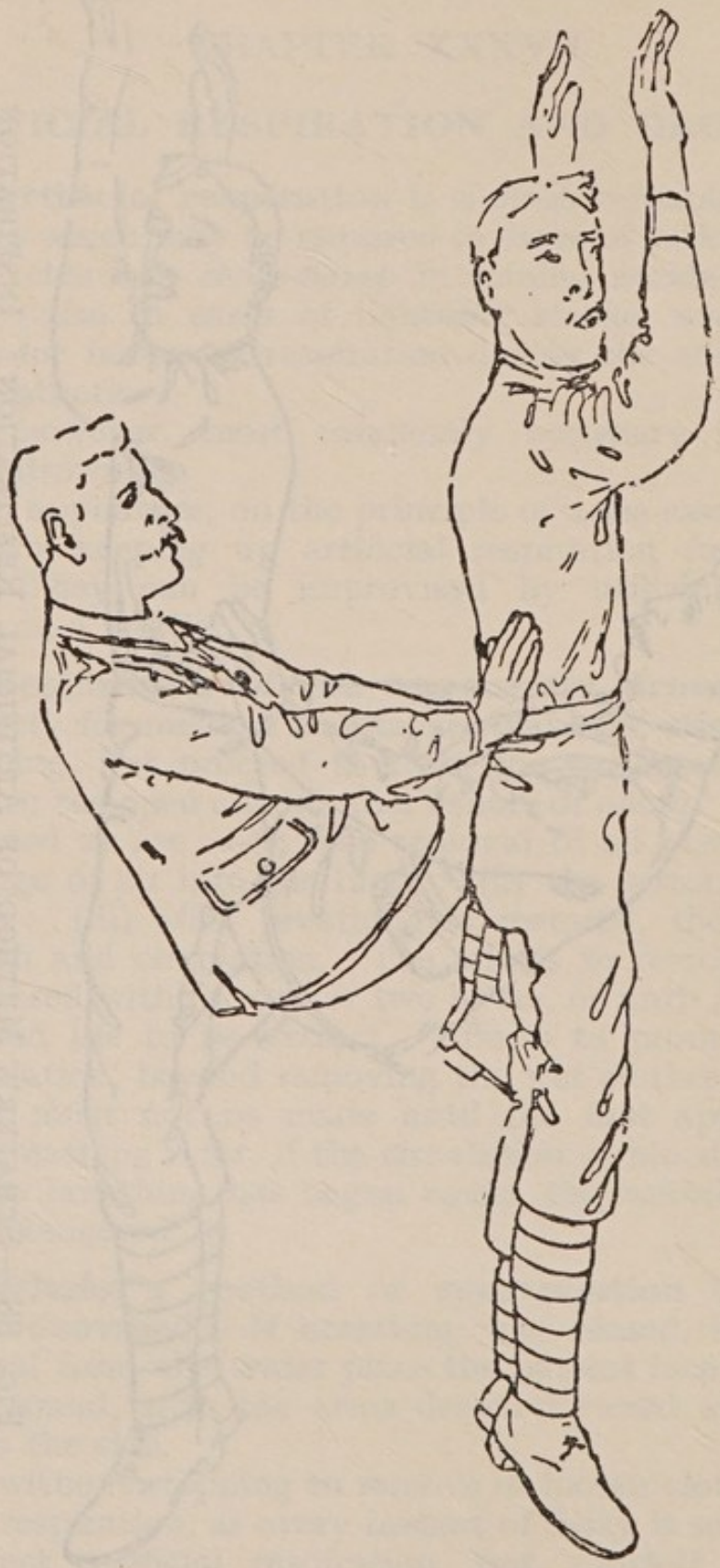


FIG. 89.—SCHAFER'S METHOD OF ARTIFICIAL RESPIRATION: EXPIRATION

and the fingers spread out over the lowest ribs, lean forward with the arms straight and steadily allow the weight of your body to fall on the wrists, and so produce a firm, downward pressure, which must not be violent, on the loins and lower part of the back (Fig. 89). This part of the operation should occupy the time necessary to count, slowly—*one, two, three.*

By this means the air (and water, if there be any) is driven out of the patient's lungs. Water and slime from the air-passages may also run out.

Immediately after this, swing backward, rapidly releasing the pressure, when air will enter the lungs. Do not lift the hands from the patient's body (Fig. 88). This part of the operation should occupy the time necessary to count, slowly—*one, two.*

Repeat this forward and backward movement (pressure and relaxation of pressure) 12 or 15 times a minute, without any marked pause between the movements. In other words, sway your body forwards and backwards upon your hands once in every four or five seconds.

Whilst the operator is carrying out artificial respiration, others may, if there be opportunity, busy themselves with applying hot flannels to the limbs and body, and hot bottles to the feet, or with promoting circulation by friction ; but no attempt should be made on the part of the operator to remove wet clothing, or to give restoratives by the mouth, till natural breathing has started again.

When this has taken place, allow the patient to lie on the right side, and apply friction over the surface of the body by using handkerchiefs, flannels, etc., rubbing the legs, arms and body, all towards the heart, and continue after the patient has been wrapped in blankets or dry clothing. As soon as possible after complete recovery of respiration, remove the patient to the nearest shelter. On restoration, a teaspoonful of warm water may be given, and, if power of swallowing has returned, small quantities of wine, warm brandy and water, beef-tea or coffee. Encourage the patient to sleep, but watch carefully for some time and allow free circulation of air round him.

678. Further instructions.—Prevent unnecessary crowding round the patient, especially if in an apartment. Avoid rough usage and do not allow the patient to remain on his back unless the tongue is secured. In no circumstances hold the patient up by the feet. On no account place the patient in a warm bath, unless under medical orders.

679. Rescuing a drowning person.—Although this is not necessarily the work of the R.A.M.C., a description of how

to rescue a drowning man in the water may be useful. The means to adopt are :—

(i) *When the drowning man is quiet or unconscious.*— When the drowning man is quiet, he should be turned on his back ; the rescuer takes hold of him with one hand on each side of the head, and conveys him to the shore, the rescuer swimming on his back. The drowning man's face should be held high above the water, and the rescuer should swim slowly with even movements.

If the man is unconscious, he should be supported by placing an arm under his chest and letting his neck rest on the shoulder. The rescuer works with his free hand as well as with his legs.

(ii) *When the drowning man is violent.*—When the man has lost self-control from fright, and struggles or tries to seize the rescuer, the latter must catch him from behind, thrusting his hands under the man's arm-pits and placing them on the chest, at the same time lifting the man's arms towards the surface to give the rescuer a better grip. The man is conveyed ashore by the back-stroke.

Sometimes the rescuer has to free himself from the drowning man's clutch. When the drowning man grips his wrists from above, the rescuer should draw his arms together inwards and upwards over the man's arms, and then force them out sideways. If the drowning man grips his wrists from below, the rescuer must swing his arms quickly in a circle inside the drowning man's, and then push them downwards, and out sideways. In the case of one hand or arm being gripped, the rescuer frees himself by bending his arm (assisting with his free hand) in the line of the man's thumb. In case the drowning man grips his neck or catches his arm or waist, the rescuer stoops over him quickly, and seizes him with one arm round the waist just above the hips, drawing him nearer to him ; and with the other arm—the hand being pressed against the man's nose and mouth, the butt of the hand under the chin—pushes his head and upper part of the trunk backwards. Should the drowning man not release his grip at once, the rescuer must bend one of his knees up against the lower part of the body, and pushing against this, force the man away from him.

CHAPTER XXXVIII

POISONING

680. Poisoning is one of the most urgent conditions with which we are called upon to deal. The cases are comparatively uncommon and occur suddenly and without warning, so it is essential to be prepared for these, as a successful issue depends on prompt treatment.

Definition.—A poison may be defined as " A substance—fluid, solid or gaseous—which, when introduced into the body in harmful quantity, is capable of impairing the functions of the body and seriously affecting health, or of injuring tissues and destroying life."

681. How poisons act.—Poisons injure health or destroy life in various ways, according to their nature. Their action may be said to be local or remote. They kill or threaten life either by destroying the tissues with which they come in contact or they produce these effects by being absorbed into the circulation, and acting on organs more or less remote from the point of their absorption such as the brain or spinal cord and the heart.

682. Poisons produce their effects in one of the following ways :—

(i) By actually burning the parts they touch, *i.e.*, the mouth, throat and stomach, and causing shock ; or by making the parts swell up so as to suffocate the patient. These poisons are called CORROSIVES ; they may be acids or alkalies—oil of vitriol is an example of an acid, and caustic potash of an alkaline corrosive.

(ii) By so irritating the parts they touch, such as the throat, stomach and bowels, as to cause inflammation, often severe in degree ; this inflammation gives rise to pain, vomiting, and later on to diarrhœa which may kill the patient by exhausting him. These are called IRRITANT poisons, examples of which are arsenic, phosphorus, decomposed foods, etc.

(iii) By being absorbed into the blood and producing their poisonous action on the brain, nerves, heart, blood or other important organ, and so interfering with their functions that death ensues. Examples of these are opium, chloroform, strychnine, prussic acid, snake-poison, arsenic. These are called SYSTEMIC (*i.e.* constitutional) poisons. Some poisons of this group are also called *narcotic poisons*, as they cause insensibility, *e.g.* alcohol and opium. It is not unusual to find that certain irritant poisons produce dangerous results on vital organs, when they become absorbed into the blood, in addition to their local irritant effects, *e.g.* arsenic and carbolic acid. Carbon monoxide, a constituent of coal gas and of the exhaust gases of petrol engines, etc., exerts its poisonous effects by combining with the hæmoglobin of the blood, and displacing the oxygen.

683. Treatment.—In all cases of suspected poisoning, medical assistance should be sent for immediately, and the directions here given should be followed at once by the orderly, as no time must be lost.

Two main principles must be borne in mind in the treatment of cases of poisoning :—

First.—Try to remove the poison already taken, if possible or advisable.

Second.—Try to lessen the poisonous effect by giving the proper remedy, sometimes called the antidote.

General lines of treatment.—(i) Remove the poison from the stomach.

(ii) Neutralize in the stomach what cannot be removed, and also what has been absorbed into the body.

(iii) Assist in getting rid of the poison from the body through the urine and intestine.

(iv) Treat urgent and dangerous symptoms.

The *siphon-tube* is the best means of removing *irritant, mildly corrosive and narcotic* poisons from the stomach. Where a siphon-tube is not available, the most easily procurable *emetics*, such as mustard and water, or salt and water, should be freely used. When the poison swallowed is known, a suitable chemical *antidote* dissolved in water should be administered.

Until medical assistance is available, the orderly must do all he can for the patient by the administration of suitable antidotes and by trying to counteract the shock by warmth.

Any poison remaining in the vessel in which it was contained, all vomited matter, or anything likely to prove of importance in the inquiry that is sure to take place subsequently, must be carefully preserved.

When a poison of which the nature is unknown has been swallowed, the following preparation may be administered freely in water :—

Carbonate of magnesia	}	Equal parts.
Powdered charcoal		
Hydrated peroxide of iron ...		

This powder is harmless, and is an antidote to many of the most common and active poisons. Hydrated peroxide of iron may be obtained by precipitating half an ounce of liquor ferri perchlor in half a tumbler of water with an equal quantity of a saturated solution of washing soda. This is quickly strained through a handkerchief and the precipitate used. Milk, or flour and water, may also be given.

684. Corrosive poisons.

Symptoms.

The symptoms come on immediately ; directly after the poison has been taken there is violent burning pain which extends from the mouth to the stomach ; the mouth and lips are stained and blistered ; there is shock and perhaps difficulty in breathing ; brownish or blackish vomit which stains the clothes or carpet upon which it falls ; there is intense thirst ; swallowing is difficult and painful.

Treatment.

Do not give emetics.—If the smell is sour, probably the poison is an acid, in which case magnesia-mixture, lime-water, or chalk and water, linseed or olive oil poured into the mouth help to stop further action by neutralizing the acidity. If the breath smells of ammonia or does not smell acid, probably the poison is an alkali, in which case some weak vinegar and water or lime-juice should be administered. Apply hot-water bottles to the feet and other means for restoration from shock. Use remedies as soon as possible. Have the tracheotomy instruments in readiness.

Scrapings from white-washed wall or ceilings may

well be used in emergency as an antidote for acids. Use weak liquor ammoniæ (liquid ammonia), or aqua calcis (lime-water), to neutralize acids rather than carbonates, as the latter produce so much gas on combination that perforation of the stomach may result.

Vinegar is the safest acid to administer.

The following are the most common corrosive poisons :—

Oil of vitriol (sulphuric acid), spirits of salts (hydrochloric acid), nitric acid, caustic soda, caustic potash, strong ammonia, oxalic acid (salts of sorrel or lemon) and carbolic acid.

685. Irritant poisons.

Symptoms.

There is faintness **and** depression accompanied by a feeling of sickness. The pain is not at first generally very great ; there is a sensation of burning, or a strong taste in the mouth and throat, coming on quickly if the poison is liquid, and less quickly if it is solid when taken. The parts touched by the poison are not burned ; the pain is not so great as in the case of a corrosive poison, but it gradually increases ; nausea, retching and vomiting set in early, accompanied by pain in the stomach ; there is diarrhœa with straining, and sometimes blood in the stools. There is intense thirst, the pulse becomes weak and rapid, the face anxious, the skin cold and clammy, and in the later stages there is shock, convulsions and coma.

Treatment.

Give emetics. Give warm water and encourage vomitting until the water returns clear ; then milk or white of egg, oil or melted butter to allay the irritation. Get the stomach-tube ready.

In phosphorus and cantharides poisoning, butter or oil should *not* be given.

The following are the most common irritants :—

Copper, stale or badly-tinned fish or meat, arsenic, antimony (tartar emetic), perchloride of mercury, zinc, iodine, cantharides and powdered glass.

686. Systemic poisons.

Symptoms.

There is no sign of burning, redness, or pain, but there may be giddiness, dimness of sight, drowsiness (gradually increasing) ; difficulty in breathing, irregular or weak pulse, delirium, cramps, convulsions. The pupils of the eyes are either widely open or tightly closed, according to the particular system of the body affected — nervous, vascular, respiratory, etc.

Treatment.

Give emetics. The stomach must be emptied by means of emetics or the stomach-tube. The symptoms must be treated ; that is, in case of drowsiness, the patient must be kept awake by being walked about, cold water being freely used, and hot coffee given. If the drowsiness becomes greater or the breathing threatens to fail, artificial respiration should be resorted to, sometimes for hours ; if the pulse is weak, give ammonia (sal volatile) ; if there are cramps, gently rub the limbs ; if delirium or convulsions are present, the patient should be carefully watched and kept as quiet as possible, and the special antidote for the poison administered.

The following are the common systemic poisons :—

Opium, chloroform, strychnine, prussic acid, arsenic, snake-poison, alcohol, drugs of the veronal group and carbon monoxide.

Carbon monoxide poisoning.—Carbon monoxide poisoning has become more common through the widespread use of motor cars.

Treatment.—Artificial respiration in fresh air, warmth and stimulants. If a cylinder of oxygen, or better still, oxygen +5 per cent. CO_2 is available, it should be used without delay for inhalation, combined with artificial respiration, unless the patient is breathing freely.

687. Emetics.—The following may be administered to produce vomiting :—

(i) Mustard : one tablespoonful to a tumbler of water.
(ii) Salt : one tablespoonful to a tumbler of water.
(iii) Sulphate of zinc : 30 grains in an ounce of water.
(iv) Ipecacuanha : 20 to 30 grains of the powder ; or, one to two tablespoonfuls of the tincture.
(v) Ammonium carbonate : 30 grains in an ounce of water.
(vi) Tickling the patient's fauces with a finger or a feather.

Remember that an emetic properly given may save the patient's life, but must not be given in a case of corrosive poisoning.

688. Demulcents.—

(i) Milk.
(ii) Olive oil.
(iii) Gruel.
(iv) Fine oatmeal gruel.
(v) White of egg.

689. Stimulants.—

(i) Brandy.
(ii) Smelling salts.
(iii) Strong coffee.
(iv) Aromatic spirit of ammonia.

690. Snake-bite, stings of insects, etc.—The poison is conveyed into the wound in snake-bite by means of a hollow fang which communicates with poison bags in the head of the snake. In certain snake-bites the poison is very powerful and may cause death very rapidly. Every endeavour should be made to prevent the poison from reaching the circulation. To do this :—

(i) Apply a tourniquet tightly round the limb some distance above the wound and between it and the heart, so that the circulation in the limb is stopped. For this purpose a piece of stout cord, a handkerchief, a strip of shirt, etc., may be used.

(ii) Give at once an ounce or more of brandy or other stimulant, as snake poison tends to stop the beating of the heart. If antivenene is available, get it ready for the M.O.

(iii) Lay open the wound freely and encourage free bleeding. If permanganate of potash crystals are available, rub some into the wound.

(iv) If the shock is very severe or the breathing becomes shallow, apply artificial respiration.

(v) If the bite is on the face or a part of the body where a band cannot be placed to check the circulation, the wound should be cut open freely to encourage bleeding and crystals of permanganate of potash should be rubbed in.

Insect bites should be painted freely with a solution of iodine.

CHAPTER XXXIX

SURGICAL INSTRUMENTS AND APPLIANCES

691. Description of instruments.—The following are brief descriptions of some of the instruments and appliances in most common use :—

Aspirator.—An instrument for drawing off fluids by means of an exhausting air-pump.

Bistoury.—A long, narrow knife, which is either straight or curved, sharp or blunt-pointed.

Bistoury, hernia.—A long, narrow knife, blunt except for about the space of an inch from the point, which is also blunt, used in the operation for rupture.

Bougie.—An instrument used for dilating strictures.

Catheter.—A tube for passing through the urethra into the bladder to draw off the urine. Catheters are either made of silver or silverplate, or of gum-elastic, or india-rubber ; they contain a wire called a *stylet*. French olivary catheters and soft rubber catheters are flexible and have no stylets. In the metal and gum-elastic catheters the eye is near the point. In French catheters it is 1½ inches from the point. English catheters are numbered from 1, the smallest, to 18, the largest ; French catheters from 1 to 30.

Caustic-holder.—A little case for holding caustic, usually made of vulcanite or silver.

Clamps, stomach.—For clamping the stomach during operations such as gastro-enterostomy.

Clips, Michel's.—Small metal clips used for closing an incision through the skin instead of sutures. There are special forceps for introducing and removing them.

Curette, adenoid.—An instrument used for removing adenoid growths from the naso pharynx.

Director.—an instrument with a groove in which to guide the point of a knife.

Drainage-tubes.—India-rubber or glass tubes used after operation for draining a wound.

Elevator.—An instrument for raising depressed pieces of bone.

Enema-apparatus.—An instrument for administering enemata.

Evacuator for stone.—An instrument used for washing out of the bladder the debris of a stone which has been crushed.

Forceps, dental.—An instrument used for extracting teeth.

Forceps, dissecting.—Plain forceps used for dissecting purposes.

Forceps, dressing.—Forceps with scissor-handles, used for removing old dressings, etc., from wounds and sores.

Forceps, Ferguson's clawed or lion-forceps.—A strong forceps with claws, used for gripping bone where much force is required.

Forceps, gouge.—A strong forceps, cutting at the points, so as to gouge bone.

Forceps, bone.—A strong forceps for cutting bone in operations.

Forceps, phimosis.—Forceps for holding the foreskin in the operation of circumcision.

Forceps, polypus.—Forceps for grasping small tumours usually in the nasal cavity.

Forceps, rib.—Forceps used for cutting away portions of ribs at operations on the chest.

Forceps, sinus.—Forceps for introduction into a sinus, which is a tubular cavity.

Forceps, Spencer Wells' or pressure-forceps.—Forceps for the compression of bleeding vessels during operations.

Forceps, tissue, Lane's.—Forceps used for holding flaps, etc., during an operation.

Forceps, tongue.—Forceps for holding the tongue, often used when giving anæsthetics.

Guillotine, Tonsil.—A sliding knife for removing the tonsil.

Hernia-director.—Made of steel, and broader than the ordinary director, used for the operation for strangulated hernia or rupture.

Insufflator.—A tube used for blowing powder into some cavity, such as the throat.

Irrigator or douche.—A metal or glass vessel to which a tube is attached fitted with a nozzle and stop-cock, used for flushing or washing wounds with boiled water or antiseptic lotion.

Laryngoscope.—An instrument for examining the throat and larynx.

Laryngotomy tubes.—Like tracheotomy tubes but flatter and used for introduction through the skin of the neck into the larynx.

Lenses, test.—Glasses of various powers used for testing the eyes.

Ligatures.—Threads of sterilized silk, linen, catgut or tendon used for tying up blood-vessels.

Lithotrite.—An instrument used for crushing a stone in the bladder.

Needle, aneurysm.—A curved, blunt instrument with an eye near the end, used for passing a ligature under an artery.

Needle, cataract.—A needle, without an eye, in a handle, used in the operation for cataract.

Needle-holder.—A strong, special forceps for holding a needle to put in stitches during operations.

Needle, surgical.—Curved and straight needles of various sides.

Œsophagoscope.—An electrically lighted instrument for examining and operating on the gullet.

Opthalmoscope.—An instrument for examining the eyes.

Paul's tubes.—Glass tubes used to drain the intestine at operation for intestinal obstruction.

Plates for fractures, Lane's.—Steel plates which are attached by screws to bone to fix a fracture.

Post-mortem case.—A case containing the instruments used in the examination after death.

Probe.—A silver instrument for probing wounds.

Retractor.—A blunt hook or flat piece of metal, bent at an angle for holding apart the edges of a wound during operation.

Retractor, amputation.—A special shield used to hold back the tissues in sawing the bone at an amputation and to prevent bone dust from getting into the wound.

Retractor, self-retaining.—A double retractor for use at abdominal operations, which does not require to be held by an assistant.

Saw, Albee's.—An electrically-driven circular saw used for cutting bone grafts.

Saw, amputating.—A saw used for sawing the bone in the amputation of a limb.

Saw, Butcher's.—A framed saw, the invention of Mr. Butcher, used for the same purposes as the amputating saw, but more especially for the excision of joints.

Scalpel.—A short knife with a curved edge, made in different sizes and used for cutting and dissecting.

Scoop.—A spoon-shaped instrument used for scraping various growths, etc.

Shears, rib.—A large scissors-like instrument used for cutting the ribs.

Snare, wire.—A special wire which can be drawn tight around a polypus or a tonsil during an operation for removal.

Sound.—An instrument for feeling what is beyond the reach of the fingers.

Spatula.—A blunt knife for spreading ointment; also an instrument used for depressing the tongue when an examination is being made of the throat.

Speculum, eye.—An instrument used to keep the eyelids apart during an operation on the eye.

Sterilizer.—An apparatus for killing germs on instruments or in dressings by means of heat.

Stethoscope.—An instrument with which to listen to the sounds in the chest.

Stomach-tube.—An apparatus used for washing out or emptying the stomach.

Sutures.—Threads of wire, silk, catgut, silkworm-gut, horsehair, or tendon used by the surgeon for stitching wounds.

Syringe.—An instrument made of glass or metal, used for injecting or withdrawing fluids.

Syringe, enema.—An apparatus consisting of an india-rubber pump to be squeezed by the hand, and two pipes, one fitted with a nozzle to pass into the anus, and one with a pewter end to slip into the basin containing the fluid to be injected.

Syringe, hypodermic.—A graduated glass or metal syringe fitted with a hollow needle, employed in the injection of medicines beneath the skin.

Syringe, lumbar puncture.—A syringe with a special long and very fine hollow needle for drawing off cerebro-spinal fluid for examination and for introducing spinal anæsthetics such as percaine.

Thermometer, clinical.—A closed glass tube containing a bulb and a fine column of mercury for registering the temperature of the human body.

Tourniquet.—An instrument for making pressure on an artery to stop the flow of blood through it.

Tracheotomy-tubes.—Two curved, silver tubes, one fitting inside the other, used for putting into the windpipe when it has been opened by an operation called tracheotomy.

Transfusion apparatus.—An apparatus used for the transfusion of blood by the citrate method.

Trephine.—A tubular saw, used in operations on the skull.

Trocar and canula.—A sharp-pointed instrument and sheath for tapping collections of fluid. Large, for tapping the belly or chest; small, for tapping hydrocele.

Truss.—An appliance used to keep the bowel in its place in cases of rupture.

Urethroscope.—A special instrument, electrically illuminated, for examination of the urethra.

Note.—Instruments and appliances authorized for military hospitals are shown in Regulations for the Medical Services of the Army and lists of contents of articles of field medical equipment are contained in the Field Service Manual for the Medical Services of the Army.

SECTION 10—NURSING

CHAPTER XL

INTRODUCTORY NOTES

692. Disease is in most cases the result of germs getting into the body and growing in its tissues. The entry may be through the skin, *e.g.* by an insect bite, as in malaria; by way of the mouth, *e.g.* in food or drink, as in enteric fever, dysentery and cholera; or by the respiratory tract, as in pneumonia, diphtheria and often tuberculosis of the lung.

Having gained entrance, the germs grow and increase enormously in numbers, at the same time forming special poisons called toxins, which produce local and general effects. As examples of local effects we have the sloughing and ulceration of the bowels in enteric fever and dysentery, the profuse diarrhœa of cholera, the inflammation of the lungs in pneumonia, and the formation of a membrane in the throat in the case of diphtheria; as examples of general effects we have fever, sweats, general wasting and weakness, prostration and delirium. Such evidences of disease are called "signs" and "symptoms."

When germs invade the body and form their poisons, the body responds by bringing its defensive forces into action; the process is somewhat complicated and cannot be explained in a few words. For our present purpose it is sufficient to note that all the organs of the body take part in its defence either by destroying the invading germs or by neutralizing the effects of their toxins. In a serious illness this defence requires the whole of the resources of the body.

In certain diseases we are able to assist the body by administering drugs that have a direct action on the invader, *e.g.* quinine in malaria, but in every case we are more or less dependent on nature's processes of cure, when the best assistance that can be given is efficient nursing.

693. The first essential in nursing is to place the patient at rest. By this is meant avoiding everything that might cause unnecessary expenditure of energy and weaken his powers of defence.

The patient's digestion is enfeebled and his diet must be regulated accordingly; otherwise the presence of undigested

food in the stomach and intestines causes great discomfort and aggravates the condition ; it may even be dangerous (*e.g.* causing hæmorrhage in enteric fever).

As little nourishment is being obtained by way of the mouth, the body, in order to obtain energy to fight the disease, has to draw on its own resources, its own storehouses. The fat of the body, the liver and the muscles are storehouses of food material which are drawn upon in this emergency to supply the heart, blood and blood-forming organs with nourishment : hence the food-energy of the fat and muscles must be conserved by protecting the patient from cold and keeping his muscles at rest.

The strain of illness falls mostly on the heart. As the result of fever, it beats more rapidly and expends more energy and at the same time it is poisoned and weakened by the toxins. Hence the importance of easing its work by keeping the patient in bed. The neglect of this precaution may have serious consequences ; for instance, in dysentery it is not uncommon for patients to faint if they are allowed to get up and go to a lavatory instead of using a bed-pan, and in the course of a severe illness even sudden sitting up in bed may cause fatal failure of the heart.

The heart and the nervous system are closely connected, and anything that weakens the nervous system weakens the heart. Hence the patient must be kept free from excitement and worry and, if possible, from pain, and given every encouragement to sleep.

