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PART I.

ROYAL ARMY MEDICAL CORPS TRAINING.

1908.

PART I.—TRAINING OF THE ROYAL ARMY MEDICAL CORPS IN FIRST AID, NURSING, ETC.

CHAPTER I.

PRELIMINARY REMARKS ON THE GENERAL SCOPE AND OBJECT OF INSTRUCTION.

1. *General duties.*—The Royal Army Medical Corps is organised for the performance of duties in connection with the Hospital, Ambulance, and Sanitary Services of the Army.

2. *Duties in hospitals.*—In hospitals, both in peace and war, at home and abroad, the corps is responsible not only for the nursing of the sick and the dispensing of medicines, but is called on to perform various duties connected with the charge of equipment, the making timely requisition for fuel, light, provisions and all requisite supplies and repairs, the cooking and expenditure of diets, the custody of patient's kits, the cleanliness of the hospital and its surroundings, the preparation of the necessary accounts, abstracts and vouchers of expenditure. The detailed instructions relating to these duties are contained in the Standing Orders for the Corps.

3. *Duties in the field.*—In the field, the corps is further charged with another duty. It supplies to the Army an organisation designed expressly for the purpose of speedily collecting and succouring the wounded during and after an engagement, and removing them from the battle-field to a place of safety. They are, moreover, charged with the attendance on the sick further to the rear in sick convoys, hospital trains and ships, and hospitals on the lines of communication to the base.

4. *Necessity for technical training.*—To enable men of the R.A.M.C. to undertake even the most elementary of these duties, either in hospitals or in the field, it follows as a matter of necessity that they must undergo a course of technical training.

5. *Preliminary training.*—This technical training will commence as soon as the recruit has gone through a short preliminary training in squad and company drill, at the School of Instruction, Aldershot.

CHAPTER II.

ANATOMICAL AND PHYSIOLOGICAL OUTLINES.

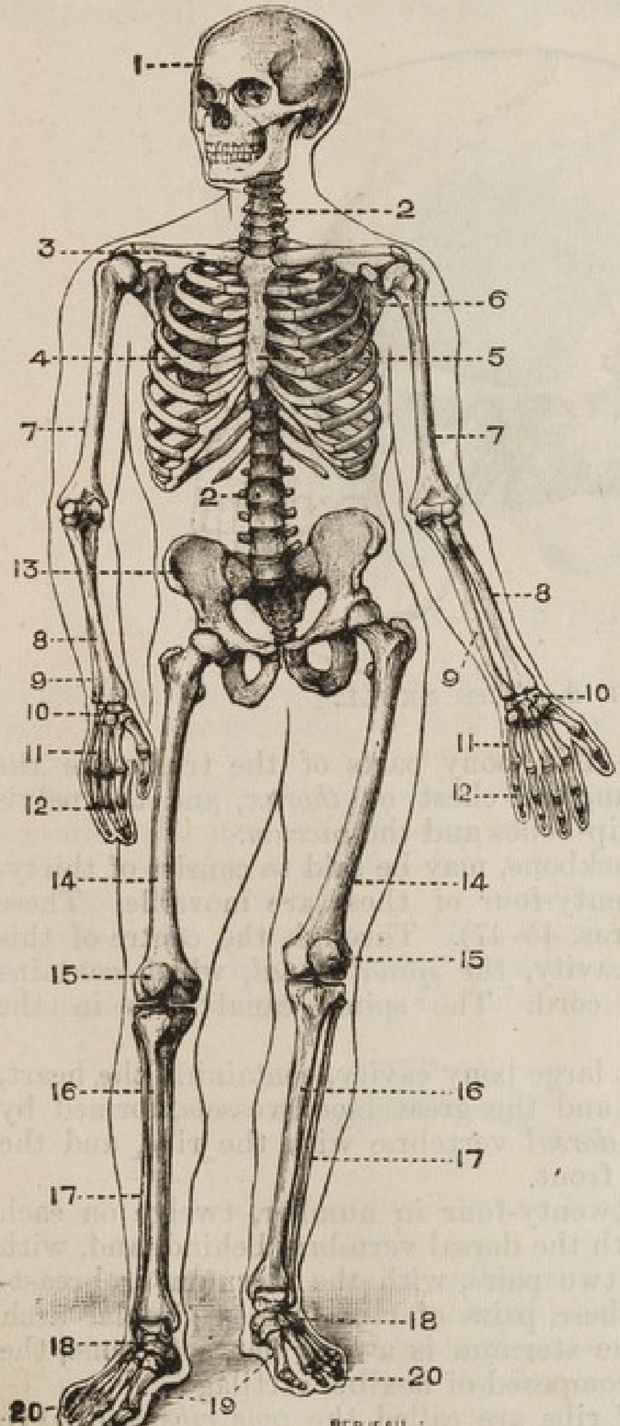
6. *Construction of the human body.*—The human body is made up of :—(1) the skeleton or bony framework with its joints; (2) the muscles, which make every movement; (3) the nervous system, which receives impressions and governs all these movements.

As every movement of the body causes waste, some means are required for nourishing it. The following are concerned in supplying such need, viz. :—

(4) The circulatory system—heart, blood, and blood vessels—to carry to different parts of the body nourishment and oxygen. (5) The respiratory system—lungs and air passages—to take in air and so give oxygen to the blood. (6) The digestive system—mouth, stomach and intestines, and certain glands—to take in and give to the system food and water. (7) The excretory system—kidneys, lungs, and skin—to extract from the blood the products of waste and to eliminate them. (8) The skin, enclosing the whole for the protection of the body and the regulation of its heat.

1. The Bones, Joints, and Muscles.

7. *Skeleton.*—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



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.
8. Radius.
9. Ulna.
10. Carpus, or wrist bones.
11. Metacarpal bones.
12. Phalanges, or fingers.
13. Pelvis.
14. Femur, or thigh bone.
15. Patella, or knee-cap.
16. Tibia.
17. Fibula.
18. Tarsus, or ankle bones.
19. Metatarsal bones.
20. Phalanges, or toes.

Fig. 1.—The Skeleton.

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 from one position to another. They also form cavities for the protection of important organs.

8. *The skull.*—The bones of the head and face are together called the skull. The skull consists of two portions, namely :—The *cranium*, a strong bony case for the protection of the brain, and the *face*, which consists of a number of bones, of which one only, the lower jaw, is movable.

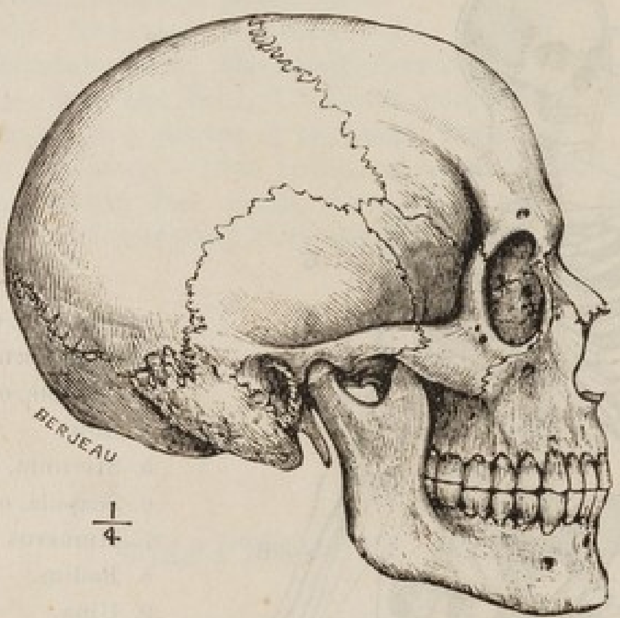


FIG. 2.—THE SKULL.

9. *Bones of the trunk.*—The bony parts of the trunk are the spinal or *vertebral* column, the chest or *thorax*, and the pelvis formed by the two large hip-bones and the *sacrum.*

The *spinal column*, or backbone, may be said to consist of thirty-three bones, but only twenty-four of these are movable. These are called *vertebræ* (see paras. 45–47). Through the centre of this column runs a canal or cavity, the *spinal canal*, which contains and protects the spinal cord. The spinal canal ends in the sacrum.

The chest, or *thorax*, is a large bony cavity, containing the heart, lungs, *œsophagus* or gullet, and the great blood-vessels, formed by the union of the twelve *dorsal* vertebræ with the ribs, and the breast-bone, or *sternum*, in front.

The ribs or *costæ* are twenty-four in number, twelve 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 front. Each of these pairs of ribs form a circular arch called the *costal arch.* The sternum is a long flat, soft bone, the lower portion of which is composed of flexible cartilage.

The first seven pairs of ribs are called the *true ribs*, and have their own costal cartilage connecting them directly with the sternum. The next three pairs are each connected with the cartilage next above it, so that they are united to each other before they reach the sternum. The remaining two pairs are not connected in any way with the breast-bone. The last five pairs are termed *false ribs*; and of these the last two pairs are called *free* or *floating* ribs.

The sacrum, and the *innominate* or nameless bones, one on either side, are firmly united to form the basin-shaped cavity of the pelvis,

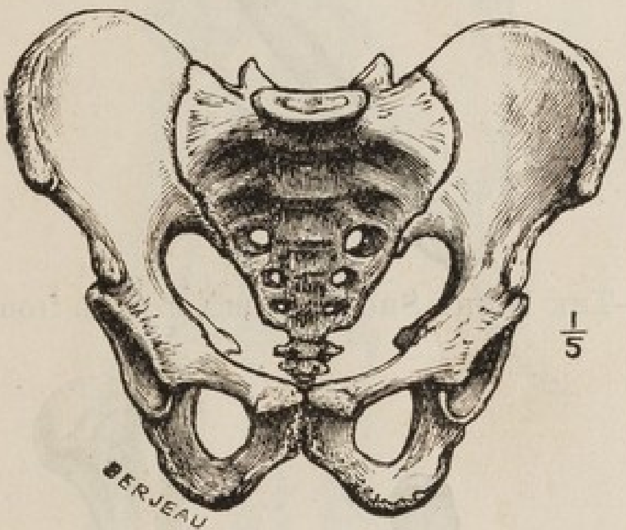


FIG. 3.—THE PELVIS.

which contains and protects the bladder and the lower end of the bowel, or *rectum*, and to it the lower extremities or limbs are attached.

10. *Bones of the upper limb.*—The upper limb is divided into the shoulder, the arm, the fore-arm, and the hand.

The *shoulder* connects the arm to the trunk, and includes two bones, the collar-bone, or *clavicle*, and the shoulder-blade, or *scapula*. The former is a long, curved bone in front connecting the shoulder-blade to the breast-bone, the latter a large, flat triangular bone lying upon the ribs behind.

FIG. 4.—THE RIGHT COLLAR-BONE (seen from above).

The bone of the arm is called the *humerus*; it is a long bone, having at its upper end a rounded head, which works in a socket in the *scapula*, or shoulder-blade, and at its lower end a roller-shaped surface, which, with the bones of the fore-arm, forms the elbow joint.

The bones of the fore-arm are the *radius* and the *ulna*. The radius extends from the outer side of the elbow to the thumb side

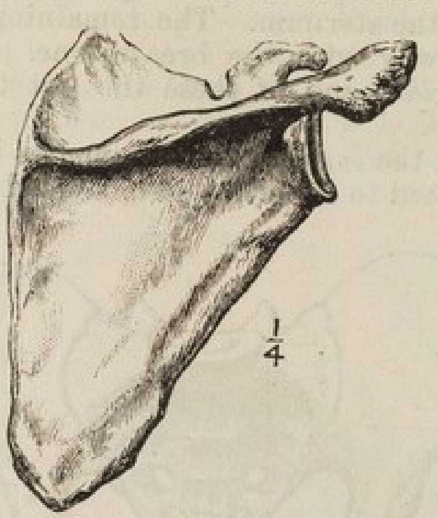


FIG. 5.—THE RIGHT SHOULDER-BLADE (seen from behind).

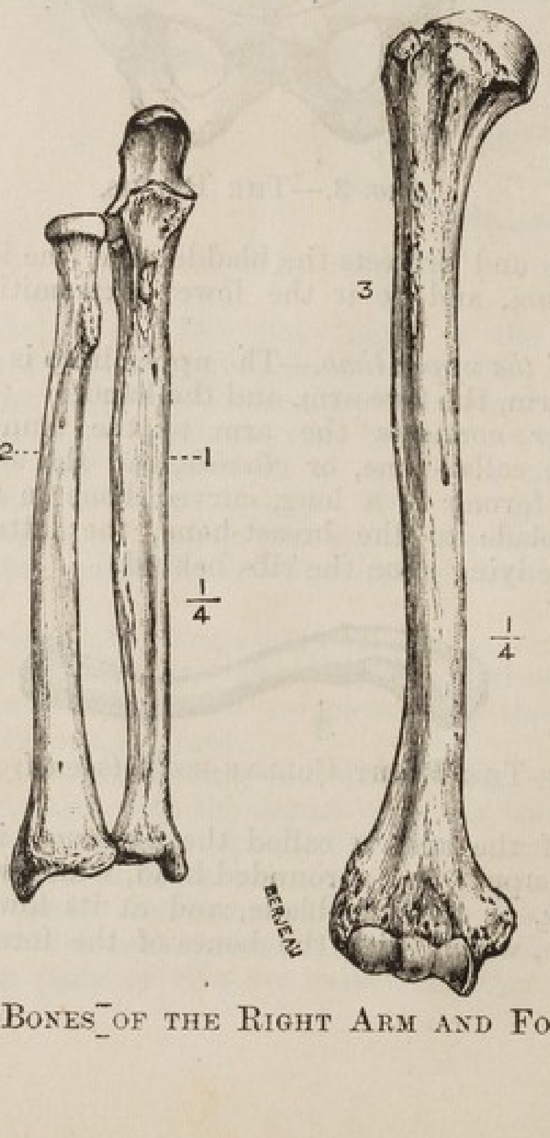
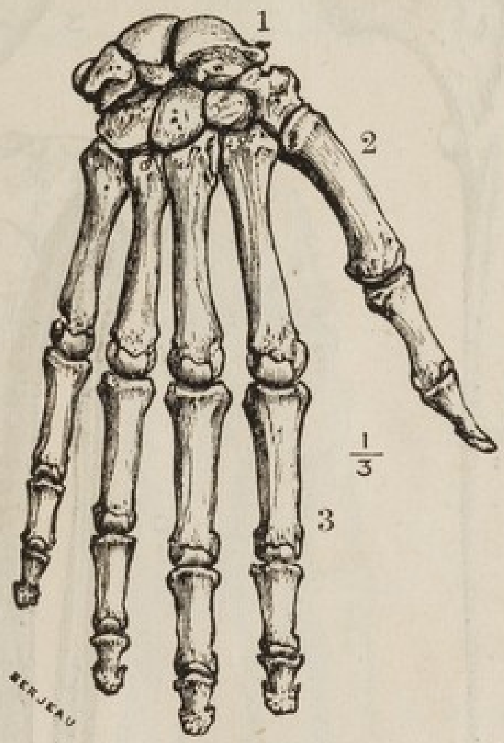


FIG. 6.—BONES OF THE RIGHT ARM AND FORE-ARM.

of the wrist. The ulna extends from the inner side of the elbow to the little finger side of the wrist. At its upper end is a projection, called the *olecranon*, 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 rows: firstly, in the wrist, or carpus, are eight small bones, called the carpal bones;



1. Carpus.
2. Metacarpus.
3. Phalanges.

FIG. 7.—THE BONES OF THE RIGHT HAND.

secondly, a row of five long bones, called the *metacarpus*, forming the palm; and lastly, three small bones, named the *phalanges*, for each finger and two for the thumb.

11. *Bones of the lower limb.*—The lower limb is divided into the thigh, the leg, and the foot.

The *thigh* is that portion which extends from the hip above to the knee below; its one bone is named the *femur* or thigh bone, and is the largest and strongest in the body. At its upper end there is a rounded head, which fits into a deep cup-shaped depression in the *innominate* bone forming the hip joint; below, the expanded end of the bone enters into the formation of the knee joint. Protecting the knee joint in front there is a small bone called the *patella* or knee-cap.

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* or shin bone, upon the flat expanded head of which rests the lower end of the thigh bone, and a more slender one on the outer side, called the *fibula*.

The construction of the foot is like that of the hand; it has three rows of bones: the ankle, or *tarsus,* is formed of seven short strong bones, called the *tarsal bones*; secondly, a row of five longer

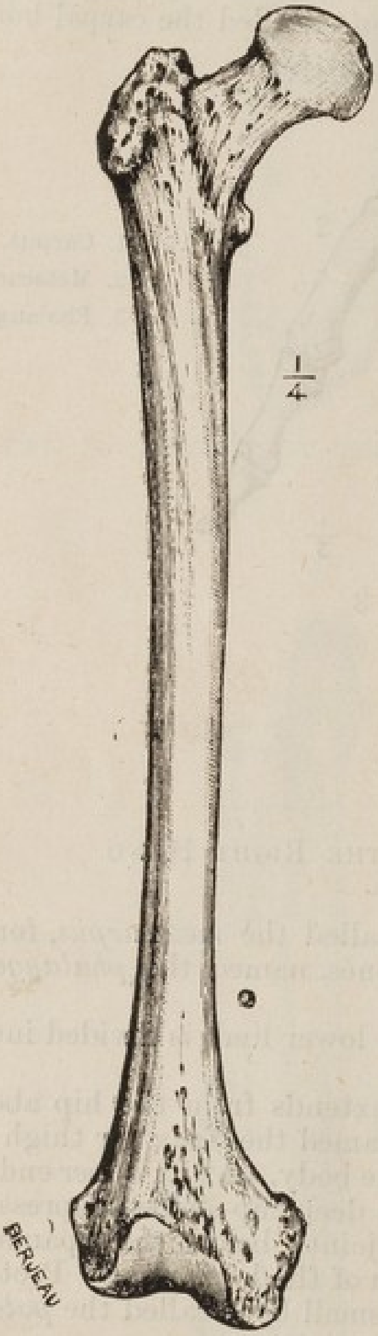


FIG. 8.—THE RIGHT THIGH-BONE (right side).

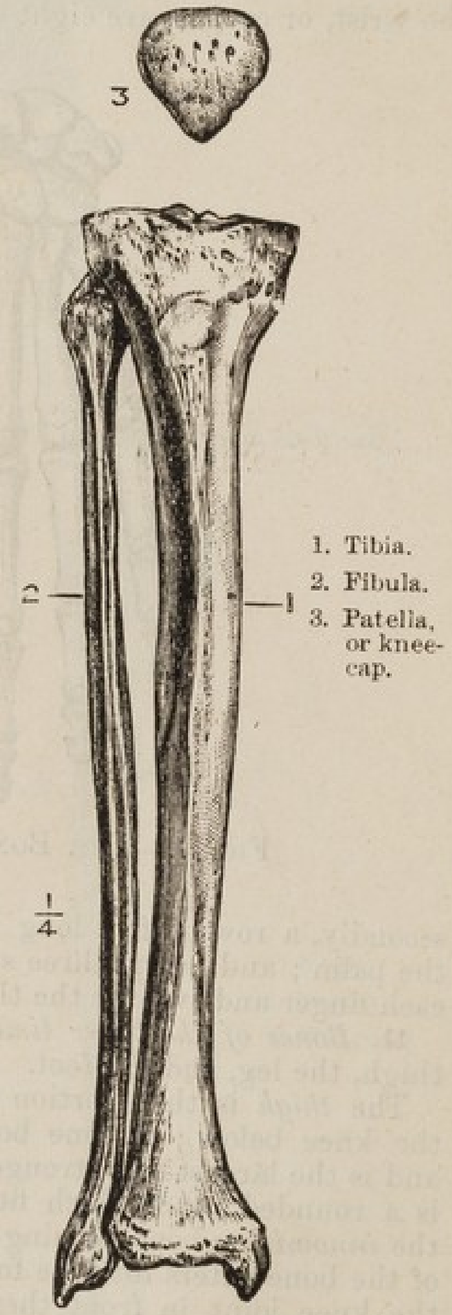


FIG. 9.—THE BONES OF THE RIGHT LEG (right side).

ones, the *metatarsus,* corresponding to the sole of the foot and instep; lastly, three small bones, named the *phalanges,* for each of the four outer toes and two for the great toe.

12. *Joints and ligaments.*—A *joint*, or articulation, is the place where two or more bones work on each other. The ends of the bones where they touch one another are covered with a smooth, glistening material called *cartilage*, and they are kept together by bands which allow the bones to move in certain directions, but are tight in certain positions, so as to prevent the bones from slipping out of place. These bands are called ligaments. From the inside of the joint an oily material, like the white of a raw egg, and called

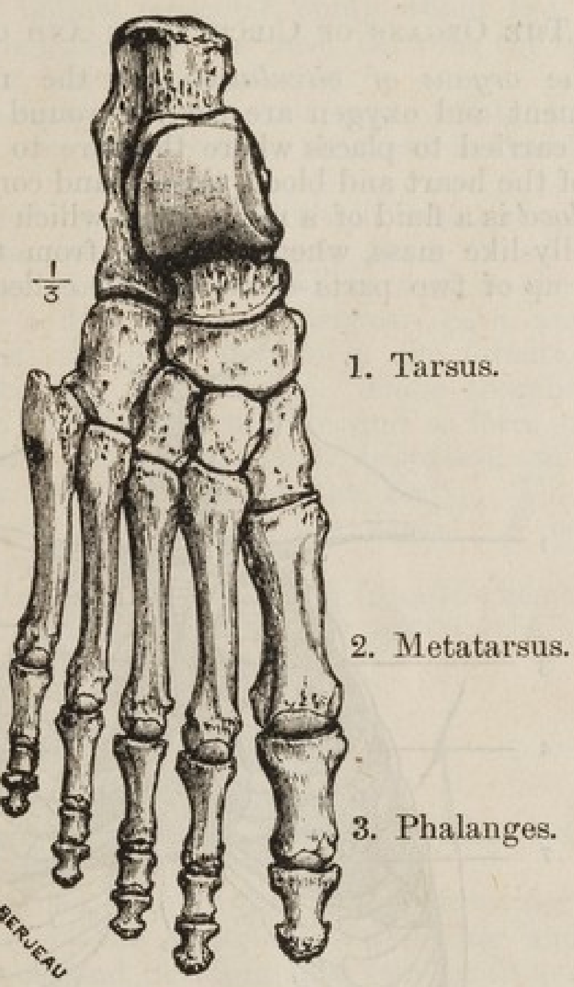


Fig. 10.—The Bones of the Right Foot.

synovia, is poured out, which allows the ends of the bones to glide smoothly over one another. The membrane which lines the joint and provides this material is called the *synovial membrane*.

The two principal kinds of joints are the ball and socket and the hinge joint. 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 the innominate bone each having a cup-like hollow, into which fit the rounded, ball-shaped ends of the long bones of the arm and thigh. The second kind of joint, working like the hinge of a door, allows of movement up and down or backwards and forwards only, as seen in the elbow and knee.

13. The *muscles* are the red flesh of the body, which is arranged in bands. These bands pass from one bone to another and are attached to the bones very commonly, by means of leaders or tendons. These muscles have the power of contracting or shortening themselves under the influence of the will, and of so moving the bones to which they are attached. In this manner the limbs and different parts of the body are made to move.

2. The Organs of Circulation and of Respiration.

14. The *organs of circulation* are the means by which the nourishment and oxygen are carried round the body, and waste matters carried to places where they are to be got rid of. They consist of the heart and blood vessels, and contain the blood.

The *blood* is a fluid of a red colour, which coagulates or changes into a jelly-like mass, when it escapes from the blood-vessels. It is made up of two parts—a clear fluid called the *liquor sanguinis*,

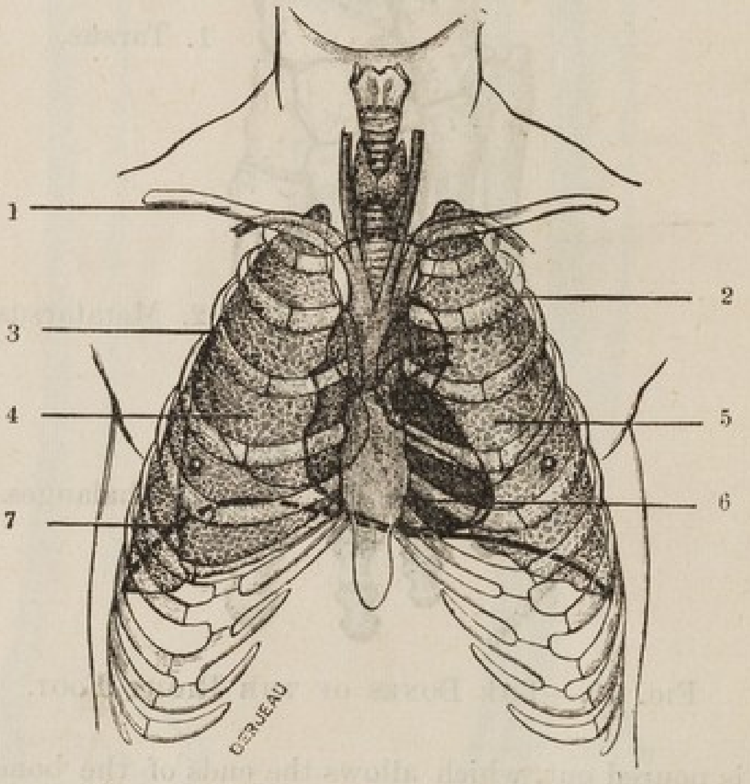


Fig. 11.—The Thorax or Chest.

1. Collar-bone. 2. Second rib. 3. Third rib. 4. Right lung. 5. Left lung. 6. Heart. 7. Cut edge of diaphragm.

which is what is seen in a blister, and many millions of very minute coin-shaped bodies, which give to the blood its colour and substance, and which collect together in the blood clot. These little discs are too small to be seen by the naked eye—

over 3,000 placed in a line side by side would not make up 1 inch. They are called *corpuscles.* The blood in the right side of the heart and in the veins of the body is dark-coloured, and requires aëration, *i.e.*, to be supplied with oxygen from the air; that in the left side of the heart and the arteries of the body is of a bright scarlet and aërated, *i.e.*, it has obtained oxygen from the air during its passage through the lungs. The dark-coloured blood is called venous blood, the bright-coloured blood is called arterial blood.

15. The *heart* is a hollow muscular pump about the size of a closed fist, lying in the middle of the chest between the two lungs, with its point, or apex, toward the left side.

It is divided into a right and left half, separated by a partition, so that nothing can pass directly from the right to the left side of the heart.

Each half is divided by another partition into an upper, thin-walled receiving chamber and a lower, thick-walled pumping chamber. The upper chamber is called an auricle, the lower a 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 about 72 times in a minute, and so force the blood into the arteries, which will be presently described, and through them into the most remote parts of the body. The blood is returned to the heart by means of the veins. A continuous circulation is thus kept up.

16. The *blood-vessels* are tubes extending from the heart to every part of the body, and which, with the heart, contain the blood.

There are three kinds of blood-vessels :—

Arteries.
Capillaries.
Veins.

The blood passes along these tubes, which open into one another, and does not escape from them.

Arteries are thick-walled, strong tubes, leading from the pumping chambers of the heart—the ventricles—branching and getting smaller as they proceed, and 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 impurities from the tissues soak into and are carried by the blood into the veins.

The capillaries form a close network all over the body, and gradually collecting together and getting larger, they become veins.

The *veins*, thin-walled tubes, commencing 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.

17. *Circulation.*—In the body there is a double circulation, owing to the fact that the oxygen required to aërate the blood cannot be taken into the blood at the same time as nourishment. Consequently, the blood has to make one round to take in and distribute the nourishment and the oxygen, and a second round through the lungs to take in the oxygen from the air which is drawn into them. Of these two rounds, or circulations, the first is called systemic, the second pulmonary. The systemic circulation is that of every part of the body except the lungs. The pulmonary circulation takes place in the lungs alone, and is for the sole purpose of aërating the blood. The blood, when it passes from the capillaries of the lungs, is aërated and bright scarlet; it remains so while it circulates through the veins of the lungs into the left auricle, from thence into the left ventricle, from thence into the systemic arteries, until it passes into the systemic capillaries, where it loses the oxygen with which it has been charged and becomes dark-coloured. It remains dark-coloured while flowing from the systemic capillaries into the systemic veins, from thence into the right auricle, then ventricle, thence into the arteries of the lungs, and from thence into the capillaries of the lungs, where aëration again takes place, and the bright red colour is restored. This is the course of the circulation. The blood in the systemic capillaries takes up nourishment from the stomach and bowels.

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 or beat 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 network 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.

18. The *organs of respiration* are the means by which air is taken into the lungs, and one of its gases, called oxygen, is given to the blood. While the oxygen is being taken into the blood, carbonic acid gas, certain other gases, and watery vapour pass from the blood into the air in the lungs, and are breathed out.

The organs of respiration, or breathing, consist of—

The *trachea*, or windpipe.
The lungs.

The *trachea*, or windpipe, is a stout tube through which the air passes into and out of the lungs. Its upper part, called the larynx, is the organ of voice, and opens into the back of the mouth and nose. The windpipe can be felt in the throat under the skin where it lies immediately in front of the gullet. In the chest it divides into two tubes, the bronchi, one for each lung.

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 when swallowing.

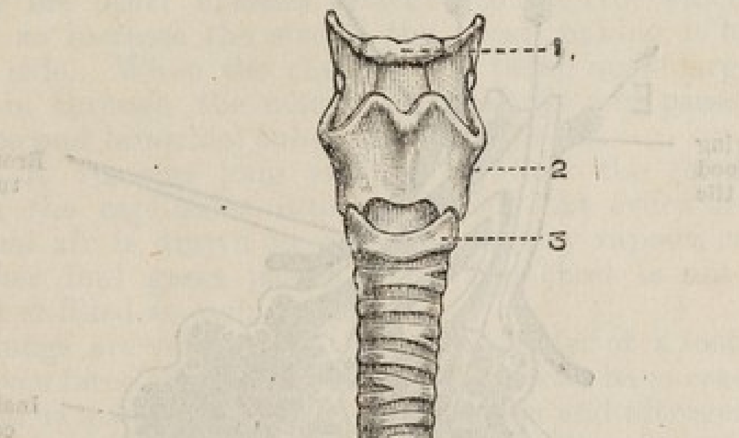


FIG. 12.—THE LARYNX, TRACHEA, AND BRONCHI.

1. Hyoid bone. 2. Thyroid cartilage, and 3. Cricoid cartilage, forming the larynx. 4. Trachea, or windpipe. 5. Bronchi.

The bronchi are stout tubes leading from the windpipe to the lungs. In the lungs the bronchi branch out in all directions, becoming smaller and their walls thinner as they proceed to their closed endings, the air cells.

The lungs, two in number, lie in the cavity of the chest, one on either 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 networks of capillaries.

The air-cells thus communicate directly with the external air through the bronchi, windpipe, larynx, mouth, and nose.

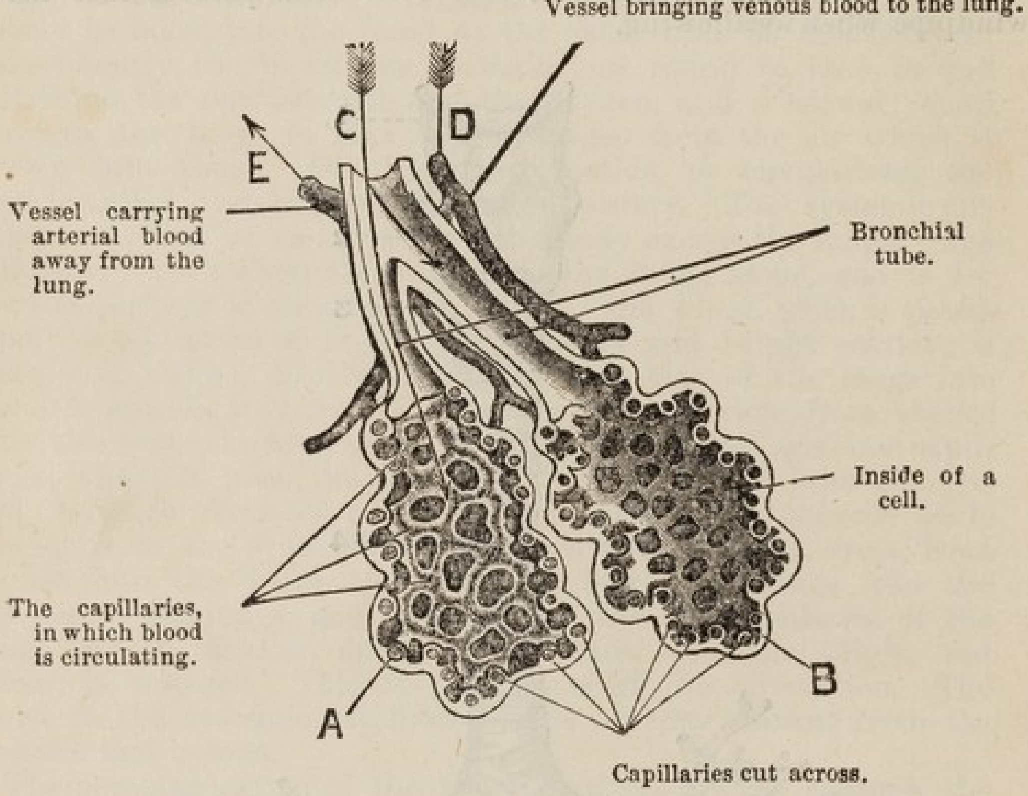


FIG. 13.—TWO AIR-CELLS OF THE LUNG CUT ACROSS.

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.

19. *Description of respiration.*—Respiration or breathing consists of—

Inspiration or drawing-in of air to the chest, immediately followed by—

Expiration or breathing out, expulsion of air from the chest.

This is followed by a pause while one may slowly count two.

These together form a complete respiration.*

A complete respiration occurs in health eighteen times in a minute. The act of respiration is carried out in the following way :—

* The importance of impressing the relation to one another of these three phases of respiration becomes manifest when the practice of artificial respiration is being taught.

There are certain muscles, by the action of which the chest is enlarged.

One of these, the diaphragm, or midriff, causes the chest to become deeper, much in the same way as a concertina when drawn out.

The diaphragm when not in action is arched upwards, being attached to the ribs and backbone, forming the floor of the chest, and separating it from the belly or abdomen. When in action and contracted, it becomes flat, pushing the belly outwards, and enlarging the cavity of the chest from above downwards.

There are other muscles attached to the ribs which raise them up and so increase the size of the chest, making it broader from side to side. When the chest is thus being made larger the air is drawn in through the mouth and nostrils and passes down the windpipe and bronchial tubes into the air-cells.

Here it remains long enough to allow the oxygen to pass through the capillaries into the blood. At every breath a little additional air is drawn in, and some watery vapour, carbonic acid and other foul gases passed out. The chest is not completely emptied or filled at each breath.

The lungs are very elastic, like the bladder of a football, and of themselves force out the air when the muscles have ceased to act.

The air is made up of two gases—oxygen and nitrogen.

Oxygen is what is required in the blood ; the nitrogen passes out just as it went in.

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.

3. The Nervous System.

20. The *nervous system* consists of :—

(1) Nerve centres.
(2) Nerve cords, or nerves.
(3) Nerve-endings.

The *nerve centres* are the brain and spinal cord, which receive all messages from the skin and organs of sense, and send out orders to the muscles to make them move in any desired way. All the thinking is done in the brain. It is contained in, and protected by, the skull.

The spinal cord proceeds from the brain down the spinal canal, and both brain and spinal cord give off all the nerve cords which proceed to every part of the body.

The *nerve cords* 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 end terminate in the nerve-endings, whether in the skin, organs of sense, or muscles.

Nerve-endings.—These are to be found in every part of the body ; for instance, it is not possible to touch any portion of the skin with the point of a needle which does not contain a nerve-ending. They are able to communicate to the brain information of what is taking place in the part where 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 to any muscle, or set of muscles, instantaneously by the nerves which pass into them, and so make them move.

4. The Digestive System.

21. This consists of two portions :—

(1) A long tube called the alimentary canal.

(2) Glands which prepare juices to be mixed with the food and digest it.

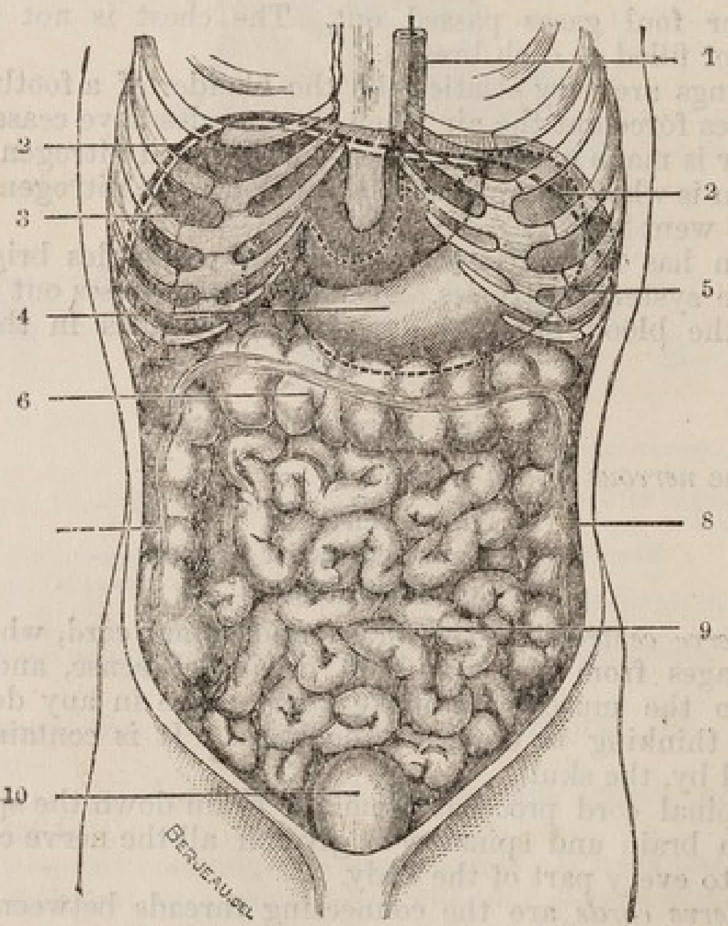


Fig. 14.—The Abdomen.

1. Gullet. 2, 2. Cut edge of diaphragm. 3. Liver. 4. Stomach. 5. Spleen. 6. Transverse colon. 7. Ascending colon. 8. Descending colon. 9. Small intestines. 10. Bladder.

The alimentary canal begins at the mouth and ends at the anus or lower opening of the bowel. It is altogether about 30 feet long.

The different parts of the alimentary canal are the mouth, gullet or œsophagus, stomach, small and large intestines.

The glands, or organs which pour juices into this canal or tube, are the salivary glands in the mouth, the gastric glands in the stomach, the liver which makes bile, two pints a day, and the pancreas which makes a juice similar to the saliva, and other glands in the walls of the small intestine.

It is necessary for proper digestion that the teeth should be in good order and kept from decay. One great means of preventing decay is to brush the teeth regularly every day. This removes the remains of food, which when left among the teeth helps to cause their decay.

The food passes through the gullet from the mouth, after being chewed or masticated and mixed with the saliva, into the stomach. As it becomes sufficiently liquefied by the action of the stomach, it passes gradually into the intestines or bowels, where further digestion takes place, and the unused parts of it are passed out about 24 hours after having been swallowed.

While it is passing down the stomach and bowels the nutritive part of it is dissolved and sucked into the blood, through the thin walls of the capillaries on the inside of the stomach and bowels, and passes from thence into the veins, and so into the circulation for the general nourishment of the body.

The position of the digestive organs is referred to in para. 24.

5. The Excretory System.

22. It is necessary to life to get rid of impurities and waste matters which accumulate in the blood, and for this purpose the kidneys, bowels, lungs, and skin have the power of gathering these matters, gases and fluid, and passing them out of the body. The kidneys pass out daily about two and a half pints of urine, which consists of water and foul matter from the blood. The lungs pass out foul gases in the expired air. The bowels assist in casting out, with the remains of the food, certain impurities, and the skin is continually passing off sweat, which consists of water and impurities from the blood.

23. *The skin.*—The skin not only covers and protects the body, and has the sense of feeling and touch, but also has in it a number of minute apertures, through which sweat and the natural grease which keeps the skin supple pass out. It has a quantity of fat under it, which keeps in the heat of the body.

It also regulates the heat of the body by means of sweating, which cools down the blood.

In order to keep the skin healthy, great attention should be paid to cleanliness.

6. The Chest and the Abdomen.

24. *Position of vital organs.*—There are two large cavities in the trunk—namely, the chest, or thorax, and the belly, or abdomen. The chest is separated from the belly by the diaphragm, a flat muscle which is concerned in respiration (*see* para. 19 and figs. 11 and 14). The walls of the chest are principally made of bone—namely, the back-bone, ribs, and breast-bone or sternum. The walls of the belly are almost entirely made of flesh, or muscles arranged in layers. The chest contains the lungs and heart; passing through the back of the chest to reach the stomach, through a hole

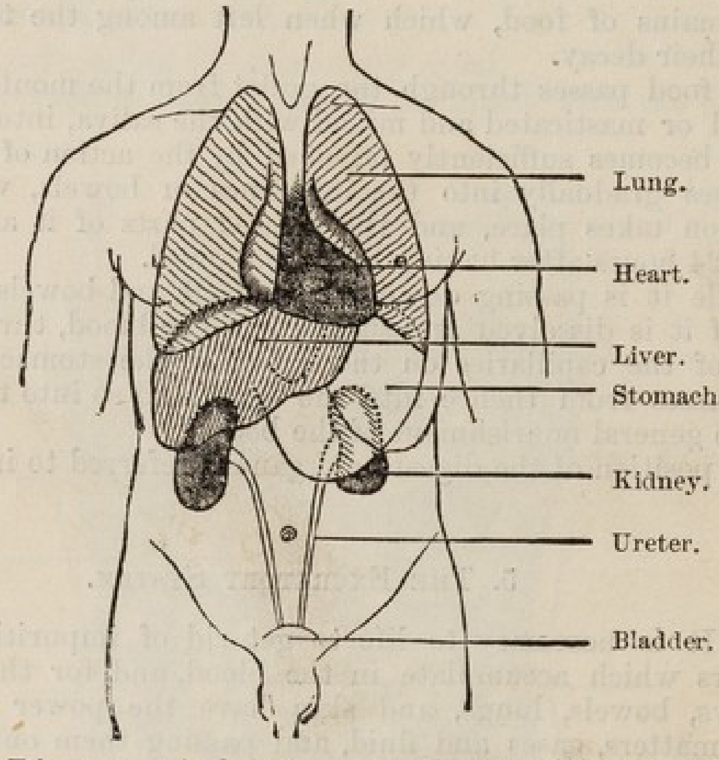


Fig. 15.—A Diagram of the Chest and Abdomen, to show the position of the Organs, as Viewed from the Front.

in the diaphragm, is the gullet. The windpipe passes from the neck into the chest. Large blood-vessels pass into and out of the chest to reach the heart.

The belly contains the stomach and bowels, the liver, spleen, pancreas, kidneys, and bladder. The liver is a very large organ. It is placed below the diaphragm, under the ribs, on the right side, and fills nearly a sixth part of the belly. The stomach is under the ribs on the left side, and varies in size according as to whether it is empty or full. The pancreas or sweetbread lies across the front of the spine just above the level of the navel.

The spleen is a large soft organ about the size of the fist. It is concerned in the formation of the blood. It is placed deeply under the left ribs, behind the stomach, and close under the diaphragm. It is apt to be enlarged in certain tropical diseases. The kidneys are deeply placed in the loins, one on each side of the back-bone, and reach as high as the eleventh rib. They are placed at the back of the abdomen. The bladder is quite low down, in the middle of the front of the belly, and only rises above the pelvis

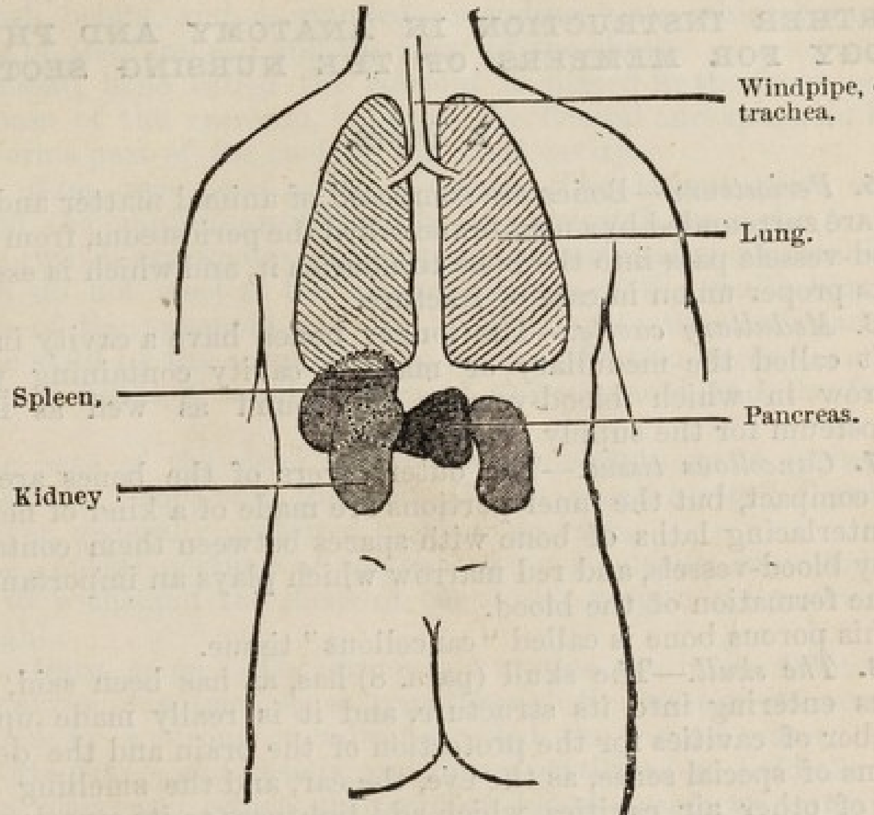


FIG. 16.—A Diagram of the Chest and Abdomen, to show the position of the Organs, as Viewed from Behind.

when it is very full. The bowels fill up the whole of the rest of the space in the belly. The urine reaches the bladder from the kidneys by two tubes, called the ureters, one to each kidney. It remains in the bladder until such time as it is convenient to pass it. The tube by which it is passed is called the urethra

CHAPTER III.

FURTHER INSTRUCTION IN ANATOMY AND PHYSIOLOGY FOR MEMBERS OF THE NURSING SECTION.

1. Bones.

25. *Periosteum.*—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 case of fracture.

26. *Medullary cavity.*—The longer bones have a cavity in their shaft called the medullary or marrow cavity containing yellow marrow in which blood-vessels are found as well as in the periosteum for the supply of the bone.

27. *Cancellous tissue.*—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.

This porous bone is called "cancellous" tissue.

28. *The skull.*—The skull (para. 8) has, as has been said, many bones entering into its structure, and it is really made up of a number of cavities for the protection of the brain and the delicate organs of special sense, as the eye, the ear, and the smelling organ and of other air cavities which add lightness to its structure and give resonance to the voice.

Many bones go to form the brain case or cranium, and the face with its air-cells and cavities.

29. *Cranium.*—The cavity of the cranium contains the brain, is continuous with the spinal canal (para. 9), and opens into it by means of a large hole at its base, called the *foramen magnum.*

The bone which has this hole in it is called the *occipital* bone. On either side of the foramen are the *condyles*, which are rounded pieces of bone which rest and move upon the topmost vertebræ of the spinal column.

The whole weight of the skull is thus borne through the condyles upon the top vertebræ of the spinal column.

30. *Sphenoid bone.*—The occipital bone is permanently united by its fore-end to the *sphenoid* bone, which forms a sort of keystone to the base of the cranium, and which has wing-like extensions passing upwards and outwards, supporting a great part of the base of the brain, and 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 outside the skull.

31. *Frontal bone.*—Attached to the fore-end of the sphenoid at the base of the skull is the *frontal* bone ; it has 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 skull.

A small bone called the *ethmoid* is 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.

32. *Base, dome and sides of skull.*—The lateral parts of the base of the cranium are formed by the occipital bone, the *temporal* bones (which are wedged in between the occipital and sphenoid but which do not meet in the central portion of the skull's base), the wings of the sphenoid and the frontal bone ; the dome and sides of the skull by the occipital bone behind, the two *parietal* and two temporal bones, a small portion of the sphenoid, and the frontal bone.

The base of the skull is very thin in certain spots, such as the roof of the orbit and the roof of the nasal cavity ; these are, however, generally protected by their position.

The central portions of the base are very strong, as must be the case to withstand the shock of the skull's weight in jumping from a height.

33. *Dura mater.*—The cranium contains the brain, from which the nerves of special sense pass through the holes in its base, and is lined by a strong membrane called the "dura mater," which supports nerves and vessels, and forms partitions to hold the brain in its place and which also contain blood-vessels to nourish the inner layers of the skull's bones, 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.

34. *Bones of the face.*—The face is formed of a good many bones which, as said, form cavities for the protection of the organs of special sense and give lightness to the structure of the head and resonance to the voice.

These bones, with the exception of the lower jaw, are fixed together immovably. (Para. 8).

These bones, are as follows :—

Superior maxillæ.—The upper jaws (*superior maxillæ*), one on each side, underlie the greater part of the cheeks, carry the upper teeth, and form most of the bony palate, the opening of the nostrils, and the inner side of the eye-socket.

35. *Malar bones and orbit.*—The cheek bones (*malar bones* are small and strong and are joined to the upper jaw-bones by their inner ends, and to the prong (or *zygomatic process*) of the temporal bone by their outer ends, and form the lower and outer part of the rim of the eye-socket: they are joined by their upper ends to the frontal bone, which last completes the eye-socket above, and joins with the upper jaw-bone to its inner side.

36. *Nasal bones.*—The two small nasal bones are joined to the frontal bone above, to one another by their inner edges, and to the upper jaw-bone by their outer edges to form the bridge of the nose.

37. *Palate bones.*—The bony palate is completed by two bones called the palate bones, which unite together in the centre, and to the upper jaw in front and form much of the hinder opening of the nostrils into the throat or pharynx.

38. *Vomer.*—A thin bone, called the *vomer*, forms the division between the nostrils, passing from the base of the skull and ethmoid bone above, to the junction of the palate and palate portions of the upper jaw-bones below.

39. *Turbinated Bones.*—There are some very thin curled bones called the *turbinated* bones, fixed to the outer walls of the nasal passages, which project into the passage, and which are covered with mucous membrane which has many large blood-vessels in it, in order to warm the air as it passes through the nostrils to reach the lungs.

These bones also serve for the spreading out of the nerves of smell in the upper part of the nostrils.

40. *Air chambers.*—There are numerous air chambers opening into the nasal passages, a very large one being situated in the back part of the upper jaw above the back teeth, and there is one in the forehead behind the brow in the thickness of the frontal bones; others exist between the two eye-sockets and above the back part of the nasal passages.

41. *Lower jaw.*—The lower jaw-bone is strong and heavy and carries the lower teeth. It is flattish in section, and bent on the flat at its centre which forms the chin, and edgeways behind the rows of teeth, to form two upward projections for attachment to the temporal bones of the cranium, with which it is articulated.

The upper ends of these two projections are rounded and smoothed to form a movable joint. They are called condyles.

42. *Its muscles.*—Very powerful muscles are attached to the lower jaw. One, called the temporal muscle, covers much of the side of the skull, and passes beneath a bony arch formed by the temporal prong or zygomatic process and the malar bone, to be attached to the upper projection of the lower jaw, in front of its rounded articular head or condyle. Other very strong muscles are attached to both sides of it lower down, and by their other ends to the bones of the face and the downward-projecting plates of the sphenoid bone (*see* cranium), which muscles give the side-to-side movement of the jaw (the temporal muscle simply moving it up and down).

43. *Special sense organs located in face cavities.*—It has been mentioned that most of the organs of special sense are located in the cavities of the face.

The eyes are contained in the orbits or eye-sockets, formed as described; the organ of smell is contained in the upper part of the nasal passages, the lower part of these passages being for breathing.

The internal ear is in the thickness of the temporal bone, and the external meatus or earhole opens behind the joint of the lower jaw. The internal ear has a communication with the back of the throat through a tube called the Eustachian tube. The sense of taste is situated in the tongue and palate.

44. *The teeth.*—There are two sets of teeth grown in a lifetime from the upper and lower jaw.

The first set, which is complete in childhood, is of twenty teeth only, and these in grown-up people give place to thirty-two.

The teeth in both halves of the upper and lower jaw and in the two jaws correspond in number and shape.

The eight front chisel-shaped teeth are called *incisors* or cutting teeth; the four on each side of these are called *canines* or dog teeth. In childhood there are eight grinding teeth behind these, called *molars*.

Adult people have the same number of incisors and canines, but in place of the four molars of childhood they have eight *bicuspids* or narrow grinders with two points each, and in addition twelve molars with three or four points or *cusps* each.

Those four furthest back are called the wisdom teeth, and may not come up till thirty years have passed.

The child teeth are called "temporary" and the adult teeth "permanent."

The buds of both sets are contained in the thickness of the jaws at birth.

45. *Vertebræ.*—The *vertebræ* (para. 9) are a number of bones which make up the spinal column. They form a jointed elastic pillar for the support of the trunk and skull by means of their bodies, which are placed one on the top of another with cushions between them (the intervertebral fibro-cartilages), and the spinal column so formed gives attachment to the ribs and limbs.

46. *Transverse and spinous processes.*—The vertebræ have projections from the hinder part of their bodies which form rings, and these rings placed one above the other form the spinal canal, a bony canal which encloses and protects the spinal cord. Projecting from the sides of these rings are two lateral bars called "transverse processes," which in the twelve dorsal vertebræ support the ribs; and from the back of the ring project central pieces called *spinous processes*, which can be seen and felt under the skin of the back as knobs of bone.

47. *Regions of spine.*—The different regions of the spine receive different names, each containing a certain number of vertebræ; these are the neck or *cervical* region with seven vertebræ, the back or *dorsal* region with twelve, the loins or *lumbar* region with five, the *sacrum* with one piece of bone consisting of five vertebræ welded together, and the *coccyx* or tail with four joints which are incomplete vertebræ.

2. Muscular System.

48. Muscles (para. 13) are responsible for all movements of the body, whether under the control of the will or not, and all movements are caused by messages travelling along the nerves to the muscles (consequently muscles all have nerves passing into their substance, and branching so as to give a fibre to each muscle fibre).

49. *Structure. Mode of action.*—Muscles are made up of threads or fibres, which in a simple muscle lie side by side, being enclosed in a sheath and generally end in tendons at one or both ends, by means of which they are attached to bones or other parts they are intended to move. The movement of these bones or parts is caused by the muscle, in response to the impulse sent along its nerve, contracting or shortening itself, and so bringing its points of attachment nearer together and bending or straightening the limb or moving the part.

50. *Involuntary muscles.*—There are, however, muscles, such as those of the heart and intestines, which are not under control of the will. Such muscles are said to be "involuntary," the muscles moving the limbs being voluntary muscles.

Voluntary muscles are made up of fibres which are striated, *i.e.*, striped transversely.

Involuntary muscles (with the exception of that of the heart) are not striped, and are of paler colour as a rule than the striped ones. They are slower in their movements and carry on the more mechanical functions of the body.

51. *Alimentary Canal.*—Muscular layers are to be found surrounding the blood-vessels and the alimentary canal, whose calibre they control, and it is by their means that the contents of the intestines are pushed along.

The involuntary muscles are under the control of the sympathetic system of nerves, a system to be found in the very lowest creatures; they move rather slowly.

Voluntary muscles, on the other hand, are capable of most rapid movements, and movements of very complicated kinds, and are under the command of the brain. The muscles of the limbs are grouped to perform such habitual actions as walking, bringing the hand to the mouth in taking food, &c.

52. *Blood supply.*—Muscles are very freely supplied with blood, as every movement causes the consumption of some of its substance, which must be removed and replaced, otherwise the muscle 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 muscle.

Moderate exercise and good feeding enlarge the muscles, and disuse and poor feeding cause them to dwindle.

53. *Development.*—The great development of muscle is seen in such persons as Sandow, 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, when the limb affected may decrease to half its proper size.

54. *Paralysis.*—When the nerves supplying muscles are destroyed, the condition of the muscle which becomes 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.

55. *Internal work done.*—There is always much muscular work going on in the body even during sleep, and when one considers that the heart never ceases to beat, that the breathing muscles never rest, and that the food in the alimentary canal is continually kept moving by muscular action, it is not surprising to find that enough energy (without counting what is used in external and visible work) is daily expended to raise a weight of 260 tons to a height of 1 foot in the twenty-four hours.

56. *Energy as heat.*—The body tissues, particularly the muscles, also produce by their slow combustion a great quantity of heat—enough in the twenty-four hours to boil sixty pints of water, previously at freezing point.

57. *Necessity for oxygen.*—The combustion or burning of the body tissues, as in the case of every fire, requires oxygen to keep it up, and produces carbon dioxide. When, as in making great exertion, the rate of the breathing is much increased, it is because more oxygen is wanted to supply the muscles in action, as it is only by spending them that movement can take place.

3. Nervous System.

58. The nervous system (para. 20) is the most delicate and complex of all the parts of the body.

The great difference between human beings and other living creatures consists in the high development of their nervous system.

59. *Cerebro spinal.*—As said, the brain and spinal cord are the centres of the "cerebro spinal" system, which is the voluntary and will-controlled system.

60. *Sympathetic.*—There is a system of nerves called the "sympathetic" system, which consists of chains of "ganglia" or knots, which are connected together and to the spinal nerves, and which automatically regulate the movements of the vital parts and blood-vessels which are not controllable by the will. This system is to be found in the very lowest animals, which have no brain proper, and no spinal cord.

61. *Brain.*—The brain consists of countless numbers of nerve cells and nerve fibres; the nerve cells are in two great masses, called the *cerebrum* or brain, and the *cerebellum* or small brain; the spinal cord also contains masses of nerve cells. The cerebrum and cerebellum are contained in the cranium, the brain being uppermost.

62. *Cerebellum.*—The greater brain is the seat of thought and the higher voluntary originations and is the seat also of most of the special senses, and the cerebellum serves to "co-ordinate" or combine the various groups of muscles in movement which together carry out such habitual actions as walking and eating.

The spinal cord proceeds from the base of the brain and is contained in the spinal canal. It extends as far as the upper lumbar vertebræ.

63. *Cerebral nerves.*—From the base of the brain and the spinal cord, nerve cords proceed—from the brain the nerves of smell, sight, hearing, taste, for the movements of the eyes, tongue and jaw, and of the muscles of the face.

From the spinal cord a pair of nerves passes between every two vertebræ for the sensations and movements of the trunk and limbs.

64. *Medulla.*—At the junction of the spinal cord with the brain, there is a piece of the cord called the *medulla oblongata* from which very important nerves come which govern the movements of the heart, of breathing, and of the stomach, and the spinal cord contains all the nerve centres for the lower physical functions of the body.

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.

65. *Lower vital functions independent of cerebrum.*—Breathing and swallowing can go on even when, as in concussion of the brain, sensibility is quite absent, but if the nerve centres which govern the vital functions are in any way interfered with, instant death is the consequence.

The brain consists of two halves, or "hemispheres," which are to all intents duplicates of one another. The halves are united together and to the cerebellum below, and are separated above 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 in these furrows.

The main blood supply of the brain passes into its base.

To perform any voluntary movement an impulse must proceed from the brain to the nerve moving the muscles required, and there must always be some reason for the movement which, however, may be physical or mental.

66. *Reflex actions.*—There are, again, many acts which are not performed intentionally, though they are done by the voluntary muscles; the acts, for instance, of coughing, sneezing, vomiting, yawning, and hiccoughing, are independent of the will, and are what are called *reflex* acts depending upon the state of the air passages and digestive organs, the impulse causing the muscular movement proceeding from centres in the medulla and spinal cord, short of the higher brain.

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"CIRCULATORY SYSTEM".

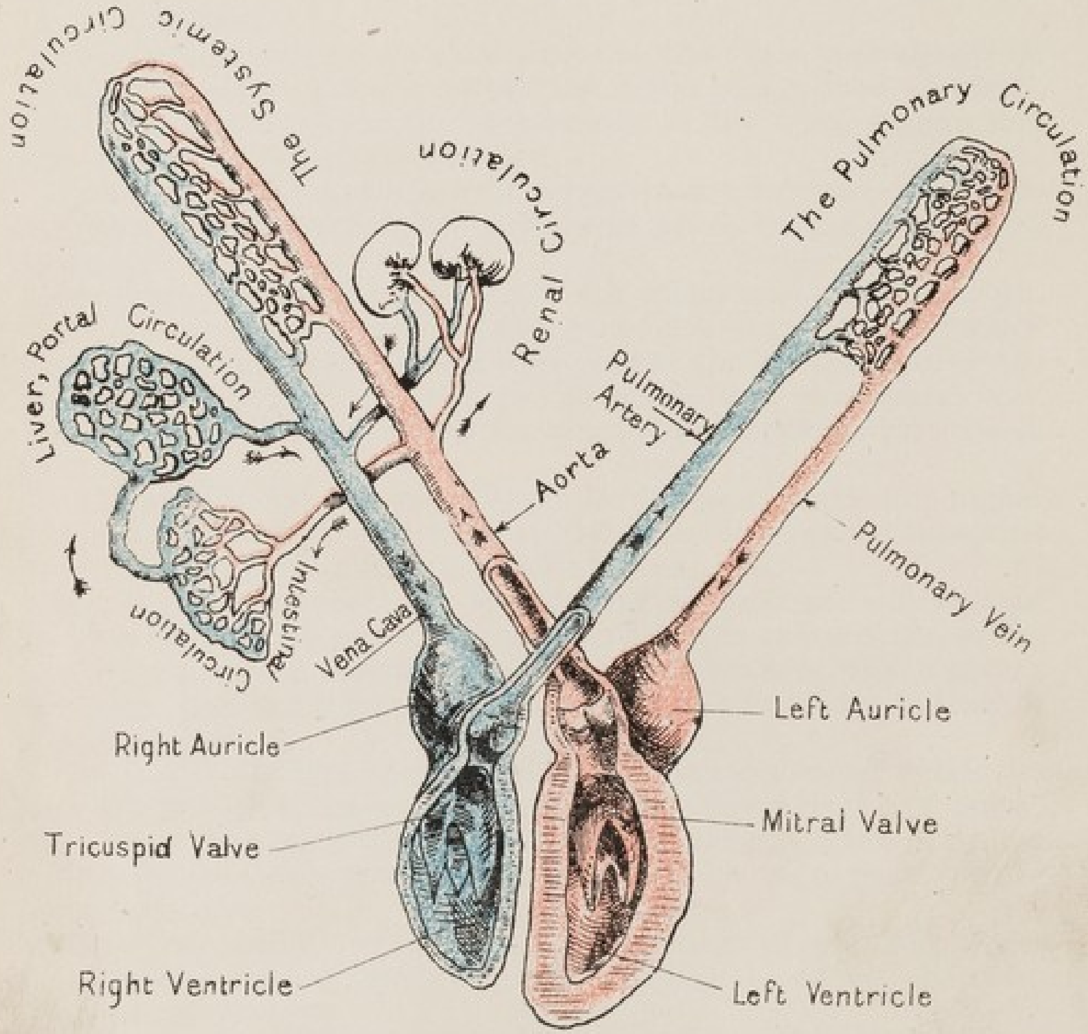

Fig. 17. *Diagram of the circulation of the blood*
The ventricles are seen in section to shew the valves
The right & left side of the heart are shewn separated

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67. *Sensory and motor nerves.*—Nerves are either "afferent" or sensory nerves which convey sensations to the nerve-centres, or "efferent" or motor nerves which convey impulses from the nerve centres to the muscles. All nerves are in connection by their central ends with nerve cells.

The sensory nerves are the nerves of the special senses, sight, taste, smell, hearing, and those of common sensation to carry impressions of heat, cold, and pain.

The motor ones are nerves causing the muscles to move, causing glands to produce their secretions, and causing the blood-vessels to enlarge or contract.

The nerves are made up of many strands of fibres, which are insulated like wires intended to carry electric currents.

The great sciatic nerve, which passes into the thigh, is the largest limb nerve in the body and is as large as the little finger.

68. *Paralysis.*—Injury to nerves causes paralysis of the parts they supply, *i.e.*, loss of sensation and of the power of movement, and the nourishment of the paralysed parts also suffers; bed sores are especially likely to occur in paralysis.

The spinal cord consists principally of nerve fibres coming from the brain to supply the trunk and limbs, and when it is torn through or badly crushed paralysis of both sides of the body is the result, extending as high as the point of origin of the lowest uninjured nerves coming off from it.

69. *Repair of nerve.*—When a nerve is completely severed it may be repaired in time, but it takes long, and sensation and power are only gradually recovered.

4. The Blood.

70. *White blood corpuscles.*—The blood and its circulation have already been described (para 14) briefly. In this description no mention was made of the white blood corpuscles. These bodies, though not so numerous as the red corpuscles, have very important duties in the body; there are about 500 red to one white corpuscle.

The white corpuscles have the power of altering their shape, and of passing through the walls of the capillaries; and they also seize and envelop and destroy germs of disease which gain access to the blood, thus protecting the body from invasion; 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 become pus corpuscles, which may be regarded as dead white blood corpuscles, collections of which form abscesses.

71. *Formation of red corpuscles.*—The white blood corpuscles are made in the spleen and lymphatic glands.

The red corpuscles have been described in para. 14. 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 principal duty is to absorb oxygen from the air taken into the lungs (para. 19), and to carry carbon dioxide from the system to the lungs, where it passes into the air in exchange for the oxygen, and is breathed out (*see* under muscular system).

72. *Result of movement.*—It must always be remembered that every movement causes the combustion or spending of some of the body tissues, and the result is transference of energy to some object, such as a cricket ball when thrown, and secondly, the production of heat (*see* also under muscle), and thirdly, the formation of carbon dioxide, which is the gas produced by all burning or rapid oxidation of organic matter.

73. *Combustion requires oxygen.*—To make combustion possible there must always be a supply of oxygen, and the necessity for the continuous supply of oxygen from the lungs and its carriage to every part of the body by means of the blood is apparent when the above-described conditions are understood.

74. *Blood plasma.*—The fluid part of the blood in which the corpuscles float (para. 14) is called *plasma*, and its function is to carry nourishment to the tissues by passing or soaking through the walls of the capillaries, to take up waste products from the tissues, and to carry them into the lymphatic system (*see* under lymphatic system) and to return to the blood stream by way of the thoracic duct.

75. *Blood-vessels.*—All the blood-vessels are surrounded by 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.

The vessel muscles are under the control of the sympathetic system of nerves (flushing and pallor are caused by the dilating and contracting respectively of the capillaries of the skin, and are caused by emotion, heat and cold, or pressure, &c., acting on the local sympathetic ganglion, whether through the brain or reflexly).

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.

76. *Blood supply of vital organs.*—The vital organs, therefore are placed in the chest and abdomen near the heart, which is the source of supply, and the brain, which is a little further off, has a particularly free supply, being fed by four large arteries, into two of which (the carotids) the blood passes direct from the arch of the aorta, and the two others (the vertebrals) are branches of the subclavians which come from the arch of the aorta.

77. *Positions of main blood-vessels.*—The main arteries of the limbs are placed in positions where they are protected from pressure and stretching, which would arrest the flow of blood through them; and in the case of the limbs the most protected side is the flexor side, towards which the limb bends.

The artery of the upper limb, for instance, passes underneath the collar bone, and thence deeply into the axilla; then passing down

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"BLOOD VESSELS."

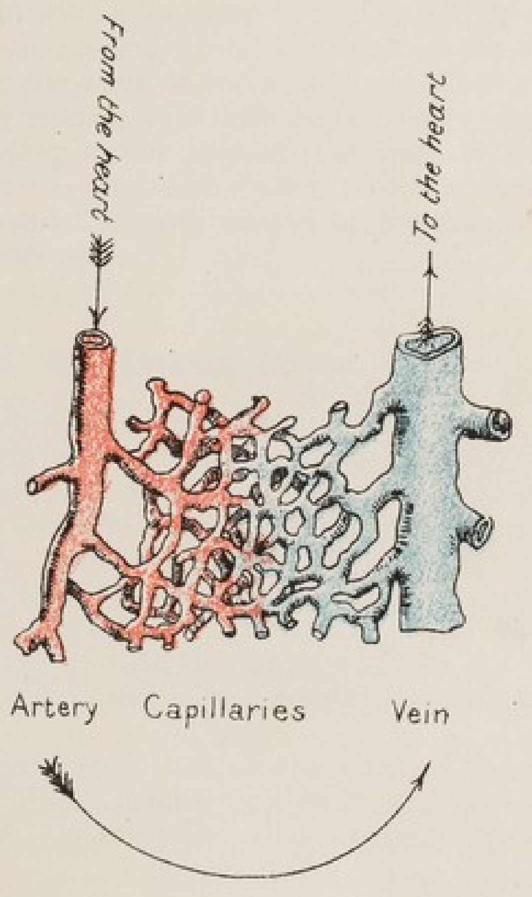

Fig. 18. *Diagrammatic sketch to shew the three classes of blood vessels.*

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the inner side of the humerus it goes in front of the bend of the elbow, where it divides into two branches, which both pass down on the inner side of the fore-arm (when the arm hangs in a natural position) and pass over the wrist on the side towards which it bends, and the deep palmar arch formed by the junction of these two arteries is protected from pressure by being buried beneath the tendons deep in the palm of the hand.

78. *Lower limb.*—In the lower limb the main artery after passing out of the abdomen first gains the centre of the groin which is on the flexor side of the thigh, and then passes deeply down on the inner side of the thigh till it arrives at the middle of the back of the knee joint. It divides into two branches a little distance below the knee, one branch 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 its muscles to reach the front of the ankle, the two meeting in the sole of the foot where the plantar arch formed by them 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.

5. The Portal Circulation.

79. When describing the systemic circulation, 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, and after passing through the interstices of the liver the blood is gathered into the hepatic or liver veins and by them passed into the main vein which enters the heart.

In the kidneys also there is a secondary circulation of similar description.

It must be borne in mind that all the work of the blood is done in the capillaries while it is moving slowly, and that there is more blood in the venous system by far, than in the arterial.

6. The Lymphatic System.

80. *Lymphatic system.*—There is a circulatory system in the body which has not yet been alluded to, called the lymphatic system.

It will be remembered that (para. 16) liquid nourishment is conveyed to every part of the body in the blood by the blood-vessels, and oozes through the thin walls of the capillaries into the tissues, from which certain waste matters soak back into the capillaries and are conveyed into the veins but the greater part of this necessary absorption is carried on by the lymphatic system, which receives the name of "absorbent system" also, on account of its important functions. It is made up of :—

(*a*) Lymphatic capillaries and lymph spaces, into which fluids from the tissues soak, and which are to be found in every part of the body.

(*b*) Lymphatic glands, to which all the lymphatic vessels converge and which are factories of white blood corpuscles and in which filtration of the lymph takes place.

(*c*) Large lymph vessels which collect lymph after it has passed through the glands, and empty it directly into the blood as it passes towards the heart in the veins.

(*d*) The lymph itself, which is a colourless or faintly yellow fluid such as is seen in a blister, and which is clear except when, as it passes charged with fat from the intestines during digestion, it becomes milky.

81. *Movements of the lymph.*—The lymph is constantly moving from the extremities towards the centre, and a large lymphatic vessel which returns it into the great vein in the chest is called the thoracic duct.

There is no outward going stream as in the case of the blood circulation, and no heart to drive the lymph; but all the vessels have many valves, and every movement of the body moves it forward, the valves preventing its return.

82. *Lymph capillaries.*—Lymph capillaries are larger and less regular in shape than blood capillaries, and commence in spaces in the tissues; they are to be found in all parts of the body, as also are blood-vessels and by their junction they form lymphatic vessels which join and branch to form networks of lymphatics, and pass into and out of the lymphatic glands.

83. *Lymphatic glands.*—The lymphatic glands are small bodies which are situated in various parts of the body, such as the bend of the knee and elbow, the groin and axilla, the back and sides of the neck, the mesentery, and root of the lungs, each set of glands receiving the lymph from the parts of the limbs and organ near which it is situated.

84. *Inflamed or septic wounds.*—It will be noticed that if there is a "septic" or festering sore on the foot, the glands in the groin below its fold become inflamed from the poisoned lymph they have intercepted, and in case of such a sore occurring on the hand, that the glands in the axilla are affected. In some general diseases the glands all over the body become enlarged.

Medicines which are rubbed into the skin become diffused by means of the lymphatic system, and those also which are hypodermically injected.

85. *Lacteals.*—The intestines are highly equipped with lymphatic vessels which take an active part in the absorption of fats into the system, and are called lacteals; they are found in the *Villi* (Fig. 20). These carry the digested fats into the mesenteric lymphatic vessels, which pass it into the thoracic duct which discharges into the great veins of the root of the neck.

The tonsils, *Peyer's patches*, and parts of the spleen are of the nature of lymphatic apparatus.

