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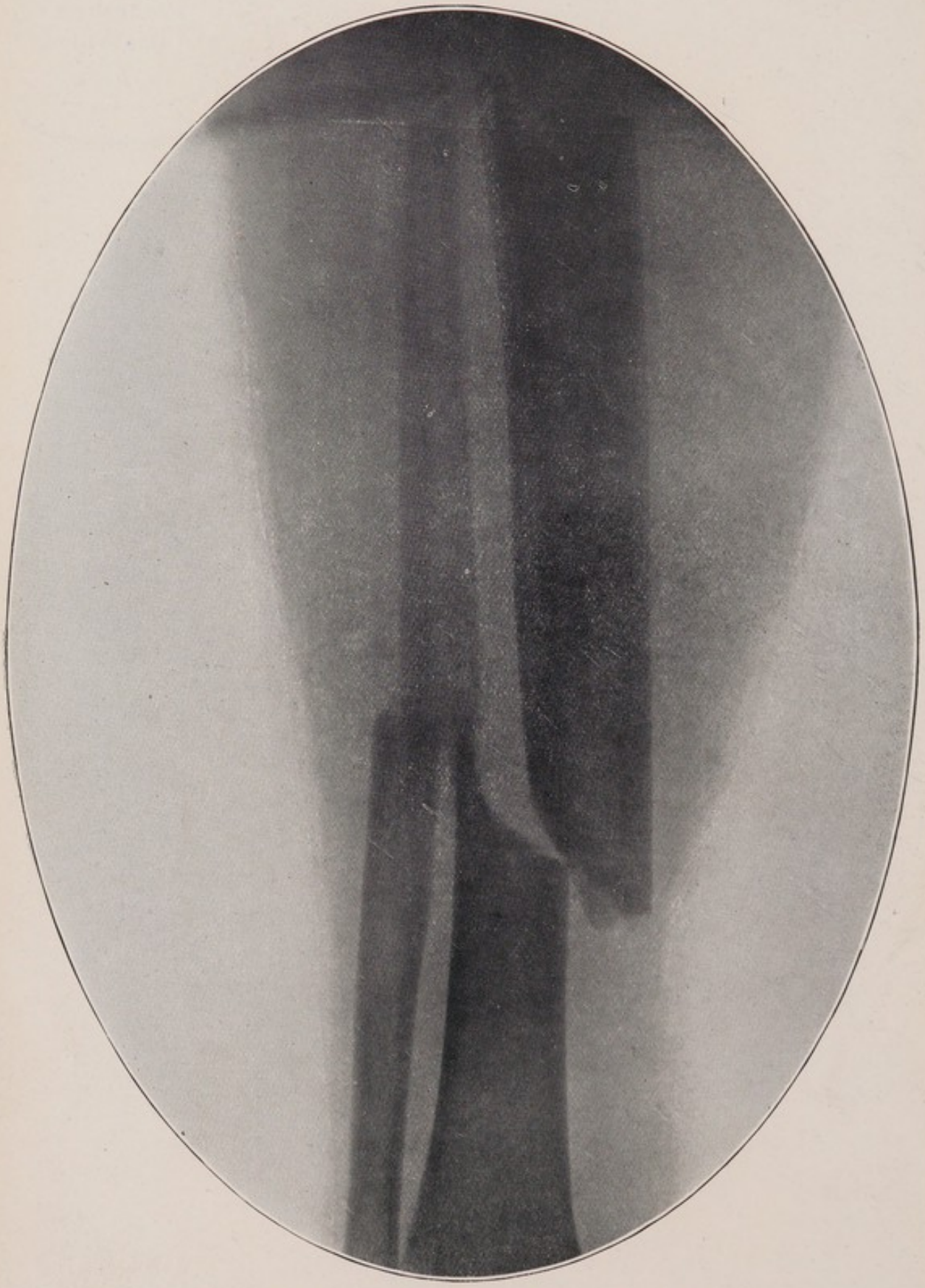

Skiagram of fracture of tibia and fibula (by Dr. J. R. Levack, X-ray Department. Aberdeen Royal Infirmary).

A

MANUAL OF AMBULANCE.

BY

J. SCOTT RIDDELL, M.V.O., M.A., M.B., C.M.,

SENIOR SURGEON AND LECTURER ON CLINICAL SURGERY, ABERDEEN ROYAL INFIRMARY; LATE EXAMINER IN CLINICAL SURGERY, UNIVERSITY OF EDINBURGH, AND EXAMINER IN SURGERY IN THE UNIVERSITY OF ABERDEEN; MEMBER OF COUNCIL BRITISH RED CROSS SOCIETY (SCOTTISH BRANCH); COLONEL, ARMY MED. SERVICE (T.F.), AND LATE ADMINISTRATIVE MEDICAL OFFICER, HIGHLAND DIVISION (T.F.); HONORARY ASSOCIATE OF THE ORDER OF THE HOSPITAL OF ST. JOHN OF JERUSALEM IN ENGLAND; EXAMINER TO THE ST. ANDREW'S AMBULANCE ASSOCIATION, GLASGOW, AND THE ST. JOHN AMBULANCE ASSOCIATION, LONDON.

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BY

THE AUTHOR.

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PREFACE TO THE SIXTH EDITION.

The Manual of Ambulance has been revised and considerably enlarged by additions to the sections dealing with Artificial Respiration, Electrical Accidents, and Ambulance Transport. Many new figures showing recent methods of improvising stretchers, railway waggons, carts, motor omnibuses, and motor lorries for the conveyance of sick and wounded have been added; for the use of these the Author is indebted to the Editors of the *Royal Army Medical Corps Journal.*

The Chapters on Fractures and Dislocations and on Foreign Bodies in the tissues are further illustrated by X-ray photographs taken by Dr. Levack, Medical Electrician to the Aberdeen Royal Infirmary.

A new Chapter on Voluntary Aid Detachments and their work is appended, and therein the relation of these Detachments to the Medical Service of the Territorial Force is fully illustrated and described.

The Author's thanks are due to Dr. W. R. Pirie for kindly assisting in the final revision of the proof-sheets and index.

J. SCOTT RIDDELL.

Aberdeen, *November*, 1913.

PREFACE TO THE FIRST EDITION.

A COMPLETE course of Ambulance Instruction, arranged as the experience of nearly a decade as Lecturer and Examiner has shown me to be best, will be found in these pages. The Manual is intended to serve not only for class use, but also as a means of reference in Emergency cases, and for those using the smaller text-books. It is profusely illustrated, particularly in the sections in which Anatomical and Surgical details are treated. Many of the figures have been reproduced from my *Manual of First Aid*, for which they were specially drawn by Dr. Alexander Don. The important subject of Ambulance Transport is fully discussed and illustrated.

For the information of Lecturers and Secretaries of Ambulance Classes, a chapter on Organisation and Management is added; whilst candidates entering for examination will find in the Appendix a series of Test papers on First Aid. These have been reprinted from papers set by me during the past six years for examinations conducted under the St. John, St. Andrew's, and Aberdeen Ambulance Associations.

I am greatly indebted to Messrs. Charles Griffin & Company for the use of several woodcuts from their other publications, and take this opportunity for thanking Dr. R. G. M'Kerron and Mr. D. R. Moir, M.A., for their kindness in assisting me with the revision of the proof-sheets and the preparation of the Index.

J. S. R.

ABERDEEN,
September, 1894.

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* This chapter is not required for Ambulance Examinations.

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A MANUAL OF AMBULANCE.

CHAPTER I.

OUTLINES OF HUMAN ANATOMY AND PHYSIOLOGY.

MEANING OF THE TERMS ANATOMY AND PHYSIOLOGY—THE SKELETON—BONE—**A.** THE CAVITIES OF THE BODY AND THEIR CONTENTS: I. THE CEREBRO-SPINAL OR HEAD AND SPINE CAVITY—THE SKULL—THE SPINE—THE BRAIN—THE SPINAL CORD—II. THE THORACIC OR CHEST CAVITY—ORGANS OF CIRCULATION—BLOOD—THE HEART—THE PULSE—SCHEME OF CIRCULATION—ORGANS OF RESPIRATION—III. THE ABDOMINAL OR STOMACH CAVITY—CONTENTS—DIGESTION—ABSORPTION—EXCRETION—**B.** THE EXTREMITIES OR LIMBS—JOINTS—LIGAMENTS—MUSCLES.

BEFORE the Ambulance Student can thoroughly appreciate the *rationale* and principles of First Aid Methods, it is necessary that he should form for himself from the perusal of an initial chapter on Anatomy and Physiology a mental picture of the component parts of the human body, and acquire a knowledge of the relation of these parts one to another, and of their respective functions or uses. It is not possible in a short chapter to deal exhaustively with this subject; what is overtaken here, however, is sufficient, if thoroughly mastered, to enable the student to follow with ease the methods described in the succeeding sections. A minute examination of an articulated skeleton, made in conjunction with a study of the letterpress and diagrams of this chapter, will greatly simplify the subject. Technical names have as far as possible been avoided; where, however, for the sake of clearness they had to be used, popular equivalents have been given.

By **Human Anatomy** is meant the study of the structure and position of the different parts and organs of the human body, while **Physiology** deals with the functions or uses of these parts and organs. In considering the Anatomy and Physiology of the human body, the first subject that naturally attracts attention is the **Skeleton.** The skeleton consists of 214 bones, and is the frame-work or central support of the body on which the flesh is hung, and to which the muscles are attached for purposes of movement. Viewed as a whole, the skeleton is more than a mere frame-work for the support of the superstructures, for it plays a considerable part in the move-

ments of the body, and has an important function to serve in

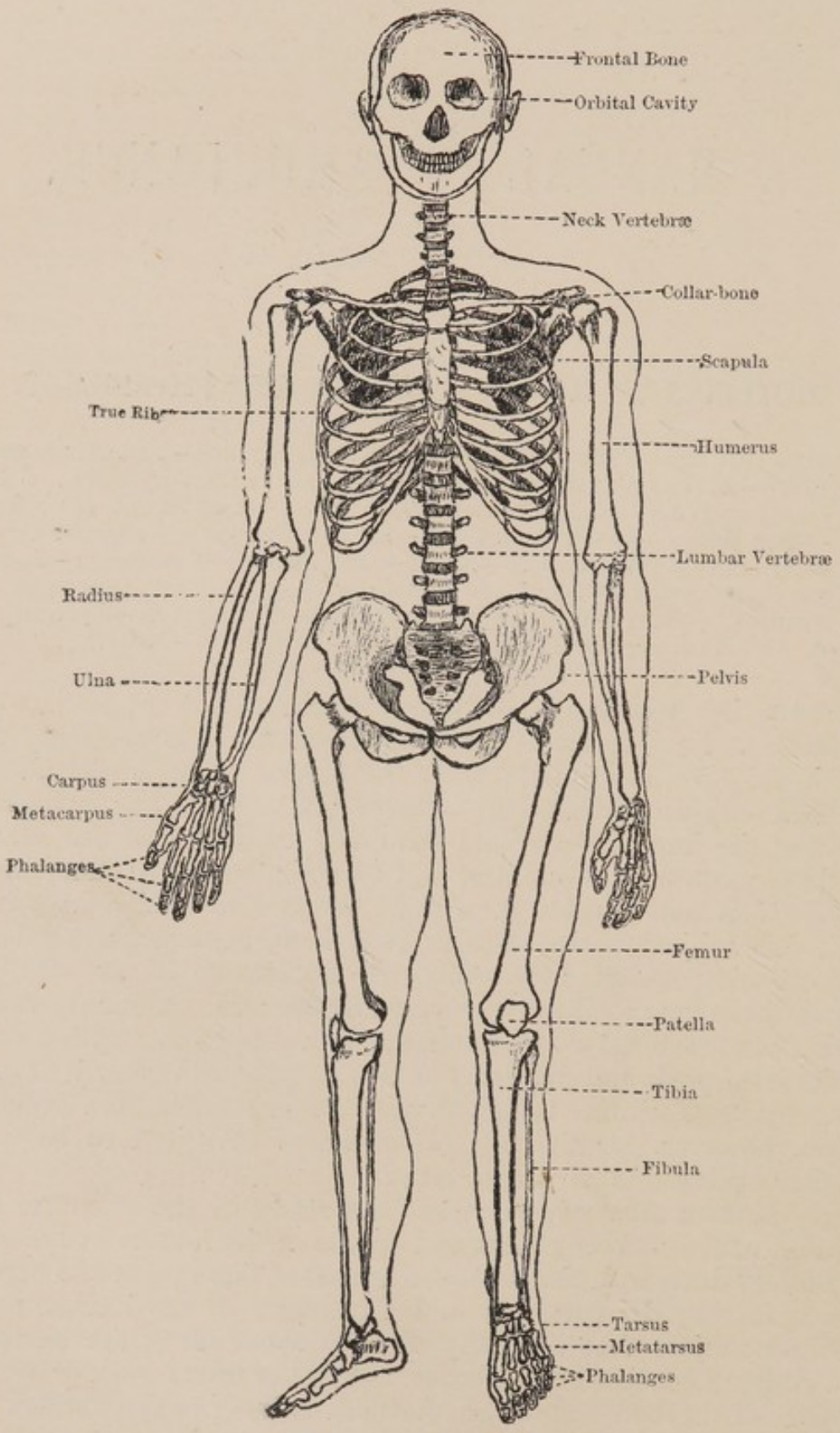


Fig. 1.—The skeleton.

affording protection to the vital organs of the body by forming

firm bony walls for the cavities which contain them. The brain and spinal cord (nervous organs, delicate and easily injured) are safely housed in the skull and spinal columns, while the chest-wall (formed by the ribs, the breast bone, and the spine) serves to protect the heart and lungs.

If from an adult skeleton we take a typical bone—*e.g.*, a thigh-bone—we find on examination that it consists of a fibrous basis impregnated with lime salts, the principal of which is phosphate of lime. These salts can be dissolved out of a bone by strong acids, leaving the fibrous basis, which is soft and easily bent, and consists of cartilage or gristle. In a young child the central frame-work is made up mainly of this cartilage or gristle, and if undue pressure be brought to bear upon it (particularly in unhealthy and improperly cared-for children, in whose bones little lime has been deposited), it readily yields, leading to the production of such deformities as "bandy legs," "knock-knee," and "curved spine." As the child grows older, lime salts are deposited in the cartilaginous basis, which becomes solid and firm, and is known as "bone." If, however, the lime salts are not deposited in sufficient quantity, owing to improper or insufficient feeding, or bad hygienic surroundings, the bones retain to a considerable extent their cartilaginous character, and tend on injury to bend rather than to break. In the healthy adult the bones of the extremities have become firm cylinders of fibrous tissue impregnated with phosphate of lime, and if a severe strain be brought to bear upon them, they will more readily fracture than bend. In elderly people the elasticity naturally present in young bones is, to a considerable extent, lost, the bones then becoming exceedingly brittle and liable to fracture. From an examination of a dried skeleton one is apt to picture the bones as masses of dead tissue, but it should be remembered that in life the bones are liberally provided with blood, which is supplied to them by nutrient arteries, and through the intervention of a specially protecting and nourishing membrane known as the **periosteum.**

Fig. 1 represents the human skeleton, viewed from the front; and after full consideration of the remainder of this chapter, in which the different parts of the skeleton are dealt with *seriatim*, it is desirable that the reader should make a careful examination of the skeleton as a whole by reference to the diagram above-mentioned, and, if possible, to an articulated skeleton.

For purposes of description, it will be found most convenient to consider Human Anatomy and Physiology under the following headings:—

(A) The Cavities of the Body and their Contents.

I. The Cerebro-Spinal, or Head and Spine Cavity.
II. The Thorax, or Chest Cavity.
III. The Abdomen, or Stomach Cavity.

(B) The Extremities or Limbs.

(A) *THE CAVITIES OF THE BODY AND THEIR CONTENTS.*

I. THE CEREBRO-SPINAL, OR HEAD AND SPINE CAVITY.

The Cerebro-Spinal Cavity, so called from its containing the cerebrum or brain and the spinal cord, is walled in by the bones which form the skull and the spine respectively (see Fig. 2). Dealing first with the bones of the head, we find that the skull consists of two parts :—(*a*) The brain case or cranium, formed by a number of "flat" bones, dove-tailing together at their so-called "sutures" to form a box in which the brain is enclosed, and (*b*) the bones of the face (Fig. 3).

Fig. 2.—The cerebro-spinal cavity.

The brain-case is formed by eight bones :—

(1) The *Frontal Bone*, anteriorly.
(2) The *Ethmoid Bone*, below it.
(3) (4) The two *Parietal Bones*, forming its upper part and sides.
(5) (6) The two *Temporal Bones*, laterally, through each of which passes the cavity of the ear.
(7) The *Occipital Bone*, posteriorly, which is perforated by a large opening known as the foramen magnum, through which the spinal cord passes. On either side of the foramen magnum is an articular prominence or condyle (see Fig. 4), which fits into a cup on the first vertebra or segment of the spine, forming a joint there.
(8) The *Sphenoid Bone*, which closes in the base of the skull, is pierced by a number of small openings which give exit to special nerves leaving the brain.

The face is made up of fourteen bones, the principal of which are the *Upper and Lower Maxillary or Jaw Bones*, the *Cheek Bones* (*Malars*), and the *Bones of the Nose and Palate*. Of these the lower jaw alone is movable. The bones of the face are so arranged as to form the mouth and nose cavities, and the orbital cavities for the eyes.

THE SPINE.—The spine is composed of segments, each of which is known as a *Vertebra*. It articulates above by two joints with the

occipital bone of the skull, while its lower end forms part of the pelvic girdle in the form of a special bone made up of five conjoined

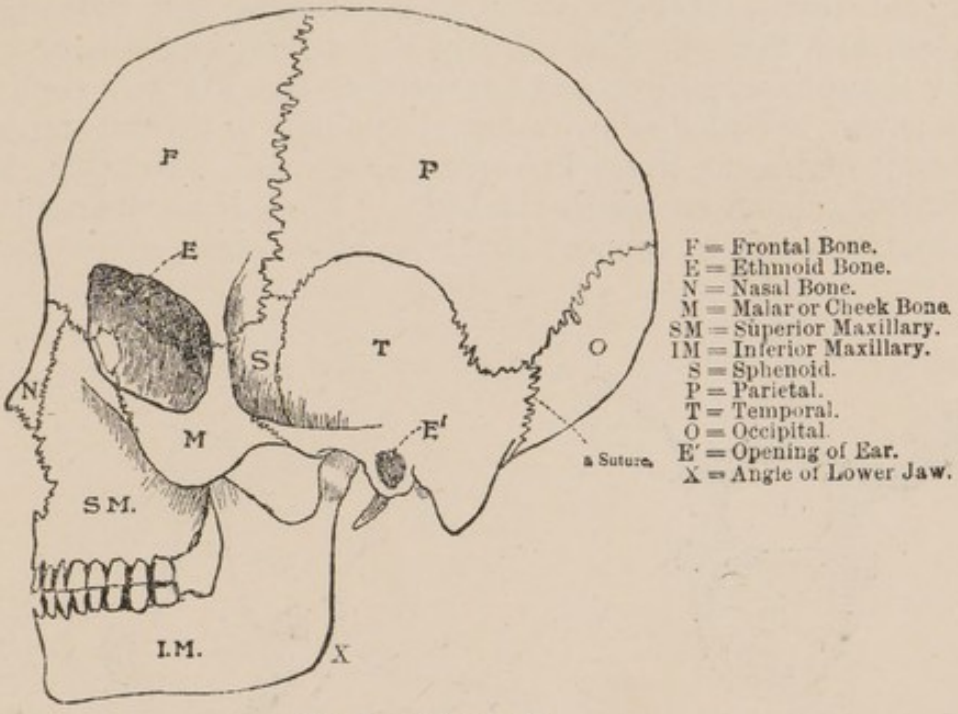


Fig. 3.—The skull.

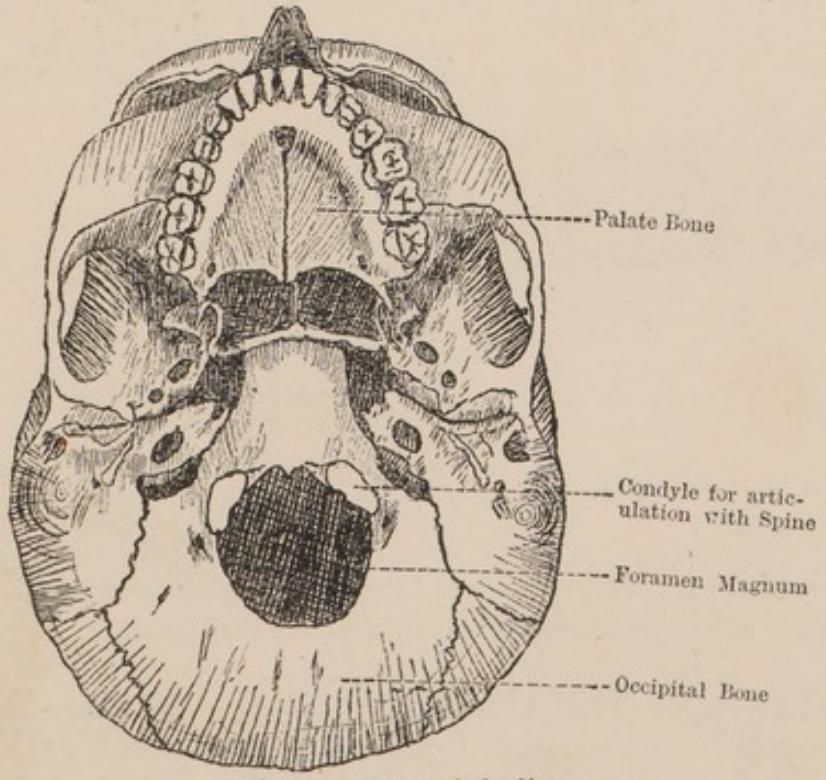


Fig. 4.—Base of skull.

vertebræ, and known as the *Sacrum* or rump bone. The spinal vertebræ, 24 in number, are divided into three sets :—

(1) The *Neck or Cervical Vertebræ*—7 in number.
(2) The *Back or Dorsal Vertebræ*—12 in number.
(3) The *Loin or Lumbar Vertebræ*—5 in number.

Each vertebra consists of a body with processes, which are adapted for the attachment of muscles and the protection of the spinal cord, a mass of nervous tissue easily injured, which lies within them (see Fig. 5). The ridge in the middle of the back is formed by the spinous processes of the vertebræ (see Fig. 6). Each vertebra is joined to its fellow by a disc of cartilage or gristle, and by strong bands of fibrous tissue known as ligaments. The spine, being the central column on which the body is hung, is so arranged as to be strong enough to support heavy weights, while, at the same time,

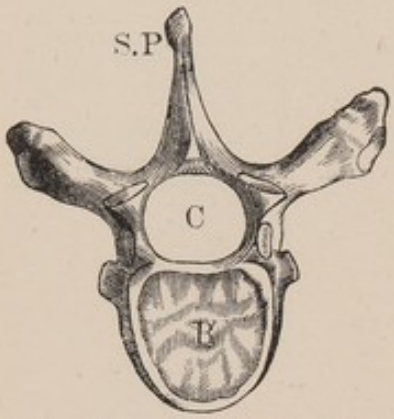


Fig. 5. — Vertebra (from above).—S.P, spinous process; C, canal for spinal cord; B, body.

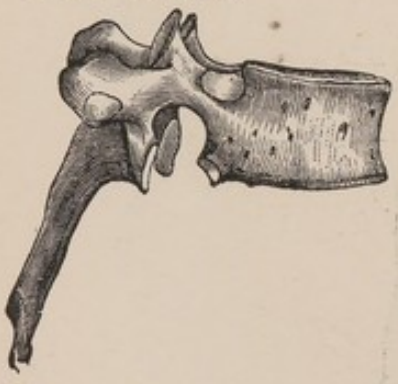


Fig. 7.—Vertebra (from side).

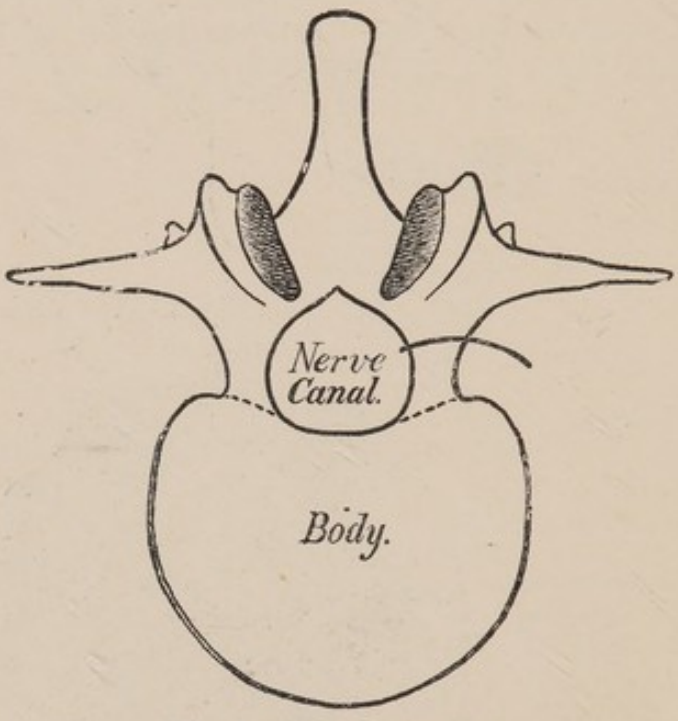


Fig. 6.—Dorsal vertebra.

in virtue of its many joints and muscular attachments, it is so pliant as to allow a very considerable range of movement.

CONTENTS OF THE CEREBRO-SPINAL CANAL.—The cerebro-spinal canal contains the brain and spinal cord, the nervous mechanism by which the sensation, the movements, and the special functions of the body are regulated. The brain is contained in the skull, and consists of three parts :—

1. The **Cerebrum** or big brain, the organ of mind ;
2. The **Cerebellum** or little brain ; and
3. The **Medulla Oblongata.**

The brain (see Fig. 8) consists of a large number of convolutions, separated by grooves, and is divided by a number of main fissures into four main lobes—*Frontal, Parietal, Occipital*, and *Temporo-Sphenoidal* —so named from the bones of the skull on which they lie. The parts of the brain which preside over the important functions of speech, movement, hearing, and sight are situated in the frontal, parietal, temporo-sphenoidal, and occipital lobes respectively. The cerebellum, or little brain, lies at the lower and back part of the skull, and has special nervous functions to fulfil, which it is unnecessary here to indicate. The medulla oblongata is a most important part of the nervous system. It lies at the junction of the brain with the spinal cord, and immediately above the opening in the skull known

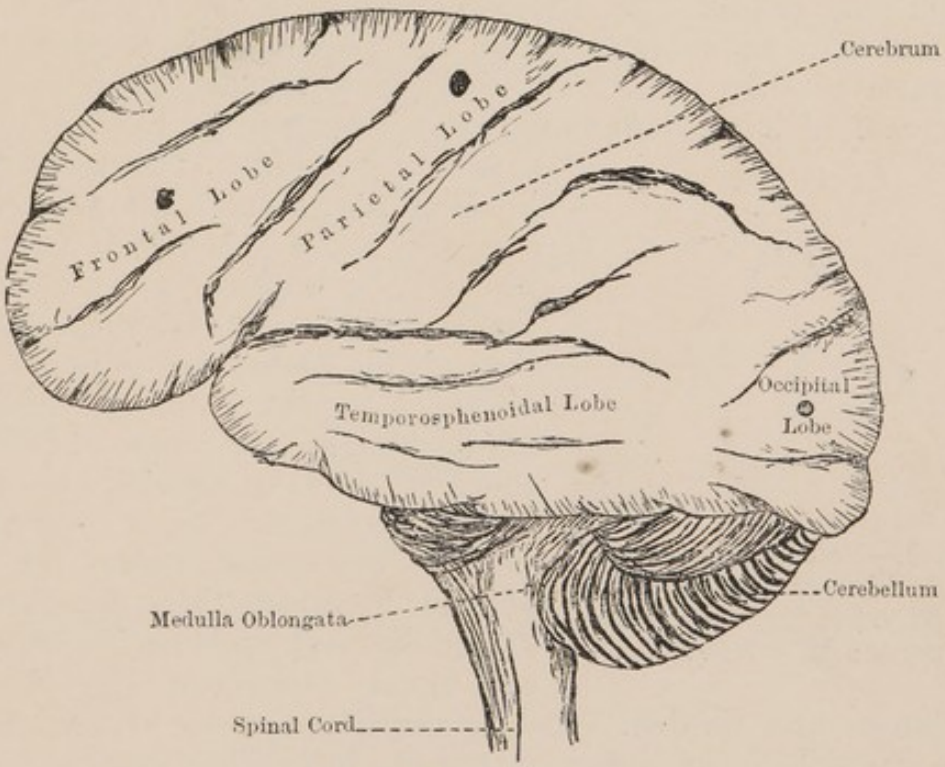


Fig. 8.—The brain.

as the *Foramen Magnum*. The medulla oblongata contains in its substance masses of nerve cells, which are known as nerve centres, and which control special actions of the body—*e.g.*, breathing, coughing, vomiting, etc. Between the brain and the skull lie the brain-membranes, or *Meninges*, which serve to keep the brain in place, and to protect it from injury.

The Spinal Cord.—In the spinal canal formed by the conjoined vertebræ lies the spinal cord. The spinal cord (Figs. 2 and 8) consists of a large number of nerves entering and leaving the brain and conveying impulses to and from the central nervous system. The spinal cord has in its centre grey nerve-matter, round which is packed the white matter formed by the ascending and descending

nerve-fibres. In the spinal cord are to be found two great classes of nerves :—

1. *Descending Nerves, Motor Nerves*, or nerves of movement, which leave the cord at different parts of its course to reach the muscles, to which they are distributed, and whose action they govern ; and

2. *Ascending or Sensory Nerves*, which convey sensation from the surface of the body, from the skin, and from the tissues, to the brain.

A Motor Nerve telegraphs from the brain to a muscle the order to carry out a special movement, and the nervous impulse so conveyed stimulates the muscle to contract. The sensory nerves convey to the brain messages from the surface of the body, and it is through them that we feel.

To take an example of an act performed voluntarily on an impulse reaching the brain through a sensory nerve :—Imagine the case of a child drawing away its hand on having its finger suddenly pricked. The sensation of pricking passes from the skin through a sensory nerve to the brain (see Fig. 9), where it is interpreted as pain, when the brain immediately telegraphs back through the motor nerves of the arm a message to the muscles, which are stimulated by their special nerves to contract and so to withdraw the hand.

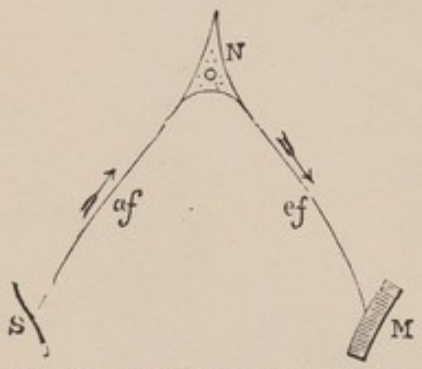


Fig. 9.—Reflex motor arc:—S, skin; *af*, sensory nerve; N, nerve cell; *ef*, motor nerve; M, muscle.

3. *Sympathetic Nerves.*—In addition to the two great classes of nerves already described, there is a third class known as "Sympathetic" nerves, which are found mainly in the chest and abdomen, and are distributed to the large organs of these cavities, the stomach, heart, lungs, intestines, etc. They preside over the important functions of digestion, circulation, and respiration.

4. *Nerves of Special Sensation.*—From the brain, through special openings in the skull, pass the nerves of "special sensation" to the interior of the ears, eyes, and nasal cavity. These nerves of special sensation preside over the four special senses—sight, hearing, taste, and smell—and convey messages to the brain from their complicated and delicately arranged nerve-endings in the eyes, ears, mouth, and nose.