694. The second essential in a good nurse is trained and careful observation of the sick. When a patient reports sick, he complains of certain things, and these are called his "symptoms." The M.O. then looks for the "signs" of disease. Now, if the nursing orderly takes an intelligent interest in the symptoms complained of, he can assist greatly in the diagnosis. For instance, if a patient complains of a cough and of spitting up phlegm, the orderly should at once give him a sputum cup for collection of the sputum ; its examination may disclose the nature of the disease.

The first thing that the M.O. asks for when he visits a patient is the nurse's report. He himself has to rely, so far as his own observations go, on a short visit to the ward, which may be at a time when the patient is not at his worst and it frequently happens that the patient's condition varies from hour to hour. The nursing orderly, therefore, whilst cultivating his powers of observation, must be able to place his observations on paper, and should practise the writing out of reports, which must be short and clear.

695. Successful nursing must, however, depend on the ability of the nurse to assist the patient and relieve his suffering. This is put to the test in dealing with a helpless patient. It is not enough to place him at rest in bed, wash him, feed him, make his bed and give him the bedpan. A helpless patient tends to lie inert on his back—a position that is apt to produce congestion or waterlogging of the lungs, which might be sufficient to cause a fatal ending. The position of the patient must be altered from time to time so that he lies on one side or the other or with the shoulders raised.

Another condition that threatens the lungs is a neglected dirty mouth. Accumulation of sordes and mucus in the mouth means excessive growth of germs, and this may extend down the respiratory passages to the lungs and cause septic pneumonia, or the extension may be along the duct through which comes the saliva from the parotid gland and cause inflammation of that gland.

The greatest care must be taken to prevent bedsores forming (*see* para. **725**), as, when once formed, they are not only a great source of discomfort and pain but dangerous to life if they become septic. Apart from the prevention of bedsores, a great deal can be done to alleviate discomfort by attention to the skin. The skin, along with the kidneys, performs a very important function in getting rid of waste products which would be harmful if allowed to accumulate. Hence the action of sweating is an important one. In some diseases sweating is a very marked symptom (*e.g.* rheumatic fever, Malta fever, malaria), and the skin is apt to become sodden with lessened resistance to the invasion of germs, in which condition prickly heat and boils may readily develop; also, if damp clothes are allowed to remain on a patient, he may get chilled and develop rheumatism or pneumonia.

696. Finally, it is essential that a nurse should understand the principles of disinfection. He must keep in mind the fact that a sick man is a possible source of infection, not only directly to his attendants and those who come in contact with him, but indirectly to others.

CHAPTER XLI

MANAGEMENT OF WARDS

697. Ventilation of wards.—By ventilation is meant the supply of fresh air to and the removal of impure air from an apartment. To render the condition of a ward wholesome, it is necessary not only to regulate its temperature but to provide for the ingress of a supply of fresh air at all times, day and night.

Composition of air.—Air consists almost entirely of two gases, oxygen and nitrogen : of the former rather more than one-fifth ; of the latter slightly less than four-fifths. There is, in addition, a minute trace of a poisonous gas called carbonic acid gas, and a small quantity of watery vapour. In the wards of a hospital the air very soon becomes loaded with impurities.

Every individual in the ward is constantly engaged, during the act of respiration, in removing oxygen from and adding carbonic acid gas to the air. The atmosphere is rendered still more unwholesome by emanations from the patients' bodies, their linen and excreta, by any foul wounds or soiled dressings, and by the burning of gas, each jet of which consumes many times as much oxygen as a man.

From these facts it will at once be seen how important it is that the personal cleanliness of patients should be constantly attended to, and that all excreta or soiled dressings be removed from the ward without delay. In addition, in order to counteract this continual fouling of the atmosphere, a frequent and thorough changing of the air is necessary.

Principles of ventilation.—The principles to be kept in view are :—(i) That the air within the ward must be kept as nearly as possible as pure as that outside, without chilling the patients. (ii) That the temperature of the ward must be maintained at or near 60° F. (iii) That ventilation must be systematic and sufficiently thorough to renew the air in a ward completely at least three times in an hour.

There are two simple but all-important facts to be remembered in carrying out the principles of ventilation :—(i) Air expands when it is heated : from this it follows that, as the air in the room expands, some of it escapes by the nearest outlet. (ii) As a result of its expansion, hot air is lighter than cold air : on this account hot air will rise, and cold air, being heavier, will fall.

Outlets.—Foul air escapes from the room by the fireplace, the windows and ventilating outlets.

Being lighter than the pure air, foul air will be found in the upper part of the room. Ventilating outlets are therefore usually placed in the ceiling. For the same reason the windows should be left open at the top to enable the warm, impure air to escape.

The fireplace is a most important aid to ventilation, as, when a fire is burning, there is a constant current of air, leaving the room by the chimney.

Inlets.—Fresh air enters a room by ventilating inlets and the windows.

In hospitals, the ventilating inlets are so arranged that the amount of air entering by them can be regulated and generally diffused over the room, so preventing draughts.

In recently built hospitals, the air, on entering these ventilators, is warmed by coming in contact with hot-water pipes. In the absence of hot pipes, the cold air should be introduced above the level of the patients' heads, so that it reaches them after mixing with the warm air of the ward. Windows have already been considered as outlets for foul air ; they also act as inlets for a large quantity of pure air and should be constantly open at the top. The opening thus caused between the sashes is the inlet. Fresh air will also enter a ward every time that the door is opened, and underneath the door even when shut ; but, if this air is from inside the building, the door should not be regarded as a suitable means of ventilation.

Patients frequently complain of cold when the windows are kept open ; the attendant must use consideration and tact as well as firmness, and by the addition of an extra blanket or a hot-water bottle, patients can generally be kept quite warm.

Duty of attendants.—Finally, the matter of ventilation requires unremitting attention from attendants on the sick. Neglect of this duty will favour the development or spread of disease, retard the healing of wounds and generally lower the health of the patients. To test the air of a ward, the attendant should from time to time go into the open air ; on re-entering, he will at once be able to detect the impurity or otherwise of the atmosphere.

698. Kitchens.—Sinks should be kept scrupulously clean at all times, strong, hot soda water being emptied down the drain to dissolve any grease.

Woodwork should be scrubbed and brasses polished daily, and paintwork and windows cleaned once a week.

Bread bins should be emptied of all old bread (which should be taken to the cookhouse for use) and washed daily.

Swill tubs should be emptied and well washed out twice daily.

699. Annexes.—Waste pipes and sinks in the annexes should be properly cleaned and flushed daily.

The inside of pans should not be allowed to get stained. All vessels in use must be kept thoroughly clean, bed-pans and urinals being cleaned and dried immediately after use. Urinals should be soaked in strong soda water once a week.

Baths should be thoroughly washed daily and rinsed round after use.

All brasses should be polished.

All woodwork should be scrubbed daily and the paintwork and windows cleaned weekly.

No soiled or infectious linen or soiled dressings should be left about in uncovered receptacles. Soiled dressing buckets should be emptied at least twice daily, after the morning and evening dressings are finished. Infectious linen should be dealt with according to para. **806.**

700. Floor of ward.—Ward floors should be swept every morning and again after each meal.

In sweeping hospital floors, it is important to raise as little dust as possible. By fastening a flannel over the broom, this can almost entirely be avoided.

When floors are polished, they should be swept before the polish is used. Polish should be applied on house flannel, and well rubbed on to a section of the floor which afterwards must be well dried and rubbed by a heavy weighted long-handled brush, the corners being done by hand; the floor should again be swept after polishing. Polished floors should be either well scrubbed with hot water and soft soap or washed over with white spirit once in six months at least.

701. Dusting.—Dusting should be done twice a day in the wards, first with a damp duster, then with a dry one for polishing. Particular attention should be paid to electric light shades and similar fixtures.

702. Stoves.—The cleaning of stoves should be completed and ashes removed before the morning sweeping of the ward; in the cleaning of them, care must be taken not to soil other things. A good plan to prevent this is to hold a thin strip of wood with one hand against the surrounding wall whilst the brush is used with the other hand. The blacklead should be made into a thin paste and applied with a small round brush over every part that is to be blacked.

When the blacklead is dry, the polishing brush should be used briskly until every part of the ironwork shines.

The ends of the fire-irons are cleaned in the same way as the stove and the bright parts rubbed with bathbrick or burnished.

The fire should be allowed to become low in order that the stove may be cleaned before it becomes too hot.

703. Walls, windows and blinds.—Walls should be swept once a week and washed down every three months.

The woodwork of windows should be cleaned by washing with warm water and soap; the glass itself is cleaned by sponging with water and methylated spirit and polished with a clean and thoroughly dry duster. Wiping over the glass daily with a duster or newspaper will help considerably to keep it in good order. Cloths used should be free from nap or fluff. Blinds must be kept free from dust.

704. Paint.—The paint-work of a ward should occasionally be scrubbed with hot water and soap. Soda should not be used, as it soon destroys the paint (including enamel).

705. Woodwork and utensils.—Bedside tables, chairs and patients' bed-head boards should be well scrubbed once a week, and diet trays daily; other articles of white wood should be scrubbed once a week with hot water and soap.

Brasses should be polished with a patent polish or a paste made of finely powdered bathbrick and water. If very dirty, they should be washed in hot water before being polished.

Vessels of tin or white metal are best cleaned by washing with hot water to remove the grease and then polishing with whitening.

In washing knives and forks, care must be taken not to put the handles into the hot water.

Tumblers and all glass articles should be washed separately, if necessary being put first of all into warm water with soda and then into cold water.

706. Beds.—Beds of up-patients should be thoroughly aired and the mattresses turned every day.

Patients confined to bed should have their beds made at least twice a day.

To make the bed, a single blanket is first placed over the mattress; over this a sheet is laid, leaving enough at the top to roll the bolster in. It is then firmly and tightly tucked in at the sides and foot, the bolster being rolled in the top of the sheet and the pillow placed on top of the bolster. The top sheet, blankets and counterpane are then spread, tucked in round the sides and foot of the mattress, and neatly folded

down at the head. A draw-sheet is used for all patients confined to bed. The width of the draw-sheet is usually half the width of an ordinary sheet, but when a waterproof sheet is used, the draw-sheet should be folded so as completely to cover the waterproof.

707. Air- and water-beds.—Air- and water-beds are used in certain cases. They are a preventive against bedsores.

The air-bed is laid on the top of an ordinary mattress. If filled too full, the bed will be hard and uncomfortable. Two under blankets should be placed over the air-bed, and the bed made in the usual way.

A water-bed is necessarily much heavier than an air-bed and is seldom used. A full-length fracture board should be placed on the bedstead, with an ordinary mattress on top, before the empty water-bed is placed in position. The water-bed is then filled with water at a temperature of 90° F. It must not be filled too full, and it must be emptied before any attempt is made to move it. To test whether an air- or water-bed is filled sufficiently, lie down on it and try it.

Both air- and water-beds must be thoroughly cleaned after use, and great care taken to avoid damaging them with pins.

The blankets under the patient covering these beds require to be frequently changed, as they become damp from perspiration.

708. Ward neatness.—Careful attention should be paid to the neatness of the ward. Uniformity is its greatest asset, *i.e.* all lockers should be arranged in a similar manner as to contents; all hats hung up in a uniform manner; all boots and shoes arranged similarly. Beds should be made in a uniform manner and in line, the even end of the pillow facing the ward entrance. After dressing the beds and putting the castors in line, a final look around the ward will show any outstanding points that may still be attended to to ensure this necessary neatness.

709. Ward discipline.—Under the direction of the M.O. and the sister, it is the duty of the orderly to attend to the discipline of the patients; this includes seeing that they get up and return to bed as ordered by the M.O., and that all patients marked "up" are in bed at the proper hour at night.

CHAPTER XLII

GENERAL NURSING

710. General outline.—The duties of a nursing orderly in the ward are many and varied ; these will be considered under the following headings :—the hygiene, the feeding and the treatment of the patient, and the reports to be rendered.

711. The hygiene of the patient.—(i) All patients marked " up " and those able to go to the bathroom should have a bath twice a week. A bath list should be kept in order to ensure that this is carried out.

In addition, the face, neck, chest, back, arms and hands should be washed twice daily.

All bed patients should be blanket bathed at least twice a week (*see* para. **721**). In all seriously ill cases and where there is profuse perspiration, a daily blanket bath is essential ; if the patient is blanket bathed in the evening, the face, neck, chest, back, arms and hands should be thoroughly washed in the morning.

The hygiene of the mouth, as described in para. **722**, brushing the hair, and cutting the nails completes the toilet. The heads of all patients should be washed on admission and once weekly. The hair of the head will be kept short.

(ii) Attendance on a patient in bed will include bringing the bedpan and the urine bottle to him when he desires them.

The bedpan will always be given with the patient's bed enclosed in screens and these and the pan will be removed directly he is ready. Urine bottles should be emptied immediately after being used.

(iii) The beds of all patients confined to bed should be made twice a day, once in the early morning and again in the evening after 5 p.m. It is essential that all patients should be washed and their beds made as late in the day as possible, in order to promote restful sleep. Unless it is contrary to the M.O.'s orders, the patient should be helped on to a chair or lifted on to another bed or a couch to facilitate mattress turning.

(iv) A helpless patient will need assistance in movements. It will be necessary to change his position from time to time or he may have to be kept in certain positions, such as sitting up or lying flat, as ordered by the M.O. (*see* para. **718**).

(v) Bed linen and patients' linen will require to be changed at fixed intervals or whenever occasion demands it, such as when the linen becomes soiled or after profuse perspirations (*see* para. **723**).

(vi) The orderly must see that the patient is provided with small articles such as handkerchiefs, spitcups, etc., and that these are available for him to use without effort when required.

(vii) The orderly must attend to the general comfort of his patients and should always be within call in case his help is needed.

712. The feeding of the patient.—This should be carried out strictly in accordance with the orders of the M.O. or sister. All fluid feeds should be measured and only the quantity ordered given. Liquid feeds must be administered to a helpless patient in a feeding cup or, if he can raise his head, by means of an ordinary tumbler or cup (*see* para. **728**).

In the case of a patient being allowed unlimited fluids, a jug of the liquid covered with a gauze cover, together with a glass, should be placed beside him. The contents of the jug should be replaced whenever required (*i.e.* as soon as it is emptied) and the amount taken in the 24 hours recorded. Solid food will be taken by the patient in the ordinary way.

Visitors must not be allowed to bring either food or drink to a patient without the permission of the sister, who will inspect what is brought in before it is taken to the patient.

713. The treatment of the patient.—This will include :—

(i) The administration of medicines by the mouth and by inhalations.

(ii) The giving of gargles and the application of lotions, ointments, plasters and fomentations.

(iii) The administration of enemata.

In all cases specific directions are given by the M.O. and the orderly has simply to carry them out.

714. Report on a patient.—The routine observations to be recorded are :—

(i) The temperature, morning and evening.

(ii) The pulse rate a minute, morning and evening.

(iii) Respirations.

(iv) The number of stools every 24 hours and their character.

(v) The frequency and amount of urine passed and its appearance. Inability to pass urine must be at once reported to the M.O.

(vi) The manner in which a patient takes his food and drink.

(vii) The appearance of the skin—the presence of rashes or spots.

(viii) The general aspect of the patient and the appearance of any symptoms such as difficulty in breathing, cough, vomiting, nausea, cyanosis, faintness or pallor, in fact *any change* in the patient's usual condition.

(ix) The time that the patient sleeps, and whether his sleep is quiet or disturbed.

715. Reports of the observations made on the patient will be rendered on going off duty and should be in writing in a book kept for the purpose. In addition, any sudden or untoward change in the patient's condition, such as collapse, severe pain, vomiting, will be reported *as soon as observed* to the M.O. or sister.

CHAPTER XLIII

THE NURSING OF BED CASES

Positions in Bed

716. The following are the positions in which patients, confined to bed, are usually placed :—

(i) *Recumbent* or flat in bed with one head-pillow ; this is used in the case of most fevers, early stages of pneumonia, dysentery and some injuries.

(ii) *Semi-recumbent*, or flat in bed with one or two head-pillows, arranged in a slant, and sometimes with the knees flexed over a pillow or bolster.

(iii) *Upright*, or sitting posture, supported by an upright bed-rest padded with pillows or, better still, by many pillows without a bed-rest ; the lower pillows, if placed at an angle, will make supports for the arms. In this position it is advisable to use an air-cushion or water-pillow to prevent bedsores, and a pillow will be required under the legs ; a pair of short blocks under the feet of the lower end of the bed will help to prevent the patient from slipping down. This position is best for cases of bronchitis and some other lung troubles, and in cases of heart disease with much dropsy.

(iv) *Fowler's position* or propped up as in the upright position. The knees must be flexed over a firm pillow or bolster, the latter being tied to the bed-head or sides of the bed to prevent slipping. This position is indicated after most abdominal operations. A special bed is now available by means of which the Fowler position is readily procured and varied at will.

(v) *Lateral*, or on one side with one head-pillow, and one or two to act as a prop for the back.

Moving of Patients

717. Removal of a helpless patient from a stretcher to a bed or operating table or from one bed to another.

General rules.—(i) Prepare the bed, rolling down the top bedclothes, and, if necessary, spread waterproof sheeting and a blanket for washing purposes.

(ii) Enquire which is the injured part and give directions for the special care necessary when lifting.

To remove a patient from a stretcher on to a bed or operating table; whenever possible the bearers carrying the stretcher should carry it to the foot of the bed or table in a line with the length of the bed—rest the head of the stretcher on the bedfoot, one bearer supporting the foot of the stretcher. Two, or preferably four, of these bearers lift the patient up by means of the blanket or other article, if any, between the stretcher canvas and the patient, or, join hands underneath him from the sides and lift, then together step carefully sideways and lower him gently on to the bed or table.

The patient may then be turned from side to side slowly and carefully for the purpose of rolling and removing the blanket or sheet on which he has been lying.

A similar process is the best method in moving a patient from one bed to another, lifting him on the lower sheet.

To remove a patient from a bed or operating table to a stretcher, the process is reversed.

A special form of stretcher with removable poles is frequently used for transporting a patient from the operating table to the ward. It can be used simply as a stretcher or on a trolley. The complete stretcher with the patient is placed on the bed, the poles pulled out and the canvas removed by rolling the patient in the same way as for the removal of a blanket, described above.

718. Moving of patients when in bed.—

General rules.—(i) Have everything required during the process in readiness before beginning to move a patient.

(ii) In cases where he is permitted to help, give the patient any instructions as to position that may be of use.

(iii) Secure extra help when moving abdominal operation cases or patients who are critically ill or suffering from injuries to the limbs.

719. Recumbent position or from recumbent to sitting position.—

(i) *Quite helpless patients.*—Two orderlies will be required, one on each side of the bed. The pillows should be adjusted first, if possible. Each orderly should put one hand under the patient's shoulders; the wrist of one gripped by the hand of the other, and their other hands under the buttocks, also gripped together. If able, the patient should fold his arms across his chest, put his head down with his chin on his chest, and draw up his knees. With their knees against the bedsides, the two orderlies should then raise the patient, without jerking, to the position required, either "recumbent" or "Fowler's."

(ii) *Patient able to help.*—One orderly is sufficient. He should stand on the right side of the patient, place the left hand under his neck or shoulders, the right round his right upper arm. The patient should put his right hand round the orderly's right arm, draw up his knees and dig his heels in the bed. The lifting effort is made together.

720.—To turn a patient.—The orderly should stand on the side of the bed to which the patient is to turn. He should flex the patient's further knee and arm and bring them towards him, then reach across the patient, putting one hand under his shoulder and the other under his pelvis, and draw him towards him. If more convenient, the draw sheet can be used for this movement by untucking it on the far side and rolling it towards the patient, who can then be gently pulled over with it.

For spinal cases two orderlies are required to keep the head, back, pelvis and legs in line: one should take the head and shoulders, and the other the pelvis and thighs—working on the same side, and drawing the patient towards them. *The greatest care must be taken to ensure that the spine is not twisted.*

721. Washing of helpless patients.

General rules for blanket baths.—(i) All patients unable to go to the bathroom should have a blanket bath on admission.

unless otherwise ordered by the M.O. or sister, and at least once a week afterwards ; if possible, once a day.

(ii) Have everything required in readiness before beginning.

(iii) Avoid draughts and unnecessary exposure.

(iv) Use plenty of hot water, soap and dry towels.

(v) Wash briskly and quickly (but not roughly) to avoid tiring the patient, but see that every part of the body is clean and dry.

(vi) Note and report any rash, swellings, scars, scratches, sores or other abnormalities.

(vii) In removing the shirt or pyjamas, remove the sleeve of the jacket or leg of the trousers from the injured side last and replace it first. Use a gown split up the back for a helpless patient.

(viii) Do not omit the cleaning of the teeth, the cleaning and cutting of the nails and the washing of the head, as necessary.

Articles required.—Screens, one long piece of waterproof sheeting, two thin blankets or bath sheets, two towels, soap, washing flannels, basin and mug, hot water, methylated or other spirit, dusting powder, nail scissors, brush and comb, the patient's toothbrush and a receiver.

Method.—Remove the top bedclothes, and cover the patient with one warm blanket or bath sheet. Roll the waterproof sheeting covered with the other warm blanket or bath sheet under him, and remove his shirt or pyjamas (*see* rule vii, above).

Wash the parts in order as follows and dry thoroughly :— face, neck and ears, arms, chest, abdomen, legs, between the legs, and lastly the back. Always wash between the legs under the blanket.

Keep the patient well covered with the blanket, only exposing the part that is being washed. When the back is washed and dried, apply methylated or other spirit and then dusting powder to the sacrum, hips and shoulders, and, if necessary, to the elbows, knees, heels and ankles, to prevent bedsores.

If the head is to be washed, change the water and proceed. After drying the head, replace the shirt, brush and comb the hair, clean and, if necessary, cut the nails and clean the teeth.

When this is completed, roll the patient over and remove the waterproof sheeting and blanket, making the under part of the bed. Shake up the pillows and arrange. Replace the top sheet and then remove the upper washing blanket. When this is done, re-make the top of the bed.

722. Cleansing of the mouth and teeth.—A patient who is not seriously ill should clean his teeth not less than twice a day.

In addition to the ordinary tooth paste or powder applied with a brush, a preparation such as the following may be used as often as is required for cleaning the mouth of the sick :— Equal parts of glycerine and boracic lotion, to which a few drops of lemon juice may be added.

Method.—Make a mop with a small piece of cotton wool wound round a pair of forceps or a small stick, dip this in the mouth wash and swab the gums, teeth and tongue. Repeat two or thrice times with fresh swabs. The patient, if able, should rinse out his mouth with the mouth wash.

Dentures should always be removed and cleaned with a tooth brush and mouth wash twice daily. A patient who is acutely ill should not be allowed to wear them.

723. Changing of sheets.—

(i) *For a patient able to turn on his side.*—(*a*) Cover the patient with one sheet or blanket and remove the rest of the top clothes.

(*b*) Roll the clean sheet lengthways to half its width, untuck the lower sheet all round, also a draw sheet and waterproof sheeting, if in use, and roll them up lengthways along one side only, towards the patient.

(*c*) Place the clean sheet along the bed with its rolled edge against the rolled edge of the soiled sheet, and tuck in the loose side firmly, beginning at the foot end.

(*d*) Go round to the other side of the bed, roll the patient gently towards you, bring the soiled sheet towards him and after it unroll the clean sheet ; carefully roll the patient back and on to his other side, remove the soiled sheet and pull through the clean one. Stretch it well to remove all wrinkles and tuck in firmly.

If a draw sheet, or waterproof sheeting, or both, are being used, these can be changed in a similar manner in their right order, and rolled through with the bottom sheet, thus making only one move for the patient.

(ii) *For a patient unable to turn.*—(*a*) Untuck the soiled sheet and roll it crossways, beginning at the head end.

(*b*) Cover the patient with one sheet or blanket and remove the rest of the top bedclothes.

(*c*) Get help to hold the patient's head and shoulders, or to support him forward, and remove the pillows and bed-rest.

(*d*) Untuck the soiled sheet and roll it under the patient's head and shoulders as far as possible, tuck in the clean sheet

across the top, and unroll to follow the soiled one. With the help of the assistant on the opposite side of the bed raise, with one hand each, first the shoulders, then the back and buttocks, and lastly the legs in turn, rolling down the soiled sheet and unrolling the clean one after it with the free hands. When the soiled sheet is out and the clean one through, tighten and remove all wrinkles from the latter by pulling it from either side, and then tuck it in. Replace the pillows or bedrest, and finish making the bed.

724. A draw sheet is used for patients confined to bed. It consists of a sheet folded lengthways, and is placed across the bed above the lower sheet and under the patient's body. It is constantly drawn through to give the patient a cool piece to lie on, and to remove crumbs and dust.

Draw through—

(i) After meals.

(ii) Whenever the sheet is soiled with discharges.

To change a draw sheet.—This can be done with the lower sheet and in a similar manner.

To change the draw sheet only of a helpless case :—

Untuck one side of the soiled draw sheet, and tuck in the clean one in its place ; pin, with safety pins, the other end of the clean sheet to the loose end of the soiled one ; then go round to the other side of the bed, and with help to lift the patient's back, pull through the soiled sheet with the clean one attached ; stretch the latter and tuck it in.

Waterproof sheeting is sometimes used to protect the mattress ; it must be kept clean and smooth, without wrinkles, and should be removed when considered no longer necessary.

Care of Patients' Skin

725. Bedsores.—Freedom from bedsores in helpless patients is a tribute to good nursing. Patients suffering from paralysis or spinal injuries are specially liable to bedsores, and the utmost care will not always succeed in entirely preventing their formation.

Cause of bedsores.—(i) Impaired circulation, which may be caused by :—

(*a*) Continuous pressure, as when the patient is left too long in one position.

(*b*) Bruising, *e.g.* from careless insertion of or prolonged use of the bedpan.

(ii) Abrasions of the skin, which may be caused by :—

(*a*) Irritation from excessive moisture from insufficient drying of the skin or excessive perspiration or in " incontinent " patients.

(*b*) Chafing on crumbs or wrinkles in under-sheets and shirts.

(*c*) A roughened bedpan.

(iii) Predisposing causes are :—Paralysis, incontinence of urine or fæces, emaciation.

Parts of the body subject to bedsores :—

Sacrum and buttocks. Hips. Shoulders. Heels and elbows. Knees and ankles.

Prevention and remedies.

(i) Careful observation for early signs in the above-mentioned parts.

(ii) Removal of the cause of pressure by frequent change of position.

(iii) Frequent washing with soap and water (using the palm of the hand) to promote the circulation, and careful drying of the part.

(iv) Application of special spirit to harden the skin after washing, followed by the application of dusting powder (equal parts of oxide of zinc, boracic and starch powder) to dry the part, both applied with the palm of the hand.

(v) For cases of incontinence and patients with very dry skins, in place of spirit, the use of one of the following :—

Zinc ointment, boracic ointment, zinc ointment and castor oil in form of an ointment, dusting with powder afterwards.

(vi) For the knees, elbows and heels, after the use of the spirit and powder, the application of a thick pad of cotton wool with a bandage to the affected part and, in addition, for the heels a pillow under the legs above the affected part, and a cradle to take the weight of the bedclothes.

(vii) The use of air or water cushions and beds.

Bedpans and Urine Bottles

726. Bedpans.—The types in common use are the *round* and *slipper*.

The *round* has a hollow handle for emptying and is made either of earthenware or enamel. This shape is easily cleaned. The *slipper* is the best shape for abdominal and other cases unable to be lifted ; is also made either of earthenware or enamel.