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THE DIGESTIVE SYSTEM

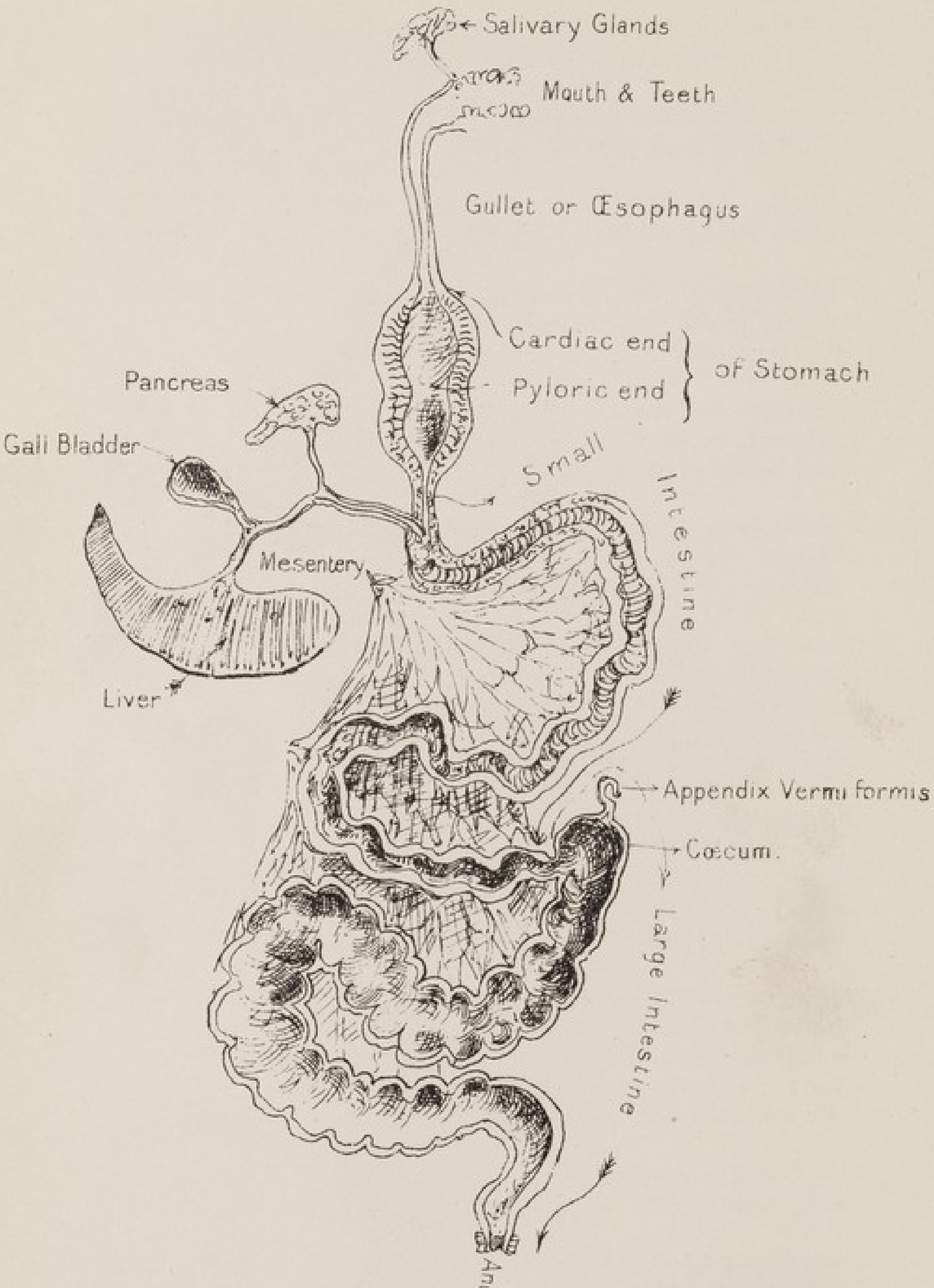

Fig. 19. *Diagram to shew Regions of Alimentary Canal. The Alimentary Canal is shewn in section and the mesentery is diagrammatic.*

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7. The Digestive System.

86. *Digestion.*—By digestion is understood the preparation of food to be received into the blood.

It is obvious that before it can be absorbed it must be dissolved.

Food, which must consist of proper proportions of certain substances, viz., meats, fats, starches, salts, and water, is first placed in the mouth, where, by the movements of the tongue and cheeks, it is turned about and kept between the teeth, the saliva running into it, until it is mixed up and can be swallowed; this is done by the tongue pushing it into the upper part of the throat or pharynx, whose muscles seize it and pass it quickly down over the top of the larynx which is covered by the flap of the epiglottis until it has passed; the muscles of the œsophagus now push it into the stomach.

The saliva begins the digestion of the starchy parts of the food.

87. *Stomach.*—The food remains in the stomach, which is here represented as a very thick bag with a slight constriction in the middle (which does not really exist, but is to show that the digestion in the stomach has two phases and that two different sorts of glands are at its opposite ends, which produce two different sorts of gastric juice).

The peptic glands are situated at the left end of the stomach (its first part), and the acid-forming glands towards the pyloric end, en route to the intestine; the pyloric funnel-shaped end of the stomach itself has no acid-forming glands, but alkaline pepsine glands.

Food remains about four hours in the stomach after which it is pressed out into the upper end of the small intestine or *duodenum* in an acid condition; the digestion of meats has been done to a considerable extent in the stomach.

A short distance down the intestine the duct carrying the bile and juice of the pancreas opens into it, and their juices are poured into the liquid food (the bile colours it yellow).

88. *Small intestine.*—The small intestine is about 22 feet in length, and it and the greater part of the large intestine are attached to the spinal column by a double layer of membrane called the mesentery, between the folds of which the blood and lymph vessels and nerves pass to and from the intestine. The mesentery also serves to prevent the intestine from kinking, as any unattached coil would be sure to do.

The interior of the upper part of the small intestine has its lining raised into transverse ridges (called *Valvulæ Conniventes*) which prevent the too rapid passing of the liquid food and form a large surface for digesting and absorbing it.

89. *Absorption.*—The whole length of the small intestine has its inside covered with small projections called *Villi* (*see* Fig. 20), which have inside them blood-vessels and lymphatics (lacteals), and which suck up the digested food as it passes along, being bathed in it.

90. *Intestinal juice.*—There are also many small glands in the walls of the intestine which produce a digesting juice, which, acting with the pancreatic juice and bile turn the contents of the intestine alkaline (they are acid on leaving the stomach), and continue its digestion.

The digestion of meats is completed by the pancreatic and intestinal juices, that of starches by the pancreatic juice, and of fat by the bile, principally.

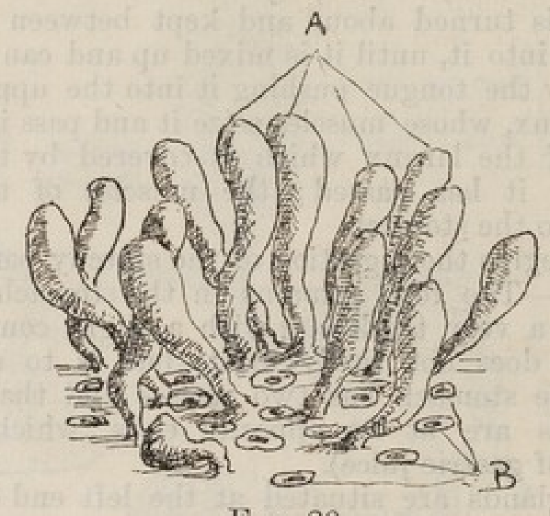

FIG. 20.

Diagram showing part of the interior of the small intestine with projections ("villi"), marked A, for absorbing digested matter, and recesses, marked B, for pouring out digestive fluid.

91. *Peristalsis.*—The intestines are furnished with circular bands forming a complete layer of involuntary muscular fibres and a longitudinal layer also; these contract slowly and in regular time, waves of contraction proceeding from the upper towards the lower end of the tube, and squeezing the food onwards; these movements are called "peristaltic" movements or *peristalsis.*

In the small intestine the fæces begin to acquire their foul smell, and its contents cease to be antiseptic (as they were in the stomach).

The contents of the small intestine pass into the large intestine, which begins in the right iliac fossa.

92. *Large intestine.*—The large intestine, which is about five feet long, begins in a blind bag-like head, into the side of which the small intestine opens; this head is called the *cæcum.* Attached to it is the vermiform appendix. (It is this small wormlike appendix which is affected in the disease called appendicitis.)

The large intestine passes upwards in the right flank, then across the abdomen, then downwards through the left flank 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 (*see* Fig. 19).

THE URINARY SYSTEM

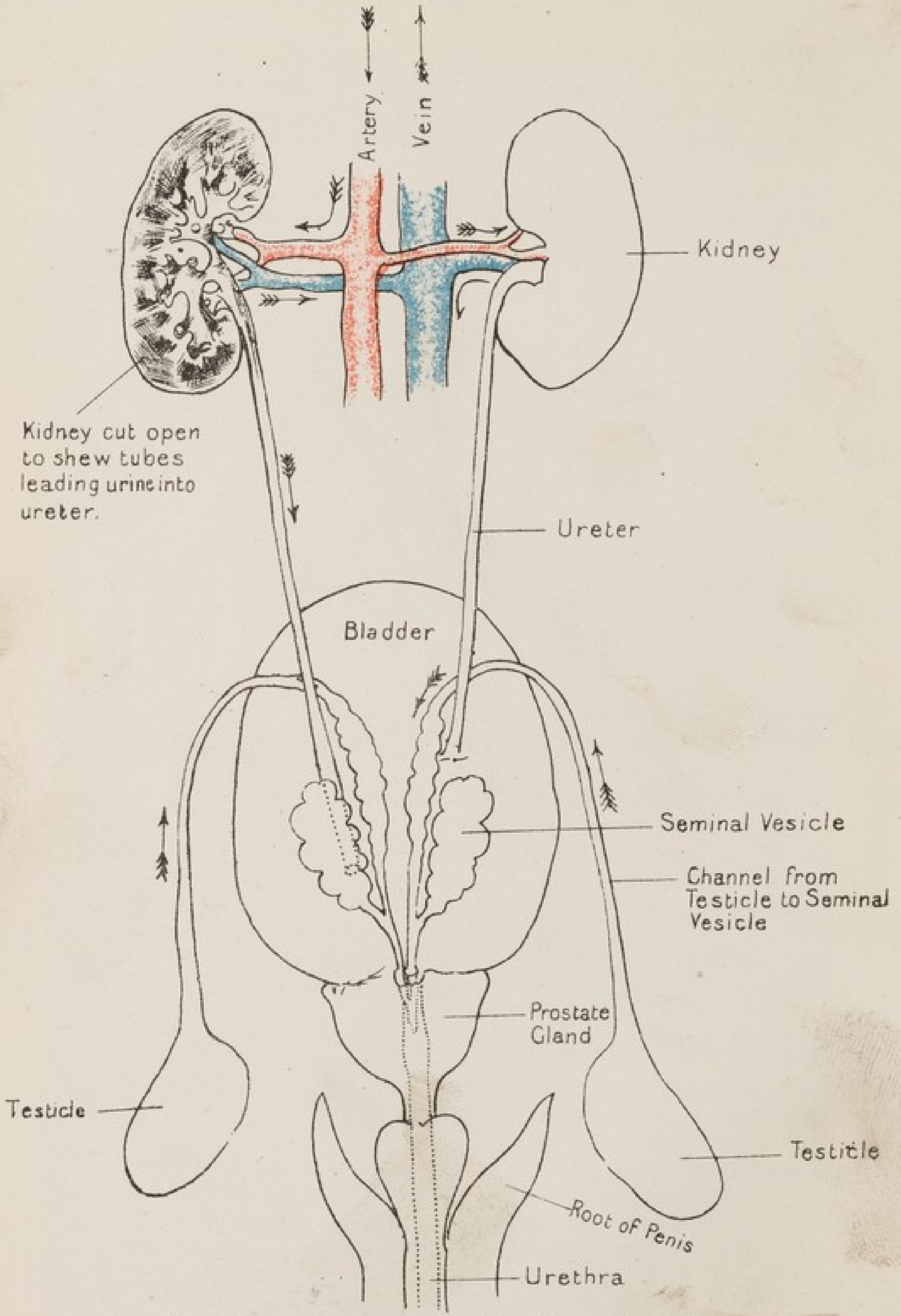

Fig. 21. *Diagrammatic sketch of genito-urinary organs*

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The process of putrefactive digestion is completed in the large intestine, and its contents become drier and formed in its lower end.

The fæces are retained in the upper part of the rectum till it is convenient to void them.

The large intestine is provided principally with mucous glands whose secretion lubricates the passage of the fæces; in the lower part of the small intestine are "Peyer's patches" and single lymphoid glands, and in the large intestine are single lymphoid glands. These lymphoid glands have no openings, and appear to have some connection with the lymphatic system.

93. *Nature of fæces.*—The anus is kept closed by means of the sphincter muscles (of which there is an inner and outer one) until it is desired to defæcate. These muscles act like purse strings, being arranged circularly around the opening.

The "fæces" are the undigested remains of food, mixed with the useless remains of the digesting fluids, and some matters excreted from the system, and the whole mass is coloured by the bile and impregnated with foul gases.

8. The Urinary System.

94. This is one of vital importance to the body, inasmuch as it takes the largest share in the excretion (or getting rid) of waste products of the body which would otherwise clog its organs and destroy life. (This actually happens when the kidneys are destroyed by disease.)

The urinary system consists of the kidneys, the ureters (two tubes which conduct the urine from the kidneys to the bladder), the bladder, and the urethra (a tube which conducts the urine from the bladder to be passed out of the body).

95. *Kidneys.*—The two kidneys are situated in the abdominal cavity (para. 24, Fig. 15), one on each side of the spinal column. They lie behind all the other contents of the abdomen, and their upper parts are as high as the last rib.

They have each a very large artery passing into, and vein passing out of them on their inner and front edge, and the ureter comes out behind the vein and artery and goes down to enter the lower and back part of the bladder.

96. *Bladder.*—The bladder is situated in the pelvis (para. 24). It is a bag which is fixed at its base, and free to expand upward. It will hold comfortably about one pint. It lies below all the intestines, and only rises into the abdomen when very full.

97. *Vesiculæ seminales.*—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.

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 goes.

The bladder has strong layers of involuntary muscle fibres which help the abdominal muscles to squeeze the urine out of it into the urethra, and which exercise pressure upon its contents at all times.

98. *Male urethra.*—The urethra in the male (to which sex these remarks alone refer) is about $8\frac{1}{2}$ inches long and $\frac{1}{4}$-inch in diameter.

It passes out from the base of the bladder through the prostate gland (see diagram) 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.

Just after it has passed through the prostate gland, the openings of the seminal receptacles pass into the urethra.

The rectum (lower end of large bowel) lies behind it as it passes the prostate.

The situation of these parts is very necessary to know, as the introduction of the enema syringe's nozzle and the passing of catheters properly depends on such knowledge.

99. *Action of 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.

100. *Quantity of urine.*—The amount of urine passed off in a day is about 50 ozs., or $2\frac{1}{2}$ pints. This quantity of urine contains about $2\frac{1}{2}$ ozs. 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, as above stated, the kidneys cease work from disease, or other cause, the blood soon becomes poisoned by the accumulation of these matters in it, and "uræmia" with convulsions and insensibility results.

The renal artery and vein are very large, and the blood passes through the kidneys fast.

101. *Vascular tufts.*—The kidneys consist of tubes which are folded and twisted, and end in small bags, each of which receives a tuft of capillary blood-vessels; at their other ends the tubes open into the commencement of the ureters, in the "pelvis" or concave side of the kidney.

102. *Tubules.*—The water of the urine passes from the blood into the little bag at the ends of the tubes through the tuft of capillaries, and as it runs down the tube it is joined by the urea and other substances which form the urine, which are produced by the cells lining the tube walls,—the cleansed blood passes on in its vessels, and the urine drains into the ureters and finally into the bladder.

103. *Retention.*—It 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" is said to occur.

To draw the water from the bladder an instrument called a

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"SECTION OF MALE PELVIS"

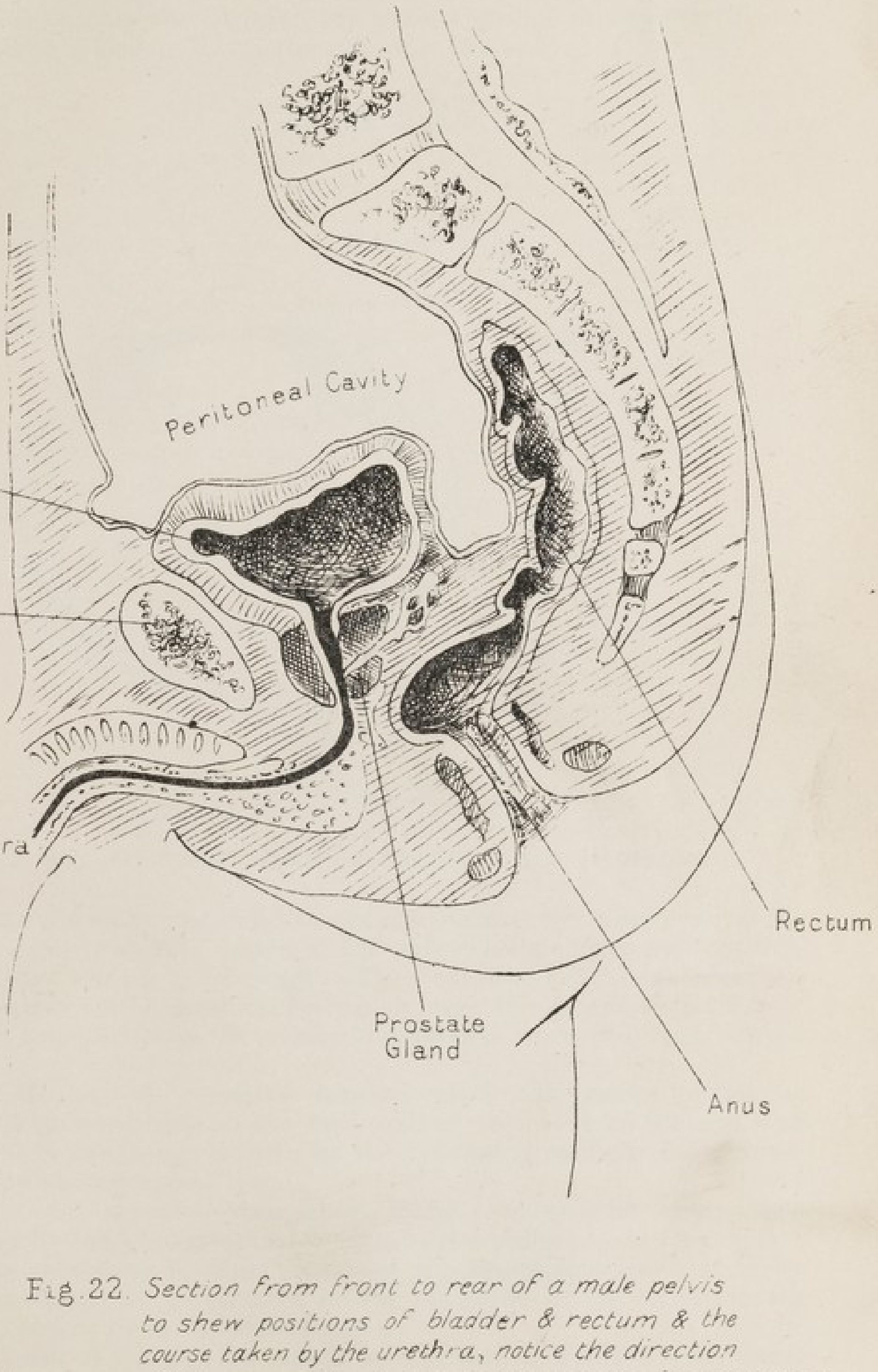

Fig. 22. *Section from front to rear of a male pelvis to shew positions of bladder & rectum & the course taken by the urethra, notice the direction of the anus with view to passing nozzle of enema syringe*

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catheter is used, which is passed in at the orifice of the urethra until it reaches the bladder, the urine running through it (it is a tube with a hole in it—in the side near the end)

9. The Eye.

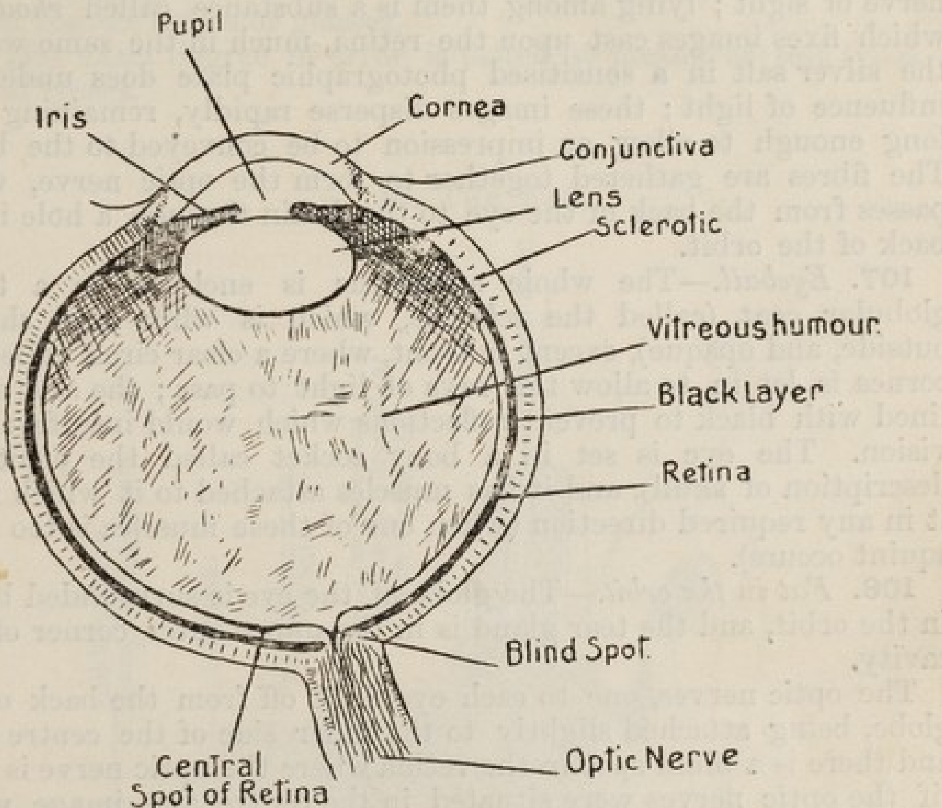

Fig. 23.—Diagram. Section through Eye (Horizontal).

104. The eyes are delicate optical organs, by means of which our brains are made aware of the shape, colour, size, and position of things within their range. They consist of (1) *Lens*—a transparent refracting medium by which large things are reduced to a small enough size to be received as images upon the back of the eye.

(2) *Retina.*—A sensitive screen called the *retina*, which is spread on the inside on the back half of the globe of the eye, and on which any image thrown by the refracting medium is instantaneously photographed.

(3) *Optic nerve.*—Nerve fibres which convey the impressions caused by the photographed images to the brain.

The refracting medium is called the *crystalline lens* (aided by the cornea). It is situated inside the globe of the eye near its front, and is about the size of a pea.

In front of the lens is a small chamber which is full of water, and behind it, filling out the shape of the eye, is a jelly-like substance called the *vitreous humour.*

105. *Iris.*—There is a sort of diaphragm which covers the edges of the lens, and by its contraction and expansion regulates the amount of light admitted to the eye. It is coloured, and the aperture in its centre is called the pupil ; it is called the *iris.*

106. *Structure of retina.*—The retina is composed of countless nerve endings and fibres leading from them to the optic nerve or nerve of sight ; lying among them is a substance called *rhodopsin* which fixes images cast upon the retina, much in the same way as the silver salt in a sensitised photographic plate does under the influence of light ; these images disperse rapidly, remaining only long enough to allow an impression to be conveyed to the brain. The fibres are gathered together to form the optic nerve, which passes from the back of the eye to the brain through a hole in the back of the orbit.

107. *Eyeball.*—The whole apparatus is enclosed in a tough globular coat (called the *sclerotic,* which is white and shining outside, and opaque), except in front, where a clear circle called the cornea is let in to allow the rays of light to pass ; the sclerotic is lined with black to prevent reflections which would interfere with vision. The eye is set in a bony socket called the orbit (*see* description of skull), and it has muscles attached to it which move it in any required direction (when one of these muscles is too short squint occurs).

108. *Fat in the orbit.*—The globe of the eye is surrounded by fat in the orbit, and the tear gland is in the upper outer corner of this cavity.

The optic nerves, one to each eye, lead off from the back of the globe, being attached slightly to the inner side of the centre of it, and there is a blind spot in the retina where the optic nerve is fixed (if the optic nerves were situated in the centre any image which fell in the centre of the field of vision would be invisible, but as it is, the blind spots in the two eyes, not being in the centre, never have the same image cast upon them, and the centre of the retina is its most sensitive part).

109. *Conjunctiva and lachrymal canal.*—The front and visible part of the globe of the eye is covered with a very sensitive membrane or skin called the *conjunctiva,* which is continued over the inner surface of the eyelids ; it is transparent over the cornea, where it is closely fixed, and also over the sclerotic, but it is thicker and has more blood-vessels in it on the interior of the eyelids. The eyeball is kept always moist, so as to move without friction, by the tears (these only overflow when in grief, or when something irritates the conjunctiva and requires to be flushed out) which come from the lachrymal or tear gland above mentioned, their surplus running down into the nasal passages by means of a tube called the *lachrymal canal* ; the openings into this canal may be seen as two pinholes at the inner corners of the eyelids when they are pulled open, away from the eyeball.

110. *Eyelashes.*—The eyelids are fringed with eyelashes, whose use is to prevent objects getting into the eyes.

111. *Errors of refraction.*—The refracting power of the eye is frequently imperfect, especially among people who do much reading or other work trying to the eyes, and instead of the picture being focussed as it should be exactly on the retina, it falls, in cases of short sight in front, and in long sight or old sight, behind it. These "errors of refraction" are corrected by the use of concave and convex lenses or glasses.

The exact degree of error is tested by means of test types and trial lenses.

10. The Ear.

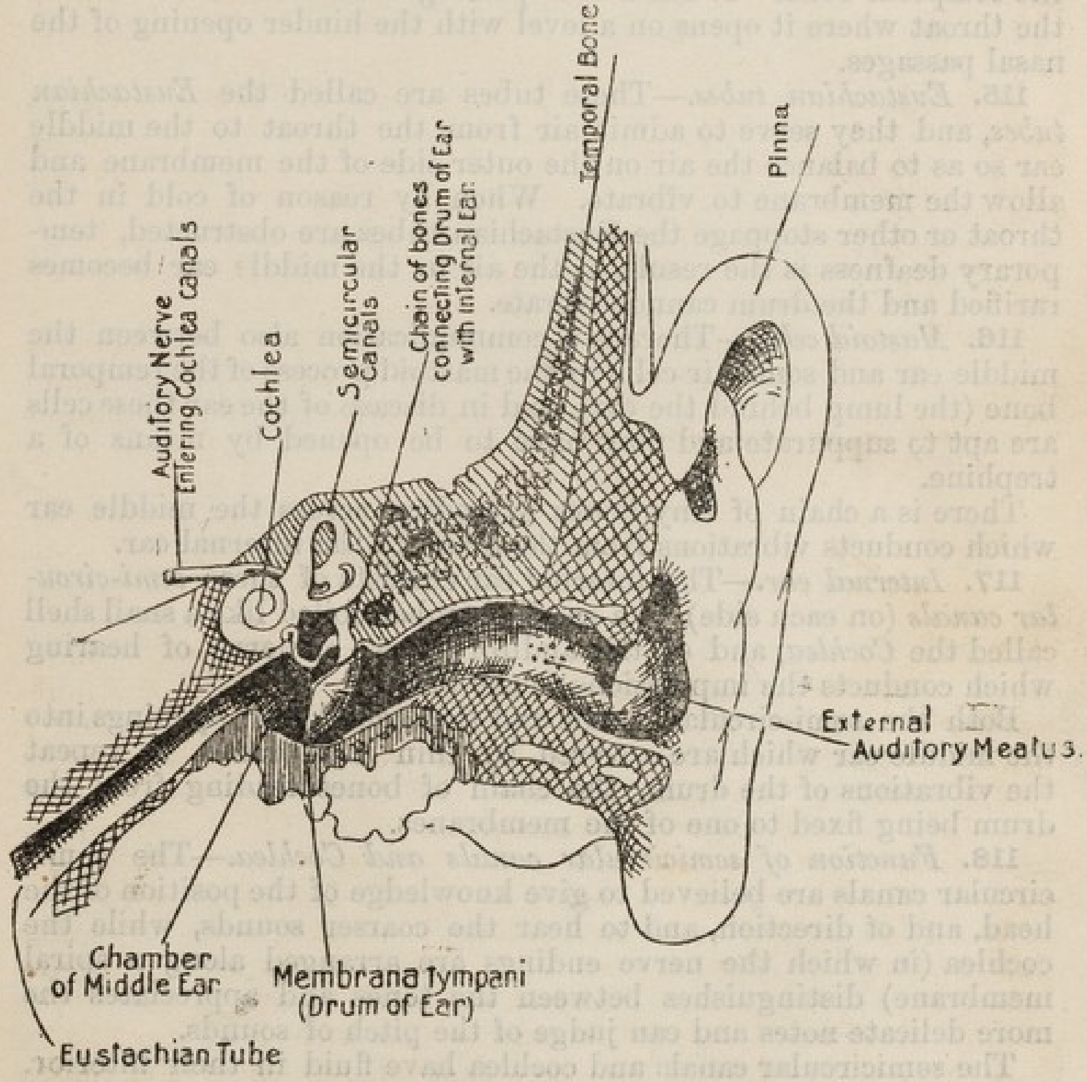

Fig. 24.—Diagram. Section through Ear.

112. *External meatus.*—This organ consists of the external flap or "pinna," which is made of cartilage, covered with skin, and shaped into ridges and depressions. It leads into the opening of the "external meatus" or earhole, a channel, the outer half of which is formed of cartilage prolonged from the pinna, and the inner half is a bony tunnel lined with thin skin.

Hairs and wax-producing glands are found in the passage, which prevent small foreign bodies from reaching the delicate drum of the ear, which is placed obliquely at the inner end of the meatus.

The passage is about one inch long and is slightly curved.

113. *Membrana tympani.*—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.

114. *Middle ear.*—The middle ear lies on the other side of the membrane, and is a small cavity hollowed out of the thickness of the temporal bone. It has a tube passing from it to the back of the throat where it opens on a level with the hinder opening of the nasal passages.

115. *Eustachian tubes.*—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 stoppage the Eustachian tubes are obstructed, temporary deafness is the result, as the air in the middle ear becomes rarified and the drum cannot vibrate.

116. *Mastoid cells.*—There is a communication also between the middle ear and some air cells in the mastoid process of the temporal bone (the lump behind the ear), and in disease of the ear these cells are apt to suppurate and may have to be opened by means of a trephine.

There is a chain of tiny bones extending across the middle ear which conducts vibrations from the drum to the internal ear.

117. *Internal ear.*—The internal ear consists of three *semi-circular canals* (on each side), of a small chamber coiled like a snail shell called the *Cochlea*, and of 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 which are covered by thin membranes, to repeat the vibrations of the drum, the chain of bones leading from the drum being fixed to one of the membranes.

118. *Function of semicircular canals and Cochlea.*—The semicircular 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.

The semicircular canals and cochlea have fluid in their interior. 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 semicircular canals from the middle ear, and are repeated by this membrane to the fluid on its other side and thus to the delicate

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NASAL PASSAGES &c.

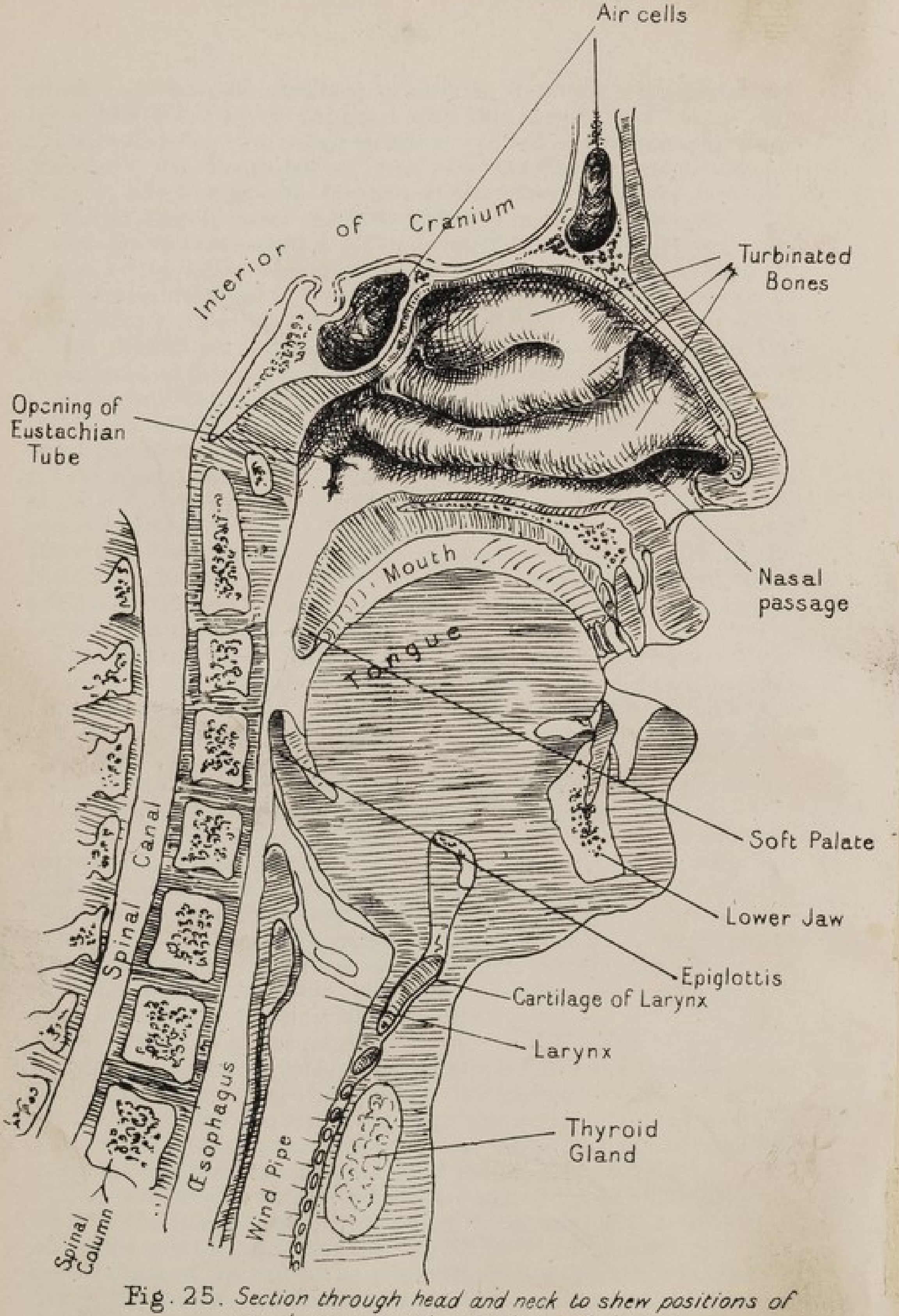

Fig. 25. *Section through head and neck to shew positions of nasal cavity, mouth, œsophagus & larynx Slightly to left of mid-line.*

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nerve endings spread out in the semi-circular canals and cochlea. The auditory nerve, as above stated, carries the impressions to the brain.

119. The external meatus sometimes gets stopped up either with wax or some foreign body: these are usually dislodged by syringing which must be done with great care, as the membrane has been ruptured by too hard syringing. The drum of the ear is often ruptured in artillerymen who stand near the muzzle of big guns when firing. This can be avoided by the placing of suitable plugs in the ears.

The Eustachian tube can be opened by the blowing of air into the pharynx with Politzer's bag or the Eustachian catheter.

11. Nasal Passages, &c.

120. The air before it reaches the lungs is warmed as it goes through the nasal passages, through which it is drawn during quiet breathing. During violent effort the mouth is also used.

The nasal passages are formed by the bones of the face and palate (*see* under skull). 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.

The outer sides have projecting from them three bones, called turbinated bones, which are curved downwards and which reach nearly to the partition, or septum, so partially dividing the passage into three channels on each side.

The floor of the passages is formed by the palate plate of the upper jaw and by the palate bone.

Several sets of air cells communicate with the nasal cavities, and the tear duct opens into the lower one.

121. *Organ of smell.*—The upper division of the passage and the upper turbinated bone are the seat of the sense of smell, the branches of the olfactory nerve or nerve of smell being spread in the mucous membrane covering them.

The mucous membrane covering the rest of the passages 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.)

122. *Nostrils.*—The nostrils, which are the front openings into these passages, look downwards, and are provided with a number of hairs inside which intercept any foreign substance and stop it from being drawn into the air passages.

123. *Posterior nares.*—The posterior nares are the openings by which the air passes into the throat or pharynx after traversing the nasal passages; they are about the same size as the nostrils.

In the operation of plugging the hinder nares and in passing the Eustachian catheter and the nasal feeding tube, the instruments are put into the nostril and pushed along the floor of the nasal passage till they reach the pharynx, passing into it through the hinder nares.

In "cold in the head" it is the mucous membrane of the nasal passages which 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 nerve.

124. *Mouth.*—The mouth can be easily inspected, and needs little description.

The teeth have been noticed (*see* under skull).

125. *Tongue.*—The tongue is a muscular organ which is fixed at its base to the hyoid bone, a small curved bone which is to be felt just above the prominence of "Adam's Apple" under the skin in front of the neck.

The tongue is covered with a rough skin on the top which has in it the nerves of taste, at the sides and back chiefly ; sweet, acid, salt and bitter are the tastes perceived by the tongue and palate, and all other tastes are perceived by the organ of smell.

It can move in most directions, and is particularly active in the mastication of food, and in speech.

126. *Salivary glands.*—There are several glands which produce saliva 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 point of the jaw ; 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.

127. *Fauces.*—The epiglottis is a cartilaginous flap covered by 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.

Near the back of the tongue on each side of the pharynx are seen the two pillars of the fauces enclosing the tonsil between them.

The roof of the fauces is formed by the soft palate, attached to which is seen behind the pendulous part, or uvula.

In swallowing, the whole of the larynx is drawn up by muscles past the "bolus" or mass of food which is gripped by the muscles of the gullet and so passed on to the stomach.

128. *Pharynx.*—The pharynx is the cavity into which the mouth, and above it the posterior nares open ; it is like a "hopper" or funnel, and is suspended from the base of the skull, and continues down to the œsophagus behind and 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* ear) open into it above the soft palate.

129. *Distribution of air and food.*—The pharynx receives both the air in breathing and the food in swallowing, and provision has to be made to direct them into their proper channels ; in swallowing, it would be fatal if food found its way into the

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"FOOD AND AIR PASSAGES."

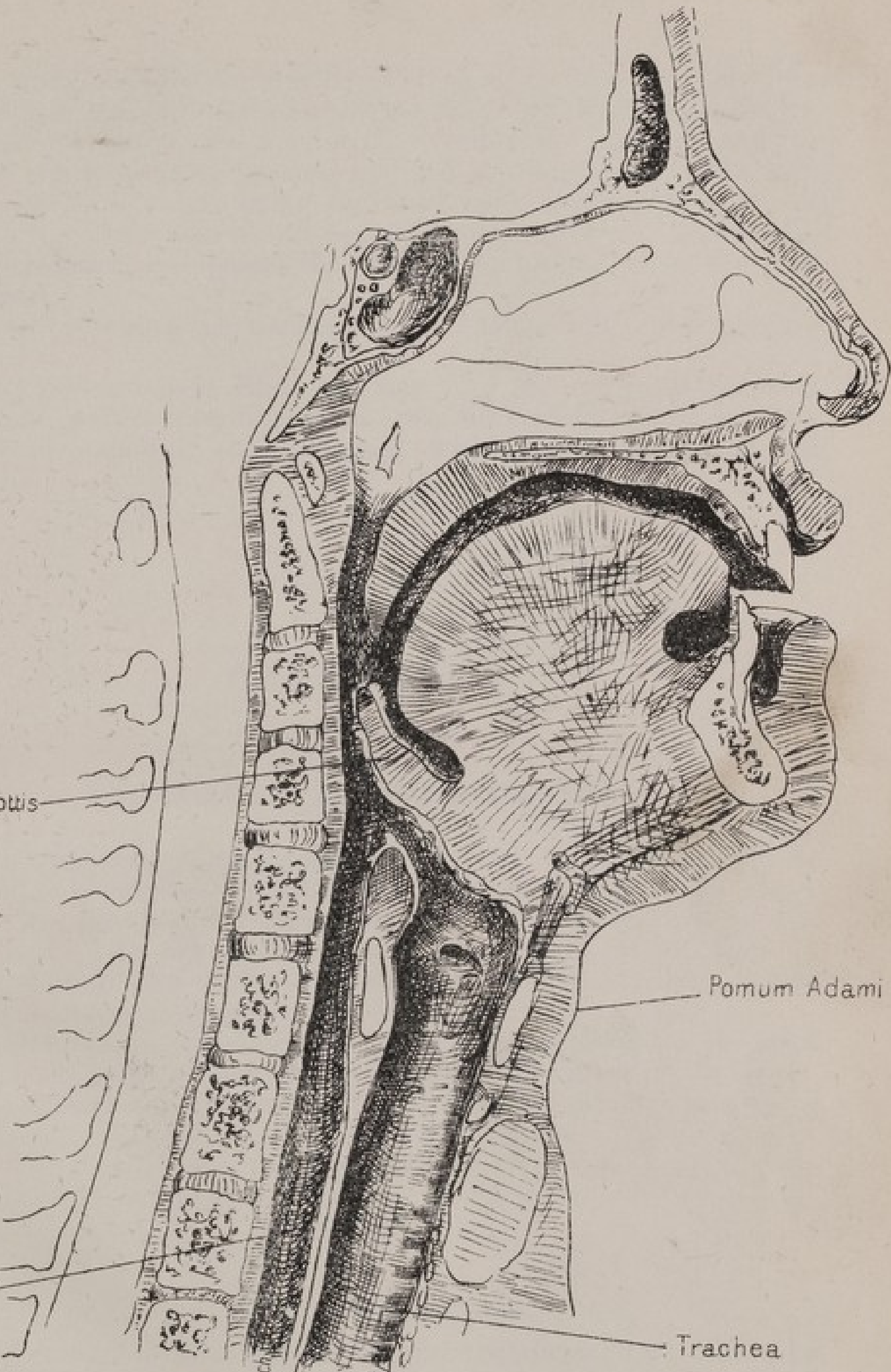

Fig. 26. Section of head & neck to shew food & air passages.

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larynx, and most uncomfortable if it went up into the nose; to prevent the passage of food into the larynx, the larynx is drawn up as before stated, the epiglottis covering its opening, and to prevent the food from passing up into the nasal cavity the soft palate acts as a valve, being flattened back against the back of the pharynx, the uvula filling up the central groove. The palate drops forward again against the back of the tongue when the food has passed.

During breathing the muscles of the palate and epiglottis are inactive.

If any foreign body finds its way into the air passages, such as food or water, coughing is at once the result, and is nature's method of expelling the substance, which would injure the air passages.

CHAPTER IV.

BANDAGES AND BANDAGING.

130. *Instruction.*—Great economy of time and labour will be effected in imparting instruction in bandaging by practising one-half of the members of the class at a time in bandaging the other half. This can probably be best carried out by forming up the men in two ranks, and then causing the front rank to bandage the rear rank, and *vice versa.*

131. *Bandages.*—Bandages are used for many purposes, the chief of which are to fix splints or dressings, to apply pressure to a part, and to support the circulation. They may be divided into three classes :—

1. Triangular.
2. Roller.
3. Special.

1. *Triangular Bandages.*

132. *Triangular bandage.*—Triangular bandages, used chiefly on field service, are made by cutting pieces of calico or linen, 38 inches square, 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.

(1) *Stowage.*—To fold the bandage for stowage, it should be folded perpendicularly down the centre, placing the two ends together, the right end on the left; then the ends and the point

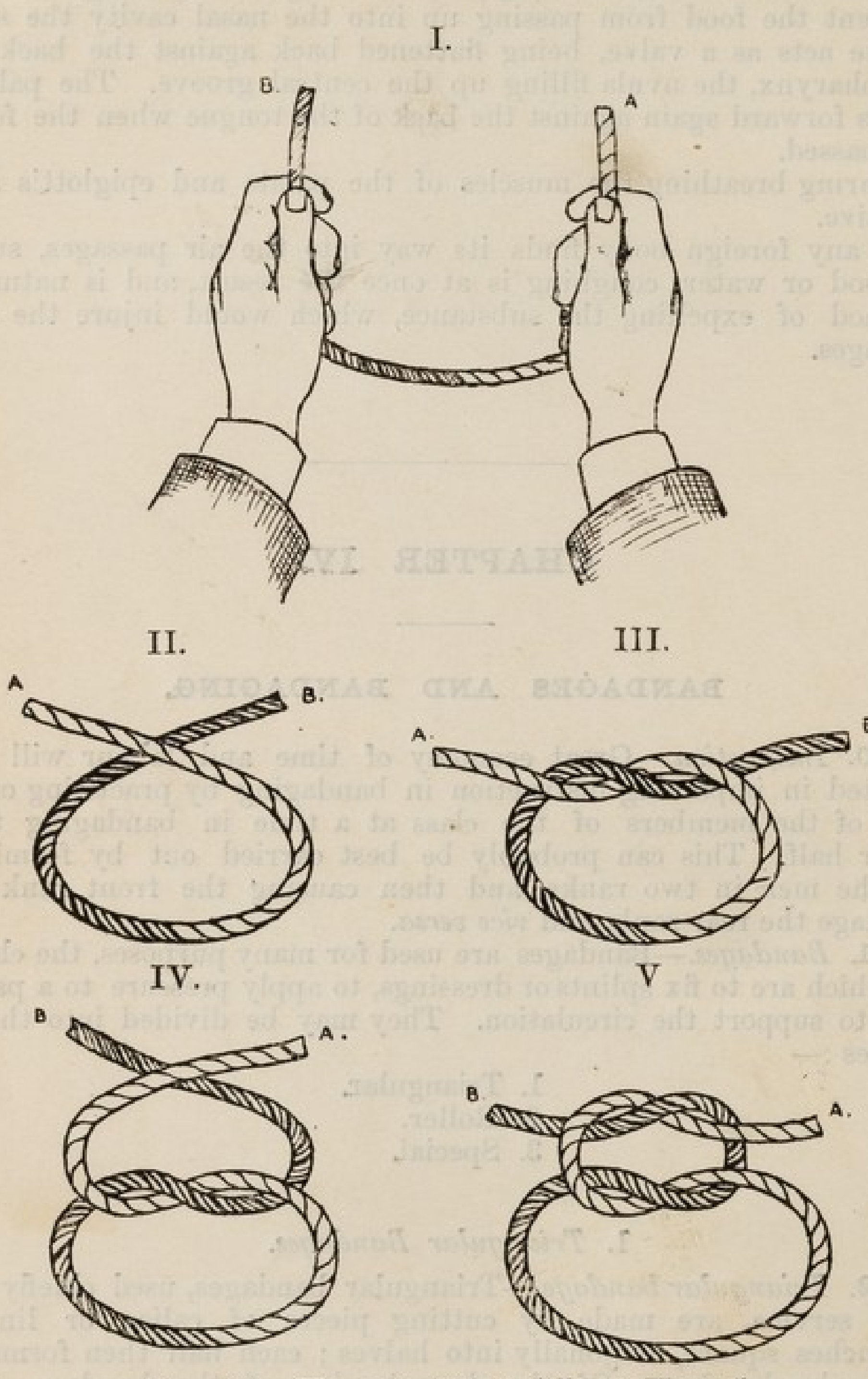

Fig. 27.—How to Tie a "Reef-Knot."

should be brought to the centre of the lower border, thus forming a square; fold in half from right to left, and in half again from above downwards twice.

(2) *Three modes of application.*—The bandage is applied as: (*a*) a whole cloth; (*b*) broad fold; or (*c*) narrow fold. The whole cloth is the bandage spread out to its full extent. The broad fold is 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. The narrow fold is made by folding the broad fold once lengthwise.

(3) *Reef knots.*—In every case where a knot has to be tied, a reef knot will be used, the formation of which is best explained by the accompanying diagrams showing how to make it and how not to make it.

I. II.

FIG. 28.—THE "GRANNY" KNOT.

(4) *Bandage top of head.*—Take a whole cloth, lay the centre on the top of the head, the lower border lying along the forehead just above the eyebrows; fold in the edge, pass the ends round behind, leaving the ears free; cross below the occipital protuberance over the point of the bandage, bring the ends to the front again, and knot off on the centre of the forehead. Place the hand on the top of the head to steady the dressing, draw the point down to tighten and fit the bandage to the head, then turn it up and pin off on the top.

(5) *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.

(6) *Both eyes.*—Place the centre of a broad fold between the eyes, carry the ends backwards, cross and knot off in front.

(7) *One eye.*—Place the centre of a narrow fold over the injured eye, pass one end obliquely upwards over the forehead, the other downwards across the ear; cross below the bump at back of head, and knot off above the eyebrow on injured side.

(8) *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.

(9) *Neck.*—Place the centre of a narrow fold over the dressing, cross the ends, bring back and knot off over the wound.

(10) *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 long end, bring it over the shoulder, and pin off to broad fold over the dressing.

(11) *Abdomen.*—Place the centre of a broad fold over the wound, and knot off on the side.

Fig. 29.—Greater Arm Sling.

(12) *To apply the greater arm sling.*—Take a whole cloth, throw one end over the shoulder on the sound side, carry round the neck so as to lie over the opposite shoulder ; place the point behind the elbow of the injured arm, allowing the other end to fall down in front of the patient ; bend the injured arm carefully, and place it across the chest on the middle of the bandage, thumb pointing towards the chin ; bring up the lower end in front of the fore-arm and knot off to the end lying over the shoulder on the injured side ; draw the point forward round the elbow and pin off.

(13) *In broken collar-bones.*—There is one exception to this method of applying the greater arm sling, viz., in fracture 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.

(14) *Fractured clavicle.*—This bandage may be also used to secure the arm temporarily in cases of fractured clavicle. Having placed a pad in the arm pit, apply the centre of a narrow-fold bandage to the outer surface of the arm of the injured side ; carry the front end horizontally across the chest, bring the back end forwards between the arm and chest, over the upper margin of front part of bandage, then up through the loop formed ; carry backwards round chest, exercising steady traction, so as to draw the arm backwards ; then secure the two ends on the opposite side of the chest. The arm-sling depicted above can then be applied ; an ordinary roller bandage may be used, taking care to place a pad between the upper arm and the chest, to draw the upper arm well back, and to support the elbow, as shown in fig. 31.

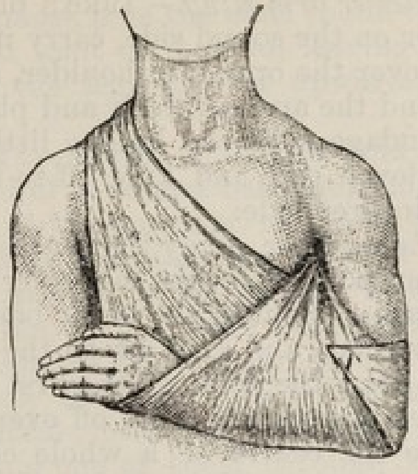

FIG. 30.—ARM SLING FOR FRACTURED COLLAR-BONE (CLAVICLE).

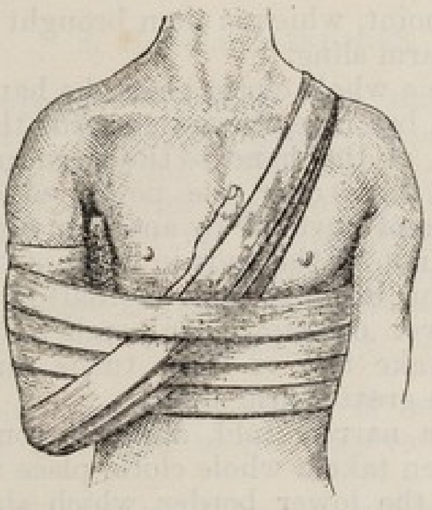

FIG. 31.—BANDAGE FOR FRACTURED CLAVICLE.

FIG. 32.—SHOULDER BANDAGE AND LESSER ARM SLING.

(15) *To apply 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.

(16) *To bandage the 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.

(17) *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 greater arm sling.

(18) *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 centre of bandage over dressing, bring ends round to opposite side of hand, cross and take two or three turns round the wrist and knot off. Apply the greater arm sling.

(19) *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.

(20) *Knee.*—Keep the leg straight, apply a broad fold, cross behind, and knot off in front below knee-cap.

(21) *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, 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.

(22) *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.

(23) *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 safety pin ; bring the other end forward between the thighs, up to the waist bandage in front, pass beneath, turn over and secure with safety pin. This forms a modified T bandage.

(24) *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.

2. Roller Bandages.

133. *Varieties.*—Roller bandages are made of calico, linen, flannel, loose-woven material, gauze impregnated with some antiseptic, or elastic webbing. The rollers ordinarily in use for bandaging the head or limbs are made of loose woven material. Flannel bandages are used for special purposes, for warmth, or after inunctions. Loose woven bandages are used with plaster of paris. Gauze bandages are used in antiseptic dressings. Elastic web bandages are used to support the circulation or exercise pressure on a limb.

134. *Sizes.*—Roller bandages consist of long strips, varying in length and width according to the part to which they are to be applied, thus :—

For the head and upper limbs, 2½ inches wide, and from 3 to 6 yards long.

For the fingers, ¾ inches wide, and 1 yard long.

For the trunk and lower limbs, 3 or more inches wide and 6 to 8 or more yards long.

They are tightly rolled on themselves in a compact cylindrical form ready for use.

135. *Instruction in rolling.*—The class will first be instructed in the proper methods of rolling a bandage, single and double headed, and at the conclusion of exercises the bandages will invariably be inspected, to see that each man hands his in properly rolled.

136. *Application of bandage.*—To apply the bandage, the operator stands or sits opposite the patient. The limb is placed in the position it is to occupy when bandaged, and care must be taken that the bandage is not put on so tightly as to cause discomfort, or swelling of the limb below ; a bandage too tightly applied may produce gangrene of the limb, by cutting off its blood supply.

If, on squeezing the tips of the fingers or toes of the bandaged limb, it is observed that the colour returns much more slowly than when this is done on the unbandaged limb, it may be assumed that the bandage is too tight. The roller is taken in the right hand when bandaging the left limbs and in the left hand when bandaging the right. The outer surface of the bandage is applied to the inner side of the wrist or ankle, and two turns taken straight round the limb from its inner to its outer side, to fix it.

(1) *Simple spirals.*—From this point the bandage may be taken up the limb in simple spirals, that is, evenly put on turns of the bandage, each overlapping for one-third the width of the bandage below, taking care to have the lower edges of the turns of bandage parallel with each other.

(2) *Reverse spirals.*—When the swell of the limb is reached, the edges can no longer be maintained parallel, the bandage will not lie evenly, and gaps occur between the turns if the simple spiral is used. It therefore becomes necessary to use the reverse.

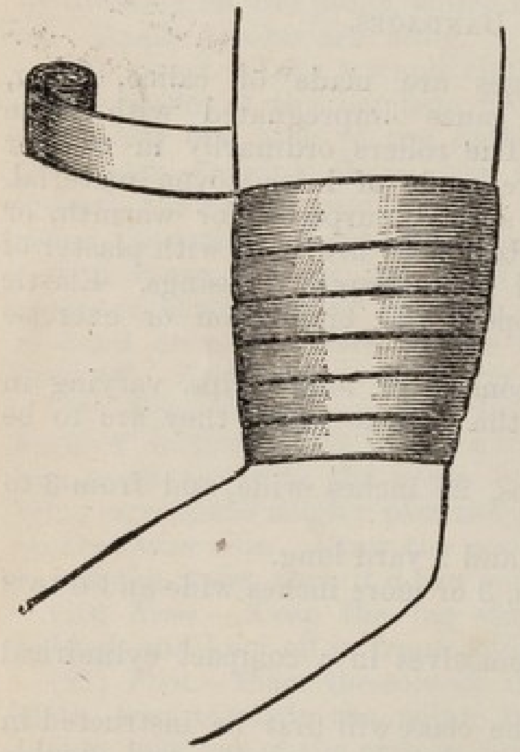

FIG. 33.—SIMPLE SPIRAL.

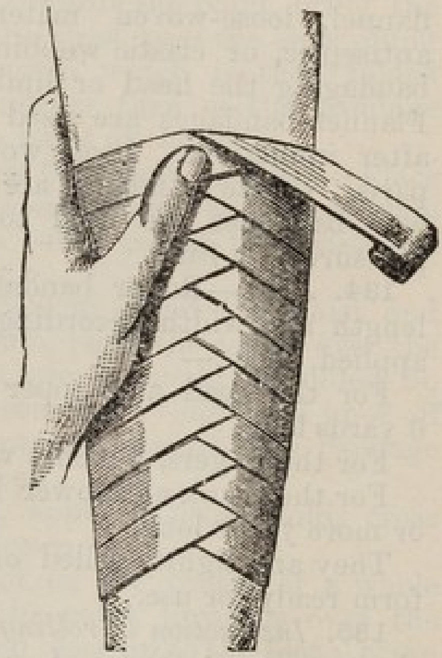

FIG. 34.—REVERSE SPIRAL.

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.

(3) *Figure of eight.*—On reaching the joint, neither the spiral or reverse will lie evenly, so that the figure of eight has to be resorted to. This, as its name implies, is applied by passing the roller obliquely round, alternately upwards and downwards, thus making a figure of eight, each figure overlapping the one below by one-third the width of the bandage. The crossings of the figures should be kept in the same line as the reverses below.

(4) *Removal of bandage.*—To remove a bandage it should be unrolled from the top, and the slack gathered into a ball and passed from hand to hand round the limb.

(5) *To bandage a finger.*—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, whence it is brought by an evenly-laid close spiral to the root; then across the back of the hand to the opposite side of the wrist which it started from, round the wrist once or twice, and pinned off.

(6) *To bandage the 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 eight, which may be repeated as often as required.

(7) *To bandage the chest.*—A roller 6 inches wide and from 6 to 8 yards long is used. It is applied from below upwards, in a single spiral, each spiral overlapping the one below for one-half its breadth. On completing 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.

(8) *To bandage 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.

(9) *To bandage the head. The knotted bandage.*—To keep a dressing on an ordinary wound of the head a few circular turns of a bandage are sufficient. To exert pressure on a graduated compress applied over a bleeding wound the knotted bandage is used. This is made with a single-headed bandage. The bandage should be 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.

(10) *To bandage the groin, shoulder or thumb. The spica bandage.*—A roller bandage may be applied to the groin, shoulder or thumb in the following manner, which is known as the spica bandage.

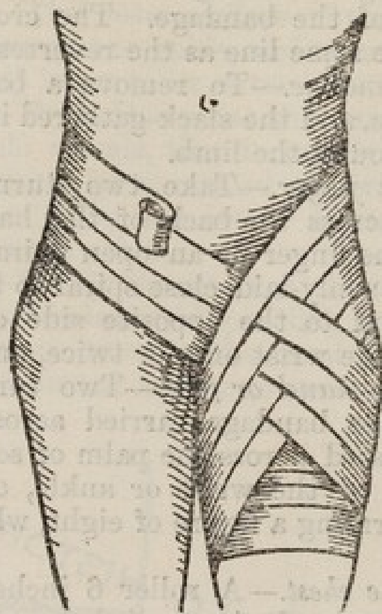

FIG. 35.—SPICA BANDAGE.

It is made by applying the bandage in a series of figure of eight turns, overlapping from below up. Take two turns of a single-headed roller round the thigh, as a point of attachment, from within outwards, 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 eight. The turns are to be repeated as often as necessary.

3. SPECIAL BANDAGES.

137. *Varieties*—(1) *The T bandage.*—The T bandage is specially prepared by taking a piece of bandage 3 inches wide and $1\frac{1}{2}$ yards long and sewing to it another similar strip 1 yard long, so as to form a T, the free end of the short portion of the T being split sufficiently to enable one portion to be brought up on each side of the scrotum. It is applied by passing the long strip round the hips so that the attached piece is at the sacrum; pin off in front. Bring up the short piece between the thighs, and fasten to the first piece in front. It is used to keep a dressing on the perinæum.

(2) *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

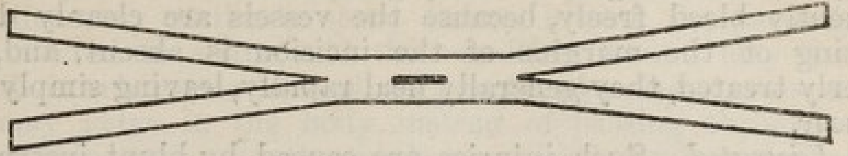

FIG. 36.—FOUR-TAILED BANDAGE.

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.

FIG. 37.—FOUR-TAILED BANDAGE (SIDE VIEW).

CHAPTER V.

WOUNDS.

138. *Definition.*—A wound may be defined as the forcible solution of continuity of any of the tissues of the body, but the term is more commonly limited to injuries of the soft parts, involving the skin or mucous membrane.

Injuries in which the skin is not involved, and in which the deeper structures, such as bones and ligaments, &c., do not participate, are usually spoken of as contusions.

Therefore wounds may be described as :—

(1) Subcutaneous, *i.e.*, contusions.
(2) Open.

139. *Classification.*—Open wounds are usually classified under the following headings :—

(1) *Incised.*—These wounds are made by sharp-cutting instruments, such as a knife, razor, or sword. They have clean-cut edges, and their length is usually greater than their depth. They frequently bleed freely, because the vessels are cleanly divided. Bruising of the margins of the incision is absent, and, when properly treated, they generally heal rapidly, leaving simply a line-like scar.

(2) *Lacerated.*—Such injuries are caused by blunt instruments, by machinery, by the wheels of vehicles, or by fragments of shells.

As its name implies, the wound has usually ragged edges, and there may be actual loss of substance. They do not as a rule bleed much, because the vessels are torn rather than cleanly divided. Bruising of the margins of the wound may occur, and they do not usually heal so rapidly as incised wounds, and the resulting scars are more marked.

(3) *Punctured wounds and stabs.*—These may be produced by any form of penetrating instrument, from a hatpin or needle, to a sword or bayonet.

The wound is deep and narrow. The skin wound may in itself be insignificant, but the chief danger of this class of wound is due to the liability of the deeper structures being injured; thus blood-vessels and nerves may be divided or the abdominal or thoracic contents injured. They do not usually bleed much externally, but may give rise to serious internal hæmorrhage. When the inflicting instrument is clean, they frequently heal without trouble.

(4) *Contused wounds.*—These are usually caused by blunt instruments, such as a stone or kick from a boot. The edges are always more or less bruised. Contused and lacerated wounds are practically the same.

(5) *Gunshot wounds*, whether caused by small-bore bullets or shells, are simply modifications of one or other of the above.

Small-bore bullet wounds.—If the bullet has not struck anything before hitting the patient it usually causes a clean wound of the punctured variety, penetrating the body right through. Accordingly, two or more skin wounds will be noticed, one where the bullet enters (called the wound of entrance), and a second where the bullet leaves (called the wound of exit). Four or more skin wounds may thus be caused by one bullet, as, for instance, when the arm and chest or both thighs are perforated. The entrance wound is usually circular in form, slightly smaller than the bullet that made it, and the edges of the skin may be slightly inverted or tucked in. The exit wound is frequently larger than the wound of entrance, and may be circular or irregular in shape, depending upon the structures injured in the body; the edges of the skin may be slightly everted or turned outwards. Between the wounds of entrance and exit there is injury to the tissues in the track along which the bullet has passed. This bullet track (taking into consideration the position of the body when struck) is usually a straight line from the wound of entrance to the wound of exit.

Thus a wound which has apparently involved the chest or abdomen may (on putting the patient into the position he was in when struck) be found not to have done so, and *vice versa.*

A bullet may strike a stone before hitting the patient and become altered in shape, and the resulting wound may then be lacerated in character as well as punctured ; and, moreover, the bullet may lodge in the body instead of passing through it as usual. Again, owing to the angle at which it strikes the body, a bullet may cause a deep groove with actual loss of tissue, instead of a wound of the punctured variety.

Shell wounds generally produce considerable laceration of the parts, and may lead to the total destruction of a limb, &c. They have no peculiarities beyond their severity, but being open ragged wounds they are more liable to septic infection.

(6) *Poisoned wounds.*—By this is meant any of the above class of wounds which has become infected with septic matter, that is to say, germs. They are of a serious nature, as the germs growing in the wound produce poisonous substances, which are absorbed into the body and produce constitutional symptoms, such as fever, &c. ; moreover, if unchecked, blood poisoning may be set up and death result. The great importance of keeping all wounds aseptic (or germ free) must therefore be obvious.

Snake bite, &c.—Under poisoned wounds may be included special wounds, such as the bites from poisonous snakes and the stings of insects ; in these the poison is injected into the wound at the moment it is made. They are very dangerous, because the poison rapidly reaches the blood, and so the patient often dies in a very short time. Wounds from poisoned arrows or spears must also be mentioned.

Treatment of snake bite.—It is most important to endeavour to allay the anxiety of the patient. The *first* thing to do is to prevent the poison from reaching the heart through the veins. This is done by immediately tying a piece of string or a strong strip of shirt or handkerchief very tightly round the limb some distance above the wound between it and the heart, so that the part below is strangled. *Next,* if any brandy or other stimulant be at hand, give a good dose, as the poison has the effect of stopping the circulation. Then, if possible, cut freely into the wound and encourage bleeding, and until this has been thoroughly done do not take off the band.

If permanganate of potash crystals are available, make a cross-shaped incision over the bite and rub some of the crystals in thoroughly.

If the breathing is bad or has stopped, use artificial respiration.

Should the wound be in a part of the body where a band cannot be placed, then at once make a crucial incision to encourage it to bleed, and give stimulants.

Treatment of stings of venomous insects.—The stings of bees, wasps, hornets, &c., should, if found, be removed, and ammonia or bicarbonate of soda, if available, be applied.

CHAPTER VI.

THE DRESSING AND HEALING OF WOUNDS (INCLUDING THE FIRST FIELD DRESSING).

140. *General remarks.*—Absolute cleanliness in the dressing of wounds is imperative. By absolute cleanliness is meant surgical cleanliness, and this means much more than ordinary cleanliness.

We have seen above that poisoned wounds are caused by their becoming infected with germs, and a poisoned wound may lead to the death of a patient.

The hands are great carriers of germs, and so may easily infect a clean wound.

A dresser should take the utmost care of his hands, especially as regards the nails and the folds of skin surrounding them. This care of the hands should be a daily duty.

141. *Rules to be followed in applying dressings.*—(1) Never begin to change a dressing until everything that is likely to be required for the new dressing is ready close to hand.

(2) Arrange the bed clothes so that no part of them can touch the wounded area; the bedding, &c., should be protected from damp, &c., by means of jaconet or mackintosh.

(3) Remove the bandages, but do not touch the actual dressing at present.

(4) Scrub your hands most thoroughly with soap and a stiff nail brush which has been soaking in antiseptic solution, or, preferably, previously boiled.

(5) Rinse off the soap and without drying your hands soak them for some minutes in antiseptic solution.

(6) Having thus cleaned your hands as thoroughly as possible, they must on no account be allowed to touch anything, such as your clothing, your face, or the patient's bedding or person. They should not be dried unless a sterilized towel is available to dry them on.

(7) Never touch either dressings or wound with the fingers. Use a pair of sterilized forceps instead.

(8) Remove the old dressing with the forceps, having first loosened it, if it has stuck, with warm antiseptic solution. Be careful to wipe from the wound outwards, so as not to carry germs from the surrounding skin into the wound.

(9) Place the fresh sterilized dressing gently in position with the forceps and then re-bandage the wounded area.

(10) Before dressing any wound or assisting at an operation which might produce infection, it is advisable to protect any cuts or scratches on the hands by covering them with a couple of layers of gauze and painting them over with collodion, so as to make a waterproof coating.

(11) If the necessary means of purifying the wound are not at hand do not attempt to wash it or wipe its surroundings ; simply apply a dry antiseptic dressing.

(12) All old dressings should be at once removed and destroyed, preferably by burning.

142. *First field dressing.*—A field dressing forms a component part of every British soldier's kit on active service, so as to be available, at all times and in all places, as a first dressing for wounds.

When officers and men go on active service the first field dressing will be placed in the pocket on the right side of the skirt of the frock (*see* Clothing Regulations), and thus the quantity of material required to be carried as medical stores is reduced. It should never be carried in the trouser pocket or stitched in the helmet. The field dressing now in use consists of :—

(1) Outer cover, sewn cloth.
(2) Two safety pins, wrapped in waxed paper.
(3) Inside cover of waterproof jaconet, the edges cemented with rubber solution, so as to render the packet air-tight, having a portion of one of the corners turned back and not cemented.
(4) Loose woven bandage, $2\frac{1}{2}$ inches by $4\frac{1}{4}$ yards, folded flat into $2\frac{1}{2}$ inches by 4 inches.
(5) Two pieces of gauze, 17 inches by 13 inches, weight of each not less than 72 grains, folded separately to suit the size of the package.
(6) Compressed absorbent cotton wool between layers of gauze (like Gamgee tissue). Weight of wool not less than 100 grains.

The pieces of gauze, the compressed absorbent cotton wool, and the layers of gauze contain 1 per cent. by weight of sal-alembroth and are tinted with aniline blue.

The contents are compressed so that the package does not exceed three-quarters of an inch in thickness.

Printed directions for use are upon the outside cover, and a printed label of directions for use is placed upon the inside cover.

Printed dire tions for outside cover :—

WAR OFFICE, MEDICAL DIVISION.

First Field Dressing.

Contents :—Two pieces of gauze, wool pad, bandage and pins.

Tear black thread in centre of long stitch. Apply first, gauze ; second, wool pad. Fasten lightly with bandage and pins. If two wounds, apply one piece of gauze to each, and split wool pad.

(Maker's name and date, month and year.)

(*sic*) SMITH & Co.,
May,
1906.

Printed label of directions for inside cover :—

War Office, Medical Division.

First Field Dressing.

Directions :—Tear open this envelope, and apply in the following order :—

If one wound :—

1st.—Gauze.
2nd.—Wool pad.

Fasten lightly with bandage and pins.

If two wounds :—

1st.—One piece of gauze to each.
2nd.—Split wool pad.

(Maker's name, date, month and year.)
(*sic*) Smith & Co.,
May,
1906.

143. *How to apply first field dressing.*—In applying the first field dressing, care should be taken to place it directly on the wound without in any way touching with the fingers either the wound or the surface of the dressing which will be in contact with the wound.

This may best be done by taking hold of the dressing by pinching it up at the back, everting it, and applying the fresh surface direct to the wound. No attempt should be made on the field to clean up the wound.

144. *Healing of wounds.*—The way in which a wound heals is as follows :—

(1) The blood escapes.

(2) The ends of the divided blood-vessels draw back, contract, and clots of blood form in them, thus stopping the bleeding.

(3) The fluid part of the blood continues to ooze out, finally gets jelly-like, and sets, forming a scab or crust.

(4) New blood-vessels gradually make their way from side to side of the wound, the circulation is thus restored, new tissue is produced and unites firmly the cut surfaces, and all that remains is a scar. This is what happens in a cut when the surfaces of the wound touch one another, and is called "healing by first intention."

When the wound is large and the raw surfaces cannot touch one another, it is said to suppurate, and small rounded projections, called granulations, grow, come up to the level of the skin 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.

The main object in the dressing of a wound is to protect it from the entry of small bodies, called germs. These not only prevent healing, but lead to the formation of matter, and, possibly, 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 the antiseptic treatment. A wound free from germs is called an aseptic wound.

CHAPTER VII.

ANTISEPTIC TREATMENT OF WOUNDS.

1. Germs.

145. These germs, sometimes called microbes, and scientifically called bacteria, belong to the vegetable world. They are to be found everywhere, especially in dust or dirt. They are on the skin; in all dressings which are not specially prepared; in clothing; on instruments, and in water which has not been recently boiled. They are extremely small, and cannot be seen by the naked eye. One of them alighting on a wound, where, owing to the warmth and moisture, it becomes active, can in twenty-four hours produce seventeen millions of like germs. The growth of these germs irritates the wound, causes it to form matter or to suppurate and produces poisonous substances, which, being drawn into the blood, cause fever and even blood poisoning. The wound is then said to become septic or poisoned. The killing of these germs which have already reached a wound, and the cleansing of the hands, skin, instruments and dressings, constitutes the antiseptic treatment of wounds.

2. Antiseptics.

146. Antiseptics are chemical substances, some of which have the power of killing germs whilst others are only able to prevent their growth. There are both liquid and solid antiseptics. For dressing wounds and cleansing the hands, &c., they are commonly employed in the form of "lotions" made by dissolving some of the substance selected in water. 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 has been mixed with 19, 39, or 999 parts of water, respectively.

The following are the antiseptics in common use :—

(1) *Carbolic acid.*—This is, ordinarily, a liquid, and is generally used in the form of a solution or "lotion" of a strength of 1 in 20, 1 in 40, or 1 in 60; 1 in 20 is used for disinfecting instruments; 1 in 40 and 1 in 60 may be used for dressing wounds or

disinfecting the hands. Solutions stronger than 1 in 20 should not be used for this purpose, as they irritate wounds and make the skin of the hands rough and numb.

(2) *Perchloride of mercury.*—This is a heavy solid substance. It is used as solutions, varying between 1 in 1,000 and 1 in 10,000. It is a very powerful antiseptic. Steel instruments should not be placed in this lotion, as it turns them black and makes cutting instruments blunt.

(3) *Biniodide of mercury*, employed in the form of a 1 in 500 solution in methylated spirit. It is used for purifying the hands or the skin of a patient before operation.

(4) *Boric or boracic acid* is generally seen as flat colourless glistening crystals or as a white powder. It is used either as the powder or as a lotion made by dissolving the acid in water (as a saturated solution). It is a non-irritating and weak antiseptic.

(5) *Iodoform*, a yellow powder of characteristic and unpleasant odour. It is used for dusting on septic wounds.