II. THE THORACIC OR CHEST CAVITY.

The chest-box, or **thorax,** is formed by the twelve dorsal vertebræ, the ribs, and the **sternum,** or breast bone. The ribs are attached to the dorsal vertebræ behind, and to the breast bone in front, and

consist of twelve pairs. The two lower pairs have no attachment in front, and are hence known as "floating ribs" (see Fig. 1). The thorax is separated from the abdomen by a large and important sheet of muscular tissue known as the **midriff** or **diaphragm** (see Figs. 10 and 11); and contains the organs of circulation and respiration, the

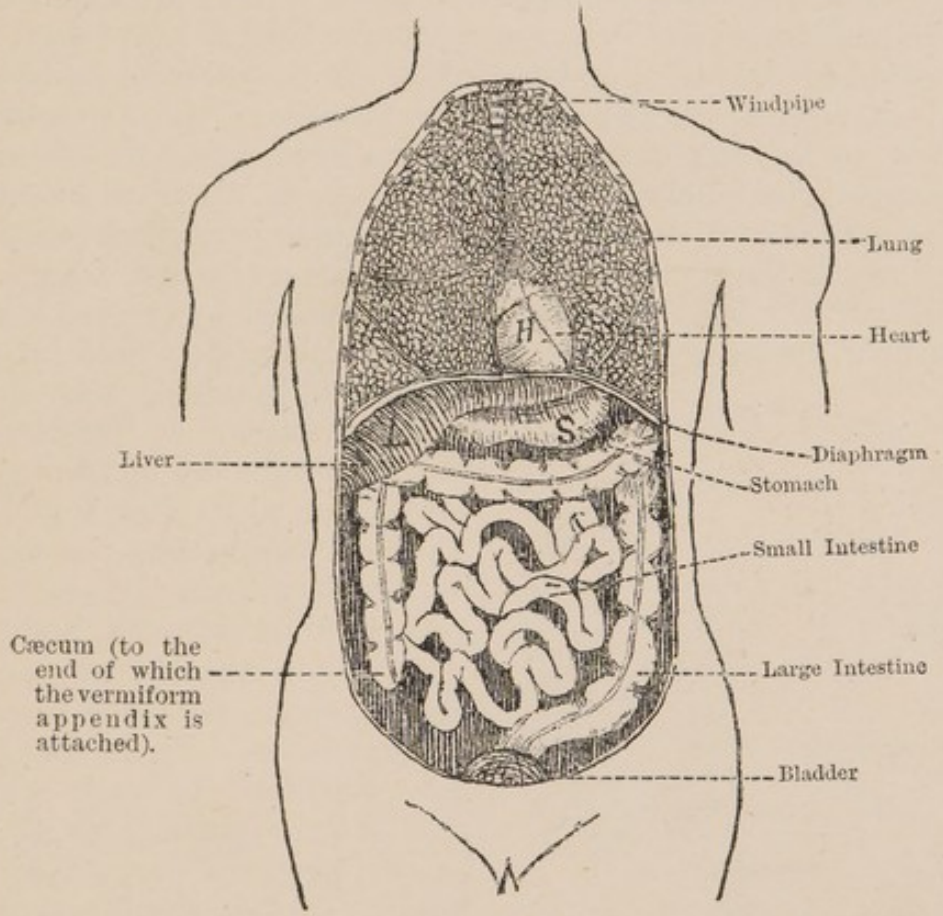


Fig. 10.—Contents of chest and abdomen (from the front).

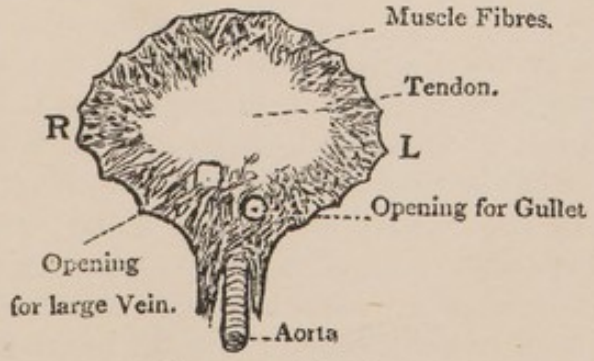


Fig. 11.—Diaphragm.

heart with its large blood-vessels, and the lungs. Through it also the gullet passes to join the stomach. The chest-wall is lined by a serous membrane known as the *pleura*, which is reflected over the surface of the lung. Inflammation of this membrane is known as *pleurisy*. The serous covering of the heart is known as the *pericardium*.

1. **ORGANS OF CIRCULATION.**—The **blood** is circulated through the body by means of the heart and blood-vessels. Blood is a fluid tissue, and has been well described as an internal medium—a "go between" the outer world and the tissues. It serves two great purposes:—(1) It carries nutrient materials to the tissues in the shape of the food-products absorbed from the intestine after digestion, and is also the medium whereby oxygen, a gaseous food, is taken up from the air entering the lungs, and carried to the tissues to assist in the chemical changes connected with vital processes. (2) Its second function is no less important, and consists in its being the channel whereby useless materials are got rid of by being absorbed into the blood, and carried by it to the kidneys and other organs whose function it is to eliminate the products formed by tissue-waste and change.

As it leaves the body, the blood is to the naked eye a simple red fluid; but the microscope shows it to consist of a clear fluid known as **serum,** in which float solid particles known as **corpuscles.** The corpuscles are of two kinds—red and white (see Fig. 12). The red corpuscles, the more important, are small discs, each $\frac{1}{3200}$ inch in diameter, and are the medium whereby oxygen is carried along the blood stream to the tissues. There are 350 red corpuscles to each white cell. When exposed to air, blood has the power of *coagulating*, or forming a clot; the blocking of a cut blood-vessel by a clot is nature's method of arresting hæmorrhage.

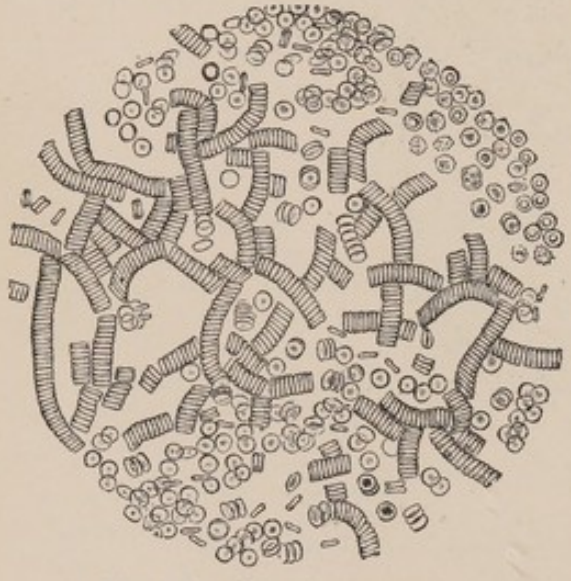


Fig. 12.—Blood corpuscles.

As the blood leaves the heart in its pure oxygenated condition to circulate through the body, it is bright red; but as it passes through the tissues, it becomes impure and darker in colour from the absorption of effete products and the loss of oxygen. We have thus in the body *two* conditions of the blood—pure and impure. Similarly, we have two sets of blood-vessels, arteries, and veins; and practically two hearts—a left heart for the reception and circulation of the pure or arterial blood; a right heart for the impure or venous blood. The vessels containing pure blood are known as **arteries**; those containing impure blood as **veins.** The only exception to this general rule is in the case of the great arteries and veins entering and leaving the lungs. The former (**pulmonary arteries**) carry impure blood from the right side of the heart to the lungs to be purified, while the latter (**pulmonary veins**) carry back to the left heart the blood purified in the lungs. Between the arteries

and the veins is a system of very minute vessels, visible only with the microscope, and known as **capillaries.** The capillaries, which are so small as to allow the passage only of single corpuscles in a row, form a looped network throughout the organs and tissues of the body. The arteries have much thicker coats than the veins, so that, when cut across, these tubes gape and bleed readily, whereas the veins, having thinner coats, are much more readily collapsible and compressible. Through the arteries the blood, propelled rhythmically by the heart, flows in a series of jets or jerks; in the veins it is slowed down into a continuous and steady stream. Thus, when an artery is wounded, the blood spurts out in jets with each heart-beat, but it issues from a cut vein slowly and steadily.

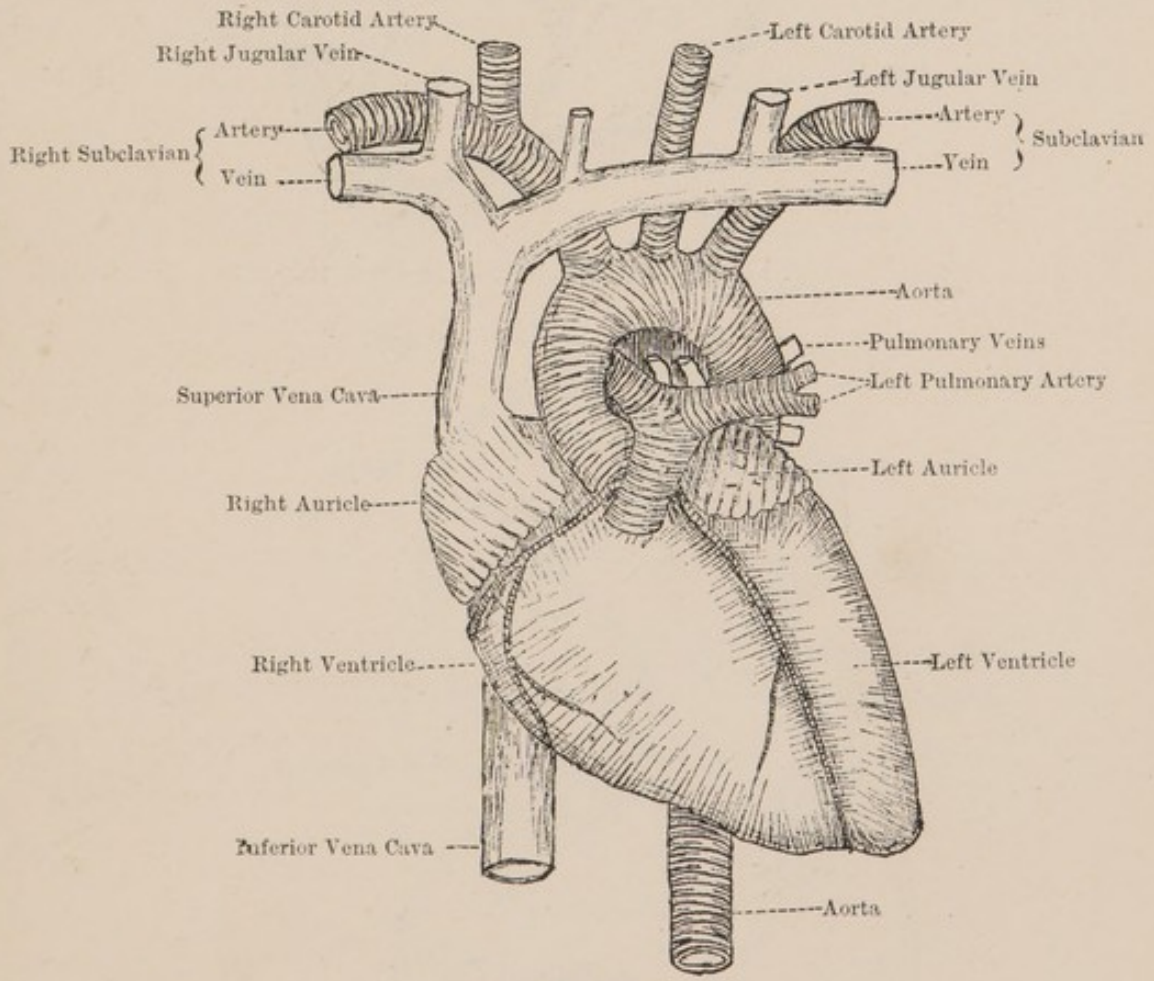


Fig. 13.—The heart.

The Heart.—The heart (Fig. 13), which is fitly compared to a force-pump, may be said to consist of two halves—a right heart and a left heart, the former venous, the latter arterial—each half being again divided into a receiving-chamber or **auricle,** and a propelling chamber or **ventricle.** The walls of these chambers are formed of muscle, by the contraction of which the blood is propelled—the direction of propulsion being regulated by **valves** (Fig. 14). Heart disease is due either to improper action of one or other

of these valves (which have contracted and become incompetent as a result of inflammation) or to faulty action of the heart muscle.

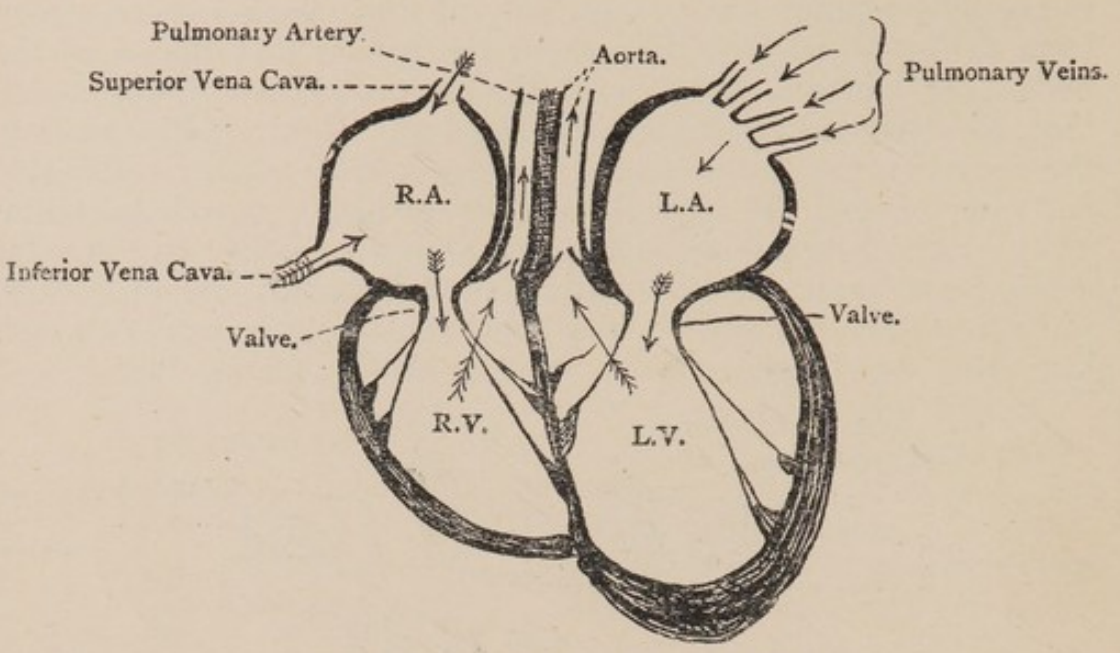


Fig. 14.—The circulation in the heart.

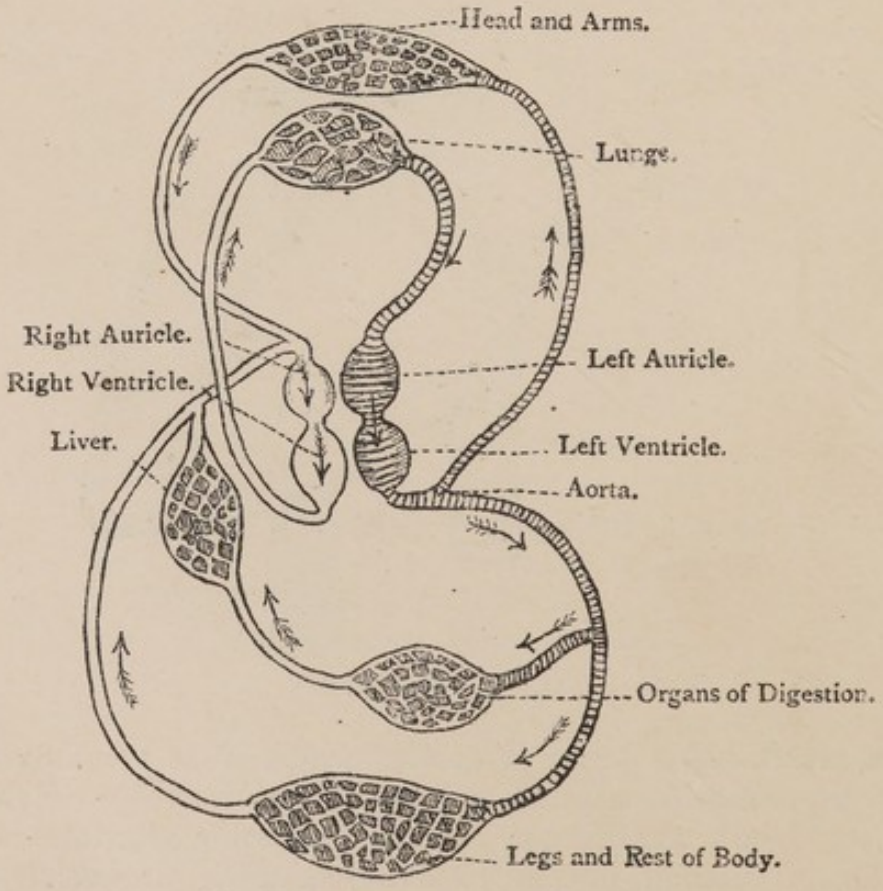


Fig. 15.—Scheme of circulation.

The Pulse.—The rate and force of contraction of the heart are estimated by the pulsation of the arteries. The pulse may be taken

in any of the larger arteries, the one usually chosen being the **radial artery** on the front and outer side of the wrist, over the lower end of the radius. The pulse may be felt distinctly, and is sometimes taken, in the **temporal artery,** half an inch in front of the opening of the ear. The normal rate of the pulse in an adult is sixty to eighty beats per minute ; at the extremes of life in young children and old people it is faster than this.

Scheme of Circulation.—The blood leaving the left ventricle by a large blood-vessel (the aorta), in a pure or arterial condition, is distributed from the arteries to the capillaries, and to all the tissues and organs of the body, which it nourishes in its passage (Fig. 15). From the capillaries it is collected into the veins, whence it passes to the right side of the heart, entering the right auricle. From the latter it passes into the right ventricle, and thence is forced through the pulmonary artery to the lungs, where it is purified.

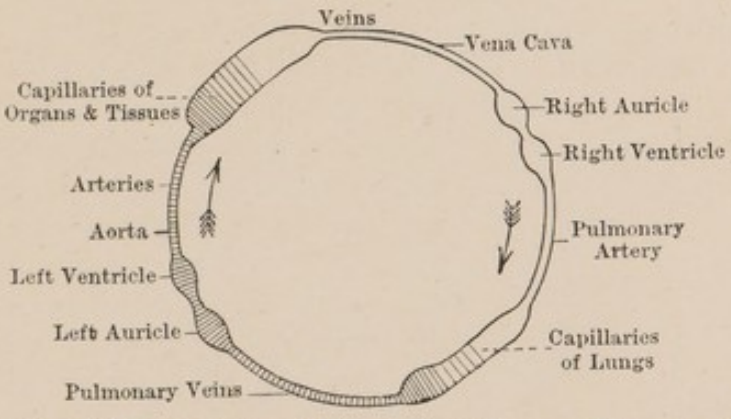


Fig. 16.—Scheme of circulation (arterial circulation shaded).

From the lungs it returns to the heart by the pulmonary veins, entering the left auricle, whence it flows into the left ventricle, and thus the circle is completed (Fig. 16).

In tabular form the order of the circulation is—

Left ventricle.
Aorta.
Arteries and capillaries.
Veins.
Venæ cavæ.
Right auricle.
Right ventricle.
Pulmonary artery.
Capillaries of lungs.
Pulmonary veins.
Left auricle.
Left ventricle.

2. **ORGANS OF RESPIRATION.**—Respiration or breathing consists of two great phases—**Inspiration,** or "breathing in," and **Expiration,** or "breathing out." The air as it is inspired consists

of three gases—Oxygen (O), nitrogen (N), and carbonic acid (CO_2). When expired air is examined, it is found to have undergone a considerable change, its carbonic acid being increased a hundred-fold, while its oxygen is considerably diminished, the nitrogen remaining unchanged. Oxygen is, therefore, taken up in the lungs during respiration, while carbonic acid is given off. The object of respiration, then, is to supply oxygen for the oxidation which is a necessary part of the **metabolism** or tissue-change of the body, as well as to remove the carbonic acid formed within the body by the combustion which attends the wear and tear of the tissues. The interchange of gases between the air and the blood in the capillaries of the lung and skin (for the skin also assists in respiration) has been called the "outer" respiration, while the similar interchange that goes on in the tissues, as evidenced by the change of arterial into venous blood, has been called the "inner" respiration.

The respiratory apparatus consists of three parts—

(*a*) **The Chest-Wall.**—The chest-wall acts like a pair of bellows, and moves the air within the lungs by the ascent and descent of the ribs consequent on the contraction of the muscles of inspiration and expiration attached to the ribs. The great muscular organ of inspiration is the **diaphragm,** or midriff, which by its descent on contraction (*vide* Fig. 17) produces a vacuum in the chest into which air is drawn.

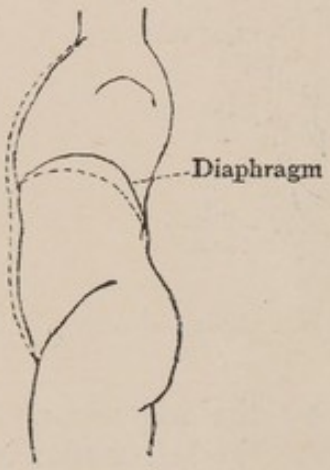


Fig. 17. — Diaphragm and abdominal wall at end of expiration (plain outline) and at end of inspiration (dotted outline).

(*b*) **The Air-Passages.**—These consist of (1) the nose and back of the throat (chambers in which the air is warmed and filtered as it passes along —Fig. 18). (2) The **larynx** (voice box or Adam's apple) contains the vocal cords by the vibration of which the voice sounds are produced. The larynx in the act of swallowing is covered by a valve-like piece of cartilage attached to the back of the tongue, and known as the **epiglottis.** This prevents food from entering the air tubes. Particles of food "going the wrong way" have passed the epiglottic valve, and cause severe coughing by irritating the mucous membrane of the voice box. And (3) the **trachea** or windpipe. The trachea divides into two **bronchi** or bronchial tubes, which ramify into smaller branches till they become very small tubes known as **bronchioles** (Fig. 19).

(*c*) **The Lungs.**—The lungs consist of an immense number of small nest-like cavities called air-sacs or **vesicles,** in which the

bronchioles terminate (Fig. 20). These little chambers contain air, and are densely covered with capillary blood-vessels, bringing their blood to the air in the lung vesicles to be purified (Fig. 21). Between the air in the lungs and the blood in the capillaries an interchange of gases goes on, which results in part of the atmospheric oxygen

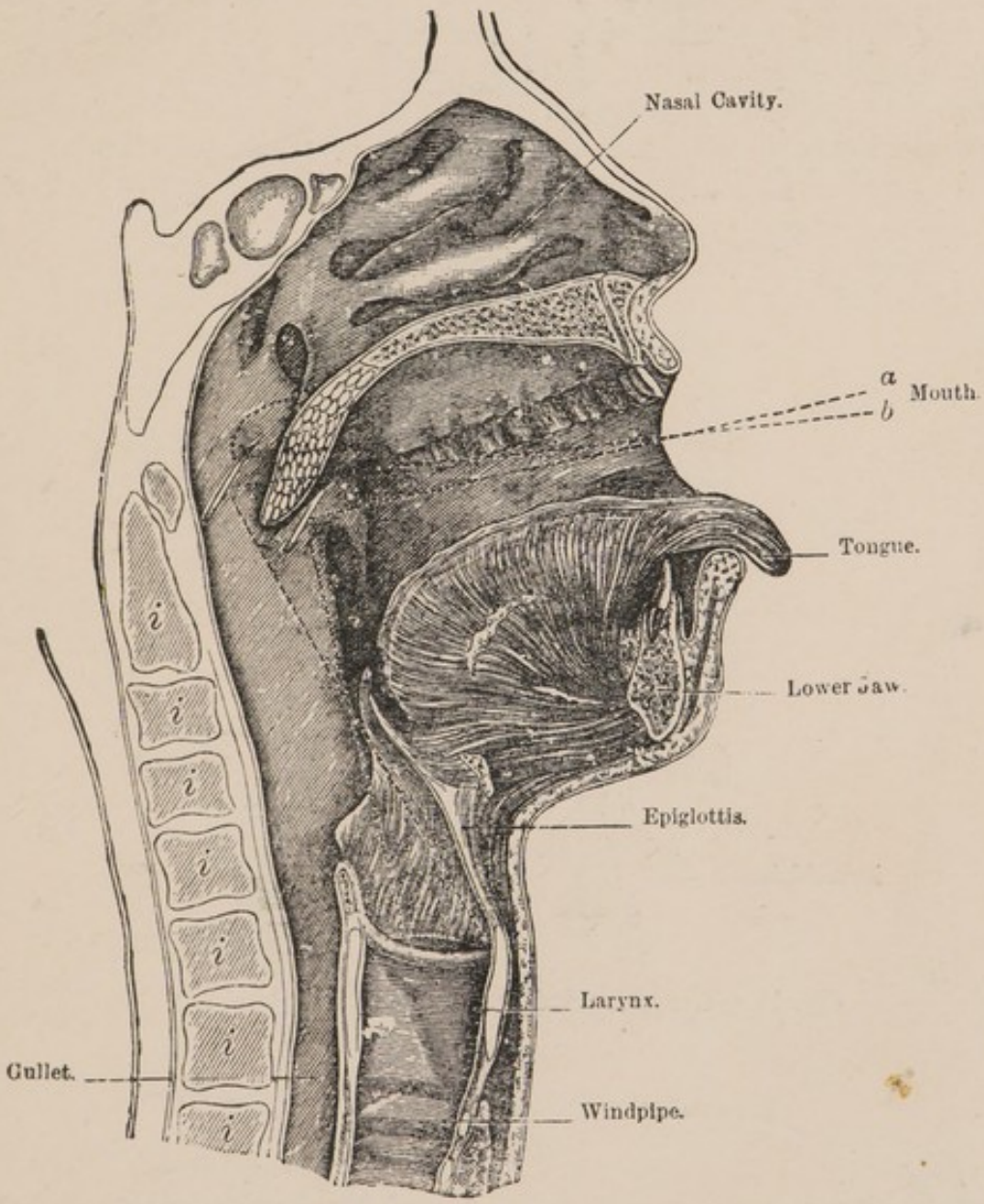


Fig. 18.—The air passages.

i i i i = Vertebræ.

being taken up by the purified blood, while the impure carbonic acid formed by tissue-change in the body is in turn given up to the air and is expired. It is mainly this " breathing out " of carbonic acid gas (CO_2) that makes the air impure in an overcrowded room.

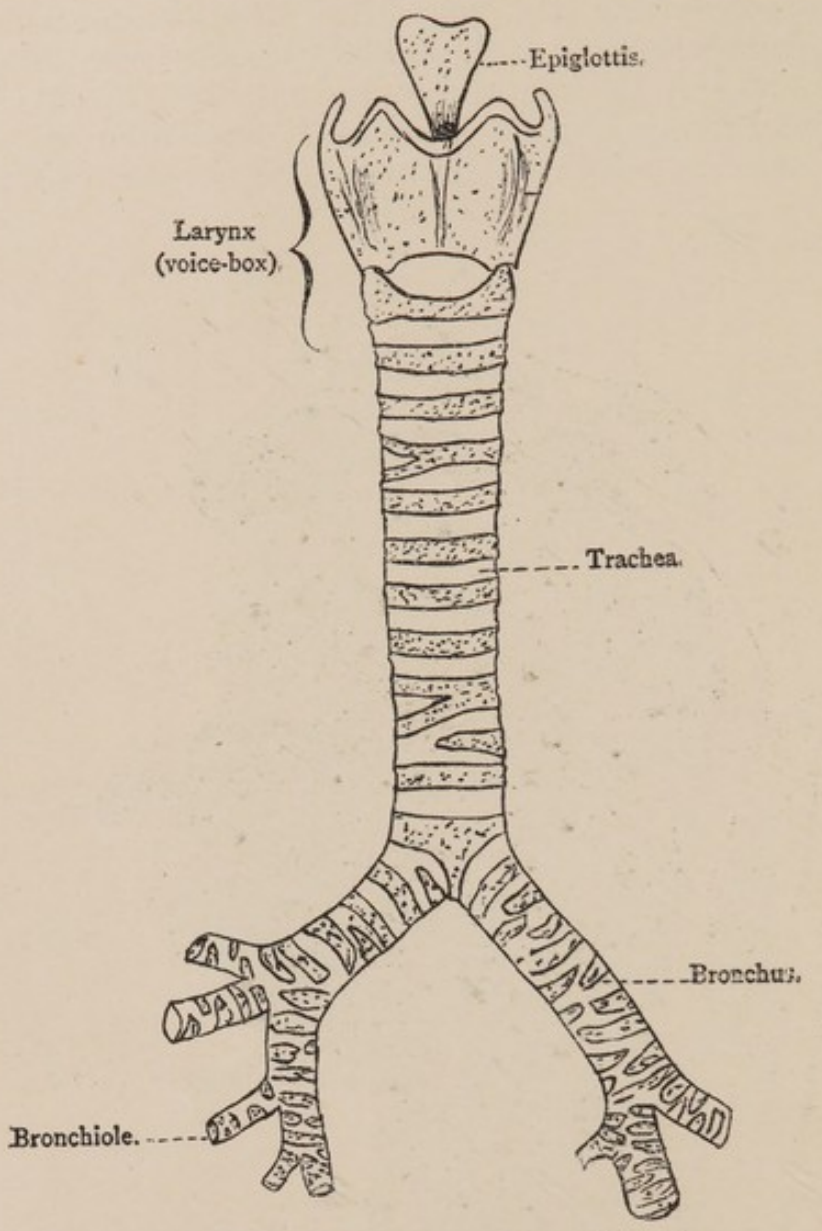


Fig. 19.—Larynx, windpipe, and bronchial tubes.

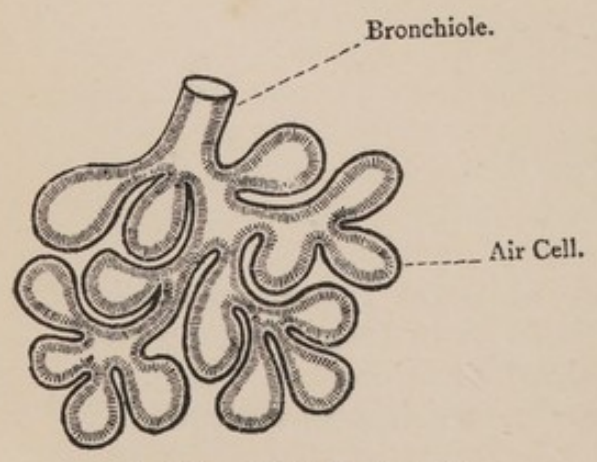


Fig. 20.—Air-cells of lung.

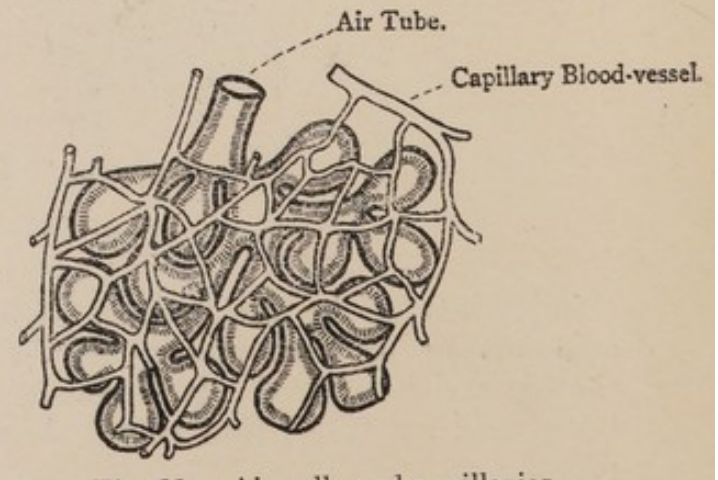


Fig. 21.—Air-cells and capillaries.

III. THE ABDOMINAL OR STOMACH CAVITY.

The abdominal cavity is divided into the abdomen proper and the pelvis. The former is bounded behind by the lumbar vertebræ, above by the diaphragm and lower ribs, and in front and at the sides by large muscles.