General rules.—(i) Never keep a patient waiting for a bedpan and always remove it as soon as he is ready.

(ii) Always give the bedpan dry (and warm in the winter) and carry it covered with a washable cloth; for infectious cases, cover also with a lid and a handle cap; all articles for infectious cases should be carefully labelled.

(iii) Empty the bedpan at once, noting and reporting any abnormality of the contents. Keep covered in a convenient place, if required for inspection.

(iv) To insert, raise the patient's pelvis by placing the left hand under his back and with the right hand place the bedpan carefully in position, to avoid bruising his back. Get help to raise a helpless case and all cases after abdominal operations.

(v) To remove, raise the patient as for insertion, or if easier, roll him away from you and perform the toilet if the patient is unable to do so. Toilet paper may be used for ordinary cases, whilst tow, with subsequent washing of the part, is best for infectious cases and some others. Absorbent wool should be used for rectal cases, and the dressing done afterwards.

(vi) Toilet paper may be removed in the bedpan. Tow and wool should be received in a separate bowl containing disinfectant powder, and disposed of with soiled dressings.

(vii) All bedpans should be thoroughly flushed with cold water immediately after use, and cleansed with soap and hot water once daily.

727. Urinals.—These are bottle shaped, and are either made of glass (the easiest to clean), earthenware or enamel. Carry to and from the patient covered by a washable cloth; empty as soon as possible and cleanse with cold water; thoroughly wash with soap and hot water once daily, and, if necessary, use soda or its equivalent. Urine required for inspection or testing should be placed in a special glass.

Administration of Food and Drink

728. Feeding of helpless and acutely ill patients.

General directions.—(i) Make sure that the patient receives the diet that he has been ordered in the correct quantities and at the correct times.

(ii) Note the amount taken and report any refusal or dislike of the food.

(iii) Place a suitable cloth below the patient's chin, use a spouted feeder (not more than threequarters full) for those unable to sit up, and raise the head, unless this movement is forbidden.

(iv) If holding the mug or feeder for the patient, give him time to take an occasional breath.

(v) A small piece of rubber tubing fitted on to the spout may be useful in some cases. This should be boiled daily and both it and the feeder kept scrupulously clean. Use a small bottle brush for cleaning the spout.

(vi) Never give the patient the impression that there is any hurry whilst feeding him.

729. Nasal feeding.—Feeding through the nose is necessary in some cases, and great care must be used in this process, as it is not unattended by danger to the patient, especially if he is unconscious.

Apparatus required.—A soft rubber catheter, size No. 6 or 7, fitted on to a small glass connection, the latter fitted to fine rubber tubing about 18 inches long to which is attached a glass funnel ; a jug containing the quantity and kind of liquid ordered, at a temperature of 100° F., a bowl of warm water to warm the rubber apparatus and to receive it after use, a lubricant, *e.g.* glycerine.

Method.—Empty the apparatus by holding it out of the water, apply a small quantity of lubricant to the catheter, hold the catheter about 3 inches from the tip, while steadying the head, insert it into the nostril at right angles to the face (not along the shape of the nose), pass it back quickly to nearly the length of the catheter. Wait, and note if the patient still breathes easily and regularly ; if he shows no sign of distress or discomfort, pinch the tube, fill the funnel with food, allow a few drops to pass, and note the breathing again. If all is well, continue pouring in evenly until finished. If this is not evenly done, air may get in and be passed into the patient's œsophagus. To remove, pinch the tube and withdraw quickly.

To cleanse the apparatus, wash through first with cold then with hot water and keep it in cold water or boracic lotion, if required again.

Danger.—The danger in nasal feeding is the insertion of the tube into the larynx instead of the œsophagus. The signs of danger are coughing or distressed breathing. Withdraw the tube immediately.

Disposal of the Dead

730. After death proceed as follows :—

Immediately before the muscles become stiff and rigid, remove all the top bedclothes except one sheet to cover the body, but leave one pillow if necessary, straighten the limbs,

close the eyes and apply pads of wet wool or lint to them if necessary. Close the mouth and apply an ordinary " fixed bandage " or bandage under the chin tied to the head of the bed.

One hour later.—Wash the body from head to foot with soap and hot water. Plug the rectum and, if necessary, the nostrils with absorbent wool. Apply a clean dressing to any wounds that there may be. Tie the ankles together and brush the hair and clean the nails ; if necessary shave the face, then dress the body in a shroud and roll in a sheet, folding over the ends of the latter at the head and foot. Pin a label on to the sheet with the man's name, particulars and date.

Place a clean sheet or Union Jack over all, and remove the body from the ward as soon as possible.

CHAPTER XLIV

OBSERVATION OF THE SICK

731. Reporting on a patient.—A concise and correct report should be kept in writing on all patients seriously ill, noting any symptoms which may arise, the amount of sleep, the amount of nourishment taken and medicines and treatment given, with the times of administration, any vomiting or nausea, the quantity of urine and number and character of stools passed. The temperature, pulse and respirations must be noted as ordered, either two-hourly, four-hourly or twice a day, and the patient's weight recorded if it is possible to weigh him.

How and What to Observe

732. Routine.—In order to avoid the omission of possibly important points, it is advisable to follow a definite routine in the observation of the sick, beginning with the general condition and passing on to the various systems as given in the following paragraphs. In mental cases special information is required and must be carefully recorded : thus the general appearance and behaviour, clothing and habits, speech and intelligence, sleep and restlessness, hallucinations, illusions and delusions, fears, as for instance of persecution, emotional

disturbances, excitement and depression are among the many points concerning which correct observation will materially aid the M.O. in arriving at a diagnosis.

Position, Expression

733. Note carefully the appearance of the patient and his position in bed. Does he look ill or in pain ? Has he a heavy and listless or wide-awake and anxious expression ? Is he well or ill nourished ? Which position in bed gives him the most ease, that is, does he lie on his back, or is he obliged to sit up to get ease in breathing ? Does he lie with his knees drawn up to relax the abdominal muscles, or does he lie on one side more than the other ? Notice the character and the duration of any pain of which the patient may complain.

The Skin, Eyes and Ears

734. Note the condition of the skin, whether hot and dry or moist and clammy, and whether the patient is pale, flushed or has a bluish tinge (cyanosis) about the face. The appearance of any rash should be noted at once. Any scars, ulcers, abrasions, bruises or discolorations and any swellings, œdema or jaundice should be reported. Note also the condition of the nails, whether discoloured, blue, clubbed, brittle or furrowed.

The eyes should be carefully observed and any irregularity in the size of the pupils, any tremor of the eyeballs, tendency to squint or other abnormality reported.

It is important to note any pain in or discharge from the ear, and in any case of head injury the escape of blood or clear fluid from the ears should be carefully watched for and reported.

Respiratory System

735. Respiration.—The points to be observed are the frequency and character of the respiration.

Frequency.—In good health the normal rate of respiration in an adult is 14–18 a minute. (As the normal pulse rate is 70–80 a minute, the ratio is roughly 1 to 4.) In many diseases of the lung or air passages, the respirations are increased and have been known to be as many as 90 a minute. The patient should never know that his respirations are being counted, for if he is conscious of it, he may unintentionally alter their frequency. The best way to count is, after taking the pulse-rate and without removing the fingers from the wrist, quietly to count the movements of the chest.

Character.—It is important to notice whether the respiration is regular or irregular, easy or laboured, quiet or stertorous,

736. Cough.—The points to notice about a cough are its frequency, duration and character.

737. Sputum.—Expectoration varies in character in different diseases and also at different times in the same disease. Note the quantity and, if it seems excessive, measure it for the 24 hours. Observe the odour and colour, the consistence, *i.e.* whether it is thick, watery or tenacious, and the presence of any blood. The quantity of blood present may vary very considerably. There may only be a few streaks or specks as the result of a severe fit of coughing and these are probably of little or no importance. Sufficient may be present to give the sputum a rusty appearance as is frequently seen in pneumonia. In cases of tubercle or injury of the lung, large quantities, either fluid or clotted, may be coughed up. This is known as *hæmoptysis* (*see* paras. **614** (xviii) and **787**).

[A patient suffering from hæmoptysis must have complete rest and be kept in the recumbent position or propped up if dyspnœa (breathlessness) prevents his lying down. Give small pieces of ice to suck and apply an ice bag to the chest, pending the arrival of the M.O.]

The Digestive System

738. The presence of sordes, *i.e.* accumulations of dried secretions, on the lips, teeth and tongue, should be noted. It should be observed whether the tongue is tremulous or not, whether clean or furred, dry or moist, or if there are any ulcers on it. Any difficulty in swallowing should be noticed, also any soreness of the throat or enlargement of tonsils; any symptoms of indigestion such as flatulence, heartburn, pain or nausea after food; any abdominal pain or distension; if there is any vomiting, note the quantity, colour, consistency and odour, and the time at which it occurs in relation to food or medicine.

The vomiting of blood is known as *hæmatemesis*. When blood has been retained for some time in the stomach, it becomes partially digested and may resemble coffee grounds in appearance.

It is important to distinguish between blood coughed up from the lungs, *i.e.* hæmoptysis and blood brought up from the stomach, *i.e.* hæmatemesis (*see* para. **614** (xviii)).

[A patient who has vomited blood must be kept absolutely at rest in a recumbent position and not even allowed to turn; the knees are flexed over a bolster. Pending the arrival of the M.O., apply an ice bag to the abdomen, clean the patient's mouth frequently, and withhold all food and drink.]

Excretory System

739. Stools.—The points to be noted are their shape, colour, form, consistence and amount, and whether they contain blood, mucus, pus, undigested food, worms, or foreign bodies; the frequency of the motion, and whether there is any difficulty or pain in passing it. Anything unusual should be kept for inspection.

740. Urine.—Note the quantity, colour, clearness and odour of the urine, also if there is any difficulty or pain in passing it. If anything unusual is noticed, the urine should be kept for inspection. Note the frequency and time of micturition. It should be remembered that the normal quantity of urine passed in the 24 hours should be about 50 oz.

The patient may be unable to pass urine, a condition known as "retention of urine." This must not be confused with "suppression of urine" when no urine is secreted by the kidneys.

Nervous System

741. Fits most commonly occur in cases of epilepsy, but are a frequent symptom of other brain conditions and sometimes of kidney disease.

The points that should be noted during a fit of any kind are:—

The onset: whether gradual or sudden, and if any part of the body is affected first.

Whether the patient loses consciousness or not. The colour of the face, whether pale, flushed or blue (cyanosed). Whether the tongue or the lips are bitten, or if there is any frothing at the mouth. Whether there is any incontinence of urine or fæces. Whether the patient is quiet, if he talks or is noisy. Whether the pupils of the eyes are dilated, contracted or unequal. Whether there is any loss of power in any limb after or during the fit. Whether restraint is necessary.

Whether the end is gradual or sudden, and if any after symptoms occur.

[A patient in a convulsion or fit should never be left alone. Care must be taken that he does not injure himself and that his tongue does not get between his teeth. To prevent this, a spoon or a cork should be inserted between the teeth to keep them apart.]

742. Delirium.—When delirium is present it should be noted whether it is of the low, muttering type, or active and noisy; also whether it is more pronounced during one part

of the 24 hours than another. If the patient picks at the bedclothes, a note should be made.

743. Sleep.—It should be noticed how long the patient sleeps, and whether his sleep is disturbed, or sound and calm.

[*Note.*—To encourage sleep, the room should be darkened, and the light shaded from the patient's eyes; he may be given a drink of warm milk or some other nourishment if this is not contrary to instructions, the face and hands may be sponged, the pillows re-arranged and a hot bottle placed at the feet if required.]

The Temperature

744. The temperature is taken by means of a small glass, self-registering thermometer known as the "Clinical Thermometer." Before a patient's temperature is taken, care must be observed to ensure that the index is set below 97° F.

The temperature can be taken in the axilla, groin, mouth or rectum. It should be taken in the morning and evening before the patient is washed. As the thermometer will register slightly higher when the temperature is taken in the mouth than in the axilla or groin, it is necessary always to take it by placing the instrument in the same place, and at the same hour. When it is taken in the axilla, the part should be wiped dry before the bulb of the thermometer is inserted, and the arm folded across the chest. The thermometer should be left in position for five minutes.

When the temperature is taken in the mouth, the bulb of the thermometer is inserted under the tongue, and the patient made to keep his mouth shut, holding the glass with his lips. The patient should not have had anything cold or hot to drink recently.

When it is taken in the rectum, the bulb should be smeared with vaseline and inserted for about one inch, and held in position. A thermometer should be specially reserved for rectal use.

After use, shake down the thermometer, cleanse it and place it in an antiseptic solution such as perchloride of mercury 1 in 2,000 or a little methylated spirit and water. Carbolic solution should not be used, as in time it destroys the readings on the thermometer. The thermometer should be rinsed in cold water and dried before use.

745. The *normal temperature* of the body is 98·4° F. In disease, the temperature may be either above or below normal, the former being much the more common. Patients with a

temperature above normal are said to be suffering from *pyrexia*; 102° F. being considered moderate pyrexia, and 104° F. or 105° F. severe pyrexia. If it reaches 106° F., it is called hyper-pyrexia.

Pyrexia varies in character. It may be continuous, remittent or intermittent. A continuous fever is one in which the fever keeps constantly at a high level. A remittent fever is one in which there is a marked difference between the morning and the evening temperature, but it does not at any time fall to normal. An intermittent fever is one in which for some part of the 24 hours there is complete absence of fever.

Fever ends either by *crisis* or *lysis*. If by the former, the temperature falls abruptly, reaching normal in from 12 to 24 hours; if by the latter, the descent is more gradual, three or four days elapsing before the temperature reaches normal and remains there.

In the course of any fever the temperature must be taken at stated intervals and recorded on the temperature chart. An excessively high temperature is dangerous to life and its occurrence must be reported to the M.O. immediately.

746. Rigors.—A rigor or shivering attack accompanied by a rise of temperature is a most important symptom to note, as in some cases it marks the onset of an acute illness. The shivering may be only slight, or it may be most severe, with a general shaking of the body, and chattering of the teeth, lasting for some minutes. Note should be taken of the duration and severity of the rigor, as well as the time at which it takes place. The temperature of the patient should be taken, and hot bottles, hot blankets and hot drinks given during the shivering stage.

The Pulse

747. Taking the pulse needs long and painstaking practice. It is one of the most important guides to the patient's condition. By it one is able to tell whether the patient is gaining or losing strength.

The *pulse-rate* in health varies from 70 to 80 beats a minute. In counting the pulse, three fingers should be placed on the radial artery at the wrist. The pulse of a sleeping patient may be taken by placing the finger on the temporal artery just in front of the ear.

The frequency, size, compressibility and regularity should all be noted.

A pulse which, with a stationary or falling temperature, gets quicker day by day is a very sure indication of a failing heart.

CHAPTER XLV

MEDICAMENTS AND THEIR ADMINISTRATION

748. Methods of giving medicaments.—The methods in common use are :—

(i) **By the mouth,** in the form of mixtures, draughts, powders, pills, tablets, cachets and capsules.

(ii) **By injection.**

(*a*) *By hypodermic injection,* that is, under the skin. This method is reserved for powerful drugs such as morphia and emetin when rapid action and very exact dosage are essential.

(*b*) *By intramuscular injection.*—Here the needle is pushed deeply into the selected muscle, and the contents of the syringe slowly injected. Many drugs may be given in this way, for example, quinine in certain cases of malaria.

(*c*) *By intravenous injection,* that is, directly into a vein. Special drugs are administered by this route, such as arsenical preparations in syphilis, or quinine in very severe malaria. It is much used for administration of curative sera in such diseases as dysentery and cerebro-spinal meningitis, and salines in cholera, conditions of shock, etc.

(*d*) *By spinal injection.*—Sera are often given by lumbar puncture into the sub-arachnoid space of the spinal canal. An illustration is antitetanic serum in the treatment of tetanus. Spinal anæsthetics such as percaine and stovaine are also administered in this way.

(*e*) *By subcutaneous infiltration.*—When large quantities of salines or curative sera are required to be absorbed slowly, they are given by injection into the loose tissue beneath the skin in some suitable site such as the flank or the axilla.

All the above injections require strict surgical cleanliness.

(iii) **By the rectum.**

(*a*) In the form of an enema to be retained and absorbed ; the fluid should be run from a glass funnel attached to a soft rubber tube or catheter which is first lubricated with glycerine or olive oil. When more than one pint of fluid is given, the container must never be held more than two feet above the bed or pressure dangerous to the bowel may result. Enemata are dealt with fully in the next chapter.

(*b*) By insertion of suppositories into the rectum. A suppository is cone-shaped, and is intended to be passed into the rectum where it is absorbed. A suppository should be wetted or oiled before insertion.

(iv) **As gargles and mouth washes.**

(v) **By inhalation.**—Preparations such as Friar's Balsam, menthol and eucalyptus are added to boiling water (one drachm of the drug to one pint of water) in an inhaler, and the patient breaths in the vapour through the mouthpiece. The inhaler should be only half filled and a towel placed round it to prevent burning the hands. Amyl nitrite is inhaled directly in the form of fumes, the capsule containing the drug being broken up in a piece of wool and the vapour then inhaled. The giving of oxygen by inhalation is so important a method of treatment as to require a special paragraph.

749. Administration of oxygen.—Oxygen should, if possible, be given through a Wolff's bottle. The bottle (containing warm water, alcohol or brandy) is connected on one side with the oxygen cylinder by rubber tubing attached to a glass tube leading through the cork to below the surface of the liquid, and on the other with an inhalation mask or a rubber catheter. By this method, the oxygen is warmed and moistened by passing through the warm water or rendered more stimulating by the alcohol or brandy.

If oxygen is given by a glass funnel held over the mouth, most of the gas is wasted.

Indications for administering oxygen are blueness of the lips and face with marked dyspnœa, due chiefly to diseases of the heart and lungs. It is essential that oxygen should be administered in such a way as to relieve and not to distress the patient. The gas should always be turned on very slowly until it can be seen bubbling gently through the bottle and, on placing the mask to the face, felt as a slight breeze. Inhalations should be given for 10 to 15 minutes at a time, unless otherwise ordered.

New cylinders should always be tested outside the ward and their marking verified in accordance with the instructions given in Regulations for the Medical Services of the Army.

750. Less common ways of giving drugs are :—

By inunction, or rubbing into the skin. Mercury ointment is one of the few drugs given in this way.

By medicated baths. These are now little used except at spas.

By application to absorbing surfaces. Drugs for eye medication are given in this way, either as eye drops or in the form of ophthalmic tablets.

751. Forms of drugs.—Drugs are prepared as follows :—

For use by the mouth. Mixtures, draughts, pills, tablets, cachets, capsules and powders.

For hypodermic injection. Hypodermic tablets, solutions, and ampoules. An ampoule is a glass capsule containing a single dose of a drug ready for injection. Many drugs are now put up in ampoules which are safe, accurate and convenient, and protect the contents from the effects of climate.

For local application. Lotions, gargles, liniments, plasters, ointments and medicated wools. These are for local use for mechanical or antiseptic effects. A gargle is a form of lotion for the throat and is both soothing and antiseptic.

For the eye, lotions and eye drops are used.

For intravenous, subcutaneous and intraspinal injection. Special curative sera are put up in phials for this purpose.

752. Administration of medicines.—The following rules will be observed in giving fluid medicines dispensed in bottles :—

i. Read the label before and after measuring the dose.
ii. Shake the bottle well, whether there is a precipitate or not, the first finger on the cork permitting the bottle to be turned upside-down.
iii. Turn the bottle label upwards whilst pouring out the fluid, the cork being retained by the fourth finger and the measure glass held on a level with the eyes. Catch the drip.
iv. Measure the dose accurately with a measure glass and not with a spoon.
v. Wash the medicine glass immediately after use.

The following general rules must also be observed :—

i. Medicines must be given as ordered punctually.
ii. A double dose must *never* be given because a previous dose has been missed.
iii. Medicines to be given by the mouth should always be kept separate from lotions and liniments.
iv. All poisons should always be kept in a separate locked cupboard.

Pills, powders, tablets and cachets are administered by placing on the tongue and swallowing with the aid of a liquid. Large powders may be dissolved or stirred in water and then drunk.

All nauseating doses should be followed by a drink of water, slice of lemon or piece of bread.

Castor oil is best given in the following way :—

Warm the glass with hot water and pour in a little lemon juice or brandy followed by the prescribed amount of oil. Lemon juice or brandy is again poured in and the edge of the glass smeared with lemon. The whole should then be swallowed like an oyster.

Croton oil is a very strong purgative and, if specially ordered, may be given as follows :—

One to two minims are dropped into a hole in a small lump of butter, put on the handle of a spoon and placed at the back of the tongue. If the patient is conscious, it may be given on a lump of sugar.

753. Times of administering medicines.—Medicines ordered three times a day are given at 10 a.m., 2 p.m., and 6 p.m. ; twice a day at 10 a.m. and 6 p.m.

Medicines directed to be taken before food are given 15 minutes before the meal ; those ordered after food immediately after the meal.

Four-hourly medicines must be given punctually at these intervals during the day and night.

Aperients are generally given in the evening, and saline purgatives before breakfast.

Narcotics (sleeping draughts) are administered the last thing at night.

754. Measures.—

60 minims	... ...	= 1 fluid drachm (℥i).
8 drachms	... ...	= 1 fluid ounce (℥i).
20 ounces	... ...	= 1 pint (Oi).
8 pints ...	... ...	= 1 gallon (Ci).
1 cubic centimetre	...	= 17 minims (approximately).
1,000 cubic centimetres	...	= 1¾ pints or 35 ounces (approximately).

CHAPTER XLVI

ENEMATA

755. An **enema** is a liquid preparation which is injected into the rectum. Enemata are of two kinds :—

(i) Those not to be retained.
(ii) Those to be retained.

756. Method of administration. *Articles required :—* (i) An enema syringe, a small pot of olive oil or soft paraffin, a bowl in which to mix the preparation, waterproof sheeting, a cloth and a bedpan ; or

(ii) A rectal tube or gum-elastic catheter, size 8 or 10, and a glass funnel joined together by a piece of rubber tubing about 2 feet long, with a small glass connection in the middle of it through which to watch the flow of the liquid ; a clip or Spencer Wells forceps to stop the flow when required ; a small pot of olive oil or soft paraffin, waterproof sheeting, a cloth, a jug to hold the liquid to be injected and a basin of hot water in which to stand the jug to keep it warm, and a bedpan.

Position.—The patient should be lying on his left side with the head and shoulders in the centre of the bed, both knees drawn up, and buttocks well over the edge of the bed. (Left lateral position.) If unfit for this position, he should be on his back, near the right-hand side of the bed, with both knees drawn up. (Dorsal position.)

Details.—(i) Place warm waterproof sheeting covered with a cloth under the buttocks, turn back the bedclothes except one blanket, exposing the patient as little as possible ; (ii) remove all air from the apparatus to be used by filling it with the enema fluid ; (iii) lubricate the nozzle or rectal tube with olive oil or soft paraffin ; (iv) dip the first finger of the left hand in the lubricant and find the anus by following down between the buttocks, then with the right hand insert the nozzle or rectal tube very gently and slowly to a length of not more than 2 inches or the length of the enema nozzle.

When using an enema syringe, hold the nozzle in position between the fingers of the left hand, and with the right hand pump slowly, evenly and continuously until the required amount has been given. If the pumping be too vigorous, the enema will be returned before it is all injected.

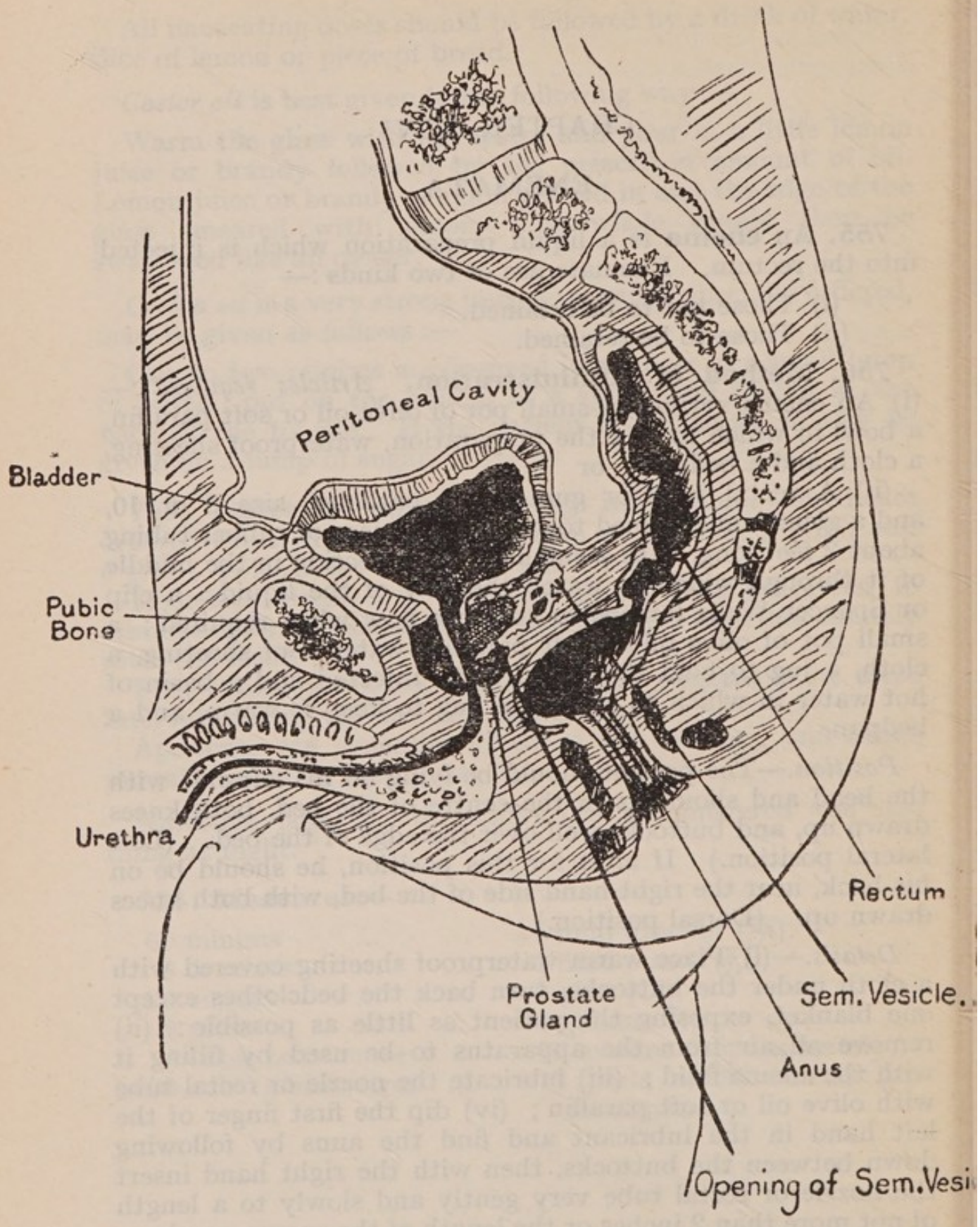


FIG. 90.—SECTION FROM FRONT TO REAR OF A MALE PELVIS TO SHO
POSITIONS OF BLADDER AND RECTUM AND THE COURSE TAKEN F
THE URETHRA: NOTICE THE DIRECTION OF THE ANUS WITH VIE
TO PASSING NOZZLE OF ENEMA SYRINGE

Remove the nozzle gently, put the patient at once on his back with waterproof sheeting and a cloth, and place a bed-pan in position.