(6) *Permanganate of potash* occurs as dark purple crystals. It is used in solutions of varying strength (generally expressed as grains to the pint). Strong solutions stain the hands brown.

3. Order in which Dressings should be done.

147. Suppose a dresser has in his wards various kinds of wounds, some that are clean such as operation wounds, and others that are suppurating, and, accordingly, containing germs as explained above. In which order should they be dressed? Clearly, the clean aseptic wounds should be first attended to, and after these are all dressed the suppurating wounds may be done; 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.

148. *Cleansing of hands.*—The necessity of thoroughly cleansing the hands between each dressing must now be obvious; if this be not done, one wound will surely be infected from another. After finishing all the dressings the hands should be cleansed again; this is for the dresser's own protection, as if omitted he may well infect his own hands through small scratches or unnoted skin abrasions.

4. How Antiseptic Dressings are used.

149. The method of using these antiseptic dressings to wounds is as follows:—

(1) In the case of an operation in hospital, where everything is at hand for the thorough carrying out of the antiseptic treatment, after all blood has been wiped away by means of antiseptic swabs the edges of the wound are drawn together by the surgeon by

means of stitches, a drainage tube, if necessary, having been inserted. Pieces of dry antiseptic gauze are next placed over the wound, and over the top of these antiseptic wool is laid—much if the wound is large, less if small. Over the wool is placed a bandage to keep the dressing in its place.

(2) In the field, or where all precautions as to sterilizing hands, skin, &c., cannot be carried out, it is best not to handle the wound at all, but simply to apply the "first field" or other dry antiseptic dressing, taking care to handle it as little as possible, and not to touch with the fingers the part of the dressing which is to come next to the wound.

150. After having applied the dressing, and splint if necessary, steps may be taken to remove the patient to a place of safety; but there is one exception to this, namely, bullet wounds penetrating the abdomen. Experience has shown that the chance of recovery in these cases depends very largely on the patient not being moved at all, but being treated for a time, if possible, where he has fallen. The reason is that the small-bore bullet makes such a small hole in the intestines that little or none of its contents may escape through it, but if the patient be moved, the contents of the gut are much more likely to escape, and set up fatal inflammation.

Starvation is the best treatment, not even water being given. Dress the wounds, disturb the patient as little as possible, erect an improvised shelter for him, impress upon him the importance of lying absolutely still, and leave him lying there until a medical officer can see him.

151. *Dressings.*—Materials used for dressings must be sterilized previous to use. In the case of dry antiseptic dressings such as gauze or wool, these have been specially prepared by being saturated in antiseptic solution, then dried, and afterwards wrapped up in waterproof paper, which has also been sterilized. They are done up in small packages, which can be considered safe for use in the field provided they have been freshly opened. The materials for stitches and drainage tubes have also been sterilized, and are usually kept ready for use in an antiseptic fluid in closed glass bottles or tubes.

152. *Trays, &c.*—All boxes, trays, basins, &c., used for holding dressings or instruments are made of some hard, smooth material, such as glass, china, or vulcanite, and are sterilized by heat before and after use. Instruments such as scissors, forceps, &c., are sometimes so made as to be able to be taken to pieces, and they, as well as knives, are made as smooth as possible without crevices, so that they can be easily cleaned and do not harbour germs.

153. *Antiseptic baths and fomentations.*—When a wound has become infected with germs, is inflamed and discharging, it is usual to treat it with antiseptic baths or antiseptic fomentations. This is done as follows:—Boric acid is the usual antiseptic used in such cases. An antiseptic bath consists of boric acid dissolved in warm water (strength, 5 grains to 1 ounce of water). The limb, or other part, is to be held in a special vessel containing this warm lotion for such a length of time as may be directed.

An antiseptic fomentation is made in exactly the same way as any other fomentation, except that several folds of boric lint are used instead of the ordinary fomentation flannel or spongiopiline.

CHAPTER VIII.

PREPARATION OF THE PATIENT, INSTRUMENTS, DRESSINGS, &c., FOR OPERATION.

154. *The patient generally.*—Before any operation of magnitude the patient should go to bed for a day or two, if not already confined there. On the afternoon previous to operation the patient should have a hot bath, but if this is not possible, he should be thoroughly washed all over while in bed; he should also have a change of linen. An aperient is usually given early in the day, so that it may act without disturbing the patient's rest on the night immediately preceding the operation. On the morning of the operation, an enema may be given some three hours, and a pint of beef tea some four hours, before the time appointed. No solid food should be given. A patient must always be reminded to pass water just before the operation. Any false teeth should be removed. Rectal cases require two days of preparation by aperient and enemas.

155. *The skin within the area of operation.*—All hair must be most carefully shaved off, so that none remains within 10 inches of the place where the incisions will be made. Then after having carefully cleansed the hands as described under the "dressing and healing of wounds," the skin within the area of operation is softened by washing with hot water and soap, then scrubbed with swabs of sterilized wool soaked in turpentine and then in ether to get rid of the grease. While the skin is being thus cleansed the patient's bedding should be kept away from the part by means of sterilized towels. After the grease has been removed, further scrubbing takes place with 1 in 20 carbolic, or perchloride or biniodide of mercury, 1 in 1,000 in water or methylated spirit. Then a compress of 1 in 60 carbolic is applied, and fastened lightly with a bandage. The above process is again gone through on the morning of the operation about two hours beforehand. On the thoroughness with which this preparation of the skin is done depends very largely the healing of the operation wound.

156. *Instruments and dressing.*—All instruments must be sterilized by boiling for 20 minutes in water to which bicarbonate of soda (ʒi to Oi) has been added. After boiling they are placed in trays containing carbolic lotion, 1 in 60, by means of a pair of sterlized forceps; on no account must they be touched with the hands. Should an instrument be dropped or touch anything while being conveyed to the tray of carbolic, it must be re-sterilized immediately. Scalpels should not be boiled, as it destroys their edge. They may be sterilized by being wiped with pure carbolic on a sterilized swab, then placed in ether for 10 minutes, being afterwards transferred to the instrument tray.

All boxes, trays, basins, nail brushes, towels, sheets, aprons, safety pins, dressings, etc., are sterilized in a special steam apparatus at 212° F. for one hour. The sterilizer is kept closed and airtight until just before the articles are required for use. They must be lifted by means of a pair of forceps or a sterilized towel, and never touched by the hands. The drums containing swabs or dressings are only to be opened when required and the contents conveyed to lotion or the surgeon by means of sterilized forceps.

157. *Ligatures and sutures.*—These are made from silk, silkworm gut, horse hair, catgut, kangaroo tendon, silver wire, &c. Catgut may be sterilized by placing in a 1 per cent. solution of iodine in potassium iodide for 7 days, and afterwards stored in absolute alcohol. Catgut and kangaroo tendon cannot be boiled.

The remainder may be sterilized by boiling for half an hour on three successive days before the operation. Horse hair should be first washed in ether to remove the grease.

158. *The hands of the surgeon and his assistants.*—The hands of all those engaged in surgery require constant attention; the nails should be kept short, carefully trimmed and clean, and all tags of skin removed daily. No rings should be worn. The hands and arms, up to the elbows, must be thoroughly scrubbed with a sterile nail brush in hot water and soap, using plenty of soap and plenty of water. Rinse off the soap with water and then use turpentine and ether to remove the grease. Next soak the hands and arms in antiseptic solution (such as biniodide and spirit lotion) for 3 or 4 minutes. Having thus cleansed the hands, they must on no account touch anything that is not sterilized, but should this happen the whole process of cleansing should be again gone through. Sterilized aprons or mackintosh coats are then put on.

159. *The Operating Theatre.*—The room and its furniture must be kept absolutely clean and free from all dust, which should be removed by cloths wrung out in antiseptic solution. All brass and metal work is kept polished. All enamelled metal work, glass, china, tables and stools, are to be cleaned with soap and water, or boiling soda water, and 1 in 40 carbolic; floors, walls and ceilings being similarly treated. The temperature of the room should be maintained at about 65° F.

160. *Antiseptic and aseptic operations.*—The above may be taken

as the general lines of preparation for operation under antiseptic precautions. It admits that some germs may be present, and takes steps accordingly to destroy them.

Recently, however, many surgeons are endeavouring to do away with antiseptics in operations to a great extent. This requires even greater cleanliness than the course above described ; it is known as the aseptic method.

161. *After treatment of operation cases.*—This is carried out on the usual lines laid down in the chapters on nursing. The patient requires watching carefully until he regains consciousness, and if there is a tendency to vomit the head should be turned to one side. For the first 24 hours after an operation the dressing should be frequently examined (without in any way disturbing it). Should blood or discharge appear, the dressing will require to be "re-packed" (*i.e.*, a fresh pad of sterilized wool applied outside the original dressing, which must not be disturbed). All antiseptic precautions must be taken. Should this or any other accident happen (such as urine being spilt), the sister or senior N.C.O. should be at once informed, as the dressing may require to be changed.

CHAPTER IX.

BLEEDING OR HÆMORRHAGE.

1. Varieties.

162. Bleeding or hæmorrhage occurs when any portion of the system of blood-vessels gives way, or is opened into by injury or disease.

There are three varieties of hæmorrhage :—

(A) Arterial.
(B) Venous.
(C) Capillary.

These three varieties may furthermore occur :—

(1) Externally, when the blood can be seen escaping, such as from a cut.

(2) Internally, when the blood escapes in the tissues or organs of the body and cannot be seen. This variety may be recognized by the symptoms of the patient, as will be subsequently described. Bleeding in moderate quantity into the tissues of the body is often spoken of as an "extravasation."

2. Internal Hæmorrhage.

163. This, as the name implies, is bleeding from a vessel or vessels inside one of the cavities of the body, chest, abdomen or skull.

This condition is one which can only be recognised by the symptoms presented by the sufferer, no blood being visible as in the case of external hæmorrhage.

Internal hæmorrhage occurs as the result of injury or disease.

(1) *Symptoms.*—The symptoms of internal hæmorrhage are: Great prostration and weakness. The surface of the body is blanched and white. The lips lose their colour, becoming ashy grey. A cold clammy sweat breaks out on the patient's forehead, and his features assume an aspect of intense anxiety. His breathing becomes shallow, hurried, and sometimes laboured. At times he yawns and sighs. His pulse is weak and may be imperceptible. Later the patient gasps for air and struggles to obtain it, gradually becomes weaker and unconsciousness sets in.

(2) *Treatment.*—Send for a surgeon. Try and ascertain the cause of the bleeding. If from disease of, or injury to, any part of the body where ice can be applied, at once apply it. Loosen anything tight about the neck or body. Give small pieces of ice to suck. Do not give stimulants. Raise the foot of the bed three or four inches from the ground. Apply hot water bottles to the patient's feet. Keep him *absolutely quiet.* Avoid all conversation with him. Try and gently restrain him should he become restless. Do everything to allay anxiety should he become nervous about his condition, as this is a most important duty in connection with the treatment of these cases.

(3) *Treatment of an 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.

3. External Hæmorrhage.

164. *Arterial hæmorrhage.*—In arterial hæmorrhage the blood escapes from the arteries. It may be known by (1) the blood escaping in jets or spurts, because it is pumped out by the heart; (2) its bright red colour; (3) that it may be stopped by pressing on the artery between the wound and the heart.

165. *Venous hæmorrhage.*—In this case the blood escapes from the veins. It may be known by (1) the blood being of a dark purplish red colour, (2) its flowing in a continual stream and not escaping in spurts, (3) that pressure applied on the side of the wound furthest from the heart stops it, while pressure applied between the wound and the heart does not do so. A dependent position, muscular exertion or straining, or any obstruction to the veins above a wound, greatly increases venous bleeding. Hence it is much greater after accidents than at operations.

166. *Capillary hæmorrhage.*—The blood escapes from the capillaries, and oozes from all parts of the wound, trickling down to the deeper parts, where it forms a little pool.

Although the above account of arterial and venous hæmorrhage gives the usual signs by which they may be distinguished, certain exceptions may occur. In some instances arterial blood may appear as venous; for example, when it comes from the bottom of a deep and narrow wound, it may flow continually instead of in spurts; or when a patient is partly suffocated it may become of a dark colour. On the other hand, venous blood exposed to air in its passage from a deep wound, may, owing to its taking up oxygen, become bright and red in colour.

167. *Further varieties.*—Further varieties of arterial hæmorrhage are spoken of as :—

(1) Primary.
(2) Reactionary.
(3) Secondary.

(1) *Primary.*—Is that which occurs at the time when the artery is wounded.

(2) *Reactionary.*—Is that which occurs after the primary hæmorrhage has ceased, and within twenty-four hours of the injury or operation. It is due to the patient recovering from the shock of the injury.

(3) *Secondary.*—Is that which occurs any time after the first twenty-four hours following an injury or operation, but it usually comes on about ten days or a fortnight afterwards. It is now rare, because its chief cause (septic infection of the wound) is now also rare.

168. *Arrest of external hæmorrhage.*—The means of temporarily arresting external hæmorrhage until more permanent means can be resorted to by the surgeon are :—

(1) Pressure.
(2) Application of heat or cold.
(3) Position of the patient.

Pressure.—If the bleeding point be within reach, hæmorrhage need cause no alarm, as pressure will control it, however big the vessel may be.

It may be applied :—

(1) Directly on the bleeding point, if necessary by means of the finger or thumb (digital compression); but preferably by plugging the wound with a piece of antiseptic gauze.

(2) Close to the wound, between it and the heart (if the bleeding is from an artery); or below the wound, that is on the side distant from the heart (if from a vein). It may be applied by the finger, or in case of the limbs, by means of a tourniquet. It should be made in such a direction as to press the vessel against some resisting structure, such as a bone.

(3) In bleeding below the knee or elbow, pressure may be applied by placing a pad in the bend of the joint and flexing the limb.

Heat or cold.—Of these, heat is the more effective, but neither

THE ARTERIES OF THE BODY

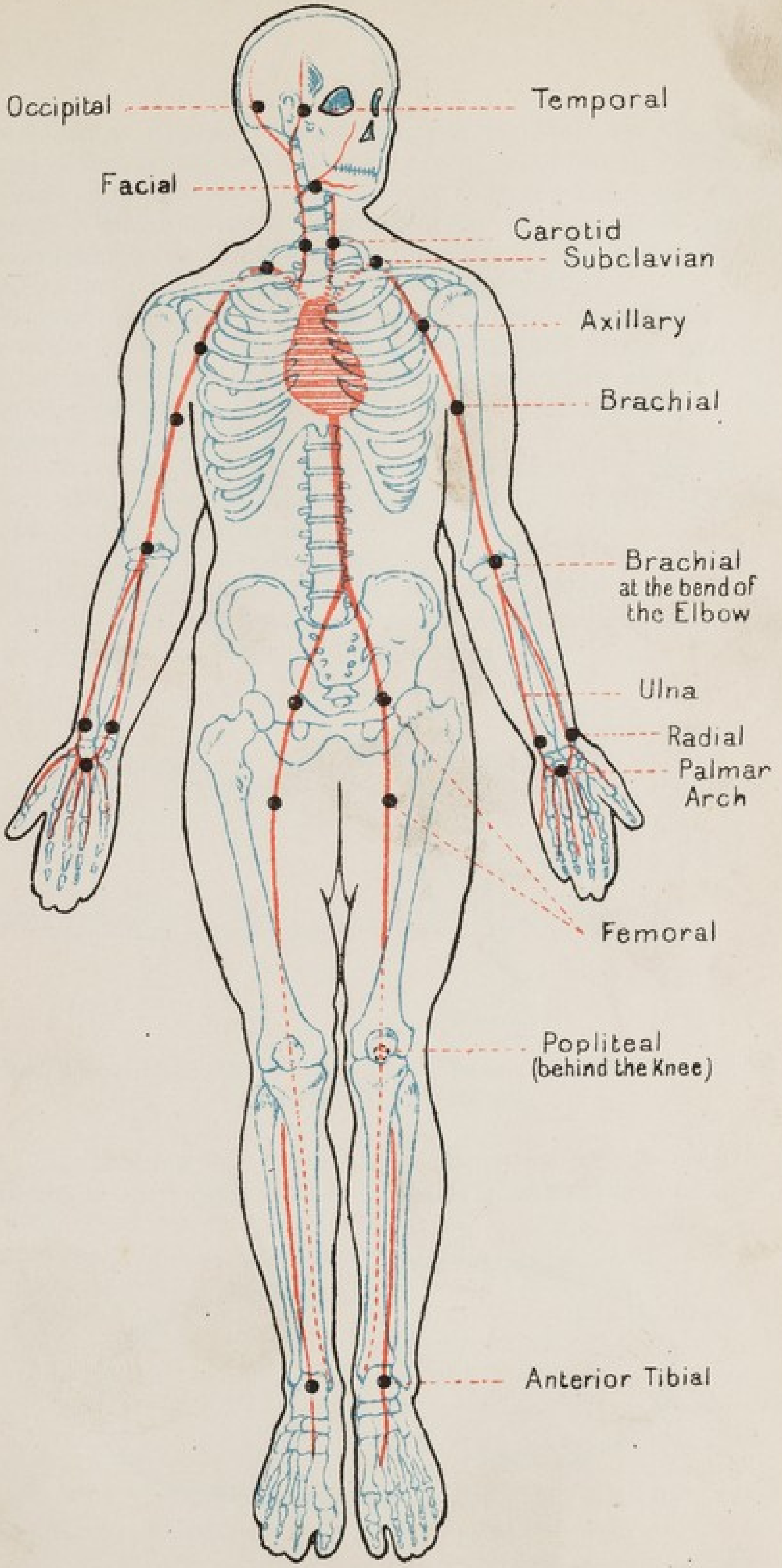

Fig. 38. *The black dots indicate the point where to apply compression.*

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are so certain as pressure properly applied. Heat may be applied by means of hot water at a temperature of from 140 to 160 degrees Fahrenheit, 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 water is not so effectual as hot; it is also liable to increase shock.

Position of the patient.—This is often of great importance. Rest, and absolute rest, is essential. Lay the patient down, and try to keep him as quiet as possible, and to allay his alarm. While keeping the patient lying perfectly still, if the bleeding is from a limb, raise it and keep it elevated.

As a rule, pressure combined with elevation (in the case of a limb) will always check the bleeding until means can be obtained for permanently arresting it.

The application of styptics (such as perchloride of iron, &c.) to stop bleeding should never be done without orders from a surgeon. Other methods of permanently arresting hæmorrhage, such as tying the vessels, can only be done by him.

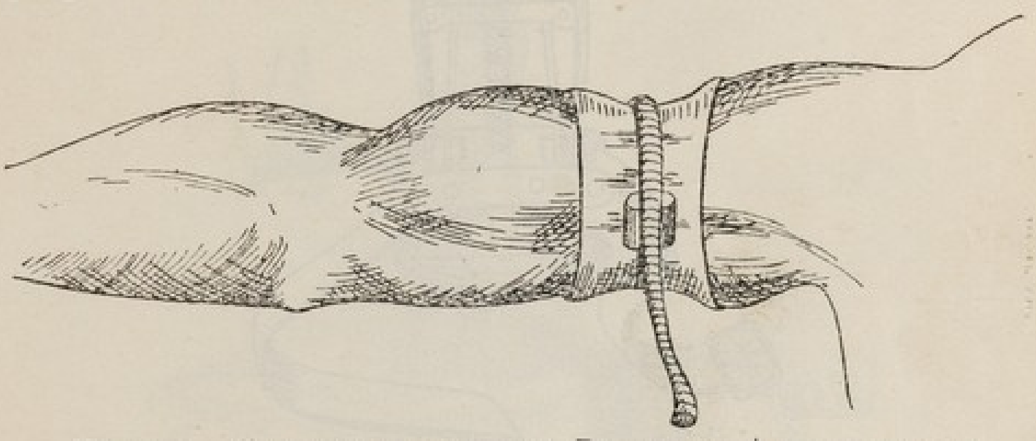


FIG. 39.—COMPRESSION OF THE BRACHIAL ARTERY BY AN ELASTIC TOURNIQUET.

169. *Compression by tourniquet.*—Compression by means of a tourniquet is only applicable in the case of the arteries of the limbs

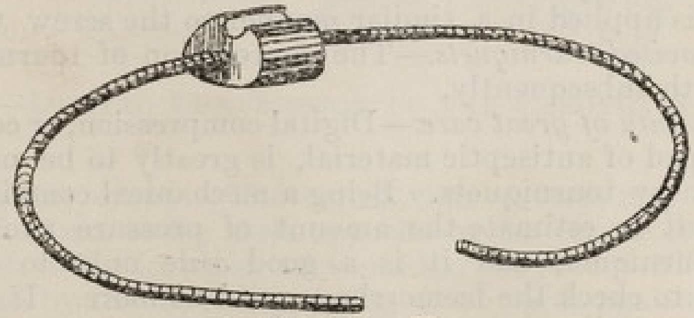


FIG. 40.—ELASTIC TOURNIQUET.

where the pad takes the place of the thumb and finger as described in digital compression.

170. *Kinds of tourniquets.*—There are three kinds of tourniquet in common use—the elastic, the screw, and the field.

(1) *Elastic tourniquet.*—The elastic tourniquet consists of thick elastic tubing which is wound tightly round the limb, and is then fixed by hooks or other appliances.

(2) *Screw tourniquets.*—The necessary parts of the screw tourniquet are a pad, a band, and a means of tightening the band so as to press the pad against the artery and so compress it against the bone.

The pad is placed over the main artery, the strap is passed round the limb and buckled. Care must be taken that the pad does not shift from its position over the artery. The screw is then turned until the bleeding stops.

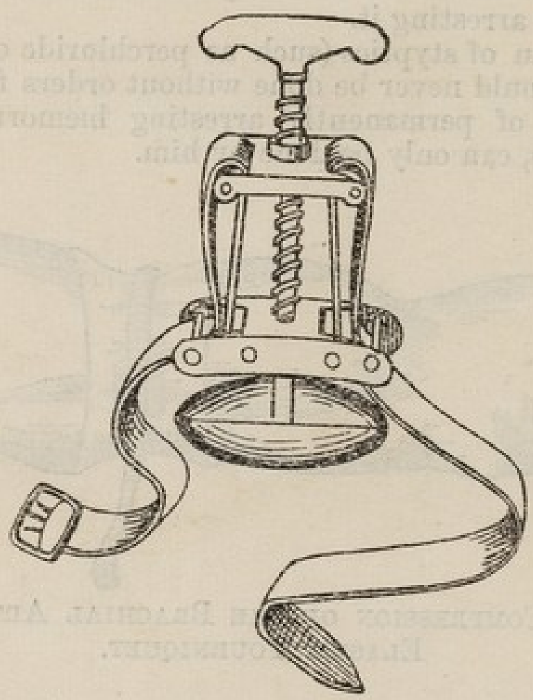


FIG. 41.—SCREW TOURNIQUET.

(3) *Field tourniquet.*—This consists of a pad fitted to a strap and buckle ; it is applied in a similar manner to the screw tourniquet.

(4) *Improvised tourniquets.*—The improvision of tourniquets will be dealt with subsequently.

171. *Necessity of great care.*—Digital compression, or compression through a pad of antiseptic material, is greatly to be preferred to compression by tourniquets. Being a mechanical contrivance, it is very difficult to estimate the amount of pressure exerted when using a tourniquet, and it is a good rule only to tighten it sufficiently to check the hæmorrhage, and no more. If great care be not taken, serious injury to other structures lying close to the artery (such as nerves and veins) may be done ; this may easily lead in the end to the death of the limb below, from mortification or gangrene. So it may be seen that a patient (who if treated with care) will recover completely, may well (if treated without care) suffer the loss of a limb or even of his life. Too much stress cannot be laid upon this most important point.

4. Further Instructions for Arresting Hæmorrhage in Special Situations.

172. Digital compression of the following arteries is carried out as below :—

(1) *Common carotid artery.*—The common carotid lying in the side of the neck may be compressed against the spine by pressing with the thumb backwards and inwards in the hollow of the neck, formed between the windpipe and the ridge of muscle running from behind the ear to the centre of the breast bone.

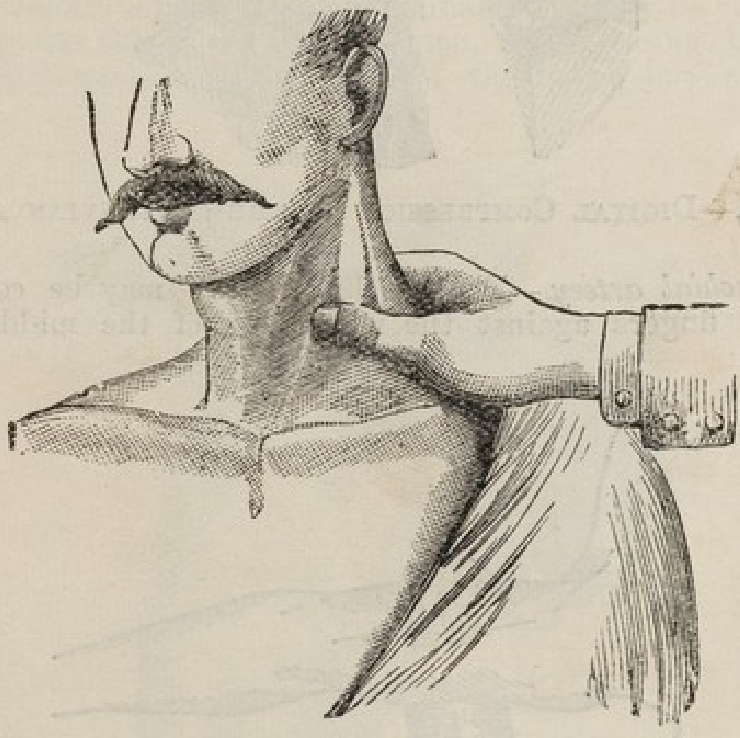


Fig. 42.—Digital Compression of the Carotid Artery.

(2) *Subclavian artery.*—The subclavian artery may be compressed at the base of the neck opposite to the centre of the collar bone. By drawing forward the shoulder, the artery will be more easily reached by the thumb pressing downwards against the first rib behind the clavicle.

(3) *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, in case of hæmorrhage either from them or their branches, tourniquets and digital compression can best be applied.

FIG. 43.—DIGITAL COMPRESSION OF THE SUBCLAVIAN ARTERY.

(4) *Brachial artery.*—The brachial artery may be compressed with the fingers against the inner side of the middle of the humerus.

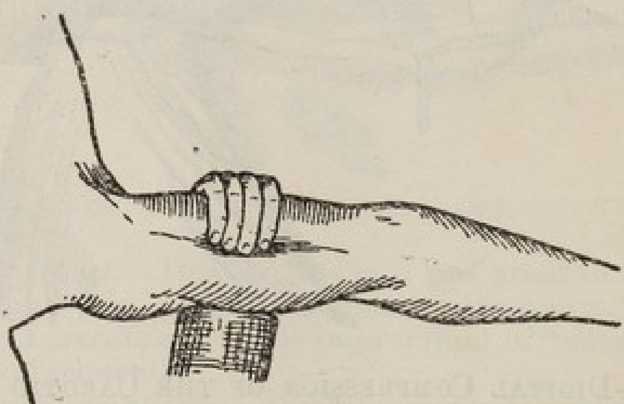


FIG. 44.—DIGITAL COMPRESSION OF THE BRACHIAL ARTERY. (BEST METHOD.)

The inner seam of the coat sleeve, or the inner margin of the biceps may be taken as a rough guide to the course of the artery. Extend the arm at right angles from the body. Then standing behind the limb, grasp the arm about the middle, the fleshy part of the fingers resting on the inner edge of the biceps muscle, thumb on the outside of the limb. Compress the artery against the bone sufficiently to arrest the hæmorrhage. In practising this method the fact of the artery being properly compressed is evidenced by the absence of the pulse at the wrist. If compressed as in Fig. 45, the artery can be more firmly pressed against the bone, and there is no danger of it slipping away under the muscle.

(5) *Radial and ulna arteries.*—Hæmorrhage from these vessels may be checked either by pressure on the brachial artery or by the flexion method with a pad in the bend of the elbow, the forearm being kept in position by a bandage passed round the wrist and arm; the limb then being bandaged to the side of the chest.

(6) *Palmar arch.*—The bleeding may be arrested as described above under the last heading. The application of a graduated compress to the palm is not advisable.

(7) *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.

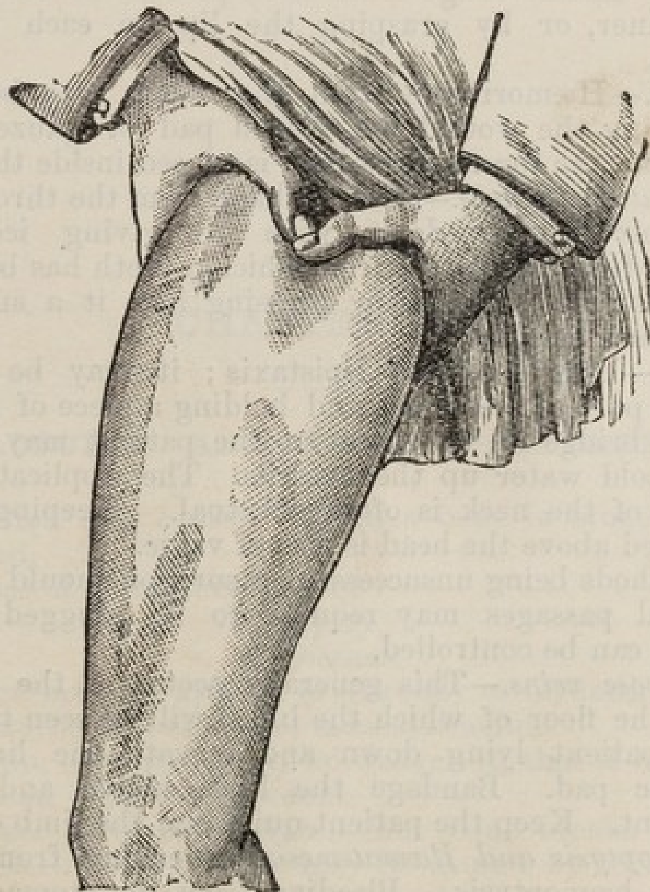


FIG. 45.—DIGITAL COMPRESSION OF THE FEMORAL ARTERY.

(8) *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 against the hip bone by pressing at the fold of the groin, or 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.

(9) *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.

(10) *Temporal artery.*—Bleeding occurring from this vessel is best controlled by an antiseptic pad being applied directly to the bleeding spot.

(11) *Scalp.*—Hæmorrhage from wounds of the scalp and forehead can be controlled by an antiseptic pad and bandage.

(12) *Tongue.*—Hæmorrhage from the tongue, if the wound is sufficiently far forward to permit of it, can be controlled by pressure with a pad of gauze. If this is not successful, pass the finger to the back of the tongue and press it forwards against the lower jaw bone.

(13) *Lips.*—Hæmorrhage from the lips can be controlled in a similar manner, or by grasping the lip on each side of the wound.

(14) *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.

(15) *Throat and palate.*—Hæmorrhage from the throat or palate can be most readily dealt with by giving ice to suck. Hæmorrhage from the cavity from which a tooth has been recently extracted may be arrested by pressing into it a small plug of antiseptic gauze or wool.

(16) *Nose.*—This is called Epistaxis; it may be treated by making the patient lie down and holding a piece of ice, if available, to the bridge of the nose, or the patient may be directed to sniff ice-cold water up the nostrils. The application of cold to the nape of the neck is often effectual. Keeping both arms fully extended above the head is also of value.

These methods being unsuccessful, a surgeon should be sent for, as the nasal passages may require to be plugged before the hæmorrhage can be controlled.

(17) *Varicose veins.*—This generally occurs as the result of an ulcer, from the floor of which the blood will be seen to be issuing. Place the patient lying down and elevate the limb. Apply an antiseptic pad. Bandage the limb above and below the bleeding point. Keep the patient quiet and the limb elevated.

(18) *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 :—

Hæmoptysis.	*Hæmatemesis.*
1. The blood is bright red in colour.	1. The blood is dark in colour, and may appear like coffee grounds.
2. It is frothy from being mixed with air.	2. It is not frothy, but may be mixed with particles of food.
3. It is coughed up.	3. It is vomited up.
4. As a rule the patient does not feel sick beforehand.	4. A feeling of sickness is often felt beforehand.
5. The patient is probably suffering from disease or wound of the chest.	5. The patient is probably suffering from disease or wound of the stomach.
	6. Blood may be passed in the motions subsequently.

It must be remembered that blood may be first swallowed and afterwards vomited, so a patient may vomit blood which has really come from his nose.

CHAPTER X.

FRACTURES AND THEIR TREATMENT.

173. *Definition and causes.*—When a bone is broken it is said to be fractured.

The causes of a fracture may be :—

1. Injury.
2. Disease.

The violence may be applied (*a*) directly or (*b*) indirectly to the bone, or it may be broken by (*c*) muscular action.

Disease of the bone itself may so weaken it, that it breaks much more easily than it naturally would.

174. *Fracture by direct violence.*—The bone breaks at the spot struck, or crushed ; the violence may be caused by a kick, a bullet, the passage of a wheel over the part, etc.

175. *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 seat of violence. As examples may be mentioned : the frequency of fractures of the collar bone from falls on the hand, and 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 ; and in the second instance the shock is transmitted from the feet, through the legs and spine to the skull.

176. *Fracture by muscular action.*—This is caused by violent contraction of the muscles. It is not so common a cause of fracture as the above. Fractures of the patella or knee-cap are not uncommonly caused in this way.

177. *Varieties.*—Fractures are described as :—

1. Simple.
2. Compound.

(1) *Simple fracture.*—When the skin over the bone is not broken the fracture is said to be simple.

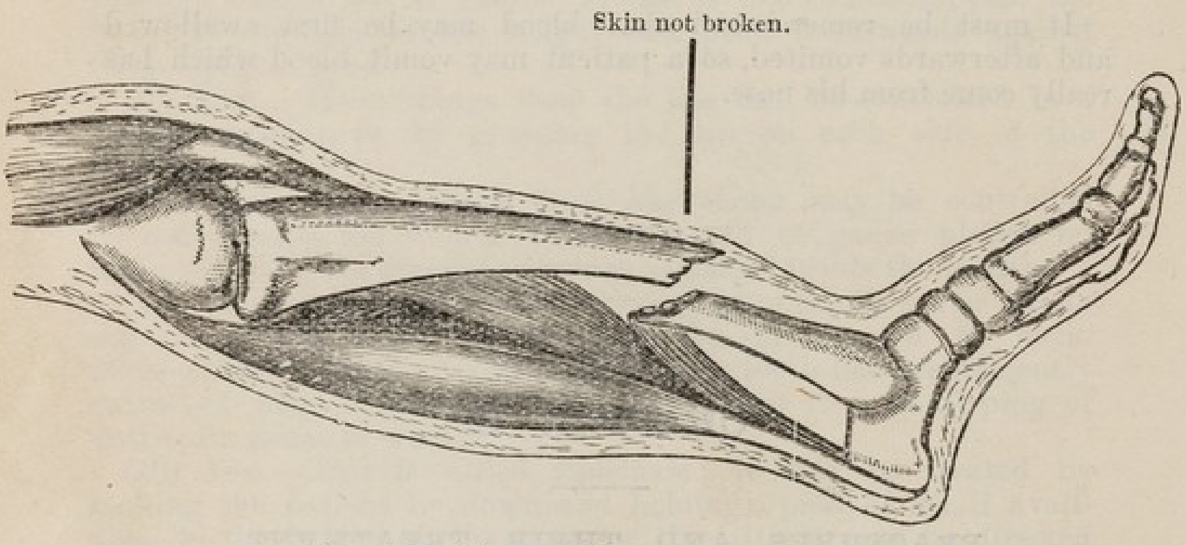


Fig. 46.—Simple Fracture of Tibia.

(2) *Compound 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. Compound fractures are much more serious injuries than simple fractures.

178. *Complicated fracture.*—A fracture (either simple or compound) 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 are damaged by a broken rib or skull ; or a fracture may be complicated by a dislocation of the bone in addition.

Fractures are further divided into :—

(1) Complete fractures, when the bone is broken right across.

(2) 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 adults.

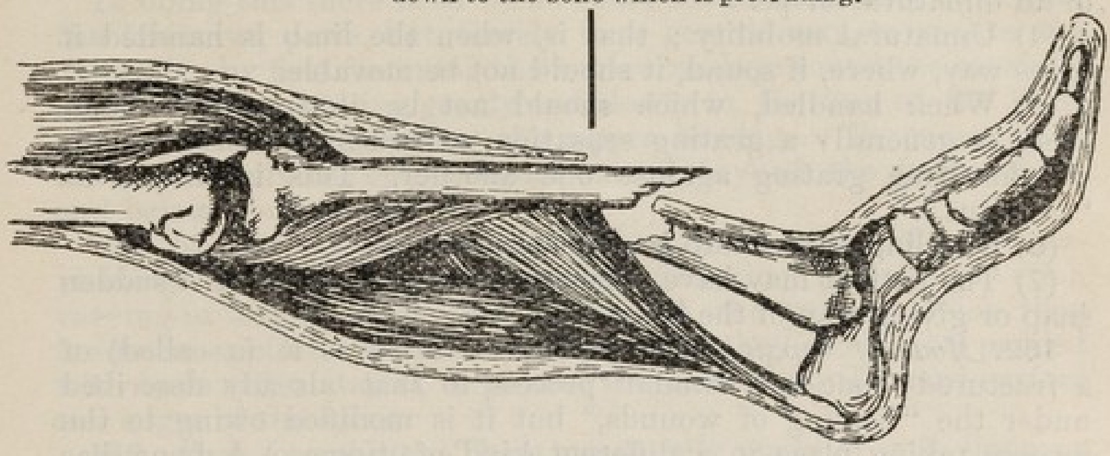


FIG. 47.—COMPOUND FRACTURE OF TIBIA.

(3) Comminuted fractures, when the bone is broken in several pieces, or even pulverised.

179. *Impacted fracture.*—When a bone is broken and one fragment is driven into and firmly fixed in the other fragment, the fracture is said to be "impacted".

180. *Line of the fracture.*—The line of the break may either be transverse, oblique, spiral, stellate, or wedge-shaped; the two latter being commonly seen in gunshot injuries.

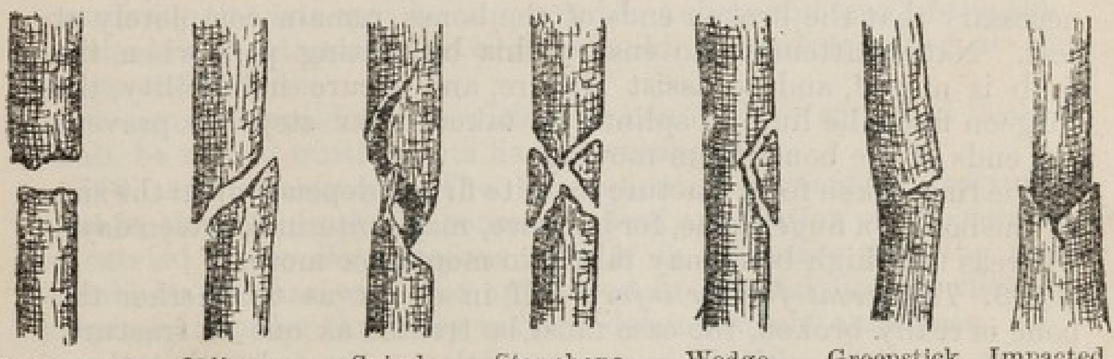


FIG. 48.—DIAGRAMS OF FRACTURES.

181. *Signs of fracture.*—It may be known that a bone is broken, by the following signs:—

(1) Pain; which is generally referred by the patient to the point at which the bone is broken.

(2) Loss of power, *i.e.*, that 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.

(3) Alteration in shape; the limb may be bent, twisted, or shortened, and, when compared with the sound limb, it appears of an unnatural shape.

(4) Unnatural mobility; that is, when the limb is handled it gives way, where, if sound, it should not be movable.

(5) When handled, which should not be unnecessarily done, there is generally a grating sensation, caused by the broken ends of the bone grating against one another. This is known as "crepitus."

(6) Swelling of the limb is generally present.

(7) The patient may have experienced the sensation of a sudden snap or giving way of the bone.

182. *Mode of repair.*—The repair (or *union* as it is called) of a fractured bone is a similar process to that already described under the "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 poured out at the time of the injury sets into a jelly-like mass, which ultimately becomes formed into new bone. This soft mass which is going to become bone is called "callus," and it surrounds the broken ends of the bone, and holds them firmly together. After the lapse of months a large portion of the callus at first formed becomes absorbed, and in the end, there may be very little trace to be seen of 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 bones 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.

The time taken for a fracture to unite firmly depends upon the size of the bone; a finger bone, for instance, may unite in fourteen days, whereas the thigh-bone may take two months or more.

183. *To prevent further injury.*—If in doubt as to whether the bone is really broken, the case must be treated as one of fracture. 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 fracture may easily be converted into the much more serious compound or complicated fracture by rough handling.

184. *Removing the clothing.*—In removing the clothing the greatest gentleness must be used. In the case of a fractured thigh or leg, the outside seam of the trousers should be split right up. Braces must be unfastened all round. There must be no dragging on taking off the clothing. The leg of the cut trousers should then be very carefully drawn to the inside of the injured limb, and the leg of the trousers on the sound limb can then be pulled off.

The sock should be cut off, after the boot has been slit up the back seam, fully unlaced and removed. In fracture of the arm the coat seam and shirt must be ripped up. Apply splints round the limbs, so as to render the fragments immovable.

In doing this there need be no effort made accurately to replace the fractured parts, but merely in a general way, to reduce the deformity by first fastening the lower bandage round the carefully applied splints, pulling gently and slowly in the line of the limb, and then securely fastening the upper bandage. To support the limb effectually the splint should extend beyond the joints above and below the fracture.

185. *Splints.*—Splints consist of supports made of some unyielding material (wood, iron, perforated zinc, pasteboard, etc.), varying in length, width, and shape with the part to which they are to be applied. Before being applied they should be padded with some soft material, to protect the limb from the hard surface and edges of the splint.

186. *Pads for splints.*—These are usually made of soft linen or calico, stuffed with cotton wool mixed with tow, or with tow alone. Care must be taken that the pads are quite even, and contain no lumps of tow or wool, which should be well teased out. Pads should be large enough to protect the limb from the edges of the splint. Some splints are covered with jaconet to keep them clean and the pads dry.

They are bound to the limb by bandages or tapes, so that when fixed the limb is protected and held firmly in its proper position.

187. *Moving a patient.*—In moving a patient all disturbance of the limb should be prevented as much as possible. In the upper extremity the arm may be supported in a sling and tied to the side. In the lower extremity the limbs should be tied together at the knees and ankles.

In no case should a man with a broken limb, or supposed broken limb, be moved until splints have been applied.

188 *After treatment.*—The subsequent treatment of fractures, that is, the setting of the bones and final application of the splints, is carried out by the surgeons; but it is necessary that the men should be familiar with the apparatus in general use in military hospitals, in order that they may render intelligent assistance.

The following are used for the treatment of various fractures.

189. Rattan cane splints for the limbs, japanned iron wire arm splints, sheets of perforated zinc, with shears, hammer, anvil, and rivets to shape and join them, plaster of Paris, and sheets of pasteboard; gutta-percha, poroplastic felt and leather, which have to be cut to shape and softened in water. There are special splints for certain parts of the body:—For the thigh bone, Liston's long thigh splint (generally jointed for packing); for the lower part of the thigh bone, McIntyre's splint; for the leg, the same splint or a metal back splint.

190. *Fracture bed.*—For cases of fracture it is necessary that the bed should be even and firm, so that in a case of fractured thigh or leg, for instance, the limb can be kept quite straight and immovable. Boards are also used for this purpose. These can be placed under the limb, leaving the rest of the bed free. A six-foot table can be used.

191. *Sand-bags.*—Bags filled with sand are very useful to steady a limb. They are placed on each side to prevent movement, and to steady it.

192. *Tight bandages.*—After a splint has been applied there may be much pain and swelling of the parts, due to the bandages being too tight. The orderly should at once inform the sister or non-commissioned officer.

193. *Plaster of Paris splints.*—For a plaster of Paris splint there are required one or two pounds of fresh plaster of Paris, which after the tin has been opened should be put on the hob, near the fire, for twenty minutes; one or two flannel bandages; three or four loose-wove or muslin bandages; two clean basins, one for the dry plaster, and the other for cold water; a newspaper is spread under the limb to protect the bedding. Method of applying: The muslin bandages are soaked in water; the flannel bandage is wrapped round the limb, which is then covered by one layer of the wet muslin bandage; a handful of dry plaster is taken, dipped into the cold water, and smeared on; another bandage is applied, and covered with more plaster, and so on. The limb is kept carefully in position till the plaster sets. Salt in the water quickens setting, gum mucilage delays it. To remove the plaster of Paris from the hands, wash in a little soft sugar and water.

194. *Improvised splints.*—On the battlefield, or in cases of emergency, specially-made splints may not be at hand, and it therefore becomes necessary to contrive an apparatus which shall take their place. Such splints are called improvised splints, and will be dealt with subsequently.

Special Fractures.

195. Under this heading only the more common fractures will be discussed. (1) *Fracture of the spine.*—This injury may result from falling from a height on the back across a bar, or on to uneven ground, or from a fall upon the head. In this fracture the vertebræ are broken and displaced; the spinal cord and nerves are damaged according to the amount of displacement present. The result being complete or partial paralysis of the parts below the seat of fracture.

Treatment:—

(*a*) Do not attempt to move the patient until a medical officer arrives; but,

(*b*) If no surgeon is available within a reasonable time, proceed to render first aid yourself.

(*c*) Pass some form of support beneath the patient; for example, a blanket, sheet, roll of canvas, etc., taking care in so doing to disturb the sufferer as little as possible, and that he himself makes no attempt to roll over.

(*d*) After this has been done, poles must be fixed on to the support on each side.

(*e*) The patient is then slowly and with the utmost care placed upon a stretcher, board, gate, etc., and carried, if possible, by four people to the nearest place of shelter, where he is kept absolutely quiet until the arrival of a surgeon.

(2) *Fracture of the skull.*—The patient may be quite unconscious or only dazed ; there may be bleeding from the mouth, ears, or nose.

Treatment.—Keep the patient absolutely quiet until he can be seen by a surgeon. Do not give stimulants. Take special care of the ears, etc., so that no dirt or septic matter may get 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.

(3) *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.

(4) *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," and remove the case to hospital forthwith.

(5) *Fracture 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.

(6) *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 examining the injured side a deformity in the line of the collar bone will be at once 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 of the closed fist in the axilla of the injured side, and apply the bandages for fractured clavicle as described under "Bandaging."

(7) *Fracture of the upper arm.*—The upper arm may be broken (*a*) near the shoulder, (*b*) about the centre of the bone, or (*c*) near the elbow joint. The usual signs of fracture are present.

Treatment.—If the fracture is near the shoulder, put a pad along the inside from the arm-pit to the elbow first; then bandage the affected arm to the side by means of a broad fold bandage, the centre over the centre of the arm and ends passed round the body and tied on the opposite side. Apply the lesser arm sling.

If the fracture occurs in the shaft or middle portion of the bone, four short splints must be applied to the arm, in front, behind, and on either side. Care must be taken that the front splint is not too long to prevent easy bending of the elbow, and that the bandages retaining the splints in position are applied above and below (*i.e.*, not over) the seat of the fracture, Apply the lesser arm sling.

If the arm bone is broken in its lower part near the elbow, the fore-arm should be bent up, the splint about to be described applied, and the arm supported by the greater arm sling. Take two pieces of moderately thin wood about three inches wide; one long enough to reach from the arm-pit to the elbow, and the other from the elbow to the finger tips; tie these together so as to form a right angle or sort of capital L, and apply the splint thus formed on the inner side of the arm and fore-arm by means of bandages above and below the fracture. Keep the thumb pointing upwards. A ready-made angular splint, if available, may of course be used in place of the above.

(8) *Fracture of the fore-arm.*—One or both bones of the forearm may be broken, the signs of fracture not usually being so evident in the former as in the latter case. There is generally in all cases loss of power and acute pain on moving the limb, and deformity at the seat of fracture. A transverse fracture at the lower end of the radius is known as a "Colles fracture;" it is very frequently of the impacted variety.

Treatment.—Is the same whether one or both bones are broken. Bend the fore-arm at right angles to the arm, keeping the thumb uppermost and the palm of the hand towards the body. Then apply two broad splints on the inner and outer sides of the fore-arm respectively, the former being long enough to reach from the elbow to the fingers, and the latter from the elbow to the back of the hand. Bandage, if possible, above and below the fracture, steadying the hand by another bandage. Finally apply the greater arm sling.

(9) *Fracture of the thigh bone.*—The thigh bone may be broken by direct violence, the bone giving way in this case where the force was applied, or by indirect violence. There is usually well-marked shortening of the limb, and the foot of the injured side is often turned outwards.

Treatment.—(*a*) Bring the foot of the injured side into line with the sound side, by gently and steadily pulling upon it. If an assistant is at hand, give the foot, after it has been drawn into its proper place, to him to keep in position until splints, etc., have been applied ; or pending the application of splints the feet may be tied together at the ankles.

(*b*) Apply a splint on the outer side of the injured limb, long enough to reach from the axilla to beyond the foot. A rifle (see "rifle splint"), broom handle, or any piece of wood long enough, may be used.

(*c*) Apply a second splint on the inside of the fractured thigh reaching from the fork to the knee.

(*d*) Secure the splints in position by bandages as follows : The first is passed round the chest just below the axillæ, and the second round the pelvis ; both these should be broad-fold bandages. The third and fourth, which are "narrow-fold" bandages, should be applied round the thigh above and below the fracture, so as to enclose the thigh and both splints. Another bandage should be passed round the leg enclosing the long splint. Fasten the ankle to the lower end of the long splint. Finally the injured limb should be bandaged to its fellow.

Rifle splint.

The following are the rules for the application of a rifle splint (Fig. 49). Remove the bolt and see that the rifle or magazine contains no cartridges.

Take a narrow-fold bandage, place it over the heel plate of the butt in such a way that two-thirds of its length are in what will be the outer side, and one-third on the other side of the butt, take a half hitch round the butt with the long end, making a half knot on the outer side above the D for the sling. Tie the ends so as to form a loop about two inches long. This is for the perineal bandage to pass through, and is called the butt loop. Leave the magazine in position, place the rifle along the injured limb, butt towards the armpit, magazine uppermost. Take a narrow-fold bandage, place its centre over the ankle of the injured limb, pass the ends behind, enclosing muzzle of rifle, cross behind. With the outer end take a turn round the muzzle in front of the fore-sight, bring both ends up, cross over instep and tie off on the inside of the foot. Take a narrow fold, place its centre in the fork, bring one end out behind, the other in front of the limb;

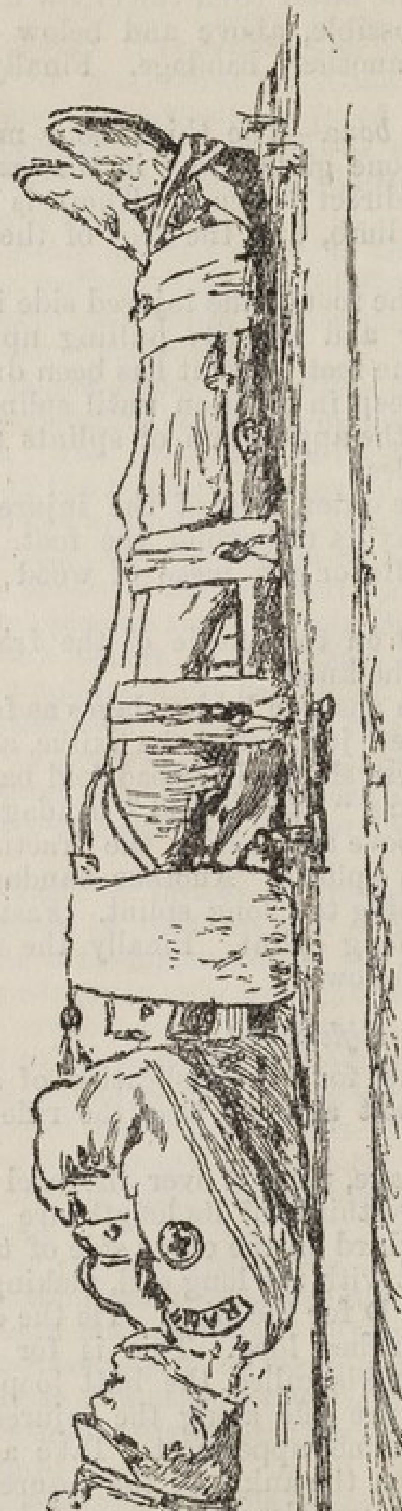
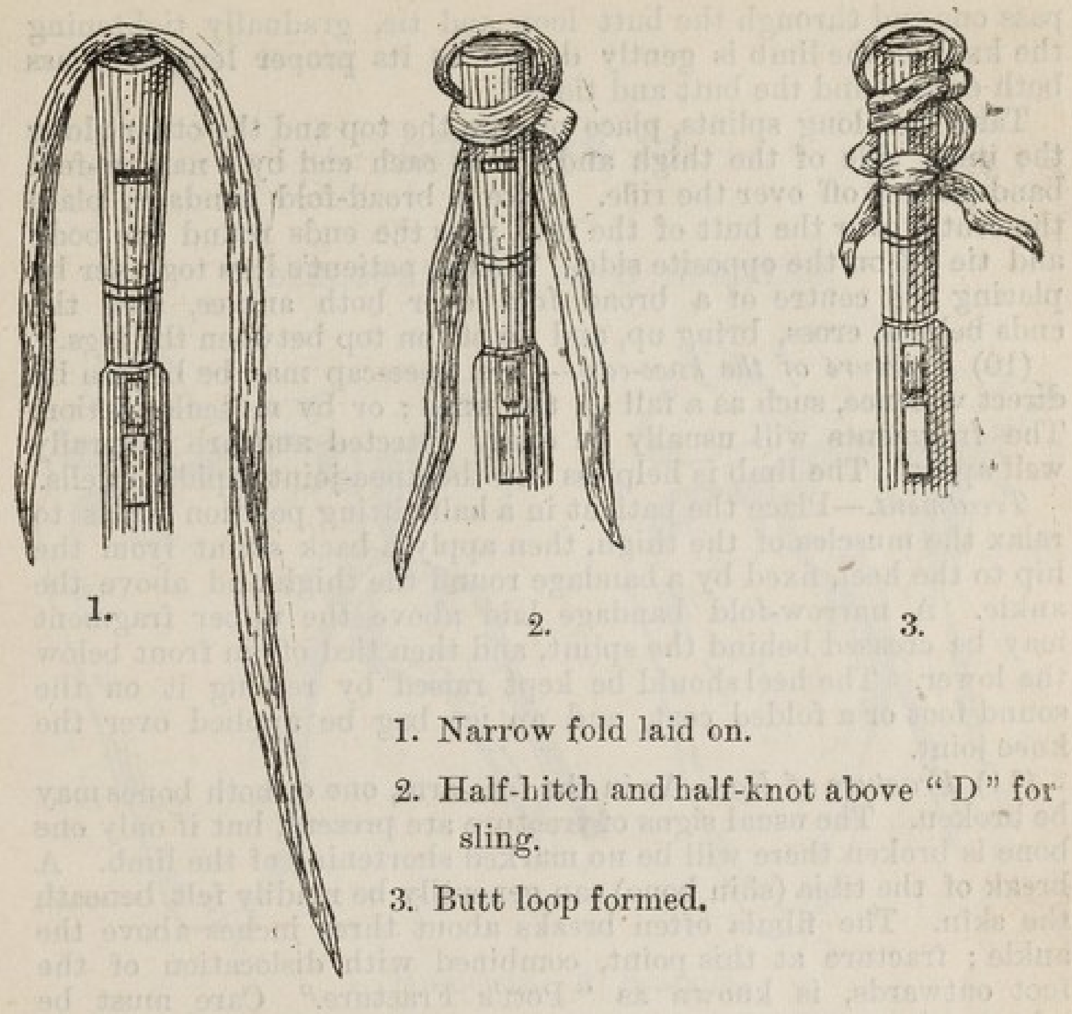


FIG. 49.—RIFLE SPLINT APPLIED.
(Short rifle (Lee-Enfield) applied).



1. Narrow fold laid on.
2. Half-hitch and half-knot above " D " for sling.
3. Butt loop formed.

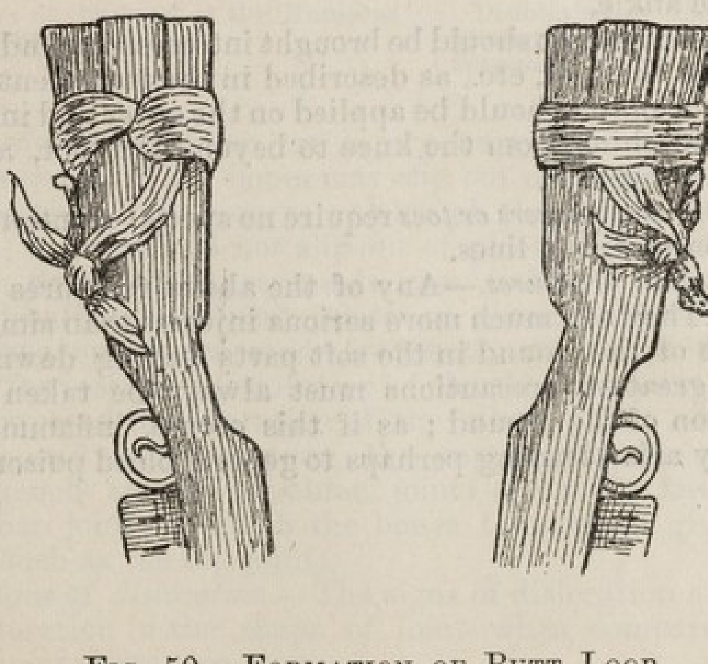


Fig. 50.—Formation of Butt Loop.

pass one end through the butt loop and tie, gradually tightening the knot as the limb is gently drawn to its proper length. Pass both ends round the butt and tie off.

Take two long splints, place one on the top and the other along the inner side of the thigh and fix at each end by a narrow-fold bandage tied off over the rifle. Take a broad-fold bandage, place the centre over the butt of the rifle, pass the ends round the body and tie off on the opposite side. Tie the patient's legs together by placing the centre of a broad fold over both ankles, pass the ends behind, cross, bring up, and tie off on top between the legs.

(10) *Fracture of the knee-cap.*—The knee-cap may be broken by direct violence, such as a fall on the knee ; or by muscular action. The fragments will usually be easily detected and are generally well apart. The limb is helpless and the knee-joint rapidly swells.

Treatment.—Place the patient in a half-sitting position so as to relax the muscles of the thigh, then apply a back splint from the hip to the heel, fixed by a bandage round the thigh and above the ankle. A narrow-fold bandage laid above the upper fragment may be crossed behind the splint, and then tied off in front below the lower. The heel should be kept raised by resting it on the sound foot or a folded coat, and an ice bag be applied over the knee joint.

(11) *Fracture of leg.*—As in the fore-arm, one or both bones may be broken. The usual signs of fracture are present, but if only one bone is broken there will be no marked shortening of the limb. A break of the tibia (shin bone) can generally be readily felt beneath the skin. The fibula often breaks about three inches above the ankle ; fracture at this point, combined with dislocation of the foot outwards, is known as "Pott's Fracture." Care must be taken not to mistake this accident for a dislocation, or even sprain, of the ankle.

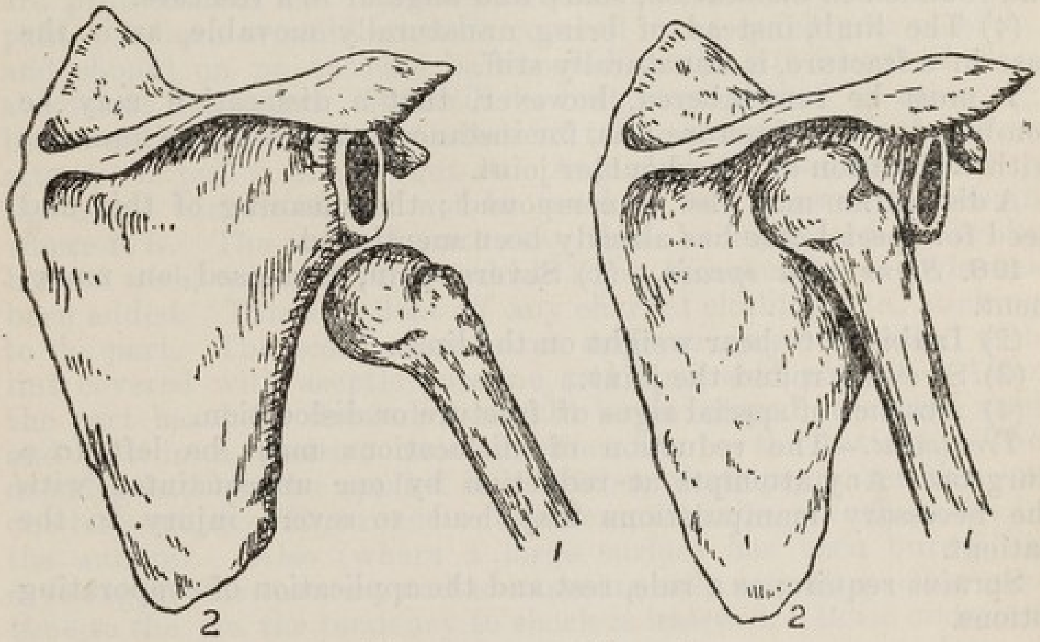
Treatment.—The limb should be brought into position and steadied by drawing on the foot, etc., as described in the treatment for fractured thigh. Splints should be applied on the outer and inner sides of the limb, reaching from the knee to beyond the foot, and both legs bandaged together.

(12) *Fractures of fingers or toes* require no special mention. They are treated on ordinary lines.

(13) *Compound fractures.*—Any of the above fractures may be compound. They are much more serious injuries than 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 ; as if this occurs, inflammation of the bone may arise, leading perhaps to general blood poisoning and death.

CHAPTER XI.

DISLOCATIONS AND SPRAINS.



1. Humerus. 2. Scapula.

FIGS. 51 AND 52.—DISLOCATION OF THE SHOULDER JOINT.

Dislocation of the head of the Humerus downwards into the arm-pit.

Dislocation of the head of the Humerus backwards on to the Scapula.

196. *Definition.*—When an injury to a joint occurs and the ligaments are torn, the bones may slip out of place. This is known as a dislocation. If, however, although the ligaments are torn or stretched, the bones do not slip out of place, the result is known as a sprain. Some joints are much more liable to dislocation than others; "ball and socket" joints on account of their extensive range of movement are more frequently dislocated than "hinge joints"; for instance, dislocation of the shoulder joint is a common injury compared to dislocation of the elbow joint. Again, joints which depend largely upon the support of the surrounding muscles (such as the shoulder joint) are more frequently dislocated than joints in which the bones themselves give the main support (such as the hip joint).

197. *Signs of dislocation.*—The signs of dislocation are :—

(1) Alteration in the shape of joint when compared with the one on the opposite side.

(2) The end of the displaced bone can often be felt through the skin.

(3) Alteration in the length of the limb.

(4) Inability to move the joint.

A dislocation can be distinguished from a fracture by :—

(1) Its always happening at a joint.

(2) By there being no grating.

(3) If the end of the bone can be felt it is found to be smooth and rounded in dislocation, sharp and angular in a fracture.

(4) The limb, instead of being unnaturally movable, as is the case in a fracture, is unnaturally stiff.

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 also be compound ; the meaning of this and need for special care has already been mentioned.

198. *Signs of a sprain.*—(1) Severe pain, increased on movement.

(2) Inability to bear weight on the limb.

(3) Swelling round the joint.

(4) Absence of special signs of fracture or dislocation.

Treatment.—The reduction of dislocations must be left to a Surgeon. Any attempts at reduction by one unacquainted with the necessary manipulations may lead to severe injury to the patient.

Sprains require, as a rule, rest and the application of evaporating lotions.

CHAPTER XII.

BURNS AND SCALDS.

199. *Immediate treatment of burns.*—The damage to the body occasioned by burns varies with the degree of heat applied to the part burnt—the more intense the degree of heat the more severe the burn. As regards immediate treatment, it should be remembered that severe burns, more particularly those situated on the head, neck and trunk and those which occupy a great extent of surface, are likely to be attended from the outset by serious constitutional disturbances described under the head of "Shock," and from which alone the patient may sink unless properly supported. Burning clothing should be extinguished by laying the person on the ground and rolling him up in a rug, blanket coat, curtain or anything of this nature that is handy.

As the danger to life in severe burns comes from shock, the sufferer's general condition should receive attention first of all. This is important.

The charred surface is temporarily protected from septic infection, owing to the germs in the skin having been destroyed by the heat. The treatment of shock should be carried out as described hereafter.

200. *Dressing of burns.*—The points to be aimed at in all cases are protection of the injured surfaces from the air, and relief of pain. A burn or scald must be covered up as quickly as possible, and should on no account be exposed to the air longer than is absolutely necessary. This will be best accomplished by removing burnt clothing which is not adherent to the charred surface ; never attempt to pull it off, but cut it. Any clothing, etc., adherent to the burnt surface should not be touched, but allowed to remain where it is. The injured part may then be immersed in, or be bathed with, warm water to which some bicarbonate of soda has been added. This will float off any charred clothing, etc., sticking to the part. The scorched or burnt surfaces may be dressed with lint covered with aseptic vaseline and boric-acid powder. After the part has been dressed it should be enveloped in cotton wool and put in a position most comfortable to the patient. The dressing had best be applied in a number of strips, rather than in one large piece. This renders their removal subsequently easier to the sufferer. Also (where a large surface has been burnt) by dressing in this manner, and so exposing only a small portion at a time to the air, the tendency to shock is lessened. Boric ointment spread on strips of lint can be used in the same manner. Deeper burns destroying the skin are liable to become septic and require such antiseptic treatment as may be ordered by the Surgeon. Burns should after the first dressing be dressed as seldom as possible. During the subsequent treatment the chief danger is sepsis, and its results. Also when the parts beneath the skin have been burnt the formation of disfiguring and deforming scars is frequent. To prevent and diminish these sequelæ the sufferer requires very careful nursing. Inflammatory affections, such as pneumonia, may follow after burns.

For burns of the face the dressings should be applied on a mask of lint or linen, in which holes are cut for the eyes, nose, and mouth.

201. *Scalds and their treatment.*—Scalds (which are caused by the application of hot fluids to the body) should be treated on the same lines as burns. When blisters form they may be pricked to permit the escape of their contents, but every endeavour should be made to avoid breaking the skin more than is necessary.

If (after the first pricking, which should be done at the margin) the blister becomes again distended and is painful, a fresh outlet should be made and the fluid allowed to escape. The convalescence from extensive burns or scalds may be prolonged and tedious, and after the first ten days a generous diet with tonics will be necessary.

Suffocation from Swallowing very hot water or by inhaling steam.

202. This is rather a common accident among children, and is always serious. It may become rapidly fatal from swelling of the upper part of the larynx causing obstruction to respiration. Treatment in such cases must be prompt and the sufferer constantly watched.

Treatment.—Apply fomentations to the front of the neck, from the chin to the top of the breastbone (sternum). Keep the patient sitting up and give ice to suck. It is best to have the sufferer at once seen by a Surgeon, as surgical treatment may be required at any moment.

CHAPTER XIII.

SHOCK, LOSS OF CONSCIOUSNESS, AND FITS.

203. *Shock* is a condition produced by any severe injury or emotional disturbance. It is usual as the result of pain, or of injuries such as extensive burns or serious mutilation of the body. The sufferer becomes pale and cold, he lies in a semi-conscious and helpless state, the face pinched, the lips ashy, the temperature sub-normal, the pulse feeble or almost absent. He often breaks out into a cold sweat, and may have fits of shivering or be restless.

Treatment.—Restoration must be attempted by placing the patient in bed with the head low. Restore warmth to the body by warm bed-clothing, hot water jars to the extremities, or the application of a mustard poultice over the heart. Administer hot drinks and stimulants in small quantities, but take care that the patient is conscious enough to swallow, or he may be choked by the fluid passing into the larynx.

204. *Insensibility*, or loss of consciousness, is due to various causes which damage or interfere with the action of the brain. It may be produced by pressure on the brain, as when bleeding takes place within the skull ; by actual damage to the brain substance, as results from a blow on the head ; from a fracture of the skull ; or from a bullet wound ; or, as is often the case, by interference with the circulation of the blood within the brain. It frequently happens as the result of the blood not being properly aerated in the lungs, either because the lungs do not act properly, or because the air supplied is impure, as when suffocation occurs in a room containing coal gas, or other poisonous gases.

Treatment.—

(1.) Send at once for a medical man.

(2.) Lay the patient on his back, and as a general rule, if the face is flushed keep the head high ; if pale, keep the head low.

(3.) Loosen all tight clothing round the neck, chest, or stomach. If there is any inclination to vomit, place the head on one side, so that the contents of the stomach may not get into the larynx and cause suffocation.

(4.) Avoid all crowding round the person, and admit free access of fresh air.

(5.) Give no food or stimulants, unless by direction of a medical man.

(6.) Do not leave the patient alone, but stay with him till help comes.

205. *Concussion* is a variety of shock caused by injury to the brain, generally from a blow or fall on the head.

The symptoms resemble those of shock, but are generally accompanied by a more confused and bewildered state of the patient, or by complete unconsciousness.

The *treatment* is as for shock, but stimulants are not to be given without orders.

206. *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 from seeing some revolting sight, 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.—Lay the patient on his back with his head low, and loosen the clothes about the neck and chest. Sprinkle cold water on the face and neck. Apply smelling salts to the nose, and, when the patient is able to swallow, administer stimulants in very small quantities. Fresh air is a necessity. If hæmorrhage be the cause it must be arrested immediately, and stimulants should not be given without orders. If it results from starvation, fluid nourishment, such as strong beef tea, should be given, but only in moderate quantities at first. Leave the patient lying down for some time after he recovers.

207. *Epileptic fits* are due to constitutional or local causes. The patient falls down insensible, and has convulsions affecting part or the whole of the body, foams at the mouth, and often bites the tongue, making it bleed.

A fit may be divided into three stages.

1st stage.—This is often commenced by a peculiar cry. The patient then falls down quite unconscious. He becomes rigid all over, every muscle being contracted ; he holds his breath ; his face becomes pale and then livid. This stage lasts from 30 to 40 seconds.

2nd stage.—Unconsciousness continues; but instead of rigidity, convulsions come on; the eyes roll; the tongue may be bitten; and urine and fæces may be involuntarily passed. This stage lasts from one to four minutes and passes slowly into

3rd stage, in which consciousness is gradually regained. The muscular spasms cease; the patient gradually comes to himself, but is very exhausted and confused mentally. He then frequently sleeps for some hours.

Treatment.—Lay the patient on his back with his head slightly raised; loosen the clothes about the neck and chest, and prevent him biting his tongue by placing something (such as a spatula, or handle of a tooth brush) between his teeth as a gag. Employ only sufficient restraint to prevent him injuring himself, and avoid pressing on the chest; it will be sufficient if one man restrains the patient's legs—kneeling by his right side and placing the right arm across the knees to do so; a second attendant lightly restrains the patient's right arm, and a third the left arm, and also watches the head. Treatment will not cut short an epileptic fit.

208. *Apoplectic fits* occur mostly in elderly persons. The patient falls suddenly insensible. The face is red, the breathing loud and snorting, and the pupils frequently of unequal size.

Treatment.—Raise and support the head and upper part of the chest. Loosen the clothes about the neck. Apply cold water to the head. Do not give stimulants.

209. *Compression* of the brain is the result of severe injuries to the head, such as fracture to the skull; the symptoms resemble those of apoplexy, and the same precautions should be taken.

210. *Sunstroke* or heatstroke, which is the result of excessive heat, occurs in hot climates or summer weather. The patient falls suddenly, generally insensible, sometimes in convulsions, the skin feeling burning hot to the hand.

Treatment.—Carry the patient at once into the shade or the coolest available place. Provide plenty of fresh air. Raise the head and remove the clothes from the neck and upper part of the body. Douche the head, neck, chest and spine, or the whole body with cold water. Avoid crowding round the patient. Do not give stimulants. Give enemas of ice-cold water.

211. *Drunken fits* are caused by the drinking of a large quantity of alcohol. They occur suddenly, but may not come on for some time after the liquor has been taken. The patient falls into a deep stupor, there is a vacant expression of the countenance, which is sometimes red. The lips are livid and pupils dilated, and the breath smells strongly of liquor.

Treatment.—Place the patient on his side with head slightly raised and do not allow him to lie on his back, or on his face. Remove all constrictions from the neck and induce vomiting. Have the stomach pump ready in case the doctor on his arrival should decide to use it.

CHAPTER XIV.

SUFFOCATION AND CHOKING, &c.

212. *General symptoms.*—These are as follows : Violent attempts to breathe, staring eyeballs, distended prominent veins in the neck, purple countenance, convulsive movements of the body, &c. If the condition causing the suffocation or choking be not speedily removed, insensibility follows and death results. Such a condition is called asphyxia.

213. *Choking.*—This may be caused by pieces of meat, coins, false teeth, or any other body lodging over the entrance to the wind pipe, and so causing obstruction to respiration. Treatment must be prompt. Forcibly open the mouth and pass the forefinger to the back of the throat and endeavour to hook up the obstructing body. In the case of children, hold them legs uppermost and thump the back between the shoulder blades. This should also be attempted in adults if the first mentioned remedy is ineffectual. In all cases send for a medical man at once.

214. *Suffocation by smoke or gas.*—Remove the person into the fresh air, and at once proceed to restore breathing by artificial respiration. In mild cases respiration may be stimulated by freely douching the chest with cold water.