The **pelvis** is a basin-shaped cavity bounded behind by the *sacrum*, or rump-bone, and its bony appendage, the *coccyx*, and at the front and sides by the haunch bones (Fig. 22). It contains the urinary bladder, the lower end of the large intestine (*rectum*), and part of the organs of generation.

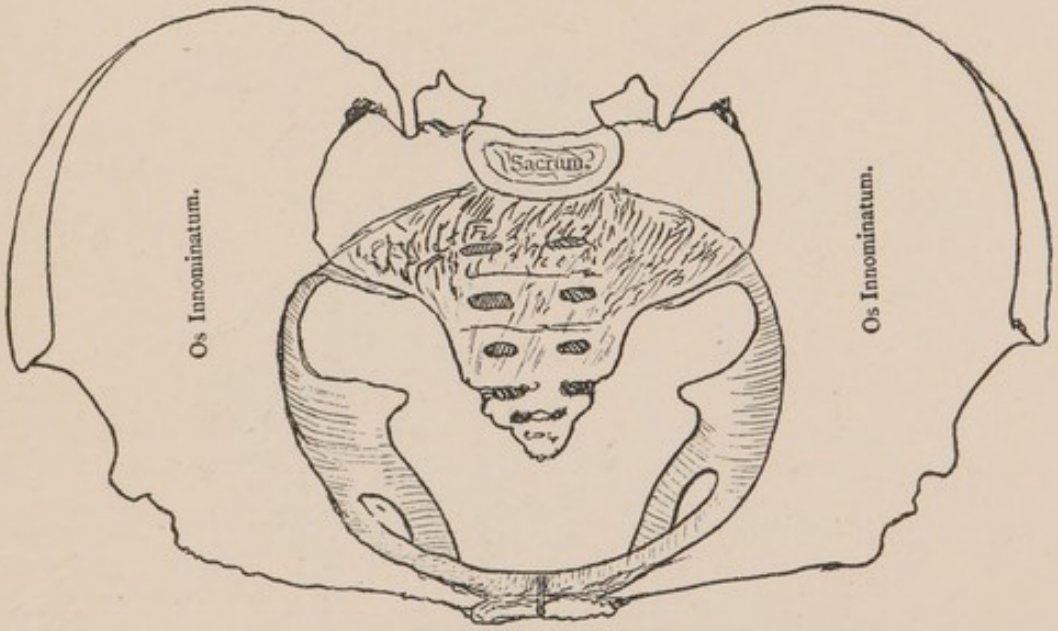


Fig. 22.—Pelvis (from above).

The **abdomen proper** contains the organs of digestion, absorption, and excretion, which will best be described under these headings. The relative position of the organs of the abdomen is shown in Fig. 10. On the left side close to the ribs and the diaphragm lies the **stomach,** while the similar position on the right side of the body is occupied by the liver. Behind and below the stomach lie the **spleen** and **pancreas** (sweet-bread). On either side of the back part of the abdomen lie the **kidneys.** From the stomach the food passes into the **small intestine,** which is a long coiled-up tube, 20 feet in length, which ends in the right flank in the large intestine. The **large intestine** arches up as shown in Fig. 10 along the right side, and, crossing over, passes down the left side to enter the pelvis. The large intestine begins on the right side, at the cæcum, from the end of which the vermiform appendix springs (see Fig. 24). The abdomen in addition contains the continuation of the **aorta** or main arterial trunk, giving off its large branches to the liver, spleen, kidneys, intestines, and other abdominal organs, and dividing opposite

the fourth lumbar vertebra into two large trunks for the supply of blood to the lower extremities (see Fig. 23). Along with the aorta runs a large vein, the **inferior vena cava,** which carries the impure blood back from the lower extremities and the abdominal organs to the heart. Running up the front of the spine, close to the aorta, is the **thoracic duct,** the function of which will be explained later. In the abdomen, high up on the left side, and behind the stomach, lies the spleen, an organ which has an important duty to fulfil in the formation of blood. The inner wall of the abdomen is covered by a serous membrane similar to the thoracic pleura, and known here as the **peritoneum.** The peritoneum is folded round the stomach,

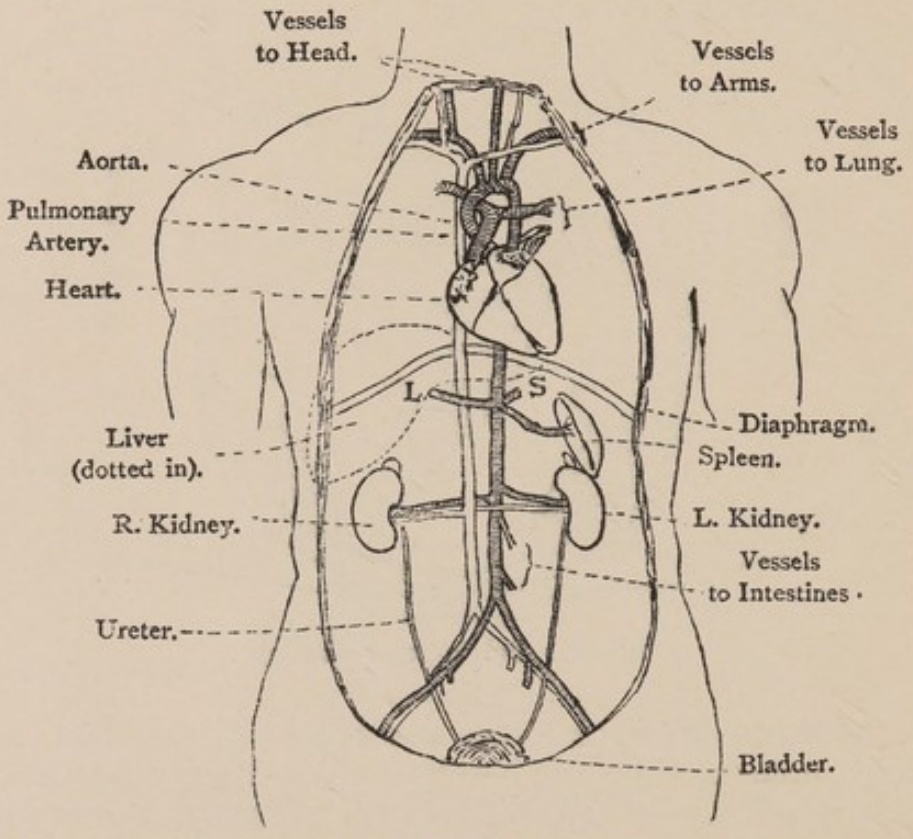


Fig. 23.—Abdominal and chest organs and vessels (lungs and alimentary canal removed). Arteries, with cross markings; veins, unshaded; L. and S., arteries to liver and stomach.

intestines, and liver, and covers the other large abdominal organs. Inflammation of the peritoneal covering of the intestine (peritonitis) is popularly known as inflammation of the bowels.

We pass next to the consideration of the three great functions of digestion, absorption, and excretion.

DIGESTION.—By "digestion" is meant the process whereby the food taken into the body is chemically changed, so as to become soluble and easily absorbable into the circulation. Foods may be divided into five great classes :—

(1) *Proteids.*—Albumen (white of egg), beef, mutton, and the ordinary flesh foods are the best representatives of this class.
(2) *Carbo-hydrates—e.g.*, starch and sugar.
(3) *Fats.*
(4) *Salts.*
(5) *Water.*

A man doing moderate work requires every day about 24 ounces of water-free-food. Of these 24 ounces, $4\frac{1}{2}$ belong to the proteid or albuminous class, and $14\frac{1}{2}$ to the carbo-hydrate or starch class.

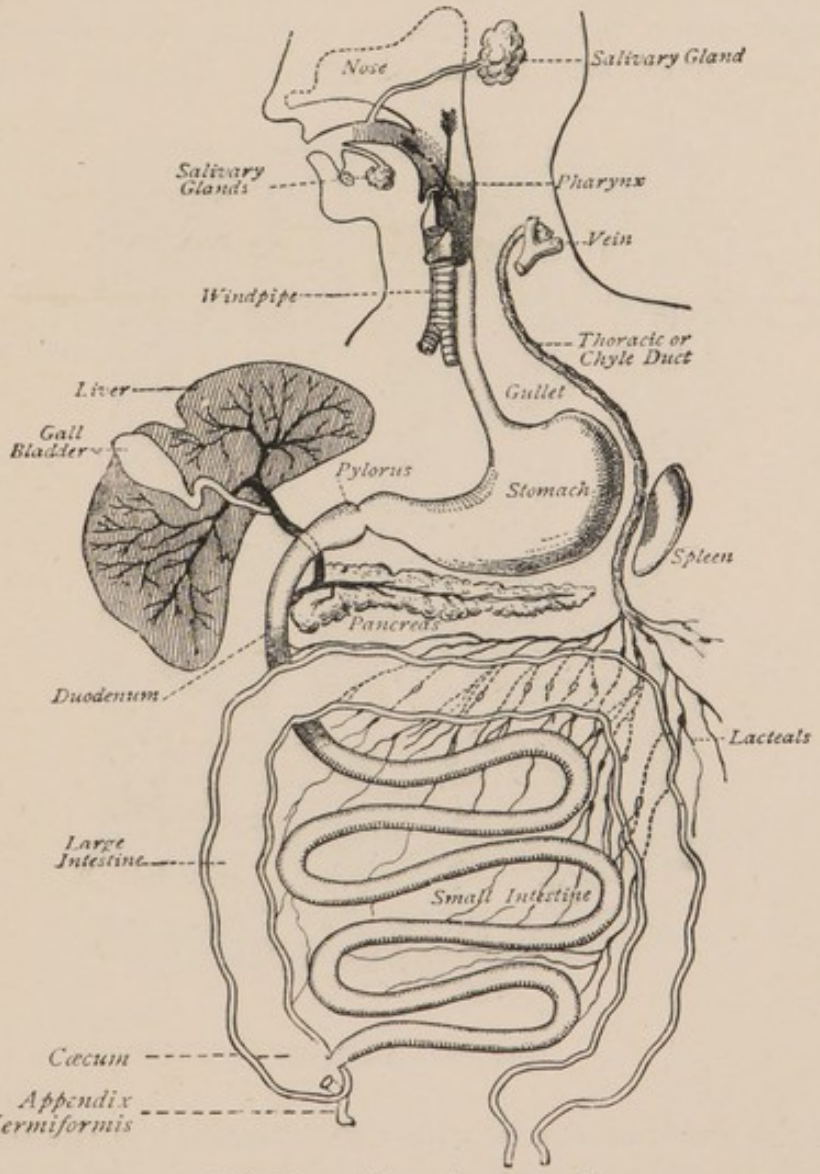


Fig. 24.—Alimentary canal.

These 19 ounces of albuminous and starchy food are insoluble, and have by the process of digestion to be so changed as to become soluble and easily absorbable into the blood. When absorbed, they are passed on to the tissues to nourish them. When the food has been broken down by chewing it comes in contact in the mouth with saliva, and has its starchy constituents acted on by a ferment present in saliva, which converts the insoluble starch into soluble

sugar (see Fig. 24). The food is then swallowed and passes into the stomach. In the stomach it is acted on by a fluid known as the **gastric juice,** which is secreted by glands in the stomach, and by this fluid the insoluble *proteids* are rendered soluble and become *peptones.* When the food has been sufficiently acted upon in the stomach it passes through the pyloric valve into the small intestine, and the partially digested food is now known as **chyme.** The chyme is slowly passed along the small intestine by the contraction of the muscular wall of the bowel, and during its passage comes in contact with other digestive fluids poured into the intestine from the pancreas, liver, and intestinal glands. By the fermentative

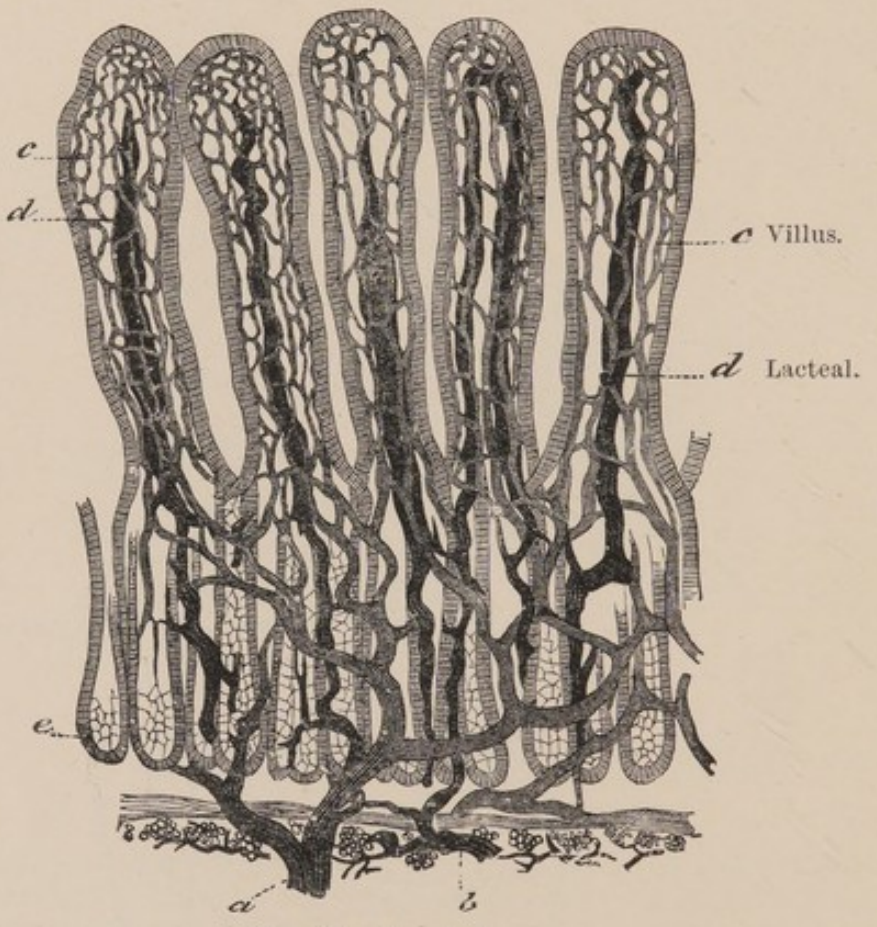


Fig. 25.—Lacteals.

action of the fluids in the intestine, the elements of the food which still remain insoluble are acted on, and become soluble. The food has now become changed into a liquid, which can be easily absorbed and is ready to be taken up into the blood.

ABSORPTION.—The chyme or soluble food is absorbed from the intestine into vessels known as **lacteals** or **milk tubes** (Fig. 25), so called from the milk-like appearance of the digested food which they contain. The lacteals lie in the centre of villi, which are microscopic finger-shaped prominences, with which the wall of the

intestine is studded. The changed food, when it passes from the intestines into these special vessels, is known as **chyle.** The lacteal vessels discharge their contents into a large vessel known as the *thoracic duct*, which passes up the front of the spine close to the aorta, and pours its contents into a large vein at the lower part of the neck. It is through this complicated process and long course that the food has to pass before it reaches the blood, and has its nourishing properties distributed to the tissues of the body. In

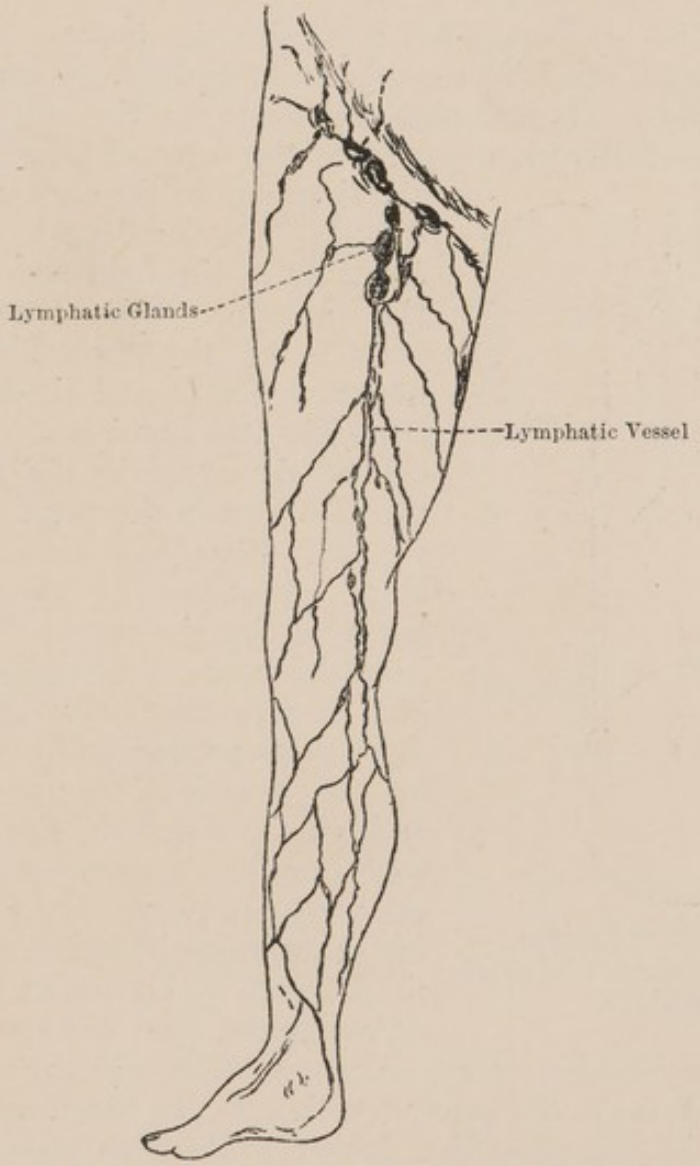


Fig. 26.—Lymphatic vessels and glands of leg.

connection with absorption, it is necessary to mention that the thoracic duct has also poured into it the contents of the lymphatic vessels. These **lymphatic vessels** are distributed through the tissues, and are said to act as sewers by taking up the excess of the fluid part of the blood shed out to nourish the tissues. These lymphatic vessels receiving, as it were, the overflow of blood, pass the lymph which they contain through the lymphatic glands before it reaches

the thoracic duct (see Fig. 26). The absorptive power of the lymphatics is well seen in the case of a poisoned wound of the hand, or a dirty leg ulcer, where the poisonous matter is taken up by the lymphatics in such quantity as to cause the nearest lymphatic glands to enlarge and inflame. The lymphatic glands of the neck frequently enlarge and become cheesy, or break down into "matter" from the action of tubercle bacilli absorbed by the lymphatics of the throat, nose, or mouth.

EXCRETION.—By excretion is meant the process whereby the waste products formed by tissue-change in the body are got rid of. The main organs of excretion are found in the urinary system. Excretion also takes place partly in the form of perspiration from the skin, and in the air expired by the lungs. The unaltered and useless elements of the food are excreted by the intestine. The **Urinary System** consists of the two **kidneys,** their **ureters** or ducts, and the **bladder** (Fig. 27). The two kidneys lie, one on each side of the spine, in the back part of the abdomen in the position shown in Fig. 23. Blood is supplied to them in large quantities by special arteries given off by the aorta. The kidneys have the power of acting on the blood, and of removing from it the waste deleterious products which are formed by the wear and tear of the tissues, and which, if left in the circulation, would produce poisonous effects upon the body generally. The fluid containing these waste products separated by the kidneys is known as **urine.** It is carried from the kidneys along the ureters to the bladder. Fifty ounces of fluid are excreted by the action of the kidneys in twenty-four hours. In fever, and in certain diseases of the kidneys, the quantity of urine passed is much diminished, while in other diseases—*e.g.*, diabetes—it is very much increased.

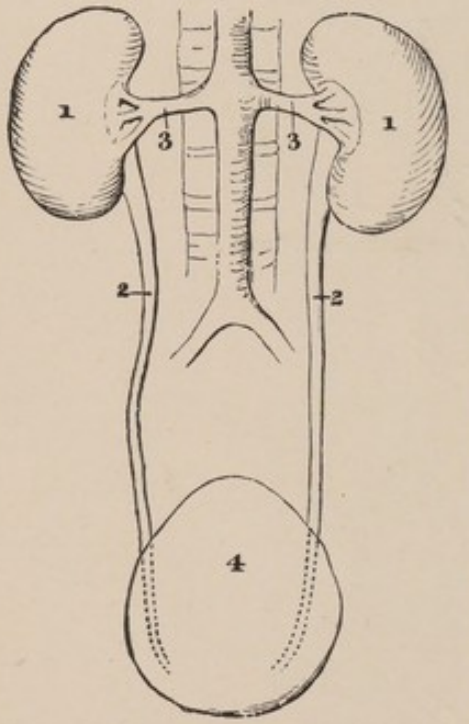


Fig. 27.—The urinary system.—1, kidney; 2, ureter; 3, renal arteries; 4, bladder.

(B) *THE EXTREMITIES OR LIMBS.*

THE BONES OF THE LIMBS.—The upper and lower limbs are built on the same plan, and are best considered together. It should be remembered that the back of the forearm corresponds to the front of the leg, and for exact comparison the thigh will be found

to correspond to the arm, the leg to the forearm, and the hand to the foot. The two extremities, so studied, present resemblances which are very striking (Figs. 28 and 29). They consist each of

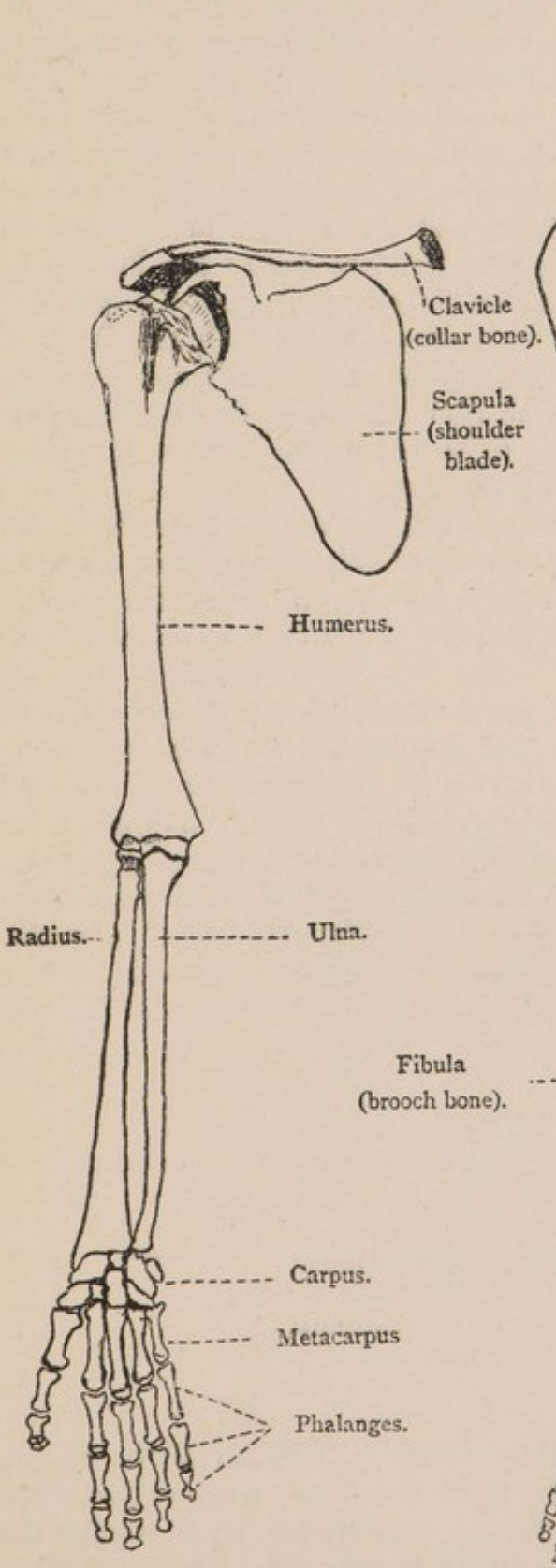


Fig. 28.—Bones of the arm.

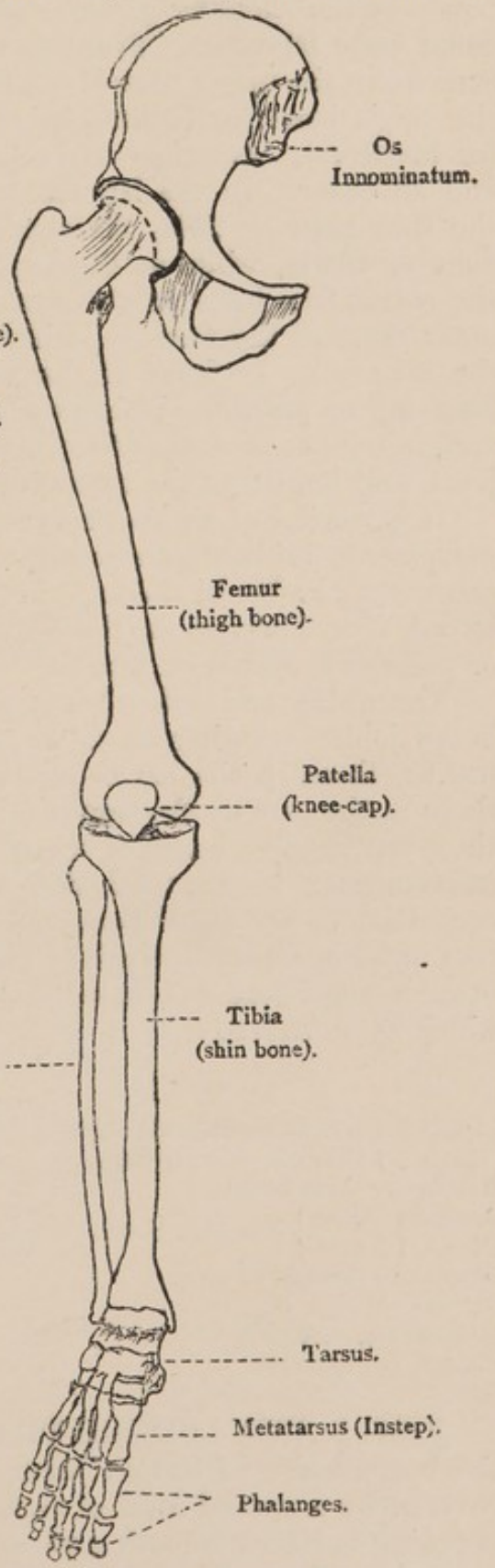


Fig. 29.—Bones of the leg.

a special bone or bones for the attachment of the extremity to the trunk. In the leg this consists of the pelvic girdle, or **haunch bone (Os innominatum),** which in the arm is represented by the two bones of the shoulder girdle—the **shoulder blade (scapula)** and the **collar bone (clavicle).** From this point of attachment a long bone runs down the upper part of each extremity—in the lower extremity the thigh bone (or **femur),** in the upper extremity the arm bone (or **humerus).** Attached to each of these are two bones, an inner and an outer. In the leg the inner and larger bone is known as the **shin bone** or **tibia,** the smaller and outer bone as the **brooch bone** or **fibula,** while in the forearm the two bones are known as the **radius** (the bone on the outer or thumb side), and the **ulna** (or inner bone of the forearm, which is distinctly felt on the back of the forearm). In front of the knee joint is a bone known as the **knee-cap** or **patella,** which may be represented by the well-marked and prominent process of the ulna to be felt on the back of the elbow joint, and known as the **olecranon process.**

It is worthy of notice that in the arm, for the purpose of greater movement, the bones are so arranged as to allow pronation, a movement not possible in the leg—*i.e.*, the two bones of the forearm can be made to cross as in the movement of placing the hand prone or palm downwards on a table.

The ankle and wrist joints are formed by a number of small bones joined together so as to give a considerable range of movement; those in the leg being known as the **tarsus** (seven bones), those in the arm as the **carpus** (eight bones). Passing forward from these are the five bones of the instep (**metatarsus**), and of the palm (**metacarpus**), while attached to each of the metatarsal and metacarpal bones are small bones known as **phalanges,** which form the toes and fingers respectively. These phalanges are three in number in each finger and toe, save in the case of the thumb and big toe, which have two only.

Arm.	Leg.
Shoulder Girdle { Scapula—Shoulder blade. Clavicle—Collar bone.	Haunch bone (os innominatum).
Humerus—Arm bone.	Femur—Thigh bone.
Radius { Outer, Ulna { Inner } Forearm bones.	Fibula { Outer, Tibia { Inner } Leg bones.
Olecranon process of ulna.	Patella—Knee-cap.
Carpus—Wrist.	Tarsus—Ankle.
Metacarpus—Palm.	Metatarsus—Instep.
Phalanges—Fingers.	Phalanges—Toes.

JOINTS AND LIGAMENTS OF THE EXTREMITIES.—Where the bones unite to form a joint, as in the knee, their surfaces are covered by a special form of cartilage or gristle, so as to render the opposing surfaces smooth and easy of movement. This is further secured by the walls of the joint being lined by a special membrane

(synovial membrane), which pours out an oily fluid known as *synovia*, and so keeps the surfaces lubricated and prevents friction. The well-known changes that take place in joints, the seat of chronic rheumatism, are due to alterations in the cartilaginous surfaces, and in the synovia. The joints of the extremities may be divided

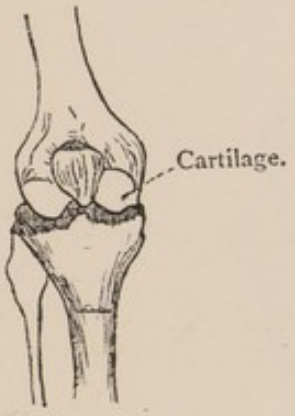


Fig. 30.—Bones and cartilages of knee joint.

Fig. 31.—Bones and cartilages of hip joint (ball and socket joint).

into two kinds—(1) the **"hinge"** joint, as seen in the knee (Fig. 30), and elbow (see skiagram, Fig. 101); (2) the **"ball and socket"** joint, as seen in the hip (Fig. 31).

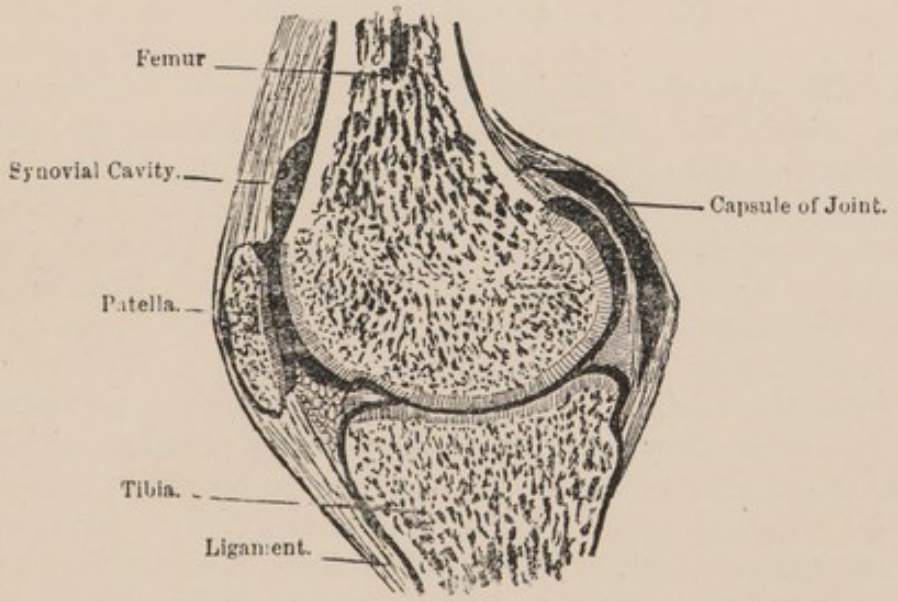


Fig. 32.—Ligaments and synovial cavity of knee joint (lateral view).

The bones at a joint are held together by strong bands or straps of fibrous tissue known as **ligaments** (Fig. 33). These permit only a certain range of movement, and prevent the joint from being dislocated or put out of place. In the larger joints the ligaments are very strong, and form **"capsules"** which entirely enclose the ends of the bones forming the joint. "Imperfect" joints are joints

in which only a limited range of movement is possible, and are best exemplified by the joints between the spinal vertebræ.