When using the rectal tube and funnel, apply the clip or forceps after filling the apparatus, then insert the tube, fill the funnel with the liquid, release the clip and raise or lower the funnel to regulate the flow to the speed required. Injections given with this apparatus should be given slowly, if to be retained, at a speed of 10 oz. to 15 minutes. When the amount required has been given, apply a clip or forceps and remove tube gently but not too slowly. The patient should then be left comfortable and quiet (being moved as little as possible) to help him to retain the injection.

757. Enemata not to be retained.—These are given for the purpose of :—

(i) Cleansing the rectum or producing an action of the bowels (cleansing and purgative).
(ii) Reducing flatulent distension (antispasmodic).
(iii) Removing intestinal worms (anthelmintic).

Varieties in use are :—

i. **Cleansing and purgative.**

(*a*) *Enema saponis.*—1 teaspoonful of soft soap or plain yellow soap (shredded and boiled down to a jelly) to 1 pint of warm water. Mix until lathered. Remove all froth ; 1 to 2 pints may be given at a temperature of 100° F.

(*b*) *Olive oil.*—4 to 5 oz. heated to 90° F. given with rectal tube and funnel, retained and followed by a soap and water enema 30 to 60 minutes later.

(*c*) *Castor oil.*—1 oz. of castor oil thoroughly emulsified with either 10 oz. of thin gruel, soapy fluid or starch mucilage. Given with a tube and funnel at a temperature of 100° F.

(*d*) *Glycerine.*—1 to 2 teaspoonfuls of glycerine injected into the rectum with a special vulcanite syringe.

(*e*) *Molasses.*—2 oz. of golden syrup mixed thoroughly with a pint of warm milk. Given with a tube and funnel at 100° F.

ii. **Antispasmodic.**

Turpentine.—Required : Oil of turpentine ½ to 1 oz., soap enema 1 pint, and 1 egg. Beat up the egg thoroughly and gradually drop in the turpentine to form an emulsion. Add the soap enema, continually stirring. No globules of turpentine should be seen floating on the surface of the mixture. Give with an enema syringe at a temperature of 100° F.

iii. **Anthelmintic.**

(*a*) *Salt.*—2 or 3 teaspoonfuls of salt to 1 pint of water. Give with a tube and funnel or an enema syringe at a temperature of 100° F.

(*b*) *Quassia.*—First cleanse the rectum with a soap and water enema, then inject 10 oz. infusion of quassia (1 in 20) with a tube and funnel at 100° F.

758. Enemata to be retained.—These are given for the purpose of :—

(i) Relieving pain and checking diarrhœa (sedative).
(ii) Relieving shock after certain operations, accidents and loss of blood, or in some cases of poisoning (stimulant).
(iii) Giving nourishment when food cannot be given by the mouth (nutrient).

Varieties in use are :—

i. **Sedative.**

(*a*) *Starch and opium.*—Required : 2 to 4 oz. of thin cold starch with the prescribed amount of tincture of opium (generally 20 to 30 minims). Given slowly with a tube and funnel.

(*b*) *Nauseating medicines and sedatives* such as bromide and chloral. Given by the rectum if the patient is unable to take by mouth. Given with a tube and funnel.

(*c*) *Iced water.*—May be given as an enema in cases of heat stroke.

ii. **Stimulant.**

(*a*) *Rectal saline* is the term applied to an enema given to supply fluid which it is intended should be absorbed into the body fluids through the lower bowel.

Rectal saline consists of ordinary normal saline solution given at blood heat (approximately 100° F.) by an apparatus which allows a continuous small amount of saline to flow into the rectum and lower bowel.

From 10–20 oz. of saline may be given in one enema. Glucose and brandy are sometimes added.

(i) Rectal saline is preferably given by an ordinary rectal tube connected to a special apparatus consisting of a thermos flask and a Ryall's drop tube. By means of the latter, the rate of flow can be seen and controlled while the flask allows the saline to be kept at a constant temperature which should be 120° to 125° F.

(ii) In the absence of the special apparatus, an ordinary douche can may be used. To this is fitted the rectal tube described above and a screw clip is passed over the tube and screwed down so as to allow a drop by drop flow. The temperature of the saline in the douche can should be 125° to 130° F. and must be frequently restored to this reading as it cools. In either case the fluid should reach the bowel at 100° F. which is approximately blood heat.

Rectal saline is given in cases of shock and loss of fluid from the body tissues, and in certain cases to relieve thirst when rectal feeding only can be employed.

(*b*) *Strong coffee.*—Required: 4 to 6 oz. of black coffee well strained and 1 oz. of brandy. It should be given slowly with a tube and funnel at a temperature of 105° F. and is often ordered in cases of drowsiness after poisoning.

iii. **Nutrient.**

Two varieties in common use are :—

(*a*) *Normal saline,* 10 oz. with white of egg beaten up and 1 teaspoonful of glucose. Given very slowly with a tube and funnel at a temperature of 100° F.

(*b*) *Peptonized milk,* with white or yolk of one egg. The whole should be made up to 5 or 6 oz. and given very slowly with a tube and funnel at a temperature of 100° F.

CHAPTER XLVII

REMEDIAL APPLICATIONS

759. Administration of gargles.—The gargle is given either warm or cold, and with or without the addition of water, as ordered. The patient takes a mouthful, throws his head back and allows the gargle to run to the back of the throat; he then breathes out gently through the mouth, thus performing the gargling. This is repeated until the gargle is finished. The fluid should not be swallowed.

760. Application of eye lotions and eye drops.—Eye lotions are applied by means of a special glass drop-bottle

called an undine or dropped into the eye from a sterile glass rod. Except in a case of eye injury, the upper and lower lids should be everted to assist the introduction of the lotions.

The patient sits in a chair with his head thrown back, and his clothing protected by a towel. A receiver is held in position to catch the lotion, which is allowed to run on to the conjunctiva from a height of about one inch from the eye. The temperature of the lotion should be 99° F.

To evert the upper lid.—Stand in front of, or behind, the patient, who should be told to look at the floor. Grasp the lashes of the lid lightly between the thumb and forefinger, draw the lid gently *outwards* and upwards and evert over the thumb.

To evert the lower lid.—The patient should be told to look upwards and the skin below the eyelid drawn downwards and outwards.

All drops, ointments, swabs, etc., used in eye-work must be sterilized.

Undines and glass rods should be boiled before and after use.

Always swab *outwards* and never use the same swab twice.

761. Application of counter-irritants.—Counter-irritants are local applications used for the relief of pain or the checking of inflammation ; some produce mere reddening of the skin, others actual blistering.

Mustard leaves.—The skin is cleansed with soap and water and the mustard leaf moistened in warm water, applied and kept in place by a piece of lint and a lightly applied bandage. Remove as soon as the skin is reddened and the patient complains of pain from burning. Dust the skin with dusting powder and cover with a piece of wool or dried lint. The mustard leaf should never be left on long enough to cause blistering of the skin.

Mustard plaster.—This is made by mixing two parts of mustard with one of flour ; the mixture is made into a smooth paste with cold water, spread on lint and covered with a layer of gauze. Hot water should never be used, as it destroys the properties of the mustard. It should be applied in the same way as a poultice.

Scott's dressing, commonly applied for the relief of chronic inflammation of joints.

Required : Scott's dressing (a compound mercury ointment), white lint, scissors, strapping, a spatula and a bandage.

Cut strips of white lint 1½ inches wide and 3 inches longer than the circumference of the limb, the strapping being cut

to the same dimensions. Spread the ointment thickly on the smooth side of the lint with the spatula and, after having washed and shaved the limb, apply the first strip to the back of the limb 2 inches below the joint, bring the ends round and cross over the front of the limb ; take the second strip and apply in the same way, overlapping the upper edge of the first ; continue until the joint is covered and then apply the strips of strapping in the same manner until the whole area to be treated is covered. The strips should overlap each other about ¼ inch in order to make them firm. Apply a firm bandage and leave for two or three days.

Liniments.—These are applied by rubbing. A sufficient quantity of the liniment is taken on the palm of the hand and rubbed into the skin over the affected area. Friction should be given with the whole hand flat and, in the case of application to the limbs, should follow the direction of the lymphatic circulation. It should be applied until the part is rendered warm and the skin reddened by the friction.

Iodine.—The skin must be dry. The solution of iodine is painted with a brush or a piece of wool ; when the first application is dry, a second application is made and the part is then covered with a piece of lint and a bandage.

Blisters.—Blistering of the skin may be produced by the application of either blistering plaster or blistering fluid.

(i) Blistering plaster. Wash and, if necessary, shave the area to be blistered. The required size of plaster is cut out and applied for 10 to 12 hours to the skin. It is kept in place by a light bandage. When the blister has appeared, remove the plaster, if necessary, with the aid of a little olive oil. Snip the blister at its lowest edge with a pair of sterilized scissors, having a sterile swab to absorb the fluid. Apply a dressing, wool and a light bandage.

(ii) Blistering fluid. The fluid must only be applied to the actual amount of skin that it is desired to blister. The surrounding skin is protected by spreading over it a layer of soft paraffin. Apply the fluid once or twice, leave the skin uncovered until dry, then cover with lint or gauze and a light bandage. When the blister appears, snip it and dress as described above.

762. Application of leeches.—Leeches are used for the relief of pain and for checking inflammation. Each leech draws from one to three drachms of blood. The smaller pointed end is the head of the animal. Before a leech is applied, the skin should be well washed and thoroughly dried and, when possible, briskly rubbed to bring the blood to the

surface. It is important to handle the leech as little as possible, a blunt glass rod and a test tube being as a rule sufficient for all purposes.

A leech will continue sucking for about three-quarters of an hour. It should never be forcibly removed or its teeth may be left in the skin, producing a troublesome wound. A pinch of salt sprinkled on the head will make the leech relax its hold. If the bleeding is to be encouraged, a fomentation should be applied to the bites; otherwise a pad of gauze should be strapped over them. The patient should be carefully watched until the bleeding has ceased, as sometimes this is very troublesome.

In the application of leeches certain precautions must be observed. They should never be applied over large vessels, over unsupported soft tissues as the scrotum, or in the neighbourhood of any orifice, such as the external auditory meatus, which has not been previously protected by a plug of cotton wool. In the region of the anus special care must be taken. Should troublesome bleeding follow leech bites, it can generally be controlled by firm pressure, but in some cases the condition will have to be reported to the M.O. The leech, after it has fallen off or been removed, should be placed in a vessel of cold water containing a little salt, when the blood will be vomited up; the leech is then put in a bottle of plain cold water securely covered with gauze.

763. Ointments.—Ointments may be applied (i) direct, as, for example, when applied to the eyelid or conjunctiva; (ii) spread evenly on the smooth side of lint; or (iii) rubbed in with the hand, that is to say, by inunction.

Inunctions.—Before an inunction is given, the site selected should be cleansed with hot water and soap and, if necessary, shaved. The oil or ointment to be applied is warmed before use.

Mercury is often administered by inunction. Mercurial ointments are poisonous and if the patient cannot carry out his own inunction, the attendant giving it should wear a rubber glove or use a flat glass stopper as a rubber. It is essential that the inunction should be thorough; the ointment should be rubbed in until the skin is no longer sticky, and appears as if it had been rubbed over with blacklead, a process which will take some 30 minutes. The treatment is carried out daily over the prescribed period, a different site being used each day.

764. Lotions.—Lotions are applied by soaking a double thickness of lint in them, squeezing out the excess of moisture

without wringing dry and then covering with jaconet or oiled silk to prevent evaporation.

Evaporating lotions should be applied on a single thickness of lint, which should be left uncovered and exposed to the air. Place the limb to be treated on a piece of jaconet, then apply the lint wrung out of the lotion and place a cradle over the limb to allow evaporation. This should be renewed as often as necessary and should always be kept moist. A second piece of lint should be kept in a bowl of lotion near at hand. This bowl should be covered with a piece of jaconet in order that the lotion may not evaporate too quickly.

765. Poultices are of various kinds, the most common being linseed and mustard.

(i) *Linseed poultice.*—Crushed linseed is most commonly used for a poultice. To make a poultice, a board, a bowl, a kettle, a jug of boiling water and a large spatula or flat knife are required ; also tow or linen on which to spread the poultice ; if tow is used, it must be pulled out flat and even to the required size. After the knife and bowl have been heated, a sufficient quantity of boiling water from the kettle is poured into the bowl. The linseed is then added, being quickly sprinkled in with one hand, while the mixture is stirred with the spatula. When sufficient meal has been added, the mixture will come away clean from the edge of the bowl, and should be turned out on the linen or tow, and spread evenly and quickly with the spatula, the latter being dipped in the jug of boiling water between each stroke. The layer of linseed meal should be a quarter of an inch thick, and it should be spread to within one inch of the edge of the linen or tow, when the former should be folded and the latter rolled in all round. Care should be taken not to apply the poultice too hot ; this can be avoided by first testing it on the back of the hand. When placed in position, the poultice should be covered with a thick layer of cotton wool and secured by a bandage.

(ii) *Mustard poultice.*—This is mustard mixed with linseed meal, the mustard being mixed separately with lukewarm water and then added to the linseed poultice. The proportion of mustard to linseed varies with the object of the poultice, being either of equal parts or one of mustard to two of linseed.

(iii) *Kaolin poultice* (*cataplasma kaolini*).—Heat the preparation by standing the tin in boiling water. When hot, spread thickly on lint and apply, cover with warmed wool and bandage in position. It should be left on from 6 to 24 hours, after which it should be renewed, as it becomes dry and uncomfortable.

(iv) *Starch poultice.*—Requisites: starch, boric powder, cold water, boiling water, linen or gauze and a spatula. Take four tablespoonfuls of white starch and add one teaspoonful of boric powder and sufficient cold water to make the starch. Pour on half a pint of boiling water, stirring continually until the starch is of a thick consistency, leave until cool and then spread thickly on the linen or lint; apply to the affected part and bandage in position.

Used to remove crusts and scabs in some skin affections.

(v) *Ice poultice.*—Requisites: jaconet or gutta-percha tissue, salt, cotton wool, ice, chloroform and a paint-brush. Cut the jaconet double the size of the required poultice and fold it in half. Cover one half with a thin layer of cotton wool, on the top of which place small pieces of ice. Sprinkle some salt over the ice, cover with another layer of cotton wool and finally with the second half of the jaconet. Moisten the edges with the brush dipped in a little chloroform and seal by pressing them together. Apply over a layer of lint and bandage in position.

766. Fomentations or stupes.—The best material for a stupe is fomentation flannel. Lint and absorbent wool are sometimes used. If used for the relief of pain, a fomentation should be changed every half-hour at least. The material for the fomentation should be placed inside a towel or wringer and laid across a bowl which has been heated, the ends of the towel or wringer projecting over the sides. Boiling water is then poured over it, after which it is wrung out dry in the towel, taken out and applied as hot as the patient can bear it. It is then covered with jaconet and wool and bandaged firmly in position.

Turpentine stupe.—One or two drachms of turpentine are sprinkled carefully on the flannel before being wrung out of the boiling water.

Opium and belladonna are sometimes applied on stupes, half a teaspoonful of either tincture being sprinkled on the flannel after it has been wrung out.

767. Hot bottles may be of tin, earthenware or india-rubber. For the feet either tin or earthenware are suitable. For any other part of the body an india-rubber bag is more comfortable and efficacious. All hot bottles should be protected with thick flannel covers. Care must be taken that the bottles do not leak and that there are no holes in the covers. It must be remembered that the following patients are peculiarly liable to be burnt: those who are unconscious from any cause, the paralysed, those who are suffering great

pain, the dropsical, the very young and the old. Patients have sustained serious and crippling burns through lack of care in protecting them from contact with very hot bottles when returned to bed after an operation and while still under the influence of the anæsthetic.

768. Ice-bags are made in various shapes and sizes to suit the part to which they are applied. The cup-shaped ice-bag is the one generally used. This should be half filled with small pieces of ice and the air expelled. Ice-bags should be refilled every two hours or when the ice has all melted. A single layer of lint should be placed between the ice-bag and the skin, and, where the whole weight would otherwise fall on the affected part, the bag should be partially supported by a cradle or similar apparatus.

CHAPTER XLVIII

BATHS, PACKS, ETC.

Baths

769. Plain water baths.—Plain water baths are used for the sick for a variety of purposes.

General rules.—(i) Obtain instructions as to the temperature of the bath required, and length of time the patient is to be in it.

(ii) Always note the temperature of the bath before putting the patient in.

(iii) Never leave a patient unattended, unless quite well, in a bath or pack of any kind.

Varieties.—(i) *Hot bath.*—Approximate temperature, 100° to 110° F.; duration, 10 to 15 minutes. Used in cases of renal colic, retention of urine, to promote perspiration in uræmia, sometimes in cholera and delirium, etc.

(ii) *Warm bath.*—Approximate temperature, 92° to 100° F.

(iii) *Tepid bath.*—Approximate temperature, 85° to 92° F.

(iv) *Cool bath.*—Approximate temperature, 70° to 85° F. Used to reduce temperature in cases of hyperpyrexia; the temperature of the bath is often lowered gradually for these cases, and may become a cold bath. Watch the patient's temperature and pulse and general condition.

(v) *Cold bath.*—Approximate temperature, 50° to 65° F. Used for similar purposes as the " cool " bath.

(vi) *Continuous bath.*—Approximate temperature, 97° F. during the day and 100° F. during the night.

These baths are continued for hours, days, and sometimes weeks, according to the nature of the case. They are used in cases of severely infected wounds, extensive burns and some skin diseases.

A thermometer should be kept in the bath and the temperature of the bath maintained. The bath should be entirely emptied once in 12 hours, when the patient should be put in bed and his bowels and bladder attended to, to prevent disturbance while in the bath. Care is required, when adding hot water and removing the cooled water, to maintain the proper temperature. Except for a hole for the patient's head, the bath must be kept entirely covered, and a strip of canvas or sheet folded lengthways, and stretched across the bath to take a pillow, will be required for his head ; also suitable padding for his back, and rests for the limbs involved.

770. Medicated baths.

(i) *Sulphur bath.*—Temperature, 92° to 100° F. Prepared by adding sulphurated potash 4 oz. to water 30 gallons. Dissolve in boiling water, then add to the bath.

(ii) *Carbolic bath.*—Temperature, 92° to 100° F. Prepared by adding pure carbolic acid 10 oz. to water 5 gallons.

(iii) *Iodine bath.*—Temperature, 105° to 120° F. Prepared by adding weak solution of iodine one teaspoonful to water one pint. Usually given as a " local " bath.

(iv) *Boric acid bath.*—Temperature 92° to 105° F. Take a saturated solution of boric acid and heat to the required temperature, or add an equal quantity of hot water to the saturated solution. Usually given as a "local" bath.

(v) *Alkaline bath.*—Temperature, 100° to 112° F. Required : (*a*) Carbonate of sodium 1 oz. to every 7 gallons of hot water ; or (*b*) bicarbonate of soda ½ lb. to every 30 gallons of hot water. Used in cases of rheumatism.

(vi) *Brine bath.*—Temperature, 100° to 112° F. Prepared by adding common salt 6 lb. to an ordinary bath.

(vii) *Mustard bath.*—Temperature, 92° to 105° F. Prepared by mixing mustard 2 to 4 oz. into a paste with warm water and adding to water 4 gallons. Used for stimulating.

771. Hot-air bath.—Temperature, 120° to 130° F., duration 30 to 60 minutes.

Apparatus required.—A full length cradle fitted with electric light bulbs on different switches so that the heat of the bath may be graduated. Allen's apparatus is not used now, as it is cumbersome and not very satisfactory.

Also required, two long pieces of waterproof sheeting, three

blankets in addition to those on the patient's bed, two towels, a bath thermometer, an ice-bag or cold, wet cloth and a bucket of water or sand in case of fire.

Method.—Roll a piece of waterproof sheeting covered with a blanket under the patient, cover him temporarily with another blanket and remove his pyjamas.

Place the electric cradle over the patient, covering it with waterproof sheeting and a blanket, then add the top bedclothes, taking care to put the sheet next the quilt, tucking in the bedclothes at the sides so as to retain all heat.

Withdraw the blanket covering the patient, and put it by the side of the fire or on the radiator with the pyjamas and one towel.

Put the bath thermometer inside the cradle where it may conveniently be got at to note the temperature. Tuck the blankets well round the patient's neck and place a towel over them under his chin. Apply an ice-bag or wet cloth to the forehead. Turn on the electric current. Give the patient hot drinks while in the bath and wipe the perspiration from his face from time to time. While the patient is in the bath, note the temperature of the bath from time to time, and never leave the ward or room, as he may feel faint. If the patient complains of exhaustion or faintness, turn off the current. The bath is continued until the temperature has been maintained for the prescribed time. Then turn off the electric current. Get an assistant to hold the bedclothes at the top, grasp the lower end of the cradle with the waterproof sheeting covering it and withdraw them, allowing the blankets which are hot to fall on the patient. Leave him covered in this way for about an hour, then rub him down with hot towels, put on warmed pyjamas and a hot blanket, removing the under blanket and waterproof sheeting, replace the top bedclothes and leave the patient comfortable.

772. Vapour bath.—Temperature 105° to 140° F.; duration 30 to 60 minutes.

This is given in the same way as the hot-air bath, except that kettles with long spouts are used and steam from the boiling water is introduced into the bed instead of hot dry air. The water should be boiling when the spouts of the kettles are inserted and the kettles should not be more than half-full.

Packs

773. Hot dry pack.—Duration 1 to 1½ hours. This is useful if the apparatus for a hot-air bath is not available.

Required: four hot blankets, six hot-water bottles with covers, two towels.

Method.—Open the blankets on a spare bed or other convenient place, and lay them one on top of the other; roll them lengthways together and place them under the patient.

Remove his pyjamas and put the latter with two towels to warm by the fire; wrap each blanket round him separately, tuck in well at the neck and fold over the feet. Place three hot-water bottles at each side and replace the usual top bedclothes. Give hot drinks frequently.

When sweating has ceased, open the blankets, dry down the patient quickly with warm towels, replace his warm pyjamas, leave him between two dry blankets and replace the top bedclothes.

774. Hot wet pack.—Duration 20 minutes, after sweating has begun.

Required: four blankets, a long piece of waterproof sheeting, a large wringer with two sticks, a small bath, boiling water, hot-water bottles.

Method.—Open out the blankets and waterproof sheeting on a spare bed or other convenient place, in order as follows:—Two blankets, waterproof sheeting, one blanket; roll these together lengthways and place under the patient, remove his pyjamas and place them with two towels to warm before a fire. Fold the fourth blanket (choose an old thin one) or a sheet lengthways, and double it into the wringer in the bath. Pour on boiling water, and with an assistant wring it out as dry as possible, using the sticks threaded into the wringer ends. Take it out of the wringer, shake it out and place under the patient as hot as he can bear it, fold it closely over him, then wrap all the blankets and waterproof sheeting, already under, separately over him; place several hot bottles round to keep it warm, put on the top bedclothes and give the patient frequent hot drinks. When ready, remove the wet blankets and waterproof sheeting, re-wrap the dry ones and top bedclothes and leave him for one hour. Finally dry him down with hot towels, replace the pyjamas, leave one blanket over the patient under the top bedclothes.

775. Cold or ice pack.—Duration 30 to 60 minutes.

Required: a long piece of waterproof sheeting, three sheets (or two sheets and 12 towels), a small bath, a large wringer, cold water, ice and a clinical thermometer.

Method.—Roll the waterproof sheeting with one sheet over it under the patient, strip and leave him covered with a sheet. Soak the sheets or the towels in cold or iced water and wring out, placing them immediately over the patient

fitting closely to each limb. If towels are used instead of the sheet, wrap the patient's limbs in the towels, using one or two towels to each limb and one over the chest and abdomen. Renew the towels constantly as they become warm, using those left in soak.

Ice may be rubbed over the towels on the arms and legs if there is much difficulty in reducing the temperature. This should be carefully done, as shock may be produced.

Take the patient's temperature when starting the pack and every 10 minutes afterwards, keeping careful watch on the pulse. Have a hot blanket and hot-water bottles in readiness. The patient's temperature should be reduced until it is about two degrees higher than that required; then remove him from the pack, dry and redress him and cover him with a sheet and a blanket. Take the temperature again an hour later.

In the event of any symptoms of shock, remove the patient from the pack at once, apply hot blankets and hot-water bottles.

776. Sponging.—Duration 15 to 20 minutes, or as ordered.

i. *Tepid sponging*, start with water at 90° F., cool down to 70° F.

ii. *Cold sponging*, start with water at 70° F., cool down to 50° F. or lower.

Required: a long piece of waterproof sheeting, two blankets or bath sheets, a sponge, towels, a basin, cold water, ice, a bath thermometer and a clinical thermometer.

This process is much employed to reduce the temperature and induce sleep—especially for cases of enteric fever.

Method.—Roll the waterproof sheeting with one blanket or bath sheet over it under the patient; cover him with the second blanket and remove his pyjamas. Note his temperature and pulse and the temperature of the sponging water. Sponge the patient with long single strokes, exposing each limb, chest or abdomen in turn; spend the last five minutes in sponging his back; take his temperature, and if it is not sufficiently reduced, begin sponging again. Reduce the temperature of the sponging water, if necessary. When ready, dry him gently by dabbing, remove the waterproof sheeting and blankets, replace the pyjamas and leave him covered with one sheet or one sheet and one blanket. If the patient shows signs of shock or shivering, stop sponging and apply a hot bottle and blanket.

CHAPTER XLIX

COMPLICATIONS OF MEDICAL CASES

777. Cardiac failure.—Failure of the heart is the commonest actual cause of death in any acute medical disease. It is necessary, therefore, that the nursing orderly should be acquainted with its signs and symptoms and should learn to recognize its onset.

The cardinal *symptoms* of cardiac failure are :—

Shortness of breath.
Faintness or vertigo.

The cardinal *signs* are :—

Rapid, feeble, irregular or thready pulse of over 120 to 130 a minute.
Rapid respirations with either pallor or cyanosis of the face.
Swelling or œdema of the feet and ankles.
Pain and tenderness over the liver and spleen.

It should be understood that the essential underlying condition is one of exhaustion of the heart muscle, and the patient is therefore kept absolutely at rest in bed in a position of greatest ease, which is usually the semi-recumbent posture or the sitting posture.

The condition is one which will be met with in greater or less degree in many of the acute cases in a medical ward. It does not always prove fatal, as by appropriate treatment the heart may recover its vitality, at any rate for the time being. Thus cardiac failure is the condition that terminates any fatal case of valvular disease of the heart—it is equally the danger that is present in every case of pneumonia or broncho-pneumonia ; it may follow the profuse hæmorrhages of gastric ulcer or tuberculosis of the lungs ; it is, in fact, the ever present danger in all acute medical diseases. It may appear quite suddenly, as happens during convalescence from diphtheria ; or rapidly, a common occurrence in pneumonia ; or gradually, as in a wasting disease like consumption.

778. *Valvular disease of the heart.*—There are four common varieties which may or may not be present together :—

Aortic regurgitation (incompetence).
Aortic stenosis (narrowing).
Mitral regurgitation.
Mitral stenosis.

All eventually lead to cardiac failure.

Sudden death may occur after a comparatively trivial effort in aortic regurgitation.