Poisonous gases are dangerous to life by replacing the oxygen in the blood.

215. *Rescue from fire.*—Before entering a building on fire, with a view to rescuing from the smoke and heat any individuals within, tie a wet handkerchief over your nose and mouth. Take off any superfluous clothing, and if possible have a bucket of water thrown over you. It is imperative you work quickly ; avoid being overcome by smoke by bending low beneath it—the air is clearest near the floor. When carrying persons out from burning buildings try especially to protect from the flames the head and neck of those you carry.

216. *Electric shock.*—Contact with an electric cable may produce very severe shock, insensibility and death. The sufferer is unable to extricate himself owing to the current depriving him of all power of moving.

It is imperative to at once get the sufferer away from the cable, and the person going to his assistance does so at great risk of being himself caught by the current. If the current can be switched off this should of course be done, but if this cannot be done endeavours to extricate the person must be made. The rescuer must insulate himself from the current, otherwise on touching the sufferer with naked hands the electricity will also hold him. There is no time to search for india-rubber gloves or mats to stand on, as the sufferer must be got away immediately. A dry wooden broom handle may be utilised to shove the person away from contact ; or an empty india-rubber tobacco pouch may be improvised as a glove. Failing these, perhaps the best thing to do is to run and jump into the air, and while in the air with both feet off the ground, attempt to kick the person away from contact; while actually in the air the rescuer is insulated from the current.

After rescuing the patient the general treatment for insensibility must be carried out, and artificial respiration begun if breathing has ceased ; any burns being left for treatment until the grave condition of shock has been overcome.

CHAPTER XV.

FROST BITE, &c.

217. This condition is the result of exposure to excessive cold. It affects the nose, ears, fingers, or feet ; the part tingles and becomes blue ; and in the more severe cases white and free from pain. The treatment is to rub the affected part with snow or cold water, avoiding taking the patient into a warm room until the part has been thoroughly but very gradually thawed. All application of heat should be avoided, as it might produce gangrene.

218. *Chilblains* are local congestions of the skin, usually of the fingers and toes, caused by exposure to cold and wet. Damp and ill-fitting boots are a common cause. If the parts have become damp they should be thoroughly dried with a soft towel, then rubbed gently with some fine bran. Keep the parts warm and protected from the cold with woollen gloves or socks worn day and night.

The chilblain may be painted with tincture or liniment of iodine. If the surface is broken, apply zinc or boric ointment and protect with cotton wool. Exercise, good food, and warm clothing are the best preventives, and are necessary for the cure of this affection. Young people and those with a poor circulation are the chief sufferers.

CHAPTER XVI.

FOREIGN BODIES IN THE EYE AND EAR.

219. Foreign bodies lodged in the eye, either on the eye-ball or under the lids, cause severe discomfort, and if not quickly removed, give rise to inflammation and great pain.

Treatment.—Prevent the patient rubbing the eye, and carefully examine it in a good light by pulling down the lower lid and gently pushing up the upper. If the foreign body is now visible, it may be removed by gently brushing it away with the folded corner of a handkerchief.

Eye-lashes sometimes get turned in and act as foreign bodies.

The patient may himself, by adopting the following simple methods, rid his eye of a foreign body.

(1) By blowing the nose violently several times in rapid succession, at the same time looking downwards and inwards.

(2) By immersing the face in water, and at the same time opening the eye and moving it about to wash out the foreign body.

(3) By taking hold of the edge of the upper eyelid, and drawing it downwards and forwards over the lower lid. On letting go of the upper lid, the foreign body may be brushed off it on to the lower lid, from which it may easily be removed.

(4) By smelling any pungent substance, such as ammonia, which, by causing a free secretion of tears, may wash the body out. Should, however, these methods fail, the following treatment should be adopted.

Let the patient sit down facing the light, stand behind him and steady his head against your chest. Tell the patient to look down. Place a probe lengthwise on the upper eyelid about half an inch above the edge. Now lay hold of the edge of the lid with the forefinger and thumb and gently pulling it upwards, fold it over the probe, which at the same time must be withdrawn with a downward and outward sweep. The eyelid having been everted, the foreign body may be seen and should be wiped off with a camel-hair brush or the corner of a handkerchief. The lid should then be pulled forward to let it resume its normal position, the patient at the same time being told to look up.

A piece of grit, cinder, or iron, sometimes becomes embedded in or sticks on the surface of the eye-ball, causing great pain and intolerance of light. Such a foreign body may be recognised as a dark spot on the clear part of the eye-ball (cornea). Its removal should be left to a medical man. Pending his arrival, or until assistance can be obtained, the eye should be filled with olive oil, and a pad of cotton wool or folded handkerchief bandaged gently over it.

220. *Lime in the eye.*—This is a very serious accident, and may cause rapid destruction of the eye.

Remedies must be prompt.

Treatment.—Fill the eye at once with olive or castor oil. Remove the pieces of lime as quickly as possible and with the greatest gentleness; but make no attempt to remove any particles which have become adherent to the conjunctivæ or eye-ball: this should be left to the Medical Officer.

Or the eye may be bathed with a warm solution of vinegar and water (about two table-spoonfuls to a pint).

By directing a stream of this on to a piece of the adherent lime, it may be washed off. Under no circumstances should force, ever so slight, be used in endeavouring to remove the pieces of lime.

Foreign Bodies in the Ear Passages.

221. In these cases you should at once bring the patient to hospital, or send for a medical man.

Never attempt, when you cannot see the foreign body, to probe for it, or even syringe the ear, with a view to its removal. If an insect gets into the ear passages and becomes fixed, pour in some olive oil so as to float it out; but it is best in all cases to wait until a doctor can examine the case. Should there be great pain, fomentations should be applied to the ear and side of the head.

CHAPTER XVII.

DROWNING.

222. *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 :—(1) The removal of all obstructions to the passage of air into the lungs; (2) the restoration of the breathing; (3) and after breathing is restored the promotion of warmth and circulation. The efforts to restore life must be persevered in 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 breathing has recommenced, the restoration of life will be endangered.

223. The steps to be taken should be as follows :—(1) Remove all obstructions to the passage of air into the lungs; therefore (a) open out clothing so as to expose the chest and waist; (b) clear away any mucus, weeds, mud, &c., from the mouth, nose and throat; (c) draw forward the tongue and keep it projecting beyond the lips either by tying a piece of tape round it, or by holding it with a dry cloth; (d) empty the water out of the lungs and stomach as much as possible; to do this, turn the patient face downwards with a large firm roll of clothing under the chest and stomach; place one of his arms under the forehead, so as to raise the mouth off the ground; press four or five times for four or five seconds each time upon the patient's back, thus squeezing the water out of the stomach and chest.

(2) Perform artificial respiration, by imitating as far as possible the movements of natural breathing; this may be done by Silvester's or Schäfer's method.

First of all give two or three smart slaps on the stomach or chest with the open hand.

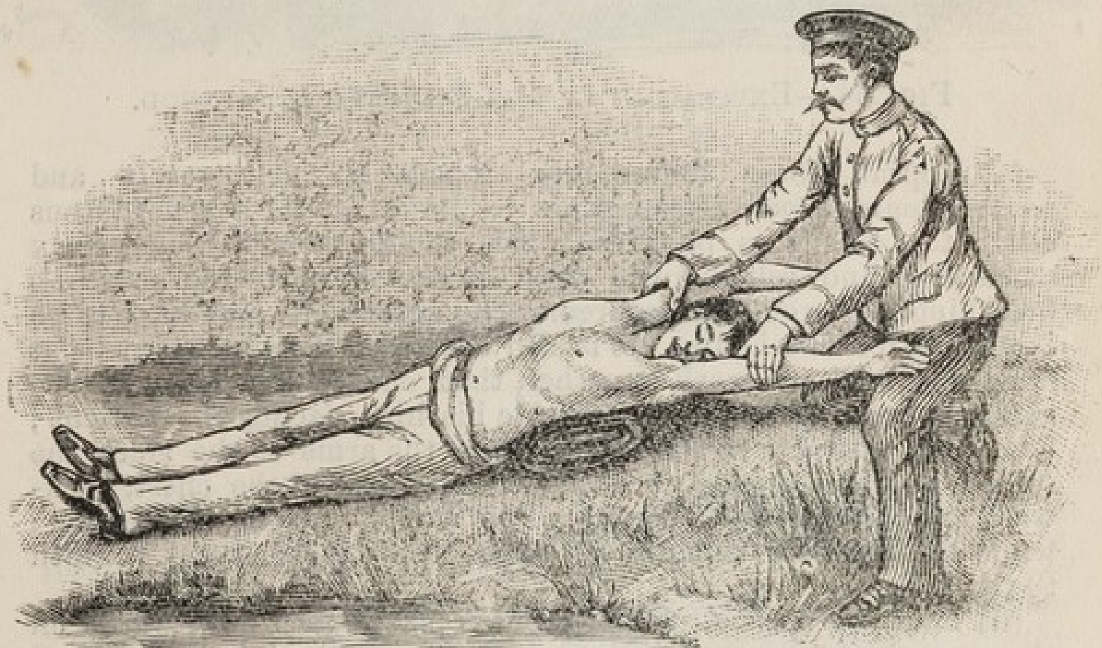


FIG. 53.—INSPIRATION IN DR. SILVESTER'S METHOD.

(i) *Silvester's method.*—In Silvester's method (adopted by the Royal Humane Society) (*a*) turn the patient on his back with the roll of clothing under the shoulder blades, the head being allowed to fall back; (*b*) kneeling at the patient's head, grasp the arms just above the elbows, draw them gently and steadily upwards above the head, and keep them stretched upwards for two seconds: by this means the air is drawn into the lungs by raising the ribs. (Fig. 53.)

(c) Then turn down the patient's arms and press them gently and firmly for two seconds against the sides of the chest, crossing the forearms over the pit of the stomach. By this means air is driven out of the lungs by depressing the ribs.

FIG. 54.—EXPIRATION IN DR. SILVESTER'S METHOD.

(d) Repeat these movements alternately, deliberately and perseveringly about fifteen times a minute, until a spontaneous effort to breathe is perceived; this should be aided by gently expanding and relaxing the chest as above, until the patient's breathing is thoroughly restored. The movements may have to be continued for two hours. It is also advisable if an assistant be at hand and two can work together, that one should kneel at the patient's head and the other astride his hips, facing the patient; when the operator at the head lowers the arms to the sides, the second operator presses on the sides and front of the chest, backward and downward, throwing all his weight into the movement; while the arms are being raised he can apply friction and warmth to the body.

(ii) *Schäfer's method.*—The patient is placed face downwards on the ground; it is an advantage to have a rolled-up coat placed under the chest, so that the head hangs down, but this is not absolutely necessary. The patient's arm is bent and placed under his forehead, thus keeping his nose and mouth clear from the ground. The operator then stands athwart the patient, or kneels by his side, and then with rhythmic movements, about thirteen to the minute, presses against the lower part of the back of the chest.

(iii) Promote warmth and circulation: (*a*) while the above treatment is being carried out the hands and feet may be dried, and as soon as blankets are procured the wet clothing may be removed and the body gradually re-clothed, taking care not to interfere with the efforts to restore breathing. (*b*) Apply friction by rubbing the limbs upwards towards the body; this may be done under the blanket or over the dry clothing. (*c*) Promote warmth of the body by the application of hot flannels or hot-water jars to the pit of the stomach, axillæ or soles of the feet. (*d*) If the power of swallowing has returned, small quantities of wine, warm brandy and water, or coffee should be administered.

224. *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. Under no circumstances hold the patient up by the feet. On no account place the patient in a warm bath unless under medical orders.

Artificial respiration must also be resorted to in cases of suffocation either from the fumes of charcoal or *choke damp*, in mining accidents; or from hanging; also in cases of lightning stroke; severe electric shock; chloroform poisoning, &c.

CHAPTER XVIII.

POISONING.

225. *Definition.*—A poison is any substance which on being absorbed into the organs of the body, or by chemical action on the tissues, injures health or destroys life.

226. A case of poisoning may be suspected by (1) the sudden appearance of the symptoms in a person otherwise healthy, (2) the symptoms coming on soon after food or drink has been taken, and if after a meal of which many have eaten, the symptoms will then be complained of by several or all who have partaken of it. The symptoms vary in character, and the treatment will depend upon the poison taken.

227. *Poisons destroy life:*—

How poisons act.—(1) By actually burning the parts they touch, such as the mouth, throat and stomach, and causing shock; or by making the parts to 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.

(2) 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 carbolic acid, phosphorus, decomposed foods, &c.

(3) 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 function that death ensues. Examples of these are opium, chloroform, strychnine, prussic acid, snake poison, arsenic. These are called "Systemic 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.

228. In all cases of suspected poisoning a medical man should be at once sent for, 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 effects by giving the proper remedy, sometimes called the antidote.

Any poison remaining, all vomited matter, or anything likely to prove of importance in the inquiry which is sure to take place subsequently, should be carefully preserved for inspection.

Treatment.—When a poison, of which the nature is unknown, has been swallowed, the following combination may be administered:—

$$\left.\begin{array}{l}\text{Carbonate of magnesia}\\ \text{Powdered charcoal}\\ \text{Hydrated peroxide of iron}\end{array}\right\}\text{equal parts.}$$

To be given freely in a sufficient quantity of water.

This preparation is harmless, and is an antidote to many of the most common and active poisons.

Hydrated peroxide of iron may be obtained by precipitating Tinct. Ferri Perchlor by liquor ammoniæ. Milk or flour and water may also be given.

229. (1) *Corrosive Poisons.*

Symptoms.

Great pain, immediately after taking the poison, in the mouth and throat, which look as if scalded; mouth and lips stained and blistered, shock and perhaps difficulty in breathing. Breath may smell very sour, or of hartshorn.

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 neutralising the acidity. If the breath smells of hartshorn or does not smell acid, probably the poison is an alkali, in which case some weak vinegar and water or limejuice should be administered. Apply hot-water bottles to the feet and other means for restorating from shock. Use remedies as soon as possible. Have the tracheotomy instruments in readiness.

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), carbolic acid.

(2) *Irritant Poisons.*

Symptoms.

Pain not at first very great; generally a sensation of burning, or a strong taste in the mouth and throat, coming quickly if the poison is liquid, and less quickly if it is solid when taken. The parts touched by the poison are not burned, and the pain is not so great as in the case of corrosive poison, but it gradually increases and vomiting sets in, with pain in the stomach, diarrhœa with straining, and sometimes blood in the stools. Much can be learned by looking at the vomited matter. Shock and exhaustion set in generally.

Treatment.

Give emetics. Give warm water and encourage vomiting until the water returns clear then milk or white of egg, oil, or melted butter to allay the irritation. Get the stomach tube ready.

The following are the most common irritants :—

Arsenic, antimony (tartar emetic), perchloride of mercury, copper, zinc, iodine, cantharides, powdered glass, stale or badly tinned fish or meat.

(3) *Systemic (Constitutional) Poisons.*

Symptoms.	*Treatment.*
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 either widely open or tightly closed, according to the particular systems of the body affected—nervous, vascular, respiratory, &c.	*Give emetics.* The stomach must be emptied by means of emetics or the stomach tube; 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, gentle rubbing of the limbs; if delirium or convulsions are present, patient should be carefully watched and kept as quiet as possible, and the administration of the special antidotes in the case of each poison. If the case is prolonged, nourishment should be given by the mouth or the rectum.

230. *Emetics, &c.*—The following may be administered to produce vomiting:—

1. Mustard. } One tablespoonful to a tumbler of water.
2. Salt. }
3. Sulphate of zinc, gr. 30 in ℥i water.
4. Ipecacuanha, gr. 20 to 30 of the powder.
   ℥ss to ℥i of the wine.
5. Ammonium carbonate, gr. 20 to 30 in ℥i water.

Remember that an emetic promptly given may save the patient's life, but they are not to be given in cases of corrosive poisoning.

Scrapings from white-washed walls or ceilings may well be used in emergency as an antidote for acids. Use weak liquor ammoniæ or aqua calcis to neutralise acids, preferably to the carbonates; as the latter produce so much gas on combination that it may burst the stomach.

Vinegar is the safest acid to administer.

CHAPTER XIX.

IMPROVISATION OF DRESSINGS—SURGICAL APPLIANCES—CARRIAGE AND DISPOSAL OF SICK AND WOUNDED.

231. In dealing with this subject it is not possible or desirable to lay down any hard and fast rules. Force of circumstances, as well as general surroundings and geographical position at the time, all enter largely into these matters. For instance, the occasions on which we may require to improvise dressings, surgical appliances, methods for the carriage of or disposal of sick and wounded, may be in peace or war, in winter or summer, in sunshine or rain, by road, rail, or sea, at home or abroad.

Much of the success attending the efforts to carry out any scheme for improvisation will depend largely on the ingenuity of those dealing with it. They must be guided not only by the immediate conditions and surroundings, but by the material at their disposal.

232. *Dressings.*—Linen, cotton, flannel, blankets, clothing, teased out wool, and tow, can be all used for improvised dressings. Any material used should be selected from as clean a source as possible. If time and circumstances allow, they should be thoroughly washed and boiled, then baked or sun dried, and when cool used at once. When not required for immediate use they should be preserved in covered receptacles, which have themselves been previously sterilized as far as practicable ; for instance, in tin biscuit boxes hermetically sealed with resin, or strips of rubber plaster ; in earthenware jars, &c.

Bark cloth, made from the bark of a species of fig tree, such as is worn by the natives in the interior of Africa, has been used with success in improvisation of surgical dressings. It was baked in earthen pots and soaked in water in which eucalyptus leaves had been boiled ; then dried and kept ready for use in stoppered and air-tight earthenware jars, which had been previously sterilized by heat.

233. *Sterilization.*—Heat is the readiest and most desirable method of sterilization of all improvised dressings and instruments. It may be moist or dry. If moist heat be selected, any utensil which can be used for boiling purposes, such as large meat tins, biscuit boxes, earthenware native cooking pots, or kettles and pans, can all be used for boiling the instruments or dressings in.

Dry heat can be obtained in the oven of a cooking range, in which dressings must be thoroughly baked.

Moist heat is greatly preferable to dry, as it kills germs much more easily; so always select it if possible. Instruments can be quickly sterilized by being held in a flame.

234. *Antiseptic lotions.*—The best substitute for these is water which has been thoroughly and recently boiled. It should be used fresh if possible, and not stored. But if storing is unavoidable, the vessels should be themselves sterilized by having water boiled in them, and they should be kept closely stoppered.

Weak solutions made of "Jeyes' fluid" or "Izal" have with success been used as substitutes for the better-known antiseptics.

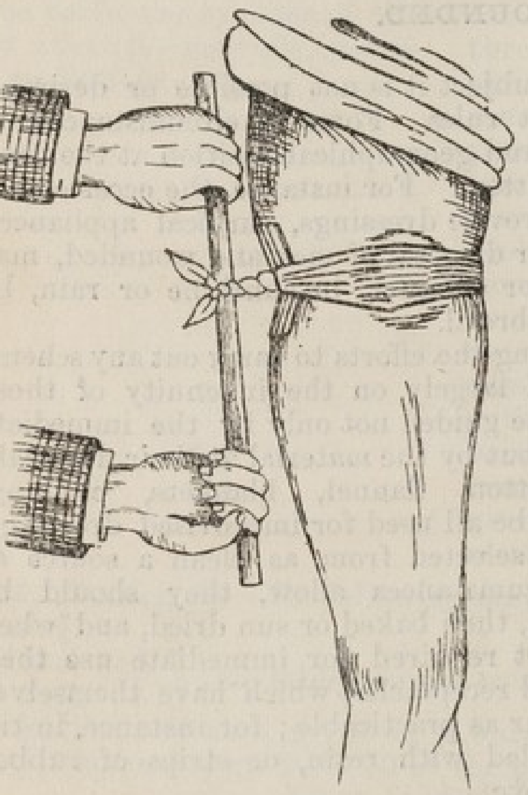


FIG. 55.—IMPROVISED TOURNIQUET FOR COMPRESSION OF THE FEMORAL ARTERY.

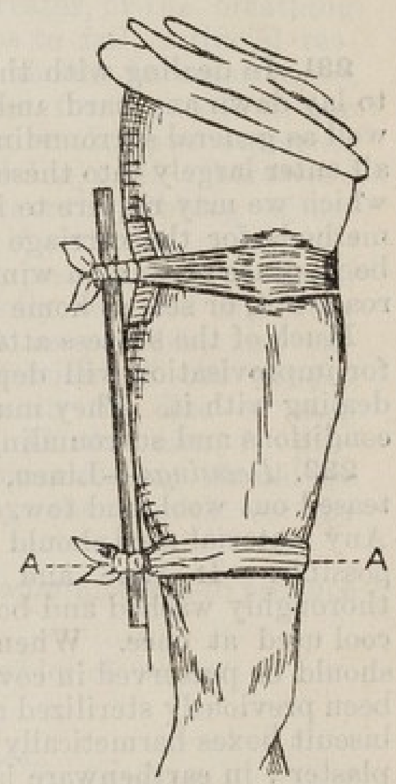


FIG. 56.—THE TOURNIQUET FIXED BY A BANDAGE AT "A."

235. *Tourniquets.*—Place some hard substance or a graduated compress over the trunk of the bleeding vessel. Over this lay the centre of a folded handkerchief or bandage, and tie the ends together on the side of the limb opposite the pad. Then place a stick or piece of wood or metal in the loop thus formed, and twist tightly until by means of the pressure thus exerted, the bleeding is arrested.

The piece of stick or whatever is used for tightening the handkerchief, is kept from loosening by a couple of folded handkerchiefs placed above and below and fastened round the limb.

In selecting the substance for making the pad, it should be specially borne in mind that it should have a smooth surface and rounded edges. A properly applied compress, which can be quickly made from strips torn from the clothing of the individual under treatment, is preferable to any other form of pad. Experience has shown that not only does it fulfil the purpose for which it is applied more effectually, but it is less painful than a stone or other hard substance used as a pad. Ill-selected stones or rough, uneven edged material used as substitutes for a pad, cannot be borne for long owing to the great pain they cause. If a stone or hard substance has to be used it must always be wrapped in a handkerchief before being applied.

The pad should, in the case of the femoral artery, be about the size of a small apple; that used for controlling the brachial artery, about the size of a large walnut. The straps and belts of a man's equipment may often be used with success in dealing with the arrest of hæmorrhage.

236. *Splints.*—A man's equipment and accoutrements, rifle, bayonet, or sword and scabbard, all form excellent material to improvise splints from. Or they can with a little ingenuity be made from wooden and cardboard boxes, backs of books, folded newspapers, telegraph wire, brush wood, lengths cut from corrugated iron in which the edges have been rounded off, folded sheet iron cut from biscuit boxes, or any available sticks or pieces of wood. The stems of banana trees split, and cut into suitable lengths, make excellent splints. Any splint can with a little practice be made from the perforated zinc (carried in No. 2 Field Medicine Pannier).

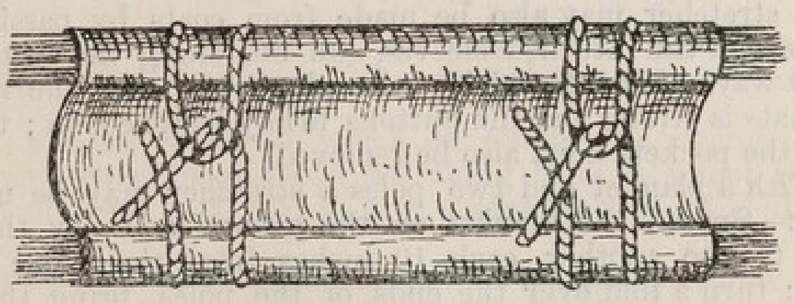


FIG. 57.—IMPROVISED SPLINT MADE OF SMALL BUNDLES OF STRAW, HAY OR RUSHES ROLLED UP IN CANVAS, CLOTH OR SOME SIMILAR MATERIAL.

(1) *Padding for splints.*—Padding for splints can be made from the clothing of the individual, animal wools, tow teased from lengths of rope, folded newspapers, moss, grass, bracken, tops of heather, wood shavings, saw-dust, or peat fibre tied in cloths, etc.

(2) *Application of splints.*—Bandages to be used for the application of splints may be made from linen and cotton material, wearing apparel, straps, rope or twine, bark of trees, straw an grass bands, strips of hide, etc.

237. *Stretchers.*—The introduction of the new pattern of rifles, owing to their length, does away to a very great extent with their utility in forming a part of an improvised stretcher. A stretcher can be readily made by taking off a gate or door from its hinges, and using it for this purpose. Hurdles or tops of barrack room tables, or lengths of iron railings may also be found to answer a similar purpose. When any of these are used, and when such can be procured, a mattress, or folded blankets, or sacking stuffed with straw, or folded tent material should be laid on and secured to the stretcher, beneath the patient.

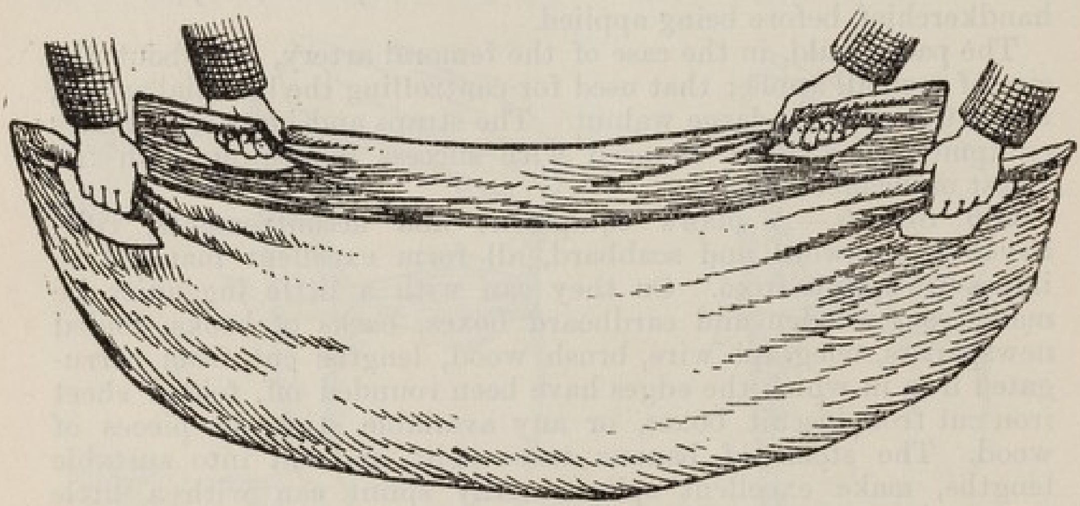


FIG. 58.—BLANKET USED AS IMPROVISED STRETCHER. SLITS CUT IN THE CORNERS FOR THE HANDS.

(1) A stretcher may also be made from coats by passing two poles through the inturned sleeves, and buttoning the coats in the ordinary way. Care should be taken, however, that the material of the coats is strong and the buttons firmly fastened on; the contents of the pockets must also be removed.

(2) With a blanket and two poles a stretcher may be made as follows:—Spread the blanket on the ground and lay the poles parallel to one another, each 10 inches from the centre of the blanket; turn a fold over the ends of the poles, bring the right side over the pole on that side to the other pole, then similarly fold the left side. A stretcher is thus formed consisting of three folds of blanket. Canvas or sacking may be similarly employed.

(3) Mattresses, cushions from railway or other carriages, strips of carpet, hammocks, ropes or strong tendrils of plants, may (with the addition of poles) be utilised as temporary stretchers.

(4) In the case of wounded cavalrymen, a horse blanket or cover can be utilised as a stretcher by tying loops of leather or a rope to each corner with a stone rolled up in them to prevent slipping of the rope. A surcingle may be used to lighten the weight by passing it through the end loops and then round the neck. The shoulders thus bear most of the weight. Two bearers could thus carry a wounded man. (Fig. 59.)

The horse blanket alone, if rolled up close to each side of the wounded man, could be carried a short distance by four men, each man grasping it at the middle and end. If lances were available, two or three on each side should be passed through several slits made in the blanket, and in this way quite a serviceable stretcher could be readily prepared.

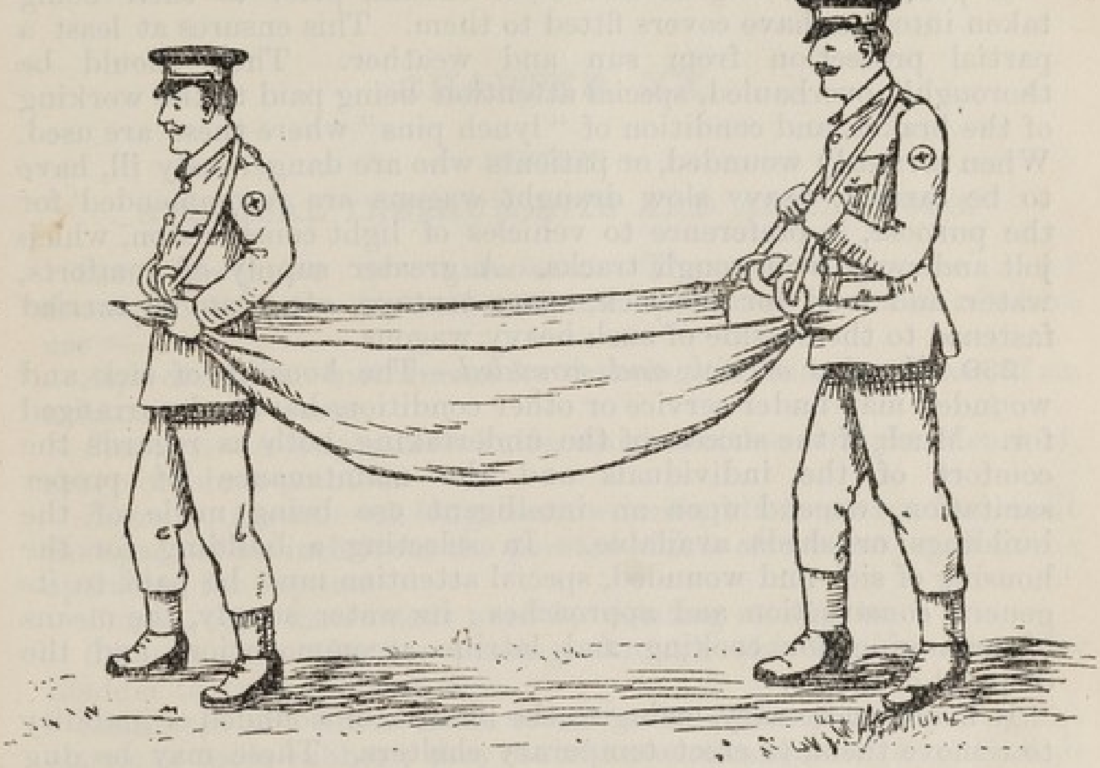


FIG. 59.—BLANKET USED AS AN IMPROVISED STRETCHER, WITH SURCINGLE, STRAPS OR CORD TO LIGHTEN THE WEIGHT.

(5) A wooden chair, to which on either side strong poles are lashed, and which in addition has slung from it a foot rest, constructed of a piece of board, is a useful method of conveying a patient.

A chair with arms should if possible be selected, and have in addition a band fastened to it for tying in the person who is being carried. It is then carried "Sedan Chair" fashion.

Railway luggage barrows, and hand carts may be used in emergency for the removal of sick and wounded. In all cases where improvised stretchers are used, they should be thoroughly tested as to their strength and suitability for the carriage of the patients prior to being used. This is most essential.

238. *Removal of sick and wounded.*—Ambulances may not always be available. Under such circumstances it will be necessary to take into use such suitable local transport as exists and can be procured.

The suitability of the conveyance for the patients to be carried should be the first consideration.

When wagons and country carts are used they should have a plentiful supply of straw, hay, dried leaves, or bracken strewn over the floor and sides. With a little ingenuity, bundles of the material used can be tied up and fashioned into pillows. If mattresses and bedding are available, these should be laid on the top of the straw for the patient's use in transit.

If possible all wagons and carts should, prior to their being taken into use, have covers fitted to them. This ensures at least a partial protection from sun and weather. They should be thoroughly overhauled, special attention being paid to the working of the brakes, and condition of "lynch pins" where these are used. When seriously wounded, or patients who are dangerously ill, have to be carried, heavy slow draught wagons are recommended for the purpose, in preference to vehicles of light construction, which jolt and sway over rough tracks. A greater supply of comforts, water and food for the sick, spare tentage, etc., can be carried fastened to the outside of such heavy wagons.

239. *Housing of sick and wounded.*—The housing of sick and wounded may under service or other conditions have to be arranged for. Much of the success of the undertaking, both as regards the comfort of the individuals and the maintenance of proper sanitation, depend upon an intelligent use being made of the buildings or sheds available. In selecting a building for the housing of sick and wounded, special attention must be paid to its general construction and approaches; its water supply, the means of arranging for cooking and latrine accommodation, and the disposal of refuse.

It may be necessary, owing to the number of wounded or inability to remove them, to erect temporary shelters. These may be dug out, or walls of turf and stones may be built up to give protection. Evacuated trenches may be used for this purpose; these can be improved by the addition of some covering to protect the patients from sun and weather.

Shelters can be constructed from wagon covers and tarpaulins stretched over the wagon poles; these form good shelters and can be stayed with reins or ropes. Temporary shelters affording protection from sun and weather can be constructed from stretchers supported on their sides or perpendicularly by means of a rifle or piece of wood or branch of a tree placed beneath them. These, with the addition of blankets or waterproof sheets hung on the weather side, afford serviceable protection. Tent d'abris constructed of blankets and rifles, or of waterproof sheets laced together and supported on sticks, afford good shelter.

In whatever place sick or wounded are under treatment a Red Cross flag should be prominently displayed.

240. *Raising patients off the ground.*—Stretchers, when available, make excellent beds; they can be used either with their rollers resting on the ground, or supported head and foot by biscuit boxes or packing cases placed beneath their handles, or on wooden trestles made for this purpose.

In conclusion it is pointed out that the foregoing are only given for general guidance.

CHAPTER XX.

SURGICAL INSTRUMENTS AND APPLIANCES.

241. *Description of instruments.*—The following are brief descriptions 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 silver plate, or of gum-elastic or india-rubber ; they contain a wire called a *stylet.* French olivary 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 $1\frac{1}{2}$ inches from the point. English catheters are numbered from 1, the smallest, to 18, the largest ; and French catheters, from 1 to 30.

Caustic-Holder.—A little case for holding caustic, usually made of vulcanite or silver.

Cupping Case.—A case containing the apparatus required for performing the operation of cupping.

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.

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, &c., 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, Liston's Bone.—A strong forceps for cutting bone in operations.

Forceps, Phymosis.—Forceps for holding the foreskin in the operation of circumcision.

Forceps, Polypus.—Forceps for grasping small tumours usually in the nasal cavity.

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, Tongue.—Forceps for holding the tongue, generally used in giving chloroform.

Guillotine, Tonsil.—A sliding knife for slicing the tonsil.

Hernia Director.—Made of steel, and broader than the ordinary director, used for the operation of 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.

Lenses, Test.—Glasses of various powers used for testing the eyes.

Ligatures.—Threads of sterilized silk, catgut, or tendon used for tying up blood-vessels.

Needle, Aneurism.—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 sizes.

Ophthalmoscope.—An instrument for examining the eyes.

Post-mortem Case.—A case containing the instruments used in the examination of bodies after death.

Probang, or Œsophageal Bougie.—A flexible instrument for passing down the gullet.

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.

Saw, Amputating.—A saw used for sawing the bone in amputations 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 excision of joints.

Saw, Hey's.—A small saw for cutting a piece out of a bone used in operations on the skull.

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.

Sound.—An instrument for feeling what is beyond the reach of the fingers.

Spatula.—A blunt knife for spreading ointments; also an instrument used for depressing the tongue when an examination is being made of the throat.

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, horse-hair, or tendon used by the surgeon for stitching wounds.

Syringe.—An instrument made of glass or metal, used for injecting fluids.

Syringe, Higginson's.—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 for giving enemas.

Syringe, Hypodermic.—A graduated glass or metal syringe fitted with a hollow needle, employed in the injection of morphia and other medicines beneath the skin.

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. (*See* Figs. 39, 40, 41.)

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.

Trephine.—A circular 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.

Wools, Holmgren's.—Coloured wools of various shades used for testing for colour-blindness.

Lists of contents of the various articles of Field Medical Equipment will be found in the Appendices of the Regulations for the Army Medical Service.

CHAPTER XXI.

CONTAGION AND DISINFECTION.

242. *Spread of infection.*—Infection is caused by the entry into the body from without of a living thing, a germ or microbe. These germs produce such infectious diseases as enteric fever, cholera, small-pox, plague, dysentery, malaria, etc. In nursing such cases, care must be taken to guard against the spread of infection, by disinfecting germs which leave the patient's body in the breath, discharges and excretions, and are able to start the disease afresh in another individual.*

243. *Personal precaution.*—It is the duty of the orderly to guard himself by all reasonable precautions against infection.

He should never go on duty fasting.

The finger nails should be kept short, a nail brush always used before taking a meal, and the hands washed and rinsed in some disinfectant immediately after touching the patient. As much fresh air as possible should be obtained, and no food should be eaten in the wards.

244. *Disinfectants.*—*A disinfectant* is something that "frees from infection," *i.e.*, it kills the small living bodies above referred to.

The only absolutely reliable disinfectant is heat in the form of boiling water, steam, or hot air of a temperature of 250° F. Articles that are disinfected by heat are said to be "sterilized," *i.e.*, they are by it rendered absolutely free from every kind of germ.

For articles that cannot be subjected to the action of heat, chemical disinfectants have to be used, called antiseptics or germ killers.

These are very much less satisfactory than heat. Of chemical disinfectants the best are carbolic acid 1 in 20, or perchloride of mercury 1 in 1000. If used in weaker solutions than these they cannot be relied upon to kill germs. Milk of lime and chloride of lime are also used for disinfecting stools (see Appendix 5, Regulations for the Army Medical Service, for disinfectant solutions).

245. *Ventilation.—Air of a ward.* Constant and free ventilation is the only method of purifying the air of a ward. Noxious emanations are given off by the patient's body, which are hurtful not only to himself but to his attendants. The risk of the latter catching disease is much diminished by free ventilation.

* The chapter on the "Prevention of disease" (Chap. XXX) should be read in conjunction with this chapter by orderlies and others after their first year of training.

The window should be kept constantly open from the top, care being taken to guard the patient from draughts. When not too cold the windows should be open top and bottom two or three times a day, and the room thoroughly flushed with fresh air, the patient being carefully covered up. A fire is an aid to ventilation.

246. *Disinfection of linen.*—A supply of bedding and clothing distinctively marked with an "I" should be set apart for the use of patients suffering from infectious diseases. (See para. 156, Regulations for the Army Medical Service). Both bed and body linen should after use be at once placed in a disinfecting solution as laid down in paras. 152–154, Regulations for the Army Medical Service, unless specially directed to be dealt with in any particular way.

Especial care is necessary in the treatment of soiled linen from Enteric Fever patients. All excreted matter should be rinsed out before placing the articles to steep in the cresol solution. Hands must be carefully scrubbed after touching soiled linen.

247. *Disinfection of stools and urine.*—In enteric fever the infectious germs are contained in the stools and urine of the patient. For disinfecting the stools in enteric fever cresol solution should be used, see para. 157, Regulations for the Army Medical Service.

Unless otherwise ordered a small quantity of cresol solution should be put in the bedpan and care should be taken that no moisture from the disinfectant remains on the outside of the bedpan.

After use it should be covered up with a china cover and removed at once from the ward, enough cresol being added to completely cover the stool.

Where water closets or slop sinks do not exist, the best method of disposing of enteric stools is to boil or burn them. Where a water closet or slop sink is available for their disposal before emptying the stools (into these) they should be mixed with an equal quantity of cresol solution, and allowed to stand for one hour to allow the disinfectant to act.

While the stool is standing, the bedpan with the china cover should be covered with a cloth soaked in cresol solution. This should also be done when a stool is being kept for inspection.

The urine should also be mixed with an equal quantity of the cresol solution and allowed to stand for an hour before being emptied, if no special method is arranged for its disposal.

All utensils (*e.g.*, feeding cups, bedpans, urinals, etc.), intended to be used by enteric patients shall be marked with an "E," see para. 157, Regulations for the Army Medical Service.

248. *Disinfection of sputum.*—Cresol solution should be placed in the spit-cup before use.

Rags or special handkerchiefs which can be burnt should be used to wipe away all discharges from the mouth and nose.

249. *Disinfection of patient's body.*—The patient should be carefully sponged from head to foot daily, care being taken that he is not unduly exposed.

In scarlet fever the flakes of skin which become detached from the body during the process of desquamation may convey the infection. Some Medical Officers therefore have their scarlet fever patients, during the peeling stage, anointed daily from head to foot with some disinfectant dissolved in olive oil. This prevents the escape of dust and particles of skin from the patient. In addition, warm baths are frequently given during convalescence.

250. *Dusting of patient's room.*—The dusting of a ward should be done with a duster damped with some disinfecting solution, to prevent the dust, in which infectious germs may be present, being scattered about ; after use the duster should be at once placed in the tub containing the disinfecting solution.

All crockery used by infectious cases should be specially marked and kept for this use only.

CHAPTER XXII.

MEDICINES AND THEIR ADMINISTRATION.

251. *Method of giving drugs.*—Drugs may be introduced into the system in several ways. They may be swallowed, inhaled, injected under the skin, rubbed into the skin, injected into the rectum or administered by means of medicated baths (see Chapter XXV).

252. *By the mouth.*—The great majority of medicines are given by the mouth. Drugs given in this way may be administered in the form of liquids, pills, powders, or in capsules.

(*a*) *Liquids.*—Before a dose of a mixture is given the label must always be read, the bottle shaken, and the exact dose poured into a graduated measure glass. The quantity must never be guessed, and spoons are not reliable measures.

When a certain number of drops are to be given a minim measure should if possible always be used, since drops vary very much in size with the character of the fluid and the shape of the bottle. When one or two minims of a medicine are ordered measure ten minims and then add enough water unless any special vehicle is ordered to bring it up to ten drachms. Each drachm of the mixture will contain one minim of the medicine.

While pouring out the medicine the bottle should be held with the label uppermost, that this may not be soiled if any drops should run down the side, and so obliterate directions.

(*b*) *Pills.*—These contain drugs in a solid form. The patient should take a small mouthful of water, then put the pill in the mouth and drink a little more water.

(*c*) *Powders.*—When small these should be shaken on the back of the tongue and then washed down with a drink of some fluid; when too large to do this, they must be mixed with water.

(*d*) *Capsules.*—These are small pear-shaped receptacles made of gelatine, which are sealed up after having a dose of the drug placed in them. In addition certain drugs are often compressed into tablets, and these may be given in the same way as pills.

253. *By the lungs.*—Drugs given in this way are inhaled. Medicines which are inhaled, *i.e.*, drawn in with the air at each inspiration into the lungs, are usually intended to act only upon the lungs, and are therefore almost entirely reserved for cases in which these organs are affected. Inhalations are also used for sore throats and when the larynx is inflamed.

Lastly, certain drugs, such as chloroform, ether, etc., are inhaled for the purpose of producing general anæsthesia.

254. *Oxygen* is often employed in cases of pneumonia, and in other diseases of the lungs. The gas is contained in a metal cylinder which is brought to the bedside. The flow is regulated by means of a stop-cock and the gas is conducted from the cylinder through rubber tubing. If the patient is strong enough he inhales the gas through a glass funnel (which is attached to the rubber tubing) and held before the mouth and nostrils. The effect is carefully watched, the flow of gas being restricted, or the funnel removed further away if any distress becomes apparent.

255. *Hypodermic injections.*—By this method the drugs to be administered are injected under the skin.

"Under the skin" is the meaning of both "hypodermic" and "subcutaneous." Absorption into the circulation is very much more rapid by this way than any other, the drug taking effect within from one to five minutes. Being such a potent method, it is as a rule used only in cases of emergency—for the relief of pain, to induce vomiting, or to stimulate the heart.

Intra-muscular injection is when the injected drug is pushed much deeper, *i.e.*, into the muscles, as in the intra-muscular administration of mercury.

256. *Inunction* means the rubbing of an ointment into the skin. The portion of the skin to be treated should be first washed with soap and water and then dried. This stimulates the circulation in the skin and enables it more quickly to absorb the medicament. This method of introducing drugs into the system is practically reserved for the administration of mercury. The chief point to be remembered is that the ointment must be rubbed into the skin and not left on it, the part being thoroughly massaged with the palm and finger tips. It should take from twenty minutes to half an hour to rub in the usual dose of mercurial ointment. The same spot should not be selected each day, as the skin may become inflamed.

It should be done by the patient himself when it is possible. If, however, it is done by the orderly he should carefully wash his hands immediately afterwards.

257. *Rectal medication.*—Drugs may be introduced into the rectum in either liquid or solid form. They are given in this way when the patient is unconscious or vomiting, or for the relief of diarrhœa or rectal pain, or for stimulating a patient who is collapsed after operation. Liquid preparations should be slowly run in through a glass funnel and rubber tube.

Suppositories are solid preparations of a conical shape and of varying sizes, according to their contents. The suppository is oiled and slowly passed well into the rectum.

258. *Accuracy in giving medicines.*—Full directions are as a rule given as to the time of administration of each dose of medicine. It should always be punctual to the minute. Three-times-a-day medicines are usually given at 10 a.m., 2 p.m., and 6 p.m., twice a day at 10 a.m. and 6 p.m.

A medicine that is ordered to be taken "before meals" should be given a quarter of an hour before food, and one to be taken "after meals," immediately after the meal is finished.

A double dose of medicine should never be given at one hour because the previous dose has been forgotten. After each dose of medicine the measure glass must be washed.

All medicines should be carefully labelled. All poisons should be kept in a separate locked cupboard. The liniments and lotions should stand on a shelf by themselves.

Fluid Measure :—

60 minims	(m. lx)	=	1 fluid drachm.	(ʒ i)
8 drachms		=	1 ounce	(℥ i)
20 ounces		=	1 pint	(o i)
8 pints		=	1 gallon	(c i)

CHAPTER XXIII.

ENEMATA.

259. An enema is a liquid preparation which is injected into the rectum. It is chiefly given to relieve pain, to stimulate, to feed the patient or to produce an action of the bowels. Its composition and size vary with the purpose for which it is used. Nutrient enemata and those prescribed to allay pain are usually small in quantity, those intended to clear out the bowels are large.

260. *Position of a patient during administration of enema.*—The patient is usually placed on the left side or on the back. It is most convenient to have the patient lying on his left side, since the large intestine runs backward from the anal aperture in the direction of the left hip, but it sometimes happens that it is impossible to put him in that position—as, for instance, after an abdominal operation or injury to the pelvis. In such a case the enema must be given with the patient lying on his back. This is more difficult, and it is wise to practise giving it in this position so that when necessary it may be done easily and not cause the patient discomfort.

When the enema is given with the patient lying on his side, the hips must be brought to the edge of the bed and flexed, also the knees. A warmed mackintosh covered with a towel is then placed under him, and the bedclothes, with the exception of one blanket, turned back. The fluid to be injected should be placed in a convenient position and the catheter or nozzle of the syringe oiled. The index finger of the left hand should be passed between the buttocks, and laid lightly on the anus and the tube passed below the finger into the rectum, sending it upwards and backwards. No force must be used, the tube being carefully passed over the small tongue of integument which is found at the anterior angle of the anus.* If the Higginson's syringe is used the fluid must be pumped in with the right hand. Five minutes should be occupied in injecting one pint. There should be no attempt at hurrying otherwise the enema may be instantly returned.

If the patient may not be turned on his side he should, lying on his back, be brought as near to the edge of the bed as possible, the right knee flexed, and the anus found as before with the index finger of the left hand. The tube is then gently passed with the right hand, being directed backwards and slightly downwards. When the injection has been given the tube should be gently and slowly removed from the rectum, and firm pressure at once applied upon the anus with a folded towel to assist the patient in retaining the enema. The buttocks being pressed together also assists in this way.

261. *Purgative enemata.*—Purgative enemata are given either with the object of assisting an easy action of the bowels, as before and after operations, or for the relief of constipation.

(1) *Soap and water enema.*—This is made by dissolving one ounce of soft soap in a pint of warm water. Ordinary yellow soap can be used. One pint is the usual quantity. This is generally administered with a "Higginson's Syringe," often with a No. 12 catheter attached to the nozzle. The temperature of the fluid should be about 100° F. The air should be expelled from the tube before it is inserted. The enema should be retained for from eight to ten minutes. When giving any sort of purgative enema a warmed bed-pan should be ready at hand for use, to prevent accidents.

(2) *Glycerine enema.*—This is usually given by means of a special vulcanite syringe holding half an ounce, the usual quantity given being from one to two drachms.

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* Almost immediately the muscle will relax and the tube slip in.

(3) *Turpentine enema.*—When given as a purgative, one ounce of oil of turpentine is mixed with fifteen ounces of thin starch.

When given for the relief of abdominal distension, half an ounce is usually given in two ounces of thin starch.

(4) *Olive-oil enema.*—An olive-oil enema consists of four ounces of oil with eight ounces of thin starch or four ounces of olive-oil run into the bowel by means of a glass funnel and long piece of rubber tubing, followed in half an hour's time by an ordinary soap and water enema, or four ounces of oil can be beaten up with sixteen ounces of soap and water and injected.

(5) *Castor-oil enema.*—This consists of one ounce of castor-oil mixed with ten ounces of thin starch, or one ounce of castor-oil mixed with three ounces of olive-oil may be warmed and injected, and followed in half an hour by a soap and water enema.

262. *Nutrient enema.*—This is given when a patient is taking insufficient food by the mouth, or when it is desired that the stomach should be kept completely at rest. The powers of digestion possessed by the rectum being limited, any food given in this way must be thoroughly digested by means of "Peptonising powders" before use. The size of the enema, together with the frequency of injection, will be as ordered, four ounces four hourly being the usual quantity for an adult.

Peptonised milk is usually the chief constituent of these enemata. The enema should be strained before administration and be at a temperature of 100° F.

Patients who are being systematically fed by the bowel should have a plain water enema once in every twenty-four hours, and in addition, before each enema is given, the rectum should be gently washed out with warm water or warm boric lotion. To do this a soft catheter, well oiled, to which a piece of rubber tubing with a glass funnel at the other end is attached, is passed into the bowel. By pouring warm water or boracic lotion slowly into the raised funnel, and then lowering it before it is quite empty to allow it to run out again, the bowel is well washed. The enema would be given by means of the same apparatus. The time taken in administering four ounces should be at least five minutes.

A large nutrient enema containing as much as one pint is sometimes ordered. This is more difficult of administration. The tube, which must be fairly large, must be passed for some distance, not more than seven inches, into the rectum in a backward and upward direction. The enema is given in the same way as the smaller one, but half an hour at least must be expended in giving one pint.

A large quantity can also be given by means of an irrigator suspended above the bed, and connected by means of rubber tubing with a catheter in the rectum. The tubing is compressed by a clip so that fluid from the irrigator can only be passed through it very slowly and thus enter the rectum drop by drop, where it is absorbed before any quantity can accumulate.

263. *Starch and opium enema.*—This is given for the relief of pain or to check excessive diarrhœa.

Two ounces of thin starch are mixed with the prescribed amount of laudanum and heated to a temperature of 100° F. It is then slowly injected into the bowel by means of a glass syringe and a rubber tube.

264. *Rectal tube.*—A long rectal tube is sometimes passed for the relief of abdominal distension. A stout rubber tube, well oiled, is passed into the rectum for about seven inches, and left in position. The other end of the tube should be placed in a small basin of carbolic lotion. If any gas escapes from the bowel it will be heard bubbling through the fluid.

CHAPTER XXIV.

EXTERNAL APPLICATIONS, COUNTER-IRRITANTS, POULTICES, ETC.

265. *A gargle* is used as a wash for the mouth and throat. A tablespoonful is to be taken into the mouth, the head then thrown slightly back and the fluid set in motion by breathing through it, at the same time taking care not to swallow any. This should be repeated two or three times on each occasion.

266. *Eye lotions* are used for washing away discharges from the eye. They are applied by means of a vessel called an "Eye Bath," by a special irrigator, or by allowing a steady stream from a pledget of cotton wool held about two inches above the eye, to run over as much of the inner surfaces of the lids as possible. This is most effectually done by everting the eyelids.

To evert the eyelids, stand behind the patient, who is told to look on the ground. Take the lashes of the upper lid between the thumb and forefinger, using the right hand for the right eye, and the left hand for the left eye. Draw the lid downwards and outwards, then turn it quickly backwards over a wooden match or metal probe, or over the finger of the other hand. Retaining the upper lid in position by means of the thumb, the lower lid is now easily everted by placing the fore-finger on the skin below the eye and drawing it downwards, the patient at the same time looking upwards.

267. *Eye drops* are applied in different ways according to the purpose for which they are used. When they are intended to act upon the conjunctiva, the lids must be everted in the usual way and the drops allowed to fall vertically upon the inner surfaces. When drops are used with the object of dilating or contracting the pupil, the lower lid is drawn downwards and one or two drops allowed to fall on its inner surface.

Before using a drop bottle, two or three drops should be allowed to escape from the nozzle so that any foreign matter in it may be washed away.

268. *Counter-irritants* are local applications used for the relief of pain or the checking of inflammation, some producing mere reddening of the skin, and others actual inflammation.

(1) *Mustard plaster.*—Two parts of mustard to one of flour are made into a paste with tepid water. This is spread evenly on a piece of linen cut to a suitable shape and size, and covered with a single layer of washed muslin, when it is ready for application.

(2) *Mustard leaves.*—These are more convenient to apply than the plaster. They should be moistened in warm water before application, the skin having been previously cleaned.

(3) *Application of iodine.*—The skin should be first washed and then the iodine painted on with a camel-hair brush. After the first coat has dried a second should be applied.

When a strong solution of iodine is ordered, the directions as to its application must be minutely observed, as it is very much stronger than the tincture and causes considerable irritation to sensitive skins.

(4) *Liniments* are very mild counter-irritants, which are rubbed in by the hand after the part has been washed.

(5) *Blisters.*—These may be applied in the form of a plaster, or painted on the part.

When the plaster is used the part should be well washed with soap and water, and sponged with ether to remove grease from the skin. The plaster is cut to the shape and size required, moistened with warm water, placed in position and secured loosely with a bandage, so as to exert no pressure on the blister when it rises.

When blistering fluid is used, the part to be painted, having been previously washed, should be outlined with vaseline or oil to keep the fluid within the required space. Two or three coats are then painted on and the part covered with wool and a loose bandage.

The plaster should be left on from ten to twelve hours. If the blister has not risen then, a fomentation should be applied. The plaster is then carefully removed, and the blister which has been produced is snipped at its most dependent point with a pair of sharp sterilized scissors, and the fluid gently pressed into absorbent wool. Sometimes the fluid is allowed to be re-absorbed, the blister being left unopened and merely protected with wool and a bandage.

(6) *The actual cautery.*—As a counter-irritant it may be used :—

(*a*) For the relief of pain, in which case the heated point is not brought into contact with the skin, but is moved to and fro just above it so as to produce a reddening of the surface.

(*b*) For the treatment of chronic joint inflammation. Here the point of the instrument, which is kept at a dull red, is lightly drawn across the part to be treated, so as to produce a superficial burn, which is dressed in the ordinary way.

269. *Leeches* are used for the relief of pain and for the checking of inflammation.

Each leech draws from one to three drachms of blood. The smaller, pointed end is the head of the animal.

Before applying a leech, 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 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, which would produce a troublesome wound. A pinch of salt on the head will make a 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.

270. *Cupping* may be either dry or wet. The dry method leaves the blood in the skin, the wet allows it to escape into a cup by means of small incisions.

Special cupping glasses are generally used for this operation, and also a special instrument for making the incisions.

271. *Ointments* may be applied either spread with a spatula on the smooth side of a piece of lint, or they may be rubbed in with the hand, that is to say, by "inunction."

272. *Lotions.*—Evaporating lotions must be applied on a single thickness of lint, which should be left uncovered. Other lotions are used by soaking a double thickness of lint in them, squeezing out the excess of moisture but not wringing them dry. They should be covered with jaconet or oiled silk to prevent evaporation.

273. *Poultices* are of various kinds, the most common being linseed and mustard.

(*a*) *Linseed poultice.*—Crushed linseed is most commonly used for a poultice.

To make a poultice, a board, a bowl, a kettle, 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 cf 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, which can be prevented 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.

(*b*) *Mustard poultice.*—This is mustard mixed with linseed, the mustard being mixed separately with luke-warm 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.

274. *Fomentations or stupes.*—The best material for a stupe is thick soft flannel. Spongio-piline is sometimes used, also lint and absorbent wool. Boracic wool is used for surgical cases. 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. Boil, ing 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 the tincture being sprinkled on the flannel after it has been wrung out.

275. *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 from great pain, the dropsical, the very young and the old.

76. *Ice-bags* are made of various shapes and sizes to suit the part to which they are to be applied. The cup-shaped ice-bag is the one generally used. This should be half filled with small pieces of ice, with which may be mixed a little common salt to intensify the cold, or sawdust or linseed meal may be added to soak up the water and so make the ice last longer.

277. *Ice-poultice.*—Crushed ice, between thin layers of linseed meal, is spread to the depth of half an inch between two layers of tissue. The tissue is then sealed up all round with chloroform or turpentine.

278. *Leiter's tubing* is soft metal tubing, the coils of which are arranged in the shape of a cap to fit on the head or knee. There are also small ones for the eye. Iced water is allowed to run though the tubes from an irrigator, and a vessel is placed so as to receive the water as it escapes.

CHAPTER XXV

BATHS, PACKS, ETC.

279. *Temperature of baths.*—In addition to the ordinary cleansing bath, baths are ordered for a variety of purposes.

The temperature of these varies somewhat as follows :—

Tepid baths	85° to 92° Fahr.
Warm baths	92° to 98° „
Hot baths	98° to 105° „

The bath thermometer should be used on all occasions.

Before giving any kind of bath, instructions should be obtained as to the temperature of the bath, and the length of time the patient is to be kept in it.

280. *Cold bath.*—A cold bath is given at about a temperature of 65° Fahr. It is given in cases of hyperpyrexia. In many cases it is not considered advisable to lower the patient directly into the cold water, the temperature to begin with being as high as 85° F., and being cooled down by the addition of iced water.

281. *Hot bath.*—A hot bath is given to relieve pain in renal colic, to soothe excitement in chorea and delirium, to relieve retention of urine, and to promote perspiration in uræmia.

These baths are usually given at the bedside, the patient being lifted into them from the bed.

282. *Hot-air bath.*—To give this a special apparatus is necessary. Allen's apparatus without the boiler is generally used.

Blankets are placed over and under the patient, and his shirts removed. A mackintosh must be placed under the lower, and two wicker-work body cradles over the upper blankets. These are covered with two blankets, over which is placed a mackintosh, and over that again another blanket. The blankets should be well tucked in under the mattress. From the foot of the bed withdraw the blankets covering the patient, insert the spout of the kettle just within the lower cradle and light the lamp, which has several wicks. The spout should be guarded by asbestos, otherwise the blankets which are pinned round it will be scorched. A cloth wrung out of iced water should be laid over the patient's forehead and kept cold. He should also be given cold water to sip.

Duration.—In the absence of any special orders, the duration of a hot air bath is 20 minutes. At the end of that time the light should be put out, the hot-air pipe withdrawn, and a warm dry blanket slipped in under the cradles. The temperature may be from 108° F. to 150° F. The latter heat can only be borne when the baths have been in use for some time. The mackintosh and cradles will then be removed and the patient left lying between blankets for an hour until he has done sweating; he should then be sponged with warm water, and a warm shirt put on.

If the patient shows signs of exhaustion or faintness during the bath, the lamp must be put out at once and the cradles removed.

283. *Vapour bath.*—This is given in the same way, except that the boiler is used in the apparatus, and the steam from the boiling water is introduced into the bed instead of hot dry air. The water should be boiling when the apparatus is inserted, and the boiler must not be more than half full. The temperature may be from 105° F. to 110° F.

284. *Mercurial vapour bath.*—To give this a patient must be sitting upright in a chair. The same apparatus is used minus the long tube for inserting under the bedclothes. A small dish containing the amount of calomel prescribed is placed over the spirit lamp under the chair. The calomel is converted, by the heat of the lamp, into vapour, which is carried upwards by the steam and deposited upon the patient's body. The patient must not be rubbed down, or the calomel would be wiped off and no benefit follow. He should be put back to bed in a warm flannel garment.

285. *Continuous bath.*—This is ordered sometimes for cases of skin disease, extensive burns, and severe local surgical injuries or disease. The bath may last for some days and should be kept at an even temperature of 100° F. A thermometer should be kept constantly in the bath.

The bath is easily kept hot by removing some of the cooled water from time to time and adding hot water about 200° F., care being taken not to burn the patient in so doing.

286. *Arm and leg baths* are much used for septic cases. They are given in a special trough-shaped bath. The bath is half filled with water, to which the prescribed lotion is added. The temperature should be 100° F.

287. *Medicated baths* :—

(*a*) *Sulphur bath.*—Six ounces of sulphur are required for thirty gallons of water. The sulphur should be first dissolved in boiling water and then added to the bath.

(*b*) *Iodine bath.*—To every pint of water one drachm of tincture of iodine is added.

(*c*) *Bran baths.*—Put four pounds of bran in a muslin bag and pour over it at least one gallon of boiling water. Fill up the bath, squeezing the bag of bran. Temperature 100° F.

(*d*) *Alkaline baths* are prepared by adding six ounces of carbonate of soda, or potash, to a hot bath. This bath is given for rheumatism.

(*e*) *Brine baths* are prepared by adding about six pounds of common salt to an ordinary hot bath.

288. *Hot pack.*—Prepare the bed by rolling in a long mackintosh with a blanket over it. Cover the patient with a blanket and remove his shirts. Take a large sheet, fold it across into four. Wring it out of water as hot as possible, using a sheet or large bath towel as a wringer. Lay the patient on his back in the bed, lay the hot sheet over him, moulding it well into him, well into the neck, and down the sides. Turn up the sides of the blanket he is lying on. Cover with a mackintosh and plenty of blankets. Hot drinks promote perspiration. The patient should remain in the pack for twenty minutes. Take away the wet sheet, blanket, and mackintosh, and cover up the patient with a hot dry blanket, and leave him for an hour.

289. *Cold pack.*—Prepare the bed as for a hot pack, wrap the patient in a sheet wrung out of cold water. If the feet become very cold, a hot bottle may be put to them. The sheet must be kept cold by being rubbed down with pieces of ice, or by being constantly watered with iced water.

The temperature must be taken every five minutes, and the pulse watched. The duration of the pack depends upon its effect on the temperature.

290. *Sponging* is employed to reduce the temperature during fever by permitting evaporation of the water from the surface of the body. Cold or tepid water is usually used. A blanket should be rolled under the patient and the shirt removed, bath towels being tucked in on each side to catch any water that may run down. The bedclothes, with the exception of one blanket, are removed. The whole body should not be exposed at one time, only the part to be sponged being uncovered. Sponge the part rapidly, particularly over the great vessels, at the root of the neck and in the groin. After sponging, the patient should only be lightly dabbed with a towel. The water should be maintained at the temperature ordered, by adding either iced water or ice as required.

CHAPTER XXVI.

THE NURSING OF HELPLESS PATIENTS.

291. *Washing of patients.*—When a patient is too ill to go to the bath, he must be washed all over in bed between blankets; under the bottom blanket should be placed a mackintosh. This blanket bath should be given to all patients on admission who are unable to take an ordinary bath, and to all patients confined to bed, at least once a week. When giving a bath, any swellings, scars, scratches or sores should be noted and reported.

Every day each patient confined to bed should be washed as far as the waist, back and front, the shirts being removed. This thorough washing should be done in the morning, and should include the skin over the sacrum, buttocks and hips. The hands should be washed in the middle of the day, and the face and hands again washed at night, also the skin over the sacrum, buttocks and hips. The hair must be combed and brushed, and the patient's brush and comb should be washed at least once a week. The teeth must be washed daily.

292. *Cleansing of mouth and teeth.*—In acute illness sordes and mucus collect on the teeth and give them a dirty appearance. When this accumulation of sordes and mucus is rapid, and when the lips and tongue are stiff and dry, attention may be needed every hour, but in ordinary cases twice a day will suffice. The mouth should be kept as moist as possible. The best sponges for washing out the mouth are made of squares of white gauze or lint, which should be burnt directly after use. One of these squares should be wrapped round the index finger, soaked with the wash, and inserted into the mouth. The teeth, gums, roof, and sides of the mouth should all be gone over. A solution of boracic, or lemon juice and glycerine may be used. Dressing forceps or small sticks of wood may be used instead of the finger, but the latter is the most efficacious. The hands must, of course, be well scrubbed directly after in antiseptic solution.

293. *To guard against bed-sores.*—This is one of the most important points to remember with helpless patients. Bed-sores result from continuous pressure on a certain spot or spots, also from friction, from moisture, creases in the under sheet or shirt, and from crumbs in the bed. Bed-sores due to pressure occur most frequently on the hips and lower part of the back, the shoulder and the heels. Those from friction are apt to come on the ankles, the inner surfaces of the knees, or on the elbows and back of the head from frequent movements. With patients

suffering from paralysis or spinal injuries the utmost care will not always avail, but generally with good nursing, bed-sores can be avoided.

Preventive measures consist in absolute cleanliness, and the removal of pressure. The back and shoulders should be washed with soap and water and carefully dried night and morning. After washing, the skin should be treated with spirit in some form—methylated spirit, brandy, or eau-de-Cologne—which should be well, but gently, rubbed in, the parts being then dusted with oxide of zinc and starch powder. In cases where the sphincter muscles are relaxed the skin should be treated with ointment to protect it from the irritating effects of the discharges, the patient being frequently washed.

Water and air beds are of the greatest possible value. Rubber ring-cushions are also very useful. The knees, ankles and elbows may be protected by a thick layer of cotton wool firmly secured by a bandage. When possible a patient should never be allowed to lie more than two hours in one position. He should be turned first on one side and then on the other, and kept there by an arrangement of pillows.

The first indication of an on-coming bed-sore should be at once reported.

294. *The moving of helpless patients.*—It requires two people to comfortably move a really helpless patient, one on each side. Each passes one hand under the patient's back at the lower part of the shoulder blades, the hands being then locked together. The other hands are passed beneath the patient's thighs close up to his hips, and also locked together. The patient is then steadily raised and placed in the sitting position.

If the patient is not too weak, and is able to help himself with the pulley, one person can raise him in bed by putting the right hand and arm well behind his back, and the left below the hips, gradually moving him up the bed, the patient at the same time assisting himself with the pulley.

Should the patient have an injury to the legs, a third person will be required to support the lower extremities.

To move a patient from one bed to another, the two beds must be placed side by side so that the mattresses are in contact. The patient is then drawn slowly across by the sheet on which he is lying, this being afterwards slipped away from under him. If there are enough assistants he can be lifted, one taking each corner of the sheet.

To prevent a patient who is very weak from slipping down into the bed after being propped up, a bolster is rolled in a draw-sheet and is then placed beneath the upper part of the patient's thighs and the draw-sheet tucked firmly in at the sides of the bed.

295. *Changing the sheets.*—Unless the patient is very ill, one person can do this easily. Only the upper sheet or a single blanket is to be left over the patient. The lower sheet and draw-sheet to be removed are loosened at the top, bottom, and each side of the bed. On one side they are then folded along their whole length as flatly as possible until they are close up to the patient. The fresh sheets should then be folded lengthwise alternately backward and forward for half their width, and placed on the side of the bed from which the soiled ones have been removed, the loose halves being tucked in at the side. The orderly then moves to the opposite side of the bed, and turns the patient on his side, facing him. The patient can be supported in this position with one hand, while the sheets to be removed are tucked as closely and smoothly as possible up to his back, their place being taken by the fresh ones which are made to follow them closely. Using both hands, the orderly now gently turns the patient towards the side of the bed away from him. The soiled sheets and the folds of the clean ones are then drawn through, the former being taken away and the latter smoothed down and tucked in their place, care being taken not to leave the smallest wrinkle. The patient can often assist in this changing by a pulley suspended above the bed, by means of which he can raise himself more or less. If the patient is quite helpless and very heavy, it is advisable to have a second person to assist. In changing the upper coverings a fresh sheet and blanket are first spread over, and the others are then slipped away from underneath. It is quite unnecessary to expose any part of the patient in changing the entire bed clothing.

296. *A draw-sheet* is used for all patients confined to bed. This is constantly drawn through, thus enabling the patient to lie on a cool spot. When the patient is taking food, the draw-sheet should be drawn after each meal to remove the crumbs, and it should be changed when soiled with discharges. Mackintoshes are used on beds only as a protection to the mattress, and should be withdrawn as soon as they are felt to be unnecessary.

297. *Feeding of patient.*—Food of a liquid nature should be administered by means of a feeding cup. If a glass or cup is used it should be only half filled. Nourishment should be given regularly, in most cases every two hours. If it is necessary to raise the patient's head to administer a drink, one arm should be inserted under the pillow and the head gently raised.

298. *Bed-pans.*—The commonest and most useful shapes are the "Circular" and the "Slipper." The round pan is generally used in hospitals. If the patient is not absolutely helpless, one person can give it. Place one hand almost under the buttocks and help the patient to raise himself, the bed-pan being then placed in position. Before attempting to remove it, the patient should be lifted right off it. The handle should be plugged with a rubber cork, and after use the bed-pan should be at once covered with a china cover, over which is thrown a cloth wrung out of some disinfectant. It is then straightway removed from the ward, and, unless needed for inspection, at once emptied, the pan being thoroughly flushed with cold water.

Urinals for use in bed are in the shape of bottles. They should be removed from the ward as soon as used. Both bed-pans and urinals should be washed once a day with soap and water.

299. *Nasal feeding.*—In some cases it is necessary to resort to nasal feeding. This is done by means of a tube passed into the œsophagus. A soft rubber tube is taken, which is well oiled, and passed into the nostril and straight backwards. The possibility of the tube slipping into the larynx must be borne in mind, but if this accident should happen, the patient would at once cough and show signs of urgent dyspnœa. To the end of the tube a glass funnel is attached, and the food, which should be carefully warmed to 100° F. and strained, is poured down in a steady stream, the tube not being allowed to become empty until the entire quantity is given. When the whole of the food has been given, and the funnel is empty, the tube should be withdrawn quickly. It should be compressed by the finger and thumb to prevent the escape of fluid into the larynx on withdrawal.

300. *Care of the dead.*—After death, before the muscles of the body become stiff and rigid, the eyes should be closed. When necessary, pads of wet wool should be placed over the eyelids. The limbs should be straightened and the mouth closed. The lower jaw is supported either by means of a roller bandage placed under it, or by putting on an ordinary jaw bandage.

About one hour after death the body should be washed from head to foot with soap and water, and the rectum plugged with wool. The ankles are tied together with a bandage, fresh dressings are placed on any wound there may be, the hair brushed, and a shroud put on. A clean sheet is placed over all.

CHAPTER XXVII.

THE OBSERVATION OF THE SICK.

301. *Reporting on a patient.*—A concise and correct report should be kept, in writing, of all patients seriously ill, noting quantity of nourishment taken with the times of administration, amount of sleep, urine and stools passed. The temperature, pulse, and respiration must be noted four hourly, and mention made if any symptom of importance is noticed.

302. *What to observe.*—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 pale or flushed, or is there a bluish tinge about the face? Is he well or ill-nourished? Which position in bed gives him the most ease, *i.e.*, 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 character and duration of any pain the patient may complain of.

Any scars, ulcers, abrasions, bruises, or discolorations about the skin, any swellings, œdema, jaundice, or any profuse perspiration should be reported. Any rash, redness, or eruption making its appearance on the skin should be carefully noted.

The eyes should be carefully observed and any irregularity in the size of the pupils, or tendency to squint, be reported.

It is important to note pain in or discharge from the ear. In any case of head injury the escape of blood or clear fluid from the ears should be watched for.

The presence of sordes on the lips, teeth, and tongue should also be noted.

It should be observed whether the tongue is tremulous or not, whether clean or furred, dry or moist, or if any ulcers are on it.

Any difficulty in swallowing should be noticed, also sore throat, or symptoms of indigestion such as flatulence, tightness of the chest, pain at the pit of the stomach or between the shoulders, or nausea after eating, together with the exact relation to food. Quantity and quality of vomit should be noticed.

Blood vomited is known as *hæmatemesis.* When blood has been retained for some time in the stomach it becomes partially digested and resembles coffee grounds in appearance.

A patient who has vomited blood must be kept in the recumbent position, and all food withheld till he has been seen by the medical officer.

It is important to distinguish between blood brought from the stomach, and blood coughed up from the lungs. Blood from the stomach is generally dark in colour, and sometimes partly clotted. It is also frequently mixed with food or traces of food, and is vomited up. Blood from the lungs is usually coughed up, is bright red in colour, frothy and rarely clotted.

Any abdominal pain or distension should be noted.

303. *Stools.*—The points to be noticed are their shape, colour, consistency, amount, and whether they contain blood, mucus, pus, or undigested food; the frequency of the motion, and whether there is any pain in passing it. Anything unusual should be kept for inspection.

304. *Urine.*—The colour of the urine should be observed, also if there is any difficulty in passing it. The patient may be unable to pass urine at all, a condition known as "Retention of Urine." This must not be confused with "Suppression of Urine" when no urine is excreted by the kidneys.

The quantity of the urine should be noticed, together with the frequency of micturition, remembering that the normal quantity of urine passed in the twenty-four hours should be about fifty ounces.

305. *Cough.*—The points to notice about a cough are its frequency, duration, and character.

Expectoration varies in character in different diseases, and also at different times in the same disease. A specimen of sputum should be kept for inspection, and if the quantity seems excessive, it should be measured for the twenty-four hours.

Hæmoptysis or the spitting of blood, if it occurs in any quantity, is almost always due to phthisis.