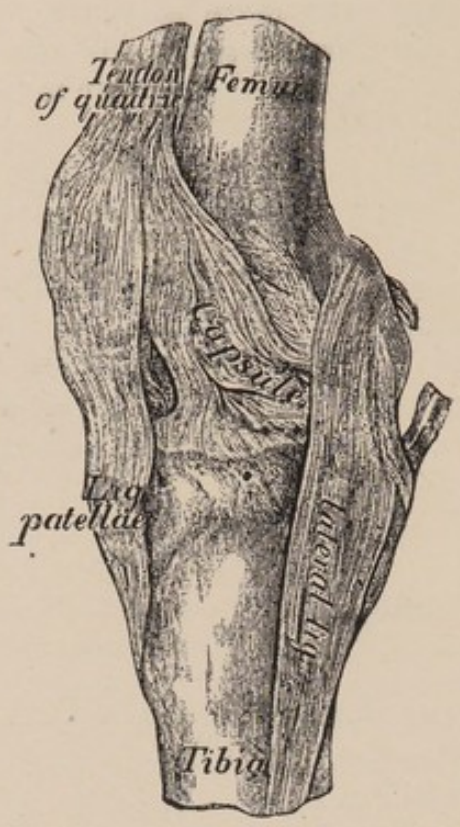


Fig. 33.—Ligaments of knee joint.

MUSCLES.—Attached to the bones are masses of contractile tissue, by which the different parts of the skeleton are moved. These masses of tissue are known as muscles, and form the red fleshy parts, or "beef" of the body. Muscles have the power, on stimulation by a motor nerve, of contracting or growing shorter, and thereby of altering the position of the parts to which they are attached. The muscles of the skeleton are under the control of the will, the stimulation causing contraction being conveyed to them directly from the brain. They are, therefore, known as **voluntary** muscles, in contra-distinction to the **involuntary** muscles, which are not under the control of the will, and which go on acting independently under a special nervous mechanism of their own. Involuntary muscles are known as **white** or **organic** muscles, and are found principally in such organs of the body as the stomach, bladder, and intestine. Heart muscle, though it is red like voluntary muscle, is involuntary; one cannot regulate the rate of contraction of the heart at will. The skeletal or red muscles, so called from their colour, may be attached to bones either directly or through the intervention of a band of fibrous tissue, which is known as a **tendon** or **sinew.** Typical muscles—*e.g.*, the biceps of the arm, and the ham-string muscles of the leg—consist of three parts:—

(*a*) *A tendon of origin.*—In the biceps muscle, the point from

which the muscle springs is a process of the scapula or shoulder blade (see Fig. 34).

(*b*) *A fleshy belly of contractile muscular substance,* which on stimulation becomes shorter and so causes movement of the bone to which the tendon of insertion is fixed.

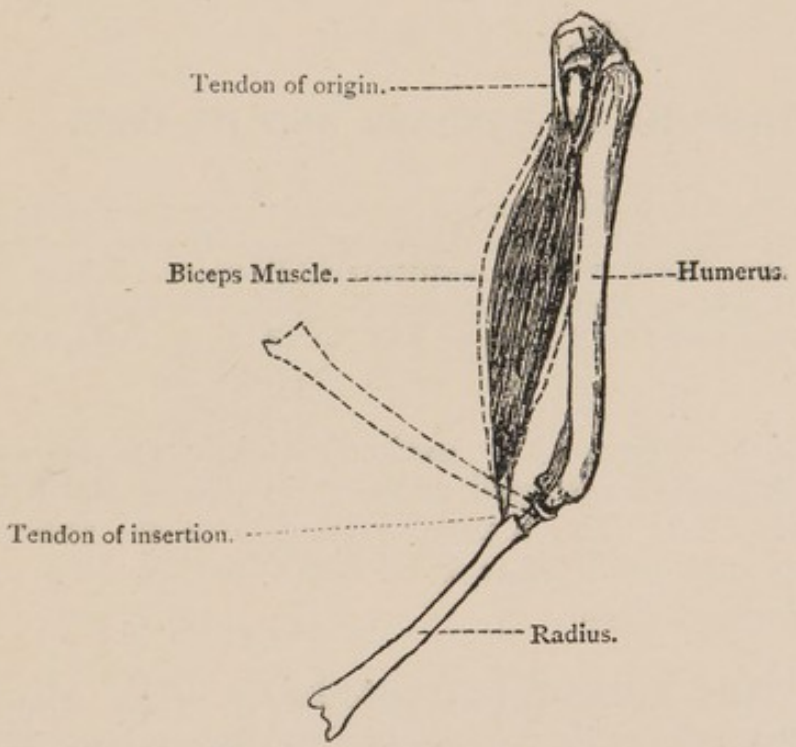


Fig. 34.—Biceps muscle, showing movement of the radius on contraction.

(*c*) *A tendon of insertion.*—In the case of the biceps, this is attached to the outer of the two forearm bones. The movement of the radius caused by contraction of the biceps muscle is shown in Fig. 34.

CHAPTER II.

THE TRIANGULAR BANDAGE AND ITS USES.

USES—FIGURED BANDAGES—HOME-MADE BANDAGES—KNOTS—LARGE ARM SLING—SMALL ARM SLING—EYE BANDAGE—LOWER JAW BANDAGE—SCALP BANDAGE—CHEST BANDAGE—SHOULDER BANDAGE—ELBOW BANDAGE—PALM BANDAGE—HAND BANDAGE—HIP BANDAGE—KNEE BANDAGE—SOLE BANDAGE—FOOT BANDAGE—THE TRIANGULAR BANDAGE AS A TOURNIQUET.

To the student of "First aid" methods a thorough knowledge of the uses and methods of application of the triangular bandage is absolutely essential. The triangular bandage is *the* emergency bandage, and its application forms an important part of the practical work of an ambulance class.

USES OF THE TRIANGULAR BANDAGE.—The triangular bandage may be employed for the following purposes in the rendering of "first aid" to the injured :—

(1) To keep dressings on wounds.

(2) To support weak or injured parts—*e.g.*, in the case of a sprained or dislocated joint.

(3) To keep splints or external supports firmly fixed to a limb in the case of a broken bone, thus saving the patient unnecessary pain, and securing the healing of the bone in proper position.

(4) To keep muscles at rest in cases of fracture, and particularly where muscles tend by contraction to pull apart the ends of a broken bone—*e.g.*, transverse fracture of the patella (Fig. 85).

(5) To stop bleeding. A bandage may fulfil this purpose in three ways :—

(*a*) Where the bleeding is slight (as in small cuts) by being applied directly to a wound over a dressing or pad of lint.

(*b*) Where the bleeding is severe, by being applied tightly round a limb at some distance *above* the bleeding point—*i.e.*, nearer the heart, so as to compress the main artery of the limb against the bone, and so check all flow of blood to the part. It is then said to serve the purpose of a **"tourniquet"** or constricting band.

(*c*) By being applied immediately beneath a bleeding point—(*i.e.*, further from the heart) in cases of burst "varicose" or dilated veins, or of severed healthy veins.

Various forms of the triangular bandage are now in use in different ambulance centres. The original triangular bandage, one used for many years in the German army, is the figured bandage invented by Professor Esmarch of Kiel. It has a base of 50 to 54 inches, and

Fig. 35.—Figured bandage.

sides of 33 to 36 inches. On its surface are printed for reference figures illustrating the methods of application of the bandage to various forms of injury. This bandage may be procured from

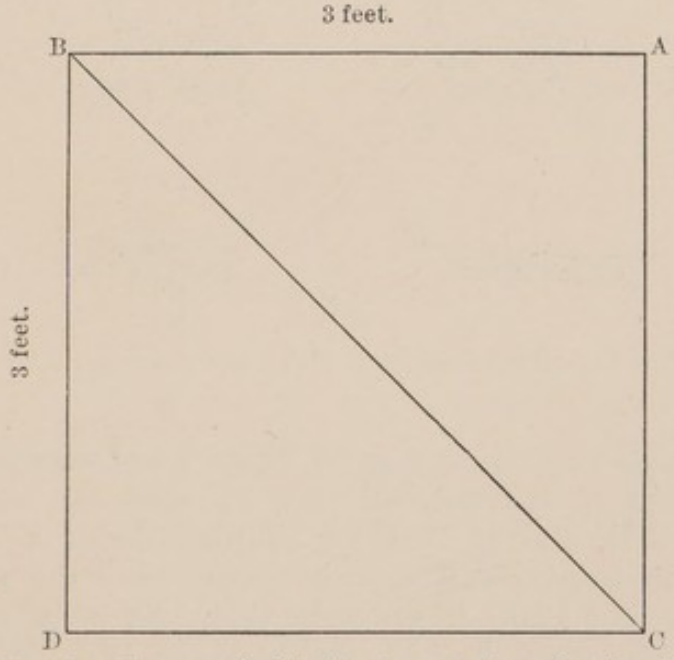


Fig. 36.—Square divided to form triangular bandages.

Messrs. Maw, Son & Thomson, Aldersgate Street, London. Bandages similar to Professor Esmarch's, but with a larger number of figures, are supplied to classes taught under the St. John Ambulance

Association, London, and may be had from the St. John Ambulance Association Stores. Sir George T. Beatson prepared a similar bandage for the St. Andrew's Ambulance Association, Glasgow. Esmarch's and the figured bandages are of special service in military surgery, to members of the police force, and in public works, where reference may have to be made at any moment by those unacquainted with ambulance methods to the proper first aid treatment of an injury. Fig. 35 shows a figured bandage made by Messrs. Evans & Wormull, London. In ambulance class practice, and in the treatment of ordinary domestic accidents, the " home-made " bandage is equally useful and much cheaper. It has also the advantage that it may be made, if necessary, from the clothing of the patient. Such a bandage is prepared by dividing into two triangles, from corner to corner, along one of its diagonals, a piece of calico or flannel 3 feet square (see Fig. 36). This is the adult size, and will be found to be too large for easy application to the juvenile model usually employed in ambulance classes. For such a purpose it is preferable to prepare two bandages by cutting a 2-feet square of calico in the way directed above. Such a bandage will be found to be more serviceable and capable of neater application.

KNOTS.—The triangular bandage should always be secured by a " reef " knot, which is much firmer than the so-called " granny "

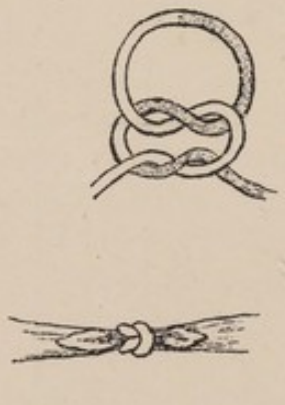


Fig. 37.—Reef knot.

Fig. 38.—Granny knot.

knot. It has also the advantage of being more easily unfastened. The reef knot is a symmetrical one, as may be seen from the diagram (Fig. 37), and is tied by running down a single hitch, the end then in front being kept in front while the second hitch is taken. The reef knot, if properly tied, will have the two free ends lying in the same line as the bandage (Fig. 37), while the " granny " knot may easily be recognised by the free ends standing after tying at right angles to the main line of the bandage (see Fig. 38). The " surgeon's knot " is firmer even than the reef ; and is tied exactly like it, save that a double turn is taken instead of a single before the second hitch is run down.

APPLICATION OF THE TRIANGULAR BANDAGE.—In describing the application of the triangular bandage to different parts of the body, it is necessary for the sake of clearness to designate its different parts by special names, and the most convenient are the geometrical terms—viz., the apex or point of the triangle A, the sides A B and A C, and the base B C (see Fig. 39).

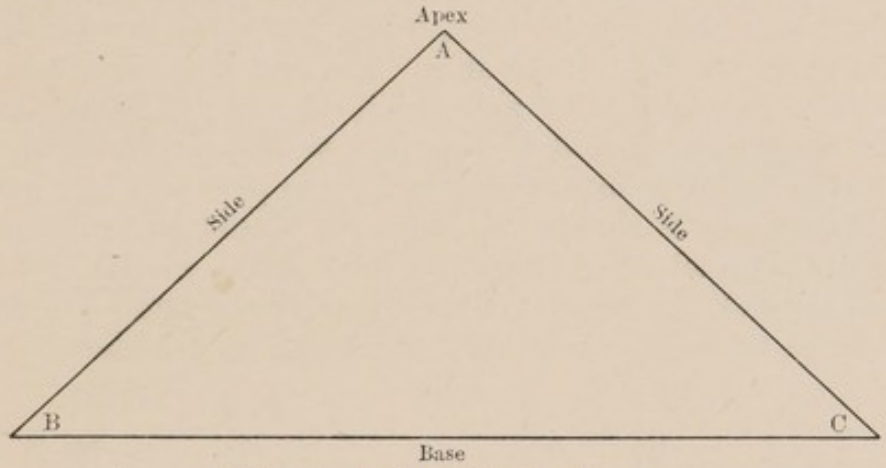


Fig. 39.—Triangular bandage.

The bandage has often to be applied in the form of a scarf or cravat, and may then be used in the form of either "broad cloth" or "narrow cloth." The triangular bandage is folded into "broad cloth" by bringing the apex A to the middle of the base B C, so that the bandage is folded first along the line 1 in Fig. 40, and then again upon itself along the line 2. The "narrow cloth" is prepared by doubling the "broad cloth" bandage upon itself—*i.e.*,

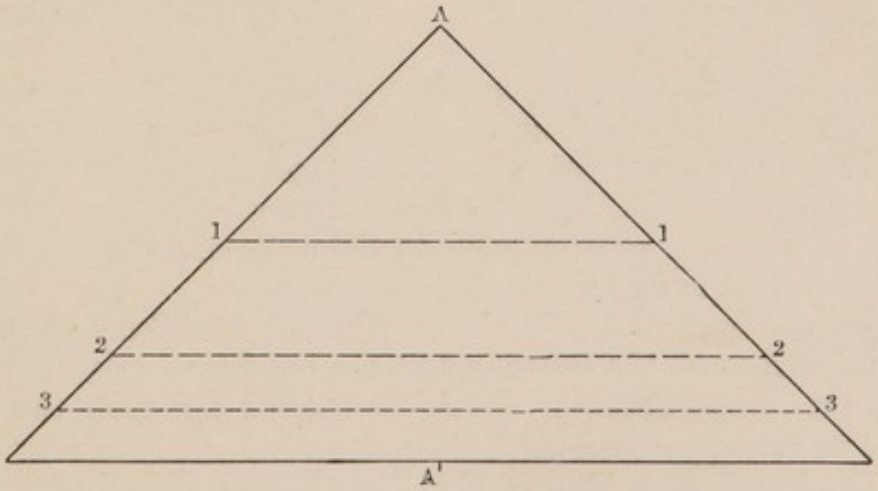


Fig. 40.—Method of folding "broad" and "narrow cloth" bandages.

"Narrow cloth." { 1. Bring A to A¹—*i.e.*, fold along line 1, 1. } "Broad cloth."
{ 2. Fold along line 2, 2.
{ 3. Fold along line 3, 3.

by folding it along the line 3 in Fig. 40. The "narrow cloth" bandage is, therefore, half the width of the "broad cloth." The

ends of the bandage should not be left hanging loose after tying, but should be neatly tucked away under the nearest fold.

The different methods of applying the triangular bandage are best dealt with in the following order :—

1. **The Large Arm Sling.**—The " large arm sling " or " broad sling," which is used in cases of fracture of the collar-bone or forearm bones, is applied by placing the hand with the little finger downwards in the middle of the base, while the apex lies between the arm and chest on the injured side. The end B is then taken over the shoulder on the injured side, while the end C crosses over the opposite shoulder ; B and C are then tied, not behind the neck, which might make it uncomfortable for the patient while lying, but over the apex of the shoulder. The ends should be tightened until it is seen that sufficient strain has been made on the bandage to take all weight off the muscles of the shoulder and arm. The bandage should be so arranged as to keep the hand on a higher level than

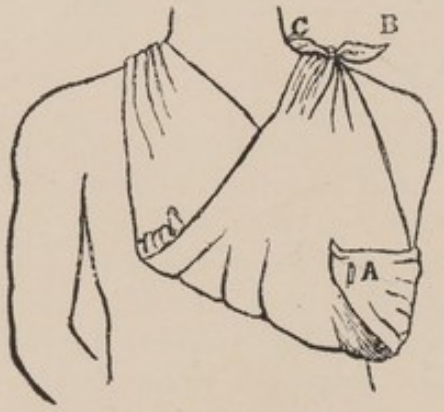


Fig. 41.—Large arm sling.

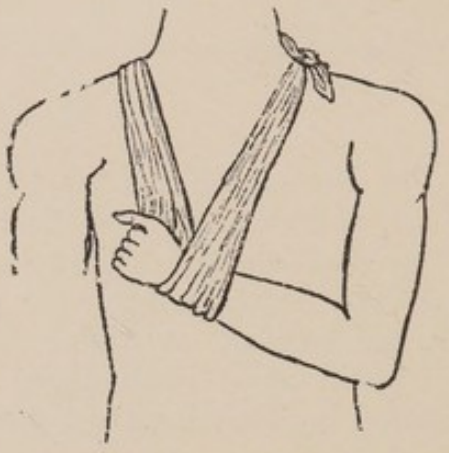


Fig. 42.—Small arm sling.

the elbow. The apex is then brought up over the front of the lower part of the arm, is pulled tight, and is pinned over the outer layer of the bandage to prevent the elbow from slipping out (Fig. 41). A safety pin is the best to use for this purpose, but where this cannot be got two ordinary pins inserted at right angles to each other will be found to be equally secure.

In cases of fractured collar-bone, where it is undesirable to press on the injured part, the lower end of the bandage, which is brought up in front of the forearm, should be carried up *under* the armpit and tied to the upper end behind the neck.

2. **The Small Arm Sling.**—The " small arm sling " or " narrow sling," which is used in cases of fracture of the upper arm, is applied in the form either of " broad cloth " or " narrow cloth," the former if the hand only is to be included, the latter if the arm is to be supported by the wrist. The wrist of the injured arm is placed in the middle of the bandage, the end C being taken over the shoulder of the injured side, the end B over the other. The bandage is knotted

off on one side of the neck, the ends being tucked away neatly (Fig. 42).

3. **The Eye Bandage.**—The triangular bandage in the form of narrow cloth is applied obliquely over the eye from above downwards, and if short is knotted off behind the head (Fig. 43), or if long is carried round the head again in the same line and knotted off in front over the forehead.

Fig. 43.—Eye bandage.

Fig. 44.—Bandage for jaw.

4. **The Lower Jaw Bandage.**—This is used in case of fracture to keep the lower jaw firmly fixed against the upper. The chin is placed in the middle of a "narrow fold" bandage, the ends of

Fig. 45.

Fig. 46.

Knotted Bandage for jaw or temporal artery.

which are carried up in a sloping direction over the top of the head, and tied well back to prevent the bandage from slipping forward (Fig. 44).

Another method of applying this bandage, which is useful also for checking bleeding from the artery of the temple, consists in applying a long "narrow fold" bandage as follows:—The chin resting in the middle of the bandage, the two ends of the bandage are carried up over the head in front of the ears, and are twisted on each other on one side, a little above the opening of the ear, if necessary over a pad placed on the temporal artery, the ends being then carried round the forehead and occiput, and knotted off over the temple. This is known as the "knotted bandage for the jaw or temporal artery" (Figs. 45 and 46).

5. **The Capeline or Scalp Bandage.**—This bandage, known also as the "shawl" bandage, is used to keep dressings or poultices on the scalp. The student standing behind the model places the bandage with the middle of the base at the root of the nose and close down on the eyebrows, the apex being left hanging loosely over the back of the neck. The ends of the base are then gathered tightly in the hand, and are carried along just above the ears, care

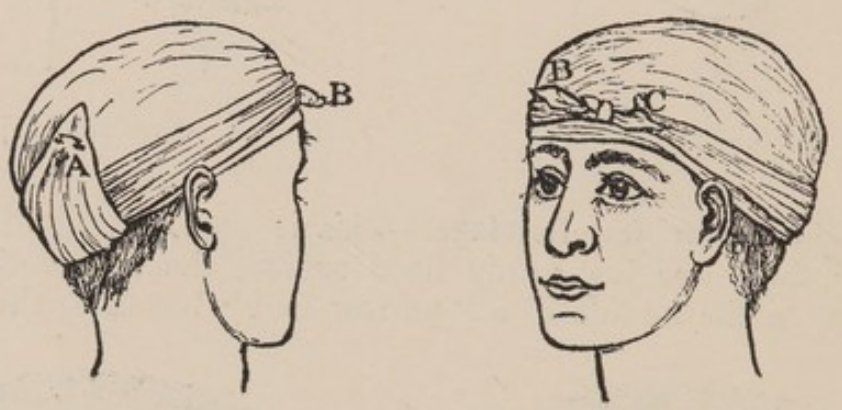


Fig. 47. Fig. 48.

Capeline bandage.

being taken that the base does not meanwhile slip up on the forehead. The ends are crossed over the apex behind the head, low down in a line continuous with the opening of the ear and below the prominence of the occipital bone, on which one has to rely for the prevention of the slipping upwards of the bandage. The crossed ends are brought forwards and upwards above the ears, and are firmly tied over the middle of the forehead (see Fig. 48), the redundant ends being neatly tucked away at the sides. The apex, kept in position by the crossed ends, is then turned up over the back of the head, and is there pinned (Fig. 47).

6. **The Chest Bandage.**—This is used to fix a dressing or to keep a poultice or fomentation in position. Standing behind the patient, place the apex A from before backwards over the shoulder of the side to be covered. Take the two ends of the base round the lower part of the chest and tie them close to the angle of the shoulder-blade on the same side as the apex crosses. This

leaves a long end, B, which is then tied to the apex A (see Fig. 50).

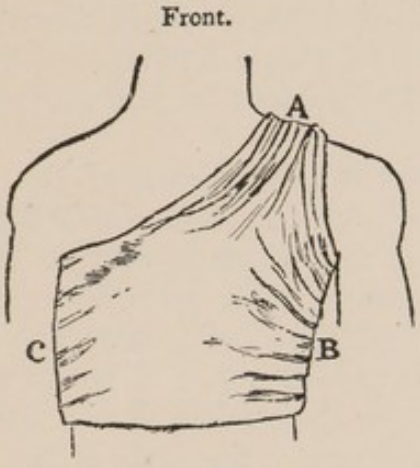


Fig. 49.

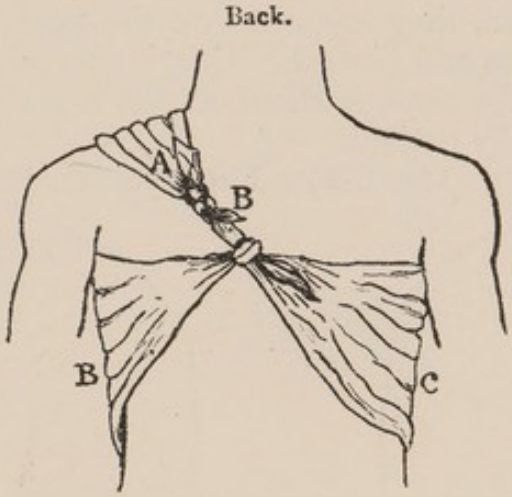


Fig. 50.

Chest bandage.

7. **The Back Bandage.**—This is applied in the same way as the last; the only points of difference are that the student stands in front of the patient, that the apex crosses the shoulder from behind forwards, and that the knots are in front.

8. **The Shoulder Bandage.**—The shoulder bandage is used to keep dressings or compresses on the shoulder, and requires for its proper application two triangular bandages, one of these serving as a fixation bandage. To secure neatness a hem of 3 to 6 inches of the base of the first bandage is turned in. The apex is carried upwards over the shoulder to lie against the neck. The middle of the new base, formed by turning in a hem as directed, now lies over the middle of the outside of the arm 4 or 5 inches below the shoulder joint. The ends are then carried round the arm in that line once or twice and tied. The apex is prevented from slipping downwards in either of two ways, first by applying a narrow fold bandage with its middle over the apex of the bandage first applied, its ends being passed over the chest and back, and tied under the opposite arm-pit. The apex is then doubled down over the fixation band and pinned (see Fig. 51). The second method consists in supporting the injured arm in a small arm sling, the apex of the shoulder bandage being fixed by the side of the sling crossing the injured shoulder and being turned down over it and pinned. It has also been proposed to cover the shoulder with one bandage by placing the apex over the

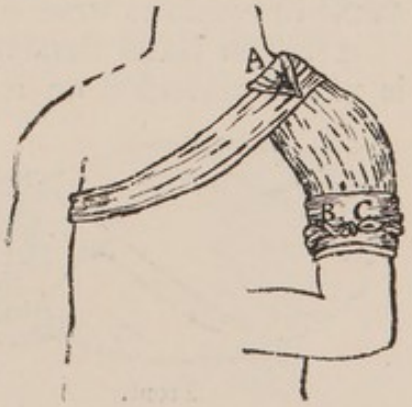


Fig. 51.—Shoulder bandage.

shoulder as described above, the ends B and C being carried round the arm once and then being brought up over the top of the shoulder where they are tied over the apex, which is then turned down over them and pinned. This, however, is not a secure bandage as, owing to the slope of the shoulder, it is readily displaced by any movement of the patient.

9. **The Elbow Bandage.**—A hem of 6 to 8 inches of the base is taken up to diminish the size of the bandage and so secure greater neatness in application. The elbow being bent, the apex is placed above it so as to lie over the middle of the back of the arm. The ends of the base being carried round the upper part of the forearm are crossed in front and pass upwards in figure-of-eight fashion over the lower part of the arm, round which they are tied over the apex, which is then turned down and pinned (see Figs. 52 and 53).

Fig. 52.

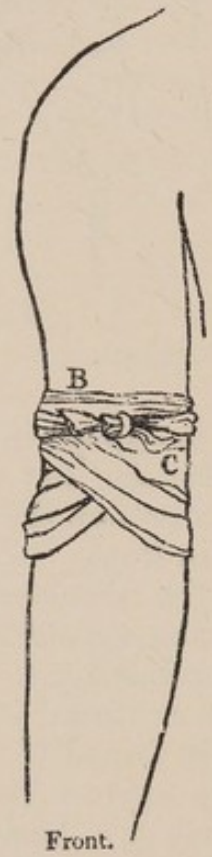
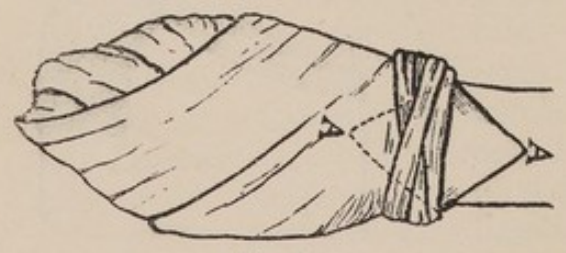


Fig. 53.

Elbow bandage.

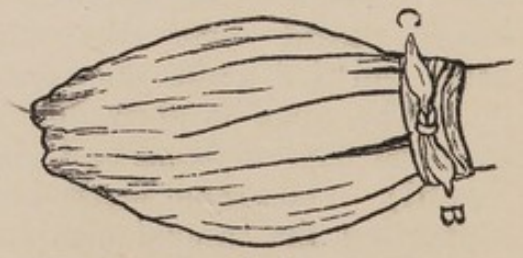
10. **The Palm Bandage.**—This may be used for keeping small dressings on the palm or back of the hand. A narrow fold bandage is placed with its middle over the palm. The two ends are passed round the sides of the hand, are crossed on its back, and are then carried round the wrist several times and tied.

11. **The Hand Bandage.**—To cover the whole hand the bandage is placed unfolded on a table with the base towards the patient,



Front.

Fig. 54.



Back.

Fig. 55.

Bandage for hand.

the operator standing by the patient's side. If the hand to be covered is a small one, a hem of 3 or 4 inches of the base of

the bandage may be turned in. The hand is then placed on the bandage, with the wrist on the middle of the base. The apex is carried up over the back of the hand to lie on the lower part of the forearm. The two ends are then carried neatly over the hand and round the wrist, which they encircle several times, and are then tied. The apex so fixed is then turned down over the tied ends and pinned (see Figs. 54 and 55).

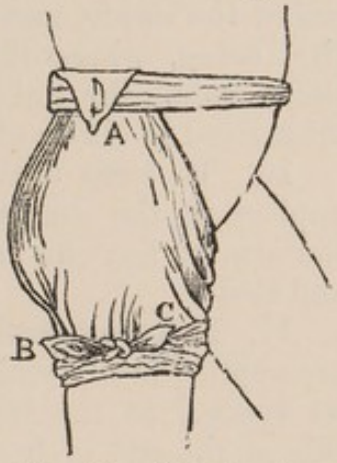


Fig. 56.—Hip bandage.

12. **The Hip Bandage.**—Two bandages are required. One of these in the form of "narrow cloth" is carried round the lower part of the abdomen as a belt or girdle, the ends being tied in front. The second bandage has its apex carried up over the outside of the hip under the "girdle," over which it is pinned. The base, with a 2- to 4-inch hem turned in, has its ends carried round the upper part of the thigh and knotted on the outside (see Fig. 56).

13. **The Knee Bandage.**—This is similar in principle to the elbow bandage (compare elbow bandage, Figs. 52 and 53). The bandage with a 4- to 6-inch hem rolled in has its apex placed over the front of the thigh about 6 inches above the knee-cap. The ends of the base are crossed on the calf of the leg, and are then carried in a figure-of-eight manner upwards over the lower part of the thigh, which they encircle. The ends are tied over the apex, which is then turned down over them and pinned.


Fig. 57.
Sole bandage.

14. **The Sole Bandage.**—This is used to keep dressings on the sole of the foot. A narrow cloth bandage is applied with its middle under the instep. Its two ends are crossed over the front of the ankle, carried round the joint, and tied (Fig. 57).

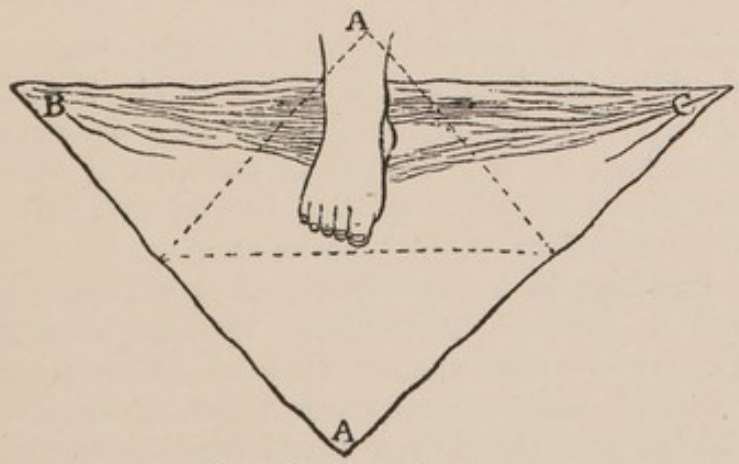


Fig. 58.—Foot bandage.

Fig. 59.—Foot bandage completed.

15. **The Foot Bandage.**—The foot is placed on the bandage with the heel a little in front of the middle of the base (see Fig. 58).

The apex is carried up over the front of the ankle. The two ends of the base are then crossed over the front of the instep, are carried round the ankle, and are then crossed under the sole to meet over the instep, where they are tied, or they may be carried several times round the ankle and there tied, as shown in Fig. 59. The apex fixed in either of these ways is turned down and pinned.

16. **To keep dressings on wounds,** a narrow fold bandage is applied in the manner most convenient. In ordinary wounds of the arm or leg, the bandage is wound several times round the limb and tied.

17. **To keep splints in position,** two or more narrow fold bandages are applied firmly embracing limb and splints. If only two bandages be applied to the fractured arm, one should be placed on either side of the site of fracture (see Fig. 60). A very handy and secure method of fixing splints by the triangular bandage is to double the narrow fold bandage on itself so that the end B meets the end C. Next carry the double bandage below the fractured limb and

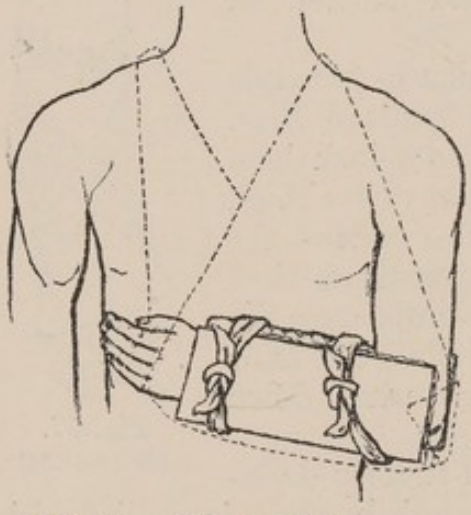


Fig. 60.—Fractured forearm in splints.