779. *Myocarditis.*—This is disease of the heart muscle, and may be said to be present to some extent in all acute febrile diseases in which toxins injure for the time being the vitality of the muscle fibres. In its chronic forms, it is the result of such infections, and is then known as *myocardial degeneration.* It is the most serious of all heart affections, because the whole power and efficiency of the heart depends upon the vitality of its muscle. Its termination is cardiac failure.

780. *Angina pectoris.*—Anginal pain, by which is meant an intense gripping pain behind the sternum, commonly occurs in two different cardiac conditions :—

(i) True angina pectoris, in which the pain is brought on by physical effort or mental excitement.

(ii) Coronary thrombosis, which is clotting of the blood in one of the coronary arteries.

In this disease the pain often occurs while the patient is at rest. Both are extremely grave conditions, and such attacks of pain should immediately be reported. The treatment of these two conditions may be essentially different, and should be withheld pending instructions from the M.O.

781. *Arterial degeneration.*—Certain conditions such as chronic kidney disease, syphilis, gout or chronic poisoning by lead or alcohol are accompanied by degenerative changes in the arteries, which become thickened and tortuous. This leads to an increase of arterial blood pressure. Such a condition (known as arterio-sclerosis) is one of the chief causes of shortening of life in individuals over 45 years of age. Prolonged high blood pressure gives rise to many degenerative changes in the body. It will be sufficient here to mention that cardiac failure and apoplexy are two of the special dangers to be looked for.

782. Diseases of the respiratory system.—The acute diseases include pleurisy, pneumonia, broncho-pneumonia and bronchitis ; of these pneumonia and broncho-pneumonia are the most important.

The orderly must bear in mind that the one essential in treatment is the prevention of cardiac failure, and he must always be on the lookout for signs of this condition. The engorgement and consolidation of the lung tissues throws great stress on the heart muscle, which has to overcome increased resistance to the flow of the blood through the lungs. In addition to this, there is defective oxygenation

(anoxæmia) of the blood from the same causes, while the cardiac muscle itself is affected by the presence of toxins derived from the organisms which swarm in the lungs. The danger of cardiac failure does not disappear at once when the fever subsides, and particular care is necessary for one or two days after the *crisis* in a case of lobar pneumonia. Acute bronchitis, except in the elderly, is not, as a rule, a dangerous disease.

Pleurisy is often an accompaniment of pneumonia. Pleurisy may give rise to pleural effusion, which, if extensive, will cause embarrassment of the heart's action from pressure. If a pleural effusion should become infected with pus-forming organisms, the condition at once becomes dangerous and calls for early surgical treatment. This affection is known as empyema.

Sometimes pneumonia and broncho-pneumonia do not subside in a normal manner, and may be prolonged for several weeks. Then one of two possibilities may occur. Either the disease slowly clears up and the patient gradually gets well, or an abscess may be formed in the lung tissue which becomes broken down into pus and is usually expelled by coughing. Pulmonary abscess should not be confused with empyema.

783. Influenza.—Pure influenza is an acute infection of the system by an organism at present imperfectly understood. It is characterized by fever of two or three days' duration, with general malaise and pains in the limbs and back. In itself it is not a dangerous disease, but the heart muscle is temporarily affected by the disease. The complications of influenza are, however, extremely serious and chief among them are pneumonia and broncho-pneumonia. The effect of influenza is to render the system much more liable to infection by other organisms, and hence care is necessary in the nursing of every case, however trivial it may appear to be.

784. Renal diseases (medical) occur as :—

(i) *Acute nephritis*, an inflammation of the kidneys presenting the features of any inflammatory condition, namely, fever and malaise. In addition, the kidneys being the seat of the affection, there is high-coloured scanty urine, which contains albumen, blood and dead kidney cells.

(ii) *Chronic nephritis*, occurring in two main forms :—

(*a*) Large white kidney, which is characterized by :—

(i) Albumen and casts in a somewhat diminished amount of urine.

(ii) Œdema of the connective tissue of the body.

(iii) Anæmia.

(*b*) Granular kidney, which is characterized by a large amount of pale, clear urine with little or no albumen and no œdema of the tissues, but a high blood pressure.

785. The special danger in kidney cases is that of *uræmia*. Uræmia is a condition of poisoning of the system by a toxin. The two varieties of kidney disease in which it is most likely to occur are acute nephritis and granular kidney.

The symptoms common in uræmia are :—

Coma, convulsions, lethargy.
Diarrhœa and vomiting.
Dyspnœa (shortness of breath).

It must be realized that uræmia is a very dangerous condition which almost always ends in death within a few days in spite of treatment.

786. Hæmorrhage from the gastro-intestinal tract.

(i) *Hæmatemesis or vomiting of blood.*—This may occur in cases of ulceration of the stomach or cirrhosis of the liver. It is always a serious complication, but is usually not fatal unless repeated. The blood is usually dark in colour and often clotted.

(ii) *Passage of blood by the bowel.*—Bleeding into the bowel below the level of the stomach occurs in ulceration of the bowel, as in typhoid fever, dysentery or duodenal ulcer.

When it takes place in typhoid fever, it is a most dangerous accident. The resulting motions will contain blood in quantity, which is usually black (" tarry ") if the bleeding is above the level of the cæcum ; much depends, however, on the quantity of blood and the time that elapses before it is passed.

Bleeding may also occur from hæmorrhoids.

787. Hæmorrhage from the lungs.—Blood-stained sputum is common in pneumonia and in influenza where respiratory complications ensue. If, however, any appreciable amount of blood is coughed up (*hæmoptysis*), it is always an indication of serious disease, and its occurrence should always be reported without delay (*see* paras. **614** (xviii) and **737**).

In all cases of serious hæmorrhage the patient must be kept absolutely at rest in the recumbent position, unless breathlessness (*dyspnœa*) requires him to be propped up.

CHAPTER L

THE NURSING OF SURGICAL CASES

788. The care of most surgical cases involves the application of two great principles—*cleanliness* and *rest*.

Cleanliness.—Surgical cleanliness means much more than ordinary personal cleanliness. It means not only freedom from dirt but freedom from germs, *i.e.* the condition of asepsis. As has been explained in Chapter XXVI, the principle of aseptic treatment is that everything brought into contact with a wound should previously have been freed from germs, *i.e.* rendered sterile, by one of the methods of sterilization.

789. Sterilization.

(i) *Sterilization and cleaning of instruments.*—Instruments (with the exception of scalpels, scissors, razors, needles and other sharp cutting instruments) are sterilized by boiling in a one per cent. solution of bicarbonate of soda for 30 minutes, after which they must not be touched by anything except sterilized forceps.

All gripping instruments, such as Spencer Wells forceps should be opened before being boiled. If the instruments are to be used dry, as is preferred by most surgeons, the inner tray of the sterilizer containing them is lifted out and placed on a table which has previously been covered with sterilized waterproof sheeting and a sterilized towel. The table is then wheeled into the theatre, where the sister transfers the instruments to her instrument table, covering them with another sterilized towel till required for use by the surgeon. In wheeling this table into the theatre, the orderly should be careful to touch only the legs and not the sterilized waterproof sheeting or towel covering the top of it.

Scalpels and the other sharp cutting instruments enumerated above should never be boiled. They should be sterilized by immersion in a tray of pure lysol or 80 per cent. alcohol for at least 4 hours; better still, they should be placed in the sterilizing fluid the evening before the day on which they are to be used; they should rest on a layer of gauze or lint and all sharp edges and points should be carefully protected.

If required very urgently, they can be sterilized by being held in boiling water by means of forceps for a few minutes before being placed in the lotion.

Needles, classified and graded in sizes, should be kept in pure lysol. When required they should be rinsed first in sterile water and then in methylated spirit and laid on a sterilized towel ready for use.

Should any instrument be dropped on the floor, or touch anything that has not been sterilized, whilst being conveyed to the table, it must immediately be resterilized.

After an operation all instruments should be scrubbed in *cold* water with a nail brush kept only for the purpose, special care being taken to remove all traces of blood from the serrations of forceps. They should then, with the exception of sharp cutting ones, be placed in the sterilizer and boiled for half an hour, the sharp cutting instruments being sterilized with lysol as previously described. After this, they should be placed in an enamel bowl containing a weak solution of lysol and water and then thoroughly dried, especially in the joints. The lysol helps to keep instruments polished and makes the process of drying easy. Before being put away, the joints of delicate instruments may be smeared with liquid paraffin or glycerine to prevent rusting. If possible, scalpels, chisels and gouges should never be used a second time without being re-sharpened.

(ii) *Bowls, trays, dishes, gallipots, etc.*, must always be boiled before use for at least 20 minutes, or, where steam pressure is available, they can be tied up in a sheet and placed in the sterilizer.

(iii) *Towels, gowns, caps, masks, dressings and swabs* should be packed in drums lightly so that the steam can penetrate thoroughly. The drums should have well-fitting calico linings to prevent the contents coming in contact with the sides of the drum, and the cover of the lining should be placed over the dressings, etc., before the lid is finally closed and the drum placed in the high-pressure sterilizer.

It has been proved that all bacteria and spores are destroyed by being subjected to compressed circulating steam at a temperature of 266° to 293° F. for 15 minutes. This is the most efficient means of sterilizing surgical dressings and other articles used in operative work. Where only a temperature of 212° F. can be obtained, the articles should be sterilized for three-quarters of an hour.

After being sterilized, the drums must be sealed up and not opened until they are required by the surgeon or nurses. The articles are then lifted out by means of a pair of sterilized forceps; on no account must they be touched with the hands.

When a drum of dressings has once been opened, any of the dressings not used must be re-sterilized.

Jaconet mackintoshes should be well powdered with french chalk and then be folded up and sterilized in the drum with the towels.

(iv) *Rubber gloves* should always be examined for holes, as they are useless unless quite sound. This is done by filling the gloves with water, and subjecting them to slight pressure ; any puncture, however small, will at once be evident.

They can be sterilized by two methods (*a*) dry and (*b*) wet.

(*a*) Dry the gloves well and powder inside and out with french chalk, turn back the top of the gloves and place a small gauze bag of chalk in one of them ; place in a calico envelope or wrap in lint, so that one glove does not touch the other ; mark on the outside of the packet the size of the gloves, and place in the drum.

(*b*) Boil for 15 to 20 minutes, take out with sterilized forceps, and place in sterile water or saline solution.

(v) *Ligatures and sutures.*—A ligature is used to tie a blood-vessel.

A suture is used for binding edges of a wound together, either at, or below, the skin surface.

Ligatures are usually made of catgut, but silk and linen thread can be used.

Sutures are made of silkworm gut, catgut, horsehair, kangaroo tendon, silver wire, silk and linen thread.

Methods of sterilizing.

Silk, horsehair, linen thread, silver wire and silkworm gut are sterilized by boiling for half an hour.

Catgut cannot be boiled but is specially prepared ; it is usually obtained already sterilized in sealed glass tubes.

Kangaroo tendon is difficult to sterilize and it is a long process. Before use, it must be tested in the laboratory and certified sterile. It can be obtained in sealed glass tubes ready for use.

(vi) The hands of all engaged in surgical work require careful attention. The nails must be kept short, carefully trimmed and cleaned and all tags of skin removed daily.

Gloves must be worn if very septic cases are being dressed.

In preparing for an operation, the hands and arms well above the elbows (after the removal of any rings that may be worn) should be very thoroughly scrubbed with soap and a sterile nail brush for at least five minutes under running water, special care being taken with the nails and between the fingers. Plenty of soap should be used ; for this purpose spirit or ether soap is provided in most operating theatres. After thorough washing, the hands should be soaked for a few minutes in some antiseptic such as biniodide of mercury lotion (1/1,000), or swabbed over with a sterile gauze swab soaked in methylated spirit.

The cap and mask are then put on, care being taken not to touch the head or face. The process of washing the hands is then repeated, after which the hands can be dried with a sterile towel.

The gown is then put on and then the rubber gloves. Should anything that has not been sterilized be accidentally touched, the whole process must be gone through again.

790. Rest.—The second great principle in the nursing of surgical cases is rest, both local and general. Thus, when the stomach has been operated on, local rest is obtained by not giving any food. After a rectal operation the bowels are usually kept confined for four or five days.

General rest is obtained by keeping the patient in bed, and rest in the case of the limbs is ensured by means of splints and bandages and other mechanical appliances, while the mental rest so necessary in cases of severe head injuries is obtained by keeping the patient isolated, whenever possible, in a quiet and darkened room.

It is the duty of the orderly to see that the special splints, bandages and other mechanical appliances, as originally applied by the surgeon, remain in the correct position. In the case of a fracture, for instance, should the splints be disturbed and the limb not kept still, the ends of the bone will constantly rub against one another, sometimes giving rise to delayed union, and in any case causing pain and discomfort. Again, a patient who is fixed in an apparatus for counter-extension may by movement put the counter-extension apparatus out of action.

791. Preparation of operating theatre.—It is of vital importance that everyone engaged in surgical work should give special attention to all aseptic details, as on the careful and conscientious carrying out of these will largely depend the success or failure of the operation. The theatre must be clean and free from dust. Most modern operating theatres are built with rounded corners and highly polished surfaces so as to afford as little resting place for dust and germs as possible.

Weekly routine.

The ceiling and walls are washed down with soap and water, windows cleaned, furniture washed and castors cleaned with methylated spirit.

Daily routine.

The floors are scrubbed with soap and water (no sweeping is ever permissible) and sinks and taps cleaned.

The tables and stools are dusted with a damp cloth, all glass surfaces being polished with methylated spirit. All lights should be dusted with a damp cloth and tested to see they are working properly. An even temperature should be maintained in the room, not less than 70° F., and plenty of sterilized hot and cold water must always be available.

The anæsthetist's table, with everything likely to be required, should be kept ready and should include not only the actual anæsthetics required, but suitable restoratives and a hypodermic syringe, tested and ready for use, in case of emergency.

Before an operation, the operating table should be warmed ; this may be done by means of electric radiators under the table or by rubber hot-water bottles placed on it. The latter are removed to accommodate the patient and may then be arranged round him, great care being taken to prevent burning.

During an operation, the surgeon, assistants and nurses who handle instruments will be prepared as described in para. **789** (vi). In addition, all others such as the anæsthetist, nurses and orderlies present in the operating theatre wear gowns, caps and masks.

792. Preparation of the patient.—Before a serious operation, the patient should be kept in bed for a day or two. During this time the patient is kept at rest and on a light diet ; the urine is examined and any aperient ordered by the M.O. given.

The day before the operation, the operation area is well shaved, and a hot bath given, plenty of soap being used. The skin should be thoroughly cleaned, the nails trimmed and the hair washed. If the patient is too ill to go to the bathroom, he must be washed all over in bed, subsequently receiving a change of linen.

The iodine method of skin preparation is now universally used. It has the advantage of being both simple and efficient and possesses special powers of penetrating the dry skin. For the success of this method of preparation it is essential that the skin should be thoroughly dry before the application of the iodine, so, after the bath is given, the skin should be cleaned with industrial spirit and covered with a sterile towel held in place by a many-tailed bandage. An hour or two later the whole operation area is painted with weak solution of iodine, a sterilized swab held by sterilized forceps being used for the purpose, or it may be sprayed with iodine by means of an iodine sprayer ; this method is economical, quick and clean. As soon as the iodine is dry, a sterilized

piece of lint and a sterile towel or sterile many-tailed bandage is applied. Great care must be exercised to keep the sterile dressings in position. If they should get out of place, the preparation previously done will be useless. On the morning of the operation, a further coating of iodine is applied to the skin and fresh sterile lint and towel applied.

For emergency operations where time is of importance, the skin is dry shaved, and the iodine painted on without any preliminary washing.

The attendant who has to carry out the preparation of the patient's skin must carefully sterilize his hands and wear gloves, and the part to be prepared must be protected from bedclothes by means of sterile towels.

If ordered by the M.O., a dose of castor oil is given on the afternoon of the day preceding the operation. If this acts well, no further preparation is required. On the morning of the operation, a specimen of urine should be saved, the teeth carefully cleaned, a mouthwash given and any false teeth removed. The last food given should be at least four hours before the operation. This usually takes the form of a light breakfast consisting of a slice of toast with a cup of tea. Many surgeons order their patients a little jam with this meal. Milk should be avoided, as it is liable to be vomited during the operation. The clothing, which consists of a long flannel gown, should open down the back. The legs are covered with long woollen stockings reaching well up the thighs.

Special preparation is required for certain operations. Joint and bone cases are given two days' skin preparation. Rectal cases require two days' preparation by purgatives and enemata. For mouth operations gargles and mouth-washes should frequently be given before the operation, and in ear operations the ear cavity is usually gently swabbed out beforehand, and, if necessary, lightly packed with sterile ribbon gauze.

793. After-treatment of operation cases.—As soon as the patient has been taken to the operating theatre, the bed should be prepared for his return. It should be made up with clean linen, a draw-sheet and waterproof sheeting placed in position, and the bedclothes folded over to one side so that the patient can rapidly be put back to bed. The pillows are removed and a towel placed across the top of the bed to protect the sheet in case of vomiting. Hot bottles, protected by flannel covers, should be put in the bed and a blanket warmed near the fire. A towel receiver should be at hand in case of sickness, also tongue forceps and a mouth gag. As a patient

after any severe and prolonged operation will suffer more or less from shock, hot saline solution should be ready at hand in case of need, as also wooden blocks to raise the end of the bed.

Whilst under the influence of the anæsthetic, the patient will require careful watching, and must not be left alone until he recovers consciousness. Very special care must be taken in carrying out the instruction of the M.O. regarding the position of the patient after the administration of a spinal anæsthetic.

If percaine has been used, the greatest care must be taken that the head is kept low.

If glucose-stovaine solution has been used, the head must be kept elevated.

If these precautions are not taken, serious results may follow.

Except as stated above, the head should be kept low, and, if there is a tendency to vomit, turned well to one side. Care must be taken that, on recovering consciousness, the patient does not disturb the dressing. A bed cradle to support the weight of the bedclothes is always very comforting, and in some cases is necessary, and should be at hand.

After all operations, food is withheld until the effects of the anæsthetic have passed off. Thirst is relieved by small sips of hot water given slowly. If the thirst is excessive, as frequently happens after an operation in which there has been great loss of blood, one pint of saline at a temperature of 100° F. is very often ordered to be given by the rectum. The after-feeding varies with the operation performed, and special instructions are usually given about it, but to no patient will any ordinary diet be given on the day of operation. Diluted milk or tea is probably the only food that will be allowed. Abdominal cases are usually given sips of hot water for the first 24 hours, and are given no solid food until the bowels have acted in response to an aperient or enema.

On the evening of the operation, the bed gown should be changed, the patient's hands and face sponged and the draw-sheet drawn through. On the morning after the operation, a specimen of urine is saved for examination.

For the first 24 hours the dressing, without being in any way disturbed, should frequently be examined. If any blood or discharge shows through the dressing, a fresh pad of sterilized wool should be applied outside the original dressing and kept in place by a bandage, and the sister or senior N.C.O. at once informed, as the dressing may require changing.

Every precaution must be taken to ensure asepsis in the case of all operations.

794. After-nursing of abdominal operation cases.—Abdominal section may be performed for a variety of reasons, but the nursing of all such cases is very similar and success depends entirely on a minute and careful attention to detail. If the operation has been prolonged and difficult, the patient may suffer severely from shock; in such cases he must be put back to bed as quickly and carefully as possible. The head should be kept low (*see* para. **793**), and the foot of the bed raised. Hot bottles should be placed in the bed, and a hot blanket next the patient.

Great care must be exercised to see that the hot bottles are placed outside the blankets and nowhere near the patient. Very severe burns have been caused by carelessly allowing them to come in contact with the patient. A bolster should be placed under the knees to prevent any strain on the abdominal muscles.

A cradle may be required to keep off the weight of the bedclothes. A pint of normal saline solution at a temperature of 100° F., to which half an ounce of brandy and one ounce of glucose have been added, will nearly always be ordered for administration by the rectum as soon as the patient has been put back to bed.

Particular attention must be paid to the pulse, and its frequency and character noted. Stimulants and a hypodermic should be in readiness in case of collapse. If retching is severe, the wound should be supported by the attendant's hand placed over the bandage.

In nursing patients after abdominal operations, especially when sepsis is present, Fowler's position is often used. Patients nursed in this way appear to suffer less from flatulence, often very troublesome after an abdominal operation, than do those nursed in a recumbent position (*see* para. **716** (iv)).

The following are some of the special points to note in the after-nursing of abdominal cases :—

(i) Watch for abdominal distension and report it at once if present.

(ii) Note whether urine is passed. Retention of urine is very common for the first day or two. The patient should be encouraged to pass water naturally, but, if he cannot do so after the first 12 hours and relief is not obtained by the application of large fomentations over the bladder and the sound of running water, the fact should be reported to the M.O. and preparations made for catheterization.

(iii) Note whether flatus is passed by the bowels.

(iv) Note whether the patient vomits.

(v) Dressings must be watched carefully to see that they remain in place and do not become soaked through and so require readjusting or repacking.

(vi) The temperature and pulse must carefully be noted and recorded on a four-hourly chart.

(vii) It is most important to note how the patient sleeps.

(viii) Diet. Special instructions as to feeding are usually given and must be carefully carried out. A Benton's chart must be kept and the general rule for the first 24 hours is :— salines 4 or 6 hourly by the rectum, and sips of sterile water by the mouth ; then gradually increasing feeds of albumen water, beef tea, chicken tea or tea. Milk is usually avoided except in a peptonized form, given very sparingly. Following the aperient and enema, which in most cases are given on the third morning after the operation, the patient is allowed more solid food.

(ix) Attention must be paid to the cleanliness of the patient's mouth, frequent mouthwashes being used.

795. After-treatment of amputation cases.—After amputation of an arm or leg has been performed, the stump should, when the patient has been put to bed, be placed on a small pillow on a splint and secured with a bandage. This helps to restrain the painful muscular startings which sometimes occur in the stump and which interfere so much with rest. The dressed stump should be left exposed so that, if any hæmorrhage takes place, it will be detected at once. A tourniquet should be at hand to deal rapidly with any severe bleeding that may occur. The greatest care and gentleness are needed in moving the patient or making the bed.

796. After-treatment of tracheotomy cases.—This is usually an emergency operation and consists in making an opening into the trachea and inserting a tracheotomy tube, through which the patient breathes. Tracheotomy tubes are usually made of silver and have an outer and an inner tube, the one fitting closely into the other. The outer tube is provided with a shield and is held securely in place by means of two pieces of tape, which are passed through holes in the shield and tied together round the neck. The inner tube is movable and is taken out at frequent intervals and cleaned.

Ceaseless vigilance on the part of the nurse is required in the after-treatment of a tracheotomy operation. The after-care consists mainly in the management of the tube, feeding and careful nursing. Constant attention to the condition

of the inner tube is necessary, as mucous and membranous deposits are likely to fill it up, and thus cut off the air supply. At first the inner tube should be taken out every two hours and cleaned rapidly with a warm solution of bicarbonate of soda which speedily removes any sticky mucus. In removing it, great care is required, the outer tube being held in place with the forefinger and thumb of the left hand. On no account must the outer tube be interfered with, except by the surgeon, and when the inner tube is removed, steps must be taken to see that the tube left in position does not become blocked with mucus.

The dressing usually consists of a bib-shaped piece of gauze, fitting round the tube, and a single layer of gauze, wrung out of hot water, laid lightly over the opening of the tube. Both these dressings will require frequent changing. If any mucus is coughed up, it must immediately be wiped away with small gauze swabs, which should be burnt at once. If feathers are used for cleaning the tube, they must be sterilized by boiling for ten minutes. They should be unbroken, and have no loose pieces at the ends. The air that the patient breathes must be warm and moist, a steam tent often being ordered, and the temperature of the ward kept at about 70° F. Nourishment should be administered regularly, a matter which is sometimes one of great difficulty. Milk thickened with arrowroot or cornflour makes it easier to swallow, but in very severe cases nourishment has to be administered by means of a nasal tube. The patient must never be left alone.

A spare inner tube, dilators, pilot scissors and dissecting forceps should be kept in an antiseptic solution by the bedside, in case the surgeon wishes to change the tube.

797. After-treatment of cases operated on for piles (hæmorrhoids).—Operations for piles are very frequently performed in the army. The preparation of the patient has been alluded to, but surgeons differ in their practice, and special instructions should always be asked for. Pile operations are very painful, but if the wounds are kept clean and the tissues aseptic, a great deal can be done to lessen the pain. After the operation, the bowels are usually kept confined for two or three days and are then opened with a dose of castor oil, an injection of three or four ounces of olive oil being made into the bowel with a soft catheter and funnel at the same time as the aperient is administered. Some surgeons recommend an enema of olive oil (6 ounces) and thin gruel (14 ounces), instead of an aperient. Unless otherwise ordered, the patient may have light diet. He should

be kept in bed until the ligatures have separated, but may be allowed to use a night commode when his bowels are opened. Any bleeding observed must be reported at once. Unless there is a tube in the rectum, blood rarely appears outside, so that the patient must carefully be watched during the first few days for signs of internal bleeding.

Piles are now frequently treated by injection. By this treatment the extensive pre-operation preparation and also the post-operation stay in bed are obviated.

798. After-treatment of hernia operation cases.—The radical cure of inguinal hernia is one of the commonest operations in the army.

The special points to be observed in the after-treatment are as follows :—

(i) The dressing is apt to become soiled with urine unless great care is taken when the urine bottle is being used. It is a good plan to pin a piece of jaconet over the dressing and make a hole in it through which the penis is made to emerge.

(ii) The patient must be kept in bed but need not lie on his back. He must not in any way exert himself and, until after the removal of his stitches, he must be washed and attended to as a helpless patient.

(iii) When the patient first gets up (usually after three or four weeks in bed), a pad of cotton wool fixed by a spica bandage should be applied over the inguinal region and worn for a week or ten days ; after this all support should be dispensed with and the patient warned against doing anything involving great exertion for a couple of months or so after the operation.

799. Some special conditions after operations.—*Secondary hæmorrhage.*—Hæmorrhage must always be watched for after major operations. Secondary hæmorrhage may occur at any time from the second day up to two weeks after an operation and is due to the slipping of a ligature, or to suppuration. Any bleeding, however slight, should be reported at once. When hæmorrhage becomes profuse, prompt action is necessary, and every endeavour must be made to deal with the emergency by appropriate remedies until the arrival of the surgeon.

800. Shock.—Every serious operation may be followed by shock (*see* Chapter XXXIII).

CHAPTER LI

THE NURSING OF INFECTIOUS CASES

801. General considerations.—An infectious disease is one that may be communicated to others.

Such diseases exhibit very different degrees of infectivity. Some may be highly dangerous to life, others considerably less so, but all require special precautions to prevent spread.

An infectious disease may be considered under the following periods :—

(i) The incubation period, *i.e.* the time between the actual entrance of the infection into the body and the appearance of the symptoms of the disease ; this period varies within certain limits in each disease.

(ii) The period of the disease during which symptoms are present.

(iii) The period (following the disappearance of the symptoms) during which the patient is still capable of infecting others.

The whole of the above together constitute the segregation period, during which the sufferer is isolated.

802. Contacts.—Those who are in intimate contact with the subject of an infectious disease during any period that it is infective are known as " contacts," and for these a quarantine period is also necessary. The quarantine period for contacts is the time during which symptoms might appear, if any of the contacts have actually contracted the infection.

803. General characters of acute infectious diseases.—The infectious diseases met with in hospital in both Britain and the tropics are acute infections, usually accompanied by fever and some by certain specific or definite manifestations. Hence these fevers are often called the specific fevers and include cerebro-spinal fever, chicken-pox, diphtheria, German measles, measles, mumps, scarlet fever, small-pox, typhoid, typhus and whooping cough.