The patient must be kept quiet, in the semi-recumbent position, and small pieces of ice may be given to him to suck. An ice bag may be applied to the chest.

306. *Fits* most commonly occur in cases of epilepsy, but are a frequent symptom of brain and kidney diseases. The duration and severity of the attack should be carefully noted, and in what part of the body the convulsions begin.

A patient in a convulsion or fit should never be left alone. Care must be taken that he does not injure himself, and that the tongue does not get between the teeth. To prevent this something should be inserted between the teeth to keep them apart.

307. *Delirium.*—When delirium is present it should be noticed if it is of the low muttering type, or active and noisy; also if it is more pronounced during one part of the twenty-four hours than another. It should be observed if the patient picks at the bed clothes.

308. *Sleep.*—It should be noticed how long the patient sleeps, and whether his sleep is disturbed or sound and calm. To encourage sleep, the room should be darkened and the light shaded from the patient's eyes. If a patient does not sleep he may be given a drink of warm milk or some other nourishment if 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.

309. *Temperature.*—This is taken by means of a small glass self-registering thermometer known as the "Clinical Thermometer." Before taking a patient's temperature, care must be taken 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 to always take it by placing the instrument in the same place and at the same hour. When taken in the axilla, the parts should be wiped dry before inserting the bulb of the thermometer, 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 taken in the rectum the bulb should be smeared with vaseline and inserted for about one inch, and held in position.

The thermometer should always be washed in tepid antiseptic solution before giving it to another patient.

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 twenty-four 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 twelve to twenty-four hours; if by the latter the descent is more gradual, three or four days elapsing before the temperature reaches normal and remains there.

310. *Pulse.*—Taking the pulse needs long and painstaking practice. It is one of the most important guides with regard 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 per minute. When 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.

311. *Respiration.*—The points to be observed are the frequency and character of the respirations, the normal number being from 15 to 18 per minute. The patient should never know his respirations are being counted. If he is conscious of it he may unintentionally alter their frequency. The best way to manage is, after counting the pulse, and without removing the fingers from the wrist, to quietly count the movements of the chest.

312. *Rigors.*—A rigor is a most important symptom to take note of. In some cases a rigor marks the onset of an acute illness. The shivering may be only slight, or it may be most severe, with a general shaking 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.

CHAPTER XXVIII.

SURGICAL NURSING.

313. *Two great principles.*—The care of most surgical cases involves the application of two great principles—cleanliness and rest.

(1) *Cleanliness.*—By surgical cleanliness is meant something more than ordinary personal cleanliness. It means not only freedom from dirt but freedom from germs.

Germs, or microbes as they are called, are present everywhere. They are so small that they are not visible to the naked eye, and can only be seen when highly magnified by the microscope.

To prevent germs from entering a wound we endeavour to ensure complete freedom from living germs on everything which may be used during an operation or during the dressing of a wound. Articles that cannot be subjected to sterilization by heat are treated by antiseptics.

Two expressions commonly used with reference to the treatment of wounds are "Asepsis" and "Antisepsis." By asepsis is meant freedom from germs, while antisepsis refers to the measures employed to destroy the germs which may be present either in the wound or on the skin.

(*a*) *Sterilization and cleaning of instruments.*—Instruments are sterilized by boiling. They are put into boiling water to which one per cent. of bicarbonate of soda has been added, and are boiled for ten minutes. Knives should only be boiled for one minute, as the more prolonged boiling blunts their edges.

After an operation the instruments should be rinsed in tepid water, and then scrubbed with a nail brush in hot water and soap, to which a little bicarbonate of soda has been added, after which they are again rinsed in water to remove the soap, and dipped in methylated spirit.

(*b*) *Ligatures and sutures* are made from silk, silkworm gut, cat-gut, kangaroo tendons, and horse-hair, and they are each sterilized in a special manner. Silk, silkworm gut and horsehair can all be boiled.

(c) *Bowls and trays* must be sterilized before use. If it is impossible to boil them they should be well scrubbed with soap and hot water, and allowed to stand in 1 in 20 carbolic for twenty-four hours before use.

(d) *Towels, gowns, dressings and swabs* are all lightly packed in tins and sterilized by heating to 212° F., in a dry sterilizer for twenty minutes. After being sterilized the tins should be sealed down and not opened till the time of operation.

When a tin has been once opened, any of the dressings left over should be re-sterilized.

(e) *The hands* require a very thorough scrubbing with soap and water. The hands and arms up to the elbows should be scrubbed for at least five minutes continuously, special care being taken with the nails, and between the fingers. Plenty of soap must be used and the water changed three or four times, or, better still, they should be washed under a running tap. The nail brush should be thoroughly sterilized, preferably by boiling. After this thorough washing, the hands should be soaked in biniodide lotion, 1 in 1,000, and left wet or wiped with a sterilized towel. Rings must on no account be worn.

(2) *Rest.*—The second great principle is rest, both local and general. Thus, when the stomach has been operated on, it is kept at rest by not giving it any food to digest. General rest is obtained by keeping the patient in bed, and rest in the case of the limbs is carried out by means of splints, bandages, and other mechanical appliances.

It is the duty of the attendant to see that the splints, bandages, and other mechanical appliances are kept as originally applied.

In the case of a fracture, if the limb be not kept still, the ends of the bone will constantly rub against one another, so giving rise to continual irritation, and union may be delayed.

314. *Wounds* are classified as :—

Incised.—Such as are made with a sharp instrument.

Contused.—Such as are made with a blunt instrument.

Lacerated.—When the tissues are torn and ragged.

Punctured.—When made by a pointed instrument.

Wounds are said to heal in two ways—by first intention, and by granulation.

In wounds that heal by first intention, the edges straightway become glued together and remain so. There is at no time any discharge beyond a small quantity of blood-stained serum in the first twenty-four hours. At the end of ten days or a fortnight the wound has completely healed, a thin red scar being all that remains of it.

Healing occurs by second intention, or by granulation if the wound is not aseptic, or if the edges cannot be brought together. Wounds which heal by granulation are much more difficult to keep free from infection. The granulations are seen as small red elevations which grow from the bottom and sides of a wound till it is filled up.

Skin grafting is employed when a large area of granulation tissue has to be covered with skin, as after extensive burns. By means of a sharp knife or razor, pieces of skin are pared off the arm or leg of the patient and laid on the granulating surface. The grafts are then covered with prepared tissue to prevent them sticking to the dressing. Those grafts which adhere, grow on the granulating surface and become centres from which the skin grows to meet that which is growing from the edges of the wound. The time taken in healing is thus materially shortened.

315. *Shock* is a condition of general depression of the whole system. This condition occurs after severe frights, injuries, and operations. Collapse and prostration are words used to express similar conditions. The symptoms to be looked for in shock are a weak, rapid pulse, a sub-normal temperature, pallor, a pinched look on the face and about the lips, cold and clammy skin, and sometimes nausea. The patient must be placed with his head low. If in bed, the foot of the bed should be well raised, and hot-water bottles and hot blankets applied. An enema of hot saline solution with brandy is often ordered. Ether and strychnine should be ready for the medical officer's use, and stimulants by mouth will probably be given.

316. *Operations.*—The day before an operation the patient's skin is prepared. Unless orders are given to the contrary, the part should be shaved, and then gently but thoroughly scrubbed with soap and water, afterwards being rubbed over with ether to remove all grease. A compress is then applied, soaked with some authorised antiseptic, according to the orders of the surgeon. This is firmly bandaged on and left till the time of the operation.

A purgative is usually given on each of the two nights preceding the operation, and on the morning of the operation, enemas should be given till the rectum is empty. Two or three may be necessary.

Food in a fluid form should be given four hours previous to the operation, but nothing else unless by special orders.

The patient should be clad in a loose flannel gown, the legs being covered with long woollen stockings, which should be sterilized.

False teeth should be removed. The patient should pass water before going into the operation theatre.

The operation bed should be made up with clean linen, a draw sheet and mackintosh placed in position, and the bed clothes folded over to one side so that the patient can be quickly put back to bed. Hot bottles should be placed in the bed, and a blanket made hot to cover the patient with, on return from the theatre.

After any prolonged operation, a hot saline solution should be prepared and ready at hand in case of need, also blocks to raise the end of the bed. A towel and bowl should be at the bed head, as the patient usually vomits on coming round after a general anæsthetic.

A bed cradle to support the weight of the clothes is advisable in some cases, and should be at hand in case of need.

In all operations food is withheld until the anæsthetic sickness has passed off. Thirst is relieved by drachms of hot water given slowly. The tongue may be kept moist by allowing the patient to rinse the mouth with a little water or soda-water. Special instructions with regard to the after-feeding of the patient will be given according to the nature of the operation, but to no patient will an ordinary diet be given on the day of the operation. Milk or milk and soda water would in all probability be the only food allowed.

On the evening of the operation the gown should be changed, the patient's hands and face sponged and the draw sheet drawn through. On the morning before and the morning after operation a specimen of urine is saved for examination.

317. *Operating Theatre.*—The theatre where the operation is to be performed must be clean and free from dust, of a temperature not less than 70° F., and there must be plenty of hot and cold water.

The table upon which the operation is performed is usually kept warm by means of hot water. It should be thoroughly cleansed before an operation and covered with a sterilized sheet. There are in addition other smaller tables for the instruments, dressings, bowls of lotion, and one for the anæsthetist's use.

318. *The after-nursing of cases of abdominal section.*—Abdominal section may be performed for a variety of causes, but the nursing of such cases is very similar. If the operation has been prolonged and difficult, the patient may suffer severely from shock. In such a case he must be put back to bed as carefully and quietly as possible, and a pillow placed under the knees, with the head low, one pillow only being used. Hot bottles should be in the bed and the foot of the bed raised. Particular attention must be paid to the pulse. It should be taken and recorded every hour for the first twenty-four hours. The frequency and character of the vomit must be noted. If retching is severe the wound should be supported by the attendant's hand being placed over the bandage. Note must be taken if urine has been passed or not, if the bowels have acted or not, and whether the patient has passed any flatus by the bowel.

Instructions with regard to the giving of nourishment must be carried out with the strictest accuracy, each feed being recorded on the chart.

Nourishment by the mouth may not be allowed for twenty-four or thirty-six hours, and then probably in very gradually increasing quantities. For allaying the excessive thirst, an enema of a normal salt solution, a pint or more, given hot, is frequently ordered, the mouth can be rinsed out with hot water, and the lips moistened from time to time.

Stimulants should be kept near at hand, and if the patient is in an exhausted condition a nutritive enema may be ordered at once.

For uneasiness and pain in the back insert a small flat pillow. The knee pillow must be adjusted and changed when necessary.

Abdominal distension must be watched for and reported.

319. *Amputations.*—After an amputation of either arm or leg has been performed, the stump should, when the patient has been put back to bed, be placed on a small pillow, to which it is secured by a bandage. This helps to restrain the painful muscular startings which occur sometimes in the stump, which should be left uncovered by the bed clothes so that if any hæmorrhage occurs it may be at once detected.

320. *Secondary Hæmorrhage.*—After major operations, hæmorrhage should be watched for during the first twenty-four or forty-eight hours. Indeed the possibility of such an occurrence should be borne in mind until the wounds have healed perfectly, as "secondary hæmorrhage" may occur several days after the operation. Any bleeding, however slight, should be at once reported. Should the hæmorrhage be profuse, prompt action will be necessary, and unless a tourniquet has been left in position, with instructions how to use it, an endeavour should be made to stop the bleeding by compressing the main artery between the wound and the heart.

321. *Tracheotomy.*—This is usually an emergency operation, and consists in making an opening in the trachea, and inserting a tracheotomy tube through which the patient breathes. A tracheotomy tube consists of a tube within a tube made of silver. 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 then tied together round the neck. The inner fits into the outer tube and projects for a short distance beyond the lower end.

The after-care consists in the management of the tube, in feeding and good general nursing. Constant attention to the condition of the inner tube is necessary, as the mucus 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 at least every four hours and cleaned unless some immediate difficulty arises, when it must be done at once. No attempt must be made to interfere with the outer tube, the surgeon alone touching that. The air the patient breathes must be warm and moist. A steam kettle may be used, and gauze ordered to be placed over the tube. Immediately any mucus is coughed up it must be wiped away with small gauze swabs, which should be immediately burnt. If feathers are used for cleansing the tube, they must be sterilized. The gauze over the tube will require constant changing. The dressing which protects the edges of the wound round the outer tube must be changed when soiled. The temperature of the ward should be kept at about 70° F.

Nourishment should be administered regularly. Sometimes this is a matter of some difficulty. Thickening the milk with arrow-root or corn-flour makes it easier to swallow, but in some cases nourishment has to be administered by means of the nasal tube, or by rectal feeding. The patient must never be left alone.

second inner tube, tracheal dilators, pilot, and dissecting forceps should be kept in an authorised antiseptic by the bedside.

CHAPTER XXIX.

MANAGEMENT OF WARDS.

322. *Annexes.*—To render the condition of a ward wholesome it is necessary not only to regulate its temperature but also to provide for the ingress of a supply of fresh air at all times day and night.

The waste pipes and sinks in the annexes must be properly cleaned and flushed daily. No soiled or infectious linen and no soiled clothing or dressings should be left standing about in uncovered receptacles. All vessels in use must be kept thoroughly cleansed.

323. *Ventilation.*—By ventilation is meant the supply of fresh air to and the removal of impure air from an apartment.

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, 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 be at once 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 :—

(1) That the air within the ward shall be kept as nearly as possible as pure as that outside, without chilling the patients.

(2) That the temperature of the ward be maintained at the proper standard, not exceeding 65° F.

(3) That ventilation must be systematic and sufficiently thorough to completely renew the air in a ward 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.

(1) Air expands when it is heated; from which it follows that, as the air in a room expands, some of it escapes by the nearest outlet.

(2) As a result of its expansion, hot air is lighter than cold air so that hot air will rise, and cold air, being heavier, will fall.

Foul air escapes from a room by :—

(*a*) The fireplace.
(*b*) The windows.
(*c*) Ventilating outlets.

Being lighter than the pure air it 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 hot 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.

Fresh air enters a room by :—

(*a*) Ventilating inlets.
(*b*) The windows.

Inlets.—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. Fresh air will also enter a ward every time the door is opened, and underneath it even when shut, but if this air is from inside the building, the door should not be regarded as a means of ventilation.

Patients frequently complain of draught 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.

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.

324. *Floor of ward.*—The ward floor should be swept every morning and again in the middle of the day. In sweeping hospital floors it is important to raise as little dust as possible. By fastening a flannel over the brush or broom this danger can be almost entirely averted.

325. *Polished floors.*—When the floors are polished they require to be first swept, then the polish used. This must be applied on house flannel on hands and knees, and well rubbed on to a section of the floor, which must afterwards be well dry rubbed by a heavy weighted, long handled brush, the corners being done by hand. Polished floors should be well scrubbed with hot water and soft soap once in six months at least.

326. *Dusting.*—Dusting should be done twice a day in the wards, with two dusters, a damp and a dry one. The damp one is used first and the dry one for polishing. Walls should be washed down every three months.

327. *Cleansing of windows.*—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 then polishing it with a clean and thoroughly dry duster. This mode of cleaning is not always necessary, for if the glass be wiped over daily with a duster it will generally suffice to keep it in good order. The cloths used should be free from nap or fluff.

328. *Cleaning of stoves.*—In cleaning stoves 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, while the brush is used with the other hand. The blacklead should be made into a thin paste and applied with the 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 bath-brick and a piece of leather or coarse cloth, or burnished.

The best time for cleaning a fireplace is before the fire has been lighted; but as this can be seldom done in hospital wards, each morning the fire should be allowed to become low in order that the stove may be cleaned before it becomes too hot.

329. *Cleaning of paint.*—The paintwork of a ward should be occasionally scrubbed with hot water and soap. Soda should not be used, as it soon destroys the paint (including enamel).

330. *Cleaning of woodwork and utensils.*—Bedside tables, boards over the patients' beds, diet trays, and all white wood should be scrubbed with hot water and soft soap. Tumblers and all glass articles should be washed separately, first in warm water with soda and then in cold water. 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. Coal scuttles and brasses should be polished with a paste made of finely powdered bathbrick and water, unless a patent polish is used, and rubbed with a piece of leather or coarse cloth. When the brasses are very dirty they should be washed with hot water before being polished.

331. *Beds.*—Beds should be thoroughly aired every day and the mattress turned.

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 the 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 mackintosh is used it should be folded so as to completely cover the mackintosh.

332. *Air and water beds.*—Air and water beds are used in certain cases. They are a preventive against bed-sores. The air bed is laid on the top of an ordinary mattress. There are several patterns, that used in military hospitals having three compartments, the smaller one of which is put to the head. The air is pumped into the three compartments separately. 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. After being placed in position on the bed it is 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.

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.

CHAPTER XXX.

PREVENTION OF DISEASE.

333. The prevention of disease depends largely on a knowledge of its causes. If we look closely into the nature of the chief diseases we find that they can be divided, roughly, into the following groups: (1) diseases which are the result of some inherited defect or fault in the make of the body, (2) diseases which are the result of accident or injury, (3) diseases which are the effect or result of climate, (4) diseases which are due to either foolish habits or faulty modes of life, and (5) diseases due to some cause or causes introduced into the body from without.

So far as soldiers are concerned, we may say that the first group does not apply, as all soldiers are medically examined before they enlist, and no men become soldiers who have body defects likely to give rise to sickness or disease. The second group we may dismiss as largely non-preventable; accidents and injuries are bound to occur occasionally, even in a well-regulated army. Of the diseases caused by climate or weather, it is doubtful whether there are many, the chief one occurring among soldiers being sunstroke or heatstroke. In the fourth group are such diseases as the various venereal affections, alcoholism, and those forms of sickness the result of the abuse of both drink and food. In the last or fifth group are diseases like enteric fever, cholera, dysentery, small-pox, plague, malaria and a number of others, all of which are caused by the entering into the body from without of the cause, which is a living thing or germ.

It is quite clear that, from the nature of their causation, the various diseases included in the last three groups are more or less preventable. Thus, sunstroke and heatstroke can be avoided by the exercise of reasonable care in safeguarding the head from the effects of the direct rays of a powerful sun and otherwise protecting the body from the effects of excessive heat. In the same way, venereal diseases can be avoided by the exercise of chastity and self-control, while, too, the effects of excessive eating and drinking are to be controlled by self-discipline, moderation and common sense. The avoidance and prevention of the diseases in the remaining group is not quite so simple, and involves a consideration of the nature and mode of action of the germs or living things which are their cause.

334. *Microbes or germs.*—The size and shape of the living things which are sometimes called germs or microbes, and which are the cause of a number of diseases, varies; their size may be anything from one fifty-thousandth to one ten-thousandth part of an inch, and their shape may be equally variable. Some are merely minute spherical granules to which we give the name *micrococci;* others, from their rod-like shape, are known as *bacilli;* whilst others, having a corkscrew or spiral form, are known as *spirilla.* All these various forms are sometimes spoken of as *bacteria,* but no matter what is their shape or size, these various germs or microbes are living things and capable of producing others of their kind. The process of reproduction amongst the micro-organisms is generally a very simple one, and takes place under favourable conditions with enormous rapidity. The spherical micrococci and the majority of the bacilli and spirilla merely divide into two. In other cases, however, the bacilli multiply by the production within their substance of a round or oval bead-like body. This is known as a *spore* or seed, and from it grows in due time another bacillus. These spores of bacteria are the hardiest forms of living matter of which we know, being able to resist extremes of heat, cold and drying, conditions which would be immediately fatal to the parent bacilli from which they have sprung.

It must not be supposed that all bacteria or germs are hurtful and capable of producing disease; it is far otherwise. The majority of micro-organisms do good, and we could not carry on our lives without them; it is only a small number which are harmful to man and able to cause disease. Should, by chance, these disease-producing germs or bacteria gain access and a foothold, as it were, in man's body, they grow and increase in numbers. Sometimes they prefer to grow in the blood, at other times in the lungs, or spleen, or liver, or the bone marrow, while sometimes they prefer to grow inside the bowel, or perhaps outside the body on the skin or in the roots of the hair. The greater number of the disease-producing germs live and thrive in the blood and other juices of the body. While growing and multiplying there they make or excrete a poison, or *toxin* as it is called, and it is the circulation of this poison or toxin in the blood and body juices which makes a man ill and gives rise to the various symptoms of the particular disease which is being caused. Whether a person is going to recover or not from the effects of the growth of the disease germs in his body depends upon how well or how successfully he can manufacture an antidote or corrective to the poison made and poured into his system by the germs. If sufficient of the antidote is made, then the germs are gradually killed and their poison neutralized, followed by the gradual recovery of the sick person. If, on the other hand, the germs make so much of the poison or the patient fails to make sufficient antidote to neutralize the germ poison, then he dies as the result of the disease caused.

This behaviour of these disease-producing germs in the human body is very similar to the action of yeast or other ferments when growing in sugary solutions such as malt and water, or apple juice or grape juice. From these sugar solutions are made respectively, beer, cyder and wine or brandy. Consider the latter case for a moment. The vintner takes the ripe grapes and throws them into a vat or tub. By crushing them up, he makes a sugary liquid into which pass various microbes either from the air or by means of the skins of the grapes which are in the sugary mass. Certain of these germs or microbes from the air or attached to the grape skins ferment the sugar, that is, split it up into carbonic acid gas and alcohol. This action of the ferment goes on until sufficient alcohol has been made so as to constitute 14 per cent. of the sugary juice. When this amount of alcohol has been formed, fermentation ceases, owing to the excess of alcohol. This is very much the same as occurs in the human body when certain of the disease-producing germs gain access to it; they go on growing and fermenting, as it were, in the blood and juices of the body until the body has manufactured a sufficiency of the antidote to stop their action. It is this curious resemblance between the two processes that has suggested the name of "fermentation-like" for many of these diseases, simply because their germs or causes behave in the human body like a ferment. Typical examples of diseases of this nature are small-pox, chicken-pox, measles, scarlet fever, enteric fever, plague, cholera, typhus, diphtheria and many others. In all of them, there is the introduction of a living germ or germs; then a period of "incubation" or hatching in which nothing can be observed; then follows the active disturbance, and in the diseases, as well as in the fermentation of the sugary liquid, the process is stopped when the microbes have multiplied to a certain extent, a temporary or permanent protection being the result. Another name for diseases of this kind is "infective." A disease like small-pox or measles, which can be passed from person to person without immediate contact between the two, is termed infectious. In these cases the infection is conveyed by mucus expectorated or by dust blown about, or carried in clothing, etc., from the first patient. Such diseases may also, of course, be communicated by direct contact. If direct contact between the sick and well is indispensable for the conveyance of a disease, it is called "contagious." In nature there is no such hard line drawn between infection and contagion, although some diseases can be more easily communicated than others. In this sense, then, the word infective includes all the germ-caused diseases, however spread.

Throughout the progress of these diseases, except in the period of incubation, the patient is able to communicate his disease to persons about him who have not been rendered safe by a previous attack. The way in which he thus communicates his disease varies in different cases. In scarlet fever, the throat, nose, ears and skin are the chief sources of contagion; in diphtheria, influenza, measles, and whooping cough, the secretions from the throat and respiratory passages; in enteric fever and cholera, the urine, stools and vomit. The protection afforded by one attack of an infective disease against its recurrence varies greatly; speaking generally, they occur but once, but second attacks are not uncommon.

335. *Means of infection.*—The modes in which infection is received vary greatly with different diseases; the chief channels of infection are the skin and the mucous membranes, particularly of the digestive and respiratory tracts. This means, man can contract infection by means of cuts, scratches or wounds of the skin (inoculation), by means of the air, and by means of food and drink. Under this latter head, milk and water are the two usual sources of infection, but uncooked food, especially oysters and mussels fed in sewage-polluted waters, may produce the same effect. Cholera, enteric fever and dysentery are the chief diseases from this source. Milk may be infected from having been handled by an infectious person, or it may convey infection of some disease from which the cow at the time is suffering, as, for instance, tuberculosis. Water may be contaminated with sewage or the excreta of a single infectious patient. When the air acts as a conveyor of infection, the infectious matter must generally be in the condition of dust. In this manner the contagion of small-pox can be carried considerable distances, tubercle possibly only a short space, and that of typhus but a few feet. Of diseases spread by inoculation or damage to the skin, notable examples are tetanus or lock-jaw following the fouling of wounds with earth, malaria and yellow fever resulting from bites of mosquitoes, plague from bites of fleas from rats, and sleeping sickness from the bites of a special fly found in various parts of Africa.

336. *Susceptibility to infection.*—It may be asked, naturally, if then these disease-causing germs are so widely scattered and can reach man in such a variety of ways, why is it that man is not infected oftener than he is? The answer is, persons vary in susceptibility to attack by different infective diseases; moreover the possibility and intensity of an attack depend on the condition of the person and on the number and the virulence of the particular microbes infecting the person. The main protection against infection by germs exists in man's own body, more particularly in the blood, whose white corpuscles swallow up and destroy a certain number of bacteria after they have been damaged by means of a chemical substance dissolved in the watery part of the blood. This protective action varies in different persons, and in the same person at different times; the most important disturbing factors being age, fatigue, injury and feeding. So long as a person keeps fit and leads a wholesome life under wholesome surroundings, this protective action is at its best; but when the vitality of the individual is lowered or the dose of infection be excessive, then the protection is proportionately overcome. Among the more common agents which lower the vitality and healthy condition of the body among human beings is alcohol. The number of persons who contract infection from germs, following the abuse of alcohol, is much larger than many suppose and in support of this view many interesting experiments have been made on animals. Thus, the disease-resisting power of the dog and pigeon against tetanus bacteria is so great that even large injections of these germs do not affect them; but both the dog

and the pigeon are quickly killed by tetanus if, twenty hours before injecting the bacteria, the animal or bird be given a dose of whisky. In the same way, certain breeds of sheep are unaffected by anthrax germs, but this power to resist infection by this disease is taken away from the sheep by giving them alcohol.

337. *Protective inoculation.*—Having now acquired a general idea of what is the nature and mode of action of infective germs, as well as of the means by and conditions under which they gain access to man's body, we may pass on to consider by what means or principles we can and must endeavour to ward off or prevent infection by them. Mention has been made of the fact that, in the case of certain of these diseases at least, infection does not occur commonly a second time ; notable examples in which this is the case being enteric fever and small-pox. This being so, the question suggests itself, why should not men be given or put in the way of acquiring a mild form of disease such as these, so that future infection of a severer nature may be rendered improbable, if not impossible? In the case of small-pox, the inoculation of people with the disease was practised formerly, in the hope of giving them a mild form of the infection, and so prevent severe cases occurring. Owing to faulty methods of inoculation, severe cases did occur, and the disease got so much out of hand that the practice of inoculation with small-pox had to be forbidden. Its place is now taken by the modern procedure of vaccination. This is really nothing but the inoculation or infecting of human beings with the germs of small-pox, after it has been through the cow or calf. In other words, the cow or calf is infected with human small-pox ; this does not make the animal ill, all that follows is the appearance of some blisters and sores on the animal, which yield a juice or lymph which, if inoculated (vaccination) into man, confers on him an ability to resist infection by the human small-pox. A very similar train of events occurs in the case of diphtheria in the horse. If inoculated with diphtheria germs, the animal does not get ill, but manufactures in its blood an antidote (anti-toxin) to the diphtheria germs and their poison. If the animal be bled judiciously, its blood yields a watery fluid, rich in anti-toxin, which, if injected into man, exercises both a preventive and curative influence on him against the human disease. The same idea is present in the attempts to ward off infection by enteric fever by injecting the germs into man, hoping thereby to give the injected person a mild attack of the disease sufficient to enable him to resist infection by natural means. The procedure is constantly being carried out in the Army, but, unfortunately, the protection against enteric infection which it gives is not as lasting or as complete as was hoped it would be. As a matter of act, the protection probably lasts only some two years, but, even so, it is something worth having, especially if it covers or tides a young soldier over a critical or dangerous period, when his powers of resistance to the disease are likely to be at their lowest and the chances of infection are likely to be at their highest.

338. *Other means of protection.*—It must be admitted that our ability to prevent or ward off infection from diseases of an infective nature by means of preventive inoculations is still small and limited to only one or two diseases, notably small-pox and diphtheria ; still, it is founded on scientific facts, and, as our knowledge becomes greater, will extend. For the present, we are bound to recognise it as a possible means of great value, and to regard sympathetically all efforts to extend its scope and application. Failing, then, a complete scheme of protection against infective diseases by means of preventive inoculations of their causative germs, on what must we depend? Obviously, on a rational and wholesome mode of life, clean air, clean water, clean food, and cleanly surroundings as attainable by a proper removal of filth and waste materials, combined with the organized control and management of the infected, and the disinfection of their infected clothing, products, and surroundings.

339. *Personal cleanliness.*—Personal cleanliness involves not only attention to the skin, but to the hair, nails, mouth, and other parts of the body. The skin is a covering for protection, and for getting rid of water in the form of sweat. This latter function is increased by exercise as well as by other causes. If sweat be allowed to continually remain and dry on the surface of the skin, or soak into the clothing, it soon becomes irritating, unhealthy and offensive. For these reasons we wash our bodies to remove, not only coarse dirt which we can see, but also the dried sweat which we cannot see. The act of washing further improves the skin, opens and cleans its pores and keeps it sweet and healthy. Most persons wash their hands and faces, but often forget parts covered by clothes. Of these, the following should be washed every day when possible : (1) between the legs and buttocks, (2) the armpits, (3) the feet and toes. In addition to this daily washing, a bath once or twice a week is necessary, but do not take these baths within two hours of having had a meal. After bathing or washing, rub and groom your skin well, and by that means improve the circulation of your blood. Hands should be washed before eating, and when washing the hands, care should be taken to trim and clean the nails. It is an important and simple matter to keep the nails clean and in good order ; the finger nails should be cut round and the toe nails straight across. Dirty nails and fingers are a common means of conveying infection.

The hair must be kept closely cut, be brushed and combed daily, and frequently washed. Pomades and grease are, as a rule, unnecessary. The mouth should be kept scrupulously clean, and the teeth cleaned at least once, if possible twice, a day by rubbing with a brush. The best time to use the tooth brush is before going to bed, so as to remove particles of food after the evening meal. The mouth should be washed out with water both morning and evening. Decaying or painful teeth ought to be reported to the medical officer. Often the gums are soft and inclined to bleed ; because this is the case do not cease to clean the teeth ; at first the tooth brush may cause a little inconvenience, but continued use will harden the gums.

Closely connected with the care of the skin is clean clothing. Dirt from the clothes reaches the skin, and dirt and sweat from the skin soak into the clothing. For these reasons, it is important to change and wash underclothing. The same clothes should not be worn by day and night; with a little management, every man should be able to keep a shirt and pair of drawers for night wear. Socks get dirty very quickly. Try and have two pairs in use, one for the morning and one for evening wear; there should be also two pairs for the wash. Unless care be taken in attention to details of this kind, it is impossible to keep the feet hard and clean. Underclothes as well as overclothes can be cleaned by brushing, shaking and exposing to the sun and air. This is nearly always possible even when washing cannot be managed, as, for instance, in camp or on the line of march. An article of kit which is often neglected is the hair-brush. Remember to wash it every three weeks or so. Do not use soap or hot water, but rinse it in a basin of cold water, to which has been added a teaspoonful of washing soda; this will remove all dirt and grease. Dry it by shaking or swinging it round, and place it to dry in the sun or wind.

340. *Clean air.*—The importance of pure, clean and fresh air cannot be over-estimated. Air is fouled by the breath we breathe from our lungs, by the effects of artificial lights, such as candles, lamps, and gas, by the products given off from fires and other burning material, by the breath of animals, and by dust and other dirt lying about and collected in rooms and passage ways. To correct this constant fouling of the air in rooms and other inhabited places, provision has to be made to admit a constant stream of fresh air, and to pass out the foul or dirty air. For these purposes, windows and various ventilator openings are provided, and it is important to see that some are constantly open to allow the air to circulate in and out. There is no need to open these apertures to such an extent as to cause unpleasant draughts because by the exercise of a little common sense, sufficient opening can be provided to let in sufficient fresh air without creating draughts. On the other hand, for fear of causing draughts, windows and ventilators must not be kept closed or blocked with paper and rags. A window is best kept open by lowering the upper sash some three inches; this will allow the incoming air to be directed well above the heads of the occupants of a room. Where an open fire is burning in a grate, this sets up a means of ventilation by drawing foul air up the chimney. Apart from securing clean air from the outside of a room or ward, much can be done to keep the air clean and sweet by keeping yourself and your clothing clean, as well as by taking care to prevent dust and dirt accumulating on floors, walls, shelves, cupboards, boxes, bedding and benches. Tables, chairs and forms should be scrubbed weekly. When possible, windows should be kept wide open all day, and the upper sashes open at least three inches at night all the year round. The surest test of a room being properly ventilated and its air being clean and wholesome, is furnished by its being free from smell and stuffiness to anyone entering suddenly from the outside fresh air. Remember that the constant breathing of foul air lowers the vitality of the body and so favours the possibility of infection by germs.

341. *Clean food.*—This matter is largely connected with both personal cleanliness and the provision of clean air and cleanly surroundings. The following rules should be observed: (1) No food should be stored or kept in barrack rooms or wards. If it must be so kept there, it should be kept in a covered jar or other receptacle. (2) The hands and clothes of all persons who handle food or cooking utensils should be scrupulously clean. (3) All bread and meat stores should be kept scrupulously clean, tidy, ventilated, and not only free from, but rendered inaccessible to flies. (4) The kitchens and all fittings, such as tables, safes, shelves, as well as cooking utensils should be clean. Cooks and their assistants must be personally clean, and wear clean washable over-clothing. As flies carry minute portions of filth and germs on their feet, contaminating all they touch, they should not be allowed to gain access to kitchens. (5) Mess orderly-men should be personally clean, and supplied with a sufficiency of towels for washing up. Remember always to eat slowly and chew food thoroughly; to do otherwise is to court indigestion.

342. *Clean water.*—The importance and need of clean and pure water is sufficiently well known. Water can be obtained clean at its source, or if it be unclean, it can be purified. All our water supplies are derived in the first instance from rain, which, falling from the clouds, reaches the earth and there either lodges and lies on the surface or soaks and sinks into the ground according to the nature and arrangement of the soil. The water which lodges on the surface or top of the earth is familiar to us in the form of puddles, ponds, pools, lakes, ditches and rivers. The water which soaks and sinks into the earth is the under-ground water, which we gain access to either by means of springs or wells. For these reasons we may speak of the chief sources of water supply as being: (1) rain, (2) surface waters from hills or highlands, and that lying on the top of the earth in ponds, pools, lakes, ditches and rivers, (3) the under-ground water cropping up to us as springs or that obtained by means of borings, shafts or wells. Each of these supplies may yield either clean or unclean water, according to the nature of the circumstances.

Rain water is nearly always a dirty water, as the surfaces on which it is collected, before being run into storage tanks, are usually unclean. Surface water running off uplands or hills may be clean or dirty, according to the nature of the land or country over which it flows. Such water running off hills over which neither man nor animal goes will naturally be cleaner than similar water flowing over manured land or over country where many men and animals go. The same must be said of other surface waters in pools, lakes, ditches, streams and rivers; sometimes this water will be clean, sometimes not, according to the nature of the banks and neighbouring country, and according as to what opportunities exist for the filth of man and animals to gain access to it. As a rule, it may be assumed that water obtained from these sources is unclean. The underground water is usually pure and clean, more particularly that which crops out to the surface in the form of springs. Whether that obtained from below the ground surface by means of wells is clean or dirty will depend much upon the nature and cleanliness of the adjacent soil, and upon whether the well itself is properly constructed and safeguarded from surface washings, and other possibilities of fouling. The comparative merits of these various sources of water supply may be stated thus :—

Wholesome	1. Spring water. 2. Deep well water. 3. Upland surface water.
Suspicious	4. Stored rain water. 5. Surface water from cultivated land.
Dangerous	6. River water to which sewage gains access. 7. Shallow-well water.

343. *Impurities in water.*—The impurities which gain access to water and so render it unclean are various. Some reach the water at its source, some during its storage, and some during its distribution. No matter how or where these impurities reach water, they exist practically in two states or conditions: they are either dissolved in the water, that is in solution, or they are merely floating in the water, that is, are in suspension. Experience has taught us that the various substances which are dissolved in ordinary waters are not, as a rule, hurtful; it is otherwise, however, with the suspended matter in waters. This suspended material is the true impurity in most waters, and may be in the form of fine sand, clay, grit or mud, that is, suspended matter which we can see with our unaided eyes; or it may be germs and similar living substances which, although floating and suspended in the water, are so small that they are not to be seen by the naked eye. In other words, an absolutely clear and crystal-like water may be full of harmful germs and most hurtful to anyone drinking it. As a matter of fact, the visible and invisible suspended impurities in water are usually associated, and it is rare to find one without the other; but it is important to remember that it may be otherwise. It is, then, the suspended impurities in water which we have to fear as giving rise to disease. How the minute and invisible germs do so has been explained. The coarser suspended matter in the form of sand and grit is only a degree less harmful; if this matter be taken into the body, it acts as an irritant to the lining membrane of the bowel, irritates and renders it inflamed; of itself, perhaps, this will not cause actual disease, but as this material is usually associated with harmful germs, the damage done to the bowel surface favours their penetration and entry into the blood and consequent ability to give rise to infection. In this manner coarse dirt and mud, though not itself causing infection, sets up conditions in the body favouring infection by germs in the water.

344. *Principles of water purification.*—If it is realized what are the impurities likely to be met with in water, the principles on which and by which they are to be removed will be readily understood. It is clear that we need not trouble about what is in solution, but aim simply to remove or render harmless that which is really suspended in the water. These, then, may be either coarse mineral grit, and mud, or they may be germs and microbes. There are three main methods by which we can purify water, namely, filtration, sterilization by heat, sterilization by chemicals. Each of these has its advantages and disadvantages.

Filtration is really an exaggerated system of straining or clarifying, and aims at purifying the water by catching or holding back the suspended matter and leaving alone whatever is in a state of solution or dissolved in the water. The success or failure to remove suspended matter from water by filtration will depend entirely upon how coarse or how fine the straining or filtering material is. If it is coarse material having fairly large pores or apertures in it, then all the finely suspended matter, such as germs, will pass through, leaving only the coarser and larger particles on the filter. Should such a water contain many or few disease-producing germs, it is clear that they will pass through, and the so-called filtered water will be just as dangerous as before. For this reason, all modern filters are made of some material which is sufficiently close in texture to prevent the passage through it of the smallest germs, and if it can keep them back it will, of course, keep back the coarse matter. The material usually employed for this purpose is specially prepared baked clay or pottery ware, made into the form of a tube. The water is forced through this earthenware, under pressure, by means of a pump, with the result that all suspended matter, including germs, is left on the surface of the filter tube, and the water which passes through comes away quite sterile and free from germs. Excellent as these clay or pottery-ware filters are for removing microbes and other minute suspended matter, their employment is often difficult when very muddy water has to be filtered, owing to the mud or fine sand and clay collecting on the filter surface and clogging up its pores so much that the water cannot get through. To avoid this it is usual to submit the water to a preliminary clearing by passing it through coarse strainers of either linen or masses of sponges which remove the coarse material and leave the filters to remove the finer particles and the germs. Though filters made of this close textured clay will keep back microbes under ordinary circumstances, it is found that, when worked under pressures of, say, 40 lb., as they commonly are worked, germs manage to work their way into the filter mass and in time may even pass through it. Usually, it takes some days for this to come about, but to make certain that none but germ-free water is delivered from these filters it is necessary to periodically sterilize and kill every germ which may be on the surface or within the substance of the filter. This is conveniently and best done by boiling these filter tubes for one minute every four days. It will be readily understood that each filter must be absolutely sound and free from cracks or flaws. Should they exist, water will pass through without having been deprived of its germs and finer suspended matter.

Heating or boiling of water is a familiar procedure for purification. It acts simply by virtue of its power to kill germs. It is undoubtedly far safer than filtration but not so readily carried out, particularly when much water has to be purified. A further objection to heat as a means of water purification is that, though it kills germs, it fails to remove mud and other coarse suspended matter. This means that if a muddy water is under treatment, some preliminary clarification or coarse straining must be carried out before the application of heat. Heat may be used for purifying water either by simple boiling, as in open kettles or saucepans, or in some special apparatus designed to economize fuel, prevent loss of dissolved gases from the water and to cool it rapidly after heating.

Chemical treatment of water is not generally employed for purification purposes, as it is often difficult to carry out and generally leaves the water with some taint or taste. Many chemicals have been suggested, some act simply by clearing the water by precipitating or throwing down all the mud and coarse suspended matter, others act by actually killing the germs and so rendering the water safe.

Each of these three methods may be considered in detail :—

345. *Filtration of water.*—The service filter-tank may be thus described. It consists of an iron tank, holding 110 gallons, mounted on two wheels. It is fitted with two pumps, two clarifying filters, and, for sterilizing purposes, eight filter tubes arranged in two batteries of four each. There is a small seven-gallon tank at the back of the cart which receives the sterilized water, and fitted to this and to tubes running along each side of the main tank are twelve taps at which water bottles are filled. A locker is placed in front for carrying spare parts, and a kettle for sterilizing the filter tubes is strapped on the top of the locker. Two lengths of hose pipe, each having a rose fitted with wire gauze at one end, and having a screw winged nut attachment at the other end, are carried coiled round hooks on the top of the large tank. (Fig. 60).

The main tank carries water which has been freed from coarse suspended matter by being passed through the clarifying filters. The clarifying filters consist of coarse sponges compressed and contained in the two horizontally placed cylinders shown on each side at the top of the hinder part of the large tank. Water can be sterilized as required. The eight filter tubes are in two sets of four, placed in separate chambers, which are fitted inside the tank. Each filter tube is covered with a cloth, which is found to lessen

To face page 154.

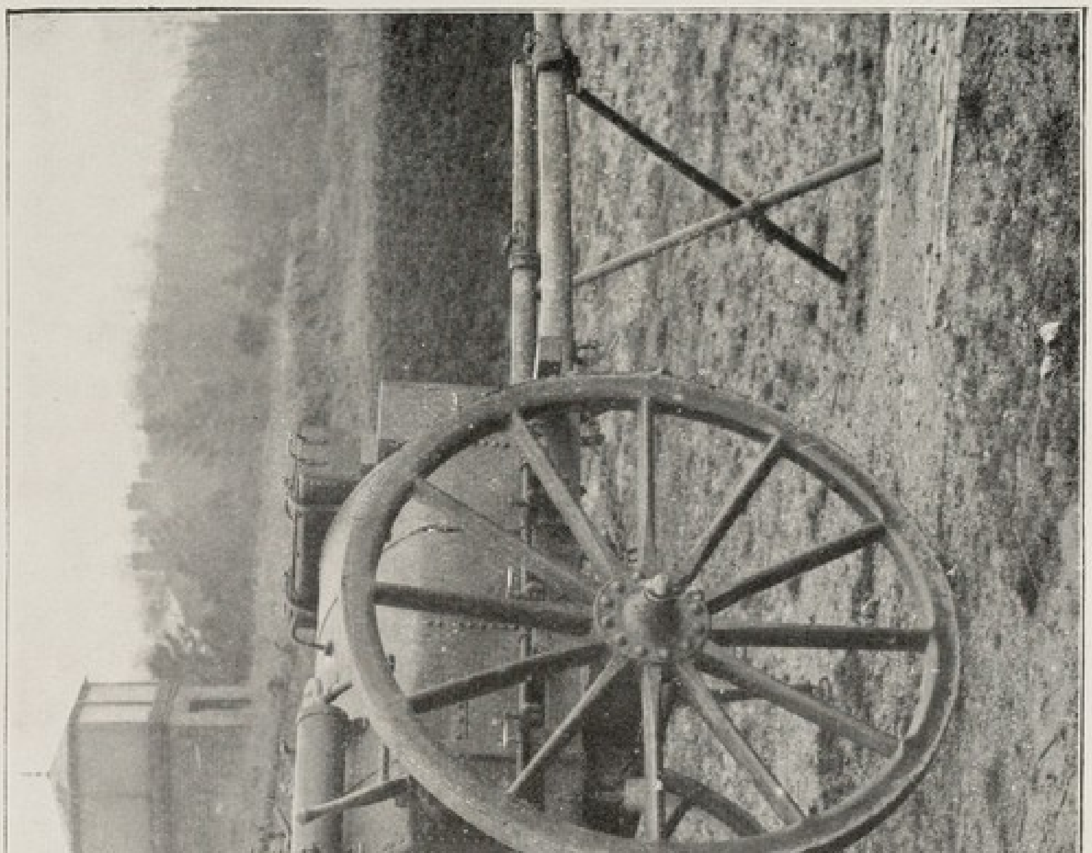


FIG. 60.—FIELD SERVICE FILTER-TANK.

clogging. The clarified water in the main tank is pumped through the sterilizing filters. Each filter-tube has its own delivery tube, or "swan-neck" as it is called, which gives, perhaps, an appearance of complication and fragility; but it is considered better to have eight separate tubes than to have them run together so as to deliver from one, as alteration of the delivery from any one of the filter tubes would give immediate evidence of defect, and show which filter was defective; and for a similar reason the tubes are made to discharge into the open.

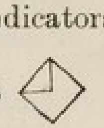
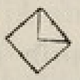
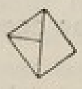
A store of sterilized water is not carried, except the water that may be in the seven-gallon tank behind. The reason for this is that the water can be sterilized as fast as it can be distributed, and the possibility of the sterilized water becoming contaminated during storage reduced to a minimum. Both tanks are readily accessible for special cleansing. Provided the source of supply is not excessively muddy, the main tank can be filled with clarified water, using both pumps, in half an hour. The same can be emptied by passage of the water through the filter tubes in forty minutes. The pumping is not laborious.

The instructions for the working of the Field Service filter tank are as follows:—

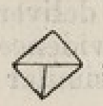
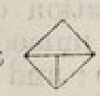
(1) The pumps are independent and can be worked together or separately; each pump serves one set of filters, namely, the clarifying and sterilizing filter on its own side.

(2) The pump can be opened by unscrewing the four bolts and lifting off the round face plate—this is seldom necessary, and should be done only by a skilled man; the valves are fitted with leather seatings, which reduce friction to a minimum and can be renewed easily.

(3) *To fill the main tank.*—Screw the wing nut of hose pipe, with leather washer inside (the newer types of this filter tank have no washers) on to the elbow union below the pump and make an air-tight joint. Drop rose end of hose into source of water supply and hang clear of the bottom. Examine the rose occasionally to remove mud or weeds.

(4) Turn the cock underneath the pump so that the indicators point towards the hose pipe and pump, thus, left  ; right  ; also turn the cocks placed between the clarifying chambers and the filter batteries thus, left  , right  ; this shuts off the sterilizing filter and opens the way for the passage of water through the sponge chamber into the main tank.

(5) The pump should be worked at about 25 strokes per minute. Pump easily and steadily, nothing being gained by pumping too vigorously.

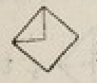
(6) *To filter direct from source through the filters.*—Turn the cocks placed between the clarifying chambers and the filter batteries thus, left , right ; this opens the way for water to pass through sterilizing filters.

(7) Fasten the bent delivery tubes (swan-necks), by means of the wing-nuts, to the eight ends of the metal tubes which come through and project above the cover of the filter batteries. The wing nuts (with leather washers inside) should be screwed up so as to make an air-tight connection.

(8) The free ends of the swan-necks should be brought together in two sets of four, so that each set delivers into one of the two circular openings on the top of the small tank situated at the back of the main tank. The lids for covering these openings should be kept closed, except when filtering is going on. The pumps are worked as when filling the main tank.

(9) If any tube is observed to be working defectively, especially in excess of discharge, the pumping on its own side should be stopped, the swan-neck of that particular filter tube removed, and a blank plug from the spare parts screwed on. This throws that tube out of use, until time can be obtained for its examination. The filtration can be resumed, meanwhile, with the remaining tubes in use.

(10) There are twelve taps at which sterilized water can be drawn. The tap underneath the small tank is intended for filling kettles, and through it the tank should be flushed out occasionally. This tap can be opened only by means of a key, kept in the locker of spare parts. This key should never be out of the care of the man in charge of the apparatus. In the newer make of these tanks, a similar tap is placed under the main tank to facilitate the drawing off of clarified water in bulk for cooking. This tap should never be used except by permission of the orderly in charge.

(11) *To pump clarified water from the main tank through the sterilizing filters.*—Turn the cock underneath the pump thus, left , right ; also turn the cock between the sponge chamber and the filter battery as in para. 6, and resume pumping.

(12) After filtering is finished, remove the swan-necks and

store them in the locker in front, screwing one of the blank plugs provided for the purpose over each of the openings of the tubes from the filters. Also remove the lengths of hose and coil them round the hooks on the top of the main tank.

(13) *To clean and sterilize the tanks and filters.*—Flush out the large tank once a month, or once a fortnight if very muddy water is in use. The small tank should be flushed out with boiling water once a week. When a tank has been standing disused for a time, both tanks should be cleaned out carefully before the apparatus is taken into use.

(14) The filter tubes should be removed every three days, and without removing the cloth in which they are wrapped; they should be placed in cold water in the flat kettle supplied, and the water raised to the boiling point.

(15) Every sixth day the filter cloth should be removed for the examination of the filter tubes. If the inside of the cloth is dirty, it may be rinsed in boiling water, but it should never be scrubbed.

(16) If the filter tubes are dirty, scrub the surface well with the brush, which is among the spare parts; rinse in clean water, replace cloth and boil.

(17) Once a week remove the sponges from the clarifying chamber and rinse in boiling water; boil the sponges once a fortnight or oftener.

A smaller filter exists for carriage on a pack animal. A mule or horse can carry two of these filters with ease, together with the vessels in which to boil the filter tubes. The principle of working and design of these mule filters is similar to those fitted to the water tank. Each filter has a pump with hose, a central clarifying or sponge chamber, and two cylinders each containing a filter tube. These latter are the same as and interchangeable with those used in the filter tanks. These mule filters are contained in wicker casings, and have all detachable parts fastened by chains. There are no washers or other parts which can be readily lost or mislaid. The sponges and filter tubes in these pack saddle filters must be cleaned in exactly the same way and as often as those in the tank filters.

346. *Sterilization of water by heat.*—This can be done by ordinary boiling in an open vessel or in some form of special apparatus designed on the heat-exchange principle, which depends on the fact that with a sufficient area of metallic surface of good conducting capacity and sufficient time, a given quantity of liquid will yield nearly all its heat to an equal amount of the same liquid. Thus, a volume of water at 212° F., will give practically all its heat to an equal volume of water at 60° F., the hot water being cooled down to about 70° F., and the cold water heated to 180° F., less the loss by radiation. A variety of these apparatus have been designed for military purposes, but the greater number have failed to be either sufficiently portable or to yield sufficient sterilized water in proportion to their size and weight. The particular sterilizer of this kind at present in use in the Service is one known as the "Griffith." The essential novelty in the Griffith water sterilizer is the recognition of the fact that a momentary exposure

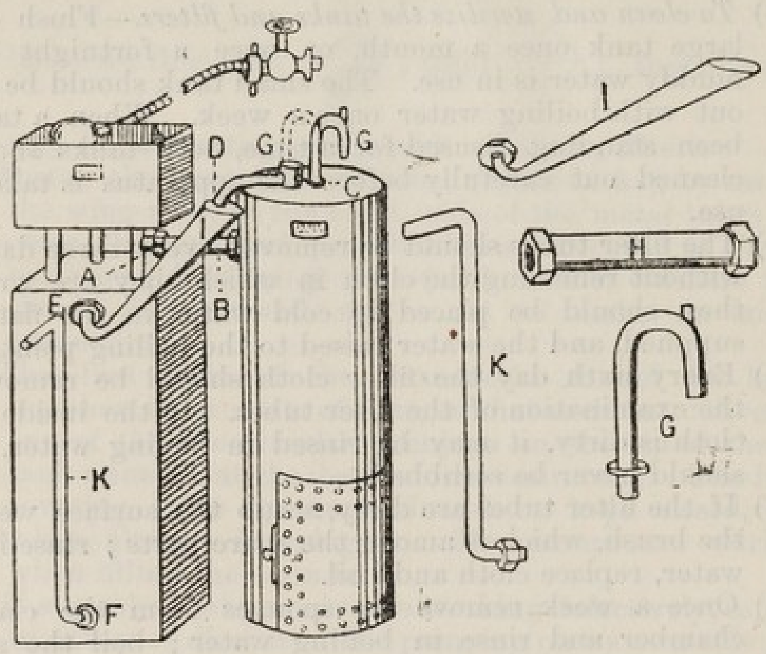


FIG. 61—GRIFFITH WATER STERILIZER.

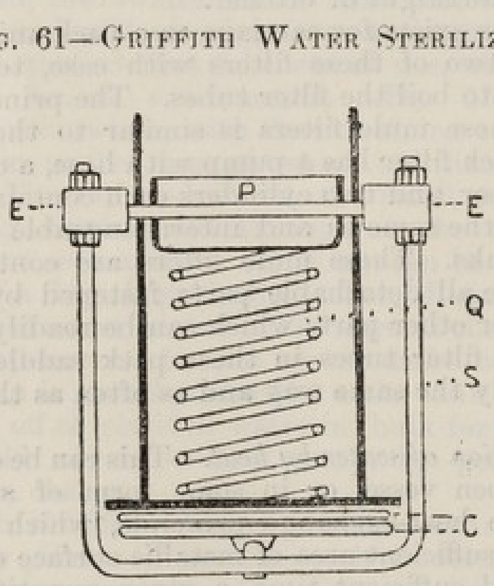


FIG. 62—VALVE OF GRIFFITH WATER STERILIZER.

of water to a temperature of 180° F. is sufficient to destroy all disease-producing germs that are conveyed commonly by water.

The general appearance of this apparatus when fitted up is shown in Fig. 61, from which it will be seen to consist of two main parts, namely, a boiler or heater on the right, coupled to a cooler constructed on the heat-exchange principle, placed to the left. Above the cooler is a small supply reservoir to which the water can be conveyed by hand or from a suitable tank or water-cart by means of the hosing, the flow of water through this duct being controlled by a screw tap and a ball valve. The heat is obtained from an oil lamp working on the pressure principle, placed beneath the heater within the door shown in the diagram ; the various other parts are drawn in the same figure, and their general object will be understood from the following directions for the use of the apparatus.

Place the heater and the cooler on a level piece of ground, about six inches apart, with the heater to the right. Connect the supply tank of the cooler by means of the armoured tubing with the water-cart or tank. Connect the heater with the cooler by adjusting the rubber union H to the openings A and B, then turn on the water to the supply tank. When the heater is seen to be nearly full of water, by inspection through the opening C, adjust the bent pipe G to the opening C, and screw the gland home ; place the lamp in position under the heater and light, or it may be lighted beforehand, and then put in position, but it must never be placed under the heater lighted unless the heater is full of water. Connect the expanded union I at E, taking care to have the expanded end around the aperture D in the heater ; now connect the outlet pipe K with the opening F at the bottom of the cooler. As the water in the heater rises in temperature it will slowly pass through D, down the expanded union I to the cooler, but no delivery of water will take place from the outlet pipe K until the inner vessel of the cooler has filled with sterilized or safe water.

The vital part of the apparatus is the valve which controls the passage of the water from the heater to the cooler, and which cannot be seen in Fig. 61 as it lies concealed within the heater. This valve is so made that it expands or opens only when the water attains a temperature of 180° F., closing automatically when this temperature is not maintained. The general plan of this valve can be seen in Fig. 62, in which C are certain capsules made of copper containing a mixture of alcohol and ether. When immersed in water having a temperature of 180° F., these capsules swell and, being retained firmly by the stirrup S against the bottom of the spring Q, force up the plug P, which again lifts or opens a valve, not drawn in this diagram. This arrangement of expanding capsules is conveniently controlled or adjusted by manipulation of the screw nuts under and over the ends of the crossbar E, and once adjusted accurately, require practically no further attention, beyond occasional inspection to see that the capsules are sound and in position. If the capsules or the spring require renewal they can be replaced readily from the spare parts supplied with the machine.

The whole apparatus packs into two boxes, one containing the heater and lamp (full of oil), the other containing the cooler.

These can be unpacked, the sterilizer put together, coupled up with a supply tank, lamp lighted, and sterile water obtained, flowing from the outlet pipe in fifteen minutes. The flow of water is regular, the average delivery being at rate of from 55 to 60 gallons in the hour. The rate of flow is dependent obviously on the amount of heat used, and whether the lamp is burning well. This it generally does, even in a breeze, but if oil needs renewing or the lamp goes out, such an interruption reduces naturally the delivery of water in a given period of time. The temperature of the water at D, that is, when it leaves the heater, varies from 180° F. to 190° F. The temperature of the finished water at the outlet pipe is usually eight degrees higher than that of the original ingoing water when the delivery is kept at 60 gallons an hour ; in all cases the water is sufficiently cool to be drunk at once. It is also sterile, as all germs have been killed by the heat to which the water has been subjected.

The capacity of the lamp for oil is 3½ pints if filled quite full ; this is undesirable, the better plan being to put in only three pints. With care this amount of oil will run the machine for two hours, but for every day working, once filling of the lamp should be reckoned to run the sterilizer for an hour and a half, or, say, deliver 100 gallons of water. In working the lamp, care has to be taken that it is kept clean, especially the nipple or aperture by which the vaporized oil escapes and burns. If oil is not available, the apparatus can be worked with wood as fuel, placed in the position the lamp occupies in the heater. This is not recommended, as it is more troublesome to work than oil, needing frequent stoking. When wood is used as fuel, a delivery of 40 gallons is obtained.

A larger type of this steriliser has been made and mounted on wheels with a small storage tank. It contains precisely the same parts as the smaller apparatus. It can turn out 350 gallons of water an hour, with an expenditure of less than three-quarters of a gallon of oil. With this large machine, some 1,900 gallons of water can be sterilised with a consumption of four gallons of oil.

347. *Sterilization of water by chemicals.*—Water can be sterilized and purified undoubtedly by means of chemicals, but as a practical method for soldiers it presents many difficulties. The chief are : the necessity of portability, simplicity in working, rapidity or action, and that the treated water be free from taste or smell. A large number of chemicals have been suggested and tried for water purification ; of these the most useful for soldiers in camp in the field are alum, permanganate of potash and the acid sulphate of soda.

If *alum* be added to a muddy water in the proportion of a table-spoonful to a bucketful, a gelatinous cloud will form and slowly fall to the bottom, carrying with it most of the mud and other suspended matter, leaving a clear liquid which can then be drawn off. This action of alum will not sterilize the water, but merely clear it ; it is, however, rather slow, taking an hour or more to act properly, but when time is no object and a muddy water has to be cleared when no filters are available, alum is a useful stand by Alum does not act well with all waters, its best effect being obtained in waters which contain lime ; rain and other soft waters do not readily clear by means of this chemical. It must not be forgotten that alum will not kill the germs ; it removes a great number by throwing them to the bottom, but to make certain, the cleared water should be boiled afterwards.

Permanganate of potash, if added to water in sufficient quantity to make it pink, is another useful means of purifying water. It acts like alum in making a sediment and causing the water to gradually clear, if allowed to stand ; it also has a mild action upon germs, killing them. This germ-killing power is, however, somewhat slow and feeble ; for this reason reliance cannot be placed on permanganate to purify very foul waters. The germ which is most readily killed by this chemical is the microbe which causes cholera. For cleaning out barrels, tanks, cisterns and other receptacles for storing water, the addition of the permanganate is extremely useful. Sufficient should be added to make the water a good rose-pink colour ; stir well and allow to stand for quite three hours. Permanganate gives no taste to the water, and is quite harmless to anyone drinking the pinked water.

The *acid sulphate of soda* is practically so much sulphuric acid in a solid form. It is supplied conveniently in tablets ; if one of these be dissolved in 1¾ pints of water or the contents of a water bottle, it yields enough acid to that water to kill any disease-producing germs which may be in that water in half an hour. The water will taste faintly acid, but not unpleasantly so ; this acid water is quite harmless and fit to drink. By the issue of these acid tablets to soldiers, it is hoped that each man will be able to keep his water bottle sweet and clean and free from germs. Thus, say a man fills his bottle full of water overnight, drops in one of the acid tablets and allows it to dissolve and remain in that water till the morning, the contents of the bottle will be quite free from disease-producing germs. He can either use that same water for drinking purposes, or he can pour that water out and fill it with filtered or boiled water. By so doing, he will be certain, however, that his bottle is clean and free from germs. At other times, he can dissolve one of the acid tablets in the bottle full of water, shake it well, and then after half an hour use the acidified water for drinking. It must be remembered that the adding of these acid tablets to a muddy water will not clear that water—that must be done by straining or coarse filtering ; the acid tablets will only kill germs in the water, and that only after half an hour. Used in this way, these tablets should be of great value to soldiers and others who are unable to get their water properly filtered or boiled or sterilized by heat.

Various attempts have been made to sterilize large quantities of water by chemicals, such as bromine, chlorine and iodine. They have not been very successful and are too complicated for military needs ; possibly, some day we may succeed in perfecting them, but at present they are not suitable for the requirements of soldiers. Anyhow, we must always remember that in chemicals we have a means of rendering water safe to drink, and that if all else fails or other means of purification are wanting, their employment is better than doing nothing.

348. *Disinfection.*—All attempts to prevent disease will be useless or ineffective unless we supplement them by efforts to destroy the active causes of each infective disease. By disinfection is meant the destruction of the active causes of these diseases, hence the term disinfectant means a germ-killer. Disinfectants must be distinguished from deodorants, such as earth or charcoal, which merely remove a smell ; and from antiseptics which merely hinder the growth of germs, without necessarily killing them, as, for instance, common salt. Disinfection may be effected in a variety of ways, but, practically, we employ disinfectants for one or other of the following purposes :—(1) to disinfect discharges from infected persons, (2) to disinfect the clothing and bedding soiled or used by infected persons, (3) to disinfect the rooms or places occupied by infected persons.

The *treatment of discharges from patients* is the most important point in the management of infection. The stools or motions should be received into a bed-pan containing a 5 per cent. solution of carbolic acid, a 3 per cent. solution of cresol or a 2 per cent. solution of cyllin, izal or kerol. The urine and vomit, if any, should be treated in exactly the same way, taking care that an amount of the disinfectant solution equal in bulk to that of the material to be disinfected be added. In the case of motions or stools, this may be taken to be quite eight fluid ounces, and this same volume of disinfectant solution must be added and mixed with the excreta by means of a piece of stick. To urine and vomit, at least four fluid ounces of the above solutions should be added each time and well mixed. Always disinfect urine from enteric fever patients.

Discharges from the throat, nose, and mouth of patients should be received into any one of the above-named disinfectant solutions. Pocket handkerchiefs should be avoided if possible, using linen rags instead, and placed at once in one of the above solutions or burnt.

The *skin* may scatter infection, especially in small-pox and scarlet fever. Frequent baths and smearing over with vaseline or oil are useful.

The *disinfection of hands* is most important for all attendants on the infectious sick. A solution of bichloride of mercury (corrosive sublimate) 1 in 1000 or one of the above solutions may be used for this purpose : but these are to be supplemented by the free use of a nail-brush and soap and water. A 1 in 1000 solution of the mercury bichloride can be made by dissolving half an ounce of the bichloride in three gallons of water, adding one ounce of strong hydrochloric acid. It is best to colour this solution with either a little fuchsin or aniline blue. The colouring is added to avoid accidental poisoning and serve as a warning.

Linen and cotton goods are readily disinfected by boiling them in water. It is advisable, however, to soak these articles in one or other of the above-mentioned disinfectant solutions for an hour, so as to reduce any possible risk of infection by handling them in the laundry. Bichloride of mercury is not a good disinfectant for linen as stains are apt to be fixed by it, and if cotton or linen soaked in it be subsequently washed with soap, without first carefully washing out the mercury, the fabrics are darkened in colour. Boiling kills nearly all germs and the addition of a little washing soda to the water hastens this effect.

Woollen articles, blankets and mattresses are liable to shrink and be otherwise damaged by boiling. Their disinfection is best secured by exposure to heat, either to dry hot air or to steam. In removing these articles to the place of disinfection, the precaution of enclosing them in canvas bags or sheets should be observed.

Dry hot air was much used in the past in ovens for the disinfection of bulky bedding. It is very unreliable, tending to scorch the articles, and needs an exposure to a temperature of 240° F. for at least four hours. It is now entirely superseded by steam. To disinfect by steam a special apparatus is required. There are a variety of these in the market. A form in general use

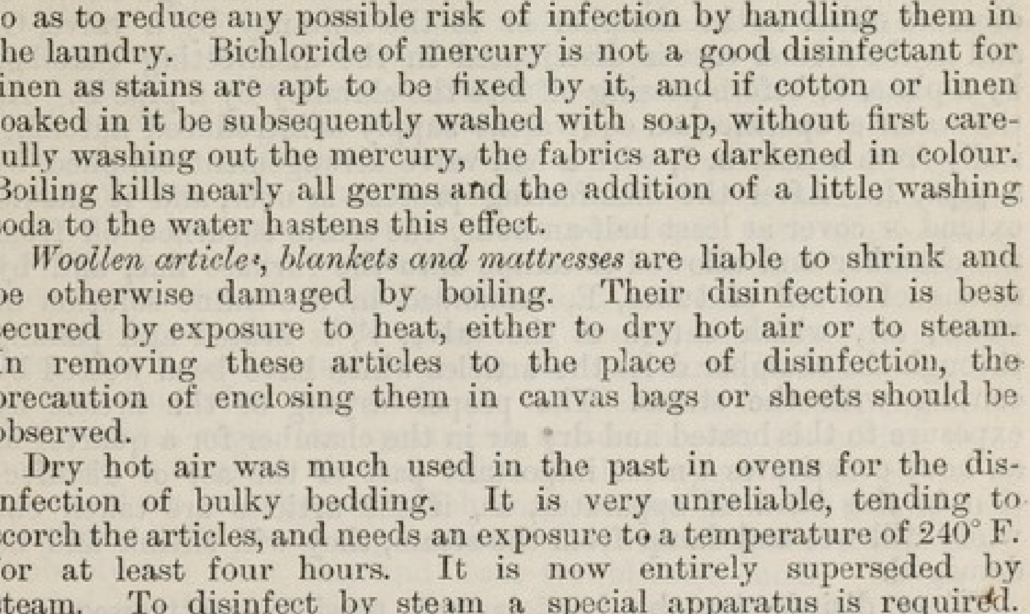


Fig. 63.—Portable Steam Disinfecting Apparatus.

in the army, and more particularly in camps, is one known as Thresh's portable or field disinfector. A diagram of this apparatus is shown in Fig. 63. It employs non-pressure steam derived from water to which salt or other saline ingredients have been added in order to raise its boiling temperature to 225° F. It can be used with ordinary water, in which case the boiling temperature will be 212° F. at sea level.

From the diagram it will be seen that the central chambers for infected articles, A, is surrounded by a jacket, B, containing the water which is heated by the furnace K. The steam given off is directed either to the chamber or to the chimney by a valve, G and in the former case is distributed in the disinfecting chamber by a plate, C, before passing off into the chimney by a pipe D. As the water evaporates, an equivalent supply is introduced automatically from a cistern, I, with a ball-valve arrangement supplied by a pipe, L. After the disinfecting process is over, and it should extend or cover at least half-an-hour, the steam is turned off from the chamber and allowed to escape into the furnace flue, and by means of a coil of tubes, E, immersed in the saline solution or water, air, which enters at the valve, F, is heated and passing through the chamber dries the articles which have been wetted by contact with the steam. The proper drying of the article by exposure to this heated and dry air in the chamber for a quarter of an hour constitutes a most important part of the act of disinfection in this kind of apparatus, as, if the articles are taken out while still wet and damp from the steam, they will shrink and be damaged.

When disinfection by heat is not possible, mattresses and pillows should be taken to pieces, the covers washed and their contents disinfected by exposure to formalin vapour as described later on, and then exposed to sun and air. In tropical countries where the sun is powerful, considerable good by surface disinfection can be secured to clothing and other articles by exposing them to the sun and wind.

Furs, boots, shoes and *gloves* are spoilt by steam. If they need disinfection, this will be best secured by exposing them to the vapour of formaldehyde by one or other of the methods to be described.

Rooms which have been occupied by infected person can only be disinfected after the people have left it. The aim or object is the disinfection of all exposed surfaces, as on them germs are liable to be lodged and resting. The disinfection of the air in infected rooms is effected sufficiently by opening windows and admitting fresh air and sunlight.

There are four chief means of disinfecting room surfaces. (a) Dry rubbing the walls, etc., by means of bread or dough. This sterilizes them by mechanically removing microbes and germs of disease. The bread is cut into pieces suitable for grasping in the hand, the cut surface being applied to the ceiling, walls, &c. The crumbs must afterwards be carefully collected and burnt *in the room.* (b) Washing or scrubbing with soap and water or some ordinary disinfectant solution. This is an excellent way for dealing with floors, forms, tables and other wooden pieces of furniture or washable surfaces. For walls and ceilings it is somewhat laborious and best carried out by spraying. (c) Spraying the ceilings, walls, floors and furniture with a disinfectant solution is a common and fairly convenient method of disinfecting surfaces. It is less laborious than dry rubbing or even wet rubbing, and less likely to damage paint or wall-paper than brushing a disinfectant solution on them. But for all that it is a slow procedure requiring much patience and time. A special spray apparatus is employed, the most effective disinfectant solution being made by taking eight fluid ounces of formalin and making up to one gallon with water. This solution is effective if carefully applied ; one gallon will suffice to spray some 600 square feet of surface, and care must be taken to see that bare patches are not left uncovered with the solution. The spray must be applied from below upwards, this secures an even application of the disinfectant and prevents the marking of the wall by streaks. The operator will experience some discomfort from the formalin vapour giving rise to smarting of the eyes, but in time this effect wears off. On completion of the spraying of all surfaces in a room, the apartment should be left closed for three hours so as to allow the full effect of the vapour given off to be exercised on any germs which may be present. (d) Fumigation constitutes the remaining method of disinfecting a surface, and is probably the most easy and least troublesome mode. It can be carried out by a variety of chemical agents or gases, but that most commonly used in the army is sulphur dioxide. In all cases, the room needs to be measured to determine the amount of space to be dealt with and also all cracks, crevices, apertures and holes by which air or gas can escape need to be carefully pasted over and closed. If this is not done, the act of fumigation is more or less useless.

Sulphur dioxide can be generated by burning 1 lb. of sulphur in a metal dish for every thousand cubic feet of space in the room. The sulphur is placed in a saucepan supported over a bucket of water, and its ignition aided by pouring some methylated spirit over the sulphur and then setting it alight. The same effect is secured by discharging cylinders of liquefied sulphurous acid gas : one cylinder of this compound gas is sufficient for a space of a thousand cubic feet. The room must be left carefully closed and kept so for quite three hours. Sulphur dioxide or sulphurous acid gas is not very reliable as a disinfectant ; it has a low penetrating power and is more or less non-effective in very dry weather.

The disinfection of a room by means of spraying the walls with diluted formalin or by fumigation with sulphur dioxide will be carried out only when specially ordered. The usual procedure to be adopted when a case of infectious disease occurs in a barrack-room, after removal of the case to hospital, is to remove all the man's bedding and clothing and disinfect them by means of steam ; on this being done, the floor under the man's bed for a distance of six feet all round the bed, the bedstead, chair, locker, or other article of furniture used by the infected person will be scrubbed with a 3 per cent. solution of cresol. In married quarters, the same procedure will be adopted after a case of infectious disease, but in addition, the whole floor and all woodwork and wooden furniture in the room will be scrubbed with cresol solution. Carpets, curtains and other draperies will be sprayed with formalin solution, removed into outer air, dried, dusted, and shaken before being returned into the room. If these procedures be carefully and intelligently carried out, it will rarely be necessary to limewhite or distemper ceilings and walls, or to strip and renew wall papers of rooms after the occurrence of an infectious disease.

349. *Sanitation of camps.*—The same principles and ideas which animate our efforts to prevent disease in barracks must be employed in camps and with doubled energy. The need of this will be at once apparent if we remember that the moment men go to live in camps they revert to a simpler mode of life, when they find themselves removed from all the elaborate appliances of barracks.

While most of the questions concerning the size and arrangement of camps will be decided for the soldier by his officer, there are a number of important details connected with both the camp and march which depend largely upon the soldier himself. A few of these points should be considered and remembered.

When ordered to go on a march, every soldier should overhaul his socks and boots and get them put in good repair. For the first few days of a march, the socks should be soaped inside to prevent chafes and blisters. Later, this will be unnecessary, as the feet will have hardened. Before starting on a march, always take a little food, say some tea or coffee with a piece of bread or biscuit. Always start with the water bottle full of either good and safe water or tea. Drink sparingly of this, for the more you drink the thirstier you become. With a little self-discipline it is astonishing how long the contents of a water bottle can be made to last. Instead of drinking a large quantity at once, just moisten the lips and mouth and then drink small quantities at a time. Avoid much smoking and talking when marching, both habits tend to make the mouth dry and cause a feeling of thirst. For the same reason, learn to breathe through the nose, with the mouth shut. When the halt is ordered and leave given to fall out for easement, every soldier should remember and endeavour to cover up both the urine and other matter which leaves the body, with some earth. To do so entails little trouble and helps to keep the place clean and sweet. Whenever possible, scrape a small hole in the ground and ease yourself in the hollow, then cover up with earth.

On halting for the day, or arriving in camp, so soon as duty permits, examine the feet. Blisters should be pricked, the feet cleaned and the socks shaken out. It is a good plan to put the left foot sock on the right foot and the right sock on the left foot. If circumstances permit, put on a clean pair. After the feet have been attended to, wash as much of the body as you can, or wipe the parts over with a wet cloth wrung dry.