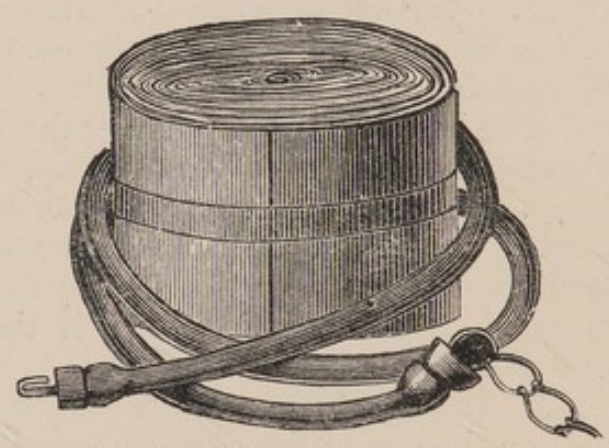


Fig. 61.—Esmarch's bandage and tourniquet.

over the splints. The end B is then carried through the loop formed by the middle of the doubled bandage, and is tied securely to the free end C. This method may also be employed to secure a dressing firmly, or to arrest hæmorrhage by a compressing pad placed over the bleeding point. The fixation of splints by the " looped triangular bandage " is frequently employed in military ambulance work.

18. **The Triangular Bandage as a Tourniquet.**—A tourniquet is an instrument employed to prevent hæmorrhage by compressing and occluding the main artery of a limb against the bone. Esmarch's tourniquet consists of a thick india-rubber cord, which is applied tightly round the limb, either next the skin or over a towel or flannel bandage (Fig. 61). An extemporised tourniquet may readily be made from a triangular bandage in the following way :—A narrow cloth bandage, which may be knotted in the centre if necessary,

or have a firm pad enclosed in its folds, is placed with the knot or pad over the main artery of the limb, the two ends being carried round and tied with a " reef " knot on the outside of the extremity, which they embrace loosely. As an alternative, the knotted ends of the bandage may be made to take the part of a compressing pad by being placed over the blood-vessel (see A, Fig. 62). Into the

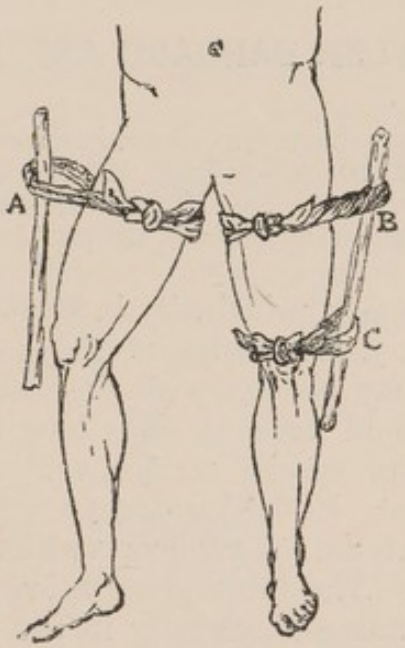


Fig. 62.—Triangular bandage as tourniquet. A, before twisting; B, after twisting; C, additional bandage for fixation.

loop made by the tied ends a rod is inserted. A walking stick, umbrella, ruler, or sword scabbard will serve the purpose admirably. The rod is then twisted round so as to shorten the bandage, which, after a few turns, is sufficiently tight to compress the artery against the bone, and so stop all circulation in the part (see B, Fig. 62). Unwinding of the tourniquet may be prevented by fixing the rod firmly to the limb by a second narrow cloth bandage (see C, Fig. 62).

CHAPTER III.

THE ROLLER BANDAGE AND ITS USES.

MATERIALS—LENGTH AND BREADTH—SIMPLE SPIRAL—REVERSED SPIRAL—FIGURE-OF-EIGHT BANDAGE—FINGER BANDAGE—CAPELINE BANDAGE—SPICA OF SHOULDER—SPICA OF GROIN—SPICA OF BREAST—SPICA OF THUMB—FOUR-TAILED BANDAGE FOR BROKEN LOWER JAW.

ROLLER bandages are used principally in Hospital work and Surgical practice, and though a knowledge of the methods of their application is not absolutely necessary to the ambulance student, it is advisable that he should have an idea how to apply this bandage to parts where it is of special service, and is to be preferred to the triangular bandage. Roller bandages are strips of calico, flannel, or other suitable material of various widths tightly rolled up to facilitate application. The table given below indicates the lengths and widths of the bandages generally in use for application to the fingers, arm, leg, and trunk.

LENGTH AND BREADTH OF BANDAGE.

	Length.	Breadth.
Fingers, . .	1½ yards.	¾ inch.
Arm, . . .	6 ,,	2-2½ inches.
Leg, . . .	8 ,,	3 ,,
Body, . .	10 ,,	6 ,,

In bandaging with the roller bandage the operator generally stands facing the patient holding the roller in his right hand. In applying the roller bandage to a limb, half a foot of the bandage is unrolled, and the free end is then placed on the inner side of the front of the arm or leg. The bandage is then firmly applied round the extremity in either of the following methods :—

1. Simple spiral.
2. Reversed bandage.
3. The figure-of-eight bandage.

1. **The Simple Spiral.**—The roller bandage may be applied over a part that is not increasing rapidly in diameter—*e.g.*, the upper

arm—in the form of the "simple spiral," where the bandage is simply rolled round the arm, each layer leaving the former uncovered by about half its breadth (see Fig. 63). Where, however, the limb is increasing rapidly in diameter—*e.g.*, in the calf of the leg and in crossing a joint—the "simple spiral" bandage gapes and puckers, and will not lie neatly. It is then desirable that the bandage should be applied either in the form of the "reversed" or the "figure-of-eight" bandage.

2. **The Reversed Bandage.**—This bandage, which is firmer than either the "simple spiral" or the "figure-of-eight," and is, therefore, to be preferred in the application of splints to a fractured limb, is applied as follows:—The bandage is fixed at the lower part of the extremity in the method detailed in the description of the simple spiral. Two or three turns of the simple spiral are

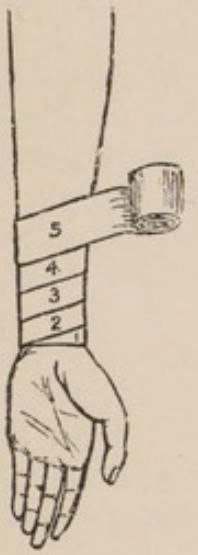


Fig. 63. Simple spiral.

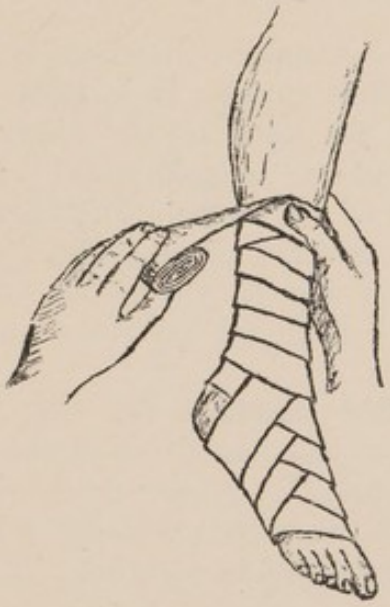


Fig. 64.—Reversed bandage.

Fig. 65.—Figure-of-eight bandage.

taken up the extremity till it is seen that the bandage will no longer lie neatly. The operator then fixes the upper part of the next layer with the thumb of his right hand on the front of the leg, and produces a "reverse" by doubling the bandage on itself in the method shown in Fig. 64. The roller is then carried round behind the limb and is pulled tight. The next layer leaves the last uncovered by about half its breadth, and, fixed by the thumb as before, is reversed in the same line as the last. The reverses should all lie on the outside of the limb. This bandage, however, is more difficult to apply neatly than the others.

3. **Figure-of-Eight Bandage.**—This bandage, which is one of the most useful for the ambulance student to learn, is applied as follows:—The bandage is fixed to the lower part of the limb by one or two "simple spiral" turns. Turns are then taken successively as shown

in Fig. 65. The first half-turn ascends on the outside of the limb, the second descends on the inside, overlapping the first, the third ascending parallel to the first, but leaving it uncovered by half its breadth, the fourth descending parallel to the second but leaving it also uncovered by half its breadth, and so on till the part is completely covered. To apply this bandage neatly, the edges of the layers of bandage should be parallel, and each layer should be overlapped by the same amount. The roller bandage may be secured by splitting the free end and tying round the limb. Safety-pins may be employed, or what is equally serviceable, two ordinary pins inserted at right angles to one another.

SPECIAL METHODS OF APPLYING THE ROLLER BANDAGE.

1. **The Finger Bandage.**—A narrow bandage is fixed round the wrist by one or two encircling turns. It is then carried up over the back of the hand to the finger to be covered, and is wound in "simple spiral" fashion up close to the point of the finger. The finger is then neatly and firmly covered in by the "figure-of-eight" method from tip to root, the end of the roller being carried back to the wrist and secured there (see Fig. 66).

Fig. 66.
Finger bandage.

2. **Capeline Bandage for the Head.**—For the application of this bandage a double-headed roller is required. This, if a proper double-headed roller be not at hand, may be made by taking two rollers and pinning or sewing their free ends together. The part between

Fig. 67.

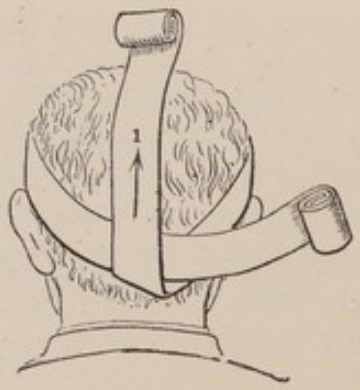


Fig. 68.

Fig. 69.—Capeline bandage completed.

Capeline bandage for the head.

the rollers is then applied to the middle of the forehead, and the rollers are carried round the forehead and temple to the back of the

head (Fig. 68). The roller, held in the left hand of the operator, encircles the head continuously on this line, and fixes the antero-posterior layer alternately at front and back. The roller, held in the right hand, is carried backwards and forwards over the head from forehead to occiput until the whole of the head has been covered (Fig. 67). The first of the antero-posterior layers should lie along the middle of the head; the second should be carried to the right side of the first, the third to the left side of the first, the fourth to the right side of the second, the fifth to the left side of the third, and so on. The completed bandage is shown in Fig. 69.

3. **Spica of the Shoulder.**—The spica of the shoulder is applied by fixing the bandage by one or two turns to the upper part of the arm close up to the arm-pit. The roller is then covered over the highest part of the shoulder round the back and under the opposite arm. It then crosses the chest and front of the arm, and is passed

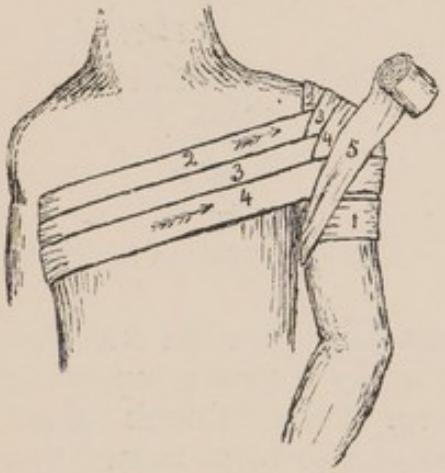


Fig. 70.—Spica of the shoulder.

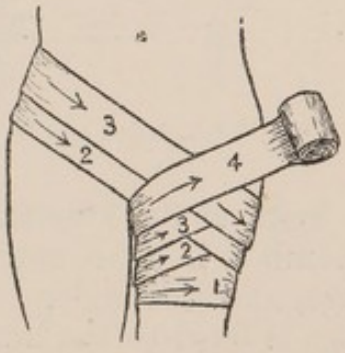


Fig. 71.—Spica of the groin.

under the arm-pit and carried up over the shoulder again, but this time on a level lower than the last, so that the shoulder is gradually covered in from above downwards by the turns of the bandage (Fig. 70).

4. **Spica of the Groin.**—The groin is covered in from below upwards in the following way:—The bandage is fixed to the upper part of the thigh by one or two simple spiral turns. The roller is then carried from within outwards over the front of the thigh and up round the hip and back, and passing over the prominence of the haunch bone on the opposite side, is carried from above downwards in a sloping direction so as to cross the thigh turn just made. The bandage is then passed round behind the thigh, and is carried up from within outwards parallel to the last layer, but higher by about half the breadth of the bandage, and so on. The hip is in this way gradually covered by layers of bandage from below upwards (see Fig. 71).

5. **Spica of the Breast.**—A breast spica or "suspensory" bandage for the breast is applied by first fixing the bandage round the chest

below the breast by one or two turns. From this point of fixation the bandage is then carried under the affected breast and over the opposite shoulder, whence it is carried down the back and round the chest. The third turn of the bandage passes round the chest, but this time on a level slightly higher than the first turn. The fourth turn passes under the breast and over the opposite shoulder, but this time on a slightly higher level than the second (see Fig. 72). The breast is thus supported by turns of bandage passing over the opposite shoulder and secured in place by turns encircling the chest.

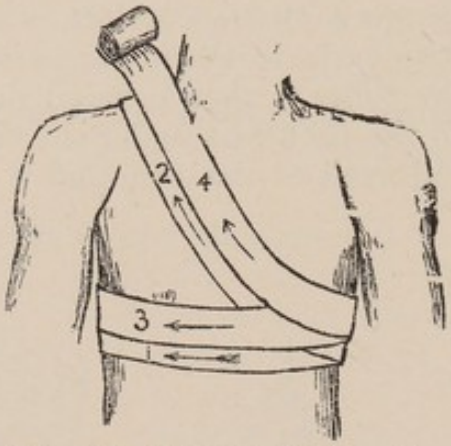


Fig. 72.—Spica of the breast.

Fig. 73.—Spica of the thumb.

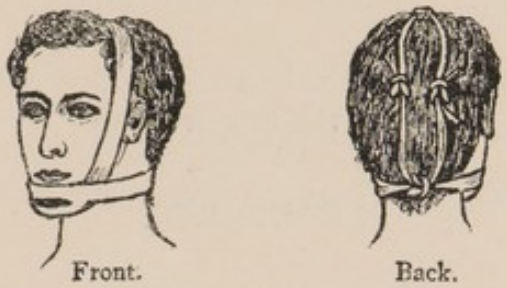
6. **Spica of the Thumb.**—In cases of dislocation and wounds of the thumb it is often necessary to apply a firm compressing roller bandage, and this is done in the form of the "thumb spica." The bandage is fixed to the limb by one or two turns passed round the wrist from within outwards. The roller is then carried up over the back and outer part of the thumb, and forms a loop close up to the nail. It is then passed over the back of the hand, round the front of the wrist, and up again over the back of the thumb to form a second loop, the second loop being nearer the wrist than the last, and leaving the last layer uncovered by about half its width. The ball of the thumb is thus covered in from the point downwards by succeeding layers of bandage (see Fig. 73).

7. **The Four-tailed Bandage for Broken Lower Jaw.**—This bandage is particularly useful in the treatment of broken jaw. A narrow roller bandage is cut in the fashion shown in Fig. 74.

Fig. 74.—Four-tailed bandage.

The chin is placed in the middle of the bandage. The two lower ends of the bandage are then taken up over the top of the head and tied. The two upper ends are carried round the chin over the lower

ends to the back of the head, where they are tied, and the four ends are then tied together as shown in Fig. 75.



Front. Back.

Fig. 75.—Four-tailed bandage applied to the jaw.

CHAPTER IV.

FRACTURES.

DEFINITION—CAUSATION—KINDS—SIGNS AND SYMPTOMS OF FRACTURE—HEALING OF FRACTURES—TREATMENT OF FRACTURES—EMERGENCY DRESSINGS FOR COMPOUND FRACTURES—SPLINTS—FRACTURES OF COLLAR BONE, ARM, FOREARM, WRIST, HAND, PELVIS, THIGH, KNEE, LEG, ANKLE, FOOT, RIBS, LOWER JAW, SPINE, SKULL.

To the ambulance student the subject to be dealt with in this chapter is a most important one. Before "first aid" methods can be applied with certainty and success in fracture cases, it is necessary to have a thorough knowledge of the general appearance and shape of the bones. It is desirable that these should be specially studied in the skeleton. It is also a matter of importance for the student to master thoroughly the points of distinction between the different forms of fracture and the signs and symptoms by which one can recognise that a bone has been broken. All that is aimed at in this chapter is to give the reader sufficient instruction to enable him to render "first aid" in cases of accident where a surgeon cannot be readily procured to attend to the injury.

In fractures, as in all other injuries hereafter dealt with, it is understood that a medical man should be sent for at once.

Fracture (Latin, *frangere*, to break) is the name given to the breaking of a bone, whether complete or partial. The injury is generally a severe one, and is easily recognised by the deformity produced: but it should be noted that in some bones, and especially the bones of the skull, there may be very slight or no displacement. Small fragments of bone may be torn off when a bone is "grazed" by a bullet. The bone may, when struck by a hard nickel bullet, be perforated without being broken across; but if struck by a soft leaden bullet, it is usually splintered or smashed into bony *débris*.

CAUSATION OF FRACTURES.—Fractures are caused mainly in three ways.

1. **Fracture by Direct Violence,** where the force is applied directly to the bone, as in the case of a thigh bone broken by a heavy weight falling upon it.

2. **Fracture by Indirect Violence,** where the bone is broken by a force not applied directly to the part that yields—*e.g.*, when the neck of the thigh bone is broken by a sudden blow on the heel and

not by a force directly applied to it at the hip, but transmitted along the leg bones by a sudden jerky fall on the foot, as in the case of a sudden step from a tramway car to the street.

3. **Fracture by Tearing off,** where a part of a bone is torn off by a sudden or violent contraction of a strong muscle—*e.g.*, in transverse fracture of the knee-cap (patella), (skiagram, Fig. 85), or by a sudden strain thrown on a strong ligament—*e.g.*, in tearing off of the tip of the brooch bone (fibula) by a forcible twisting inwards of the foot.

KINDS OF FRACTURES.—There are two great classes of fractures—

1. Simple fracture.
2. Compound fracture.

It is of importance to distinguish between these, as compound fractures are much more serious than simple fractures, and require extra care in "first aid" and subsequent treatment.

Simple fracture is where a bone has been broken transversely or obliquely across, and where there is no skin wound leading down to the seat of fracture (see Fig. 76).

Fig. 76.—Fracture of humerus.

Compound fracture is where, from extra violence or from rough handling of a simple fracture, one of the broken ends of the bone has been forced through the flesh and skin, thus leaving a tunnel wound communicating with the air, through which foreign materials may reach the broken ends of the bone. Such contamination of the wound is likely to cause blood-poisoning, and forms an additional and very great source of danger to the patient. The danger of severe bleeding is also to be noted in connection with compound fractures, as the broken ends of the bone may tear large blood-vessels. In rendering "first aid" in the case of a "compound fracture," it is, therefore, of importance to secure the purification of the wound by washing, and to prevent the entrance of poisonous matter to the wound by proper dressings. It should be remembered that a simple fracture may readily be converted into a compound one by clumsy or rough handling. This is particularly the case when the broken bone has a sharp edge under the skin unprotected by soft parts as in the shin.

Where, from the nature of the injury (*e.g.*, in crushing by machinery), the bone at the site of fracture has been very much splintered or broken into small fragments, the fracture is said to

be a **comminuted** one. A **complicated** fracture is where, in addition to the break, important structures in the vicinity have been injured —*e.g.*, when the main vessels of the limb are injured, or where the broken bone penetrates an important organ, as in fractured pelvis, where the bladder is ruptured, or where the brain or lung is lacerated by a broken parietal bone or rib respectively. A fracture is called **impacted** when the bone is broken and one fragment is driven into and firmly fixed in the other. This is not uncommon in cases of fracture of the neck of the thigh bone produced by direct violence. In children, and specially in "ricketty" children, the bones, being composed mainly of cartilage or gristle, tend to bend rather than break. The condition produced is very similar to that of a bent green bough or twig, and is known as a **"green stick"** fracture. In old or debilitated persons, or where the bones are diseased, a bone may break suddenly without violence being applied. This is known as a **spontaneous** fracture. Fractures, according to their appearance, are described as transverse, oblique, spiral, and T-shaped.

SIGNS AND SYMPTOMS OF FRACTURE.

The **symptoms** are :—

1. *Pain*, which is of a peculiar lancinating character, and is generally referred exactly to the site of injury.

2. *Inability to use the part.*—This is generally the first symptom that attracts attention.

The **signs** are :—

(1) *Swelling* and a bluish discolouration from bruising of the part, and effusion of blood.

(2) *Deformity*, or an unusual shape of the part. In a fracture of the shin bone for instance, there is an unusual curve between the knee and the ankle.

(3) *Unnatural mobility—i.e.*, the bone can be moved at a part where it should be quite fixed. In the case of a broken thigh bone there is a sort of "false joint" between the hip and the knee—*i.e.*, there is movement at a part where it does not exist naturally. This is one of the chief signs of fracture.

(4) *Crepitus or grating.*—When the two ends of a broken bone are rubbed gently together, a grating sensation is conveyed to the hand holding the limb, and in some cases a grating noise may be heard. This sign, however, should not be sought after except in cases of doubtful fracture, and then only by skilled and gentle hands. It is a sign absolutely diagnostic of fracture. The existence of a fracture is usually verified by a skiagram or X-ray photograph (see Figs. 80 to 87).

Healing of Fractures.—A broken bone heals by blood being shed out between and around its broken ends. By the reaction set up

at the site of fracture, and by the organisation of the blood clot into fibrous tissue, there is formed round and between the broken ends a ferule of strong connective tissue. As time goes on lime salts are deposited in this tissue, which becomes converted into bone. The broken bone becomes, after a time, as firm and strong as before the accident. Deposition of lime in the fibrous ferule takes a variable period for its completion, principally depending on the size of the bone and on the extent of the injury. In a weak or aged person the process of healing is slower. Roughly speaking, the time required for the healing of the various bones is as follows :—

Bone of finger (phalanx), two weeks.
Bone of palm (metacarpal), two weeks.
Bone of instep (metatarsal), two weeks.
Rib, three weeks.
Collar-bone, four weeks.
Forearm bones, five weeks.
Arm bone (humerus), six weeks
Leg bones, seven weeks.
Thigh bone, ten to twelve weeks.

These points with regard to the healing of bones are here detailed for purposes of reference, and more as a matter of interest to the ambulance student than as a necessary part of his knowledge.

TREATMENT OF FRACTURES.

(A) Compound Fractures.

Where the fracture is compound, in addition to the treatment to be detailed below under simple fractures, one must arrest hæmorrhage, and see to the purification of the wound and the prevention of septic matter from entering and causing blood-poisoning. This is secured by washing the wound well at the time of injury with water, and preferably with warm water which has been boiled and allowed to cool down. It is an additional safeguard if an antiseptic or disinfectant substance be added to the water to destroy the poison already introduced into the wound. The best are carbolic acid (a teaspoonful to the half-pint of water), tincture of iodine, and Condy's fluid diluted with an equal bulk of water. The "emergency" disinfectant, which is most serviceable, and which is usually at hand, is "alcohol," which may be used in the form of a lotion of pure whisky, or whisky diluted with water. Brandy, gin, or methylated spirits may also be used. Other handy disinfectants are turpentine, vinegar, oil of cloves, and a strong solution of common salt. A dressing has next to be prepared for the wound. The best dressing is a piece of lint or handkerchief which has been boiled or soused in tincture of iodine, turpentine, methylated spirits, or

whisky. After a careful washing of the fractured wound, the dressing is fixed by a triangular bandage, a layer of cotton wadding or a pad of lint or linen being placed between the dressing and the bandage. The pressure of the dressing is usually sufficient to stop the bleeding. The after treatment is exactly the same as in a simple fracture, the limb being " set " and " put up " in splints, as described below.

Different forms of emergency dressings for compound fracture are in use. Emeritus-Professor Sir Alexander Ogston prepared, some years ago, a modification of von Lesser's emergency army dressing, in which in small space are to be found an antiseptic dusting powder (iodoform), a pad of wool, bandages, safety-pins, etc., with printed directions for application. This compact little packet can be carried about easily, and nothing better could be desired for an " emergency " dressing in a case of compound fracture. The policemen of Aberdeen were provided each with a similar packet, which was prepared for them under the direction of the late Dr. Macgregor and myself, after our lectures to the Force, delivered under the auspices of the Aberdeen Ambulance Association. The packet consists of a waterproof envelope, on which are printed the contents and the method of their use. The packet is a flat one, and is easily carried in the pocket of the constable's tunic. It contains a triangular bandage with safety-pins, boracic lint (to be used either as a mop for washing wounds or as a dressing), adhesive plaster, and a small flat tin box filled with iodoform ointment, and secured with an elastic band, which is itself utilised in fixing the tongue during " artificial respiration." This emergency packet has frequently been employed by Aberdeen policemen, and has proved of special service in several cases of severe burns treated by them.

(B) **Simple Fracture.**

General Treatment.—Certain general rules can be laid down which are applicable to the treatment of all fractures. The general method of treating a fracture is to bring the broken ends of bone back into proper relative position. This is known as **setting** the bone. The method consists in pulling gently on the two broken ends until all overriding has been done away with. This, however, should not be attempted by the " first aid " student. Skilled treatment is desirable, and all the student should do is to bring the bones into proper alignment, and into the easiest possible position for the patient. When the part has been brought back to its natural shape and condition as nearly as possible, it has next to be kept fixed in that position by external supports or splints. This is known as **putting up.** Splints are applied to either side of a broken bone, or sometimes all round it, thus acting like a ferule, and are maintained in position by two triangular bandages, fixed one above, the other below, the site of fracture. Additional bandages may

be employed above and below to fix the limb more thoroughly, and so prevent any chance of movement at the seat of fracture. All splints should be well padded by cotton wool, silk handkerchiefs, or other soft material; if necessity demand, grass, hay, straw, or sand may be used for padding. It is generally advisable in fractures of the limbs not to remove the clothing. If it is necessary, for the purpose of deciding whether the bone has been broken, to examine the part minutely, the clothing should not be pulled off, but be cut along the seams with a pair of scissors. The less movement and handling the fractured part has before the application of splints the better.

Splints are ordinarily made of wood, and vary in length, breadth, and shape, according to the bone that is fractured. Surgeons generally employ pine-wood, pasteboard, or poroplastic splints, or encase

Fig. 77.—Duncan's rattan cane splints.

the part in plaster of Paris bandages. Gooch's army splinting, which consists of strips of lath backed with wash leather, is also

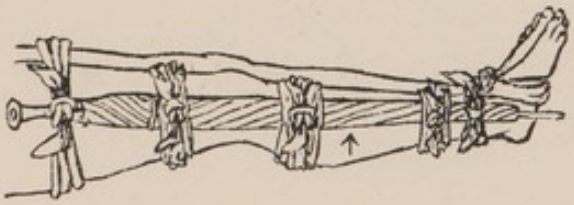


Fig. 78.—Fractured leg splinted with umbrella and other leg. Arrow marks site of fracture.

very serviceable. Army splints are frequently made of wire, and have the advantage of being light and durable, and not too warm for the patient. Rattan cane splints are also frequently employed, and are advantageous from their lightness and flexibility (Fig. 77). Emergency splints may be easily improvised from materials at hand, as, for example, folded newspapers or periodicals, sword scabbards, straw bottle-covers, ornamental flower-pot covers of wicker-work, packing post paper, stockings stuffed with straw or sand, bark from a tree, twigs rolled in cloth, umbrellas (see Fig. 78), walking sticks, and for the thigh, guns and rifles, billiard cues, skirting boards from walls, etc. One may also utilise one part of the body as a splint for another—*e.g.*, one leg as a splint for the other, the upper jaw as a splint for a broken lower jaw, or the sides of the chest as a means of support for a broken upper arm. Fig. 79 shows Messrs. Evans & Wormull's field fracture box, which contains all the neces-

saries for the treatment of the different fractures. Wooden, wire, jointed long splints, and plaster of Paris bandages for application in fracture cases, are arranged so as to be packed in small compass

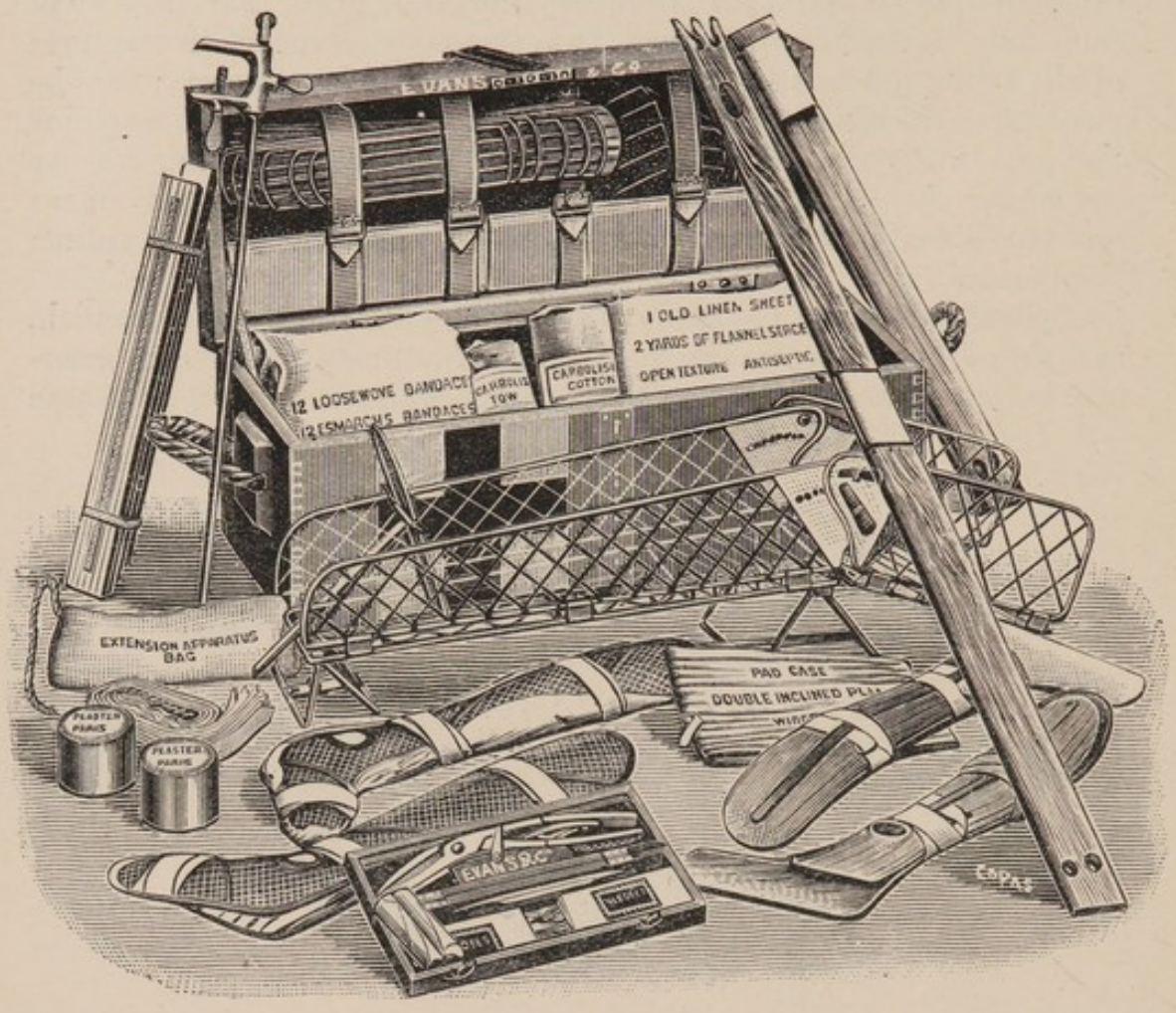


Fig. 79.—Field fracture box (weight about 52 lbs.), containing two jointed thigh splints, wood; one set leg splints, right and left, wire; one set leg splints, right and left, wood; half-set Pott's splints, wood; one set Pott's splints, wire; six pasteboard splints; one radius splint, wire; one double inclined plain, wire; 1 lb. plaster of Paris, in ½-lb. tins; ½ lb. cotton wool, antiseptic; ½ lb. tow, carbolised; 2 yards flannel serge of open texture, antiseptic; 2 yards guttapercha tissue; twelve loosewove bandages; twelve triangular bandages, plain; twelve straps with buckles; one old linen sheet; one counter extension apparatus; one set gypsum bandage instruments in case.

and easily carried. The weight of the field fracture box is only 52 lbs.