Many of the infectious diseases are accompanied by a skin rash.

All of them must be considered infective to others within the period of isolation laid down for each.

804. The *nursing* of infectious cases therefore calls for special measures, the reasons for which may be summarized as follows :—

(i) The patient is a danger to all who come in contact with him, because his disease is directly communicable to other people.

(ii) The disease may be communicated :—

(*a*) Directly by contact.

(*b*) Indirectly, by air, dust, contamination of food, water, clothing, etc.

In either case the disease is conveyed by the transfer of the infective agent or germ from the patient to other persons.

805. *To combat the spread of infection* certain precautions are taken, as follows :—

(i) Isolation of the patient until all risk of infection is past.

(ii) Isolation of contacts, *i.e.* those who have been in contact with the patient at any time during the infective period. This includes isolation of those in immediate attendance on the patient.

(iii) Special precautions in dealing with the patient :—

(*a*) The disinfection of all clothing, bedding, utensils and implements used by him.

(*b*) The protection of those attending him by the use of gowns, masks, special ward clothes, etc.

(*c*) The attention to personal hygiene of those attending him, in order that accidental infection of the hands, clothing or utensils may not be the means of conveying the infecting agent to others.

The above are the general considerations that apply to all cases in isolation ; the practical application of the special measures required is detailed in the following paragraphs :—

Details of I. Hygiene and II. Nursing.

806. I. Hygiene.—Infectious cases are nursed in well ventilated wards maintained at a temperature of 50 to 60° F., with windows kept open to ensure ventilation. No unnecessary furniture and articles such as carpets, curtains, etc., should be allowed.

All articles used in an infectious ward must be looked upon as infected and, on removal from the ward, must be treated at once, to render them free from infection :—

(i) Sheets, pillow-cases and washable articles of clothing are soaked in 2½ per cent. cresol solution (four ounces of cresol to a gallon of water) for at least half an hour and dried before being sent to the laundry. They should be placed in the cresol solution in the ward immediately they have been removed from the bed or patient.

(ii) Blankets, mattresses and articles of clothing not usually sent to a laundry are wrapped in sheets which have been wrung out of cresol solution and removed for treatment in a steam disinfector. If a disinfector is not available, such articles are thoroughly sprayed with 2 per cent. formalin solution and exposed to the air to dry.

(iii) Boots and other leather articles, uniform caps and such like which would be spoilt by treatment in a steam disinfector are treated with formalin as above.

(iv) Books, papers and articles of little value are burnt when considered necessary.

(v) Dressings from the patient are burnt immediately.

(vi) All secretions and discharges, urine and excreta must be regarded as infectious and either burnt or treated with cresol solution, as follows :—

(*a*) Swabs and paper handkerchiefs are burnt.

(*b*) The contents of sputum cups, receivers used for gargles or mouthwashes, urinals and bedpans will be mixed intimately with equal quantities of 2½ per cent. cresol solution and allowed to stand for at least half an hour before being disposed of. During this time the utensils should be covered with cloths wrung out of cresol solution. After standing, the utensils are emptied, cleaned and left to soak in a bath of cresol solution for one to two hours, then washed and dried ready for use.

(vii) All articles of crockery, knives, forks and spoons used by the patient are specially marked for the use of that patient only and are sterilized by boiling each time they have been used.

(viii) For the cleaning of a ward, dusters, etc., damped with cresol solution should be used. Scrubbing water must be mixed with cresol solution before being disposed of. All sweepings must be burnt at once. Special brooms, pails, etc., should be kept for each ward.

807. II. Nursing.—The actual nursing of an infectious case as regards the usual routine of washing, diet, treatment, etc., is conducted on the same lines as a non-infectious helpless case with certain additional cares and duties which have to be conscientiously carried out.

(i) Extra attention to the mouth and throat as in diphtheria and cerebro-spinal fever, to the eyes and ears as in scarlet fever, and to the skin in those diseases which give rise to discharges from lesions as in small-pox and chicken-pox.

(ii) More frequent observation of temperature, pulse, respiration and general condition.

(iii) Unremitting care over disinfection at all time during the course of the disease.

808. Conveyance of meals to an infectious ward.—Trays, utensils and crockery for use in an infectious ward must be clearly marked with red paint so that they cannot be used for any other ward. After food has been transferred from them to the plates, etc., used by the patient, they must be carefully sterilized before being returned to the cookhouse.

809. Convalescence of patients.—Care must be taken that patients convalescing from different infections are not allowed to mix or come in contact with one another in any way.

810. Procedure on discharge of patients.—The patient should be taken to the bathroom by the orderly attending him. A bath, containing one ounce of lysol to the full bath of water, should previously have been prepared by a non-infected orderly. The orderly from the infectious ward removes the patient's infected clothing for disinfection, swabs the bathroom floor with cresol solution and leaves. A non-infected orderly then brings the patient's personal clothing, etc., which has been disinfected since his admission. After dressing, the patient goes to a non-infected ward or room to await discharge and must on no account be allowed to return to his old ward.

811. Disinfection.—Full directions as to disinfection are given in Regulations for the Medical Services of the Army.

812. The personal hygiene of the nursing orderly.—A nursing orderly in attendance on an infectious case must remember two facts :—

He is himself liable to contract the disease.

He is always a means by which infection may be conveyed to those outside.

Strict attention to the following points must therefore be rigidly enforced :—

(i) The orderly should, on going off duty, take off his infected clothing, have a bath and put on his other clothes in which he takes his food, exercise, etc. The head, face, hands and finger nails should receive special attention. The nails must be kept short and the hair cut. He should never fail to get open-air exercise, and should aim at keeping himself as healthy as possible. He should use an antiseptic gargle two or three times a day. He should never come on duty without having had his proper meal beforehand.

(ii) On coming on duty, he should change his clothes again and put on an overall, and, if required by order of the sister, a cap and gauze mask also. These must be changed whenever they become soiled.

(iii) While on duty in the sick room he must :—

(*a*) avoid unnecessary contact with the patient ;

(*b*) wash his hands after handling the patient or infected articles ; for this he should use 1/2,000 biniodide or perchloride or 1/40 lysol ;

(*c*) never partake of any food or drink.

(iv) An orderly should never attempt to continue at duty if he is feeling in any way unfit, but must report his condition at once to the sister or M.O.

(v) An orderly is not expected to carry in his head the details of the diseases that he is nursing, such as times of appearances of rashes, periods of quarantine, etc., but he must make himself fully acquainted with the special routine of the infectious sick room and should try to understand the special dangers of contracting the disease and of carrying infection by his own person and clothes, and of spreading infection beyond the sick room by allowing infected articles or discharges to be dealt with in any way other than that laid down for his observance.

813. Antiseptics which may be used.—(i)—*Dangerous on account of highly poisonous properties.*

1/2,000 solution mercuric chloride
or
1/2,000 ,, ,, biniodide } for disinfecting the hands.

(ii)—*Not dangerous.*—

Cresol solution 2½ per cent. (4 oz. to 1 gallon) } for soaking linen, cleaning bedpans, urine bottles, etc.

1/20 carbolic lotion—for cleansing small articles such as tongue depressors, forceps, etc.

Formalin solution (8 oz. to 1 gallon) } for soaking linen, washing the iron work of beds, etc.

Note.—Commercial formalin is a 40 per cent. solution of formaldehyde.

SECTION 11—FOOD AND COOKERY

CHAPTER LII

FOOD AND NUTRITION

814. Introduction.—For ordinary purposes, food may be regarded as anything that, taken into the body, is capable of supplying material for growth and the repair of waste or of furnishing energy for bodily heat and work.

815. The principal constituents of food are proteins, carbohydrates, fats, water and certain mineral substances.

In addition, all fresh animal and vegetable foods contain small traces of substances known as vitamins.

Most of the food substances require to be digested by the digestive juices before they can be absorbed and made use of in the body. These changes take place in the alimentary canal.

The Chief Constituents of Food

816. Proteins.—The proteins are complicated nitrogenous substances, and are the only food substances that can build up and repair tissues ; they are therefore essential constituents of all dietaries.

Meat consists mainly of proteins ; they are also present in other tissues of all animals, and in vegetables, but vegetable protein is of less value to the body than an equal amount of animal protein.

In addition to building up and repairing the tissues, the protein metabolized in the body yields a small amount of energy.

817. Carbohydrates and fats.—The chief carbohydrates in foods are starches and sugars. During digestion, the starches are converted into sugar (glucose) and absorbed as such. Fats are derived both from animal sources (the fat of meat, lard, suet, butter, etc.), and from vegetable sources (margarine, salad oil, etc.). Oils are liquid fats and are usually of vegetable origin.

The carbohydrates and fats are the chief sources from which the body obtains the energy required for work and the production and maintenance of the body's heat, and a diet

containing too much carbohydrate or fat leads to the storage of fat in the body. A small amount of stored fat is beneficial, because it forms a reserve of material which can yield energy.

818. Accessory food factors (vitamins).—Practically all *fresh* foods contain small traces of substances which are essential for the maintenance of health and for the production of growth. In their absence, growth may cease, the repair of wounds may be interrupted, or certain diseases, such as scurvy and beri-beri, may arise. These substances are called vitamins; they are destroyed by prolonged cooking and by certain chemicals such as bicarbonate of soda, which is sometimes used in cooking green vegetables to retain their colour.

A diet composed only of preserved meats and dried vegetables infallibly leads, in the course of a few months, to disorders of nutrition.

The cream of milk contains a large proportion of the particular vitamin that is necessary for the growth of the body; hence its vital importance for the nourishment of children.

819. Mineral substances.—Mineral salts are essential to health. Common salt, being required in large quantities, is added to the food, but the other salts of the body, such as those of calcium, iron, sodium, potassium and phosphorus, are obtained in sufficient quantity from the materials forming an ordinary diet.

820. Water.—Water serves for the solution and conveyance of food to the various parts of the body, and also for the excretion of useless products. It is not received into the body solely as a liquid, but forms a large proportion of the solids taken; thus bread contains 42 to 43 per cent., a carcase of mutton 39 per cent., and an average side of beef 57 per cent.

821. Food values.—Except in the growing animal, in those who are putting on weight and during convalescence, nearly the whole of the food absorbed is oxidized in the body, *i.e.* it is burnt at a very slow rate. In this process of oxidation, energy is produced, most of it in the form of heat, which serves to keep the body warm, while the remainder supplies energy for muscular movements and other functions of the body. In the growing animal and in convalescence from any disease that has caused loss of weight, part of the food stored in the body is used to form new tissues or to replace those lost.

The energy value of different foods can be ascertained by estimating the amount of heat produced when a definite

amount of the substance is completely burnt or oxidized. The unit for measuring this heat is termed a Kalorie (*i.e.* a large calorie or Kilocalorie), and is the amount of heat required to raise one kilogramme of water one degree Centigrade, or, roughly, four pounds of water one degree Fahrenheit. Although this estimation of food values is a useful guide in drawing up dietaries, the results cannot be rigidly applied to human food, as, for a variety of reasons, man is not able to extract the full energy value of the food.

The energy values of the three chief constituents of food are, in round figures, as follows :—

Carbohydrates	4	Kalories per gramme.
Fats	9	,, ,,
Proteins	4	,, ,,

If, then, we know the composition of a food, its approximate food value is easily reckoned from the above figures. Thus, milk contains roughly 3 per cent. protein, 4 per cent. fat and 5 per cent. carbohydrate. One hundred grammes of milk will provide, therefore, the following Kalories :—

Carbohydrate	$5 \times 4 = 20$ Kalories.
Fat	$4 \times 9 = 36$,,
Protein	$3 \times 4 = 12$,,

or a total of 68 Kalories for one hundred grammes of milk.

One pint of fresh milk contains approximately 400 Kalories.

822. Food requirements.—A certain quantity of food is required to furnish energy for (i) the "internal work" of the body, *i.e.* the heart's work, respiration, etc. ; (ii) the maintenance of body warmth ; (iii) the renewal of tissues. This quantity of energy, which requires some 1,680 Kalories daily, must be supplied to keep the body alive quite apart from the performance of any visible work.

A further supply of food is required to provide energy for "external work," and this quantity depends largely on the amount of work done. The human body can convert about one-quarter of the total energy value of the food into energy available for work. The ordinary work of a soldier, parades, fatigues, etc., requires the expenditure of 300 to 400 Kalories ; his food must, therefore, contain four times this number of Kalories, *i.e.* 1,200 to 1,600, in order to furnish the energy required for external work ; to this must be added the 1,680 Kalories required for the internal work of the body. In peace time the ration should contain at least 3,600 Kalories, while on manœuvres or active service it should furnish over 4,000 Kalories. This calculation is based on the work done, but several other factors also influence the quantity

of food required. Thus, a big man requires more food to replace tissue waste and loss of body heat; a cold climate or insufficient clothing leads to rapid loss of heat from the body, to replace which the supply of food, especially fatty food, should be increased. In a warm climate, the escape of heat is facilitated by reducing the clothing, so that, as the work is much the same, the amount of food taken remains nearly the same.

CHAPTER LIII

FOOD INSPECTION *

823. Introduction.—The steward should be well acquainted with the characteristics of fresh food and be able to detect foodstuffs which are not up to contract or have become unfit for issue. The cook should know the various "cuts" or joints into which carcases of beef, mutton, pork, etc., are divided, and should also be capable of judging foodstuffs as to quality and fitness for human consumption.

824. Meat.—The conditions of contract require that meat shall be "well-fed, good, sound, sweet and wholesome." It is also usually stipulated that ox beef shall be not under two or more than five years old, and heifer or cow beef not under two or more than four years.

Meat may be roughly divided into four classes:—(i) Home-bred and killed, including every kind of bull, ox, cow, heifer, sheep and pig. (ii) Foreign bred, but killed in Great Britain, principally beef. This class is generally of good quality, having been well fed. (iii) Refrigerated or chilled beef, chiefly American and Canadian, which is killed and dressed abroad, wrapped in canvas, and hung up in cool chambers, at a temperature of about 36° to 40° F. The meat of this class is generally like that of (ii) class, as the animals are killed in prime condition and the rigid inspection is a guarantee against the importation of unsound meat. Refrigerated meat differs slightly in appearance from freshly-killed meat; it can be distinguished by:—(*a*) the fat of the meat being pink, owing to staining by the juice of the lean which escapes; (*b*) the outside of the meat presenting a dull, dead colour,

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* This subject is described in detail in R.A.S.C. Training, Vol. III (SUPPLIES).

when compared with the lustre on the outside of good, fresh meat; also, occasionally, the marks of the canvas covering being visible; (*c*) the dressing not being always so clean and neat as in home-dressed meat. If there is the slightest suspicious smell to be discovered on the outside, the flesh should be cut into and examined. (iv) Frozen meat, principally mutton, which is chiefly imported from Australia and New Zealand in an actually frozen condition. It can easily be distinguished, before it is thawed, by its hard, cold touch. The fat is not stained as in refrigerated meat. When thawed it can be distinguished by:—(*a*) the outside having a wet, sometimes greyish or so-called parboiled appearance and the oozing and dripping of liquid from the meat; (*b*) the general colour of the fat being dull-white; (*c*) the flesh having a uniform pink appearance, owing to the diffusion of the colouring of the blood, and not mottled as in fresh meat.

Beef.—A healthy carcase of well-fed beef has externally a round well-filled appearance. The muscle or flesh should be soft and silky to the touch, full of juice and of a slaty blue colour, but a freshly cut joint changes colour in a few minutes to a bright cherry red as the result of exposure to the atmosphere. The flesh should be elastic under slight finger pressure, and free from any tendency to " pit "; moist without being wet and well mottled or marbled with fat.

In the old cow, there will be a total absence of marbling, and the lean will be harsh and stringy to the touch, duller in appearance and deficient in juice, and there will generally be little fat. In the old bull, the flesh is dark in colour, feels like india-rubber, marbling is absent and there is a much greater proportion of muscle than fat.

The colour of the fat varies from cream or pale straw to bright yellow. It should be well set. The amount of fat in a carcase should be about 53 per cent. of the total weight and the proper proportion of bone is from 17 to 20 per cent.

The various joints into which beef is cut are described in R.A.S.C. Training, Vol. III (Supplies).

Mutton.—The fat in good well-fed mutton should be firm and white and fairly abundant. A common complaint is that it is too fat, but good mutton is unobtainable without a fairly high proportion of fat. The muscle should be red, soft and silky to the touch, moist without being wet and slightly elastic under the pressure of the finger. There is sometimes a little marbling, but it is rare. The division of the carcase into joints is described in R.A.S.C. Training, Vol. III (Supplies).

Bacon.—The lean parts should be of a pale pink colour (if it is very red, this denotes a high percentage of salt), the fat white and firm to the touch, the rind thin. Bacon is tested by inserting a skewer or knife into the fleshy parts of the meat and smelling the blade when withdrawn. There should be no unpleasant odour.

Fish, Poultry, Rabbits, etc.

825. Fish. *Fresh fish.*—The eyes should be prominent and bright, the gills bright red in colour, the flesh firm and stiff. When pressed with the finger, it should not pit and there should be no unpleasant smell. All fish, when delivered, should be cleaned, unbruised and unbroken. A pinkish colour along the back-bone of white fish is a sign of staleness.

Cured fish.—The fish should present a wholesome shiny appearance. Should there be any doubt regarding its freshness, an incision should be made in the thick part of the flesh near the back-bone; if there is any unpleasant smell, the fish must be rejected.

826. Poultry.—Fowls ought to be young, fresh and in good condition, and weigh not less than 1½ lb. or more than 1¾ lb. when trussed. Signs of age are shown by stiff horny feet, long spurs, dark-coloured hairy thighs, stiff beak and bones.

There should be no smell or discoloration of the skin. The back generally discolours before the breast. The feet should be limp and pliable, not stiff and dry, which is the sure indication of a stale bird. The condition of the flesh should be firm and not flabby, and the bird should be plump; the breast-bone is sometimes broken across to produce this appearance.

Turkeys are usually supplied to patients in hospital at Christmas. They should be of medium size, weighing from 10 to 12 lb. The skin of young birds is soft and smooth, not coarse and irregular as found in older birds. The lower part of the breast-bone should be pliable, the legs dark in colour. Hen turkeys are considered the best for cooking.

827. Rabbits.—Rabbits are frequently issued to hospitals in lieu of chicken. Old rabbits can be distinguished by their blunt claws and dry ears.

828. Eggs.—The average hen's egg weighs about 2 oz. avoirdupois. In order to ascertain the freshness of an egg, hold it up to the light; when the centre appears to be the most transparent part, it is a sign of freshness. Stale eggs are more transparent at the larger end. Another method of

ascertaining the freshness of eggs is to place them in brine—a solution of 8 oz. of salt in one gallon of water. Fresh eggs will immediately sink. Stale eggs will float. Stale or small eggs should be rejected.

829. Milk.—Cow's milk enters very largely into all dietaries; every care must be taken to use it when fresh, since, owing to the action of germs, lactic acid is formed after some hours and the milk becomes sour. The cleaner the milk, the longer it will keep fresh and sweet; therefore great care must be taken that the vessels in which it is kept are perfectly clean, and that it is protected from dust (which always contains germs). The cooler the temperature at which it is kept, the longer will the milk remain sweet.

The cream should not fall below 6 per cent.; this may be tested by placing the milk in a long glass, marked with graduated divisions, and reading off the amount of cream that has risen after 24 hours; or a strip of paper may be marked in divisions (tenths and hundredths) and gummed to the glass.

The specific gravity ranges between 1030 and 1034 at 60° F.

Good milk should be of a full opaque white, or have a very slightly yellowish tinge; this is best seen by placing it in a glass on a sheet of white paper. It should have a slight, agreeable odour, and characteristic sweetish taste, without any pronounced taste or smell of any kind. A distinct, objectionable, sweetish taste is sometimes present. The cause of this is that the cows are being fed on turnips and turnip tops. The attention of the contractor should at once be called to the condition of the milk supplied. Such milk is easily discernible in light milk dishes such as egg flips, sweet souffles, light custards.

The chief adulterations are:—(i) the addition of water; (ii) the removal of part of the cream, with or without the addition of water; (iii) the addition of the so-called preservatives, as bicarbonate of soda, borax, boric acid, salicylic acid or formalin. The addition of water lowers the specific gravity and, generally speaking, there is a loss of three degrees for every 10 per cent. of water added. On the other hand, removing the cream (skimming) raises the specific gravity; so that in milk that has been creamed and watered the specific gravity may be normal. This test must therefore be used in conjunction with the estimation of the cream present.

830. Butter.—Butter is obtained by churning, either from the milk directly, or from cream that has previously been separated. It should be of a good, rich-yellow colour, pleasant

and characteristic smell and taste ; the taste may be slightly salt, but should not be in the least rancid or bitter. The quantity of added salt varies considerably, but nowadays much less (generally 2 or 3 per cent.) is used than formerly, other preservatives, such as boric acid, being used instead ; of this there should not be more than 0·5 per cent. Butter which has been insufficiently churned will exude drops of milk when pressed and is very likely to go sour. Margarine is largely used as a butter-substitute ; but it must be distinctly labelled as such, and must not be used to adulterate butter. Margarine is not suitable as a substitute for butter for children and invalids, as it contains none of the vitamins that are essential for growth.

831. Vegetables.—Fresh vegetables and fruit should not be used if they have become stale. If received in bulk, they must be removed as soon as possible from the bags or boxes containing them, and laid out separately on shelves to allow the free access of air. This prevents fermentation and decay.

832. Cereals.—Wheat, barley, tapioca, sago, oatmeal, etc., if old or stale, have a greyish dull appearance. The same remarks apply to the manufactured products such as cornflour, flour, ground rice, macaroni, rolled oats, sago, semolina, tapioca.

The skin of butter beans, haricot beans, dried peas and lentils presents a shrivelled appearance when they are old.

833. Tinned foods.—The preservation of foods in tins is carried out by heating the foodstuffs to a high temperature, 115° to 120° C. and closing the tin so that all air is excluded. The heat kills all germs, and by closing the tin whilst the contents are still hot a partial vacuum is formed in the tin when it cools owing to the contraction of the air. This contraction sucks in the ends of the tin, making them slightly concave.

In damaged tins or in tins in which the contents have not been completely sterilized, putrefaction may set in with the formation of gas, which bulges out the ends of the tin. Such a tin is said to be " blown " and should be rejected.

The contents of a tin containing food should be emptied out of the tin as soon as it is opened.

Generally speaking, owing to the heat to which most foods are subjected in the process of being tinned, practically all vitamins are destroyed.

CHAPTER LIV

METHODS OF COOKING

834. Introduction.—The object of cooking is to convert raw foodstuffs into a form that can be more easily digested and assimilated. At the same time the heat employed in cooking food is an important factor in the destruction of parasites or disease germs with which food may be infected or contaminated.

As a rule, heat in some form is necessary in the preparation of food ; but it must not be forgotten that the heat used in cooking must be applied scientifically to produce the best results ; also, that the prolonged heating of all foodstuffs will eventually destroy the vitamins or accessory food substances that are essential to the maintenance of health and even life. Prolonged heating at a low temperature is more destructive of vitamins than a high temperature for a short while ; hence the undesirability of a diet containing too many stews and hashes.

835. Roasting.—Meat and poultry intended to be roasted, after being properly trimmed, or trussed, must be hung before a sharp fire, or placed in a very hot oven, for the first 15 minutes, whereby a thin, brown crust is formed on the outside which prevents the escape of the nutritive juices. This is especially necessary in the case of red meat such as beef and mutton, but it also applies to white meat such as veal, pork and poultry.

After this the heat must be reduced, or the meat must be drawn back so as to allow it to cook more gently. Veal, lamb and pork should, after the preliminary stage of quick roasting, be cooked by moderate heat, because these take somewhat longer to cook than other meats, and must therefore be cooked more gently. Whether the meat is roasted before the fire or in the oven, the basting must be carefully attended to, as this renders the meat more juicy and tasty. Either butter or dripping may be used for this purpose, but in the case of poultry the former is recommended.

In small hospitals the meat sent for roasting is generally the middle or chuck ribs. Before roasting, the bones should be removed and broken up for stock ; the meat should then be rolled and skewered or, if necessary, tied with string.

836. Baking.—The main difference between baking and roasting proper is that in the former case the cooking process is performed in closed vessels, ovens, or similar compartments ; in the latter, before an open fire.

Baking, like roasting, is cooking by means of dry heat. The heat is obtained from close fires, coal or gas, or from a steam jacket at a high temperature, as in some so-called bakers' ovens. Meat, fish, poultry, potatoes, puddings, cakes, bread, pastry, custards, etc., are cooked by this method.

837. Braising.—Braising is a combination of roasting and stewing, and is used mainly in the cooking of inferior joints and poultry. They should first be larded, or pieces of fat ham or bacon placed on top, and put in a stewpan with a tight-fitting lid. A layer of vegetables and herbs such as carrots, onions, peppercorns, bay-leaf, thyme and parsley, together with a small ladle of stock, should be added. The meat should be turned over occasionally and removed when sufficiently cooked. The meat thus treated not only retains its own juice, but also absorbs the flavour of the vegetables with which it is cooked. The gravy, after careful removal of the fat, may be thickened, if desired, with a little flour, and finally strained.

838. Boiling.—This simple way of preparing food is commonly employed, either (i) to cook the substance while retaining its nourishing juices, or (ii) to extract the nourishment from a substance, as in making beef tea or stock.

To retain the nourishing juices of meat or poultry, it must not be put into the pot or vessel until the water is actually boiling. The water, which should be seasoned with salt, must be allowed to boil briskly for at least ten minutes to harden the external portion of the meat, etc., and so retain the nourishing juices ; when this has been effected, the cooking must be completed by gentle simmering.

When it is desired to extract the nourishing juices, the foodstuffs must be cut into small pieces and put into cold water and then brought slowly to the boil ; the process is then continued by simmering till practically all the nourishment has been extracted by the liquid. Scum must be removed at intervals.

839. Steaming.—Steaming is cooking in moist heated vapour, *i.e.* cooking over boiling water or in steam chests. Although in most respects the results of steaming are the same as in boiling, the former process is more gradual than boiling, and retains more completely the natural juices. Steaming, being economical and simple, is one of the most satisfactory

methods of cooking many articles of food, and is especially recommended in invalid cookery and for large institutions. The actual loss in weight of meat cooked by steam is slightly less than by boiling.

The steam should be turned on full for a period of from 15 to 30 minutes, after which it should be reduced and the cooking carried on gently until completed. Potatoes are an exception to this rule, full steam being required for these during the whole process.

840. Stewing.—Stewing is, in reality, cooking in a small amount of liquor at a low temperature. By this method the coarse or tough parts of meats can be made tender.

For certain stews, the meat—especially red meat—is partly fried in butter or dripping before being actually stewed, whereby an improved flavour is obtained. Special care should be taken not to overcook a stew. A little vinegar sprinkled over coarse meat before cooking helps to make it tender.

841. Frying.—This process of cooking may be divided into two methods :—(i) *deep or wet frying*, (ii) *dry frying*.

(i) *Deep frying.*—Deep frying is cooking by immersion in fat or oil heated to a temperature of about 420° F. or nearly twice that of boiling water. The fat bath must be deep enough to cover the articles to be cooked, and hot enough to encrust or brown the surface of the articles so cooked ; when it is at the right temperature, it should be still, not bubbling, and a light-bluish smoke or vapour should rise from it. If the fat is not hot enough, anything put into it becomes sodden, greasy and unpalatable.