In camps, overcrowding is difficult to avoid. Every soldier should bear this in mind and endeavour to be as cleanly in his person and as tidy in his habits as possible. If so, the chances of infection in the crowded tents can be much reduced. Another good rule to follow is to keep as little food in the tent as possible, and always try and eat food outside rather than within the tent. Each day, the sides of the tent should be laced up, all kit taken out, shaken, and aired. This permits of the tent floor being also sweetened and aired. Of course, where camps are changed each day this is unnecessary.

Every soldier should remember to ease himself only in the authorized places, that is, in the latrines and urine pits or tubs provided. On no account should indiscriminate or casual easement be permitted, it merely means fouling of the ground with possible infectious matter. When using the latrine, every man should carefully cover up his excrement with some earth. This is most important, especially in hot countries where flies abound. If the excrement, including the urine, is not covered up, flies at once attack it and quickly bring back some of the filth into the tents and place it on food or on men's faces and hands. Always, when using a camp or other latrine, endeavour to prevent the urine soiling the edges or sides of trenches or pails. The urine needs as much care as the solid matter, and should be as carefully deposited and covered up. The latrines in camp are simple trenches, made by digging them 3 feet long, 1 foot wide, and 1 foot deep. Men, when using them, should stand straddle-wise and take care that the whole of the liquid and solid material falls into the trench, covering up with earth as soon as possible.

Never throw pieces of food about in camp, such material quickly attracts flies. All this kind of matter should be placed at once in special pits dug for the purpose, or into tubs or other receptacles provided for the same : where possible these receptacles should be kept covered over. Each day, this material must be taken away and either buried or preferably burnt. The burning of this refuse is often difficult, but with a little ingenuity and trouble it can be made to burn, particularly if shallow trenches be made leading to the bottom of the mass to be burnt, these trenches act as draught holes and so help the burning. Dead animals are difficult to burn or bury, particularly if there are many of them. Probably, the simplest method of dealing with carcases, is to disembowel them, bury the entrails and inside parts, and stuff the rest of the carcass with straw or other rubbish and set fire to it. This will not burn the whole mass, but it will scorch it sufficiently to prevent a nuisance.

Slop water from kitchens and ablution places needs to be dealt with on the same lines. Of itself it will not cause disease, but if left lying about it attracts flies, which can and do convey disease. This sullage and greasy water should be poured on to trenches suitably dug, the upper ends of which should be filled with twigs and brushwood. This acts as a strainer, catches the grease and soap, allowing the liquid to run away. Each day, this greasy brushwood should be burnt and fresh supplies substituted.

The object of every soldier in a camp should be to keep that camp clean and tidy, and no camp should be left until all rubbish and refuse has been cleaned up, buried and well covered up with soil or else destroyed by fire. Much of the trouble and harm which results to soldiers in camp is the outcome of thoughtlessness, carelessness, untidiness and disobedience of orders. The dirt which invariably results from these faults leads to enteric fever, dysentery and diarrhœa. Every soldier should make it a matter of honour to do his level best to avoid these faults and mistakes. Unless each soldier understands this, and not only is careful himself to attend to these matters, but makes his comrades do so also, we shall never be able to reduce the amount of preventable disease on field service. If, however, every man would do his share in being personally clean and careful in these little details which have been mentioned, the well-being of himself and comrades would follow quickly and easily.

CHAPTER XXXI.

FOOD AND COOKING.

(1) General Instructions.

N.C.O.'s and men under training in Military Hospitals as Cooks will be instructed upon the lines laid down in the following paragraphs 350 *to* 443 *as well as in the* "*Duties of Cooks,*" *as laid down in Standing Orders R.A.M.C.*

350. *General Observations.*—It is part of a cook's duty to become acquainted with the various cuts or joints into which the carcases of beef, veal, mutton, and pork, &c., are divided.

He must likewise be able to tell good quality meat from indifferent or bad meat. In the case of meat, or any other product sent in, which is found to be inferior in quality, or unfit for use, the same is to be immediately reported to the steward in accordance with the standing orders.

351. *Meat.*—The following hints are for guidance in the matter of detecting good from bad quality meat :

Meat may be roughly divided into four classes :—

(*a*) Home-bred and killed, including every kind of bull, ox, cow, heifer, sheep and pig.

(*b*) Foreign-bred but killed in England, principally beef. This class is generally of good quality, having been well fed. The rigid inspection on arrival in this country is sufficient protection against the importation of diseased animals. There is often a deficiency in fat owing to wasting during the sea voyage. Occasionally there are signs of bruising, or even laceration of the flesh, due to injury from bad weather. Meat in this condition should not be accepted.

(*c*) Refrigerated meat, 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° Fahrenheit. The meat of this class is generally like that of (*b*) 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 :—

(1) The bruised condition of the shanks due to the chain which is passed round the hind legs during the process of slaughtering.

(2) The fat of the meat is pink, owing to its being stained by the juice of the lean which escapes.
(3) The outside of the meat will present a dull, dead colour, when compared with the lustre on the outside of good fresh meat, also occasionally the marks of the canvas covering can be seen.
(4) The dressing is not always so clean and neat as in English dressed meat, and the pizzle and root are not always entirely removed.

If there is the slightest suspicious smell to be discovered on the outside, the flesh should be cut into and examined.

(*d*) Frozen meat, principally mutton, which is chiefly imported from Australia and New Zealand in an actually frozen condition. It can be easily 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—
(1) The outside having a wet, sometimes greyish or so-called, parboiled appearance; there will be oozing and dripping of liquid from the meat.
(2) The general colour of the fat is dull white.
(3) The flesh has a uniform pink appearance, owing to the diffusion of the colouring matter of the blood, and is not mottled as in fresh meat.

352. *Salted meat.*—If there is any doubt as regards salted meats a portion should be tested by cooking, which will often reveal deficiencies otherwise not recognisable.
(1) The salting may be well done, but the parts inferior. Examine those pieces at the bottom of the cask, and compare several pieces to see if there is a fair proportion of good parts of the animal.
(2) The salting may be well done, and the parts good, but the meat old. Here the extreme hardness or toughness and shrivelling is the test. See if the year of salting is on the cask.
(3) The salting may be well done, but the meat bad. If the meat has partly putrefied, no salting will entirely remove its softness, and there may be an offensive smell or greenish colour.
(4) The salting may be badly done either from haste or bad brine. Signs of putrefaction will be present; the meat is paler than it should be and has a bad odour, &c.

353. *Inspecting meat.*—When inspecting meat it should be hung up so that it can be seen on all sides without handling. Twenty-four hours after being killed is the best time for the inspection.

The following points must also be attended to:—
(*a*) Quantity of bone.
(*b*) Quantity and character of the fat.
(*c*) Condition of the flesh.
(*d*) Condition of the marrow.

(*e*) Age of the animal.

(*f*) Sex.

Percentage of bone.—In lean animals the bone is relatively n too great a proportion ; 17 to 20 per cent. may be allowed.

Fat. The fat is a most important item. The interior of a carcase should be covered with a bright, healthy looking fat. In a fat ox it may be as much as one-third of the flesh, it should be firm and white, or pale straw colour.

Marrow. Condition of the marrow. The marrow in the hind legs should be solid 24 hours after the animal has been killed. The colour should be light rosy red ; if dark, with spots of black, the animal has been sick or putrefaction has commenced. The marrow of the fore-leg bones is more fluid, otherwise it should present the same characteristics.

354. *Beef.*—Bull-beef may be distinguished from ox-beef by the size of erector muscle, pizzle, and pelvic bones, the absence of a plentiful supply of "cod" and "kidney" fat, a general massiveness of the bones and muscles, and almost a total absence of that coating of the fat on the exterior of the carcase which is the characteristic of well-fed ox-beef. The lean will be very coarse and stringy in texture, dark in colour, with an absence of juice and marbling by fat. The feel to the finger and thumb will convey an indiarubber like consistency, instead of displaying the marbled, juicy, and florid coloured appearance of ox-beef, which is also smooth and silky to the touch. The fore-quarter of the bull is very large, the collar or crest requires the whole hand to grasp it, whilst in the ox it can be grasped with the fore-finger and thumb. If the neck has been removed suspicion will at once be aroused.

In the fore-quarter the ribs of the heifer or young cow show the pinkness of youth, but in an old cow they will be white and more bleached as age advances, and there is a general want of fat. The meat of a heifer is like that of a young ox, and very difficult to distinguish from it ; whilst that of an old cow is coarse, stringy to the touch, dark in colour and with an absence of moisture. The fat is plentiful on the exterior, coming right to the shoulder ; in the cow it is yellow in colour and scanty.

355. *Mutton.*—Good mutton is of deep red colour when cut, the fat should be white and firm, and should not be coarsely ingrained with the lean. Small-boned mutton is generally the best and most profitable. The greater portion of contract mutton is too fat, the proportion of fat to lean being so great as frequently to give rise to complaint. The way of detecting the amount of fat on a carcase without cutting it through is to look at the shoulders ; if a bluish tint is discernible the proportion of fat is not too great. Should the contractor refuse to remove the surplus fat, the carcase should be rejected. When joints only are received, if too fat, the butcher should be asked to trim them or to make adequate allowance.

356. *Fish.*—Fresh fish is firm and stiff, the drooping or not of the tail being a fair criterion on this point. The eyes should be bright and prominent ; the gills a bright red colour. Flat-fish, like

plaice, sole, brill, or turbot, keep better than herrings, mackerel, or mullet. All fish should have been cleaned, be unbruised, unbroken and free from smell, when delivered. Cod fish is considered better if it is allowed to soak in cold slightly salted water a few hours before it is cooked, as this makes the flesh firmer.

When small flat-fish, such as plaice, dabs, &c., are tendered, see that you get something beside head and fins; a proper allowance of weight should be made for heads, &c.

Stale fish is not only unwholesome, but sometimes poisonous. Fish with the least unpleasant smell should at once be rejected.

357. *Fowls.*—Fowls are frequently required for the use of the patients in the hospital. They ought to be young, fresh, in good condition, and weigh not less than $1\frac{3}{4}$ 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 discolouration 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. There should be some fat, which is a sign of health and good feeding, but there is no advantage in having one excessively fat, as this only wastes away in the cooking, and is not always agreeable to a sick person. The flesh is not marbled like that of the ox, but the fat is accumulated in a layer over the body.

From Christmas to April chickens are most difficult to obtain; and consequently during this period of the year greater care and caution should be exercised in inspecting those sent in by contractors.

358. *Eggs.*—The average hen's egg weighs about 2 ozs. 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 is to make a solution of brine (one part of salt to ten of water) and place the egg in the solution. Good or fresh eggs will sink to the bottom whilst the stale ones will float. Stale or small eggs should be rejected.

In using eggs for cooking purposes, such as adding them to other ingredients, poaching or frying, each should be broken into a clean cup or basin before being used. In this way, bad ones can be best detected.

359. *Milk.*—Cow's milk enters very largely into all dietaries: every care must be taken to use it when fresh, as 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.

Genuine milk must contain at the least 8·5 per cent. of non-fatty solids and 3 per cent. of fat : such a milk, though genuine, would be of poor quality : good milk should yield not less than 12·5 per cent. total solids, and 3·5 per cent. fat ; and during the winter months these figures should be 12·9 and 3·8 respectively.

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° Fahrenheit.

Good milk should be of a full, opaque white, or 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.

The chief adulterations are :—(1) the addition of water : (2) the removal of part of the cream, with or without the addition of water : (3) the addition of starch, gum, dextrine, flour, or glycerine : (4) the addition of the so-called preservatives, as bicarbonate of soda, borax, boric and salicylic acids and formalin. The addition of water lowers the specific gravity, and generally speaking there is a loss of three degrees for every ten per cent. of water added. On the other hand, removing the cream (skimming) raises the specific gravity : so that in milk that has been both creamed and watered the specific gravity may be normal. This test must therefore be used in conjunction with the estimation of the cream present.

On account of the many risks of contamination of the milk, during milking of the cow, during storage, and during distribution to the customer, it is generally desirable to boil, or sterilise, or "pasteurise" it, before use. Milk will be rendered safe for drinking by simply bringing it to the boil for a minute or two. But as many people object to the taste of boiled milk, it is preferable, when possible, not to raise it to the boiling temperature, but to heat it to 160° Fahrenheit for twenty minutes. This is sometimes called "sterilising" the milk, but it is better called "pasteurisation." A special arrangement is provided, consisting of an outer chamber or jacket, to contain boiling water or steam, and an inner vessel in which is placed the milk. The directions accompanying the apparatus must be strictly followed. The milk should be stirred frequently, to prevent the scum forming on the top. Great care must be taken that the milk does not become fouled by dust after it has been heated. All parts of the apparatus must be kept scrupulously clean.

360. *Butter.*—Butter is obtained by churning, either from the milk directly, or from cream that has been previously separated. It should be of a good rich yellow colour, pleasant and characteristic smell, and taste ; this may be slightly salt, but should not be in the least rancid or bitter. The amount of fat in butter ranges between 80 and 90 per cent. : the water should not be more than 16 per cent. : the quantity of 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 ought not to be more than 0·5 per cent. Oleo-margarine, which is purified ox-fat, is largely used as a butter substitute; but it must be distinctly labelled as such, and must not be used to adulterate butter.

(2) Cooking Methods.

361. *Roasting.*—Meat and poultry intended to be roasted, must, after being properly pared, trimmed or trussed, be hung before a sharp fire, or placed in a very hot oven for the first fifteen 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 roasted before the fire or in the oven, the basting must be carefully attended, as this renders the meat more juicy and tasty. Either butter or dripping may be used for the purpose, but in the case of poultry, the former is recommended.

362. *Time required to cook a joint.*—No hard and fast rule can be laid down as to the exact time required for cooking a joint or bird, because this depends greatly upon the size and the age of the animal or bird. As a rule, fifteen minutes to the pound is allowed for red meats such as beef and mutton, and twenty minutes to the pound in the case of white meat, such as veal, pork or lamb. In every case allow fifteen to twenty minutes over and above the specified time.

363. *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 other compartments of that description, in the latter before an open fire.

Baking, like roasting, is cooking by means of dry heat, or dry heated air. This heat is obtained from close fires, coal or gas, or from steam at a high temperature externally applied, as is sometimes the case in so-called bakers' ovens. As before mentioned, meat can be roasted in ovens as is mostly the case in large institutions such as hospitals, infirmaries, prisons, &c.; this is known as oven roasting. Unless the ovens are well ventilated, and are kept clean, the fumes given off by the meat are apt to affect its flavour, and it will not be found so crisp on the outside as that roasted before an open fire. Ovens are chiefly adapted for baking bread, pastry, cakes, and certain puddings.

364. *Boiling.*—Boiling, or cooking in boiling liquid, is one of the most common forms of preparing food.

There are two distinct objects attained in adopting this process of cooking, which produce different characteristic results, the first being to retain the nourishing juices, and the second to extract the goodness of the materials used as is the case when preparing stock, soups, or broths.

To retain the nourishing juices when meat or poultry is to be boiled, it must not be put into the pot or vessel until the water, which should be seasoned with salt, and if possible vegetables, is actually boiling. The article thus added must be allowed to boil briskly for at least ten minutes ; for here, as in roasting, the heat must be great enough to harden the external portion and so retain the nourishing juices. This hardening process must not, however, be carried to excess, and after the preliminary stage of actual boiling, the heat must be reduced to that of simmering. In all ordinary cooking it must be remembered that simmering heat, which is the middle point of culinary heat, is more effective than violent or fast boiling.

To extract the nourishing juices, the materials used must be put into cold water and then be brought slowly to the boil. After removing the scum, the cooking process is continued by slow, *i.e.*, simmering, heat until the preparation is sufficiently cooked in the liquid, which must contain practically all the goodness of the materials used.

The average loss in boiling meat is about 25 per cent. of its weight. About 20 minutes to every pound of meat, and 20 minutes over should be allowed for boiling or steaming. The following parts of meat are the best for boiling : *viz.*, the brisket and round of beef, legs and necks of mutton or lamb ; chops are also suitable for boiling or steaming, and are considered better if so cooked for invalids. Chickens are more digestible when boiled than roasted.

365. *Boiling vegetables.*—All green vegetables must be boiled fast in slightly salted water. Old potatoes should be put into cold or tepid water and allowed to boil fairly fast till tender ; in other respects the above rules apply equally to the cooking of vegetables.

366. *Steaming.*—Steaming is cooking in moist heat or heated vapour *i.e.*, cooking over or surrounded by boiling water. Although in all respects the results of steaming are the same as in boiling, the former process is more gradual (slower) than boiling, and is therefore for many reasons to be recommended. Steaming is regarded as one of the most satisfactory and convenient methods of cooking many articles of food, and is especially recommended in invalid cookery, and for large institutions where cooking on a large scale has to be daily performed.

Besides being economical, steaming is also a simple process. The best flavour is obtained and the largest proportion of nutritive juices retained by this method of cooking without loss of substance. The actual loss in weight of meat cooked by steam is slightly less than by boiling. The rules given for boiling are equally applicable to steaming, the preparation of materials being also identically the same as for boiling.

Meat, fish, potatoes, soups, &c., are usually cooked by steam. In all such cases the water or other liquid such as stock, liquor, &c., is to be brought to the boil, and after a period of from 15 to 30 minutes, the steam should be somewhat reduced so as to allow the contents of the steamer to cook more or less slowly till the articles, solid or liquid, to be steamed, are quite done and fit for serving. Exception to this rule is made in case of green vegetables and potatoes, full steam being required for these during the whole process.

367. *Stewing.*—This may be termed an auxiliary of the boiling process. Stewing in reality is cooking in a small amount of liquor at a low temperature, and is therefore an improved form of boiling, and forms one of the most popular cookery methods on the Continent. By this method, otherwise coarse or tough parts of meat can be made tender and nourishing, and as the gravy or sauce in which the meat, &c., is stewed, is always served up, it naturally contains the good properties of the chief ingredients employed. More nourishment can thus be gained by this mode of cooking than by any other, so that it becomes the most profitable as well as the most useful form of preparing food.

For certain stews, the meat—especially red meat—is par-fried in butter or dripping before being actually stewed, whereby a distinctive development of flavour is obtained. Special care should be taken to avoid the meat being stewed from becoming overdone; it must only be cooked until tender, and not to a rag. This fact is often overlooked by cooks. A little vinegar sprinkled over coarse meat before cooking, considerably aids the process of rendering it tender.

368. *Frying.*—This process of cooking may be divided into two methods :—

(*a*) Deep or wet frying.
(*b*) Dry frying.

(*a*) *Deep frying.*—Deep frying is cooking by immersion in hot fat or oil, at a temperature which must be nearly twice that of boiling water (which is 212° Fah.) There must therefore be enough fat (clarified dripping, lard, suet, or oil) to well cover the articles to be cooked. The fat or oil must be hot enough to produce similar results as in roasting; that is, to encrust or brown the surface of the articles so cooked. Unless the fat is heated to the correct degree of temperature, frying becomes a failure, as anything put into fat or oil which is barely hot, becomes sodden, greasy, unpalatable and often uneatable. It is therefore of very great importance that the frying fat should be of the proper degree of heat before the articles are put in it to fry. When fat or oil is at the right temperature for frying, it should be still, not bubbling, and a light bluish smoke or vapour should rise from it.

Deep frying is best adapted for fish, croquettes, rissoles or fritters. With the exception of paste-coated things or fritters, articles to be fried must be either dipped in batter, coated with flour, or egged and crumbed before being immersed into 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 in order to free it from excess of fat, which is most objectionable, particularly so in dishes intended for invalids.

The best fat for frying is that obtained from beef suet, lard, or mutton suet. The latter 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 added to the other bulk of raw or cooked fat when it is being clarified.

(*b*) *Dry frying.*—Dry frying, also known as sauteing or pan-frying, is best adapted for cutlets, fillets, steaks, chops, bacon, kidneys, liver, eggs, etc. Only a small quantity of fat must be used, really only just sufficient to prevent the articles so cooked from burning—just enough to barely cover the bottom of the pan in which the frying is performed. Butter is the most suitable fat to be used for this purpose. It must be allowed to get thoroughly hot, but not burning, before commencing to fry. Frequent turning to prevent hardening or burning, especially in the case of meat, is essential for this mode of cooking.

369. *Grilling or broiling.*—This is known as the quickest cooking process; it is sometimes called broiling. A clear fire, preferably of coke or coal, is the great essential to its success. Grilling is to cook in front or over a fire by the help of a grid-iron or grill. Mutton chops, cutlets, kidneys, steaks, fillets, split and skewered pigeons, slices of cod, haddock, whiting and soles, &c., can be cooked in this manner. Fish must always be well done. The gridiron must be kept clean and well greased every time it is used. The articles to be grilled must be placed between or over the grill. Frequent turning is most necessary. From ten to fifteen minutes are required to cook a moderate-sized chop or steak. They should be juicy when grilled and not allowed to cook dry.

370. *Directions for carving.*—All meat, whether roast, boiled, or steamed, should be carved as economically as possible. Joints of meat, such as a leg of mutton or lamb, shoulder of mutton or lamb, ribs of beef or sirloin of beef, should invariably be cut through to the bone, so that the richer juices which lie near the bone may be served to the best advantage. Neatness in carving must at all times be aimed at, for a joint which is mutilated and hacked to pieces instead of being cut into neat slices, is not only wasteful, but spoils the appearance as well as the enjoyment of an otherwise well-cooked and wholesome meal.

A carving knife and fork, and a steel wherewith to sharpen the knife, are all the tools needed. If the knife and fork are properly handled, there is no need to touch the meat with the fingers, as is too often the case.

(*a*) *Beef.*—In small hospitals the parts sent for roasting are generally the middle and chuck ribs (the middle has four, and the chuck three ribs) or part of them. In this description of joint, the bones should be cut out, broken and placed in the soup, and the meat then rolled, skewered, and tied with a strong string. If baked, the meat should have a piece of greased paper placed over it. In carving for distribution, the meat should be cut in slices; if, however, the joint is roasted with the bone, the meat should be removed in one piece from the bone by inserting the knife under it, close to the bone; the bones should be used for soup.

When the buttock and mouse buttock are supplied for roasting, the meat should be cut when raw from the bone and then cut across in pieces two inches thick.

The French make a hole in the meat half an inch square, with a skewer, and fill it with fat. The pieces should then be cooked very slowly and carved for distribution in slices of half an inch thick across the grain. The same plan should be adopted when the meat is stewed or boiled in soup.

(*b*) *Mutton.*—Mutton should be carved into rather thicker slices than beef, but not too thick.

Fat, both here and in beef, should be evenly distributed, allowing a small piece or slice for each diet or ration.

In carving a leg of mutton, hold the knuckle or shank-bone in the left hand, the inside of the leg turned upwards. The first slice should be cut slantways, close to the knuckle, and continue cutting in slices down to the thigh bone, passing the knife round it. The fat from the broad end should be cut away in the first instance and distributed as required.

In a shoulder of mutton, the meat, before being cut up into diet portions, should be removed from the bone in the following way:—Cut the meat off in one piece from the under part of the blade-bone by running the knife close to the bone; then turn the joint over and cut down on each side of the ridge bone; then run the knife up under the meat close to the blade-bone: there will only remain a few pieces round the shank bone, which should be cut up and distributed among the diet portions. The meat should be cut in slices across the grain.

If a neck of mutton is roasted, it should be trimmed and a great part of the fat removed. The scrag end should be boned, rolled, and tied round, the bones being put into the soup. For broth, the neck of mutton should be divided into chops; for convalescent diet, they should be skewered and tied up, and boiled in the broth.

(3) Recipes and Directions for Cooking.

371. *Stock and the stock-pot.*—It is most important that a stock-pot should be kept going daily in every kitchen. The object of a stock-pot is to produce a nourishing broth or liquor, which is used for various purposes instead of water, but mainly for gravies and soups. A large boiling pot, a copper boiler, or steam vessel can be used for this purpose, and it should be provided with a top.

Into it are put all kinds of bones from meat, provided they are fresh, and trimmings of meat. The bones must be chopped small before they are put in the stock-pot, or cooking vessel; either cooked or raw bones and meat can be used. To these the necessary quantity of cold water is added (average quantity being three pints of water to one 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 must be carefully removed. Fresh soup vegetables (not potatoes) such as onions, carrots, turnips, and also a small cabbage if possible, previously washed, cleaned and cut up, are next added. Allow about four hours of gentle boiling. During the process of boiling the scum must be removed occasionally, but the fat rising to the surface must not be removed until the stock is finished. A little salt should be added with the bones, &c., as this will help to bring up the scum and other impurities more quickly. After this the stock should be strained and used as directed.

Note.—*In warm weather stock should be made without vegetables, or it will turn sour. Vegetable flavouring can be added as required.*

372. *Fish stock.*—Put the skin, bones and trimmings of fish in a saucepan, and cover it with milk and water in equal quantities; add pepper and salt to taste, also a slice of onion and carrot, a sprig of parsley and a blade of mace. Simmer for about half an hour and strain; it is then ready for use.

373. *To clarify fat.*—Ingredients in the following proportions should be used, *viz.*, 7 lbs. fat (beef suet or mutton fat) to 1 pint water. Cut the fat in small pieces of even size, and remove the skin or sinews; put the fat into a large stew-pan with the cold water. Boil it, stirring occasionally until the liquid is quite clear and the pieces of fat appear crisp. Allow it to cool a little, and then strain it into a basin containing a little cold water.

374. *Beef tea.*—1 pint water (cold), 1 lb. lean beef, ½ teaspoonful salt.

(*a*) *Quick method.*—Remove all fat, sinews and skin from the meat, then shred the meat finely, put it in a saucepan with the water and salt, and let it soak for 15 minutes, put the saucepan over a very moderate heat, and stir with a fork for half an hour; strain through a fine strainer, add more salt if necessary, and serve hot.

(*b*) *Slow method.*—Remove all fat, sinews and skin, and shred the meat finely, put it in a jar with the water and salt, stand the jar in a saucepan of simmering water, or put it in a cool oven for two or three hours. Strain; remove any fat with kitchen paper, and serve.

(*c*) *Raw beef tea.*—1 oz. finely shredded lean beef, 1 tablespoonful water. Put the meat and water into a jar, and stand the jar in a warm place for one hour; strain and serve in a coloured glass or cup.

375. *Beef juice.*—Place half a pound of lean, juicy beefsteak on a griller over a clear hot fire; heat it through without actually browning; cut it into strips; press out the juice with a lemon squeezer into a hot cup, add a little salt, and serve with toasted slices of bread.

376. *Iced beef tea.*—Beef tea made by either the slow or quick method can be iced. Allow the beef tea to get cold and put it in a pewter pot or earthenware basin. Place this in a pail surrounded with crushed ice and salt, and let it stand for about 40 minutes. At the end of that time stir up the beef tea and beat up for several minutes; allow it to stand for another 10 minutes and repeat this operation two or three times until it appears to be frozen and is quite smooth.

377. *Beef tea with oatmeal.*—Mix a tablespoonful of well-cooked oatmeal with two of boiling water; add a cupful of strong beef tea, and bring to the boiling point. Rice may be used instead of oatmeal. Add salt and pepper to taste, and serve with toasted bread.

378. *Beef tea jelly.*—Soak half an ounce of gelatine in water, heat up nearly a pint of strong beef tea, or mix a small 1 oz. pot of essence of beef or extractum carnis with three-quarters of a pint of hot water. Drain the gelatine, melt it in a small stewpan and add to the beef tea when quite dissolved. Strain into a wetted mould and stand in a cool place till firm. Un-mould and serve as required.

379. *Mutton broth.*—One lb. scrag-end of mutton, 1 quart of water, 1 dessert-spoonful of pearl barley or sago, 1 clove, 6 pepper-corns, 1 teaspoonful of chopped parsley, 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 three hours, skim again, then add the parsley. When cooked remove the bones.

Note.—If vegetable flavouring is allowed, 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 one 1 teaspoon-ful of the cooked meat, and add it to the broth before serving.

380. *Chicken broth.*—One small chicken, 1 quart of water, 6 peppercorns, 2 cloves, 1 onion, 1 dessert-spoonful of chopped meat, 1 teaspoonful of parsley, 1 ounce of blanched barley, pepper and salt to taste.

Cut the chicken into small pieces, put it into a saucepan with the cold water; simmer gently for about three hours; season and strain. If liked, an ounce of barley or tapioca may be cooked with it. A small chopped onion would also make it more savoury.

381. *Filleted fish.*—Fish should, if possible, be filleted from the bone. This is done by first removing both skins, cutting off the head, making a cut down each side of the backbone, and then inserting 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 filletted and cooked in the same way as soles. Slices of cod can also be cooked in this way. (See also other methods.)

382. *Boiled fish.*—When cod, haddock, ling, &c., are to be boiled they should be cut into slices when raw, and each slice rolled and tied round with string, which is removed when the fish is dished up. This should be served with a plain white sauce.

383. *Boiled whiting.*—Put the whiting into a saucepan of hot water flavoured with vinegar and salt. Cook gently for about six minutes. Do not allow the water to boil, or the fish will break. Try with a skewer to see if it is cooked. Drain and serve on a hot plate.

384. *Fried fish.*—Fish to be fried is best filleted, except cod, which can be fried if cut into slices—it must be dried as far as possible in a cloth, and then be dipped into batter (frying batter) or else be egged and crumbed. There must be sufficient fat in the frying pan to well cover the fish during the whole process of frying, and the fat must be boiling hot before the fish is put into it (see note on frying).

385. *Fried sole.*—Wash, wipe, skin and trim the sole. Dip it lightly into flour, and season with very little pepper and salt. Egg and crumb the sole. Fry in boiling hot fat. Drain it carefully and serve hot.

Note.—A more simple way to fry a sole is to dip it into milk and then into flour ; then fry to a golden brown in hot fat.

386. *Fried filleted plaice.*—Fillet the plaice (remove the black skin), put a very little salt, pepper and lemon juice on each fillet ; roll up or leave them flat, then brush over with beaten egg and cover with bread-crumbs, fry in boiling fat, drain on a cloth or paper, and serve

387. *To prepare fish for steaming.*—Skin the fish—sole or whiting—point the tail, remove the eyes, cut off the fins, then sprinkle over the fish a little salt and a few drops of lemon juice.

388. *To steam fish*—Have a steamer or a saucepan of boiling water ready ; put the fish in the steamer or on a plate or colander over the saucepan, and steam until the flesh will come easily from the bone (about 20 minutes is usually sufficient) ; put the fish on a hot plate, pour over it enough white sauce to cover the fish, and serve hot.

Note.—Slices of cod are also suitable for steaming, and are prepared in the same way as above directed.

389. *Fish cakes.*—Half pound cooked fish (cod, whiting, haddock, or other white fish), 2 oz. mashed potatoes, ½ oz. of butter, one yolk of egg, pepper and salt.

Free the fish from skin and bones, and chop the meat finely. Melt the butter in a saucepan ; stir in the fish and potato, and bind with the yolk of an egg. Season to taste. Form into small round flat cakes. Egg and crumb them. Fry in very hot fat, and drain.

390. *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 it into small portions. Make a white fish sauce. Season it 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 ten minutes with the spices, then make the sauce as directed.

391. *White fish pudding.*—6 oz. of cooked fish, 1 oz. soft bread-crumbs, one egg, mace, nutmeg, salt, pepper, and 2 oz. of butter.

Chop or mash the fish and warm it up in the butter, add the bread-crumbs, 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 one hour, or bake in a tin buttered and coated with bread-crumbs for half an hour.

392. *Chops and steaks.*—Both chops and steaks are best if broiled on or between a griller in front of or over a good fire (coal, coke, or gas). When this is not possible, they should be broiled, *i.e.*, dry fried in frying pans, adopting the following method :—Slightly trim the chops from superfluous fat and flatten a little with a bat. The same applies to steaks :—Use a clean and dry pan ; heat it over the fire and put in a little dripping or butter (barely enough to cover the bottom of the pan) ; when hot, put in the meat and let it cook, *i.e.*, broil rather quickly so as to brown the surface of the meat, then turn it (avoid piercing the meat with a fork or knife, or the juices will escape) and let the other side get browned likewise. After this, allow the meat to cook somewhat slower till done. Chops and steaks of moderate thickness require from fifteen to twenty minutes to cook—they must not be overdone, and every care must be taken that the meat is juicy when served.

393. *Steamed chop.*—Loin chops are best, trim off the fat and roll up the end, which may be skewered. Place it on a small plate and put it in a stewpan, containing stock or seasoned water, also a sprig of thyme and a little parsley. Cover the pan and cook thus for half an hour or longer till the meat is tender. Serve it with mashed potatoes.

394. *Minced mutton.*—Remove the bone and fat from a mutton chop, and mince it very finely. Melt ½ oz. of butter in a small stewpan, when hot put in the meat and cook very gently for 10 minutes. Season very lightly with salt and pepper, and serve with small fingers of toasted bread or dry biscuits.

395. *Beefsteak balls.*—Scrape the required quantity of lean beef with a sharp knife, so that there is nothing left but the tough fibres, to each half pound of meat add the yolk of one egg, season with salt and pepper, and mix well. Shape into balls of even size. Use a little flour or breadcrumbs for shaping. Melt some butter or dripping in a frying pan, when hot put in the meat balls, and fry to a golden brown. Serve with a little thin brown sauce.

396. *Roast and baked fowl.*—A fowl to produce 1 lb. of meat (or two diets) should weigh, when raw, not less than $1\frac{1}{4}$ lb.—it should be roasted whole, and afterwards divided. But if 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.

397. *Gravy.*—A little hot gravy should always be poured round each portion of roast or baked meat and poultry. To make gravy, proceed as follows:—

Pour off the fat from the pan in which the roast joint or fowl was cooked—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.

398. *Boiled chicken.*—Draw the chicken for boiling in the same way as for roasting. To truss, 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 leg, body, 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 completely close the opening. Put the chicken into rapidly boiling stock, boil it for five minutes, then let it simmer for 29 minutes to each pound and 20 minutes over, lift the chicken out of the stock, drain it well, put it on a hot dish, remove skewer and string. Cut it up into portions and serve with plain white sauce, or with egg sauce, as may be ordered. If served plain a little of the stock or liquor should be poured over each portion.

399. *Stewed tripe.*—One lb. of tripe, 1 onion $\frac{1}{2}$ pint of milk, $\frac{1}{2}$ oz. of flour, pepper and salt.

Blanch the tripe and remove all fat, and cut into square pieces. Put the tripe, the onion (chopped) and the milk into a saucepan. Season with pepper and salt. Simmer gently for two hours. Blend the flour smoothly with a little cold milk and pour it in. Stir until it boils up, let the whole simmer for $\frac{1}{4}$ hour and serve very hot.

400. *Savoury suet dumplings.*—To each $\frac{1}{2}$ lb. of flour, take 4 ozs. finely chopped beef suet, 2 eggs, $\frac{1}{2}$ teaspoonful of baking powder, $\frac{1}{2}$ teaspoonful sweet herbs, 1 tablespoonful of chopped parsley, salt and pepper to taste. Mix the dry ingredients in a basin, and moisten with the egg previously beaten up and mixed with a little milk or stock into a fairly stiff paste. Make up into small balls and boil or steam them for about $\frac{3}{4}$ hour in stock or water. These dumplings can be served with gravy or white sauce.

Sauces, &c.

401. *Plain fish sauce.*—A plain sauce can be made of the skin, bones and trimmings by boiling them in a little water, with a slice of onion, a sprig of parsley and salt and then straining.

402. *White fish sauce.*—To be served with baked, steamed, or boiled fish. 1 oz. of butter, $\frac{1}{2}$ oz. of flour, $1\frac{1}{2}$ gill of milk or fish stock, pepper and salt, 1 teaspoonful of lemon juice.

Rub the butter into the flour until quite smooth, put it into a saucepan with the milk and stir until it boils. Season with pepper, salt and lemon juice, cook for at least ten minutes and strain. Pour this over the fish with which it is served.

403. *Anchovy sauce.*—Take a pint of white sauce, or of melted butter sauce, and mix whilst hot with an ounce of essence of anchovy. (A few drops of lemon juice may also be added.) This sauce is served with boiled or fried fish, and should always be sent to table in a sauce boat, and not poured over the fish.

404. *Melted butter sauce.*—Two ozs. of butter, $1\frac{1}{2}$ ozs. of flour, about $1\frac{1}{4}$ pints of cold water, salt.

Melt the butter in the saucepan, stir in the flour, add the water gradually (if it is to be served with fish, use fish stock in place of water) ; stir, bring it gently to the boil and season with salt.

This sauce is served usually with boiled vegetables or with boiled fish.

405. *White sauce.*—$1\frac{1}{2}$ pints of milk, $\frac{1}{2}$ pint of ordinary stock, 1 onion, 1 clove, 2 ozs. of butter, 3 ozs. of flour, 6 peppercorns, 1 bay leaf, a pinch of salt, 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, then moisten with the stock and boil up, then add the milk, &c. Let all boil until the flour is thoroughly cooked, this will take about ten to fifteen 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.

406. *Caper sauce.*—Make $\frac{1}{2}$ a pint of melted butter sauce as directed, chop coarsely 3 tablespoonsful of capers, add these with a tablespoonful of vinegar to the sauce, boil for five minutes and serve. This sauce is usually served with boiled mutton or with boiled fish.

407. *Parsley sauce.*—Heat up a pint of white sauce. When quite hot, stir in the chopped parsley (add one teaspoonful of lemon juice if liked), boil for five minutes and serve.

N.B.—The parsley after being chopped should be put in the corner of a cloth and washed under the cold water tap, and squeezed dry before it is put into the sauce.

408. *Egg sauce.*—One pint of white sauce or melted butter sauce, 2 eggs, a few drops of lemon juice.

Boil the eggs for fifteen minutes, put them into a basin of cold water to cool, take off the shells and chop the eggs not too finely. Heat up the sauce, and when ready stir in the chopped eggs. A few drops of lemon juice or vinegar may be added if desired.

409. *Brown sauce.*—$1\frac{1}{4}$ pints of gravy or rich stock, one onion, one carrot, 2 ozs. of butter or dripping, $1\frac{1}{2}$ ozs. flour, $\frac{1}{2}$ oz. of mushroom ketchup, $\frac{1}{2}$ oz. of 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 brown, put in the vinegar, ketchup and gravy and continue stirring until it boils, then skim well, and allow it to simmer for twenty minutes. Strain and season to taste, re-heat and skim, and serve as required.

410. *Fried potatoes.*—Wash and scrub the potatoes, peel them thinly, cut them lengthwise into thin slices, then cut the slices into long thin strips, 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 and drain them well on a cloth or paper and serve. Frying is one of the best methods by which to cook potatoes.

411. *Brussels sprouts.*—Trim the sprouts by removing the outer leaves and wash them in cold water. Add a tablespoonful of salt to the boiling water, put in the sprouts, and keep them boiling rapidly, without a cover, until the stems are soft (usually about twenty minutes) then melt 1 oz. butter in a saucepan for each pound of sprouts, add the sprouts to it, strain, season with salt and pepper, then shake them well, dish them up and serve hot.

NOTE.—*Soda is often added to preserve the colour of vegetables; this is quite unnecessary if vegetables are boiled rapidly and served at once. Soda may cause indigestion and therefore should never be added in invalid cooking.*

412. *Baked tomatoes.*—Cut the tomatoes in halves, crossways, scoop out a little of the pulp, and mix in with breadcrumbs, grated cheese, chopped parsley and a little butter. When these ingredients have been well mixed, fill the tomatoes with them, place them on a buttered tin, season with a little pepper and salt, and bake in a hot oven from fifteen to twenty minutes.

413. *Spinach.*—For each 1 lb. of spinach take $\frac{1}{2}$ oz. of butter or dripping, salt and pepper.

Pick and wash the spinach, put it into a small quantity of boiling water and boil until tender. When done, drain the spinach on a colander and chop up finely. Melt the butter in a stewpan, then put in the chopped spinach, season with pepper, stir over the fire until thoroughly hot, add a little stock if found too thick, serve hot with pieces of toasted bread.

414. *Scrambled eggs.*—Two eggs, $\frac{1}{2}$ ounce butter, 1 tablespoonful milk, pepper and salt, 1 slice of hot buttered toast.

Beat up the eggs, add to it the milk, pepper and salt, melt the butter in a saucepan, pour in the egg mixture, and stir until the egg is just set, spread it on the prepared toast, and serve hot.

415. *Savoury omelet.*—Two eggs, $\frac{1}{2}$ ounce of butter, 2 teaspoonsful of chopped parsley, 2 drams of milk, pepper and salt.

Break the eggs into a basin, beat them well with a fork, add milk and parsley, season with pepper and salt. Dissolve the butter in a frying or an omelet pan. When quite hot, pour in the mixture, stir slowly with a fork over a quick fire and shake the pan. When the eggs begin to set, shape and roll the omelet on one side of the pan, allow it to take colour, then turn quickly on to a hot dish and serve.

416. *Sweet, or jam omelet.*—Two eggs, 2 drams of milk, ½ oz. of sugar, ½ oz. butter, ½ to 1 oz. of jam, a pinch of salt.

Break the eggs into a basin, beat them well, add the milk, half the sugar, and the salt. Melt the butter in an omelet pan, and when this is hot, pour in the other mixed ingredients and stir over a quick fire. When the eggs begin to set, shape and roll the omelet towards the edge of the pan, allow it to take colour, put the jam previously warmed in the centre, fold in the edges, turn the omelet on to a dish, sprinkling over it the remainder of the sugar and serve hot.

Puddings.

417. *Rice.*—One oz. Patna or Carolina rice, ¾ pint of milk, ½ oz. sugar, 1 egg.

Wash the rice, put it in a saucepan with the milk, and let them simmer until the milk is thick, add the sugar and flavouring, and well beaten egg, pour the mixture into a slightly greased pie di·h or pudding tin and bake in a moderate oven from 20 minutes to half an 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 found excellent.

Other farinaceous foods which can be used and suitable for milk puddings are—tapioca, sago, barley, cornflour, semolina, &c.

418. *Tapioca.*—Three-quarters of a pint of milk, 1 oz. of tapioca, ½ oz. of sugar, 1 egg, flavouring essence.

Put the tapioca to soak in the milk for a few minutes, then cook over the fire until the tapioca is quite tender. When it is cooked let it cool slightly, then add sugar and beaten egg and a few drops of flavouring essence. Butter a pie dish, pour the pudding into it, and bake for about twenty minutes.

419. *Custard.*—One pint of milk, 2 eggs, 1 oz. sugar, flavouring.

Beat the eggs, add to them the milk and sugar and flavouring, pour the custard into a pie dish, and bake in a moderate oven for twenty minutes ; sprinkle sugar over, and serve either hot or cold. The same ingredients can be put in a greased basin and steamed or they can be put in a double saucepan or jar and boiled.

420. *Savoury custard.*—A savoury custard can be made by substituting herbs, chopped meat, and pepper and salt for sugar and flavouring.

421. *Suet.*—Three ozs. beef suet, 6 ozs. flour, 2 ozs. sugar, 1 egg, ½ oz. or 1 teaspoonful baking powder. a pinch of salt.

Remove the skin from the suet and chop it very finely. Put it in a basin with the flour, sugar, baking powder and salt. Beat up the egg and stir in. Work into a smooth paste and fill into small well greased moulds. Cover each with buttered paper and steam for forty-five to sixty minutes. Turn out and serve with honey jam or golden syrup.

422. *Sago.*—One oz. sago, $\frac{3}{4}$ pint milk, 1 egg, 1 oz. sugar. Proceed the same as for rice pudding.

Jellies.

423. *Milk.*—Half pint milk, $\frac{1}{4}$ oz. gelatine, rind of $\frac{1}{2}$ lemon, 1 oz. sugar.

Put the gelatine in the saucepan with as small a quantity as possible of water to melt it; add the milk, sugar, and lemon peel cut very thin, and stir over very moderate heat until all is well blended; then strain it into a basin and stir occasionally until it is cool. Pour it into small moulds and put in a cool place to set.

424. *Lemon.*—Half pint of lemon juice, $1\frac{1}{2}$ pints of water, 6 ozs. of sugar, 1 inch of cinnamon, 4 cloves, $2\frac{1}{2}$ ozs. gelatine, the rind of 4 lemons thinly cut, 2 whites of eggs and the shells.

Put all these ingredients into a saucepan together. Whisk until it boils. Let it stand for five minutes. Strain through a clean cloth previously scalded. When firm turn out into jelly moulds.

425. *Wine.*—If wine is allowed, add one gill of sherry to the above, in which case use that amount of water less.

426. *Egg.*—Two lemons, 6 ozs. sugar, 2 eggs, $\frac{1}{2}$ oz. gelatine.

Put the gelatine into a saucepan, add to it the sugar and lemon rind, strain on to this the lemon juice, and make up to 1 pint with water, to this add the eggs previously beaten, then stir over the fire until the gelatine is melted, and the eggs are well blended; the mixture must not boil. Strain into small moulds, and put them in a cool place to set, and turn out when required.

The chief points in preparing egg jelly are, firstly, that the jelly must not be allowed to boil. If it does boil, the albumen of the eggs become hardened and indigestible, and secondly, that the lemons must be very thinly peeled, or the jelly will be bitter.

Beverages.

427. *Lemonade.*—Two large lemons, $1\frac{1}{2}$ ozs. sugar to every 2 pints of boiling water.

Put the thinly peeled lemon rind, the lemon juice and sugar into a jug, and pour over this the boiling water. Cover and let cool, then strain and serve. A little more sugar may be added if needed. Great care must be taken to peel the lemon very thinly and to remove the white skin afterwards, otherwise the lemonade will be bitter.

428. *Toast water.*—Toast three slices of stale bread to a very dark brown, *but do not burn it;* put it into a jug, pour over it a quart of boiling water, cover closely and let it stand on ice or in a cool place until cold. Strain; a little wine and sugar may be added if allowed.

429. *Oatmeal tea.*—Three ozs. of coarse oatmeal, 1 quart boiling water, the thin rind and juice of half a lemon, 1 oz. of sugar.

Put the oatmeal into a jug. Pour on to it the boiling water and add the thin rind of half a lemon and the sugar. Cover the jug and let it stand near the fire for an hour or more. Then strain off the tea and serve it.

430. *Egg tea.*—Beat up the white of an egg to a stiff froth; add to it the yolk, previously creamed with a dessert spoonful of castor sugar. Mix and stir in half a cupful of boiling milk or water. Stir well, so as to thoroughly mix the egg, &c. Strain into a cup, and grate a little nutmeg on the top. The latter is, of course, optional.

431. *Koumiss.*—One gill of sour buttermilk, 1 gill of water, 1 pint of new milk.

Put the above ingredients into a jug and stand it in a warm place for three days, mixing it well each day. On the third day fill a bottle two-thirds full, and cork it tightly. In two more days the koumiss will be ready for use.

432. *Rice water.*—Carolina rice 2 ozs., sugar 2 ozs. to every 5 pints.

Wash the rice thoroughly in cold water, then soften by steeping it for three hours in a quart of water kept at tepid heat; afterwards boil slowly for an hour and strain. This may be flavoured with lemon rind or clove. The sugar may also be added if liked.

433. *To blanch barley.*—Cover it with cold water, bringing to the boil and strain.

434. *Barley water.*—Two ozs. barley, 2 ozs. sugar, for every five pints.

(1) *Clear.* Blanch the barley; then put it back into the saucepan and add five pints of cold water. Bring it to the boil and let it simmer for half an hour. Strain and add the sugar. Allow to cool.

(2) *Thick.*—Proceed as above, only instead of boiling for half an hour, boil down to two-thirds of liquid. Strain and add sugar.

As barley water will only keep a few hours, it should stand in a cool place and should never be heated to boiling point again.

435. *Barley milk.*—Quarter of a pound patent barley, 1 pint of milk, ½ pint of water, 1 oz. of sugar.

Boil the barley in the milk and water for two hours, sweeten with the sugar and serve while it is just warm.

436. *Egg flip.*—Two eggs, ½ oz. sugar, 1 small glass of wine or lemon if allowed.

Put the yolks of the eggs and the sugar in a tumbler, and stir until creamy. Beat the whites of the eggs to a stiff froth and stir it lightly in. Serve. Half the juice of a lemon or a little wine (sherry or Marsala) can be used to flavour if allowed.

437. *Junket.*—Half a pint of milk, 1 teaspoonful sugar, ½ teaspoonful rennet, 2 drops of flavouring essence.

Dissolve the sugar in the milk. Warm the milk to 98 Fah. Add the rennet and flavouring. Allow it to cool, and when firm place it on the ice for about an hour. Serve with sugar, and cream if allowed.

438. *Gruel.*—Two ozs. of oatmeal, 1½ ozs. sugar to make 2 pints.

Mix the oatmeal with a little cold milk or water ; boil the remainder and pour it, when boiling, on the oatmeal ; return the mixture to the saucepan and boil for ten minutes. Add the sugar and serve very hot.

439. *Flour gruel.*—Mix a tablespoonful of flour with enough milk to make a smooth paste, and stir into it 1 quart of boiling milk. Boil for half an hour and be careful not to let it burn. Salt and strain.

440. *Arrowroot gruel.*—Mix one teaspoonful of arrowroot with four of cold milk ; stir it slowly into half a pint of boiling milk and then let it simmer for five minutes. The mixture must be stirred all the time. Add a half teaspoonful of sugar, a pinch of salt, one of cinnamon (or in place of cinnamon use a little brandy or a dozen large raisins). A corn starch, or rice flour gruel can be made in the same way.

441. *Oatmeal porridge.*—Two ozs. of oatmeal with 8 ozs. milk.

Stir the oatmeal gradually into a pint of boiling water, and let it come to the boil whilst stirring. Cook gently for about an hour. Add a pinch of salt and serve with the cold milk. The porridge must be stirred occasionally whilst cooking.

442. *Milk porridge.*—One oz. of flour, 1 pint of milk, ¼ teaspoonful of salt.

Heat the milk in a clean saucepan, saving enough cold milk to mix the flour to a smooth batter. Add this gradually to the hot milk and cook for half an hour, stirring frequently. Add a pinch of salt, and serve.

443. *Bread and milk.*—Rub bread-crumbs through a fine sieve, put them in a cup and cover with boiling water, then place a saucer on the top of the cup ; allow the crumbs to steep for fifteen minutes, drain off the water and in its place pour on some warm milk. Beat the whole well up, and then put the bread and milk into an enamelled saucepan and boil gently for a minute or two, stand it aside to cool a little, and before giving it to the patient, stir it, and see that it is nice and smooth, adding a little sugar and more milk if liked.

Directions for Sterilizing Milk by The Aymard Milk Sterilizer. Six gallon Tin Sterilizer.

444. 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 place the two lids and insert the thermometer through them. In about twenty minutes the milk will indicate upon the thermometer a temperature of 195 degrees. The furnace door must now be opened and the milk kept at this temperature for five 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 degrees. 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 sl ou'ld not be stored in the sterilizer. The vessel the milk is transferred to should be covered with a clean cloth to prevent unnecessary exposure to the air. The milk should be stirred every three or four 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 and allowed 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 gets broken the following means may be adopted, viz.:— In about twenty minutes from the commencement 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.

CHAPTER XXXII.

THE GENEVA CONVENTION.

445. The Geneva Convention of July 6th, 1906, takes the place of the Geneva Convention of August 22nd, 1864, in wars between Powers that are signatory to it. But should either of the belligerent Powers have not yet ratified the former, then the latter remains in force. It is, therefore, necessary at present to have a knowledge of both Conventions, as fifteen only out of the thirty-five Powers, whose representatives signed the Convention in 1906, had ratified it by the end of 1907. Great Britain ratified it on 16th April, 1907.

446. The chief point sto be noted in the New Convention are that the sick and wounded must be taken care of irrespective of nationality ; that medical personnel must be left in charge of sick and wounded, and that, when they are captured by the enemy, they are to continue their duty under his directions. They will be sent back to their own side only when the enemy can arrange to do so conveniently to himself and by the route which he shall determine. They cannot claim to be sent back at once, but they can claim the same rates of pay and allowances from the enemy which are given to the corresponding ranks in the enemy's medical service. The same kind of protection is given to personnel in charge of convoys, and none of the personnel, medical or otherwise, including sentries and picquets appointed to protect medical units and convoys, are to be regarded as prisoners of war, if they fall into the hands of the enemy.

447. 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.

In the Convention of 1864, these points were not clearly expressed, and the protection was only given when sick or wounded were actually found with the medical unit. In the New Convention the protection is granted under all circumstances.

448. The New Convention has somewhat complicated provisions regarding the method of dealing with the material of medical units and convoys. Briefly they are as follows :—

1. 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.
2. 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 want to use for other purposes than as a hospital, the Convention permits of this being done, if the sick and wounded in it are properly provided for elsewhere.
3. The medical material of convoys, including special ambulance and medical waggons along with their teams, ambulance trains and river or lake ambulance boats, are to be restored, but not the general service or other military vehicles of convoys.
4. Material belonging to voluntary aid societies is private property, under 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.

5. Similarly, civilian vehicles, belonging to convoys, can only be retained by the enemy on requisition.

449. The distinctive emblem of the Red Cross on a white ground is the emblem and distinctive sign of the medical services of armies and not, as is popularly supposed, of voluntary aid societies. The latter are entitled to the use of the sign and the words "Red Cross" only when they are authorised by the State to render assistance to the regular medical service of its army and are employed with medical units and establishments of armies. That point is clearly defined in the Convention, although the previous Convention does not recognise Red Cross Societies in any way.

The national flag of the belligerent must always be hoisted along with the Red Cross flag, except when a medical unit is captured by the enemy, in which case the Red Cross only is flown.

The other points in the Convention have no special bearing on the medical service, as such, but rather on the Commanders of Armies and States.

Geneva Convention of August 22nd, 1864.

Article I.

Ambulances and military hospitals shall be acknowledged to be neuter, and, as such, shall be protected and respected by belligerents so long as any sick or wounded may be therein.

Such neutrality shall cease if the ambulances or hospitals should be held by a military force.

Article II.

Persons employed in hospitals and ambulances, comprising the staff for superintendence, medical service, administration, transport of wounded, as well as chaplains, shall participate in the benefit of neutrality whilst so employed, and so long as there remain any wounded to bring in or to succour.

Article III.

The persons designated in the preceding Article may, even after occupation by the enemy, continue to fulfil their duties in the hospital or ambulance which they serve, or may withdraw in order to rejoin the corps to which they belong.

Under such circumstances, when those persons shall cease from their functions, they shall be delivered by the occupying army to the outposts of the enemy.

Article IV.

As the equipment of military hospitals remain subject to the laws of war, persons attached to such hospitals cannot in withdrawing, carry away any articles but such as are their private property.

Under the same circumstances an ambulance shall, on the contrary, retain its equipment.

Article V.

Inhabitants of the country who may bring help to the wounded shall be respected, and shall remain free. The Generals of the belligerent Powers shall make it their care to inform the inhabitants of the appeal addressed to their humanity, and of the neutrality which will be the consequence of it.

Any wounded man entertained and taken care of in a house shall be considered as a protection thereto. Any inhabitant who shall have entertained wounded men in his house shall be exempted from the quartering of troops, as well as from a part of the contributions of war which may be imposed.

Article VI.

Wounded or sick soldiers shall be entertained and taken care of, to whatever nation they may belong.

Commanders-in-chief shall have the power to deliver immediately to the outposts of the enemy, soldiers who have been wounded in an engagement, when circumstances permit this to be done, and with the consent of both parties.

Those who are recognized, after their wounds are healed, as incapable of serving, shall be sent back to their country.

The others may also be sent back, on condition of not again bearing arms during the continuance of the war.

Evacuations, together with the persons under whose directions they take place, shall be protected by an absolute neutrality.

Article VII.

A distinctive and uniform flag shall be adopted for hospitals, ambulances and evacuations. It must, on every occasion, be accompanied by the national flag. An arm-badge (*brassard*) shall also be allowed for individuals neutralized, but the delivery thereof shall be left to military authority.

The flag and the arm-badge shall bear a red cross on a white ground.

Article VIII.

The details of execution of the present Convention shall be regulated by the Commanders-in-chief of belligerent armies, according to the instructions of their respective Governments, and in conformity with the general principles laid down in this Convention.

Article IX.

The High Contracting Powers have agreed to communicate the present Convention to those Governments which have not found it convenient to send Plenipotentiaries to the International Conference at Geneva, with an invitation to accede thereto ; the Protocol is for that purpose left open.

Article X.

The present Convention shall be ratified, and the ratifications shall be exchanged at Berne in four months, or sooner if possible.

Geneva Convention of July 6th, 1906.

Chapter I.—*The wounded and Sick.*

Article 1.

Officers and soldiers, and other persons officially attached to armies, shall be respected and taken care of when wounded or sick, by the belligerent in whose power they may be, without distinction of nationality.

Nevertheless, a belligerent who is compelled to abandon sick or wounded to the enemy shall, as far as military exigencies permit, leave with them a portion of his medical personnel and material to contribute to the care of them.

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 are prisoners of war, and the general provisions of international law concerning prisoners are applicable to them.

Belligerents are, however, free to arrange with one another such exceptions and mitigations with reference to sick and wounded prisoners as they may judge expedient ; in particular they will be at liberty to agree—

To restore to one another the wounded left on the field after a battle ;

To repatriate any wounded and sick whom they do not wish to retain as prisoners, after rendering them fit for removal or after recovery ;

To hand over to a neutral State, with the latter's consent, the enemy's wounded and sick to be interned by the neutral State until the end of hostilities.

Article 3.

After each engagement the Commander in possession of the field shall take measures to search for the wounded, and to insure protection against pillage and maltreatment both for the wounded and for the dead.

He shall arrange that a careful examination of the bodies is made before the dead are buried or cremated.

Article 4.

As early as possible each belligerent shall send to the authorities of the country or army to which they belong the military identification marks or tokens found on the dead and a nominal roll of the wounded or sick who have been collected by him.

The belligerents shall keep each other mutually informed of any internments and changes, as well as of admissions into hospital and deaths among the wounded and sick in their hands. They shall collect all the articles of personal use, valuables, letters, &c., which are found on the field of battle or left by the wounded or sick who have died in the medical establishments or units, in order that such objects may be transmitted to the persons interested by the authorities of their own country.

Article 5.

The competent military authority may appeal to the charitable zeal of the inhabitants to collect and take care of, under his direction, the wounded or sick of armies, granting to those who respond to the appeal special protection and certain immunities.

CHAPTER II.—*Medical Units and Establishments.*

Article 6.

Mobile medical units (that is to say, those which are intended to accompany armies into 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 units and establishments are entitled ceases if they are made use of to commit acts harmful to the enemy.

Article 8.

The following facts are not considered to be of a nature to deprive a medical unit or establishment of the protection guaranteed by Article 6:—

1. That the personnel of the unit or of the establishment is armed, and that it uses its arms for its own defence or for that of the sick and wounded under its charge.

2. That in default of armed orderlies the unit or establishment is guarded by a picquet or by sentinels furnished with an authority in due form.

3. That weapons and cartridges taken from the wounded and not yet handed over to the proper department are found in the unit or establishment.

Chapter III.—*Personnel.*

Article 9.

The personnel engaged exclusively in the collection, transport, and treatment of the wounded and the sick, as well as in the administration of medical units and establishments, and the 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.

These provisions apply to the guard of medical units and establishments under the circumstances indicated in Article 8 (2).

Article 10.

The personnel of Voluntary Aid Societies, duly recognised and authorised by their Government, who may be employed in the medical units and establishments of armies, is placed on the same footing as the personnel referred to in the preceding Article, provided always that the first-mentioned personnel shall be subject to military law and regulations.

Each State 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 authorised, under its responsibility, to render assistance to the regular medical service of its armies.

Article 11.

A recognized Society of a neutral country can only afford the assistance of its medical personnel and units to a belligerent with the previous consent of its own Government and the authorization of the belligerent concerned.

A belligerent who accepts such assistance is bound to notify the fact to his adversary before making any use of it.

Article 12.

The persons designated in Articles 9, 10, and 11, after they have fallen into the hands of the enemy, shall continue to carry on their duties under his direction.

When their assistance is no longer indispensable, they shall be sent back to their army or to their country at such time and by such route as may be compatible with military exigencies.

They shall then take with them such effects, instruments, arms, and horses as are their private property.

Article 13.

The enemy shall secure to the persons mentioned in Article 9, while in his hands, the same allowances and the same pay as are granted to the persons holding the same rank in his own army.

Chapter IV.—*Material.*

Article 14.

If mobile medical units fall into the hands of the enemy they shall retain their material, including their teams, irrespectively of the means of transport and the drivers employed.

Nevertheless, the competent military authority shall be free to use the material for the treatment of the wounded and sick. It shall be restored under the conditions laid down for the medical personnel, and so far as possible at the same time.

Article 15.

The buildings and material of fixed establishments remain 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 dispose of them, in case of urgent military necessity, provided they make previous arrangements for the welfare of the wounded and sick who are found there.

Article 16.

The material of Voluntary Aid Societies which are admitted to the privileges of the Convention under the conditions laid down therein is considered private property, and as such to be respected under all circumstances, saving only the right of requisition recognized for belligerents in accordance with the laws and customs of war.

Chapter V.—*Convoys of Evacuation.*

Article 17.

Convoys of evacuation shall be treated like mobile medical units subject to the following special provisions :—

1. A belligerent intercepting a convoy may break it up if military exigencies demand, provided he takes charge of the sick and wounded who are in it.

2. In this case, the obligation to send back the medical personnel, provided for in Article 12, shall be extended to the whole of the military personnel detailed for the transport or the protection of the convoy and furnished with an authority in due form to that effect.

The obligation to restore the medical material, provided for in Article 14, shall apply to railway trains, and boats used in internal navigation, which are specially arranged for evacuations, as well as to the material belonging to the medical service for fitting up ordinary vehicles, trains and boats.

Military vehicles other than those of the medical service, may be captured with their teams.

The civilian personnel and the various means of transport obtained by requisition, including railway material and boats used for convoys, shall be subject to the general rules of international law.

Chapter VI.—*The Distinctive Emblem.*

Article 18.

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 armies.

Article 19.

With the permission of the competent military authority this emblem shall be shown on the flags and armlets (*brassards*) as well as on all the material belonging to the Medical Service.

Article 20.

The personnel protected in pursuance of Articles 9 (paragraph 1), 10 and 11 shall wear, fixed to the left arm, an armlet (*brassard*) with a red cross on a white ground, delivered and stamped by the competent military authority, and accompanied by a certificate of identity in the case of persons who are attached to the medical service of armies, but who have not a military uniform.

Article 21.

The distinctive flag of the Convention shall only be hoisted over those medical units and establishments which are entitled to be respected under the Convention, and with the consent of the military authorities. It must be accompanied by the national flag of the belligerent to whom the unit or establishment belongs.

Nevertheless, medical units 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 Red Cross.

Article 22.

The medical units belonging to neutral countries which may be authorized to afford 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.

The provisions of the second paragraph of the preceding Article applicable to them.

Article 23.

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 units and establishments and the personnel and material protected by the Convention.

CHAPTER VII.—*Application and Carrying out of the Convention.*

Article 24.

The provisions of the present Convention are only binding upon the Contracting Powers in the case of war between two or more of them. These provisions shall cease to be binding from the moment when one of the belligerent Powers is not a party to the Convention.

Article 25.

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 26.

The Signatory Governments will take the necessary measures to instruct their troops, especially the personnel protected, in the provisions of the present Convention, and to bring them to the notice of the civil population.

CHAPTER VIII.—*Prevention of Abuses and Infractions.*

Article 27.

The Signatory Governments, in countries the legislation of which is not at present adequate for the purpose, undertake to adopt or to propose to their legislative bodies such measures as may be necessary to prevent at all times the employment of the emblem or the name of Red Cross or Geneva Cross by private individuals or by Societies other than those which are entitled to do so under the present Convention and in particular for commercial purposes as a trade-mark or trading mark.

The prohibition of the employment of the emblem or the names in question shall come into operation from the date fixed by each legislature, and at the latest five years after the present Convention comes into force. From that date it shall no longer be lawful to adopt a trade-mark or trading mark contrary to this prohibition.

Article 28.

The Signatory Governments also undertake to adopt, or to propose to their legislative bodies, should their military law be insufficient for the purpose, the measures necessary for the repression in time of war of individual acts of pillage and maltreatment of the wounded and sick of armies, as well as for the punishment, as an unlawful employment of military insignia, of the improper use of the Red Cross flag and armlet (*brassard*) by officers and soldiers or private individuals not protected by the present Convention.

They shall communicate to one another, through the Swiss Federal Council, the provisions relative to these measures of repression at the latest within five years from the ratification of the present Convention.

General Provisions.

Article 29.

The present Convention shall be ratified as soon as possible. The ratifications shall be deposited at Berne.

When each ratification is deposited a *procès verbal* shall be drawn up, and a copy thereof certified as correct shall be forwarded through the diplomatic channel to all the Contracting Powers.

Article 30.

The present Convention shall come into force for each Power six months after the date of the deposit of its ratification.

Article 31.

The present Convention, duly ratified, shall replace the Convention of the 22nd August, 1864, in relations between the Contracting States. The Convention of 1864 remains in force between such of the parties who signed it who may not likewise ratify the present Convention.

Article 32.

The present Convention may be signed until the 31st December next by the Powers represented at the Conference which was opened at Geneva on the 11th June, 1906, as also by the Powers, not represented at that Conference, which signed the Convention of 1864.

Such of the aforesaid Powers as shall have not signed the present Convention by the 31st December, 1906, shall remain free to accede to it subsequently. They shall notify their accession by means of a written communication addressed to the Swiss Federal Council, and communicated by the latter to all the Contracting Powers.

Other Powers may apply to accede in the same manner, but their request shall only take effect if within a period of one year from the notification of it to the Federal Council no objection to it reaches the Council from any of the Contracting Powers.

Article 33.

Each of the Contracting Powers shall be at liberty to denounce the present Convention. The denunciation shall not take effect until one year after the written notification of it has reached the Swiss Federal Council. The Council shall immediately communicate the notification to all the other Contracting Parties.

The denunciation shall only affect the Power which has notified it.

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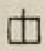
PART II.—ROYAL ARMY MEDICAL CORPS DRILLS AND EXERCISES.

LIST OF DIAGRAMS.

Part II.

KEY TO FIGURES.

 Commanding Officer.

 Major.

 Captain.

 Lieutenant.

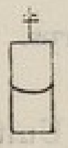
 Quartermaster.

 Sergeant-Major.

 Sergeant or Staff-Sergeant.

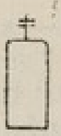
 Bugler.

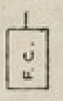
 6-Horsed (heavy) Ambulance Wagon (1 Wagon Orderly to each), Mark VI. (Length, with team, 16 yards.)

 4-Horsed Ambulance Wagon (1 Wagon Orderly to each), Mark V*. (Length, with team, 11 yards.)

 2-Horsed (light) Ambulance Wagon (2 Wagon Orderlies to each), Mark I. (Length, with horses, 7 yards.)

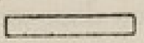
 Water Cart. (Length, with horses, 4 yards.)

 General Service Wagon. (Length, with team, 11 yards.)



Forage Cart. (Length, with horses, $4\frac{3}{4}$ yards.)

 Bearer Sub-Division (front rank in Fig. 35).

 Tent Sub-Division (rear rank in Fig. 35).

DEFINITIONS.

G.O.C., General Officer Commanding.
P.M.O., Principal Medical Officer.
M.O., Medical Officer.
O.C., Officer Commanding.
C.O., Commanding Officer.
N.C.O., Non-Commissioned Officer.
R.A.M.C., Royal Army Medical Corps.

NOTE.—The term "Ambulance" means a Field Unit.

The wagons for removal of sick and wounded are termed "Ambulance Wagons."

PART II.—ROYAL ARMY MEDICAL CORPS DRILLS AND EXERCISES.

CHAPTER I.

SQUAD AND COMPANY DRILL.

1. The Squad and Company Drill in use in the Royal Army Medical Corps is contained in "Infantry Training":—

Part I. Sections 3–44. (Squad Drill.)
Part II. Sections 59 (3), 60–69, 71, 74, and 75. (Company Drill.)
Part VI. Sections 184, 185, and 187. (Ceremonial.)

CHAPTER II.

FIELD TRAINING.

A. Organisation of a Field Ambulance.

General Description.

2. *Divisions.*—A "Field Ambulance" is composed of two divisions—"Bearer" and "Tent"—and is divisible into three sections, "A," "B," and "C," each of which consists of a bearer subdivision and a tent subdivision. Each section is complete in both personnel and equipment, and capable of being moved, or even mobilised, independently of the others. The complete ambulance will accommodate 150 sick, 50 in each section. "A," the headquarter section, differs in some of its details from "B" and "C," which are identical in their composition.

3. *Stretcher Squads.*—The bearer division is divided into three subdivisions, each consisting of six stretcher squads under an officer. A stretcher squad is made up of one private, R.A.M.C., in charge, and five others, who may be specially enlisted men.

4. *Ambulance Wagons.*—There are ten ambulance wagons, four in section "A," and three each in sections "B" and "C."

5. *Wagon Orderlies.*—In each section a corporal, R.A.M.C., will be in charge of one wagon, privates of the others.

6. *Dressing Station.*—The dressing station, which is formed under the direction of the O.C., normally consists of the personnel of one of the tent subdivisions, with a forage cart and a water cart. Further personnel from the other tent subdivisions may be ordered forward to assist. It may be desirable in the course of, or after an action, to bring up the remainder of the tent division and so absorb the dressing station, or, under certain circumstances, the tent division may be used instead of a dressing station being formed. This should usually only be done when the site is suitable for the encampment of the whole Field Ambulance and under the orders of the superior authority.

7. *Transport.*—The transport consists of six general service wagons (two for each section), three forage carts and three water carts (one for each section). The wagons and carts will be horsed with four and two horses respectively.

8. *Keeping Touch.*—One of the supernumeraries, mounted if possible, will be told off to keep touch between the dressing station (if formed) and the various portions of the unit, and the C.O. may convey his orders by him.

9. *Distinguishing Flags and Lamps.*—The Field Ambulance, like other British medical establishments in the field, is distinguished during the day by a flag bearing the Geneva cross on a white ground, flying above the Union Jack, and during the night by two white lamps placed horizontally.

10. *Personnel.*—The detail of the personnel and vehicles are as shown in "War Establishments."

B. Duties in the Field.

11. *Position.*—The position of the unit on the line of march is as described in "Combined Training."

12. *Disposition in Action.*—The following is the normal distribution of the unit in action :—

(1) The "Bearer Division," each subdivision of which consists of one officer (captain or lieutenant), one staff sergeant or sergeant, one bugler, and six stretcher squads.

(2) The ten ambulance wagons and ten wagon orderlies from the bearer division.

(3) The dressing station (if considered necessary) (furnished usually by a subdivision of the tent division) and the spare draft horses.

(4) The "Tent Division," less the dressing station personnel.

(5) The remainder of the unit. Men of the Army Service Corps not directly in charge of vehicles or horses will remain with the baggage of their section.

On approaching the scene of action, the O.C., leaving in a suitable position the tent division and transport, moves forward the bearer division with the personnel, forage cart, and water cart required to form the dressing station, and also the spare draft horses.

13. *Advance of Bearer Division and Dressing Station.*—The transport should be drawn to the side of the road, or preferably parked on any available ground in immediate proximity to the road. The bearer division and dressing station will, when required, be advanced. It should be remembered that the range of modern rifle fire, together with the fact that the stretcher bearers have frequently to perform their duties without opportunities of taking cover, may cause their advance to be delayed.

14. *Dressing Station.*—When the bearer division, the personnel and matériel for the dressing station are advanced, the O.C. will select and make known a rendezvous for the ambulance wagons, which in ordinary circumstances will be at the position chosen for the dressing station. Subject to the exigencies of the military situation, the following points should be considered in selecting this site.

It should be :—

(1) As far forward as possible consistent with reasonable safety.
(2) Near a road and on the probable line of advance or retreat.
(3) As near water as possible.
(4) In a position under cover from gun and rifle fire.
(5) On a site of sufficient space to allow of the whole unit being encamped, in case the site be chosen as the camping ground for the entire field ambulance.

(Sites hidden in or by woods are not recommended, as they are difficult to find and may hamper the movement of the wagons or limit expansion.)

The forage cart will be unpacked, ground sheets, blankets, and necessary medical and surgical equipment taken out and distinguishing flags erected. Kitchens dug and, if necessary, simple shelters erected, and full preparation made for the temporary treatment and feeding of the wounded.

The stretchers, haversacks, and water-bottles will now be distributed and the stretcher squads formed up.

15. *Collecting Wounded.*—The search for the wounded will then be conducted and the officers will be responsible for the direction of the ambulance wagons of their respective subdivisions, utilising, if necessary, flags, semaphore, or other means of direction on trees, walls, &c. ; they will see that the ambulance wagons are advanced as far as possible to meet the stretcher squads, and will give orders as to which cases may be carried back direct by hand seat, pick-a-back, &c.

16. *Duties of Bearers and R.A.M.C. Privates in Charge.*—The bearers, under the general direction of their officers, will collect the wounded, and upon No. 4 of the squad (the R.A.M.C. private in charge) will devolve the rendering of first aid (if not already rendered by, or under the direction of, the medical officer with the regiment or bearer division) to the patient, and the placing of him in a suitable position on the stretcher with regard to his particular injury.

17. *Responsibility of the R.A.M.C. Private*—He will carry the surgical haversack, and on no account will he become separated from it, as he will be often able to render assistance to cases in a position where the stretcher squad could not be brought.

18. *Specification Tallies.*—A specification tally will be filled up and attached to the wounded man when the necessary surgical treatment has been afforded, any precaution required in transit being noted. The counterfoil should be completed at the same time. Green coloured tallies will be used for those requiring immediate attention, and white for other cases.

19. *Serious Cases.*—The attention of a medical officer should, when possible, be called to each severely wounded man before removal, and he will give directions as to the proper method to be adopted. In certain cases, and under certain conditions, it may be inadvisable to remove them at once. Severe cases would naturally be the first chosen for removal.