SYMPTOMS, SIGNS, AND TREATMENT OF SPECIAL FRACTURES.

1. **Fracture of the Clavicle or Collar-Bone.**—The collar-bone is generally broken at the junction of its inner and middle thirds by a heavy fall or blow on the shoulder (skiagram, Fig. 80).

To face p. 53 (1)]

Skiagram (Fig. 80).—Fracture of left collar-bone.

Skiagram (Fig. 81).—Fracture of lower end of humerus.

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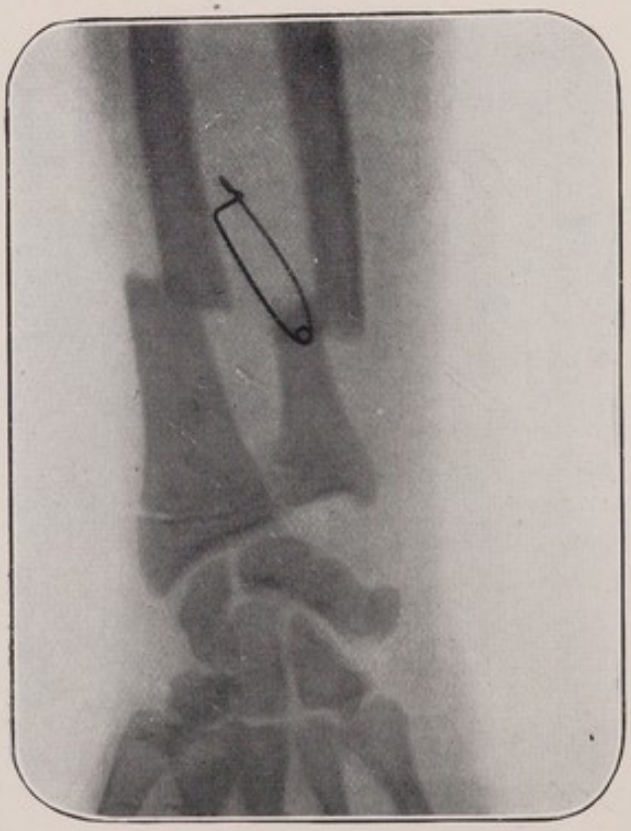
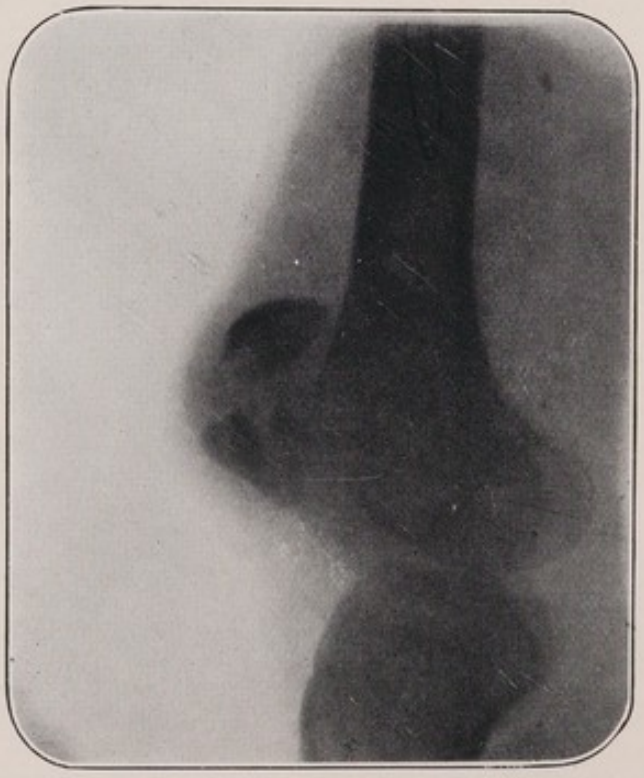
Skiagram (Fig. 82).—Fracture of middle of shaft of humerus.

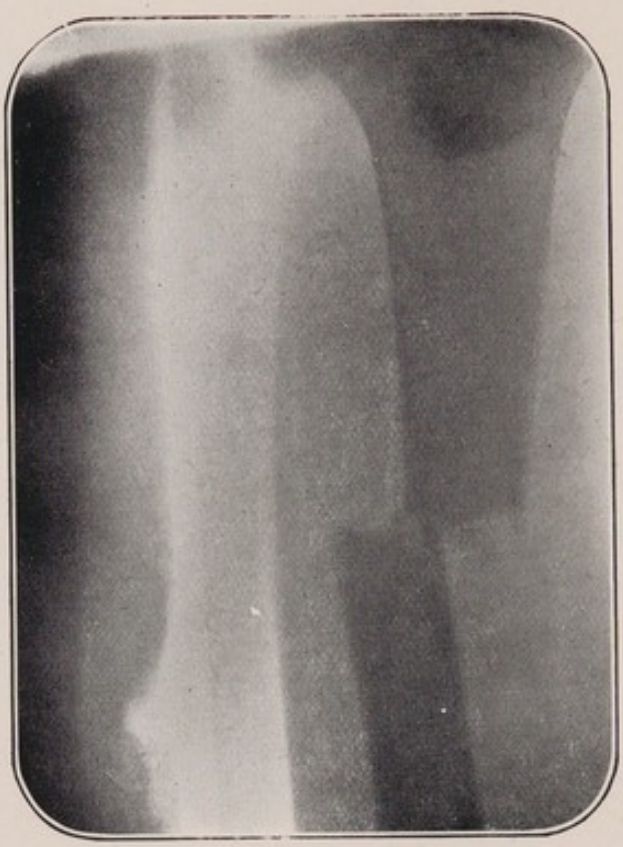


Skiagram (Fig. 83).—Fracture of both bones of forearm in young patient (showing lower epiphyses of radius and ulna, and safety-pin which fixed bandage).

Skiagram (Fig. 84).—Fracture of olecranon process of ulna



Skiagram (Fig. 85).—Fracture of patella.



Skiagram (Fig. 86).—Fracture of shaft of tibia.

Skiagram (Fig. 87).—Fracture of neck of thigh bone

Symptoms.—There are the ordinary signs of fracture as detailed on p. 48. The patient is generally found supporting the elbow of the injured arm with his hand, as shown in Fig. 88.

Treatment.—Three triangular bandages are required.

(1) Fold up a triangular bandage into a neat pad and place it in the arm-pit, so as to force outwards the outer fragment of the broken bone.

(2) Apply a second bandage as a large arm sling. Pull on the ends of the bandage until the weight of the injured arm is taken off the shoulder, and until the arm is sufficiently raised to bring the two ends of the broken collar-bone into proper position, and to remedy the deformity.

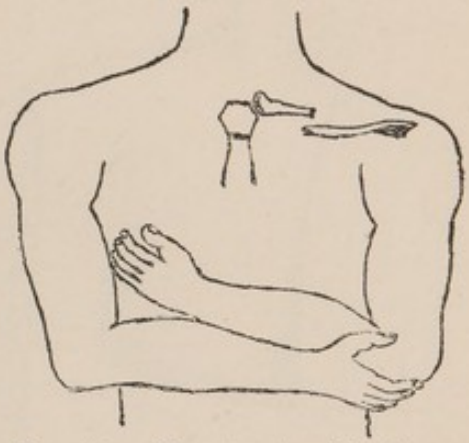


Fig. 88.—Fractured collar-bone.

It is generally recommended that the lower end of the bandage be taken under the arm-pit instead of over the tender spot at the point of fracture (see chapter on "Bandaging").

(3) Take a triangular bandage folded as "narrow cloth," place its middle over the elbow of the injured arm outside the sling, and carry its ends round the chest to fix the arm firmly against the side, and so with the leverage of the pad in the arm-pit to force the outer fragment outwards. This brings the two ends of the broken bone into proper position (see Fig. 89), and prevents over-riding at the site of fracture.

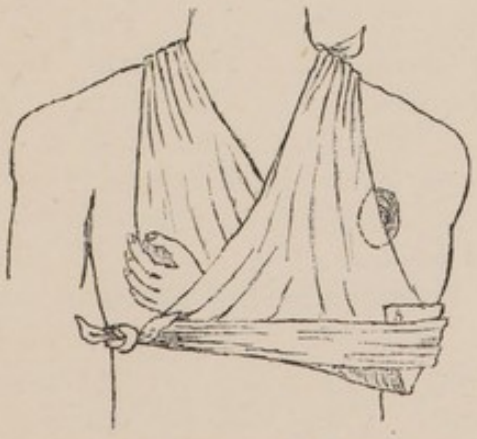


Fig. 89.—Fractured collar-bone treated with bandages and arm-pit pad.

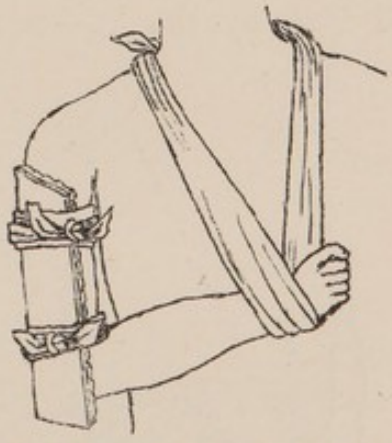


Fig. 90.—Method of treating fractured arm.

2. Fracture of the Arm (skiagram, Figs. 81 and 82).—*Symptoms.*—The ordinary signs and symptoms of fracture.

Treatment.—The "first aid" treatment consists in applying either four or five narrow splints surrounding the limb, or better, two broad firm splints applied, one on the inside, the other on the outside of the arm. Extemporised splints in the form of folded

newspapers, magazines, straw bottle covers, or ornamental flower-pot covers may be employed (see Fig. 92).

If wooden splints be employed, they should be padded if placed next to the skin, and unpadded if applied over the clothes. The

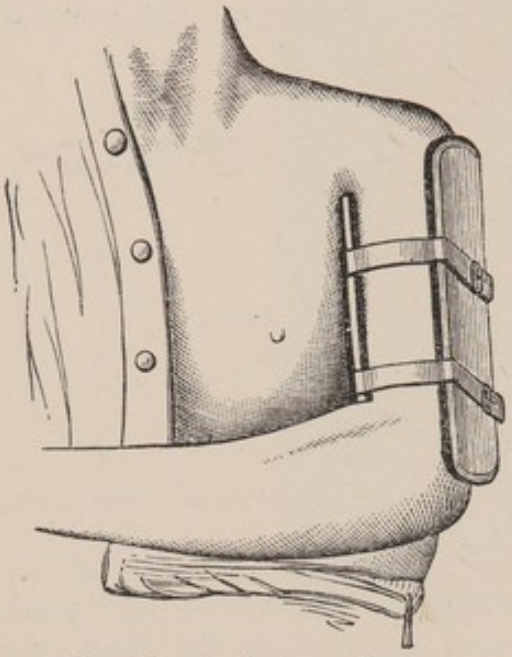


Fig. 91.—Splints applied to fractured arm.

Fig. 92.—Fracture of humerus. Flower-pot ornament as splint, secured with triangular bandage.

splints should be fixed by two "narrow fold" triangular bandages applied tightly, one on each side of the fracture (Figs. 90 and 91), and best by the "looped triangular bandage" (see chapter on "Bandaging"). The arm should be supported by a *narrow* arm sling. The large arm sling if used tends to force the lower part of the bone upwards, and cause over-riding of the broken ends.

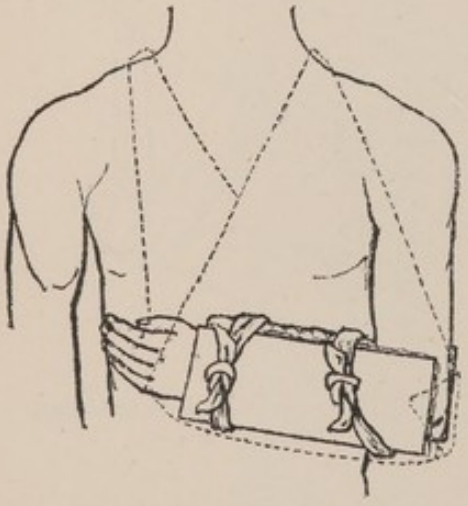


Fig. 93.—Fractured forearm in splints.

3. Fracture of the Forearm (skiagram, Fig. 83)—*Symptoms.*—The ordinary signs and symptoms of fracture. Pain will be elicited on pressing the two forearm bones gently together.

Treatment.—The treatment is the same, whether the fracture be of both bones of the forearm or of one only. Splints are applied on the front and back of the forearm, the arm being semi-supinated—*i.e.*, turned with the thumb upwards (see Fig. 93). The splints must be padded if placed next the skin, and are fixed by triangular bandages applied

firmly on either side of the fracture. The arm is then supported in a large arm sling.

The olecranon process or upper end of the ulna may be fractured by a fall on the elbow. There is much swelling and extravasation of blood, and a gap can be felt as the upper end is pulled up by the powerful triceps muscle (skiagram, Fig. 84). The forearm should be placed in a line with the upper arm, and a long anterior splint applied from the arm-pit to the fingers.

4. Fracture at the Wrist.—A fracture at the wrist is not an uncommon result of a fall, the arm being outstretched to break the fall, and the patient striking the ground first with the palm of the hand. It is generally the lower end of the radius that is broken.

Symptoms.—Those of an ordinary fracture, and the hand is generally pulled towards the radial or thumb side. The deformity is well marked.

Treatment.—Pull gently on the hand to get the bones into proper position. Apply splints on the front and back of the forearm, the front one reaching from the wrist to the elbow, the back one from the knuckles to the elbow. Fix these by a palm bandage, and by two forearm bandages, and sling in a large arm sling.

5. Fracture of the Hand.—For any fracture of a metacarpal bone or phalanx, cut a piece of cardboard to fit the palm of the hand, including the fingers. Fix the splint by a palm bandage, and support the hand by a narrow arm sling.

6. Fracture of the Pelvis generally takes place at the front of either or both haunch bones, and is caused either by a fall from a height or by a compressing force—*e.g.*, a person being "boxed" against a wall by a bull or run over by a carriage. The bladder and other internal organs are often injured in this fracture, and these complications form one of its chief dangers. If pelvic fracture be suspected from the history of the accident the patient should be carefully lifted, carried on a stretcher, and placed in bed. A broad flannel bandage should be firmly applied round the pelvis. Medical aid should be summoned at once.

7. Fracture of the Thigh Bone.—*Symptoms.*—The thigh bone is fractured either at its neck or at some point in its shaft. The fracture at the neck (skiagram, Fig. 87) is caused by a fall on the hip, or in old people by indirect violence, the force acting from the foot along the leg, when the foot suddenly strikes the ground, as in stepping suddenly from a cab or tramway car. In the case of the shaft the fracture is usually caused by direct violence applied to the bone. In addition to the ordinary symptoms of fracture, there may be noticed in the case of a broken thigh bone, a shortening of the limb by one to three inches, while the leg usually lies with the foot everted (*i.e.*, with the outer border of the foot lying on the ground or couch), and cannot be voluntarily moved from that position by the patient.

Treatment.—The "first aid" treatment consists in applying a splint to the outer side of the leg, long enough to reach from the arm-pit to 2 or 3 inches below the foot. The thigh should be securely bandaged to the splint by two triangular bandages, one above and one below the seat of fracture, and the splint should be fixed firmly by additional bandages, one at the foot, a second a little below the knee, and a third round the chest at the upper part (Fig. 94). For

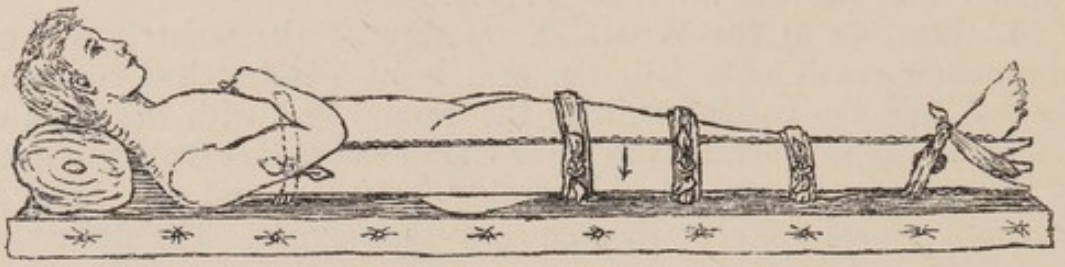


Fig. 94.—Thigh fractured at ←— and put up with a Liston's long splint.

additional security the injured should be fixed to the sound limb by two bandages, one applied at the upper, the other at the lower part of the leg. The patient should not be lifted, if possible, until splints have been applied in the method described. Extemporised splints may be used in the form of a rifle, a billiard cue, a broom-handle, a paling post, or part of the skirting board of a room.

8. Fracture of the Knee-cap is caused either by direct violence applied to it, or by a strong and sudden contraction of the muscles in front of the thigh, causing a "fracture by tearing off." In the former case there is considerable swelling, but not much deformity, in the latter a distinct gap can be felt between the fragments (skiagram, Fig. 85).

Treatment.—Bandage the knee with a triangular bandage in the way already described. Apply along the back of the limb a long splint reaching from the buttocks to the heel, and fix it by four triangular bandages, two of which encircle the limb immediately above and below the knee-cap. If a long splint cannot be easily got, apply to the back of the knee a folded newspaper or periodical, and fix it with the knee bandage, then bandage one leg to the other.

9. Fracture of the Leg (skiagrams, Fig. 86 and Frontispiece).—*Symptoms.*—The symptoms are those of ordinary fracture. Pain is elicited on gently pressing the two leg bones together. The tibia and fibula may be broken at any part of their shafts, and may be broken separately or together. A common fracture of the brooch bone or fibula is at its lower end, and is caused by a sudden twisting of the foot either outwards or inwards. Owing to the bones of the leg lying so close to the skin a simple fracture of the leg may be readily converted into a compound one by faulty handling, as in carrying the patient with the leg unsupported by splints. This is particularly the case in fracture of the shin bone.

It is, therefore, advisable that splints be applied before the patient is lifted from the ground.

Treatment.—Splints should be fixed on either side of the leg by two bandages, which are applied one above, the other below, the site of fracture (see Fig. 95). The two legs should then be bandaged together, to afford additional support. Improvised splints may be used in the form of umbrellas, walking sticks, packing post paper, books, periodicals, folded newspapers, stockings filled with sand, etc. Army splinting may be employed, and is very serviceable; the method of its application is shown in Fig. 96.

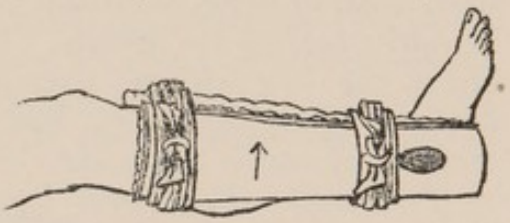


Fig. 95.—Fractured leg treated by external and internal splints. Arrow marks site of fracture.

10. Fracture at the Ankle.—This is generally of the lower end of the brooch bone, and is to be treated like a leg fracture. It is generally caused by "going over" the side of the foot.

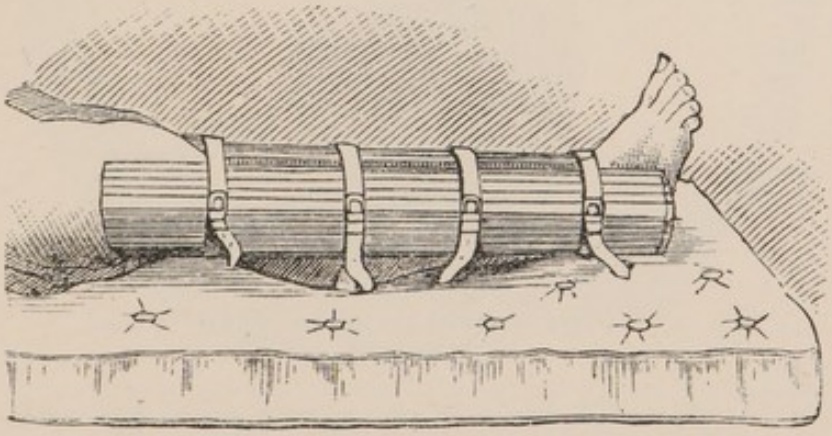


Fig. 96.—Army splinting applied to fractured leg.

11. Fracture in the Foot.—This is generally of a metatarsal bone or phalanx.

Symptoms.—Pain on pressure, and crepitus.

Treatment.—A soft pad should be placed on the painful part and fixed by a bandage. The part should be rested.

12. Fracture of the Ribs.—*Symptoms.*—There will be a history of compression of the chest-wall by the patient being run over, or sustaining a blow or heavy fall on the side. Severe pain on the injured side will be complained of, generally described as a "stitch." It is caused by the two ends of the broken rib rubbing on each other. The pain will be increased by pressure on the side with the hand, or by the patient taking a deep breath. Fracture of the ribs is often complicated by the broken ends being driven into the lung. This is shown by the collapsed condition of the patient, by difficulty of breathing, and, it may be, by spitting of blood.

Treatment.—Support the chest-wall by two or three triangular bandages tied tightly round it, or by a flannel binder or "bolster-slip," if that can be procured.

13. Fracture of Lower Jaw.—*Symptoms.*—The jaw, generally from a fall or blow, is broken at its weakest part, about three fingers' breadths behind its middle. The patient is unable to speak or to move the jaw without extreme pain. The line of the teeth is broken. Bleeding from the mouth will often be present, and crepitus is easily made out.

Treatment.—The lower jaw is fixed to the upper jaw—which is the best splint for it—by a triangular bandage applied in either of the two methods already described (Figs. 44, 45, and 46), or by the four-tailed bandage (Fig. 75).

14. Fracture of the Spine.—*Symptoms.*—There will be the history of a severe accident, a fall from a height, a severe blow on the back, or a crushing of the spine, as by a carriage or traction engine passing over the body. The special danger of the accident consists in the possible injury to the spinal cord (see Fig. 97). Pressure on the

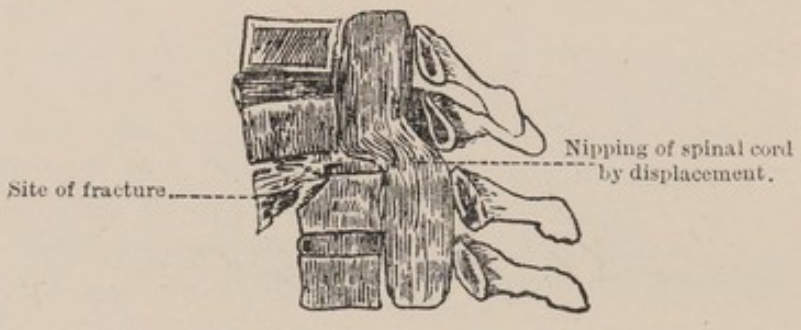


Fig. 97.—Fracture of spine with nipping of cord.

spinal cord by the narrowing of the spinal canal by broken pieces of a vertebra, or by one vertebra being driven off another, will cause paralysis of all the muscles below the seat of injury. Both legs will then be helpless, which may be tested by tickling the soles of the feet, when the patient will be unable to draw his legs up.

Treatment.—If from the history, visible deformity, or pain over the spine with signs of paralysis, fracture of the spine is suspected, the patient must be moved most carefully. He should be lifted *en masse*, the spine being kept as straight as possible. If he has to be carried, it is best done on a door or shutter, to prevent bending of the spine. He should be placed in bed on a straw mattress. All that one should aim at in "first aid" is to prevent further injury to the spinal cord by keeping the spine as rigid as possible.

If the patient suffer from shock, a condition of nervous disturbance or depression following a severe injury, stimulants may be administered with caution.

15. Fracture of the Skull.—The skull may be fractured on the vault or top, or on its lower surface or base.

(*a*) Fracture of the Vault.

Symptoms.—There will be a history of a blow sustained on the vault, of a heavy body having fallen on the head, or of a fall from a height. There will generally be a scalp wound of greater or less extent leading down to the seat of fracture, or a large extravasation of blood below the scalp. The surface of the skull may be simply fissured or cracked, but in more severe cases the bone at

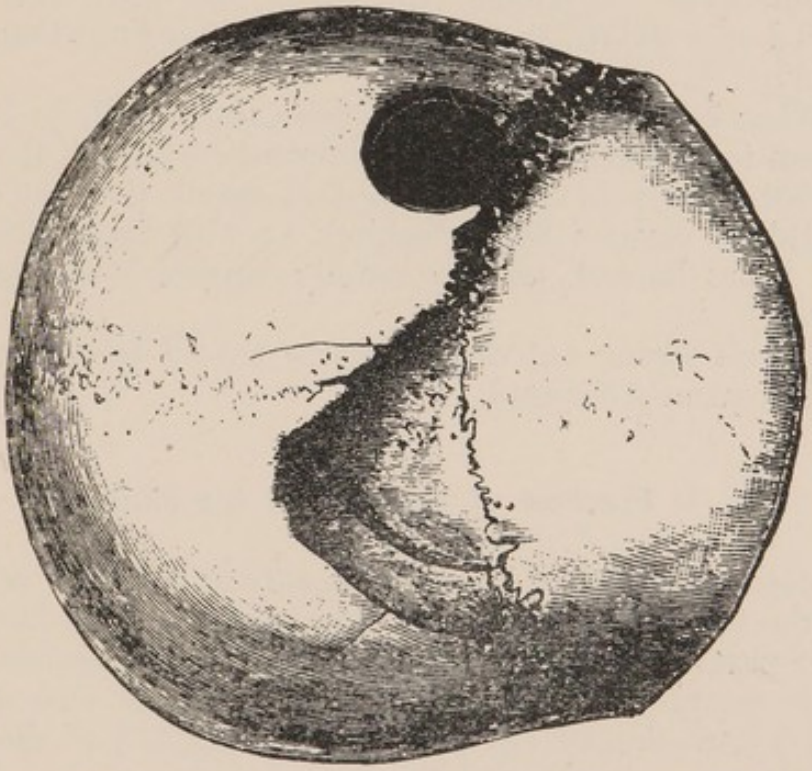


Fig. 98.—Depressed fracture of vault of skull (showing also trephine opening made to allow elevation of the depressed bone).

the place of injury is driven in so as to be below the level of the bone around. It is then known as a "depressed" fracture (Fig. 98). The danger of such a fracture consists in direct injury to the brain, in the tearing of its membranes, and in the compression of the brain by the depressed piece of bone, or by the clotted blood shed at the time of the accident between the skull and the brain (see Fig. 99). The patient, if conscious, will complain of pain at the injured part, but in severe cases will be either partially or wholly unconscious.

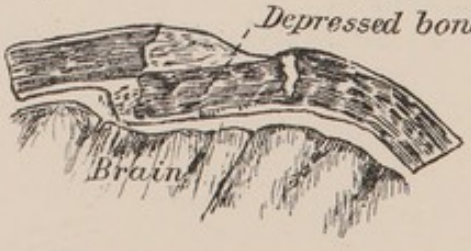


Fig. 99.—Depressed fracture of skull.

Treatment.—As the condition is a grave one, the sooner the patient is seen by a medical man the better. Do not on any account give the patient a stimulant—the favourite treatment by the

uninitiated for every form of accident—as it is more than likely to cause fresh bleeding, and increase the pressure on the brain substance, from which the patient may be already suffering.

Conduct the treatment of such a case in the following order :—

(1) If there be a surface wound wash it with water, or with a disinfectant solution, as described under compound fracture. Place a cold compress or dressing over the wound, and fix with a bandage.

(2) If the patient has to be carried to a house or hospital, procure or improvise a stretcher (*q.v. infra*), and carry him with his head raised on a pillow, so that it is on a higher level than the rest of his body.

(3) When he is put into bed, his head should still be kept high, and a clean towel placed below it to prevent soakage of the pillow.

(4) Hot bottles should be placed alongside the feet and legs, and should be covered with stockings or with flannel to prevent the skin being burned, as may readily happen if the patient be insensible.

(5) Towels wrung out of cold water should be applied to the head and frequently changed.

(*b*) Fracture of the Base of the Skull.

Symptoms.—There is a history generally of a fall or of a heavy blow on the top of the head. The base of the skull is fractured by the upper part of the spine being driven forcibly against it. The prominent symptoms are bleeding from the nose and ears, dilatation or contraction of the pupils (" the black ") of the eye, and unconsciousness.

Treatment.—1. Keep the head high.

2. Apply towels wrung out of cold water over the head and frequently change them.

3. Hot bottles should be used, with the precautions abovementioned.

4. No stimulant should be given.

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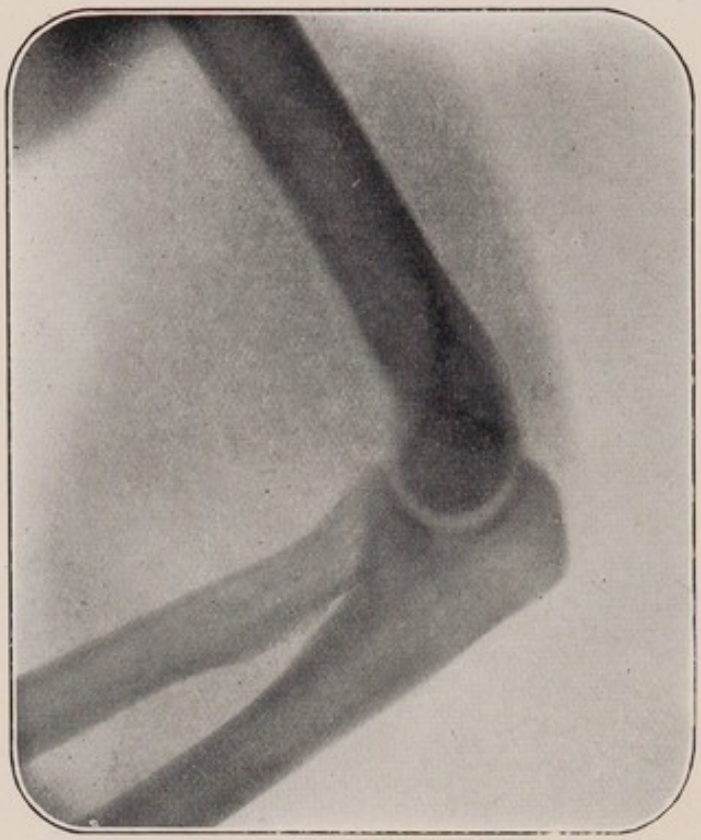


Skiagram (Fig. 101).—Normal elbow joint (hinge-joint).

Skiagram (Fig. 102).—Dislocation of elbow joint (both forearm bones dislocated backwards over lower end of humerus).

CHAPTER V.

DISLOCATIONS AND SPRAINS.

DISLOCATION: DEFINITION—VARIETIES—SYMPTOMS—TREATMENT—SPRAINS: DEFINITION—SYMPTOMS—TREATMENT.

Dislocations.—A dislocation is a displacement of the bones at a joint, and is caused by violence applied in such a way as to force apart the joint surfaces and drive the head of the bone through a weak part in the ligamentous capsule of the joint into the structures outside—*e.g.*, in dislocation of the hip joint, the head of the femur leaves the cup in which it naturally lies, and is forced through the capsule of the joint either backwards or forwards on to the haunch bone. Fig. 100 shows the backward dislocation of the head of the femur. In severe cases, fracture of the bones at the joint may occur along with the dislocation, and this not uncommonly happens in the ankle, where, in addition to the displacement at the joint, the ends of the tibia and fibula are broken. The most common situations in which dislocations occur are the fingers, shoulder, elbow, ankle, hip, and jaw (compare skiagrams, Figs. 101 and 102).