Deep frying is the best way of cooking fish, croquettes, rissoles or fritters. With the exception of fritters and those which are paste-coated, articles to be fried must be dipped either in batter, coated with flour, or egged and crumbed, before being immersed in the hot fat. It is also most essential that anything that is fried should be carefully drained on paper or a cloth before being served, to free it from excess of fat ; this is most important in dishes intended for invalids.

The best fat for frying is that obtained from beef suet or lard ; mutton suet is not so good as beef suet. The dripping from roast meat, and the fat from the stock-pot or from stews, should be saved and clarified for the fat bath.

(ii) *Dry frying.*—Dry frying is best adapted for cutlets, fillets, steaks, chops, bacon, kidneys, liver, eggs, etc. Only a small quantity of fat should be used—just enough barely to cover the bottom of the pan. It must be allowed to get thoroughly hot, but not burning, before beginning to fry. Frequent

turning is necessary to prevent hardening or burning, especially in the case of meat. Steak tongs should be used for turning the articles being cooked ; a fork should not be employed as the punctures made by it allow the juices to escape.

842. Grilling.—Cooking by exposing the article to the direct rays of the fire is called grilling or broiling. A bright clear fire made with a mixture of coke and cinders is essential. The gridiron, which must be scrupulously clean and well greased every time that it is used, is fixed in a sloping position at a convenient height above the embers ; this prevents the melted fat from dropping into the fire and so causing smoke or flame. From 10 to 15 minutes is required to cook an ordinary chop or steak, which should be served at once while still hot. Frequent turning with a pair of tongs is essential. Cutlets, chops, birds, fillets, steaks, slices of cod, haddock, whiting, soles, etc., can be cooked in this manner.

843. Average loss in cooking meat.—The approximate percentage of weight lost in cooking meat is as follows :— Roasting 30, baking 25, boiling 20, braising 15–20, stewing 15–20, steaming 15.

CHAPTER LV

RECIPES IN GENERAL USE

844. Introduction.—In the space available it is only possible to describe the principles involved in the preparation of the various classes of foodstuffs and to give recipes for the commoner dishes in each class. No two cooks prepare any dish in exactly the same manner, and it is the expression of one's own individuality in the making of any particular dish that makes cooking so fascinating.

All cooks should keep a notebook in which additional hints and recipes may be recorded from time to time.

The ingredients of the various dishes must be accurately weighed or measured ; to neglect to do so is to ask for failure. If rule of thumb is employed by the beginner, failure of his labours will frequently follow. Scales, weights and measures should always be used.

845. The stock-pot.—A stock-pot will be kept in every kitchen to provide the liquor required for various purposes, but mainly in the preparation of gravies and soups. A large boiling-pot, copper boiler or steam vessel can be used for this purpose, and it should be provided with a tap.

Into it are put all kinds of bones and trimmings of meat. The bones must be broken up before they are put in the stock-pot or cooking-vessel; about three pints of water are added to each pound of bones and meat. The whole must then be allowed to come slowly to the boil, when the scum which rises to the surface should be carefully removed; but the fat rising to the surface must not be removed until the stock is ready. A little salt should be added with the bones, etc., as this helps to bring up the scum. After this, the stock should be strained and used as directed.

It is not advisable to add vegetables to a stock-pot. When vegetables are added, it means cleaning the pot out daily. If the stock-pot is used for a supply of liquor for soups, gravies and sauces, it may be used for three days in winter and two days in summer. At the end of the day, the contents of the stock-pot should be placed in an enamelled or earthenware container and removed to the larder, where it should be placed on a wooden or iron frame so as to admit free passage of cool air round the bottom and sides of the vessel.

846. Soups.—Soups are divided into four classes :—Clear soups, purées, thickened soups, broths.

Clear soups are made from clarified stock, various garnishes being added which give them their distinctive names.

Purées are made by rubbing the materials of which the soup is made through a sieve; the purée, or pulp, thus made is then stirred into the liquor of the soup, as in lentil soup or spinach purée. The sieve removes the tough lentil husks.

Thick soup.—Soups are thickened by the addition of either (i) flour, cornflour, rice-flour, tapioca, semolina or small sago; or (ii) a mixture of yolk of eggs and milk or cream.

Broth is stock made from beef, mutton, veal, chicken, etc.; it is not clarified, and usually small pieces of the meat and vegetables are served in it, as in Scotch broth or mutton broth.

Soup recipes. *Julienne soup.*—To make four pints, take 2 quarts clarified stock, 1 carrot, 1 onion, 1 turnip, 1 stick of celery, pepper and salt to taste.

Cut the vegetables into fine shreds about an inch long and boil in the stock until well cooked. Add seasoning. This quantity is sufficient for eight persons.

Haricot or lentil purée.—To make four pints, take 8 oz. haricot beans or lentils, 4 pints stock, ham or bacon broth, or water (with bacon bones and rind), 1 carrot, 2 onions, 1 turnip, 2 strips of celery, ⅛ oz. dried herbs, salt and pepper.

Wash the haricot beans or lentils, soak in cold water for 12 hours. Put them in a stewpan with the stock, bring to the boil, skim carefully. Add the vegetables sliced thinly, and dried herbs; let simmer gently for 3 hours, or until tender, skim frequently. Remove the bones and rind if used, rub the remainder of the ingredients through a hair sieve, return to a clean stewpan, bring to the boil, stirring meanwhile, season to taste.

The above is sufficient for eight persons.

Tomato soup.—To make two pints, take 2 lb. tomatoes, 1 small carrot, 1 turnip, 1 onion, 1 small bunch of herbs, 1 stick of celery or a pinch of celery seed, 1 tablespoonful cornflour, 1 oz. clarified fat, pepper and salt, 1 lump of sugar (optional) and the liquor from the tomatoes, made up to 1 quart, with stock and water.

Slice the vegetables and cook them in the fat for 10 minutes without browning, then add the liquor, herbs, pepper, salt and sugar.

Cook until tender (when nearly cooked, add the tomatoes). Pass through a hair sieve and thicken with cornflour. Stir until it boils. Cook 10 minutes and serve.

The above is sufficient for four persons.

Mutton-broth.—To make 2 pints, take 1 lb. scrag-end of mutton, 1 quart water, 1 dessert-spoonful of pearl barley or sago, 1 clove, 6 peppercorns, 1 teaspoonful of chopped parsley and salt to taste.

Take the meat off the bones and cut into dice. Trim off the fat and put the meat and bones into a saucepan with the water; add the salt and bring slowly to the boil. Skim well. Add the rest of ingredients. Simmer gently for about 3 hours, skim again, then add the parsley. When cooked, remove the bones, peppercorns and clove.

Note.—If vegetable flavouring is desired, cut up a small onion, half a small carrot and a turnip, and cook them in the broth. Blanch the barley before using; chop finely about 1 teaspoonful of the cooked meat, and add to it the broth before serving.

The above is sufficient for four persons.

Chicken broth.—To make 1 pint, take ½ chicken, or the inferior joints of a fowl 12 oz., 1 pint water, ½ oz. blanched barley or rice, 1 clove, 3 peppercorns, ½ a teaspoonful of chopped parsley, 1 small onion, salt and pepper.

Cut the chicken into small pieces, put them in a stewpan with cold water, bring to the boil, skim well, add the clove, peppercorns and onion, let simmer slowly for about 3 hours, season to taste, strain and serve.

If the barley or rice is to be included, after straining return the broth to the saucepan, add the cereal, let simmer gently till cooked, stir in the parsley and serve.

The above is sufficient for one person.

Chicken cream soup.—To make 2 pints, take 12 oz. chicken, 1 quart stock or water, 1 onion, 1 carrot, 1 strip of celery, 1 oz. flour, 1 oz. butter, 5 oz. boiling milk, a pinch of grated nutmeg, salt and pepper.

Cut the chicken into small pieces, clean and prepare the vegetables, slice them thinly, put into a stewpan, cover with stock, bring to the boil, skim carefully, add the nutmeg, let simmer gently for 4 hours and strain. Melt the butter in a stewpan, mix the flour smoothly with it, stir in the boiling milk until a thin paste is formed, add the stock previously made, bring to the boil and season to taste.

The above is sufficient for four persons.

"Economy" soup.—1 gallon water, 7 or 8 lb. bones (broken), 3 lb. mixed vegetables (carrots, onions, turnips, a small stick of celery—celery leaves or seeds can be used when fresh celery is unobtainable), pepper and salt to taste. Place the water and bones with a sprinkle of salt in a saucepan, bring gently to the boil and allow to simmer for 4 or 5 hours, skimming carefully. Prepare and dice the vegetables ; after removing the bones add the vegetables and cook until tender.

847. Fish.—There are three classes of fish :—

(i) Oily fish, such as salmon, eels, herrings and mackerel. The flesh of these fish is dark, because the oil is distributed round the muscle fibres, and, although it is richer and more nutritious than the flesh of white fish, it is more difficult to digest.

(ii) White fish, such as whiting, soles, cod and plaice. The oil or fat in these fish is stored to a large extent in the liver, with the result that the flesh is light, digestible and particularly white in appearance. For invalids white fish should always be selected, never the oily kinds.

(iii) Shell fish, such as oysters, crabs, lobsters, etc. These fish, with the exception of the oyster, are less digestible than the other classes.

Fish must be fresh and well cooked. Stale or under-cooked fish is not only unpleasant to eat but also dangerous.

Fresh-water fish must be cleaned at once, since, if left uncleaned for long, it will develop a muddy flavour. If the fish smells at all muddy, it should be washed or even soaked in salted water. Early cooking is important. Staleness in fish is not easily detected when the fish has been kept on ice ; but its apparently fresh condition rapidly changes when once removed from the ice. White fish are best cooked by frying, oily fish by baking or grilling, since, if cooked in fat, they become even richer than before. All fish should be washed in salt and water, with the exception of dried and smoked fish, which should be wiped with a damp cloth, and salt fish, which require soaking in cold water to extract some of the salt. The eyes, gills and scales should be removed from all whole fish, the fins and tail trimmed, and the inside thoroughly cleaned and wiped. When scaling round fish, begin at the head and work downwards, but for flat fish reverse the direction and begin at the tail.

Fish stock.—8 oz. skin, bones and trimmings of fresh fish, 1 blade of mace, 1 small onion, 1 sprig of parsley, 1 pint cold water, salt and pepper.

Put the bones, etc., of the fish into a stewpan, cover with cold water and season to taste. Add the onion, sliced thinly, blade of mace and parsley, simmer for 15 minutes and strain.

Filleted fish.—Fish should, if possible, be filleted from the bone. This is done by first removing both skins, cutting off the head and making a cut down each side of the backbone, and then running the knife under the flesh close to the bone. Each sole will make four fillets, which should be placed in a previously buttered baking-dish. A piece of buttered paper is then placed over the fish, which is baked in the oven from 10 to 15 minutes. Small haddocks and large whiting are best filleted and cooked in the same way as soles. Slices of cod can also be cooked in this way.

Boiled fish.—Place the cleaned fish in a stewpan containing a small quantity of hot water flavoured with salt, bring to the boil, remove the scum that arises on the surface and allow to simmer gently until done. Do not permit the water to boil continuously or the fish will break.

The time required for cooking depends entirely upon the class and thickness of the fish. When the fish separates easily from the bone, it should be removed from the water. Drain and serve on a warm plate with white fish or parsley sauce made from the stock in which the fish has been boiled. When cod, hake, ling, etc., are to be boiled they should be cut in slices when raw, and tied round with string, which is removed when the fish is dished up.

Fried fish.—After washing the fish, dry it well.

There are three ways of preparing fish for frying, viz., by dipping it in milk and flour; by coating it with prepared batter; and by egging and crumbing; the last is the nicest method, but also the most expensive.

The pan used for frying should contain sufficient fat to cover the fish completely. Dripping, lard or oil can be used for frying purposes, but must be properly heated before the fish is placed in it. Only a small quantity of fish should be fried at a time, and the fat should be allowed to get thoroughly hot before the next lot is put in the pan.

As soon as the fish is done, drain it and place it on paper so as to absorb all the fat. It should be dished up on folded paper placed on a hot dish, and garnished with small pieces of lemon and a few sprigs of parsley.

When frying is completed, allow the fat to cool a little and strain it to remove any loose crumbs or bits of batter. The fat will then be quite fit for future use.

Grilled sole.—10 oz. sole, ½ oz. margarine, ¼ lemon, salt and pepper.

Wash, wipe and trim the sole, season with salt and pepper, melt the margarine in a small saucepan and brush the liquid over both sides of the fish. Place it on a clean, warm, well-greased grill and cook over a clear bright fire for about 10 minutes, turning frequently. Serve hot with small pieces of lemon.

Fish cakes.—6 oz. cooked fish (cod, whiting, haddock or other white fish), 6 oz. mashed potatoes, pepper and salt.

Free the fish from skin and bone, mince or chop finely, wash, peel and steam the potatoes, mash, or rub them through a wire sieve, and mix well together; chopped parsley may be added, season to taste. Mould into four round flat cakes, dust lightly with flour and fry in deep boiling fat. When cooked, drain carefully on kitchen paper and serve on a hot plate.

Fricassee of fish.—First cook the fish in salted water, flavoured with a blade of mace and a sprig of parsley. Remove the skin and bones and divide into small portions. Make a white fish sauce. Season with lemon juice, nutmeg, pepper and salt. Put in the pieces of fish and heat up. Serve with plain boiled rice. If cooked fish is used, put the bones and skin into the water and simmer for 10 minutes with the spices, then make the sauce as directed.

Fish soufflé.—10 oz. white fish, 1 oz. butter, 1 oz. flour, 5 oz. boiling milk, 1 egg, salt and pepper.

Melt the butter in a stewpan, stir in the flour, when sufficiently cooked, add the boiling milk, mix well and stand aside to cool.

Remove the skin and bones from the fish, rub through a wire sieve and season with salt and pepper. Place the fish in a mortar, add the yoke of egg, pound thoroughly, whisk the white to a stiff froth and stir in lightly. Have ready a well-greased mould or shape, put in the mixture, cover with greased paper and steam slowly for 45 minutes. Serve with white fish sauce.

White fish-pudding.—6 oz. cooked fish, 1 oz. soft bread-crumbs, 1 egg, mace, nutmeg, salt, pepper and 2 oz. butter.

Chop or mash the fish, warm it up in the butter and add the breadcrumbs, previously soaked in half a gill of milk or cold stock. Season with salt, pepper, a pinch of ground mace, and a grate of nutmeg, then add the beaten-up egg and mix well. Steam in a buttered mould 1 hour, or bake in a tin buttered and coated with breadcrumbs for ½ hour.

848. Meat dishes.—*General notes.*—Beef should be under- rather than over-cooked. Mutton is generally preferred well done. Veal, lamb and pork should always be well cooked; otherwise they are not so easily digested. Freshly-killed meat will take longer to cook than that which is well hung. When stewing meat, use as little water as possible. Generally the juices from the meat are nearly sufficient to cook it in. In frying, the pan must be frequently shaken to prevent sticking.

To bake a joint.—Allow 15 minutes to every pound of meat, and 15 minutes for warming through. It is advisable to use a double tin, the lower containing water, which generates steam and so prevents the dripping from the meat from being burnt and making an unpleasant smell.

Flour the meat and put it on a trivet placed on the inner tin. If a trivet is not at hand, two clean rib bones will answer the purpose. For the first 10 minutes keep the oven very hot, then cool down to a moderate heat by opening the ventilator to allow the steam to escape; otherwise the meat will be sodden.

Baste the joint frequently; just before serving, sprinkle a little salt over it. When cooked, place on a hot dish and pour all the dripping from the pan into a basin for future use when cold.

Pour about 1 gill of hot water into the dripping pan and scrape the brown particles off the pan with which to colour the gravy. The gravy should be poured round the joint,

not over it. When the joint is cut, the escaping juices will run into the gravy.

Boiled beef.—Fresh meat must be placed in boiling water slightly salted ; as soon as the joint is in, the saucepan should be drawn off the fire, so that it may only simmer until done.

Salt meat must be put into warm water and brought to the boil, then allowed to simmer until done.

When the joint is cooked, serve it on a hot dish, with a teacupful of the liquor in which it was boiled poured over it.

The rest of the liquor may be served for soup, if not too salt.

Mince.—Ingredients: scraps of cold meat, 1 small onion, chopped parsley, a small bunch of sweet herbs, a little flour, toasted bread cut into fancy shapes, and a little dripping.

Put the sweet herbs into a saucepan and boil for about an hour. A little parsley may be added. Chop the onion fine and brown it in a saucepan ; then add the flour and cook and brown that ; when nicely coloured, add the meat finely minced and season to taste ; strain the gravy from the herbs on to the meat and browned onion, then let it simmer very slowly. The toasted bread should be arranged round the dish and kept in position by a little flour and water, the mince being placed in the centre. Sippets of fried bread or a poached egg may be served on the mince.

849. Poultry. *Roast and baked fowl.*—Before being cooked, the fowl must be plucked, singed and drawn. To draw the fowl, lay it back downwards on the table ; cut a slit in the skin of the neck, leaving enough to form a flap ; through this opening insert the middle finger and loosen the entrails, doing this carefully and thoroughly so that less trouble may afterwards be met in drawing the bird. Next cut off the vent and draw the fowl carefully, taking out all the entrails. Special care must be taken to avoid breaking the gall bladder as this may ruin the bird by imparting a very bitter taste to the flesh. The inside must then be carefully wiped out, as also the flap of skin at the neck. Lastly, dip the legs in boiling water, scrape them and cut off the claws, also the tips of the pinions.

A fowl to produce 1 lb. of meat (or two diets) should weigh, when dressed and drawn, ready for cooking, not less than $1\frac{1}{2}$ lb. and not more than $1\frac{3}{4}$ lb. in its raw state.

Note.—The foregoing specification is for Great Britain ; it may vary at other stations.

The fowl should be roasted whole and afterwards divided.

If, however, one portion of a fowl only is required, it should be cut from the raw fowl, covered with buttered paper and either baked or roasted. In baking fowls, the oven should be hotter than for meat. If a fowl has been once cooked to make it hot again place it on a plate in a basin, with very little water under the plate ; it should be covered over with a little butter and heated in the oven for 20 minutes.

Boiled chicken.—Draw the chicken as described in the preceding paragraph. To truss it, cut off the legs at the knee-joint ; then loosen the skin over the legs and force the lower part of the leg under the skin ; put a skewer through the wing, upper part of the leg, other leg and wing ; tie a piece of string round the " parson's nose," then round the lower part of the chicken so as to close the opening completely. Put the chicken into rapidly-boiling stock and boil it for five minutes ; then let it simmer for 20 minutes for each pound of weight and 20 minutes over ; lift the chicken out of the stock, drain it well, put it on a hot dish and remove the skewer and string. Cut it up into portions and serve with plain white sauce, or with egg-sauce, as may be ordered. If it is served plain a little of the stock or liquor should be poured over each portion.

850. Gravy.—A little hot gravy should always be poured round each portion of roast or baked meat and poultry. To make gravy, pour off the fat from the pan in which the joint or fowl was roasted ; strain this fat (the excess should be kept for further use) ; then add the required quantity of stock or bone-liquor, stir over the fire so as to blend the whole, season lightly with salt and pepper, boil for 5 minutes, then skim and strain.

851. *Stewed rabbit.*—1 rabbit, 1 onion, 1 oz. flour, salt and pepper.

Cut the rabbit into neat pieces, split the head and allow that and the neck to soak in salt water to draw out the blood. Wash and place in a saucepan with the onion and sufficient cold water or stock to cover. Let simmer gently for 1½ hours or until tender ; skim well. Mix the flour, salt and pepper with a little cold white stock or water, add carefully to the stew and boil for 5 minutes. Bacon bones or rind cooked with the rabbit will improve the flavour.

852. Vegetables.—All green vegetables, including asparagus, broccoli, cauliflower, carrots, parsnips, new potatoes, turnips, etc., should be put into sufficient boiling water to which a small quantity of salt has been added, but old

potatoes should be placed in cold water and allowed to boil slowly until tender. The object to be aimed at is not only the cooking of the vegetables to perfection, but the retention of their colour. This is attained by making certain that the water is actually boiling before the vegetables are put into it, and, in the case of green vegetables, by keeping them boiling fast in an open saucepan till sufficiently cooked. Soda must not be added to the water, as it tends to destroy the vitamins or health-giving properties of the green vegetables.

Broccoli, brussels sprouts, cauliflowers, savoys, etc., should be cleansed thoroughly before cooking by allowing them to remain in slightly salted water for at least an hour, with frequent shaking to remove sand, grit, insects and other impurities. Spinach requires special attention. It should be washed in several changes of water.

Fried potatoes.—Wash and scrub the potatoes, peel them thinly, cut them lengthwise into slices, then cut the slices into long, thin strips and keep them in cold water until ready to fry. Have a frying-pan with sufficient hot fat (lard, dripping or oil) to cover the potatoes. Drain the potatoes carefully and fry in the hot fat until they are a light brown colour ; lift them out, drain them well on a cloth or paper and serve. Frying is one of the best methods of cooking potatoes.

853. Puddings. *Pastry.*—Good results in making pastry can only be attained by the exercise of care and attention to detail. The flour should first be sifted through a sieve, and baking powder then added. Baking powder is a preparation of acid and an alkali which gives off carbonic acid gas on the addition of water. The air and the gas in the pastry expand when the pastry is heated ; it is this expansion which makes the pastry light. Cool hands are essential and all ingredients must be carefully weighed.

Proportions : ½ lb. flour, 3 oz. lard or butter, ½ teaspoonful of baking powder, 1 gill cold water.

Sift the flour, add to it the baking powder and a little salt, and rub in the fat until the mixture resembles fine bread crumbs ; mix with cold water into a stiff paste, using a wooden spoon.

Flour the board and rolling-pin and roll the paste to the shape of the pie dish. Damp the edges of the dish, then moisten the rim, put on the cover, cut up the edges and decorate. Bake in a quick oven for half an hour, brush over quickly with cold water and dredge with castor sugar for fruit tarts. For meat pies brush over quickly with the white of an egg mixed with 2 oz. of milk before baking.

Suet pudding.—1 oz. chopped beef suet, 2 oz. flour, $\frac{1}{8}$ oz. baking powder, $\frac{1}{16}$ oz. salt and about $1\frac{1}{2}$ oz. water.

Remove the skin from the suet and chop it very finely. Put it in a basin with the flour, baking powder, and salt, mix and add sufficient water to make to a light consistency. Work into a light paste and fill into small, well-greased moulds. Cover each with greased paper and steam for 45 to 60 minutes. Turn out and serve.

Rice pudding.—1 oz. Patna or Carolina rice, 12 oz. milk and $\frac{1}{2}$ oz. sugar.

Wash the rice, put it in a saucepan with the milk and let it simmer until the milk is thick ; add the sugar and flavouring, pour the mixture into a slightly buttered pie dish or pudding tin and bake in a moderate oven from 20 minutes to $\frac{1}{2}$ hour ; dredge with sugar and serve.

Note.—Lemon, cinnamon, nutmeg, cloves and other spices may be issued as flavouring. When flavouring is used, it should be put in the pudding just before it is baked. A thin piece of lemon-rind boiled in the milk and removed before baking is excellent.

Other farinaceous foods suitable for milk puddings are tapioca, sago, barley, cornflour, semolina, etc.

College pudding.—6 oz. flour, 4 oz. currants, 2 oz. bread-crumbs, 4 oz. sugar, 4 oz. suet, 2 eggs and milk.

Mix all the dry ingredients thoroughly. Moisten with beaten eggs and a little milk. Three-parts fill some buttered moulds with the mixture. Cover with greased paper and steam $1\frac{1}{2}$ hours. Serve with sweet sauce.

Custard pudding.—1 egg, 12 oz. milk, $\frac{1}{2}$ oz. sugar and a little cinnamon, lemon essence or nutmeg.

(i) Beat the egg, add to it the milk, sugar and lemon essence if required, stir briskly until the sugar is dissolved, pour the custard into a buttered pie dish or pudding tin, sprinkle over the cinnamon or nutmeg and bake in a moderate oven for about 20 minutes. Serve either hot or cold. The same ingredients can be put into a greased basin and steamed or placed in a double saucepan and boiled.

(ii) $\frac{3}{5}$ oz. dried or preserved eggs, 1 oz. cold water, 12 oz. milk, $\frac{1}{2}$ oz. sugar and flavouring as above.

Put the required amount of dried eggs into an earthenware basin or pie dish, pour the water over them, stir thoroughly and allow the eggs not less than 3 hours to absorb the water. If required for immediate use, the eggs may be soaked in tepid water for about 10 minutes ; when ready, beat them briskly, add the milk and sugar, also lemon essence if required,

stir well until the sugar is dissolved, pour the custard into a buttered pie dish or pudding tin, sprinkle over with cinnamon or nutmeg and cook in a slow oven until set. If the oven is too hot, the custard will be spoilt by curdling. Serve either hot or cold.

854. Oatmeal porridge.—1 oz. oatmeal, 4 oz. milk, 10 oz. cold water and $\frac{1}{16}$ oz. salt. Bring the water to the boil; whilst it is boiling, sprinkle in the oatmeal, add the salt, stirring briskly to prevent lumps forming; cook gently for about 1 hour. The porridge must be stirred frequently whilst cooking, to prevent burning. Serve with cold milk and sugar if required.

855. Sauces.—White sauce and brown sauce form the base of most sauces. They are, therefore, often termed the master sauces.

White sauce.—1½ pints milk, ½ pint ordinary stock, 1 onion, 1 clove, 2 oz. butter, 3 oz. flour, 6 peppercorns, 1 bay-leaf, a pinch of salt and nutmeg.

Boil the milk in a saucepan, peel the onion and stick the clove in it. Put it into the milk with the bay-leaf and peppercorns. Stir the flour into the butter, previously melted, in a saucepan. Cook *without browning* for a few minutes. Next moisten with the stock and boil up; then add the milk, etc. Let all boil until the flour is thoroughly cooked; this will take about 10 to 15 minutes. Take out the onion, bay-leaf and peppercorns. Add a pinch of nutmeg, if desired, and one of salt. If it is not smooth, pass it through a sieve. Should a richer sauce be desired, a small piece of fresh butter or a little cream may be worked in after the sauce is strained, but it must not boil again. This sauce is suitable for boiled mutton, chicken or rabbit.

Another white sauce commonly used for boiled vegetables, such as cauliflowers, artichokes, onions, etc., is made as follows:—Melt a piece of butter, the size of a walnut, in a saucepan; when melted, add a spoonful of flour and thoroughly mix a mixture of half stock and half milk to make it of a consistency of cream. If too thick, add a little milk or stock gradually to thin it; the sauce should be of a consistency to cling to the article of food. Then add sufficient milk; boil and pour it over the vegetable and serve.

Brown sauce.—1¼ pints gravy or rich stock, 1 onion, 1 carrot, 2 oz. butter or dripping, 1½ oz. flour, ½ oz. mushroom ketchup, ½ oz. vinegar, salt and pepper.

Peel the onion, scrape the carrot, cut up both into small pieces; melt the butter or dripping in a saucepan, and, when

hot, add the vegetables and flour, stir over the fire until the whole is of a rich brown colour, put in the vinegar, ketchup and gravy, and continue stirring up until it boils, then skim well and allow it to simmer for 20 minutes. Strain and season to taste, re-heat and skim, and serve as required.