20. *Removal of Wounded.*—Men with slight injuries able to walk, should be directed to the dressing station, or to where the ambulance wagons can be met. All stretcher squads, as soon as they have carried their patients to the dressing station or placed them in an ambulance wagon, will return to the front to collect further casualties. As each wagon is loaded it will move off under the charge of the wagon orderly to the dressing station where it will unload and return to the front. It will carry back with it additional stretchers and dressings if required. Upon arrival at the dressing station, the wounded should at once be sorted according to the severity of their wounds and be temporarily treated, if necessary. Subsequently, should the dressing station not be selected as the site for the ambulance camp they will be conveyed to any buildings, camp, &c., where the tent division may have established itself as a camping ground for the entire ambulance. Every advantage will be taken of good roads and level ground.

21. *Field Ambulance Camp.*—The position of the Field Ambulance Encampment having been decided upon, the tent division will occupy it, but will not necessarily pitch their tents, as buildings, huts, &c., will if available, be utilised for the accommodation of the wounded, in which case, the mobility of the unit will not be impaired. Here the particulars of each case will be entered in the admission and discharge book: the necessary reports upon the number and names of wounded will be prepared for transmission to the proper quarter, and the various duties in connection with the nursing, feeding, and treatment of the sick or wounded as well as with the disposal of arms, ammunition, valuables, clothing, &c., will be carried out.

22. *Application of General Principles.*—The foregoing instructions must necessarily be varied to meet the different exigencies of warfare, locality, the use of tents and buildings, forward or retro-

grade movements, &c. The general idea is, that the dressing station is an advanced post to which the Tent Division should be moved up as soon as military exigencies admit, thus bringing, as far as possible, the ambulances to the wounded, instead of the wounded to the ambulances.

23. *Transfer of Wounded to Hospital.*—As a Field Ambulance is a mobile unit, steps should be taken to transfer the sick and wounded to the rear as soon as possible after an action.

The above principles apply equally to a section of the Field Ambulance.

C. Organisation of a Cavalry Field Ambulance.

24. *General Idea.*—As cavalry move with rapidity and operate over extensive areas, a specially mobile unit is essential; to meet these requirements the Cavalry Field Ambulance has been formed.

25. *Divisions and Sections.*—A Cavalry Field Ambulance is composed of two divisions "Bearer" and "Tent" and is divisible into two sections "A" and "B," each of which consists of a bearer and a tent sub-division. Each section complete in both personnel and equipment is capable of being moved or mobilised independently.

26. *Bearer Division.*—The bearer division comprises six stretcher squads, three with a bugler in each sub-division under an officer. Each squad consists of four men, one of whom must be a R.A.M.C. private; the remainder may be specially enlisted on mobilisation. It also includes six heavy ambulance wagons, and four light ambulance wagons equally divided between the two sections. One R.A.M.C. corporal or private will be in charge of each heavy ambulance wagon, and one R.A.M.C. corporal and private or two privates are told off to each light ambulance wagon.

27. *Tent Division.*—The detail of the remainder of the personnel and vehicles is as shown in "War Establishments."

D. Duties in the Field.

28. *Position.*—The position of the unit on the line of march is the same as that of a Field Ambulance laid down in "Combined Training."

29. *Disposition in Action.*—As it is obviously impossible, owing to the wide dispersal and rapid movement of cavalry, for the bearer division of a Cavalry Field Ambulance to work in quite the same manner as that of a Field Ambulance, some modification is necessary, but the method will conform as far as practicable, to the lines laid down for a field ambulance. Each ambulance wagon may act more or less independently as directed by the O.C. the ambulance, and the formation of a dressing station will, as a rule, be unnecessary, and often out of the question.

30. *Light Wagons Acting Independently.*—In the event of a cavalry regiment or squadron being ordered to act separately, one of the light wagons will be detailed to accompany it, being placed temporarily under the orders of the M.O. attached to the detached unit. The number of light wagons admits of one being detailed to each regiment when the O.C. the ambulance considers this course necessary; but, upon return to camp, the light ambulance wagons will invariably rejoin the headquarters of the ambulance.

31. *The* Rôle *of the Light Wagon.*—The *rôle* of the *light wagon* is to keep in as close touch as possible with the regimental line of assistance. It acts as a feeder to the ordinary ambulance wagon, bringing in more distant casualties to the latter, but keeping up connection with the regiment. The *heavy ambulance wagons* advance at a safer distance, maintaining, as far as possible, touch with the lighter ones. They will work between a selected spot and the Tent Division, where the wounded will receive all necessary attention, prior to their speedy removal to a Clearing Hospital. Buildings should always be utilised by the Tent Division when available.

32. *Carriage of Personnel.*—As far as circumstances allow, the personnel will usually be carried in the ambulance wagons as long as these are not occupied by sick and wounded.

33. *Application of General Principles.*—The officer in command of this unit must be prepared to adapt his plans rapidly so as to meet as far as can be foreseen the various changes and movements which take place when a cavalry brigade is operating in the field, and on his initiative and power of improvisation, &c., the successful working of the unit will largely depend.

CHAPTER III.

FORMATIONS AND MOVEMENTS OF FIELD AMBULANCES.

A. The Field Ambulance.

34. *Inspection and Line of March.*—For inspection, and usually on the line of march, the Bearer and Tent Sub-division of each section will parade together. To facilitate disengaging* when the Bearer Division is ordered forward the Bearer Sub-divisions (except wagon orderlies) will fall in on the right, the Tent Sub-divisions on the left of each section respectively. Field Ambulances parade by the right in all formations.

* A Bearer Sub-division may be disengaged and formed up in any convenient manner, *e.g.*, by being marched clear of the remainder, and ordered to fall in by squads (each man having been told off to his squad on mobilization). Nos. 3 supply stretchers. Nos. 4 provide themselves with surgical haversacks and water-bottles.

A Field Ambulance on the line of march with other troops will follow its own division unless otherwise ordered, and will normally march in rear of the Brigade Ammunition Columns.

The road space covered by a Field Ambulance in Column of Route by Sections is 385 yards.

35. *Formations.*—A Field Ambulance may be drawn up for inspection in line or in column according to the ground available.

36. *Field Ambulance in Line.*—(1) The Medical Corps will be drawn up as a company of three sections in line, "A" section on the right, "B" section in the centre, and "C" section on the left (Fig. 1).

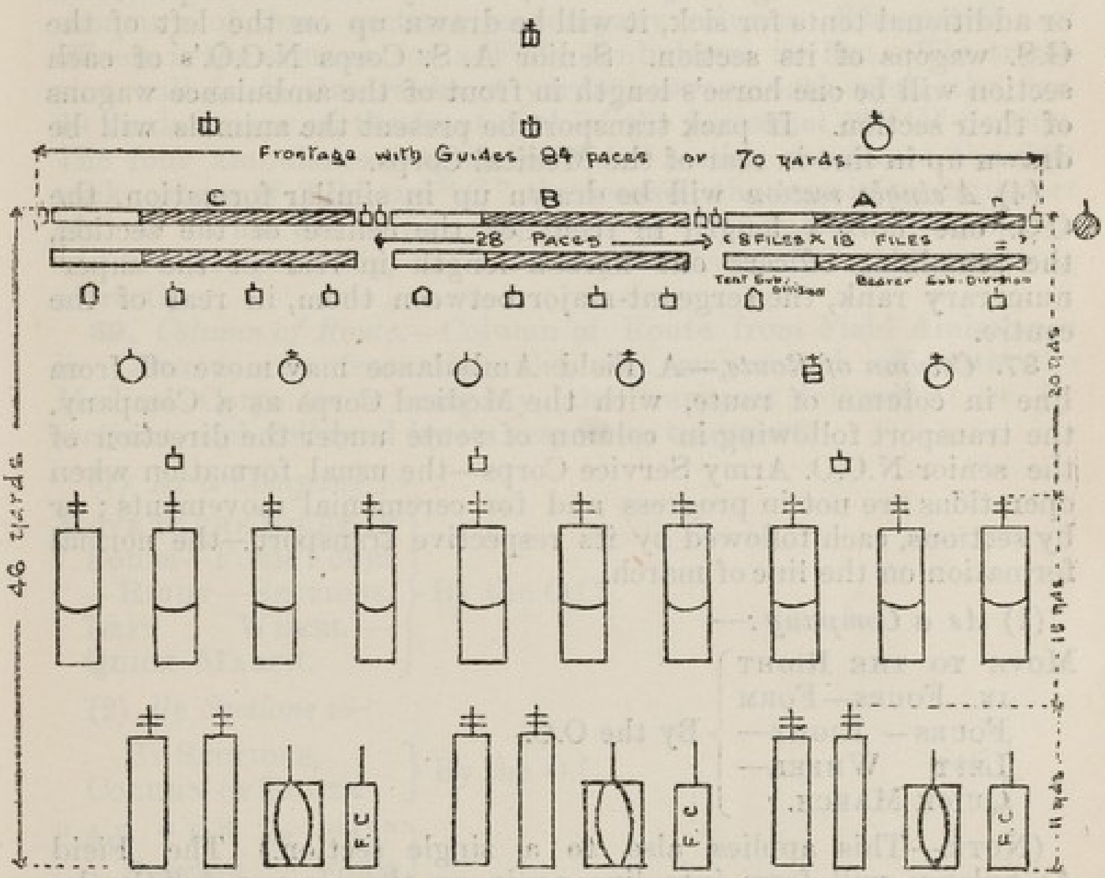


FIG. 1.—FIELD AMBULANCE IN LINE BY THE RIGHT.

(For key, see Frontispiece.)

(2) *Position of Officers.*—When the whole Field Ambulance is on parade together the senior Captain of "A" Section will act as a section commander. Section commanders will be one horse's length in front of the centre of their sections, the O.C. the Field Ambulance two horses' lengths in front of the centre of the line of section commanders. The other officers and the sergeant-major will be one horse's length behind the supernumerary rank of their respective sections, and the Quartermaster, if on parade, four paces to the right of, and in line with, the front rank.

(3) *Transport.*—The transport will be drawn up in rear in two

ranks at close (or half) interval, the first rank 20 yards in rear of the front rank of the Medical Corps, the second rank 4 yards from the first, measured from tailboards to heads of leaders; the directing flanks of the whole covering correctly. The Ambulance wagons (with wagon orderlies on the near side of the box seat) compose the first rank, the wagons of "A" Section on the right, those of "B" in the centre, and "C" on the left. In the second rank the remaining transport will be drawn up by sections in line ("A" on the right) and in the following order from right to left of each section, viz:—forage cart, water cart, two general service wagons. When a second forage cart is added, to carry blankets for personnel or additional tents for sick, it will be drawn up on the left of the G.S. wagons of its section. Senior A. S.' Corps N.C.O.'s of each section will be one horse's length in front of the ambulance wagons of their section. If pack transport be present the animals will be drawn up in line in rear of the Medical Corps.

(4) *A single section* will be drawn up in similar formation, the C.O. one horse's length in front of the centre of the section, the remaining officers one horse's length in rear of the supernumerary rank, the sergeant-major between them, in rear of the centre.

37. *Column of Route.*—A Field Ambulance may move off from line in column of route, with the Medical Corps as a Company, the transport following in column of route under the direction of the senior N.C.O. Army Service Corps—the usual formation when operations are not in progress and for ceremonial movements; or by sections, each followed by its respective transport—the normal formation on the line of march.

(1) *As a Company:*—

MOVE TO THE RIGHT IN FOURS—FORM FOURS—RIGHT—LEFT WHEEL—QUICK MARCH.	By the O.C.

(NOTE.—This applies also to a single section.) The Field Ambulance will form into line again on the command "On the Left-Form Company," or into column (see para. 38) on the comman "On the Left, Form Sections." In both cases the caution "At the Halt" will be given if it is intended to halt in line or column.

(2) *By Sections:*—

BY SECTIONS—COLUMN OF ROUTE.	By the O.C.
"A," "B," OR "C" SECTION—FORM FOURS—RIGHT—LEFT WHEEL—QUICK MARCH.	By the Section Commanders.

Each section of the Medical Corps as it moves off in succession is followed by its own transport in column of route, commanders of sections in rear, allowing an interval of 10 yards between the transport of the sections in front and the leading section of fours of their command. Line or column may be re-formed on the principles mentioned in (1) of this paragraph, section commanders forming their sections into line or column on the order of the O.C. "(At the Halt) Form Line" or "Form Column"; commanders of sections in rear allowing for the transport of the preceding section.

38. *Field Ambulance in Column* (Fig. 2).—(NOTE.—Not applicable to a single section.) The Medical Corps will be drawn up as a company of three sections in company column. The position of officers is the same as for a Field Ambulance in line. The transport will be in five ranks, 4 yards between each rank, the first 20 yards in rear of the front rank of the personnel of "C" Section. The four ambulance wagons of "A" section constitute the first rank; those of "B" and "C" the second; the remaining transport of "A" forms the third rank; that of "B" and "C," the fourth and fifth, respectively, the directing flanks of the whole covering correctly.

39. *Column of Route.*—Column of Route from Field Ambulance in Column. As from line the unit may march off with the Medical Corps as a company, the transport following; or by sections, each followed by its respective transport.

(1) *As a Company* :—

MOVE TO THE RIGHT IN FOURS—FORM FOURS—RIGHT—SECTIONS, LEFT WHEEL—QUICK MARCH. } By the O.C.

(2) *By Sections* :—

BY SECTIONS, COLUMN OF ROUTE. } By the O.C.

"A," "B," OR "C" SECTION, FORM FOURS—RIGHT—LEFT WHEEL—QUICK—MARCH. } By the Section Commanders.

Each section moving off in succession, followed by its own transport, as from a Field Ambulance in Line.

40. *Ceremonial.*—Sections may be sized irrespective of subdivisions.

Inspection or Review.—(1) In line, as for a R.A.M.C. Company.

(2) In Column. Section commanders act as described for Captains of R.A.M.C. Companies in column.

When officers are ordered to "Take posts in Review Order," the C.O. and section commanders remain in their positions when in Line, the remaining Officers take post in line with the section

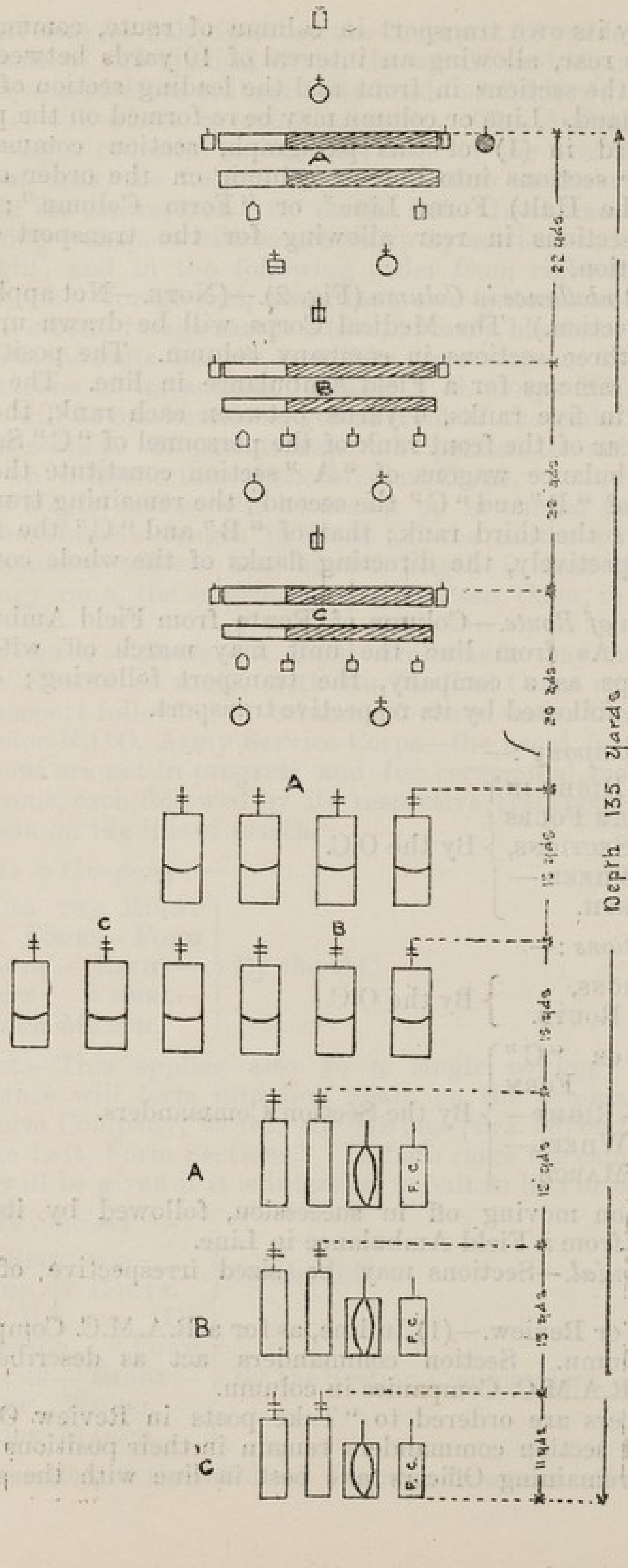


FIG. 2.—FIELD AMBULANCE IN COLUMN BY THE RIGHT.
(For key, see Frontispiece.)

commanders. In Column the C.O. and section commander of "A" Section remain steady, all other officers take post in line with the section commander of "A" Section.

Marching Past.—A Field Ambulance will march past in the formation of a Field Ambulance in line.

The general principles for marching past as laid down in Infantry Training and Army Service Corps Training will be observed by the Medical Corps and Transport details respectively.

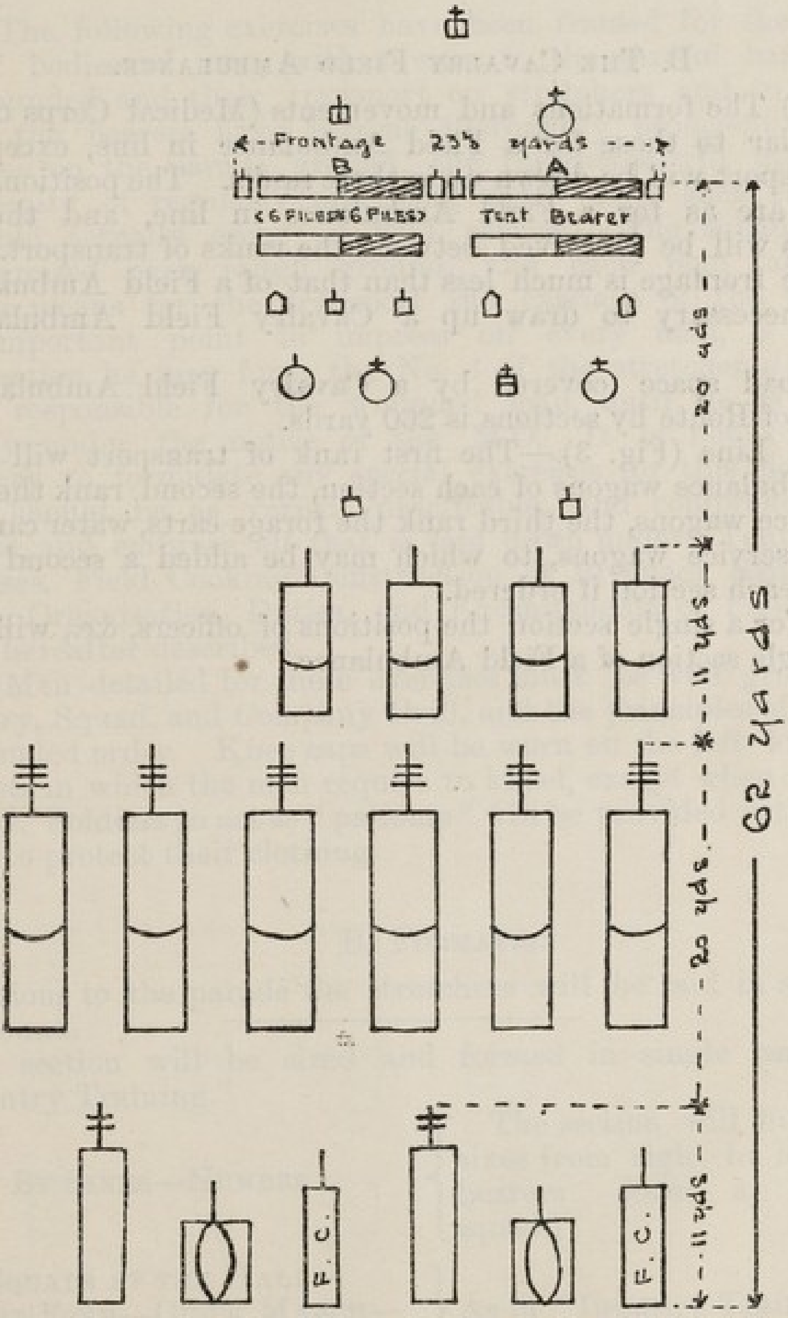


Fig. 3.—Cavalry Field Ambulance in Line by the Right.

(For key, see Frontispiece.)

Under these circumstances, stretchers will not be carried in the hand when marching past.

When more than one Field Ambulance is to march past, the O.C. the whole will place himself two horse's lengths in front of the commander of the leading unit, the officer acting as adjutant two horse's lengths in rear of the centre of the last line of transport.

Distance between units 20 yards, measured from tailboards to commanders of units.

B. The Cavalry Field Ambulance.

41. (1) The formations and movements (Medical Corps on foot) are similar to those for a Field Ambulance in line, except that the transport will be drawn up in three ranks. The positions of the officers are as for a Field Ambulance in line, and the same distances will be preserved between the ranks of transport.

As the frontage is much less than that of a Field Ambulance, it is not necessary to draw up a Cavalry Field Ambulance in Column.

The road space covered by a Cavalry Field Ambulance in Column of Route by sections is 260 yards.

(2) In Line (Fig. 3).—The first rank of transport will be the light ambulance wagons of each section, the second rank the heavy ambulance wagons, the third rank the forage carts, water carts, and general service wagons, to which may be added a second forage cart for each section if ordered.

(3) For a single section the positions of officers, &c., will be as for a single section of a Field Ambulance.

CHAPTER IV.

STRETCHER EXERCISES.

A. General Remarks.

42. The following exercises have been framed for the instruction of bodies of men, with a view to the careful handling of the wounded and their transport on stretchers and in wagons. When the bearers have become thoroughly proficient in these exercises on the parade ground, the Instructor will take every opportunity of regularly practising them under such conditions as would actually occur on field service. The squads should be exercised over rough ground, and each man taught the various means for the transport and carriage of the wounded. The important point to impress on every man, is that on mobilization he may form the No. 4 of the stretcher squad, and so be responsible for the wounded man, until he is brought directly under the notice of the M.O. It is not considered necessary to formulate any special exercises for this field work, which should be as varied, practicable, and comprehensive as possible, and embrace all that is laid down under Tent-pitching Exercises, Field Cooking, Construction of Bivouacs, Sanitation of Camps, Organisation, Duties, and Encampments of Field Ambulances hereafter described.

43. Men detailed for these exercises must be well grounded in Infantry, Squad, and Company Drill, and the principles of working in extended order. Knee caps will be worn on the left knee at all exercises in which the men require to kneel, except when otherwise ordered. Soldiers to act as "patients" will be provided with ground sheets to protect their clothing.

B. Formation

Previous to the parade the stretchers will be laid in a heap on the ground.

The section will be sized and formed in single rank as in "Infantry Training."

By Sixes—Number.	The section will number by sixes from right to left. (Six bearers form a stretcher squad.)
Squads at the Halt—Right Form—Quick March—Left Turn—Right Dress.	As in "Infantry Training."

The bearers are now proved.

FIRST RANK. NO. 1 BEARERS—STAND AT EASE.
SECOND RANK, NO. 2 BEARERS—STAND AT EASE, and so on.

The bearers will thus be proved.

SQUADS—ATTENTION.

NUMBER THE SQUADS.

NO. 3 BEARERS—RIGHT (OR LEFT) TURN—SUPPLY STRETCHERS—QUICK MARCH.

Two.

The No. 1 bearers number from right to left.

On the word MARCH, the No. 3 bearers will march to the pile of stretchers where each bearer in turn will stoop, lay hold of a stretcher, and place it on his right shoulder at the slope, holding it by the lower racket, rollers to the front and lead on, stepping short. As soon as the last bearer is provided with a stretcher, he will give the command *About Turn—Forward.* The party will turn about and rejoin their squads in quick time, halting as they arrive in their places. Taking the time from the leading bearer, they turn to the front, and passing the lower ends forward, place the stretchers on the ground to the right of the squads, rollers to the right, front ends of the poles in line with the toes of the Nos. 1, and rise together working by the right.

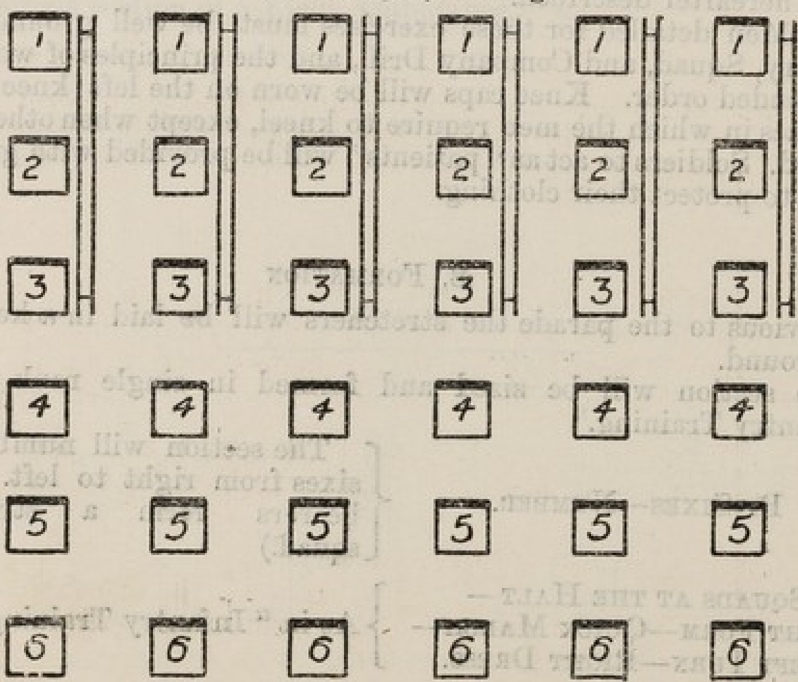


FIG. 4.—"STAND TO STRETCHERS."
No. 2 in position at centre of Stretcher.

Stand to Stretchers.	On the word Stretchers, the Nos. 1 place themselves with their toes in line with the front ends of the poles. Nos. 3 with their heels in line with the rear ends of the poles, close to and touching the stretcher with their right foot. Nos. 2, 4, 5, and 6 will take up their positions one pace behind, and covering off the bearer in front of them (see Fig. 4).
Lift Stretchers.	On the word Stretchers, Nos. 1 and 3 stoop, grasp both handles of the poles with the right hand, rise together holding the stretcher at the full extent of the arm, rollers to the right.
Lower Stretchers.	On the word Stretchers, Nos. 1 and 3 stoop, place the stretcher quietly on the ground, and rise smartly together.

C. Dismissing.

Lower Stretchers. By the Right—Quick March. Squads—Halt. Stand Easy.	The squads are marched clear of the stretchers.
Remove Knee-caps.	Knee-caps are removed and collected.
Squads—Attention. Dismiss.	As in Infantry Training.

D. Exercises with Closed Stretchers.

Lift Stretchers.	As before detailed.
By the Right (or Left)—Quick March.	The squads will advance.
Squads—About Turn.	The whole turn about, the stretchers being passed from one hand to the other by the Nos. 1 and 3.
Change Stretchers.	If the squads are advancing, the Nos. 1 will pass the stretchers from one hand to the other behind them. The Nos. 3, seeing this done, will pass the stretchers from one hand to the other in front of them, the Nos. 2 moving diagonally to their places. If the squads are retiring, Nos. 1 act as detailed for Nos. 3, and the Nos. 3 as for Nos. 1, Nos. 4, 5, and 6 in each case continue in their respective places.

The stretcher must be carried in the right hand when the command About Turn is given.

E. Moving to a Flank.

When it is necessary to move to a flank, the command *Right* (or *Left*) *Turn* is given. When a squad is marching to the right, and the command *About Turn* is given, the Nos. 1 and 3 will seize the handles of the stretcher with the left hand and cut away the right while turning about, resuming the grasp with the right hand after the turn has been completed.

Changing Direction.

At the Halt—Right (or Left) Form.	On the word Form, the No. 1 of the squad on the flank named will make a full turn, the remainder of the Nos. 1 a partial turn in the required direction, the remainder of the bearers a partial turn in the opposite direction.
Quick March.	On the word March, the No. 1 of the squad on the flank named stands fast, the remainder step off and, glancing to the right (or left), move by the shortest route to their places in the new alignment, halt, and take up their dressing independently.

G. Extending.

From the Right (Left, or any named Squad) to Four Paces Extend.	*On the March.*—On the word extend, the named squad will continue to move on in quick time, the remainder will make a partial turn outwards, double to their places, turning to their front, and breaking into quick time as they arrive there (see Fig. 5).
On the Right (Left, or any named Squad), Close.	On the word Close, the named squad will continue to move on in quick time; the remainder will make a partial turn towards it, double to their places, turning to their front and breaking into quick time as they arrive there.

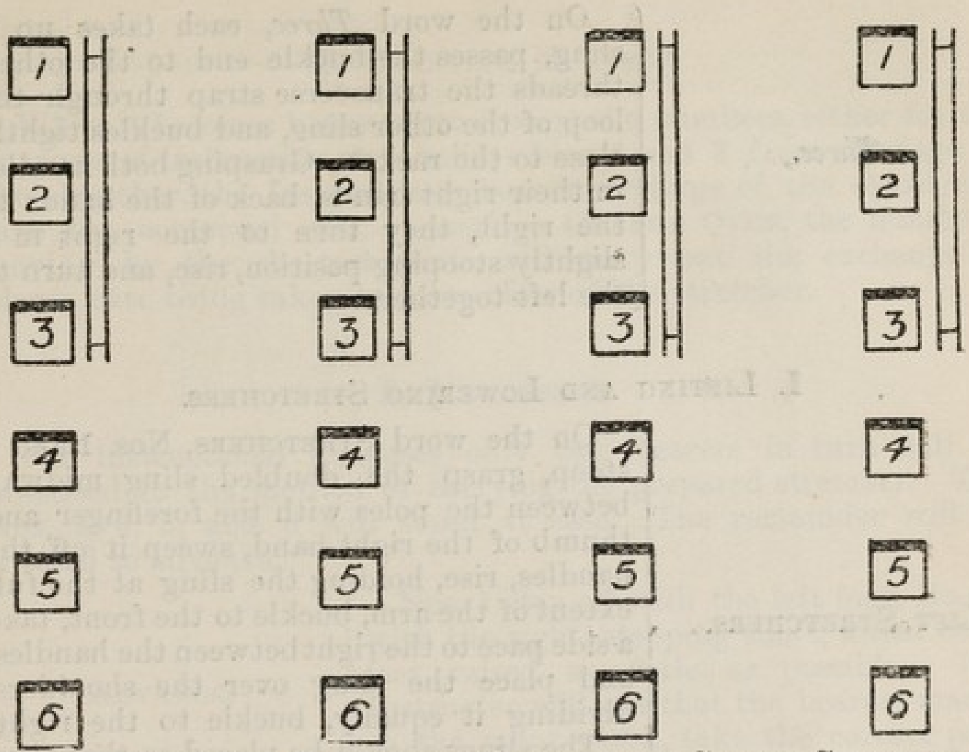


FIG. 5.—POSITION IN EXTENDED ORDER WITH CLOSED STRETCHERS.

H. EXERCISES WITH PREPARED STRETCHERS.

Preparing and Closing Stretchers.

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

PREPARE STRETCHERS.	Nos. 1 and 3 turn to the right, kneel on the left knee, unbuckle the transverse straps, and place the slings on the ground beside them, separate the poles, and straighten the traverses.
Two.	On the word *Two*, each takes a sling, doubles it on itself, slips the loop thus formed on the near handle, and places the free ends over the opposite handle, buckle uppermost. They then rise and turn to the left together.
CLOSE STRETCHERS.	Nos. 1 and 3 turn to the right, kneel on the left knee, remove the slings and place them on the ground beside them, push the traverses in, raise the canvas, and approximate the poles.
Two.	On the word *Two* they rise, lifting the stretcher, face one another, place the handles of the poles between the thighs, rollers to the right, and roll the canvas tightly round the poles to the right.

Three.	On the word *Three*, each takes up a sling, passes the buckle end to the other, threads the transverse strap through the loop of the other sling, and buckles tightly close to the racket. Grasping both handles in their right hands, back of the hands to the right, they turn to the right in a slightly stooping position, rise, and turn to the left together.

I. Lifting and Lowering Stretchers.

Lift Stretchers.	On the word Stretchers, Nos. 1 and 3 stoop, grasp the doubled sling midway between the poles with the forefinger and thumb of the right hand, sweep it off the handles, rise, holding the sling at the full extent of the arm, buckle to the front, take a side pace to the right between the handles, and place the sling over the shoulders dividing it equally, buckle to the right. The slings should be placed so that they lie well below the collar of the frock behind and in the hollow of the shoulders in front.
Two.	On the word *Two*, stoop, slip the loops over the handles, commencing with the left, and grasp the handles firmly.
Three.	On the word *Three*, rise slowly together, lifting the stretcher, No. 3 conforming closely to the movements of No. 1.
Lower Stretchers.	On the word Stretchers, Nos. 1 and 3 slowly stoop and place the stretcher gently on the ground, slip the loops from the handles and stand up, remove the slings from the shoulders, holding them as before described.
Two.	On the word *Two*, they stand to stretchers, stoop, place the slings on the handles, as in prepared stretchers, and rise together.

J. Adjusting Slings.

In the event of the slings requiring to be adjusted, either as regards length or for the greater comfort of the bearers, the Instructor or bearer in charge of the squad will detail a bearer to carry this out, the length of the sling being adjusted, when necessary by means of the buckles.

K. CHANGING NUMBERS.

When it becomes necessary to change the numbers, either for the purposes of instruction or to relieve Nos. 1 and 3 from carriage of the stretcher, the Instructor or bearer in charge of the squad will give the command *Nos. — and —* CHANGE OVER, the numbers, moving by the shortest route, will carry out the exchange of places, care being taken to move clear of the stretcher.

L. MOVEMENTS.

For instructional purposes only two bearers in turn will be practised in the method of carrying the prepared stretcher. The Nos. 2, 4, 5, and 6 will stand at ease. The remainder will be ordered to advance.

ADVANCE.	Nos. 1 step off with the left foot, Nos. 3 with the right, stepping short, knees bent, feet raised as little as possible. The Instructor will see that the bearers march on the point given, take the correct pace as regards length, &c.
RETIRE.	Each No. 1 will move round on the circumference of a circle of which No. 3 is the centre. No. 3 will mark time, turn gradually in the direction named. The whole move forward when square.
ADVANCE.	Each squad will resume the original direction to the front, by a movement similar to that detailed for retiring. On arriving at the position of the squads, the stretchers will be lowered and the bearers changed.
RIGHT (or LEFT) INCLINE.	As detailed for RETIRE, but only one-eighth to the right or left.

M. LOADING AND UNLOADING STRETCHERS.

Loading.

COLLECT WOUNDED. ADVANCE.	Each squad doubles by the shortest route to its corresponding patient, and halts without further word of command one pace from the head of and in a line with the patient (see Fig. 6).

The Nos. 4 will then proceed to the patient and examine his injury, and if his carriage on the stretcher is necessary will give the commands *Lower Stretcher—Prepare Stretcher.*

Whilst the stretcher is being prepared by Nos. 1 and 3, the disengaged bearers will advance and render to the patient such assistance as may be required (see Fig. 7).

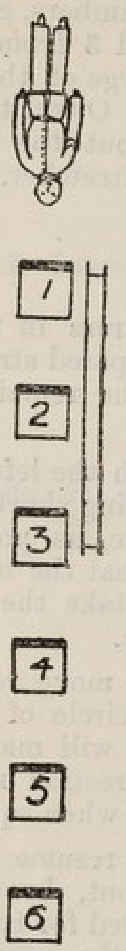


FIG. 6.—' COLLECT WOUNDED—ADVANCE.'

The Squad has advanced, halted, and lowered Stretcher.

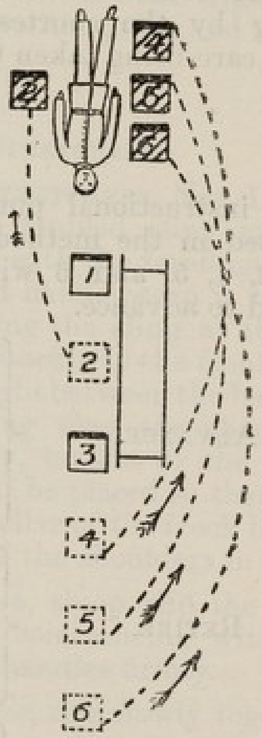


FIG. 7.—" PREPARE STRETCHER."

Disengaged bearers advancing and rendering assistance to Patient.

The necessary assistance having been rendered, the Nos. 4 will give the command *Load Stretcher*, when the bearers will place themselves as follows :—Nos. 1, 2, and 3 on the left, 4, 5, and 6 on the right of the patient ; Nos. 1 and 4 at the knees, 2 and 5 at the hips, 3 and 6 at the shoulders, the whole kneeling on the left knee. Nos. 1 and 4 pass their hands beneath the patient's knees, 2 and 5 beneath the hips, 3 and 6 beneath the shoulders, care being taken of the injured part, one of the bearers being specially detailed for this purpose (see Fig. 8).

LIFT. — The Nos. 4 will then give the command *Lift* when the whole will carefully lift the patient on to the knees of Nos. 1, 2, and 3.

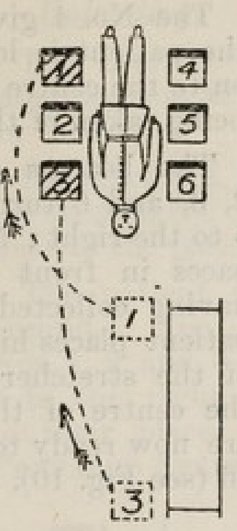


Fig. 8.—"Load Stretcher."

Bearers placing themselves in position to lift Patient.

Two.	Nos. 4, 5, and 6 then disengage, rise; Nos. 4 and 6 step back one pace. No. 5 turns to his left, doubles to the stretcher, takes hold of and raises it, left hand across the near pole, resting on the left hip, carrying the stretcher, returns to his place between 4 and 6, and places it beneath the patient.
Three.	Nos. 4 and 6 step forward one pace, and together with No. 5, kneel down on the left knee and prepare to assist in lowering the patient (see Fig. 9).

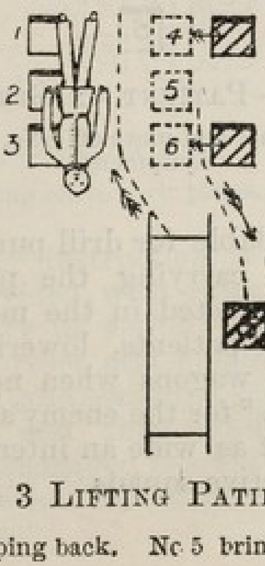


Fig. 9.—Nos 1, 2 and 3 Lifting Patient on to their Knees.

Nos. 4 and 6, stepping back. No. 5 bringing the Stretcher.

Lower. The No. 4 giving the command *Lower*, the patient is lowered slowly and gently on to the centre of the canvas (special care being taken of the injured part).

Two. The bearers disengage, rise; Nos. 1, 2, 3, and 6 turn to the left; Nos. 4 and 5 to the right; No. 4 places himself three paces in front of the stretcher. No. 6 having collected the kit and arms of the patient places himself three paces in rear of the stretcher. Nos. 2 and 5 opposite the centre of the stretcher. The whole are now ready to lift stretchers and move off (see Fig. 10).

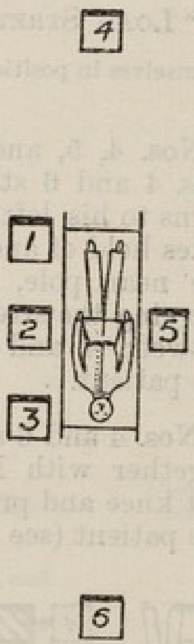


Fig. 10.—Patient on Stretcher.

Bearers ready to lift stretcher and move off; No. 6 with patient's rifle and equipment.

When the ground available for drill purposes permits, the class should be exercised in carrying the prepared stretcher over various obstacles and instructed in the methods most suitable to the safe carriage of the patients, lowering the stretcher, and carrying it as in loading wagons when necessary. With a view of minimising the "target" for the enemy's fire, the bearers should be instructed to move at as wide an interval as possible, keeping in touch with their respective squads.

Unloading.

UNLOAD STRETCHER.	The bearers place themselves in the same position at the stretcher as described for LOADING.
LIFT.	As described for LOADING, except that the stretcher is carried forward three paces clear of the patient's feet.
LOWER.	The patient is gently lowered to the ground. The bearers disengage, rise; Nos. 1, 2, and 3 turn to the left, 4, 5 and 6 to the right, and the whole step off to their places at the stretcher as in PREPARED STRETCHER (see Fig. 11).

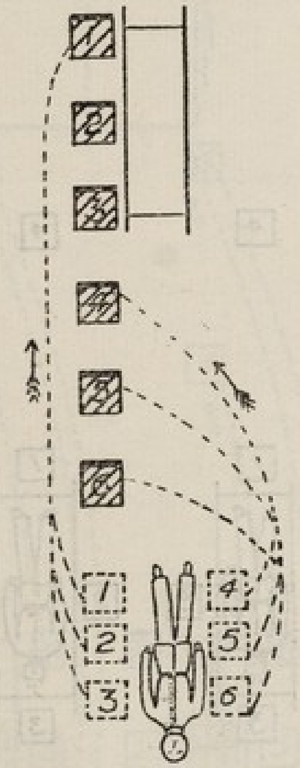


FIG. 11.—UNLOADING. "LOWER."

Bearers stepping off to their places at the Stretcher.

When the class under instruction is advanced sufficiently, the patients should be provided with rifles, and where possible such kit as they would carry in action. As the squads retire the No. 6 will take up the rifles and holding them pointing upwards open the breach, detach and examine the magazine to ensure that the rifle is unloaded, and then rejoin their squads. When necessary one of the disengaged bearers will assist in carrying the kit of the patient, or when desirable it may be used as a pillow or support to the patient.

N. Loading and Unloading Ambulance Wagons with Patients on Stretchers.

Loading.

For instructional purposes the squads will be numbered by fours. Wagon Orderlies will be told off to each wagon. They will lower the seats and rails of the upper compartment and prepare them for the reception of the wounded.

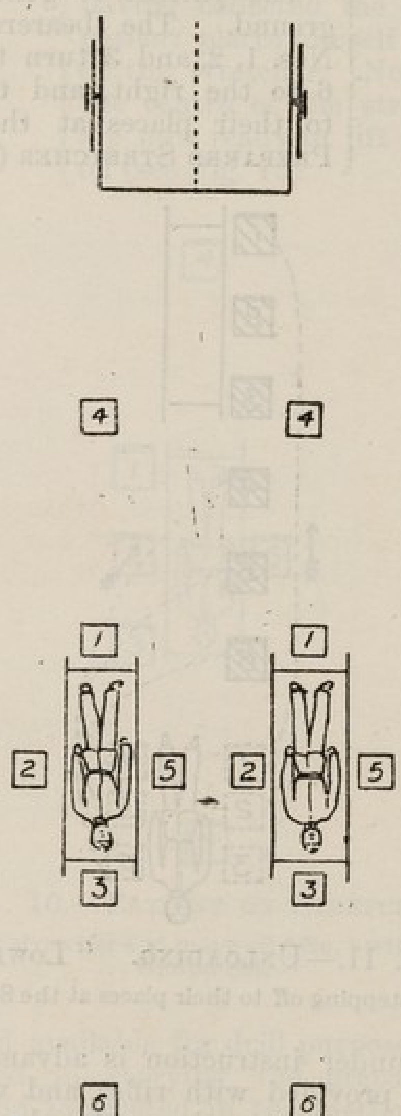


Fig. 12.—"On Wagons—Retire."

Two squads are shown halted. Four paces from the tail-board of the wagon.

The line of Stretcher Squads retires towards the line of wagons, the four

On Wagons—Retire. — squads on the left as the line is retiring, proceed to the wagon on the extreme left The next four squads to the next wagon, and so on to the right of the line, closing in and halting without further word of command, four paces from the tail-board of the wagon.

The stretchers will be lowered to the ground and the slings fixed as follows:—Nos. 1 and 3 turn to the right, kneel on the left knee, pass the loop of the buckle end, buckle downwards, over the near

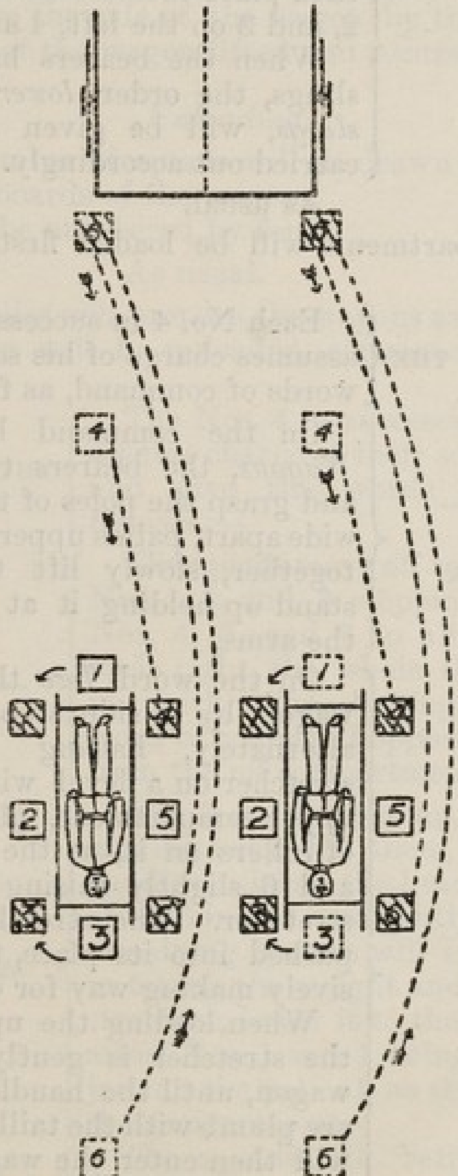


FIG. 13.—"LOWER STRETCHERS AND FIX SLINGS.
Two Squads showing movements of No. 6 and position of bearers for loading.

Lower Stretchers and Fix Slings. handle, carry the sling under and round the opposite handle close up to the canvas, back to the near handle, round which two or three turns are made, pass the transverse strap round the pole between the racket and traverse and fasten the buckle outside the sling between the poles and stand to stretchers; whilst this is being done the Nos. 6 will fix the rifles and put away the patients kit in the wagon, then rejoin their squads and take up their positions opposite No. 3. The bearers will then place themselves as follows:—Nos. 1, 2, and 3 on the left, 4 and 5 on the right.

When the bearers have learned to fix slings, the order, *lower stretchers and fix slings*, will be given as one order and carried out accordingly.

Stand Easy. As usual.

The upper compartments will be loaded first commencing with the Off-side.

Squads in Succession from the Right—Load. Each No. 4 in succession from the right assumes charge of his squad and gives the words of command, as follows:—

No. Squad—Attention. Load Wagons. On the command by numbers *Load Wagons*, the bearers turn inwards, stoop and grasp the poles of the stretcher, hands wide apart, palms uppermost. Then acting together, slowly lift the stretcher and stand up holding it at the full extent of the arms.

Two. On the word *Two* they advance to the wagon by a side step, crossing the feet alternately, halting and lifting the stretcher on a level with the floor of the upper compartment, place the front pair of rollers on it, at the same time Nos. 3 and 6 slightly raising the head of the stretcher. The stretcher is then gently pushed into its place, the bearers successively making way for each other.

When loading the upper compartments the stretcher is gently pushed into the wagon, until the handles at the head end are plumb with the tailboard. Nos. 3 and 6 will then enter the wagon, No. 3 proceeding to the foot, No. 6 to the head end of the stretcher, gently push it into its place and secure it there.

Re-form Squad.	As soon as the stretcher is in its place and Nos. 3 and 6 have rejoined, the bearers break off and re-form squad as in file, facing the field three paces behind and to the right of the remaining squads.
Stand Easy.	As usual.

As soon as the off upper compartment is loaded, the next squad will be ordered to load the near upper compartment. As soon as this is completed the lower compartments will be loaded in the same way. When loading the lower compartments, it will not be necessary for Nos. 3 and 6 to enter the wagon.

When the wagon is fully loaded the upper back seats will be securely strapped to the side of the wagon by the Wagon Orderly, and the tail-board of the wagon lifted and secured in its place.

Unloading.

The requisite number of squads will be drawn up 10 paces from and facing the tailboards of the wagons.

The squads will be numbered by fours.

Stand Easy.	As usual.

The wagon orderlies will prepare the wagons as for loading. The lower compartments will be unloaded, commencing first with the off compartment.

Squads in Succession from the Right—Unload.	The Nos. 4 in succession from the right assume charge of their squads as in loading and give the words of command as follows :—
No. Squad—Attention. For Unloading—Take Post.	The squads move off towards the wagons, Nos. 1, 2, and 3 stepping short, allow the Nos. 4, 5, and 6 to align themselves on their right, the whole then move forward in quick time, halting without further word of command opposite to and one pace from the off compartment.
Unload Wagons.	Nos. 3 and 6 move up, the other bearers making way for them, lay hold of the handles raising the head of the stretcher about 6 inches, and gently withdraw it, the remaining bearers will in succession assist in taking the weight and withdrawing the stretcher, lower it to the full extent of the arms, Nos. 1 and 4 being careful to avoid jarring the patient, as the stretcher leaves the compartment.
Two.	The squads will retire and place the stretcher on the ground selected for this purpose, then stand to stretchers.
Stand Easy.	As usual.

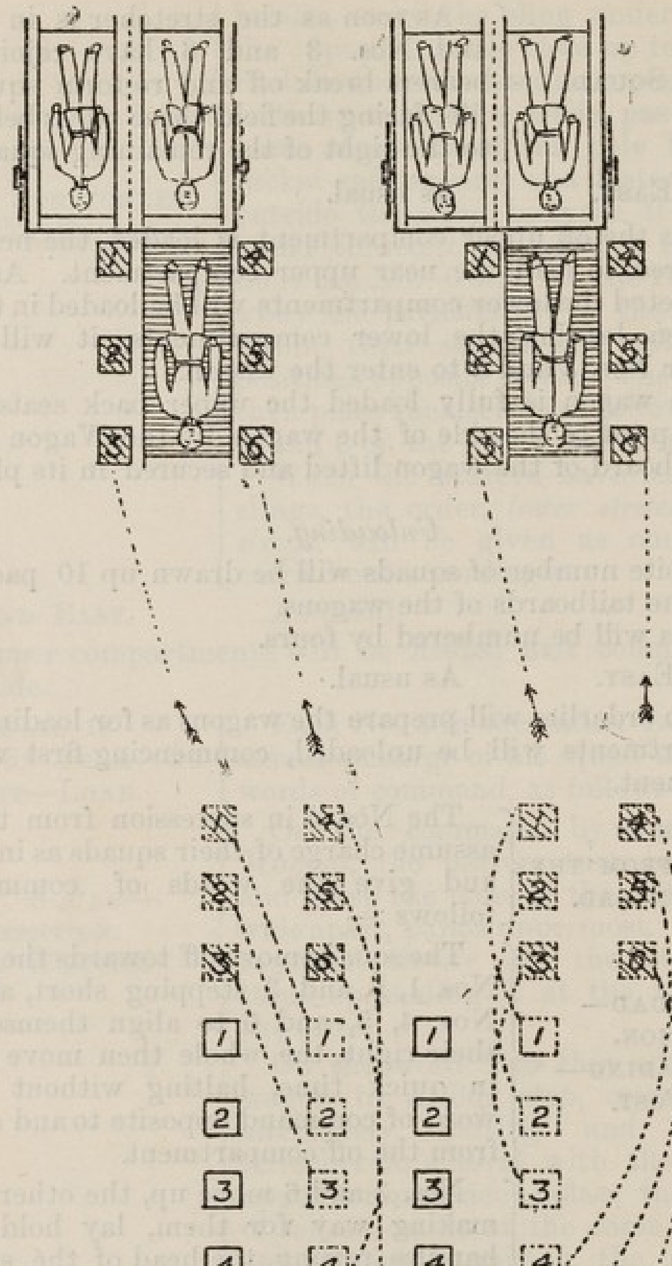


FIG. 14.—UNLOADING WAGONS.
Squads taking post, and unloading.

In unloading the Upper compartment Nos. 3 and 6 enter the wagon as in loading, withdraw the stretcher until the handles at the head end are plumb with the tail-board of the wagon; they now rejoin their squad and the stretcher is withdrawn as in previous detail.

When all the compartments are unloaded, the Nos. 6 will return, collect and remove the kits and arms of the patients and rejoin their respective squads.

O. Exercises for Stretcher. Mark I, Special.

When supplying stretchers, care should be taken that the stretchers are placed on the ground with the hooded, or head end of the stretcher towards the Nos. 3.

Loading.

The patient having been placed on the stretcher, Nos. 2 and 5 raise the hood, adjust the front pair of lines, passing them through the leather loops fixed on the stretcher, and fastening off. Nos. 3 and 6 at the same time pass the rear lines through the eyes in the rear of the canvas and secure them. The bearers then rise together, Nos. 1, 2, and 3 turn to the left, Nos. 4, 5, and 6 to the right.

Lifting.

On the command Lift Stretchers, the Nos. 1 and 3 will lift the stretcher as before. As soon as this is carried out, Nos. 4 and 5 step back and place themselves by the side handles on the right of the stretcher. Nos. 2 step up and place themselves by the side handles on the left in line with Nos. 4. The Nos. 6 turning outwards and passing round by the head of the stretcher, place themselves on the left of the stretcher in line with Nos. 5.

Advancing.

On the command Advance, the whole move off. Nos. 1, 2, and 6 with the left foot, Nos. 3, 4, and 5 with the right. Nos. 2, 4, 5, and 6 laying hold of the side handles, will assist in carrying the stretcher.

Lowering.

The stretcher will be lowered to the ground, and the bearers place themselves at the stretcher as for unloading. (Nos. 1, 2, and 3 on the left, Nos. 4, 5, and 6 on the right.)

Unloading.

On the command Unload, Nos. 2 and 5 unfasten the front lines, Nos. 3 and 6 the rear lines, and lower the hood. As soon as this is done the patient is lifted as before.

Loading Wagons.

Previous to the stretchers being placed in the wagons, the side handles will be pushed under the stretcher.

P. Loading and Unloading Stretchers with Reduced Numbers.

With Four Bearers.

Exercises with four bearers can be carried out in a similar manner to those laid down for six, the detail for Nos. 5 and 6 being omitted.

When loading and unloading stretchers, the Nos. 1, 2, and 3 will be on the left of the "patient," No. 4 on the right, opposite No. 2. The "patient" will be lifted and lowered as usual, No. 4 disengaging to fetch or remove the stretcher. No. 2 will be responsible for the "patient's" kit.

In loading and unloading wagons, Nos. 1 and 2 will be at the foot end of the stretcher, and 3 and 4 at the head end.

With Three Bearers.

(1) In the event of there being only three bearers available, the stretcher will be placed at the "patient's" head, and in the same line as his body. The bearers will then lift the "patient," rise to the erect position, carry him head foremost over the foot of the stretcher, the horizontal position of his body being maintained throughout the movement, and then lay him in a suitable position on the canvas. When unloading, the "patient" will be lifted and carried head foremost over the head of the stretcher. To lift the "patient":—one bearer, placing himself on the injured side in a line with the "patient's" knees, raises and supports the lower limbs, while the other two, kneeling on opposite sides of the "patient" near his hips, facing each other, each pass an arm under his back and thighs, lock their fingers so as to secure a firm grasp, and raise and support the trunk.

With Two Bearers.

(2) When only two bearers are available, the stretcher will similarly be placed at the "patients" head, and in the same line as his body. The bearers will then lift the "patient," rise to the erect position, carry him, in loading, head foremost over the foot of the stretcher, and in unloading, head foremost over the head. The method of lifting will vary according to whether the lower limbs are severely injured or not. (*a*) With a severe injury of one of the lower limbs, both bearers place themselves on the injured side; the one in a line with the "patient's" knees must raise and support the lower limbs, the one near the "patient's" hips, the body; assisted by the "patient" himself as far as possible, the horizontal position of the "patient's" body being maintained

throughout the movement. (*b*) With the lower limbs intact, or only slightly injured, the "patient" may be lifted by the improvised seat described in the next section, provided there are no symptoms of shock present; in the latter case, method (*a*) must be resorted to.

Q. Formation of Hand Seats.

The company will be drawn up in double rank and numbered; odd numbers right files, even numbers left files.

Form Two-handed Seats.	On the word Seats, the right files turn to the left, and the left files turn to the right.

Fig. 15.—Two-handed Seat.

Two.	On the word *Two,* each even No. locks the fingers of his left hand with the fingers of the right hand of the odd No. facing him, palms uppermost, and each places the disengaged hand upon the other's hip.
Files Right and Left—Turn.	The files resume the position of attention and turn in the original direction.

R. Exercises with Country Carts, General Service Wagons, &c.

General Remarks.

It may be necessary to employ country carts or General Service wagons for the transport of the wounded. When used for this purpose the floors of such conveyances should be thickly covered with straw, on which the stretchers conveying the wounded requiring the recumbent position should be placed.

In practising loading these carts or wagons, stretchers and patients will be drawn up on the parade ground, as detailed for Ambulance Wagon Drill, and the same steps taken to load and unload as in the case of ambulance wagons. In loading, however, the Nos. 1 and 4 of each squad, after the end of the stretcher has been placed on the floor, will spring into the wagon, and, with the assistance of the other Nos. on the ground, lift the stretcher into position.

Sometimes the recumbent wounded have to be put into the wagons without stretchers, none being available. When this happens, the bearers, following as far as possible the instructions given for lifting wounded in Stretcher Exercises will lift each wounded man, and carefully carry him to the wagon. On arriving at the back of the wagon, No. 4 will get into it, and supporting the wounded man under both shoulders will lift him in, assisted by the other Nos., who will subsequently get into the wagon and help to place the wounded man in the most advantageous position possible.

Unloading is the converse of this proceeding.

S. Exercises with Railway Wagons.

The railway wagons in this country which can be made use of for the purpose of transporting wounded men are passenger carriages, in which the patients can, if necessary, be laid on the seats, and goods wagons. No special instructions appear to be necessary for loading and unloading wounded men as are able to walk and assume the sitting posture, recumbent patients alone being alluded to in the text.

(1) *Preparation of Wagon by Zavodovski's Method.*

To prevent jarring, these wagons require to be fitted with some special apparatus. That most generally used is known as Zavodovski's (Fig. 16). To prepare a wagon according to Zavodovski's method the following stores are required :—

4 cables,
16 ropes prepared with loops,
8 large hooks and rings,
32 small ring bolts,
4 stout poles of suitable length,
8 field stretchers, and
28 stout cords for lashings.

The large hooks and rings are inserted in the sides of the wagon near the roof; from these the cables are suspended across the wagon, the poles are secured lengthwise to the cables and the

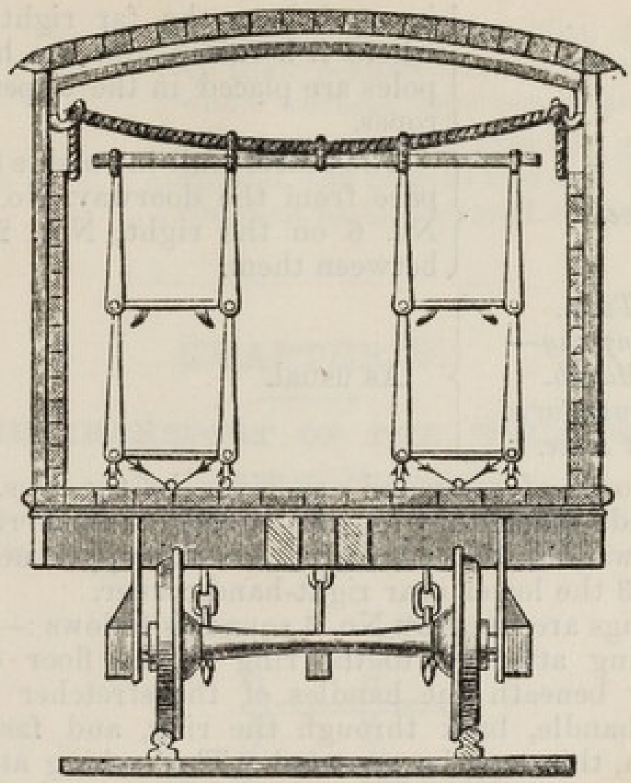


FIG. 16.—TRANSVERSE SECTION OF A GOODS WAGON FITTED ON ZAVODOVSKI'S PLAN.

looped ropes attached to them. By means of these, two tiers of stretchers are supported, four stretchers in each tier. The lower tier is made fast to the small rings on the floor.

(2) *Railway Wagon Exercise.* (*Loading.*)

The bearers with lowered loaded stretchers will be drawn up in extended order 10 paces from and facing the goods wagon.

FIX SLINGS. STAND EASY.	As usual.
SQUADS—IN SUCCESSION FROM THE RIGHT—LOAD.	Each No. 4 in succession from the right assumes charge of his squad and gives the words of command, as follows :—
No. Squad—Load Wagons.	As in Wagon Exercise.
Two.	The squads advance by the nearest way to the wagon, wheeling when opposite to, and one pace from, the doorway, and the stretcher is carried into the wagon head first, the Nos. 2 and 5 bearers releasing their hold of the stretcher and remaining outside as this movement is carried out. The stretcher

	is carried to the far right-hand corner, where it is raised, and the handles of the poles are placed in the upper loops of the ropes.
Three.	The bearers fall in outside the wagon one pace from the doorway, No. 1 on the left, No. 6 on the right, Nos. 2, 3, 4, and 5 between them.
Right Turn. *Rejoin Company—* *Quick March.* *Halt—About Turn.* *Stand at Ease.*	As usual.

Similar words of command are given by the Nos. 4 of the successive squads when they see the squad on their right falling in outside the wagon. No. 2 squad loads the upper near right-hand corner, No. 3 the lower near right-hand corner.

The lashings are fixed by No. 4 squad as follows :—

The lashing attached to the ring in the floor of the wagon immediately beneath the handles of the stretcher is carried up round the handle, back through the ring, and fastened off. If long enough, this may be repeated. The lashing attached to the ring lying between the handles is passed up round the left handle, back through the ring, round the right handle, and back to the ring : thus forming a V where it is fastened.

The upper tier is steadied by a lashing starting from a ring-bolt in the side of the wagon, which is carried across and secured to the opposite side, a firm hitch being taken round each handle. The lashings will be drawn tight to prevent the swaying of the stretchers.

The left half wagon is loaded in a similar manner.

(3) *Railway Wagon Exercise.* (*Unloading.*)

The converse of loading. The lashings of the left half of the wagon are unfixed, and the unloading commenced with the near lower stretcher on the left.

The squads will be drawn up 10 paces from and facing the wagon.

SQUADS—IN SUCCESSION FROM THE LEFT—UNLOAD. *No. Squad—Attention.* *For Unloading.* *Take Post.*	As in Wagon Exercise, but halting one pace from the doorway.
Two.	On the word "*Two,*" Nos. 2 and 5 take a side pace outwards. Nos. 3 and 6 then enter the wagon and proceed to the head of the stretcher, Nos. 1 and 4 to the foot, lift and remove it from the loops, and carry it clear of the wagon. As it is brought

through the doorway, Nos. 2 and 5 take up their positions at the stretcher, and the whole working together advance ten paces.

Three. The stretcher is lowered gently to the ground, the bearers rise and take up their positions as in prepared stretchers.

CHAPTER V.

THE TRANSPORT OF THE WOUNDED.

A. General Remarks.

44. During an action and immediately afterwards first aid to the wounded is rendered by the medical officer of the unit, and the

Fig. 17.—Improvised Seat, as an Aid in Carrying a Man Pick-a-Back.

Made of twisted straw, &c., wound round a strong stick or pole.
AA. The seat. BB. Arm loops for Bearer.

regimental stretcher bearers, trained according to King's Regulations. They are assisted by the squads of the bearer division of the Field Ambulance, who will get into touch with them as soon as possible.

In some of the Continental armies, ambulance dogs are used for seeking out the wounded after an action has taken place. These trained dogs have not yet been adopted in our army, but some successful experiments have been carried out with them at Aldershot.

Wounded men are carried out of action either pick-a-back, by two-handed seats, or on stretchers, till they are placed in the ambulances for removal to the Tent Division.

If conscious, and able to hold on, a man can be carried by another pick-a-back. If a stout piece of wood or board, and the braces made of straw-rope, rushes, &c., as shown in Fig. 17, are used, they add greatly to the comfort of the wounded man, and ease the bearer carrying him.

In case of a fractured leg and only one bearer on the spot. After applying a splint, the wounded man could be assisted to the nearest cover by the method shown in Fig. 18, till removed by a stretcher squad.

FIG. 18.—ASSISTING A MAN WITH BROKEN LEG TO MOVE TO A POSITION OF SHELTER.

The injured limb being supported by a sling whilst the man works himself along the ground.

If the patient is helpless he may be carried by means of "the fireman's lift" (Figs. 19, 20, 21).

FIREMAN'S LIFT.

FIG. 19.

FIG. 20.

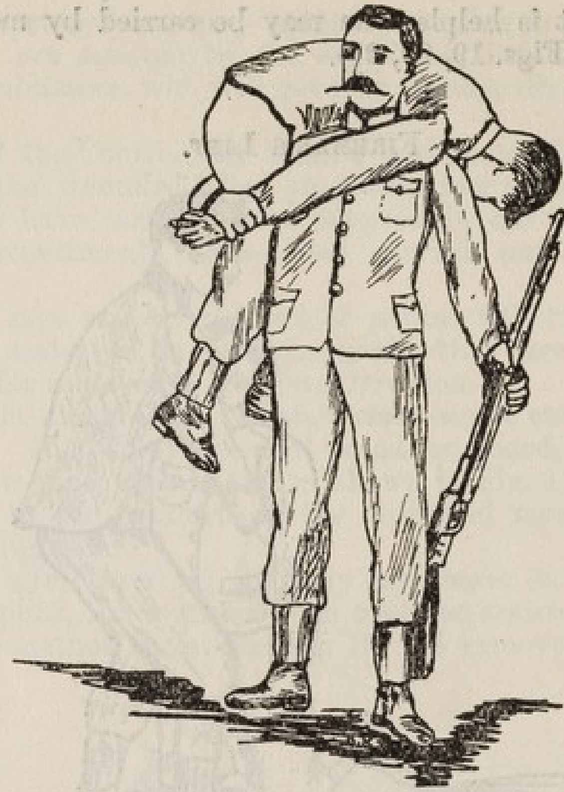


Fig. 21.

This means is well adapted for cases of insensibility, and is carried out as follows :—

(1) Roll the "patient" over on the face, the arms to the side.
(2) Stand at the head, place your hands beneath the "patient's" shoulders, and raise him to the kneeling position (see Fig. 19).
(3) Place your hands under his armpits, raise him up, stoop, place your head beneath his body, bring his right arm around your neck, put your right hand around "patient's" right thigh, bring his weight well on to the centre of your back (Fig. 20), grasp his right wrist with your right hand, and rise to the erect position (Fig. 21).

B. Removal by Two Bearers.

45. If able to sit up, a patient can be carried by the two-handed seat described under Stretcher Exercises (Fig. 15). If the man is insensible, one bearer kneeling behind passes his hands under his armpits and clasps them in front of his chest, the second bearer carries him feet first with a leg on either side. If the lower limb is injured, however, both legs should be tied together and carried in a horizontal position.

In the case of mounted men, if no bearers are near, a wounded man can be taken out of action by a comrade who places him on his horse. If only slightly wounded and he can sit in the saddle the comrade should sit behind; if badly hit, he should place the wounded man in front of him, with his face to the horse's tail and hold him in his arms, the wounded man able to assist, holding on to the cantle of the saddle with both hands; or he might be laid across the saddle face downwards, and supporting himself with one foot in a lengthened stirrup, could be led by a comrade.

To carry an insensible man on a horse, place the man astride over the horse's withers, his head facing the horse's tail, if possible make a pad with horse blanket on the saddle, cross the stirrup leathers over the man's back, and secure by the head rope to the stirrup irons from the off to the near side under the horse's belly. His legs would naturally hang clear of the horse's shoulders, and in this way he could be led or galloped out of action.

The occasion might arise in savage warfare when a dead man has to be brought away on a horse. He could 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. Tie the second rope round his waist and continue it round his ankles with a tail free. Cross the stirrups over the saddle of the horse, lift him on, face downwards, head to the offside. Pass the tail of the rope from the wrists under the horse's belly, and fasten to the stirrup which hangs over the near side, similarly pass the second rope under the belly and fasten to the stirrup on the off side, the horse can then be galloped out of action.

It is of the greatest importance in all field work to know how to tie up a horse so that he cannot move from the spot, or to tie two horses together. The whole of the personnel of a Cavalry Field Ambulance should certainly possess this knowledge.

This 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 near side and rebuckle.

At the same time the stirrup iron should be run up to the flap of the saddle.

C. To Couple two Horses together.

46. Horses can be securely coupled by turning the 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 reins when tied are not more than 6 to 8 inches long.

D. Removing Wounded Man from Horse.

47. If the squads of the Cavalry Field Ambulance are within call, the following methods are suitable for lifting a wounded man off his horse. Three bearers are enough, but a fourth can hold the horse's head. In the case of an injured lower limb, Nos. 1, 2, and 3 approach on the wounded side. On the word "*Lay hold*" (given by No. 1) No. 1 from behind catches hold of the pelvis and sound leg. No. 2 is held round the neck and shoulders by the wounded man, and No. 3 holds the wounded limb. On the words "*Ready*" "lift off," the "patient" is taken off and held over the stretcher placed alongside, and on the word "*Lower*" is laid on it. In the case of injured upper limb, the wounded man is approached on the sound side. No. 1 supports pelvis and legs, No. 2 is held round the neck by the "patient's" sound arm, and No. 3 supports the wounded limb. Words, same as before.

Many ingenious devices have been suggested for carrying men on litters and stretchers on horseback, tying them into chairs strapped on to the horse, and using various supports for the back, &c., but they are of little or no practical value in the field.

Cacolets or folding chairs hooked on to pack saddles, and carried on pack animals can, however, be used with advantage for the transport of sick and wounded, in hill and desert warfare, where wheeled transport is impossible.

E. Description of Stretchers.

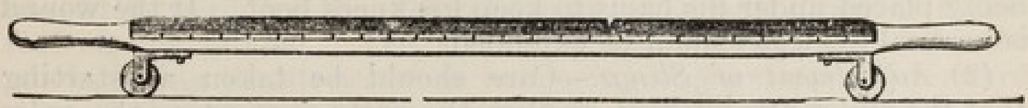
48. The regulation ambulance stretchers in use are those known as Mark I, Special Mark I, and Mark II.

In *Mark I* stretchers the canvas, which is tanned, is fastened to the poles by copper nails through an edging of leather; the poles are square and kept apart the required distance by two flat wrought-iron jointed bars called traverses, and they are fitted with four brackets each carrying a 3-inch gunmetal or wooden roller. A pillow and pair of shoulder slings are provided with each stretcher. The pillows are wedged shaped, varying from $3\frac{1}{2}$ to $1\frac{1}{2}$ inches in thickness, and are kept in the ambulance wagon for use with the stretchers supplied with the wagon. There are eyelet holes in the canvas of the stretcher at both ends for the attachment of the pillow at either end by strings. The sling, which is either a broad leather strap, or if of the latest pattern, a strip of tanned web, has at either end a loop, one of which is furnished with a buckle by means of which the sling can be lengthened or shortened, and at the opposite end is a narrow transverse strap fixed at right angles, which is buckled round the stretcher when closed.

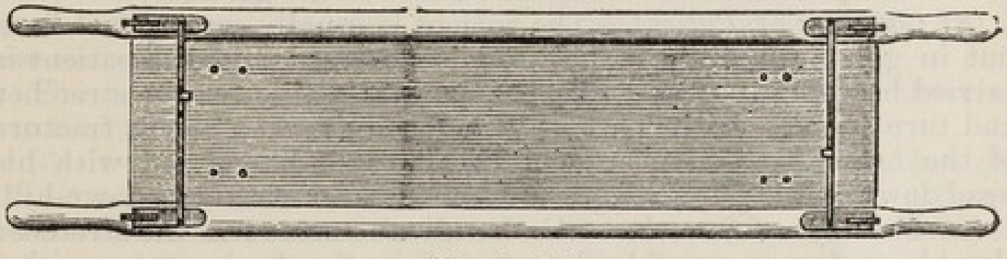
Special Mark I.—The ambulance stretcher, Special Mark I, is fitted with a collapsible hood for use in hot climates or for protection from the rain, and with four hinged handles, two on each side, so that it can be carried by six bearers. It is also provided with four shoulder pads. This stretcher is especially well adapted for carrying a wounded man a long distance. It weighs 8 lbs. more than the Mark I stretcher.

The following are the dimensions and weight of the Mark I stretcher :—

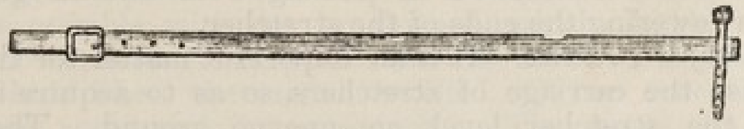
Length	Canvas	6 feet	0 inches.
	Pole	7 ,,	9 ,,
Width, total		1 ,,	11 ,,
Height		0 ,,	$5\frac{7}{8}$,,
Weight...		34 lbs.	
Tonnage		·08 tons.	