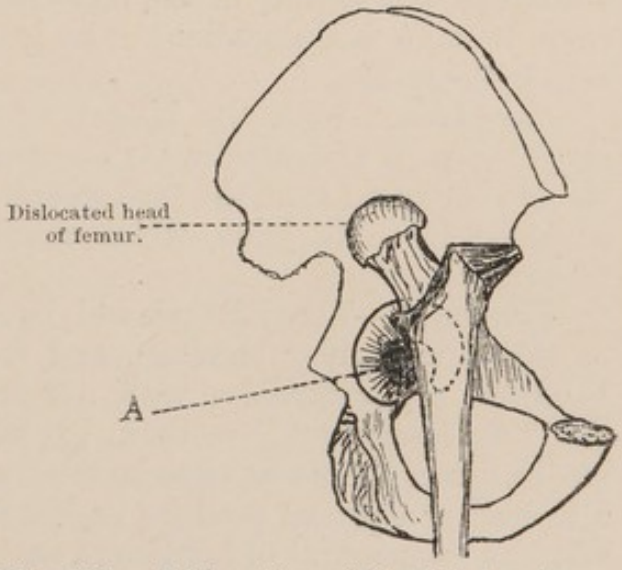


Fig. 100.—Dislocation of hip joint. A, cup in which head of bone should lie.

Symptoms.—The symptoms are not unlike those of fracture. These are deformity, swelling, and inability to use the part. A grating sound may sometimes be made out, but it is not the true crepitus of fracture. It is worthy of notice that in a dislocation the part is fixed where it should naturally be movable, whereas in a fracture there is, as has been explained, unnatural mobility or movement where none should exist.

Treatment.—The treatment of a dislocation consists in "reducing" it—*i.e.*, in manipulating or pulling the dislocated bone back into its proper relative position. Such manipulation in the case of a large and important joint requires special skill and training, and should

not be attempted by an ambulance student. The first aid treatment consists in preventing further injury, and in relieving pain by fixing the dislocated joint securely by bandages, and, if necessary, binding the limb to a splint.

In the case of dislocation of the phalanx of a finger or thumb, an attempt may be made to bring the parts back into position by pulling on the dislocated phalanx, which should immediately return with a snap into its natural position. If this result is not at once attained, the part should not be roughly pulled on, but should be left for inspection and treatment by a medical man. In dislocation of the lower jaw, if a medical man cannot be soon in attendance, the ambulance pupil may endeavour to reduce the dislocation by pressing on the back teeth of the lower jaw with his thumbs, the pressure being directed downwards and backwards. The thumbs should be covered with a handkerchief or towel to prevent their being bitten. If pressure be properly applied, the jaw will go back into position with a jerk.

Sprains.—A sprain is a "missed dislocation," and consists in a stretching and tearing of the ligaments of a joint by a force insufficient to cause a dislocation. The joint in which it is most usually seen is the ankle.

Symptoms.—With the history of the injury there is also considerable pain and swelling. The part is usually discoloured from the blood effused from the torn structures. There may be an effusion of blood into the joint, which renders the part very painful on movement.

Treatment.—The joint should be covered with cotton wadding or folded triangular bandage, and firmly bound with a "cravat" bandage, or, preferably, with a roller bandage applied firmly in the "figure-of-eight" method. If the pain be very great, and a medical man cannot at once be got, relief may be given by applying a linseed or oatmeal poultice or hot fomentation, on the surface of which a teaspoonful of laudanum may be sprinkled.

CHAPTER VI.

HÆMORRHAGE.

INTERNAL AND EXTERNAL HÆMORRHAGE—THE ARTERIAL SYSTEM—THE VENOUS SYSTEM—KINDS OF BLEEDING—TREATMENT OF HÆMORRHAGE—ABUSE OF STIMULANTS IN THE TREATMENT OF HÆMORRHAGE—TREATMENT OF CAPILLARY BLEEDING—STYPTICS—TREATMENT OF VENOUS BLEEDING—TREATMENT OF ARTERIAL BLEEDING—POINTS OF COMPRESSION OF THE MAIN ARTERIES OF THE BODY—METHODS OF ARRESTING HÆMORRHAGE FROM THE MORE IMPORTANT ARTERIES—VOMITING AND SPITTING OF BLOOD—BLEEDING FROM THE NOSE—BLEEDING FROM THE SOCKET OF A TOOTH—BLEEDING FROM HÆMORRHOIDS—BLEEDING FROM THE EAR—BLOOD IN THE URINE—HÆMOPHILIA—INTERNAL HÆMORRHAGE—COLLAPSE FROM HÆMORRHAGE.

Hæmorrhage (from the Greek words signifying " flowing of blood ") is the name given to an escape of blood from large or small blood-vessels, either **externally** from wounds or **internally** into the tissues, organs, or cavities of the body. **Internal** hæmorrhage is not a subject which requires to be dealt with at length in an ambulance text-book. So far as it is a matter of interest and importance for the ambulance student it will be touched on at the end of this chapter, and will meet us again in the section dealing with apoplexy. **External** hæmorrhage, however, is a matter of the greatest importance, and must be exhaustively treated. Before one can thoroughly understand the different forms of bleeding and the rationale of their treatment, it is necessary to have some idea of the structure and relative anatomy of the main blood-vessels. From what has been already said in the description of the circulation of the blood it will have been seen that the pure arterial blood leaves the left ventricle of the heart to supply nourishment to the tissues by a large blood-vessel known as the **aorta.** This large blood-vessel sends off branches to the head and neck and to the trunk and limbs. All such blood-vessels containing pure blood for the nourishment of the tissues are known as **arteries.** The arteries have thick walls which contain muscular fibres, so that through nervous influence they have the power of dilating and contracting. This is of importance in connection with the arrest of hæmorrhage. An artery, if cut only partly across, tends from the contraction of these muscular fibres to gape, and through the open wound so formed in the vessel a large stream of blood will escape. On the other hand, if the vessel be divided transversely across, the cut ends tend by their contraction

to be drawn upwards and downwards respectively into the sheath or covering of the artery, and to curl up inside it, with the result that less blood escapes through the contracted and retracted ends. The method by which nature arrests bleeding is by the formation of a clot in the cut end of the vessel.

The large arteries given off by the aorta divide and subdivide to supply the muscles, bones, and superficial structures of the body. The ultimate small ramifications of the arteries are known as **arterioles,** and divide into a regular net-work of very minute microscopic blood-vessels known as **capillaries.** From the capillaries the blood nourishes the tissues, giving up its nutritive properties to them, while it in turn takes up into similar small vessels the waste products formed by the wear and tear of the tissues. Thus the blood running in a pure form in the arterial capillaries is rendered impure in the tissues, and passes through a small net-work of venous capillaries to the vessels which are to convey it back to the heart. The returning vessels are known as **veins.** Beginning as small veins, similar in size to the arterioles, they gradually unite into large blood-vessels which run along with the main arteries of the limb and pour their contents into two large veins known as the **superior** and **inferior venæ cavæ,** which enter the right auricle of the heart. The veins have much thinner walls than the arteries, and have little power of contraction. This is a matter of importance, as the escape of blood from a large cut vein would be much more serious than that from an artery were it not for the fact that the blood pressure in the veins is very much less, and the return current in them much more sluggish and less powerful than in the arteries, which have blood pumped into them directly from the heart.

Before going on to the description of the different forms of bleeding and their treatment, it is essential that a detailed description be given of the anatomical "lines" and relative position of the main arteries and veins of the body.

ARTERIAL SYSTEM.—The **aorta,** the largest artery of the body, after leaving the left ventricle of the heart, forms an arch (see Fig. 105), and passes down in front of the spine lying on the front of the bodies of the vertebræ. In its course it gives off branches to supply arterial blood to the walls of the thorax and abdomen, and large branches to the liver, stomach, kidneys, and intestines (see Fig. 23). It divides opposite the fourth lumbar vertebra into two branches, known as the **common iliac arteries.** Each of these again divides into two branches—the **internal** and **external iliac arteries,** the internal passing down into the pelvis, the external directly to the upper part of the thigh, where it takes the name of the **femoral** or **thigh artery** (see Fig. 104).

Arteries of the Leg (see Figs. 104 and 105).—The femoral artery passes down the front and inner side of the thigh, and at the junction

of the upper two thirds with the lower third, dips behind to lie in the middle of the space at the back of the knee joint, known as the "ham." It is there called the **popliteal artery.** The line of the femoral artery is from the middle of the groin or upper part of the thigh down to the middle of the inner side of the knee joint. The popliteal artery, at its lower part, lies directly in the middle of the ham, and divides immediately below the knee joint into two branches, which run down the back of the leg, the one on the tibial or inner

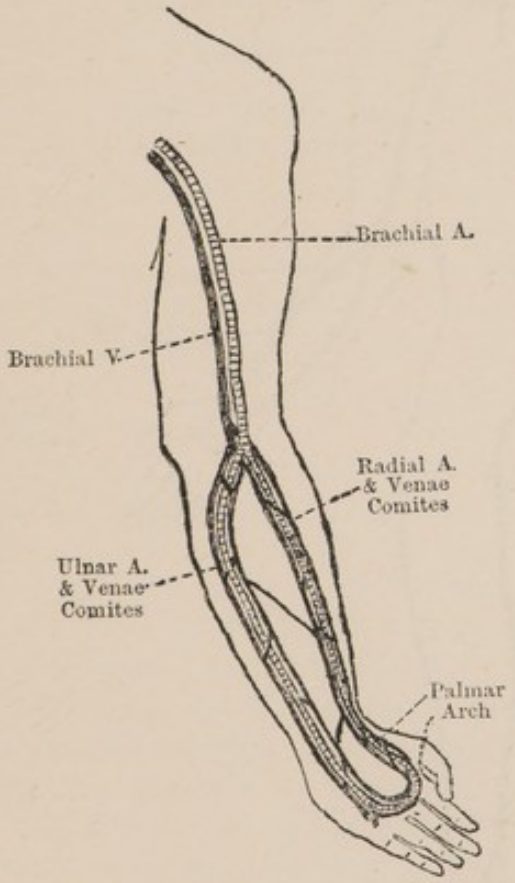


Fig. 103.—Arteries and veins of left arm. Arteries with cross markings. Veins black. (Highly diagrammatic.)

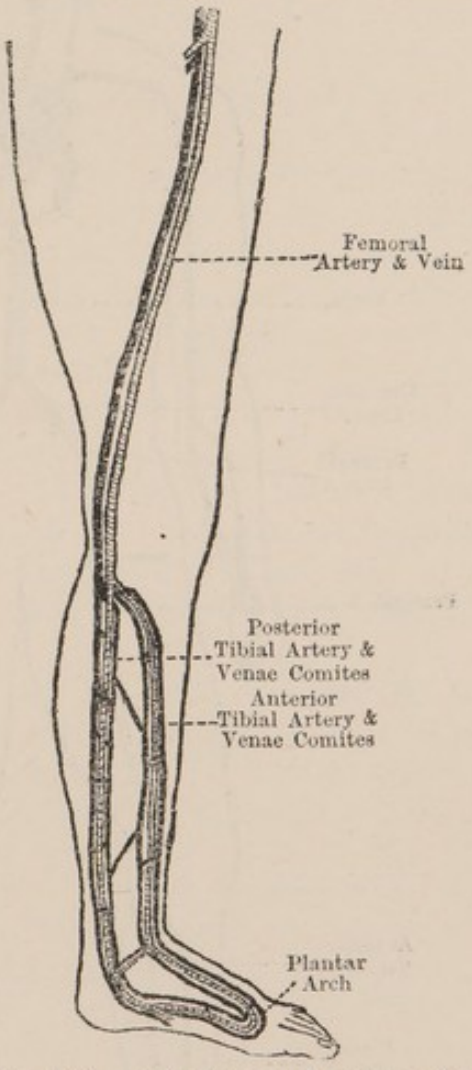


Fig. 104.—Arteries and veins of left leg. Arteries with cross markings. Veins black. (Highly diagrammatic.)

side being known as the **posterior tibial artery,** the one on the fibular side as the **peroneal.** From the posterior tibial artery a branch passes forwards between the tibia and fibula, at the upper part of the leg, to nourish the structures on the front of the limb, and is known as the **anterior tibial artery.** The posterior tibial artery passes behind the posterior edge of the tibia at the inner side of the ankle into the sole, where it forms an arch close to the ball of the toes, from which branches are given off to supply the toes. This

arch is known as the **plantar arch.** Roughly, then, it may be said that on the thigh, where there is one long bone, there is one main

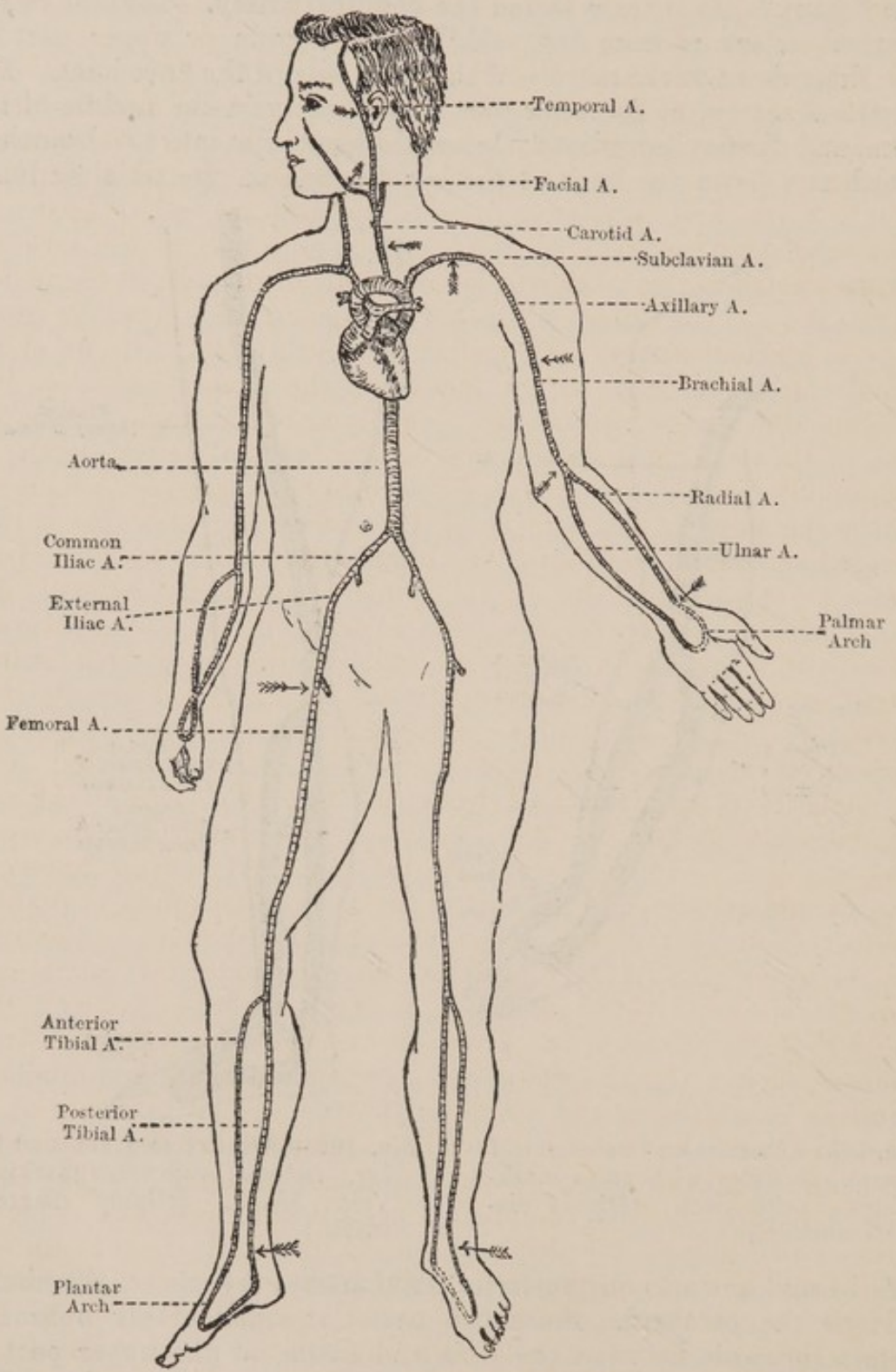


Fig. 105.—Scheme of arterial circulation with points of compression marked by arrows.

artery running along it, while the two bones of the leg have each a corresponding artery, the inner of which gives off a branch to

supply the front part of the leg, and forms an arch on the sole of the foot, from which is derived the blood supply of the toes. A similar arrangement will be found to obtain in the case of the arteries of the arm and forearm.

Arteries of the Arm (see Figs. 103 and 105).—From the arch of the aorta spring large arteries to supply the head and the arms. The main artery of the arm passes from the aortic arch between the first rib and the clavicle into the arm-pit. It lies directly on the first rib, and can be compressed against it, and is known as the **subclavian artery.** In the arm-pit or axilla it becomes the **axillary artery.** It runs down the inner side of the arm to the middle of the front of the elbow. From the arm-pit to the elbow it is known as the **brachial artery,** and its line is from a little in front of the middle of the arm-pit to the middle of the elbow—*i.e.*, along the inner border of the biceps muscle, or, roughly speaking, "along the line of the seam of a coat sleeve." The brachial artery divides in the middle of the front of the elbow into two branches, which run down the front of the arm along the radius and ulna, the former termed the **radial,** the latter the **ulnar artery.** The beating of the pulse at the wrist is due to the filling of the radial artery. The ulnar artery passes over the wrist and enters the palm, where it joins with a small branch from the radial and forms an arch (**palmar arch**), branches from which supply the fingers. The ulnar artery gives off a branch at its upper part which passes between the bones to supply the back of the forearm.

Arteries of the Head and Neck (see Fig. 105).—From the arch of the aorta there passes up a large artery on each side to supply the face and neck structures, and the brain. These are known as the **carotid arteries,** and the line of their course is, roughly speaking, from the junction of the collar bone and breast bone to the angle of the lower jaw. The carotid arteries may be readily compressed against the transverse processes of the vertebræ on which they lie. From the carotids are given off branches to supply the brain, tongue, face, neck, and scalp. It is important that the ambulance student should know the course of the two special branches of the carotid arteries known as the **facial** and **temporal arteries,** as bleeding from the trunks or branches of these is not uncommon. The facial artery may be readily compressed against the lower jaw, which it crosses two fingers' breadths in front of its angle. It runs up over the cheek, and in addition to other branches gives off the coronary arteries which run in the substance of the upper and lower lips. The temporal artery may be felt pulsating a finger's breadth in front of the opening of the ear, where it is easily compressed (Fig. 105).

THE VENOUS SYSTEM.—The veins are the blood-vessels which return to the heart the blood which has been rendered impure

in the tissues. The blood, therefore, while it runs in the case of the extremities *down* the arteries, has an *upward* course in the veins. In the neck the arterial blood *ascends* to the brain, etc., while the

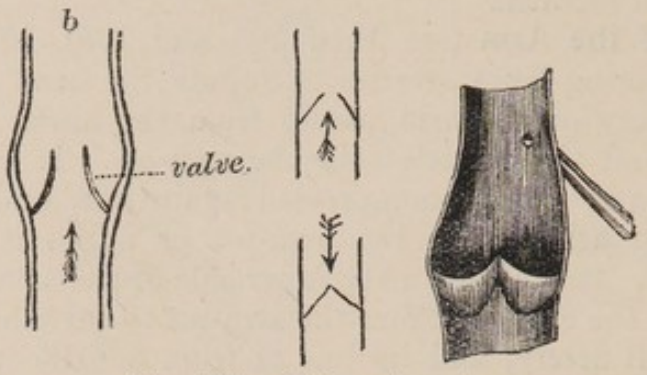
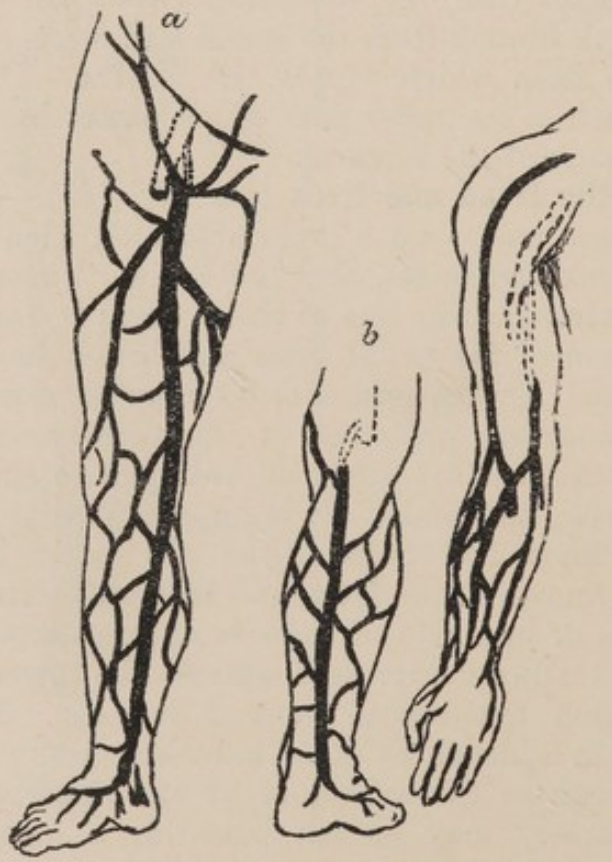


Fig. 106.—Valves in veins.

returning venous blood passes *downwards* to reach the heart. Veins may be divided into two great classes :—

I. Superficial Veins.
II. Deep Veins.

I. Superficial Veins.—These veins run in the tissues which



Front. Back. Front.

Fig. 107.—Superficial veins of leg and arm.

immediately underlie the skin. They are provided with valves to assist in supporting the blood column. These valves (Fig. 106)

form little pockets on the side of the vein, and allow the blood current to pass upwards in a partially filled vein, but when the vein is full they are pushed together towards the centre of the vessel so as to occlude its lumen, and support the column of blood in the vein. The most important of the superficial veins are the following :—

1. **The Internal Saphena Vein.**—It runs down from the middle of the thigh behind the knee, and along the inner side of the leg, passing in front of the ankle to the foot (Fig. 107). This vein is frequently dilated or varicose.

2. The superficial veins of the forearm join in front of the elbow to form two large veins, which run up the sides of the upper arm (Figs. 107 and 108).

3. The **External Jugular Vein** — the superficial vein of the neck—runs from just in front of the ear down to the middle of the collar-bone, under which it dips.

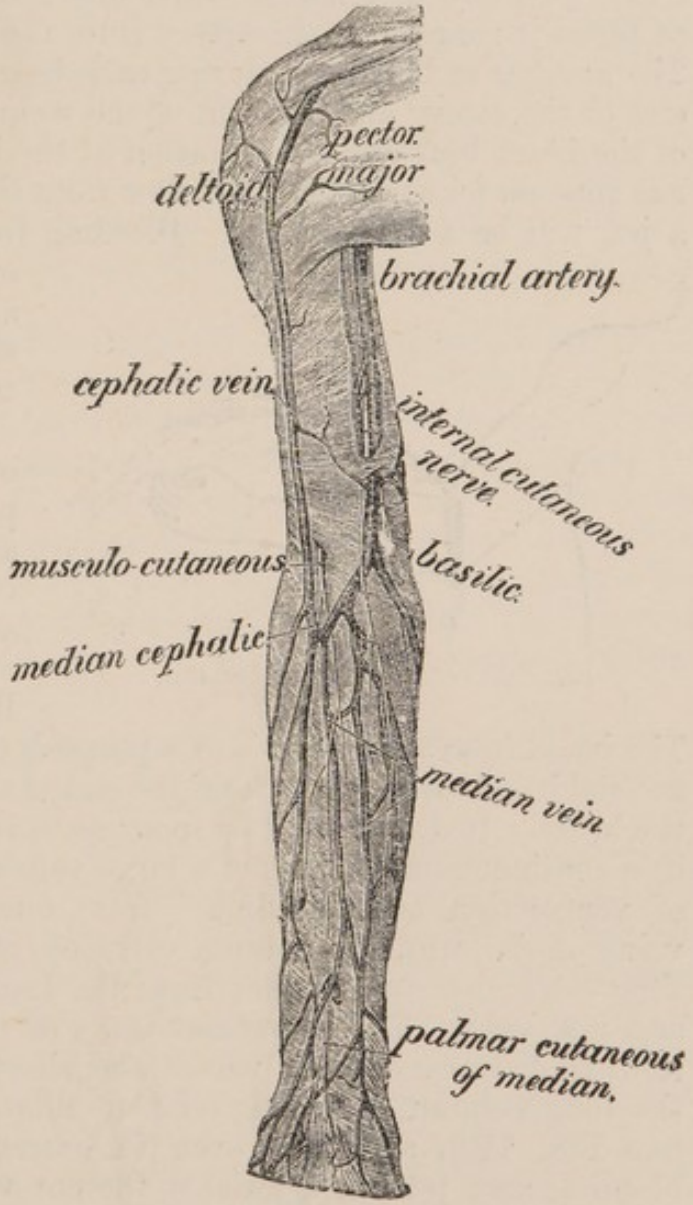


Fig. 108.—Superficial veins of arm and forearm.

II. Deep veins are the veins which accompany the large arteries and lie in the tissues considerably deeper than those just described. The large vein running with the carotid artery is known as the internal jugular vein. In the upper and lower limbs the arrangement of the deep veins is practically the same, and they receive the names of the arteries with which they run. In the thigh and upper arm the main artery has a large vein running along its inner side. In the leg and forearm each of the two arteries has venæ comites, or accompanying veins—*i.e.*, a vein on either side (see Figs. 103 and 104).

KINDS OF BLEEDING.—There are three varieties of bleeding :—

1. **Arterial Bleeding, or Bleeding from a Cut Artery.**—The blood from a cut artery spurts out in jets with each heart beat (Fig. 109). It is bright red in colour, and comes from the end of the vessel which is nearest the heart—*e.g.*, if the radial artery be cut transversely at the wrist, where it is popularly known as the pulse, the blood will issue from the end of the artery nearest the elbow, as will be readily understood when one remembers that the current of blood is running in the artery from the elbow towards the hand. The amount of blood lost during each heart beat will depend on the size of the artery and position of the wound in it, also on the force of the heart beat and the duration of the bleeding. If the bleeding has gone on for some time, the flow from the artery, instead of being a jet, will be a mere trickle. Bleeding from an artery of the face or scalp is at first very alarming, but rapidly subsides, and is easily controlled by pressure.

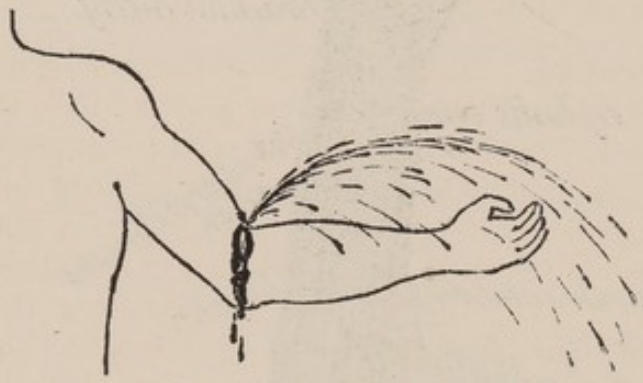


Fig. 109.—Cut artery spouting.

The surgical treatment of a cut artery consists in picking up the artery with a forceps and tying a ligature of sterilised catgut or silk round the vessel.

2. **Venous Bleeding or Bleeding from a Cut Vein.**—The blood from a cut vein is of a purplish colour—much darker than arterial blood—and comes from the end of the cut vessel furthest from the heart. It does not jet or spout as in arterial bleeding, but issues in a continuous flow. When a large vein is cut, as in the operation of venesection or "bleeding" from one of the large superficial veins of the arm, the column of blood may, from the pressure in the vessel, rise some inches from the limb, but the flow is steady and not jerky. The superficial veins of the lower extremity, from the insufficiency of their valves and the pressure on their walls of the long column of blood, tend to dilate or become "varicose" (see Fig. 110), and may even in extreme cases burst. Venous bleeding may jet like arterial if the cut vein lies immediately over an artery, the pulsation being conveyed to the vein from the artery below.

3. **Capillary Bleeding.**—Blood from cut capillary vessels is reddish in colour, and the bleeding consists of a steady flow or ooze. It is best exemplified by the bleeding from the socket of a tooth recently extracted, or the ooze from a cut made in shaving.

TREATMENT OF HÆMORRHAGE.—Abuse of Stimulants in the Treatment of Hæmorrhage.—It is the unfortunate custom in

many parts of the country to give to the suffering patient in all forms of accident, as a universal remedy, a quantity of stimulant in the form of brandy or whisky. While this may in certain cases of injury, such as burns, be of service, and indeed be necessary, nothing more injurious can well be imagined in cases of excessive hæmorrhage, either external or internal, *where the hæmorrhage is not arrested, and is not under control.* By the administration of stimulants in such cases, the heart is made to beat faster and a larger amount of life's vital fluid is forced with greater rapidity through the wound in the vessel. In all cases of hæmorrhage, before a stimulant is administered, it should be well seen to that the bleeding has been arrested, and that means have been taken to prevent its recurrence. If collapse from hæmorrhage occur with the symptoms described under that heading at the end of this chapter, it will be advisable to administer stimulants, but only under the conditions there stated.

Treatment of Capillary Bleeding.—Most cases of capillary bleeding can be treated satisfactorily by pressure. The method consists in pressing on the bleeding point firmly with a clean sponge or piece of lint or linen. The pressure should be kept up continuously for two or three minutes. If pressure be not sufficient to arrest the bleeding, it may be necessary to call in the assistance of styptics. Styptics are substances which have the property of assisting the formation of a blood clot, and so of arresting bleeding. The following are the styptics most commonly in use, with the method of their application :—

1. *Hot Water.*—A sponge or piece of lint wrung out of water as warm as can be borne by the hand may be firmly applied to the wound.

2. *Cold Water.*—A sponge or compress of lint or linen wrung out of cold water may be employed. This is useful in cases of bleeding from the nose, cold compresses being applied over the bridge of the nose. If this fail, the nostrils should be firmly plugged with lint or cotton wadding wrung out of cold water.

3. "*Steel Drops*" (tincture of perchloride of iron) form an excellent styptic, though slightly painful. A few drops should be applied on a handkerchief to the wound.

4. *Burnt or Dried Alum* (alumen exsiccatum) is also very serviceable as a styptic. It may be applied to the wound as a powder or in solution. It is particularly useful in bleeding from the socket of a tooth recently extracted, and is applied on small pledgets of cotton wool, with which the socket is firmly plugged.

5. *Turpentine* may be applied on linen.

6. *Common Salt*, either applied in crystals or as a strong solution, also acts as a styptic.

7. *Nitrate of Silver* ("lunar caustic") has also been employed for this purpose.

8. *Tannic Acid* may be dusted as a powder on the part, or a little of the glycerine of tannic acid may be smeared over the bleeding surface. A very strong infusion of tea will serve the purpose, if pure tannic acid be not at hand; the tannin in strong tea, having astringent properties, will help coagulation.

9. *Gallic Acid* may be used in the form of a powder dusted on the part.

10. *Adrenalin*, or *Suprarenal Gland Extract*, is specially useful in stopping hæmorrhage from the mucous membrane of nose, mouth, or throat.

11. *Friar's Balsam* (compound tincture of benzoin) may be used.

Treatment of Venous Bleeding.—Bleeding from a cut vein may be arrested by any of the following methods :—

1. *By Digital or Finger Pressure.*—If the wound be a small one pressure with a finger or thumb will usually be sufficient.

2. *By Compression.*—In the case of bleeding from a small vein, all that is necessary, as a rule, is to place a firm pad of lint or linen over the wound, and bandage it firmly by a "narrow fold" triangular bandage. Thereafter the limb should be raised to diminish the amount of blood supplied to the part.

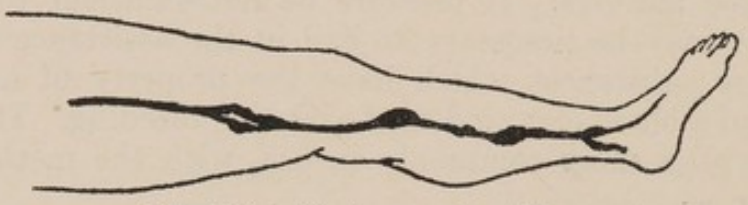


Fig. 110.—Varicose vein of leg.