Bread sauce.—2 oz. breadcrumbs, 1 small onion, 1 clove, ½ oz. butter, or 1 tablespoonful of cream, 1 blade of mace, ½ pint milk, salt and pepper. Put the milk, peeled onion with the clove stuck into it, blade of mace and breadcrumbs in a saucepan, boil for 15 minutes, stirring to prevent burning. Remove the onion and mace, season to taste, stir in the butter or cream until it is dissolved and serve hot. The consistency of the sauce when finished should be that of thick cream.

White fish sauce.—½ oz. butter, ¼ oz. flour, 4 oz. milk or fish stock, salt and pepper, lemon juice ½ teaspoonful.

Melt the butter in a stewpan, stir in the flour, add the milk or fish stock, stir until it boils and season with salt, pepper and lemon juice. Cook for about 10 minutes then strain. Pour over the fish and serve.

N.B.—Wherever butter is included in a recipe, the same quantity of margarine can be used in lieu.

CHAPTER LVI

HOSPITAL DIETARY

856. The articles of food from which a selection may be ordered for the preparation of diets in a military hospital are laid down in Allowance Regulations. This allows the O.C. hospital to prepare varied menus for each class of diet.

857. The menus should be based on the needs of the ordinary patient ; if it is considered desirable to increase the diet for any special case, additional articles, as laid down in Allowance Regulations, may be ordered on the diet sheet and diet summary as " extras." This also applies to malt liquors, wines, lemonade, etc. Extras should not be issued for patients taking their meals in the dining hall.

858. When a patient's condition is such that it is not considered advisable to place him on any diet, " No diet "

is entered on the diet-sheet and diet summary; such food as he may require is ordered as extras, and specially prepared in the hospital kitchen according to instructions.

859. At least two weekly menus should be prepared for ordinary diet, each being used alternately, advantage being taken of the seasonal prevalence of fruits and vegetables so that variety is obtained, the average cost for each patient being kept about the same all the year round.

CHAPTER LVII

INVALID COOKERY

860. The following recipes are intended mainly for sick persons. The seasonings and flavourings recommended may have to be reduced or omitted in the case of weak or impaired digestions.

861. Arrowroot.—½ oz. arrowroot, 10 oz. milk, ½ oz. sugar.

Mix the arrowroot with 2 oz. of cold milk, stir it slowly into the remaining 8 oz. of boiling milk; let it simmer for a few minutes, stirring briskly all the time; add the sugar, a pinch of cinnamon or a little brandy. Serve. Water may be substituted for milk.

862. Gruel.—1 oz. oatmeal, 1 pint milk, ½ oz. sugar.

Mix the oatmeal with a little milk, boil the remainder; when boiling pour it on the oatmeal; return the mixture to the saucepan; boil for 10 minutes, add the sugar; serve very hot.

863. Porridge.—2 oz. medium oatmeal, 1 pint water, salt.

Have freshly drawn cold water, add salt and bring to boiling point. Sprinkle in the oatmeal, stirring all the time to prevent lumps forming. Boil and stir for the first 5 or 6 minutes until the meal is swelled. Simmer for at least 1 hour, stirring occasionally. If necessary, add more boiling water, as the porridge should be of a pouring consistency.

864. Benger's Food, Horlick's Malted Milk, Mellin's Food and other patent foods should be prepared according to the directions printed on the labels.

865. Junket.—10 oz. milk, ½ oz. sugar, 1 teaspoonful rennet, 2 drops of flavouring essence or a pinch of nutmeg.

Warm the milk to 98° F., add the sugar ; when dissolved, pour into a small bowl or dish ; stir in the rennet and, if desired, the flavouring essence. When set, remove to a cool place. Grated nutmeg may be distributed over the surface if preferred to the flavouring essence.

866. Whey.—½ pint milk, ½ lemon, ½ oz. sugar.

Bring the milk to the boil, stir in the strained lemon juice and add the sugar. Let it simmer for a few minutes until the curd separates, allow to cool, strain off the whey ; serve.

867. Bread and milk.—4 oz. bread, 10 oz. milk, ½ oz. sugar.

Remove the crust from the bread, cut into medium sized dice, put them in a basin, cover with boiling water, place a small plate on the top of the basin, allow to steep for 10 minutes, drain off the water. Boil the milk, add the sugar, pour the milk over the bread ; set aside in a cool place before serving.

868. Beef juice.—8 oz. beef steak, a pinch of salt.

Place a lean juicy beef steak on a grill over a clear hot fire, warm it through only without browning the outer surface ; place it on a warm plate, cut it into strips, press out the juice with a lemon squeezer into a hot cup, add a little salt, serve with a small piece of toast.

869. Beef tea.—(i) 8 oz. or 12 oz. lean beef, ⅛ oz. salt, 1 pint stock or cold water. Remove the fat, skin and sinews from the meat, shred the meat finely, put it into a stewpan with the stock or cold water and salt, let it soak for 15 minutes, place the stewpan over a moderate heat, stir frequently with a fork, strain through a fine strainer ; serve hot, time 45 minutes.

(ii) Remove the fat, sinews and skin from the meat and mince the meat finely, place it in a jar with the water and salt, stand the jar in a saucepan of boiling water or put it in a slow oven for 2 or 3 hours. Strain, remove carefully any fat with kitchen paper ; serve hot.

870. Chicken tea.—Cut an ordinary sized chicken into pieces, breaking all the bones. Put into an earthenware jar with 2 pints of cold water and a little salt. Cover the jar tightly and stand in a saucepan of boiling water. Simmer (*but do not boil*) for 4 or 5 hours and then strain.

871. Egg flip.—1 egg, ¼ oz. sugar, 1½ oz. port, sherry or brandy, if ordered.

Place the yolk of the egg and the sugar in a basin, whisk until creamy, add the wine. Beat the whites to a stiff froth and stir in lightly ; pour in a tumbler ; serve.

872. Egg nog.—1 egg, 10 oz. milk, ½ oz. sugar, ½ oz. brandy or whisky.

Place in a basin the egg and sugar, beat them well together ; stir in the brandy or whisky. Pour into a tumbler, fill up with hot milk, mix well ; serve.

873. Poached egg.—1 round buttered toast, 1 egg, salt and vinegar.

Butter the toast and keep it hot. Half fill a frying-pan with water, add salt and 2 or 3 drops of white vinegar to help to set the egg. Boil the water. Break the egg into a cup and slip it into the water at the side of the pan. Gently baste the top of the egg with the water and cook for about 2 minutes until the white is set. Drain on a fish slice and serve on the toast.

874. Albumin water.—Whisk up the whites of 2 eggs to a stiff froth and add these with a pinch of salt to a pint of cold boiled water, mixing them well. Strain before giving to the patient. A flavouring of lemon juice may be added, unless required for a case where lemon would be harmful.

875. Barley water.—1 oz. barley, 1 oz. sugar, 2½ pints water.

Blanch the barley by covering it with cold water, bring to the boil ; strain, put it back in the saucepan with a small piece of lemon rind, add 2½ pints of cold water. Allow to boil, let it simmer for half an hour ; strain and add the sugar.

Barley water will only keep for a few hours ; therefore it should always be kept in a cool place and never re-heated to boiling point.

876. Rice water.—1 oz. Carolina rice, 1 oz. sugar, 2½ pints water.

Wash the rice thoroughly in cold water, soften by steeping it for 3 hours in a pint of water kept at tepid heat, afterwards boil slowly for an hour and strain. Flavour with lemon rind or orange juice ; sugar may also be added if required.

877. Toast water.—4 oz. stale bread, ½ oz. sugar, 1½ pints water.

Cut the bread into slices, toast to a very dark brown, but do not burn ; if this is done, it will impart a very unpleasant flavour to the water. Place them in a jug with the sugar, pour on the boiling water, cover closely, stand in a cool place and serve when cold.

878. Lemonade.—1 lemon, ¾ oz. sugar, 1 pint boiling water.

Place the lemon rind, thinly peeled, the lemon juice and sugar into a jug and pour over this the boiling water. Cover, allow to cool, strain and serve. Care must be taken to peel the lemon very thinly; if the white skin is included, the lemonade will taste bitter.

879. Lemon jelly.—5 oz. lemon juice, 1¼ oz. gelatine, 3 oz. sugar, 15 oz. water, white of egg and shell, two cloves, the rind of 2 lemons cut thinly, a pinch of cinnamon.

Put all these ingredients, with the white of egg slightly beaten, into a saucepan together. Whisk until it boils. Let it stand for five minutes. Strain through a clean cloth previously scalded, and pour into jelly moulds; when firm, turn out.

If wine is allowed, add 2½ oz. of sherry to the above after straining, in which case use that amount of water less.

CHAPTER LVIII

THE SERVING OF PATIENTS' FOOD

880. When meals are served in dining halls, the arrangements should be on the lines laid down in The Management of Soldiers' Messing, with such modifications as may be found advisable. Intelligent attention to every detail in connection with the serving of patients' food, either to those confined to bed or to those in dining halls, is a most important part of a nurse's duties. Progress in many cases is much influenced by the amount of nourishment taken, and this may often depend largely on the way in which it is served. Thus meat, bacon, fish, poultry, etc., should be very carefully trimmed of all excess of fat. Vegetables, gravy and sauces should be served in separate receptacles. Beef tea should have all floating fat skimmed off. Bread and butter should be cut in thin slices. Tea must be freshly made. Meat and pudding should not be served at the same time. Water for drinking should be within easy reach.

One of the most important points in this connection is scrupulous cleanliness in every detail. The cloth covering the tray or table must be spotless, the glass and plate polished and bright, and the table arrangements dainty and attractive.

Care should be taken to see that nothing is spilt in carrying the tray, and that glasses are not filled too full. Food intended to be taken hot should be brought to the patient *hot* and not lukewarm; covers must always be used. Small portions only should be put before the patient; a large plateful will often be refused, when a daintily arranged one would be eaten and enjoyed.

The food must never be kept in the sick-room, but brought freshly to the bedside; similarly, the tray should be removed from the ward directly the meal is finished.

In the case of a patient confined to bed, the orderly should, before bringing his meal, see that he is quite ready to begin it. If able to feed himself, he should be comfortably propped up in bed, and everything that he will require put conveniently to hand. If he is helpless, great patience and care must be taken in feeding him.

Punctuality in serving meals to invalids and the strictest accuracy in observing and reporting on the amount of food actually taken are very important points.

As a general rule, meals should, as far as possible, come as a surprise and not be discussed beforehand; some patients, however, have strong likes and dislikes with regard to food, and these, when expressed, should never be neglected.

CHAPTER LIX

MISCELLANEOUS HINTS FOR COOKS

881. Points for all cooks to remember.—

(i) Maintain a high standard of personal cleanliness and smartness, particular attention being paid to hands and finger-nails.
(ii) Keep all kitchen utensils spotlessly clean.
(iii) Cook tidily, using as few utensils as possible.
(iv) Always use steam in preference to boiling. Only boil when steam is not available.
(v) Keep a sharp eye on all pots, pans and ovens in use. Really good cooking demands constant attention.
(vi) Never slam an oven door.

(vii) Never add new stocks of flour, tea, potatoes and similar commodities to stocks in hand.
(viii) Master the directions before beginning any recipe.
(ix) Always practice strict economy. To waste food is a crime.
(x) A well conducted kitchen requires a very small receptacle for refuse.

882. It sometimes happens that scales, etc., are not obtainable and that, consequently, quantities have to be estimated. In these circumstances the following table will be found useful as a guide :—1 egg weighs 2 oz. and the same sized piece of butter or suet weighs roughly the same.

1 teacup of flour	=4 oz.
1 breakfast cup of flour ...	=8 oz.
1 heaped tablespoonful of light material or a flat tablespoonful of heavy material ...	=1 oz.
4 teaspoonsful	=1 tablespoonful.
2 teaspoonsful	=1 dessertspoonful.
1 tumbler	=½ pint.
1 gill	=2 wineglasses.
3 pennies	=1 oz.
12 pennies	=¼ lb.
1 two-shilling piece and a sixpence	=½ oz.
1 halfpenny and a threepenny bit	=¼ oz.

883. Baking in gas-stoves.—In baking cakes and pastry in a gas cooking stove, the oven must be thoroughly heated before operations begin. When the oven has attained the proper temperature, the gas should be lowered until the flame is scarcely more than half-inch in length. If the gas is left too high whilst the cakes, etc., are cooking, the heat is concentrated on the underside of the baking tins, thus hardening the cakes too rapidly and probably burning them.

884. Salting meat.—*Ingredients.*—16 to 20 lb. meat, 2 oz. mixed herbs, 2 gals. water, 5 lb. salt, 2 lb. sugar, 2 oz. saltpetre.

Meat to be salted should have the kernels and glands removed ; it should then be well wiped with a dry cloth and hung until tender ; some of the salt should be warmed and rubbed equally well over and into the various parts of the meat, which should then be set aside in a cool place until next day, so that it may drain thoroughly. The remainder of the salt and other ingredients are then put into the water,

which is brought to the boil, carefully skimmed and allowed to cool. The meat is placed in the pickle and left to soak for 7 days ; it should be turned once daily, the tub containing it being kept covered with a lid. Pickle, after being once made, may be used again, provided that it is boiled and carefully skimmed each time the meat is removed, fresh salt and water being added to replace the loss.

885. To clarify fat.—Cut up any scraps of cooked or uncooked fat into small pieces, and put them into a stewpan with enough cold water to cover them completely. Let this boil with the lid off until all the water has boiled away and nothing is left but brownish bits of fat. It must be stirred occasionally to prevent burning, which would spoil it. Allow it to cool a little and then strain it through an old sieve or strainer into a basin.

When quite cold, it makes a cake of pure fat, which may be used for frying instead of lard or oil, or in plain cooking in place of butter. After being used for frying, fat should always be strained to remove bread-crumbs, etc. It can be reclarified repeatedly and fresh fat added to it.

886. To clarify dripping.—Pour it out of the dripping pan into a basin with about half a pint of cold water and boil ; when it is cold, take the cake of dripping off the water, scrape all the sediment off the bottom of the cake and wipe it dry.

887. Baking powder.—*Recipe No.* 1. *For general use.*—1 lb. bicarbonate of soda, 2 lb. cream of tartar, 1 lb. ground rice.

Recipe No. 2. *For cakes.*—1 lb. bicarbonate of soda, 1½ lb. cream of tartar, ¼ lb. tartaric acid.

Recipe No. 3. *For self-raising flour.*—40 lb. flour, 8 oz. bicarbonate of soda, 4 oz. tartaric acid, 6 oz. cream of tartar.

888. The Aymard milk-sterilizer.—Directions for sterilizing milk with the 6-gallon tin sterilizer :—

The water is placed in the outer pan to such a height that it will run out of the tap. The tap is turned off and the fire is lighted. The two lids are now removed, and the required quantity of milk is poured into the milk chamber (it is best to strain the milk previously). Now replace the two lids and insert the thermometer through them. In about 20 minutes the milk will indicate upon the thermometer a temperature of 195° F. The furnace-door must now be opened and the milk kept at this temperature for 5 minutes ; then rake the fire out. The milk is now sterilized. In order

to cool the milk, remove the thermometer and the outer lid, but on no account the inner lid, for, if the inner lid is removed even momentarily, a scum forms. Introduce a hose-pipe into the outer pan, or, in case no constant supply is available, pour water in with a bucket, at the same time turning on the tap. Place a thermometer again in the inner lid in position. The cooling process must be continued until the temperature falls to 100° F. After this the thermometer may be removed, cleaned and placed in a position of safety. The milk is now ready to be served out, and should be ladled into vessels for distribution ; or, if intended to be kept in the canteen, should be transferred to a separate vessel. It should not be stored in the sterilizer. The vessel to which the milk is transferred should be covered with a clean cloth to prevent unnecessary exposure to the air. The milk should be stirred every 3 or 4 minutes during heating and cooling by drawing the handle of the stirrer up and down once or twice. In order to get all the milk out of the sterilizer, lift it bodily out of the pan and pour it out through the spout. The sterilizer should be cleaned by filling the milk chamber with cold water ; allow it to stand for a short time, then wipe out and dry. The water in the outer pan will be ready for use without re-filling. Always leave the lid off the sterilizer until required for use again. No sand should be used in the milk-chamber, and soda is unnecessary. If the thermometer is broken, the following means may be adopted :—In about 20 minutes from the beginning of heating, steam will issue freely from the lid and spout. This does not occur until the temperature of the milk has reached 195° F., as previous to this the milk-chamber acts as a condenser.

APPENDIX I

TABLE OF FOODS IN SEASON WITH TIME REQUIRED FOR COOKING

Food	Season	Mode of cooking and average time required per lb.
Beef ...	All the year	Roasted, baked 12–15 mins. Braised, boiled 15–20 mins.
Mutton ...	All the year	Baked or roasted, 15 mins. Boiled, 18 mins.
Lamb ...	March to August ...	Roasted, 15 mins.
Veal ...	March to August ...	Baked, 18 mins. Stewed, 20 mins.
Chicken ...	All the year	Roasted, weight of 2 lb., 30 mins. Boiled, stewed, grilled.
Turkey ...	September to January	Roasted, 15 mins.
Rabbit ...	September to March ...	Boiled, stewed, 12 mins.
Grouse ...	August to November	Roasted, average time per bird, 20–25 mins.
Partridge ...	September to December	Roasted, 20 mins.
Pheasant ...	October to January ...	Roasted, 30–35 mins.
Snipe and Woodcock.	October to December	Roasted, 12–15 mins.
Hare ...	September to March ...	Baked, 1 hr. Stewed, 1½ hrs.
Venison ...	September to January	Roasted, 8–10 mins.
Cod... ...	September to March ...	Boiled, 12 mins. Baked, 12 mins.
Haddock ...	August to February ...	Baked, 10 mins. Fried, 5 mins.
Hake ...	Winter	Baked, 12 mins.
Halibut ...	Summer	Boiled, 10–12 mins. Baked, 10 mins.
Herrings ...	July to January ...	Grilled, 8 mins. Baked, 10 mins.
Mackerel ...	April to November ...	Baked, 10 mins. Grilled, 8 mins.
Plaice ...	May to January ...	Steamed, 8 mins, if filleted. Fried, 6 mins. if filleted.
Salmon ...	February to September	Boiled, 15 mins. if filleted. Grilled, 10 mins. if filleted.
Soles ...	All the year	Fried, 6 mins. if whole.
Whiting ...	May to January ...	Fried, 6 mins. if whole.
Asparagus ...	April to July	Boiled or steamed, 10–20 mins.
Beans, French.	June to October ...	Boiled, 15–20 mins.
Beans, runner.	July to October ...	Boiled, 15–20 mins.
Beans, broad	July to August ...	Boiled, 10–15 mins.
Beetroots ...	September to March ...	Steamed—boiled, 1½ hrs. Baked, 2 hrs.
Broccoli ...	Autumn	Boiled, 10–20 mins.
Brussels sprouts.	September to February	Boiled, 10–20 mins.
Cabbages ...	All the year	Boiled, if young, 10–15 mins. if old, 20–35 mins.

APPENDIX I—*continued*

Food	Season	Mode of cooking and average time required per lb.
Carrots ...	August to April ...	Boiled, young, ½ hr.; old, 2–2½ hrs.
Cauliflowers	Summer	Boiled, 15–20 mins.
Celery ...	October to February	Boiled or stewed, ½–1 hr.
Leeks ...	November to March ...	Boiled or stewed, 30–50 mins.
Lettuces ...	Summer	Boiled, 10 mins. Salad.
Onions ...	All the year	Boiled, 1–2 hrs. Baked, 2 hrs. Fried, 15 mins.
Parsnips ...	October to April ...	Boiled, 1–1½ hrs.
Peas ...	July to September ...	Boiled, fresh and young, 10–15 mins.
Potatoes (new).	May to August ...	Boiled or steamed, 20–25 mins.
Potatoes (old).	All the year	Boiled or steamed, ½ hr. Baked, 2 hrs. Fried, 15–20 mins. Sauté, 15 mins.
Savoys ...	October to March ...	Boiled, 30 mins.
Spinach ...	April to November ...	Boiled, 10–15 mins.
Tomatoes ...	June to December ...	Baked, 15–20 mins. Boiled, 10 mins.
Turnips ...	August to March ...	Boiled, ½–1 hr.
Vegetable marrows.	August to October ...	Boiled, 15–20 mins.
Apples ...	September to April ...	Stewed, 10–20 mins. Pie, 30 mins. Tart, 15 mins. Pudding, 2 hrs. Fritters, baked, 20 mins.
Bananas ...	All the year	Stewed, 5 mins. Fritters. Fruit salad.
Blackberries	September to October	Stewed, 5 mins. Tartlets, 10–15 mins. Pudding, 2 hrs.
Cherries ...	June and July ...	Stewed, 5 mins. Tart, 45–60 mins.
Currants, red, black, white. ...	July to September ...	Stewed, 30 mins. Tart, 45–60 mins.
Damsons ...	September and October	Stewed, 15–20 mins. Pudding, 2½ hrs. Tart, 45–60 mins.
Gooseberries	May to August ...	Stewed, 8–12 mins. Tart, 45–60 mins.
Lemons ...	All the year	Flavouring lemonade. Ice-cream.
Oranges ...	November to June ...	Fruit-salad. Ice-cream. Jellies.
Pears ...	September to March ...	Stewed, 30–40 mins.
Raspberries	June to August ...	Stewed, 20 mins. Tart, jelly, tartlets, ice-cream.
Rhubarb ...	March to June ...	Stewed, 5–15 mins. Tart, 45–60 mins.
Strawberries	June and July ...	Raw. Jelly. Cream. Ice-cream.

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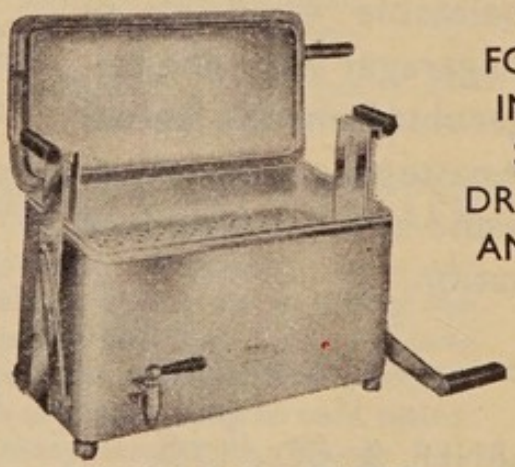
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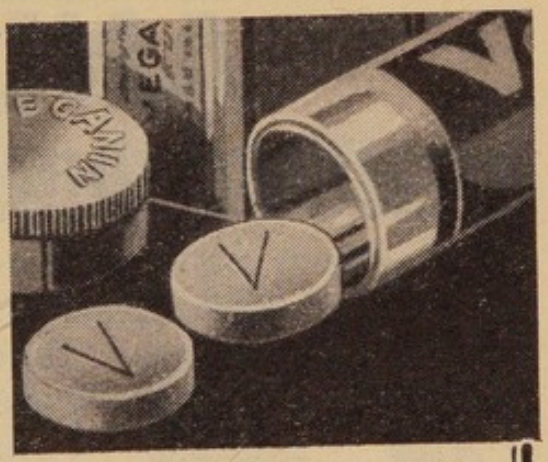
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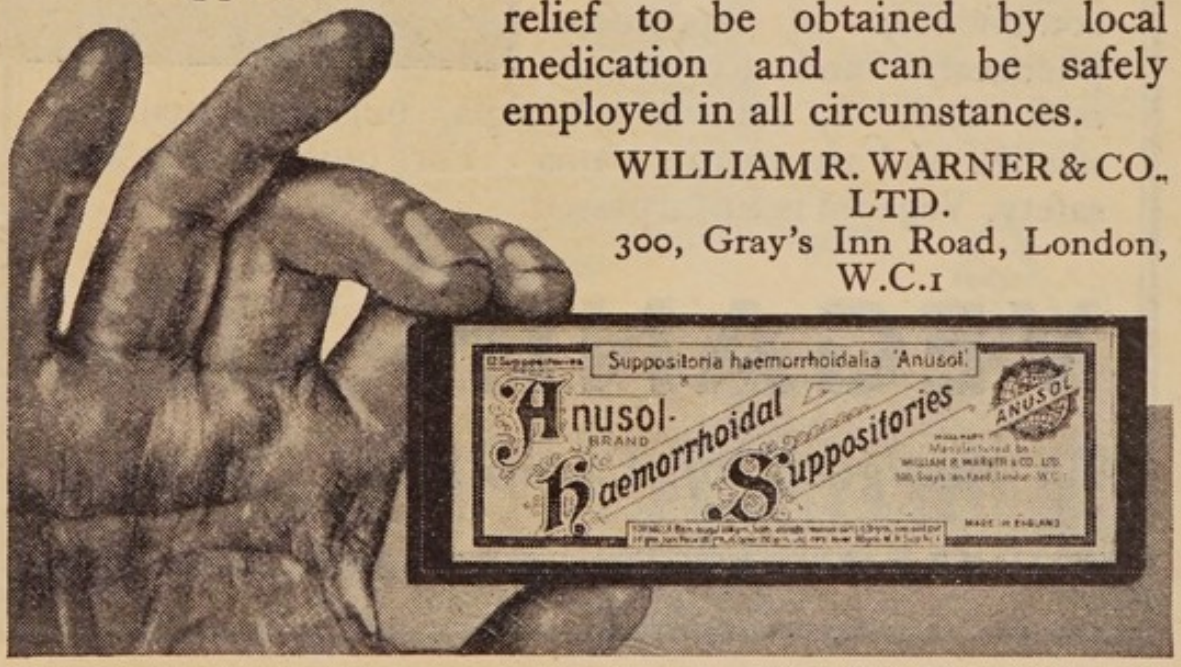
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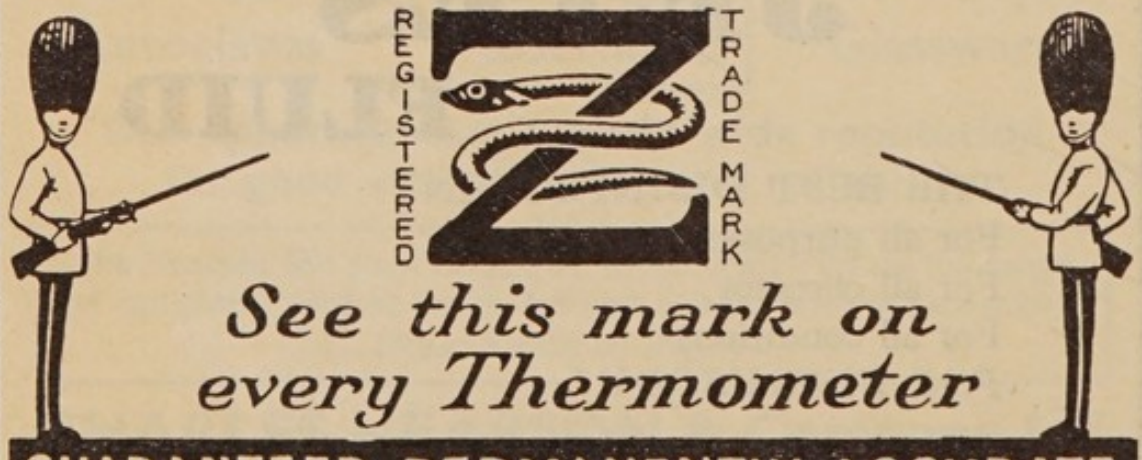
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