Side Elevation.



Plan (under).



Sling, with Transverse Strap.

FIG. 22.—AMBULANCE STRETCHER, MARK I.

Mark II.—This stretcher is generally similar to Mark I, except that the poles are fitted on the under side with steel U-shaped runners instead of brackets with rollers.

F. GENERAL RULES FOR THE CARRIAGE OF STRETCHERS.

Position of Patient, &c.

49. (1) *Consideration of the Nature of Injury.*—Special care should always be taken to notice the part injured and the nature of the injury, as these determine in a great measure the position in which the patient should be placed during transport. In all cases the head should be kept low, and on no account pressed forward on to the chest. In wounds of the head care should be taken that the patient is so placed that the injured part does not press against the conveyance.

In wounds of the lower limb the patient should be laid upon his back, inclining towards the injured side ; such position being less liable to cause motion in the broken bone during transport in cases of fracture.

In wounds of the upper limb, if the patient require to be placed in a lying-down position, he should be laid on his back, or on the uninjured side, as in cases of fracture there is less liability in these positions of the broken bones being displaced during transport.

In wounds of the chest there is often a difficulty in breathing. In such cases the patient should be placed with the chest well raised, his body at the same time being inclined towards the injured side.

In transverse or punctured wounds of the abdomen, the patient should be laid on his back, with his legs drawn up, so as to bring the thighs as close to the belly as possible, a pack or other article being placed under his hams to keep his knees bent. If the wound is vertical his legs should be extended.

(2) *Adjustment of Slings.*—Care should be taken at starting that the slings are buckled so that the parts supporting the poles are all at equal distances from the surface of the ground.

(3) *Carriage of Patient.*—The patient is usually carried feet first, but in going up hill the position is reversed, and the patient is carried head first. To do this the bearers will lower the stretcher and turn about. If the patient is suffering from a recent fracture of the lower extremity he will, in all cases, be carried with his head down hill. The stronger and taller bearer should be down hill.

(4) *Carriage of Stretcher.*—Under all circumstances the stretcher should, as far as possible, be carried in the horizontal position which may be maintained in passing over uneven ground, by raising or lowering the ends of the stretcher.

Necessity for Practice.—It is an important matter for the bearers to practise the carriage of stretchers, so as to acquire facility in keeping the stretcher level on uneven ground. The bearers trained and habituated to this duty perform it with ease and dexterity, irrespective of difference in their heights; while those who have not practised it are not unlikely to cause considerable distress to the patient when they have to carry him up and down hill. A concerted action of the front and rear bearers is necessary, and each must be aware what part he is to perform, according as the end of the stretcher at which he is placed is rendered higher or lower by the unevenness of the surface over which they are passing. This can best be acquired by practising the carriage of the stretcher up and down steps, or over uneven ground.

Passing a Wall or Fence.—No attempt will be made to carry a patient over a high fence or wall, if it can possibly be avoided, as such is always a dangerous proceeding. A portion of the wall should be thrown down, or a breach in the fence made, so that the patient may be carried through on the stretcher; or, if this be not practicable, the patient should be carried to a place where a gate or opening already exists, notwithstanding the distance to be traversed may be increased by the proceeding. It is better to do this than risk the safety of the patient.

(5) *Crossing a Ditch.*—On arrival at a ditch to be crossed the No. 4 should select a piece of level ground near its edge where the stretcher should be lowered.

The bearers will then take up position at the stretcher as in loading wagons; the stretcher, with the patient on it, is then lifted and carried as near the edge as possible and lowered to the ground.

Nos. 1 and 4 descend into the ditch, lay hold of the handles of the stretcher, and lifting it draw it forward; the remaining bearers in succession descend and take hold of the stretcher which is then passed forward to the opposite side, and the front pair of rollers rested on top of the bank.

Nos. 1 and 4 now climb up and guide the stretcher which is pushed forward by the other bearers until both pairs of rollers rest on the ground. The remaining bearers climb up, and the whole, lifting the stretcher as in loading wagons carry it forward clear of the ditch and place it on the ground, the bearers taking up position as in "prepare stretchers." The No. 4 should then examine the patient with a view to readjusting dressings, &c., if necessary, after which the march will be resumed.

The necessary words of command for lifting and lowering stretchers, &c., will be given by No. 4.

(6) *Crossing a Canal or River when no Boats or Bridges are Available.*—In this case it is necessary to improvise a raft on which one or more stretchers can be placed. This can be done as follows:—Dig a trench 7 feet by 7 feet by 3 feet, and into this place a large tarpaulin or cover of a wagon, fill the trench as tightly as possible with cut brushwood, which should be firmly stamped down, enough tarpaulin should have been left to fold over and bind when the trench is filled. When taken out bind with strong ropes and fasten securely. The whole can then be floated across with the assistance of the bearers.

(7) *Stretcher never to be Carried on Shoulders.*—On no account will bearers carry a stretcher on their shoulders, as it is necessary that one of them should have the patient in view. In the event also of the patient falling from such a height, owing to one of the bearers tripping or being wounded, his injuries might be considerably aggravated.

G. Stretcher Carriers.

50. *The Brook-McCormac.*—Various vehicles have been designed for the carriage of a loaded stretcher, perhaps the most useful of which is that known as the Brook-McCormac Ambulance Stretcher Carriage. It consists of two rubber-tyred wheels on an axle, fitted with a wooden framework, upon which a service stretcher is placed and locked by catches. The bearers place themselves between the handles of the stretcher in front and behind, and so propel the carriage (see Fig. 23).

It is well adapted for use in base hospitals.

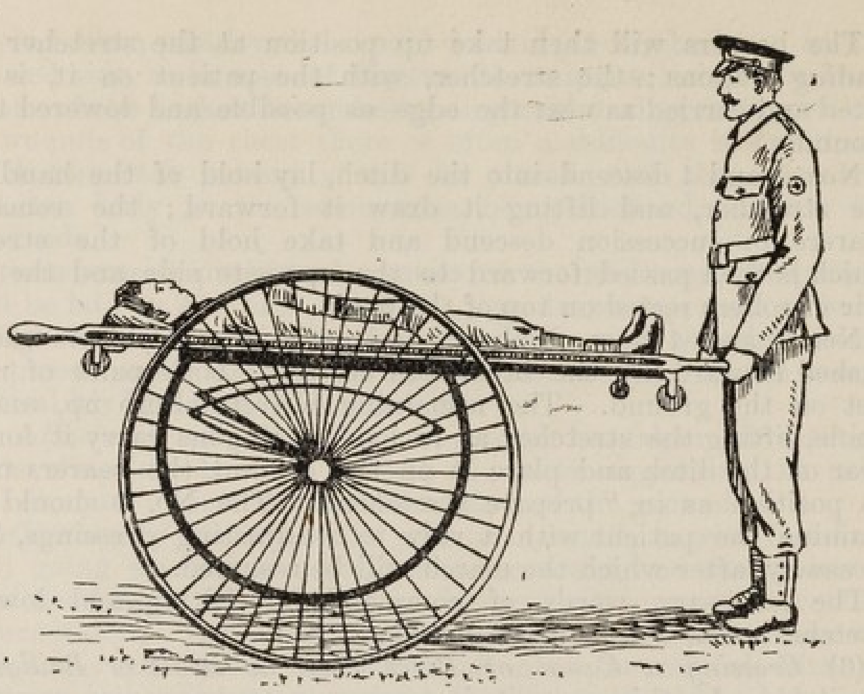


FIG. 23.—THE BROOK-MCCORMAC AMBULANCE STRETCHER CARRIAGE.

H. DESCRIPTION OF AMBULANCE WAGONS.

The regulation vehicles which are designed expressly for the conveyance of the sick and wounded are called ambulance wagons. Those in use at the present time are Mark V*, Mark VI and Mark I (light).

Mark V, Ambulance Wagon.* (*Fig.* 24.)

51. This wagon is a conversion of the present Mark V. It is constructed to accommodate four men on stretchers (two stretchers on the floor and two on the seats immediately above) or 12 men sitting (six on each side) or two men on stretchers (above the floor) and four sitting (at the rear end).

Lockers, "Medical" and "Drivers," are formed under the driver's seat, and are closed by doors opening outward below the footboard. Three lockers are also provided at the front end of the interior, one on each side of the floor, and a narrow one for comforts immediately beneath the centre of the driver's seat. Fittings to carry thigh splints above the front lockers are also provided.

Two stretchers are placed on the floor of the wagon, the wheels resting on rubber pads to prevent slipping, and two on the lifting seats supported on iron brackets. Above the seats are rails (two long and two short) on hinges upon which the stretchers traverse, the ends of the stretcher pole passing through the heel board on driver's seat. On the large rails are bevelled pieces of wood with indiarubber pads in which the wheels of the stretcher rest to prevent sliding.

The vehicle is fitted with a perch, and a "Jacob's" lock fore-carriage, which reduces the strain on the body in travelling, and admits of large front wheels being used, so as to minimise the pull

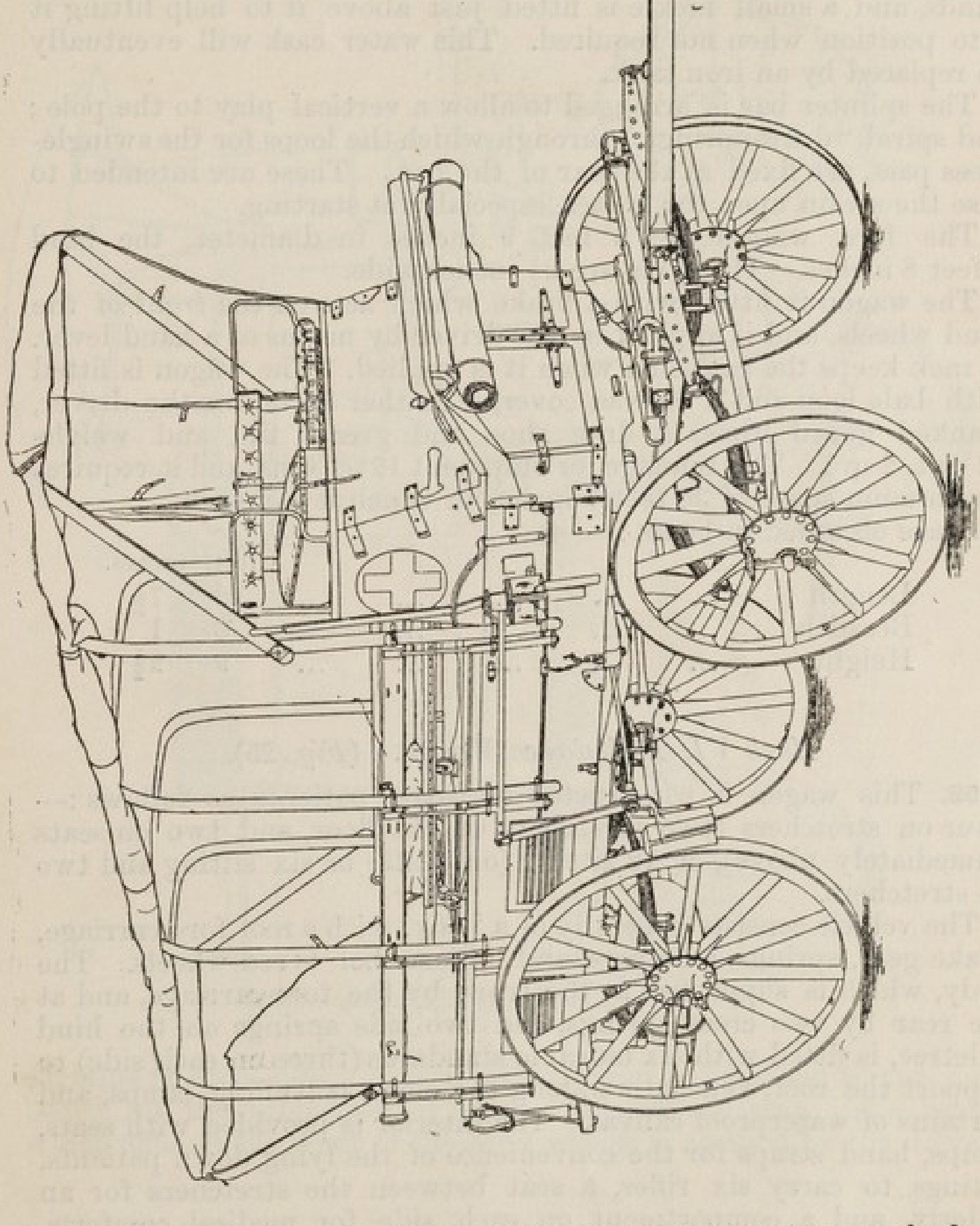


FIG. 24.—WAGON, AMBULANCE, MARK V.*

on the horses. It is also fitted with a pole and swingle-trees for long rein driving. There is a sliding step to the back of the wagon, which when not in use, can be raised and pushed close up to the tailboard in guides fixed along the bottom for that purpose. The sides are fitted with ventilators, staples for the bale hoops, and standards for the back rail. Fittings are attached to the back rails and under the seats for carrying rifles, and there are two straps attached to the back rails for the safety of the patients.

Sockets are fixed to the sides for supporting the lamp brackets.

A wooden ladder to assist the patients in mounting is carried, and is strapped to the underside when not in use. A water cask, capable of carrying 10 gallons, is secured under the rear by iron bands, and a small tackle is fitted just above it to help lifting it into position when not required. This water cask will eventually be replaced by an iron tank.

The splinter bar is arranged to allow a vertical play to the pole; and spiral "draw-springs" through which the loops for the swingle-trees pass, are fixed at the rear of the bar. These are intended to ease the strain upon the horses, especially at starting.

The fore wheels are 3 feet 9 inches in diameter, the hind 4 feet 8 inches. The tyres are 2½ inches wide.

The wagon is fitted with a brake which acts on the front of the hind wheels, and is applied by the driver by means of a hand lever. A rack keeps the brake on when it is applied. The wagon is fitted with bale loop and a canvas cover, a leather apron for the driver, cranked guard irons, a drag shoe and grease tin, and weighs 22 cwt. 2 qrs. The tonnage for shipment 12·98 tons, and it requires a minimum space of 30 feet 7 inches in which it can turn.

Space occupied in boats :—

	feet.	inches.
Length	12	7½
Breadth	6	1
Height	9	2½

Mark VI. Ambulance Wagon. (*Fig.* 25).

52. This wagon is constructed to carry patients as follows :— Four on stretchers (two stretchers on the floor, and two on seats immediately above), or 12 sitting (on seats) or six sitting and two on stretchers.

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, &c., 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

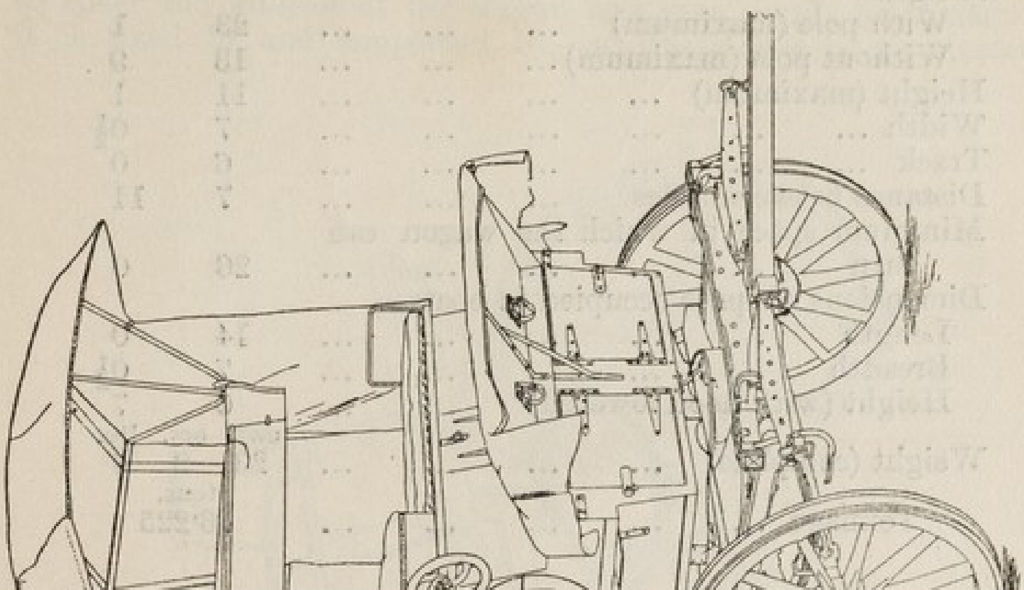


FIG. 25.—WAGON, AMBULANCE, MARK VI.

curtains at each side. A waterproof apron is attached to the foot-board 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.

Dimensions, &c.

	feet.	inches
Length—		
With pole (maximum)	23	1
Without pole (maximum)...	13	9
Height (maximum)	11	1
Width	7	0½
Track	6	0
Distance between axles	7	11
Minimum space in which the wagon can turn	26	0
Dimensions of space occupied in boats—		
Length	14	0
Breadth	7	0½
Height (with hood lowered)	6	7
	cwt. qrs. lbs.	
Weight (complete)	23 2 6	
	tons.	
Tonnage	16·225	

Mark I. Light Ambulance Wagon. (*Fig.* 26.)

53. This wagon is constructed to carry two patients on stretchers, or eight sitting, six inside and two outside.

The vehicle consists generally of a body, fore-carriage, brake gear, cover, axletrees, and four wheels.

The body which is supported at the front by the fore-carriage and at the rear by the two side springs on the hind axletrees, consists principally of an oak frame, with sides, floor and tailboard, the interior forming a well for the stretchers and seats. The front portion consists of a footboard and lockers, the top of the lockers forming the driver's seat, which is provided with guard irons, back rest, and driver's seat box. The front part of the body is supported over the fore-carriage by two bolsters (one upper and one lower) separated by transverse springs, a sweep plate being fixed to the underside of the lower bolster. The hind axletree is connected to the lower bolster and sweep plate by a perch with front and rear stays. The interior is provided with two removable arm rests and three hinged seats on each side, which may be turned upwards and secured to a back rail. The floor is fitted with indiarubber pads for the stretchers, which are secured by leather straps. The tailboard, which is hinged to the floor, is fitted with a folding step. A compartment to carry an aluminium water tank is formed under the floor at the rear. A leather guard strap is attached to two standards at the rear to protect the sitting patients. One of the lockers under the driver's seat is accessible from the interior, and is closed by a door; another, with two compartments and a tin-lined box, is accessible from the foot-board. Fittings are provided to carry two lamps outside and one inside. The brake which acts on the front of the hind wheels is applied by the driver. The cover, which is removable, is made of canvas and duck, and is formed to cover the interior of the wagon and give ample head room; it is fixed to, and supported by, two main bale hoops pivoted

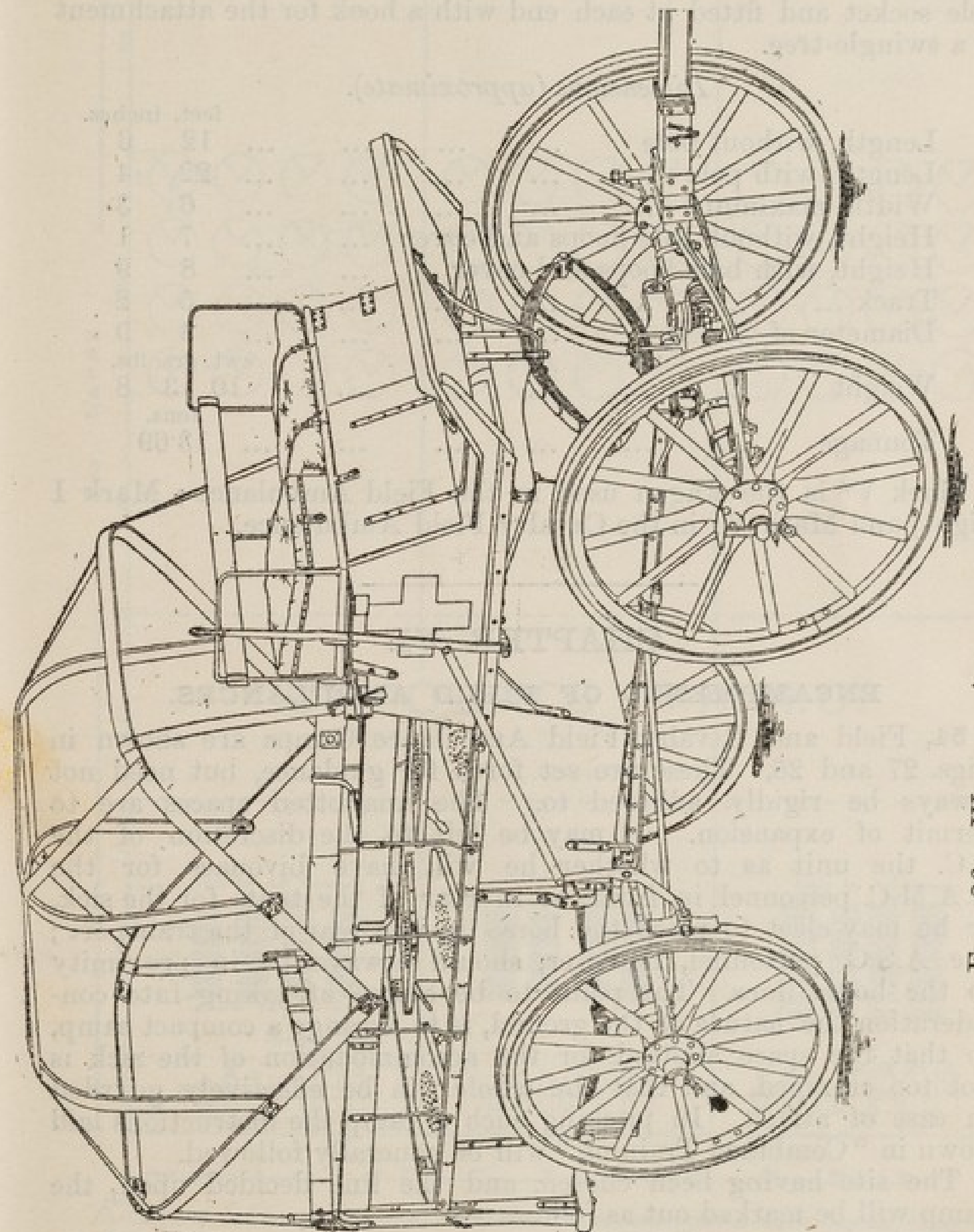


FIG. 26.—WAGON, AMBULANCE, LIGHT, MARK I.

together at the ends of each side rail, and two smaller hoops, one being pivoted to each main hoop. The cover is fixed by staples to the rear of the driver's seat, and is secured to the wagon by two straps at each end and tabs at each side. The body and fore-carriage are connected by a main pin, which passes through the sweep and wheel plates in front of the front axletree. The fore and hind wheels are of the same diameter. The fittings for draught consist of a draught pole, two swingle-trees, a draught bar, and two pole chains. The pole is secured to the pole socket by a pin and key ; the draught bar is pivoted at its centre to the pole socket and fitted at each end with a hook for the attachment of a swingle-tree.

Dimensions (approximate).

	feet.	inches.
Length, without pole	12	6
Length, with pole	22	4
Width, maximum	6	3
Height, without bale hoops and cover	7	1
Height, with bale hoops and cover	8	9
Track	5	2
Diameter of wheels	3	9
	cwt. qrs. lbs.	
Weight	10 3 8	
	tons.	
Tonnage	13·69	

Mark V* is the wagon used in the Field Ambulance ; Mark I (light) and Mark VI in the Cavalry Field Ambulance.

CHAPTER VI.

ENCAMPMENTS OF FIELD AMBULANCES.

54. Field and Cavalry Field Ambulance Camps are shown in Figs. 27 and 28. These are set forth for guidance, but need not always be rigidly adhered to. The unallotted spaces are to permit of expansion. It may be left to the discretion of the O.C. the unit as to whether he will have bivouacs for the R.A.M.C. personnel in front, or in rear of the tents for the sick, or he may elect to place the horse lines in rear of the transport ; the A.S.C. personnel, however, should always be in proximity to the horse lines. The point to be aimed at, taking into consideration the nature of the ground, is to arrange a compact camp, so that the space allotted for the accommodation of the sick is not too cramped, and that the whole can be effectively guarded in case of attack. In pitching such a camp the instructions laid down in "Combined Training" will be generally followed.

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, viz., for a Field Ambulance 120 yards, for a Cavalry Field Ambulance 80 yards (if sections are pitched together) ; mark this with a second tent peg or flag. The front of the camp being thus laid down, the rear of the ground will now be determined.

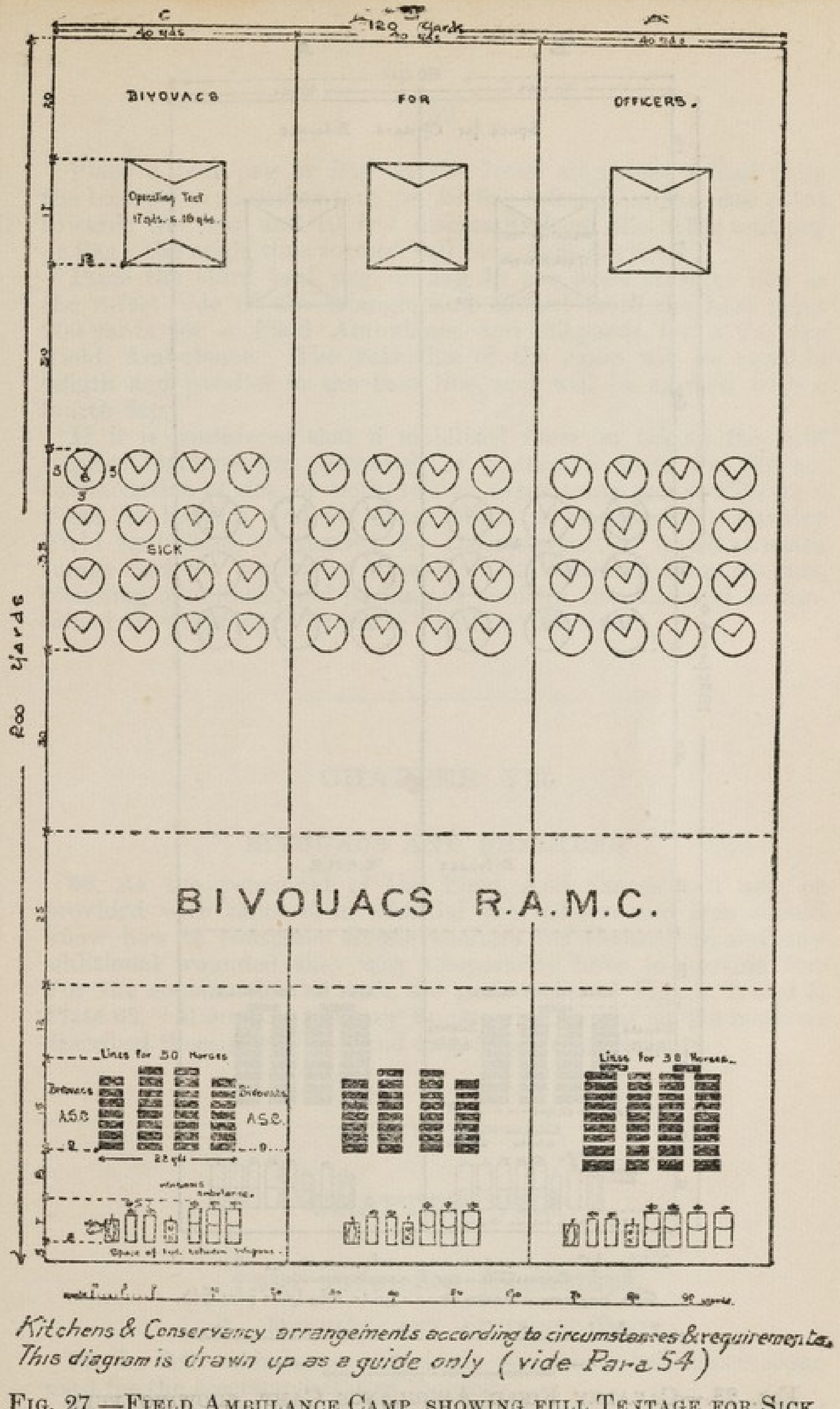


FIG. 27.—FIELD AMBULANCE CAMP, SHOWING FULL TENTAGE FOR SICK.

(3 Sections A, B, and C). Personnel—10 Officers, 1 W.O., 16 Staff Sergeants and Sergeants, 3 Buglers, 221 Rank and File; total 251, of whom 59 are A.S.C. Horses—Riding, 14; Draught, 84; total, 98.

NOTE.—When a blanket for each man is specially ordered to be carried, an extra forage cart per section will be required, in addition to those shown in the above diagram. Also 3 extra A.S.C. drivers and 6 extra draught horses for these vehicles. This extra transport is sufficient for the carriage of tents in addition, if these are ordered to be taken.

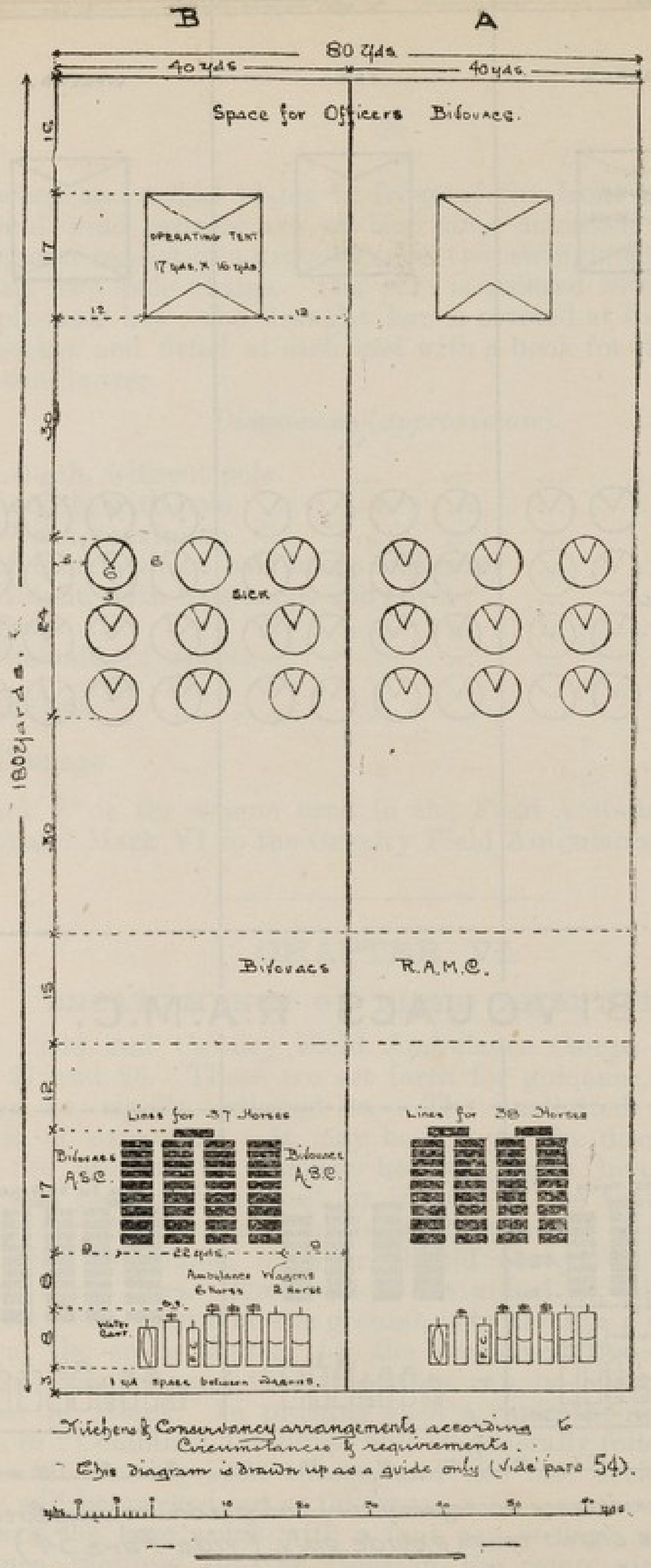


FIG. 28.—CAVALRY FIELD AMBULANCE CAMP, SHOWING FULL TENTAGE FOR SICK.

2 Sections (A and B). Personnel—6 Officers, 1 W.O., 9 Staff Sergeants and Sergeants, 2 Buglers, 102 Rank and File; total 120, of whom 44 are A.S.C. Horses—Riding, 9; Draught, 66; total, 75.

NOTE.—When a blanket for each man is specially ordered to be carried, an extra forage cart per section will be required, in addition to those shown in the above diagram. Also 2 extra A.S.C. drivers and 4 extra draught horses for these vehicles.

This extra transport is sufficient for the carriage of tents in addition, if these are ordered to be taken.

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 the 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 for a Field Ambulance and 180 yards for a Cavalry Field Ambulance. 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.

If it is considered that a mobilized force on taking the field require blankets for personnel, or additional tents for the accommodation of sick, or both, twelve extra tents per section for a Field Ambulance, and six extra tents per section for a Cavalry Field Ambulance are carried, for the transport of which an extra forage cart per section is allowed. For watering arrangements, picketing of animals, and parking of vehicles, the instructions contained in "Combined Training" will be followed.

CHAPTER VII.

BIVOUACS AND SHELTERS.

55. As the personnel of the Field Ambulances will not be provided with tents, it is essential that officers and men should know how to construct simple shelters for themselves, and any additional wounded they may temporarily have to provide for. For the construction of such, see para. 192, and Figs. 1, 2, and 3, Plate 62, "Manual of Military Engineering." The simple methods described therein will be found to meet all requirements.

CHAPTER VIII.

TENT PITCHING EXERCISES.

A. Pitching and Striking Tents.

56. In field ambulances the single circular or bell tent is alone used for the accommodation of the sick.

57. *Pitching Tent by Two Men.*—The following is the method of pitching a tent by two men :—No. 1 to be told off as pole man, No. 2 to be told off as tent man. No. 1 falls in with the pole in his left hand, and mallet with five pegs in his right; No. 2 to cover him with tent and pin-bag. When No. 1 is moved to the position his tent is to occupy, No. 2 will follow with the tent, and fall in five paces in 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 of the pole; he then shakes the tent out of its valise, and spreads it on the ground with the door uppermost. 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, 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. Both men will now proceed to the tent, one to the right and the other to the left of the door. Each will take the second rope counting from the door on each side, and draw the tent on to the ground it is to occupy. These ropes will both be attached to the front peg. The men will then count the ropes until they come to the fourth from the ropes already fastened to the front peg, and attach them to the right and left pegs. No. 2 will count five more ropes, and fasten the last to the rear peg at full length. No. 1 will, in the meantime, take up the pole and fit the smaller end of it in the cap of the tent, in the case of a double-circular tent, passing it through the hole in the inner lining, keeping the bottom of the pole to the front. No. 2 will assist in fitting the pole into the top of the tent. No. 1 will get inside the tent, No. 2 will hook the fly of the tent over the pole. No. 1 will raise the pole about 3 feet from the gronnd, 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 the centre peg, lifting the upper end of the pole at the same time. No. 2, when the tent is raised, tightens the five ropes which have been fixed to the four pegs. No. 1 continues to support the pole 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 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. This is continued until all the ropes have been made fast. Those to the windward should be first driven. The two second ropes, which were first fixed to the front peg, are now separated—a peg being driven for each. The curtain of the tent should now be pegged down. The door of the tent should be opened, the ropes attached to its lower corners being fastened to the second peg on the right and left of the doorway.

The mallets, spare pegs, pin bag, and valise are 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.

58. *Trenching a Tent.*—If it is necessary to trench a tent, it is done in the following manner :—Before the curtain of the 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 with the spade held upright, about 6 inches deep. A second cut is made leading into it, about 6 inches from it all round. The turf, so cut out, is laid with the grass downwards, round the outer edge of the trench. The curtain is then pegged down into the inner side of the trench.

59. *Striking a Tent.*—To strike a tent, both men will take off and coil down all the ropes but those attached to the two front, right, left, and rear pegs. The fly is unhooked : No. 1 goes inside and takes hold of the pole ; No. 2, in the meantime, draws out all the pegs to which the ropes are not fixed. The pegs holding the curtain will have been drawn out already. 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 down. 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 places 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 into its valise. Mallets are taken apart, and their heads put into the peg bag with the pegs. Their handles are put into the tent valise. The pin bag is then put into the valise on top of the tent, and 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.

B. Hospital Marquee Pitching Exercise.

Description of Marquee.

60. A hospital marquee, inside dimensions 29 feet long and 14 feet wide, weighing 512 lbs. complete, consists of :—

1 inside linen roof. 1 outside ditto. 8 walls (4 inside and 4 outside). 82 bracing lines (40 inside and 42 outside), with wood runner and button to each. 2 wooden vases, painted red. 2 weather lines (90 feet each) with large runners.	Packed in a canvas valise, laced up in the centre, and marked on the outside "Hospital Marquee."
180 small tent pegs. 4 large ditto (for weather lines). 2 mallets.	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 two pieces, and 3 standard or upright in two pieces.	Lashed together in one bundle by two box cords.
1 waterproof bottom, made of painted canvas, in four pieces, each piece measuring 15 feet by 8 feet.	Rolled in a bundle round a thin pole, and tied by three box cords.

61. *Laying Out the Ground for Pitching.*—Undo and empty the peg bag (keeping the four large pegs for the weather lines by themselves), 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 peg at its centre and at each of its two end holes. These pegs will mark the positions of the standard or

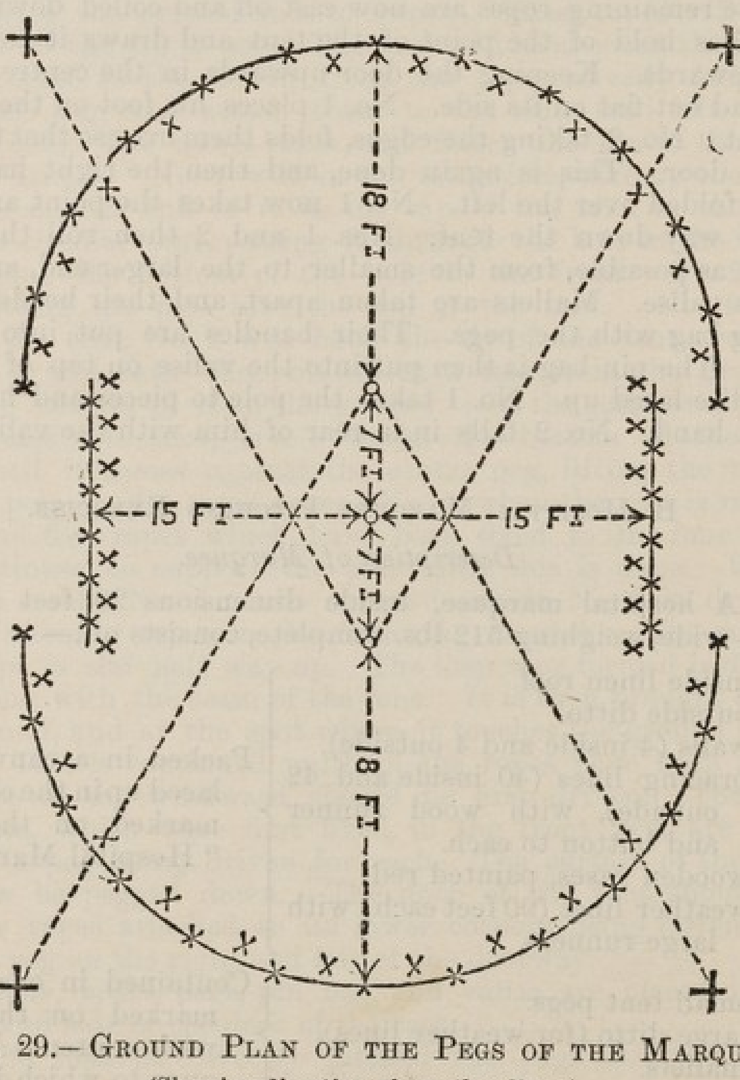


FIG. 29.—GROUND PLAN OF THE PEGS OF THE MARQUEE.
(Showing direction of weather lines.)

upright poles, and will be 7 feet apart. With each end peg as centre, in a semi-circle, with a radius of 6 yards, lay 13 pegs with their points inwards where they are to be driven. This will be easiest done as follows :—Step 6 yards from one of the end pegs and, in a straight line with the three standard pegs, lay the centre peg of the semi-circle ; next step 6 yards to each side of the end peg, and, on a line at right angles to the three standard pegs, lay a peg for each end of the semi-circle ; then lay at each side, between the centre peg of the semi-circle and the two end pegs, equal distances apart, five pegs, and the semi-circle of 13 pegs is complete. The other end will be done in the same way.

For the sides of the marquee, on a straight line parallel to the three standard pegs, and 5 yards distant, lay six pegs, the first and the last of which will be 18 inches distant from the lines formed by each end standard peg and the two end pegs of each semi-circle. Now the pegs for the outer roof are all laid, and should be driven in before proceeding further.

For the inner roof, lay a peg between each two pegs of the outer roof, but on a line 1 foot further in. The space, however, between the third and fourth pegs on each straight line is to be left blank for the doorway. These driven, the pegs are complete for the marquee, except the four weather line pegs. These are each driven at a corner where two lines would meet to form a right angle if drawn from each end and centre peg of the semi-circle.

62. *Arrangement of Marquee before raising.*—The ground being laid out, carry the marquee within the line of pegs, unlace the valise, and arrange and spread out the marquee, the roofs one inside the other, in such a manner that the base and ridge will be parallel with the line of the standard pegs and the former touching them. 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, insert the ridge pole, and roll up the upper side of the inner roof in a similar manner.

Fix the two pieces of each standard pole together by their numbers. This done, pass them through the openings in the inner roof, and their pins through the holes in the ridge pole, through the eyelet in the two end web slings, and also through the eyelet holes in the ridge of the outer roof. Now fit the vases on the pins of the end standards and pass the opening lines of the ventilators through the holes in the ridge of the inner roof by the side of the standards. Next pass the lines for opening and shutting the windows through the corresponding eyelets in the inner roof. Unroll the inner and outer roofs to their proper position, bring the ends of the standard poles so as to prop against the three standard pegs, and square the ridge pole on the three standards thus placed.

63. *Raising the Marquee.*—To raise the marquee, ten men and one N.C.O. will be required. These will be styled four weather-line men, six standard men, and one director. One weather-line man will take up a position at each large peg, holding in his right hand the runner and in his left the line, with a loop ready at any moment to slip on the peg. Two standard men will

take up a position at each pole, one at the foot, the other at the top, facing each other. When the instructor sees all are ready, he will give the word to raise, when all, working together, should steadily erect the standards, taking care not to raise one before the other. The instructor should now go to the side and dress the standard poles, tightening and slackening the weather lines as required until the poles are perpendicular. He should next go to the end and dress the poles in a similar manner in that direction.

64. *Putting on the Bracing Lines.*—The weather-line men should not leave their posts until the bracing lines are on. Four of the standard men should put on the bracing lines, whilst two of them should take mallets and drive in any loose pegs there may be. To put on the bracing lines, two men should go to each side of the marquee, commencing with the outer roof ; one should take the line at one side of the window, and the other the line at the other side, which should be put respectively on the third and fourth pegs of the outer straight line, thus working towards the ends until meeting the men from the other side. In tightening the bracing lines the marquee should be pulled towards the pegs so as to slacken the line, otherwise the pegs will be pulled out of the ground. The lines of the inner roof should be put on in a similar manner, beginning at each side of the window, and working round to the ends. When two lines are together, they should for the present go on the same pegs, but afterwards be shifted.

65. *Putting on the Curtains.*—The curtains are in eight pieces, four for the inner wall and four for the outer wall. The outer curtain should be put on so that the ground flap be inside, and that it can be pegged on the outside. The inner curtain should be put on with the flap out, so that it can be pegged on the inside. Commence with the outer curtain at each side of the doorway and work round towards the ends, taking care to leave enough to overlap and close the doorway. When the curtains are on, they should be pegged down both inside and outside.

66. *Trenching a Marquee.*—A trench, 9 inches broad and 4 to 6 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 the ledge and run under.

67. *Points to be Attended to.*—When rain comes on, 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 a heavy dew. Thus it will be necessary to slack them when rain is expected, and also at night if there is a heavy dew. Again, if the ropes have been wet, they will slacken as they dry, and will require to be braced up, otherwise the marquee may flap and draw the pegs. The doorway of the marquee should be on the sheltered side. The curtains should be taken off the pegs and raised daily for ventilation. They can be fastened to the bracing lines by the buttons of the peg loops.

68. *Striking the Marquee.*—Unfasten the curtains at the bottom,

and unhook them from the roof, beginning with the inner one. Fold each piece into eight parts. The four weather-line men should now stand by the weather lines while four men should unfasten and do up into a skein the bracing lines, beginning with the inner roof at each side of the doorways and working round to the ends. The two mallet men should take up the pegs as the lines are taken off them, and put them away in the peg bag.

69. *Lowering the Marquee.*—The men should take up positions as in pitching, one to each weather line and two to each pole. When all are ready, the N.C.O. should give the word to lower. The weather-line men should take the lines off the pegs, but keeping a firm hold, and the standard men should have hold of the poles. All together they should steadily lower the poles, the men at the feet of the poles keeping them from slipping, and the other men lowering them by walking backwards towards the ridge, in the same way as men lowering a ladder.

70. *Repacking the Marquee.*—Roll up the four weather lines and take the vases off the pins, leaving them there attached by the ventilating cords. Spread out the roofs and roll up the upper flap, so as to expose the ridge pole. Next pull away the standard poles, and remove the ridge pole from the slings.

71. *Folding the Marquee.*—This done, unroll the upper fold of the roof. Bring over each end to the centre, across the middle of the window, and fold the square thus made from side to side into three equal parts. Place the eight pieces of curtain on the roofs lengthwise, overlapping in the centre, and the flaps towards the thick end. Roll up the whole, thus placed, evenly, commencing with the thick end, taking care not to have the roll too wide or too narrow for the valise.

72. *Putting Marquee in Valise.*—Spread out the valise, and shoving one of the side flaps under the marquee, roll it in. Having arranged the flaps, lace them, commencing with the ends.

C. Operating Tent.

(1) *Description.*

73. The tent is rectangular in shape, and has a doorway at each end. It is fitted with six 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 two upright poles and one ridge pole, each made in two pieces.

Dimensions, &c.

	feet.	inches.
Length	20	0
Width	14	0
Height	9	4
Height of wall	3	0
	lbs.	
Weight of tent ... (about)	116	
Weight of tent *with poles* and appurtenances complete. ...	181	

The duck used in making this tent is of the same quality as for Mark V circular tents (S. 7359). For the main part of the tent the duck is 27 inches width, and $10\frac{1}{4}$ oz. per yard in weight. For the wall, 36-inch duck is used, of about $13\frac{3}{4}$ oz. per yard in weight.

The valise and the 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 ventilators, this tent must be folded and rolled up lengthwise, and the weather lines must not cross the ventilators when the tent is pitched.

(2) *Drill for Pitching Operating Tent.*

74. *Numbers Required.*—1 N.C.O. and 6 men—two as pole men, four as tent men. Pole men take ridge-pole and uprights, tent men take pegs and mallets (a maul is required to drive large pegs).

Tent men unpack tent and spread it on the ground flat, the lower edge about two paces from the ridge pole, and top to windward.

Pole men put ridge pole together, and lay it on the ground on site of tent, and a peg is driven in at each end of it. Pole men stand back to back with these pegs between their feet.

Two tent men take post at pegs, back to faces of the two pole men, and take five paces to their front, dress themselves on pole men and turn windward.

Two other tent men join them, and stand back to back with them, the four now take six paces to their front and halt.

The pole men take a maul and four large pegs, and drive them at points marked by feet of tent men.

The four men return to pegs, marking ends of ridge-pole, and after taking two paces in continuation of the line marked by it, turn back to back at right angles to the line, take six paces to the front and halt. Four large pegs are driven at their feet by pole men for weather lines; pole men return to poles and lay the frame with the feet of the uprights against the pegs first driven, ridge to windward.

Tent men roll up the upper side of the tent until the top is exposed, and the pole men raising the poles, the underside of the tent is drawn beneath them, and the poles adjusted; the vases with weather lines are now fitted on, the lines uncoiled, and the four tent men, taking one each, move towards the weather-line pegs. The pole men working with them, the tent is raised and the lines fastened to the pegs. The lines must not be crossed. The four tent men each take an upper corner rope (distinguished by its 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.

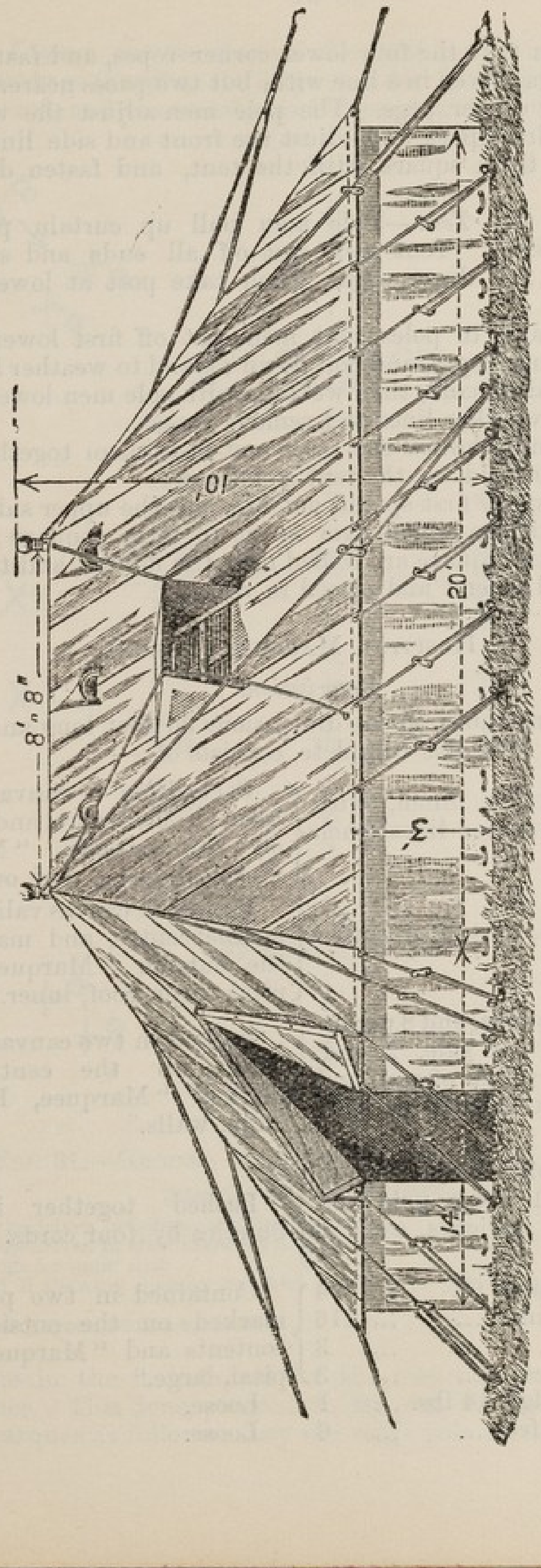


FIG. 30.—OPERATING TENT (MARK I).

The tent men take the four lower corner ropes, and fasten them to the small pegs driven in a line with, but two 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.

75. *Striking the Tent.*—Pole men pull up curtain pegs and let down windows. Tent men cast off all ends and side lines and coil them, and draw pegs. Then take post at lower corner pegs.

Pole men stand to poles, tent men cast off first lower corner, then upper corner ropes, and coil down; stand to weather line pegs, cast off and hold in hand, then working with pole men lower tent to windward, coil weather-lines and remove vases.

The pole men withdraw the poles and lash them together.

The tent men fold up the tent as follows:—

The under side is first spread out flat, and the upper side drawn over it; the ends are folded over so as to form a square; the top and bottom of the square are folded over the middle, and the whole rolled from end to end and placed in valise.

D. Hospital Marquee (Large).

Description.

76. A large marquee, inside dimensions 35 feet long and 17 feet wide, weighing 1,149 lbs. complete, consists of :—

1 roof, outside, linen, 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 roof, inside, cotton, 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 side, 2 end, and 2 doorway pieces of wall and 4 porchway poles packed in each valise.		Packed in two 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 two pieces.		Lashed together in two bundles by four cords.
Pins, wood, large ...	94	Contained in two pin bags, marked on the outside with contents and "Marquee, Hospital, large."
Pins, wood, small ...	116	
Mallets ...	3	
Bases for poles ...	3	
Hammer, sledge, 14 lbs. ...	1	Loose.
Pins, steel, 3 feet ...	6	Loose.

77. *Laying out the Ground for Pitching.*—Undo and empty the two pin bags (keeping the large pins for bracing lines of inner and outer roofs and the small pins for pegging down the walls); fit the

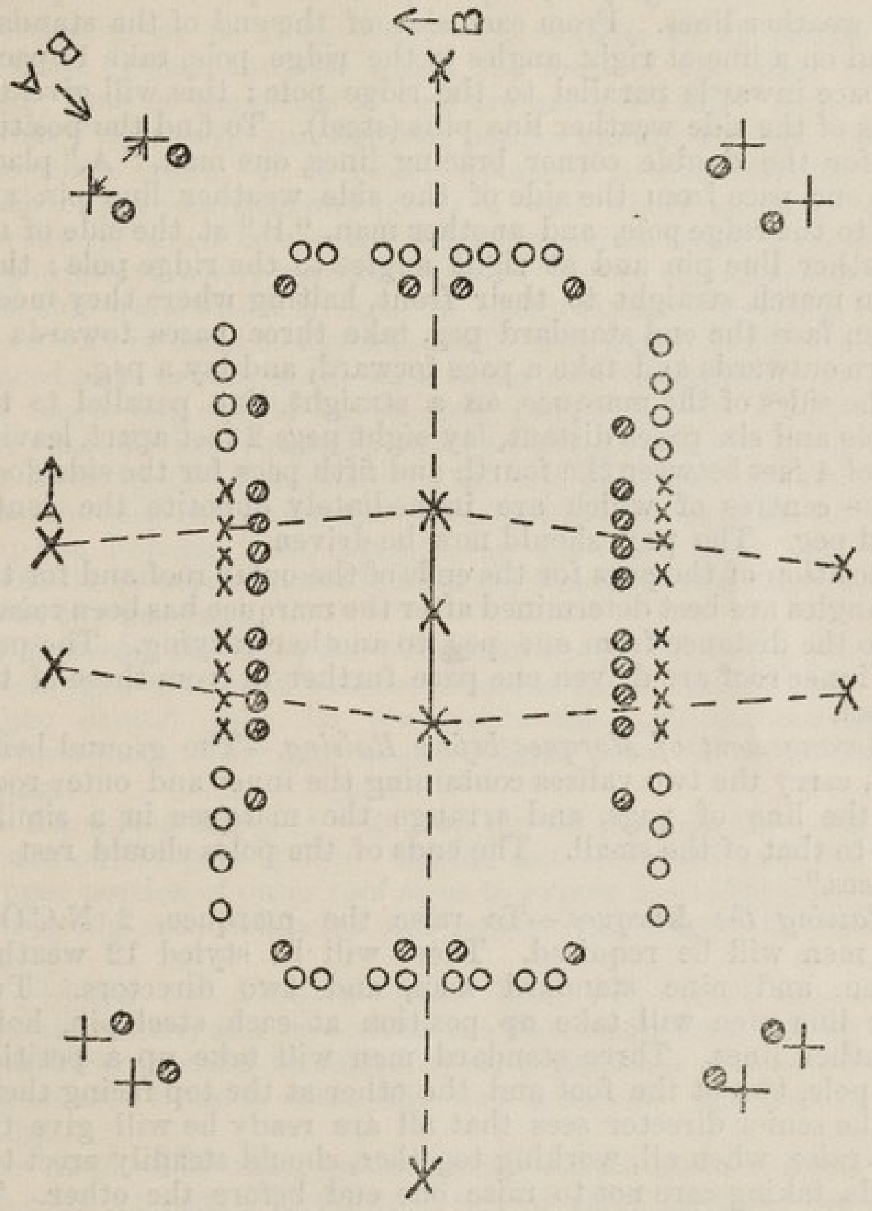


FIG. 31.—GROUND PLAN OF PEGS OF MARQUEE (LARGE).

(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 showing manner in which positions of pegs for corner bracing lines are found.
Pitching space, 80 feet by 55 feet.

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 positions of the standard poles. From each end peg and in a line with the ridge pole, step 12 paces and place a steel pin for the end weather lines. From each side of the end of the standard pegs, and on a line at right angles to the ridge pole, take 11 paces, then a pace inwards parallel to the ridge pole; this will give the positions of the side weather line pins (steel). To find the position of 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 will 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 and take a pace forward, and lay a peg.

For the sides of the marquee, on a straight line parallel to the ridge pole and six paces distant, lay eight pegs 2 feet apart, leaving a space of 4 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.

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

78. *Arrangement of Marquee before Raising.*—The ground being laid out, carry the two valises containing the inner and outer roofs within the line of pegs, and arrange the marquee in a similar manner to that of the small. The ends of the poles should rest on the "bases."

79. *Raising the Marquee.*—To raise the marquee, 2 N.C.O.'s and 21 men will be required. These will be styled 12 weather line men, and nine standard men, and two directors. Two weather line men will take up position at each steel pin, holding weather lines. Three standard men will take up a position at each pole, two at the foot and the other at the top facing them. When the senior director sees that all are ready he will give the word to raise, when all, working together, should 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 Instructor should now dress the standard poles from both end and side, and when perpendicular the weather lines should be made fast round the steel pins.

80. *Putting on the Bracing Lines.*—The weather line men should not leave their posts until the bracing lines are on. The standard men now put on the bracing lines, commencing with the four double corner ones, which should be well stayed out by means of the triangular runners, after which pegs for bracings lines of ends, and triangles of outer roof, and of inner roof should be driven and 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 porchway poles should now be fixed.

81. *Lacing on to Inner Roof.*—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 porchways are marked "centre" in the centre front. 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 the middle front of each of the four porchways where marked "centre" before commencing to lace on the side wall, which is done in continuation of doorway piece; the end wall is laced to the side wall. The loops on the walls 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.

82. *Striking the 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, commencing with the inner roof. The pegs should be taken up as the lines are removed from them and put away in the peg bags.

83. *Lowering the Marquee.*—The men should take up positions as in pitching, two to each weather line and three to each pole. The marquee should then be lowered in the same manner as the small marquee. The end weather lines must be kept taut in lowering.

84. *Repacking 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 outer roof so as to expose the ridge pole; next pull away the standard poles and remove the ridge pole from the slings.

85. *Folding the Marquee—Inner Roof.*—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, and should not be unlaced from it when the tent is struck. The roof is then rolled up.

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 which brings them on top and in a proper position for rolling. Roll up the roof from the thick end.

86. *Putting Roofs in Valises.*—Spread out the valise, and shoving one of the side flaps under the roof, roll it in. Having arranged the flaps, lace them, commencing with the ends.

87. *Wall.*—The wall is rolled up the width of the bamboos inserted in the wall ; 2 side, 2 end, 2 doorway pieces of wall, and 4 bamboo porch poles being packed in each valise. Two of the poles in each valise are turned the reverse way, viz. :—the bottoms being placed alongside the spikes : this prevents the spikes from piercing the canvas valise.

CHAPTER IX.

FIELD COOKING.

88. To cook rapidly and well is an art not difficult to acquire, and which soldiers should be encouraged to learn. The means generally used for cooking in the field are by Flanders or service kettles, and the mess tin, the lid of which can be used as a frying-pan.

Service kettles are as follows :—

Name.	Weight.	Contents.	Surface diameter.	Depth outside measure.	Number of men will cook for.	
					With vegetables.	Without.
	lbs.	gals.	inches.	inches.		
Oval, large ..	8	3	$13\frac{1}{2} \times 9$	11	8	15
,, small ..	$4\frac{3}{4}$	$1\frac{3}{4}$	$12\frac{1}{2} \times 8\frac{1}{2}$	8	5	8

On arrival in camp of the Field Ambulance or section thereof, the cooks will at once proceed to make the kitchen. This can either be a trench kitchen or a wall kitchen.

(1) *The Trench Kitchen.*—If the encampment be only for the night, one or two trenches, according to the number to cook 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. It will be advantageous if these trenches are cut on a gentle slope. This trench will hold 7 of the large oval kettles. The large oval kettle will cook for 8, or without vegetables

15 men ; the small oval kettle will cook for 5, or without vegetables 8 men.

Iron cooking 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

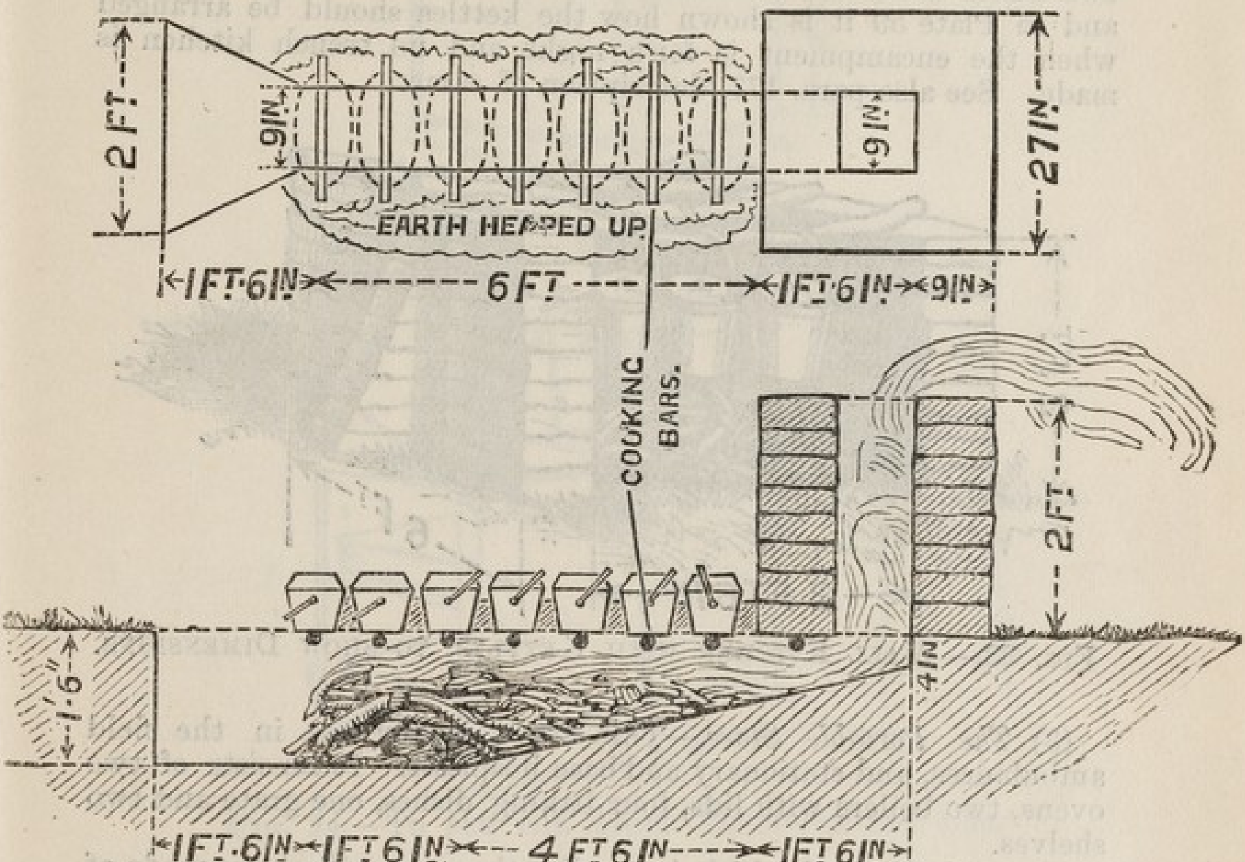


FIG. 32.—PLAN AND SECTIONAL ELEVATION OF TRENCH KITCHEN WITH CAMP KETTLES, TO SHOW DIMENSIONS AND DETAIL.

loops of the handles. The fuel, generally wood, is fed into the trench from the splay mouth.

(2) *The Wall Kitchen.*—On damp or marshy sites a wall kitchen will be found to answer best, constructed as follows :—Cut some sods of turf about 18 inches long by 9 inches wide, and lay them in two parallel lines 6 feet long with an interval between them of 2 feet 6 inches. Build these walls 2 feet high for large oval, and 18 inches high for small oval, kettles. Lay the wood all over the bottom between the two walls. Place sticks through the handles of the kettles and hang them over the centre with the ends of the sticks resting on the walls. Light the fire. This trench will hold about 12 large oval, or 20 small oval, kettles.

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 cooking in mess tins, preserved meat tins, and the improvisation of Field Ovens, together with useful recipes for Field Cooking are given on pages 61–70 of The Manual of Military Cooking.

In the Manual of Military Engineering, Plate 57 shows the "Broad Arrow" Kitchen, sufficient to cook for the personnel of two whole Field Ambulances. Plate 58.—The Gridiron Kitchen, and in Plate 59 it is shown how the kettles should be arranged when the encampment is for a night, and no trench kitchen is made. See also para. 177, description of same.

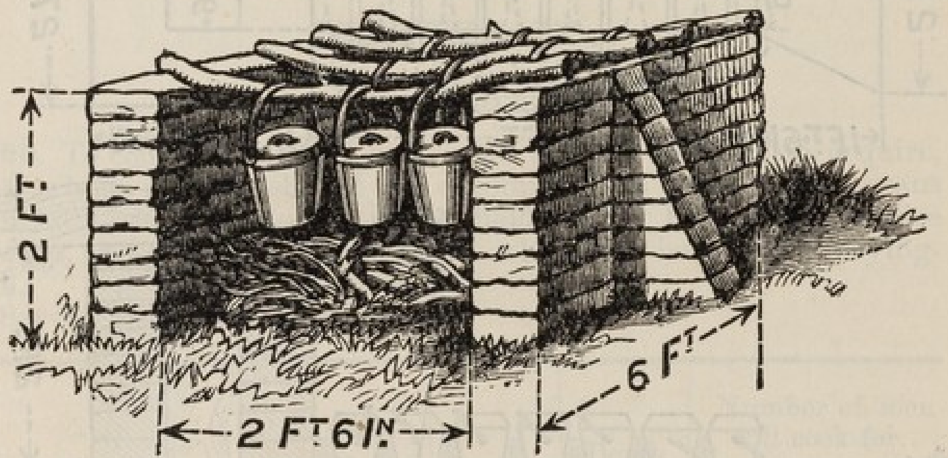


FIG. 33.—WALL KITCHEN WITH KETTLES, TO SHOW DIMENSIONS.

(3) *The Portable Stove.*—This stove is for use in the field ambulances, and stationary and base hospitals. It consists of two ovens, two boilers with lids, four baking dishes, one grate and two shelves.

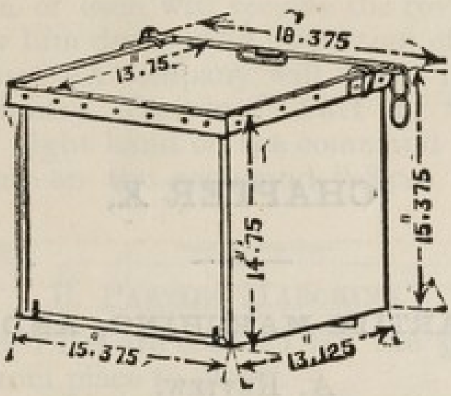
The ovens (one of which is smaller than the other) are made of steel plate. The grate is made of wrought iron, and the boilers and baking dishes of tin plate.

Each apparatus is considered capable of cooking for 50 patients.

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 space. The doors of the oven 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.

Troops should, under all circumstances, have their dinners ready one hour and a half after the rations are issued.

PACKED.



READY FOR USE.

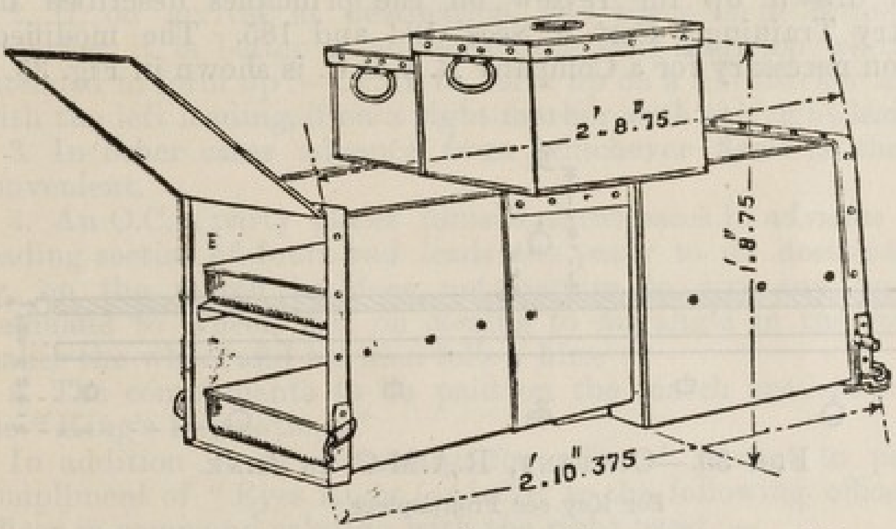


FIG. 34.—TO PUT THE STOVE TOGETHER FOR USE.

TO PACK THE STOVE FOR TRANSPORT.

89. 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.

Total weight ... ... $90\frac{1}{2}$ lbs.

Dimensions, packed for transport—

Height...	14 inches.
Length	$18\frac{3}{4}$ "
Depth	$16\frac{3}{4}$ "

CHAPTER X.

CEREMONIAL, PARTIES MARCHING, AND R.A.M.C. CALL.

A. Review.

90. *Formation.*—A Company of the Royal Army Medical Corps will be drawn up for review on the principles described in "Infantry Training," Part 6, Secs. 184 and 185. The modified formation necessary for a Company R.A.M.C. is shown in Fig. 35.

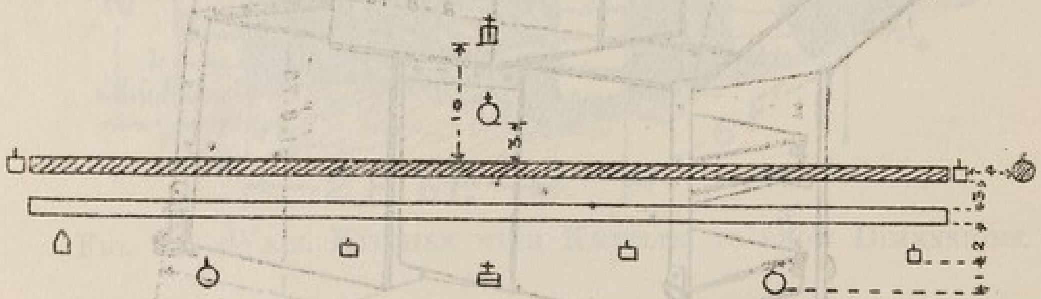


Fig. 35.—Company, R.A.M.C. in Line.

For Key see Frontispiece.

When two or more companies parade together they may be drawn up in line or in column. Commanding or Staff Officers of grouped companies so drawn up for inspection take the positions ordered in "Infantry Training" for battalion commanding and staff officers.

Receiving the Reviewing Officer.

91. Attention—General Salute.—When the reviewing officer arrives in front of the centre at a distance of about 60 paces, he will be received with a salute, the officers saluting with the right hand, taking the time from the C.O., and the bugler sounding the General Salute.

92. *Inspection in Line.*—The C.O., who will ride on the side farthest from the troops, accompanies 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.

93. *Inspection in Column.*—When companies are received in column, the captain of each will receive the reviewing officer with a salute, and follow him during the inspection of his company.

94. *Marching Past.*—A company will march past in the manner described in "Infantry Training," Part 6, Sec. 187; officers saluting with the right hand on the command "Eyes Right," and completing the salute on the command "Eyes Front," taking the time from the O.C.

B. Parties Marching.

95. The following rules are collated for the guidance of officers marching parties from place to place:—

1. Except for very short distances all movements should be in column of fours.

2. If, on arrival at destination, the party is to form up on a marker, it is better to advance from that 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 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, &c., 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 the "King's Regulations."

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:—

(1) G.O.'sC. the command or division to which the party belongs.
(2) P.M.O.'s of the command or division to which the party belongs.
(3) 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.

R.A.M.C. Call.

96. The calls for the Royal Army Medical Corps are given in "The Trumpet and Bugle sounds for the Army."

The following is the Corps Call :—

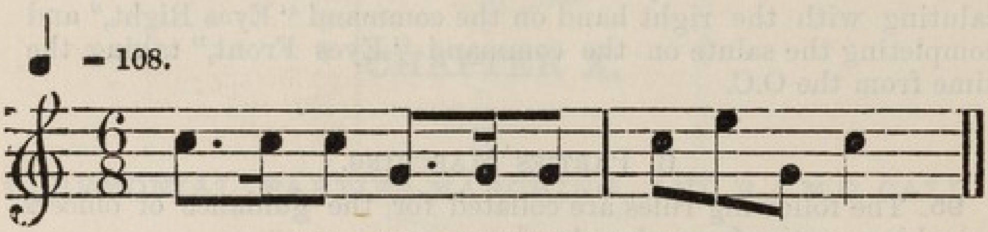


Fig. 36.—R.A.M.C. Call.

The following is the Corps March Past :—

"Her bright smile haunts me still."

Published by Hawkes & Son, in No. 2 March Book.

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