3. *By a Tourniquet.*—In the case of bleeding from a large vein, the measures mentioned above may be insufficient. It may then be necessary to apply a constricting band or tourniquet to the vein. The tourniquet should, of course, be applied on the side of the vein furthest from the heart—*e.g.*, in the case of a cut vein of the calf of the leg, the constricting bandage should be applied between the cut and the foot. In bleeding from a large severed or burst varicose vein (Fig. 110), first apply pad pressure, and if that be found insufficient and soakage still go on, apply the tourniquet as directed. In severe bleeding, where it is not at once evident whether the hæmorrhage is arterial or venous, a tourniquet should be applied to the main artery of the limb, as described below. This will cut off the blood-supply of the limb.

Treatment of Arterial Bleeding.—Bleeding from an artery may be arrested, according to the severity of the bleeding, by one or other of the following methods :—

1. *Elevation.*—In the case of bleeding from an artery of the leg or arm, the arrest of hæmorrhage will always be assisted by elevating the limb, and thereby diminishing the amount of arterial blood

passing to the part. In the case of arterial bleeding from the leg, the method of elevation is carried out by bending the thigh at a right angle to the trunk, the patient being in a recumbent position. In the case of the arm, the limb should be held up above the head.

2. *Pressure.*—If the bleeding be from a small artery, it may be arrested by applying pressure over the wound with a handkerchief, or pad of lint.

3. *Digital or Finger Compression on the Wound.*—In cases of hæmorrhage from one of the large arteries, in addition to the application of local pressure, the part is to be compressed by the fingers. This is particularly useful in small punctured or stab wounds.

4. *Digital compression against the bone* at the nearest suitable point between the wound and the heart. This is exactly similar to the way in which a plumber stops the escape of water from a burst leaden pipe, by pressing together the two sides of the pipe above the point of escape, the only difference being that, of course, in the case of the artery, continuous pressure must be maintained to keep its walls in contact and check the flow of the blood stream. The exact methods of applying digital compression at different points will be described below in dealing with the treatment of bleeding from the special arteries.

POINTS OF COMPRESSION OF THE MAIN ARTERIES OF THE BODY.

(See Fig. 105, where the points of compression are indicated by arrows.)

(1) **Temporal Artery**—against the temporal bone, a finger's breadth in front of the opening of the ear.

(2) **Facial Artery**—against the jaw, two fingers' breadth, or 1 inch, in front of the angle of the jaw.

(3) **Carotid Artery**—against the transverse processes of the vertebræ on the side of the neck, an inch from the middle line.

(4) **Subclavian Artery**—against the first rib behind the middle of the collar-bone.

(5) **Axillary Artery**—against the head of the humerus at the junction of the anterior with the middle third of the arm-pit.

(6) **Brachial Artery**—against the humerus at the inner border of the biceps muscle, in the line of the seam of the coat-sleeve.

(7) **Radial Artery**—at the wrist, against the radius at the junction of the outer with the middle third of the front of the forearm.

(8) **Ulnar Artery**—at the wrist, against the ulna at the junction of the inner with the middle third of the front of the forearm.

(9) **Femoral Artery**—in the middle of the groin against the haunch bone.

(10) **Posterior Tibial Artery**—at the inner side of the ankle behind the prominence of the lower end of the tibia.

(11) **Anterior Tibial Artery**—against the tarsus at the middle of the front of the ankle.

5. *Tourniquet Compression.*—The compression of an artery by a compressing bandage or tourniquet, applied at the nearest suitable point between the wound and the heart, should supersede as soon as possible the method of digital compression, which is naturally the method one would use first in a serious case of hæmorrhage. The tourniquet generally in use in surgical practice consists of an elastic tube or cord wound tightly round the limb, so as to compress the vessel against the bone (see Fig. 111). The elastic tourniquet

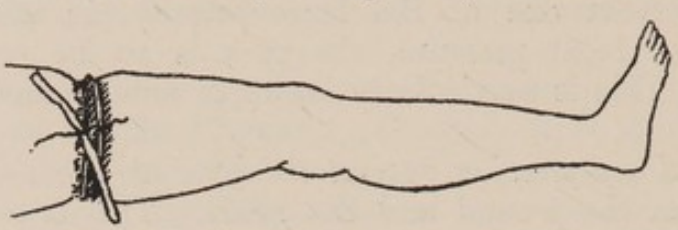


Fig. 111.—Esmarch's tourniquet on thigh.

is applied either next the skin or over the clothing. It is known as Esmarch's tourniquet, and the method of its use, as applied to the thigh, is shown in Fig. 111. In military ambulance work and in surgical practice, Petit's screw tourniquet is occasionally employed. It consists of a pad to compress the artery, with a narrow strap which encircles the limb, and is fixed by a buckle. A very powerful brass screw is attached to the strap, and by screwing

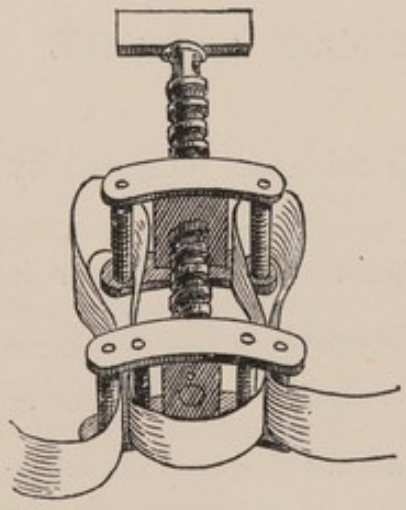


Fig. 112.—Screw tourniquet (Petit's).

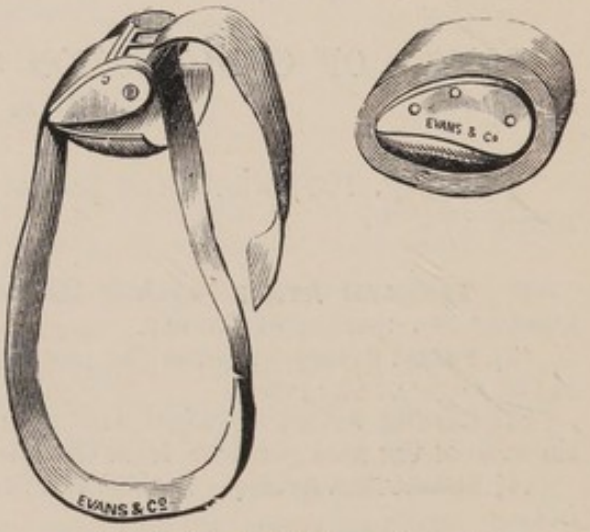


Fig. 113.—Field tourniquet.

down the pad (Fig. 112), the artery can be compressed with great force.

The surgical haversacks of the army medical department are supplied with field tourniquets (Fig. 113), which may be applied, if necessary, over the clothing, and provide a ready and reliable means of checking hæmorrhage from gunshot and other wounds. The improvised tourniquet is made from a triangular bandage, as described in Chapter II. (see Fig. 62). The knot and the tied ends

of the bandage, or a special pad placed below or in the folds of the bandage, form the compressing pad, and are placed immediately over the main artery of the limb, while continuous pressure is exercised by twisting the bandage on itself by a ruler or walking-stick inserted in the loop end of the bandage. When sufficient compression has been got to entirely stop the flow of blood through the artery, the tourniquet rod is either held in position by the hand, or is secured firmly to the limb by a triangular bandage (see Fig. 62). In any case of extensive bleeding from the limbs, be it arterial or venous, while finger compression of the main artery of the limb above the wound is being made by the ambulance pupil, a tourniquet should be applied under his direction immediately above the point of digital compression, and should not be removed until it is seen that the bleeding has been checked. In making digital compression on a large artery the fingers readily tire, and have to be superseded by the continuous pressure of the elastic or improvised tourniquet. A tourniquet, however, should not be left tightly applied for an indefinite period, as prolonged pressure is apt, particularly in old and infirm people, to cause gangrene or mortification of the parts from which the blood supply is cut off by the constricting band. A safe rule is not to leave the tourniquet tightly applied for longer than an hour, after which time it should be slackened *with care* and left loose for a short time unless severe hæmorrhage recur, when the tourniquet should be immediately tightened. If the patient has to make a long railway or carriage journey under a tourniquet before medical aid can be got, an attendant thoroughly conversant with the use of the constricting bandage should in every case accompany him, and should slacken and tighten the tourniquet as may be found necessary with the precautions mentioned above.

The Methods of Arresting Hæmorrhage from the more important Arteries :—1. **Temporal Artery.**—Bleeding from the scalp or temple is to be dealt with by pressing the artery in the wound directly with the finger, or by a pad held in place by a triangular bandage (see Figs. 45 and 46). It may be arrested if the bleeding be excessive by pressing the temporal artery against the temporal bone a finger's breadth in front of the opening of the ear (see Fig. 105).

2. **Facial Artery.**—Bleeding from the face is to be arrested by digital compression of the bleeding point in the wound, assisted, if necessary, by pressing the facial artery against the bone two fingers' breadth in front of the angle of the jaw (Fig. 105).

3. **Arteries of the Lips (Coronary Arteries).**—Bleeding from the lips may be arrested by squeezing the lip firmly between the index finger and the thumb, or by compressing the facial artery.

4. **Artery of the Neck (Carotid Artery).**—Bleeding from the carotid artery or any of its branches, as in cut-throat wounds, is to be arrested by plugging the wound by a finger or thumb, or by a pad of lint or a handkerchief, while compression is kept up on

the carotid artery against the spine. This is done by pressing with the thumb in the line already mentioned, on the artery just in front of the large muscle of the side of the neck, while the fingers lie behind the neck (Fig. 105). The right hand would then be used in compressing the patient's left carotid artery, the left in compressing the right carotid artery. Pressure, of course, has to be made between the bleeding point and the heart.

5. **Artery of the Arm-Pit (Axillary Artery).**—Bleeding from the artery in the arm-pit may be arrested in either of two ways :—

(*a*) By placing a firm pad in the arm-pit, and binding the arm firmly to the body ; and

(*b*) Where the first method fails to entirely stop the bleeding, it may be arrested by compressing the subclavian artery against the first rib by the thumb, which is pressed down on the artery *behind* the middle of the collar bone. The exact method of compressing the subclavian artery is shown in Fig. 114.

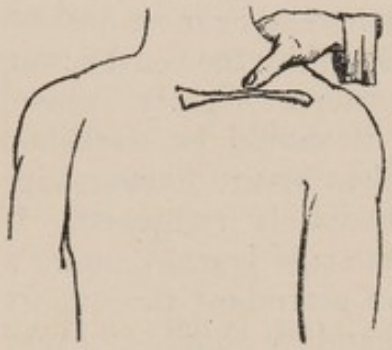


Fig. 114.—Compression of subclavian artery by thumb.

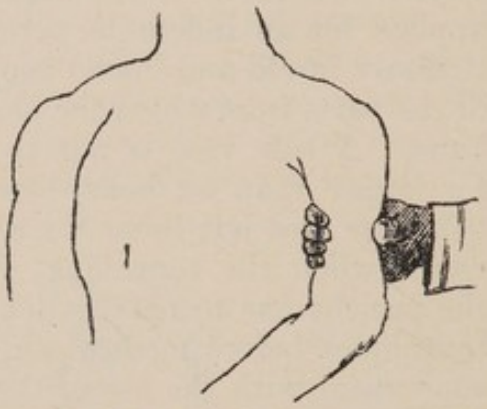


Fig. 115.—Digital compression of brachial artery.

6. **Artery of the Arm (Brachial Artery).**—Bleeding from the artery of the arm is to be arrested by (*a*) digital compression of the artery against the humerus just internal to the biceps muscle, and between the wound and the heart. The artery is said to run in the line of the seam of the coat-sleeve. The fingers passed behind the arm lie immediately over the artery, as shown in Fig. 115, while a great power of compression is got by grasping the arm with the thumb on its outer aspect ; or (*b*) by a tourniquet applied in the same situation. A pad and firm bandage should, in addition, be applied over the wound.

7. **Bleeding from the front of the elbow** is to be arrested by (*a*) placing a pad in the bend of the elbow and binding the forearm to the arm with a triangular bandage ; or (*b*) by compressing the brachial artery by the fingers or a tourniquet.

8. **Arteries of the Forearm (Radial and Ulnar).**—Bleeding from either of these arteries is best arrested by digital or tourniquet compression of the brachial artery. It may also be accomplished

by placing a pad in front of the elbow joint, and bandaging the forearm firmly to the arm, as shown in Fig. 116. Sufficient pressure is thus brought to bear on the brachial artery at the elbow.

9. **Bleeding from the Hand (Palmar Arch).**—Bleeding from the hand is best arrested (*a*) by pads placed over the radial and ulnar arteries at the wrist, and firmly fixed with a triangular bandage; or (*b*) by a tourniquet tightly applied round the lower part of the forearm. Bleeding from the palm may also be arrested by making the patient grasp a pad placed in the palm while the fingers are tightly bandaged over it.

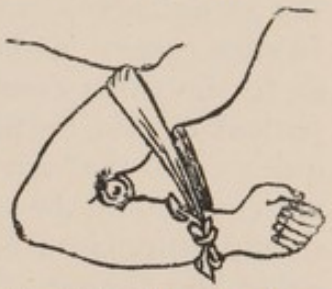


Fig. 116.—Bleeding from forearm checked by pad and flexion.

10. **Artery of the Thigh (Femoral Artery).**—Bleeding from the femoral artery is to be arrested by (*a*) digital compression in the middle of the groin by two thumbs, one backing the other, as shown in Fig. 117; or (*b*) by a tourniquet (with or without a pad below it) applied between the wound and the heart. When bleeding occurs high up in the thigh a tourniquet applied above the wound will tend to slip downwards, and digital compression is then the only means to be relied on.

11. **Artery at the back of the Knee-Joint (Popliteal Artery).**—Bleeding from this artery may be checked by (*a*) placing a firm pad at the back of the knee-joint, and binding the leg firmly to the thigh, and fixing it with a triangular bandage; or (*b*) by digital or tourniquet compression of the femoral artery.

12. **Arteries of the Leg (Anterior and Posterior Tibial and Peroneal).**—Bleeding from any of the large arteries of the leg is best arrested by digital or tourniquet compression of the femoral artery.

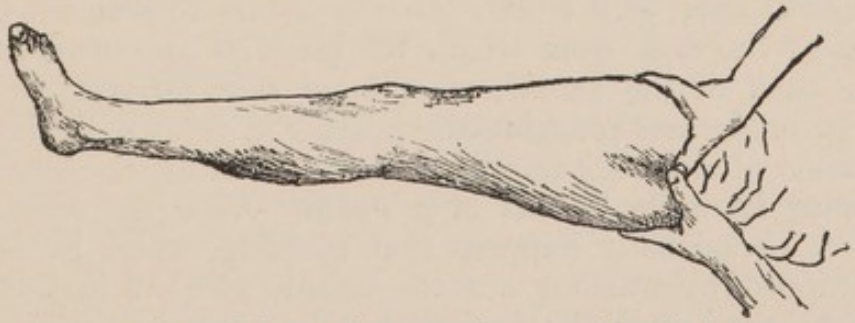


Fig. 117.—Compression of femoral artery by two thumbs (pressure should be applied in middle of groin in line of artery).

An alternative plan is to place a large pad in the space behind the knee-joint and to bandage the leg firmly to the thigh (compare Fig. 116).

13. **From the Sole of the Foot.**—Bleeding from the sole arteries may be arrested by (*a*) a small pad placed just behind the tibia at the inner ankle, and firmly fixed by a triangular bandage; or (*b*) by digital or tourniquet compression of the femoral artery.

Vomiting and Spitting of Blood.—Though bleeding from the lungs —spitting of blood or hæmoptysis—and bleeding from the stomach —vomiting of blood or hæmatemesis—are not usually included in a description of "first aid" in hæmorrhage, it is expedient that the ambulance pupil should be familiar with the following points :— In such cases a medical man should be sent for *at once* with a message as to the exact condition from which the patient is suffering. The patient should be put into bed in a darkened room, and kept very quiet until the arrival of the doctor. If ice can be procured, the patient should be allowed a little of it to suck. On no account should stimulants be given. In ordinary cases internal styptics as gallic and tannic acids, steel drops, turpentine, etc., are employed, and may be got ready for use, but should not be administered without the sanction of the medical attendant. In these cases an important part of the "first aid" treatment is to keep cool, to avoid exciting the patient, who is usually in a very nervous condition, and to have ready for the medical attendant whichever of the above styptics can be procured. The vomited or expectorated blood should not be thrown away, but should be kept for the doctor's inspection.

Bleeding from the Nose.—Bleeding from the nose is often very troublesome. It may be arrested by placing pads of lint soaked in cold or iced water over the root of the nose, or by applying wet compresses or ice bags to the upper part of the neck. If this is not sufficient a firm plug should be placed in each nostril, the patient being kept seated in a chair. A firm plug of lint is very serviceable, or as a substitute a handkerchief may be used, the middle of which is passed into the nose for about an inch by the blunt end of a pencil. Into the pouch of handkerchief so formed cotton wadding is tightly packed with the pencil end. A medical man should be summoned at once, as it is very often necessary to plug the posterior openings of the nose from which the blood is apt to escape down into the back of the throat, in spite of firm plugging applied in front. In mild cases plugging the nostrils in front with lint soaked in a solution of alum is generally sufficient to arrest the bleeding.

Bleeding from the Socket of a Tooth.—After the extraction of a tooth it occasionally happens that bleeding, which is, as a rule, easily stopped by washing out the mouth with warm water, may recur some time after the patient has left the dentist's operating room. The amount of blood that may be lost in such a case is often very considerable, and it is well that the ambulance student should have some idea of how to check it. In cases where the assistance of the dentist or a medical man cannot be got, it is best treated by washing out the mouth with very warm water and by packing securely into the socket of the extracted tooth with a pencil or wooden penholder small pledgets of cotton wadding which have been previously rubbed in dried alum powder or soaked in adrenalin solution. If difficulty is experienced in getting the plug to remain

in position, it may be overcome by making the patient keep the mouth firmly closed, the teeth of the opposing jaw then serving to keep the plug in position.

Bleeding from Hæmorrhoids.—Patients suffering from large internal hæmorrhoids or piles may occasionally, when the bowels are constipated, lose a considerable amount of venous blood. Where the escape is considerable it may, till the arrival of a medical man, be treated by washing the parts with very warm water, and by applying on a piece of lint a little of the gall and opium ointment which patients suffering from this condition generally have at hand.

Bleeding from the Ears.—Bleeding from the ears is generally a symptom of fracture of the base of the skull. Medical aid should be summoned at once, and the patient kept in a recumbent position with the head raised till the arrival of the surgeon.

Blood in the Urine.—Blood in the urine is generally a sign of disease of the bladder or kidney—*e.g.*, Bright's disease, stone in the bladder, etc.—and is generally a serious condition, requiring immediate surgical treatment.

Hæmophilia.—Certain individuals, happily few in number, inherit a tendency to bleed owing to a deficient power of coagulation of the blood. In these people the slightest touch or knock is apt to be followed by a bruise, and if the patient have even a small artery or vein cut the amount of blood lost may be very considerable indeed, owing to the deficient power of coagulation. A person with this inherited tendency to lose blood is known as a "bleeder," and the condition is called hæmophilia. The condition is fortunately rare, but will explain to the ambulance student those cases which are occasionally met with, where the bleeding from a small cut may be so considerable as even to endanger life, and may require energetic surgical treatment before it can be arrested.

Internal Hæmorrhage.—If a large vessel in the chest or abdomen be cut by a stab wound or burst from internal disease, a large amount of blood may escape into the thoracic or abdominal cavity, while little or none may come to the exterior of the body. The condition can generally be inferred from the appearance of the external wound if the bleeding be due to injury, or from the personal history of the patient if due to disease. The pallor, coldness, and faintness of the patient are all indicative of a serious loss of blood. It is essential that medical aid should be at once summoned. The patient should be laid in bed, or on a sofa, in a darkened room, with the head low, and the treatment described below for collapse from hæmorrhage should be carried out, save that no stimulant of any form should be given without the sanction of a medical man.

Collapse from Hæmorrhage.—When a patient becomes collapsed from the loss of blood, the condition is easily recognised by the faintness and dizziness complained of, by the feeble nature of the

pulse, by general pallor, seen particularly in the face, and by the coldness of the body, and especially of the extremities. The condition may be so pronounced as to produce swooning and insensibility of the patient, and the condition is then known as syncope.

Treatment.—The patient should be laid at once between warm blankets, with the head low. Warm bottles should be packed round him. Alcoholic and diffusible stimulants, like tea and coffee, should be given freely if the patient can swallow, *but only if the hæmorrhage has been satisfactorily arrested, and there is no probability of its re-appearance on reaction setting in.*

CHAPTER VII.

WOUNDS.

SHOCK—VARIETIES OF WOUNDS, INCISED, CONTUSED, PUNCTURED, LACERATED—CHARACTERISTICS AND TREATMENT—THE ANTISEPTIC TREATMENT OF WOUNDS—ANTISEPTIC METHODS—EMERGENCY ANTISEPTICS—ANTISEPTIC TREATMENT IN AMBULANCE CASES—POISONED WOUNDS—THE TRUE POISONED WOUND—STINGS—SNAKE BITES—HORSE BITES—DOG BITES—CAT BITES—TREATMENT.

WOUNDS vary in degree from a mere abrasion of the cuticle or rubbing off of the superficial layer of the skin to severe conditions, when the whole of the structures of a limb may be rent asunder —*e.g.*, in some cases of machinery accident where, if the limb be not pulled entirely off, the muscles, sinews, and bones are torn across, and the upper part of the limb is kept in connection with the lower only by the elastic skin and the tissue immediately underlying it. In cases of severe wounds, particularly in nervous people, a condition is apt to supervene which is known as *shock*. Shock is the name given to a condition where the vitality of a patient is greatly lowered, owing to a sudden and violent impression on some part of his nervous system produced by the injury. This nervous impression acts first upon the heart and may in extreme cases cause death by arrest of the heart's action. Shock also, however, manifests itself by its action on the other organs, and on the tissues generally. Where shock is well marked, the following are some of the prominent signs:—The patient looks collapsed, is helpless, and is unable to move. There is marked pallor of the surface of the body, and particularly of the face. The temperature of the body is much lowered, the patient feels cold, and may shiver. The respiration is feeble and gasping. The pulse is small and irregular, and may even be imperceptible.

Such a condition is apt to be brought about by any serious accident—*e.g.*, a compound fracture, a gun-shot or lacerated wound, or a severe burn.

Treatment of Shock.—The treatment of shock consists in bringing about reaction by the application of heat and the administration of stimulants. This is attained by stimulating the patient, first by ordinary stimulants, as whisky or brandy, and next by warm diffusible stimulants like tea and coffee. Teaspoonful doses of sal-volatile in water are also very useful. The room should be

kept warm. The patient should be placed in bed between blankets, and warm bottles should be freely applied. His head should be kept low.

Wounds may for purposes of description be divided into the following four classes :—

1. Incised or clean cut wounds.
2. Contused or bruised wounds.
3. Punctured or stab wounds.
4. Lacerated or torn wounds.

1. **Incised or Clean Cut Wounds.**—Incised or clean cut wounds are produced by a knife or other sharp cutting instrument, and have cleanly divided edges. The fibres of the tissues involved are cut directly across, and, therefore, the wound gapes (Fig. 118), and in addition tends to bleed considerably, as the vessels have undergone a similar division. An incised wound if clean generally

Fig. 118. Incised wound.

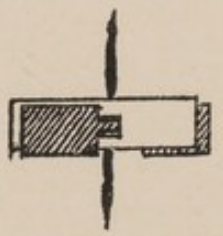


Fig. 119.—Wound, closed by two strips of plaster.

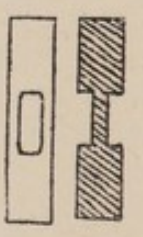


Fig. 120.—Method of cutting strips of plaster.

heals in a few days by " first intention," skin uniting to skin and the other structures in the depth similarly.

Treatment.—After the bleeding has been arrested in the usual way, the wound should be washed and dressed. If the wound gape, the edges may be brought together by strips of adhesive plaster, and best in the method shown in Figs. 119 and 120. To seal the edges of a wound that is not gaping much, Friar's balsam or collodion is sometimes applied. An emergency dressing for an incised wound may be extemporised from a piece of linen soaked in tincture of iodine, turpentine, or whisky, covered with cotton wool, and fixed by a triangular bandage in the " cravat " form.

A special form of incised wound is the **cut-throat wound**, which, from the tenseness of the structures in front of the neck, usually gapes considerably. There is generally a considerable amount of hæmorrhage from cut veins (external and anterior jugular veins), and, not uncommonly, the windpipe is cut across, the patient then breathing through the wound in the neck, the whizz of the out-rushing air being distinctly heard. In some cases the large artery of the neck (carotid artery) is divided, and the patient succumbs from hæmorrhage before help arrives. The treatment of ordinary cases of cut-throat consists in preventing the patient from doing

himself further harm, and to attain this, force may often have to be used. The bleeding, if venous, must be arrested by pressure on the bleeding points in the best way possible. If the windpipe be cut, blood should, as far as possible, be prevented from entering the lungs. Medical aid should be summoned at once, and the patient should on no account be left alone till the arrival of the doctor. If the carotid artery or any of its main branches be cut, pressure should be made on the carotid artery low down in the neck against the transverse processes of the vertebræ on which it lies. This is best done by the thumb, which is pressed deep into the tissues of the neck half an inch to the outside of the windpipe. The opening in the neck through which the patient is breathing should not be closed by a plug or otherwise, but the blood from the edges of the wound should be mopped up and not allowed to trickle into the windpipe. The bleeding is, as a rule, easily arrested by pressure.

2. **Contused** or **Bruised Wounds.**—Contused or bruised wounds are generally produced by blows from a heavy body—*e.g.*, a policeman's baton, or by sudden and severe pressure, as in the case of a horse-bite inflicted through the clothes.

The characteristics of such a wound are pain and swelling, with some amount of bruising or ecchymosis. The bruising is due to the extravasation of blood. The blood is of a dark venous colour, but after a day or two the bluish-black colour begins to fade from the absorption of the blood pigments, usually beginning at the border of the bruise, and gradually passes through different shades of colour—green, yellow, and lemon—back to the normal.

Treatment.—This consists in applying pressure to prevent further swelling by a pad of cotton wadding or linen fixed by a triangular "narrow cloth" bandage, or, better, by a firmly applied "figure-of-eight" roller bandage.

To diminish the swelling and amount of extravasation either tincture of arnica or hazeline may be rubbed gently into the part or applied on compresses of lint.

A special form of contused wound is the **gun-shot wound.** This, if produced by a bullet, will usually show an "entrance wound," small, and with inverted edges, while the "wound of exit" will be larger, and have torn and lacerated edges. If produced by a shot-gun fired close to the body, there will usually be considerable bruising, and a tunnel wound leading into the depth, or if fired further off numerous pellet wounds will be seen.

No gun-shot wound should be interfered with, save for the application of a disinfectant dressing. No attempt should be made to remove the bullet, even though its position be known. The part should be very carefully handled, as it is not uncommon for the bone to be splintered or fractured. Hæmorrhage is to be treated in the usual way. In the case of hæmorrhage from a gun-shot

wound of the chest, the wound should be plugged with an antiseptic plug. A patient with a gun-shot wound usually suffers from the condition known as "shock," already described, and has to be treated accordingly.

3. **Punctured** or **Stab Wounds.**—Punctured or stab wounds differ in degree according to the depth of the puncture and the nature of the weapon producing it. When caused by a needle or small knife-blade, such wounds readily heal, but if produced by teeth or by stabbing with a dagger or bayonet they are much more serious, for three reasons—(*a*) owing to the number and importance of the structures cut; (*b*) the increased risk of severe hæmorrhage; and (*c*) the chance of the decomposition of blood and the infection of other tissues in the depth of a wound imperfectly drained.

Treatment.—Hæmorrhage is to be treated in the usual way. The wound should be carefully washed with some disinfectant solution, and a dressing applied. If the pain be very great a poultice may be applied over an antiseptic dressing.

4. **Lacerated** or **Torn Wounds.**—Lacerated or torn wounds are very common in machinery accidents, are characterised by the lacerated and torn condition of the part, and are accompanied by little or no bleeding, owing to the pulling out of the coats of the vessels. They are commonly found on the hand, in wounds produced by circular or cross-cut saws, and in severe cases the whole limb may be so much torn and pulped by heavy rollers, forked teeth, or cog-wheels of machinery that it is impossible to save the part, and the limb must be amputated. Lacerated wounds are easily recognised by the appearance of the part. They are characterised by little pain, and by only slight hæmorrhage. In severe cases the tearing of the vessels may be so great that no hæmorrhage takes place at all. Indeed the arm may be torn off and only a few drops of blood lost. Lacerated wounds generally heal by "second intention" or ulceration, an ulcer being formed and the skin growing inwards from the edges. This process takes some weeks, and is generally attended with a fair amount of discharge from the wound of the nature of pus or matter.

Treatment.—A lacerated wound should be carefully washed and dressed, and the part rested.

Antiseptic Treatment of Wounds.—In pre-antiseptic days wounds were either left open to the air or very imperfectly dressed, with the result that putrefaction generally set in, and the wound did not heal. By very careful examination and experiment it was found that the cause of this putrefaction in wounds lay in the air, and that if the air were excluded from the wound much better results in healing were obtained. This putrefaction in a wound is known as sepsis, and a putrefying wound is known technically as a septic one. The antiseptic treatment of wounds has as its essential characteristic the management of wounds in such a way

as to prevent this septicity or putrefaction taking place. The air itself is, however, not the cause of the mischief. In the air float minute particles, which, when examined, are found to be living organisms capable of multiplying. These organisms are known as **germs.** By their multiplication and growth in a wound they produce fermentation, just as yeast cells growing and multiplying produce fermentation in a sugary liquid; and the result of the fermentation so produced is the formation of putrefactive or poisonous matters, which gain access to the blood and cause the condition known as blood-poisoning. Pasteur and Lord Lister were the first to show the importance of these organisms in relation to the treatment of wounds, and since their great discovery much light has been thrown on the subject by microscopic investigation and experimental research. A large number of organisms have now been isolated and proved to be the cause of special diseases—*e.g.*, erysipelas, cholera, diphtheria, etc.

The antiseptic treatment of wounds has, since its original introduction, undergone, at the hands of the late Lord Lister and others, considerable change. It is now known that the special germs which cause such fatal infective wound disorders as blood-poisoning, erysipelas, etc., can be readily killed (even if present in large numbers in a wound) by special substances, which are known as **antiseptics.** The antiseptic first recommended, and the one that has held its own ever since its introduction, is carbolic acid. It is one of the antiseptics that will be found most serviceable for ambulance work, for a foul wound can be rendered pure by washing with strong carbolic acid solution. A solution of 1 part of carbolic acid in 40 parts of water, which is a safe strength for the ambulance pupil to employ, can be readily made by mixing half a wine glassful of liquid carbolic acid with a pint of water. It is advisable not only to wash the surface and depth of the wound with carbolic water, but also to thoroughly disinfect the skin for some distance round the wound with the antiseptic solution. Carbolic acid, if used in strong solution and in large quantity, is absorbed into the blood and produces a poisonous effect. Other acids, such as boric and salicylic, have been used for the same purpose, and though less powerful are also less poisonous. Probably the favourite antiseptic at the present time is iodine, which may be used superficially as the ordinary tincture of iodine or diluted with an equal bulk of water for a lotion. Another most powerful and reliable antiseptic is mercury in the form either of corrosive sublimate or biniodide of mercury, which may be used for emergency purposes in the form of a solution of 1 part of the sublimate in 2,000 parts of water. The best method of using corrosive sublimate is in the form of the soloids or small compressed tablets of this substance as prepared by Messrs. Burroughs, Wellcome & Company, Snowhill Buildings, London. One of these soloids dissolved in a pint of water gives

a solution of the strength of 1 in 1,000. For large manufactories in which accidents are common, or for the purpose of taking abroad, no more reliable or easily portable form of antiseptic store can be found than a small bottle of Messrs. Burroughs, Wellcome & Co.'s corrosive or biniodide soloids.

For hospitals, railway depôts, ambulance waggons, surgeries, police stations, and other places where attention to accidents is

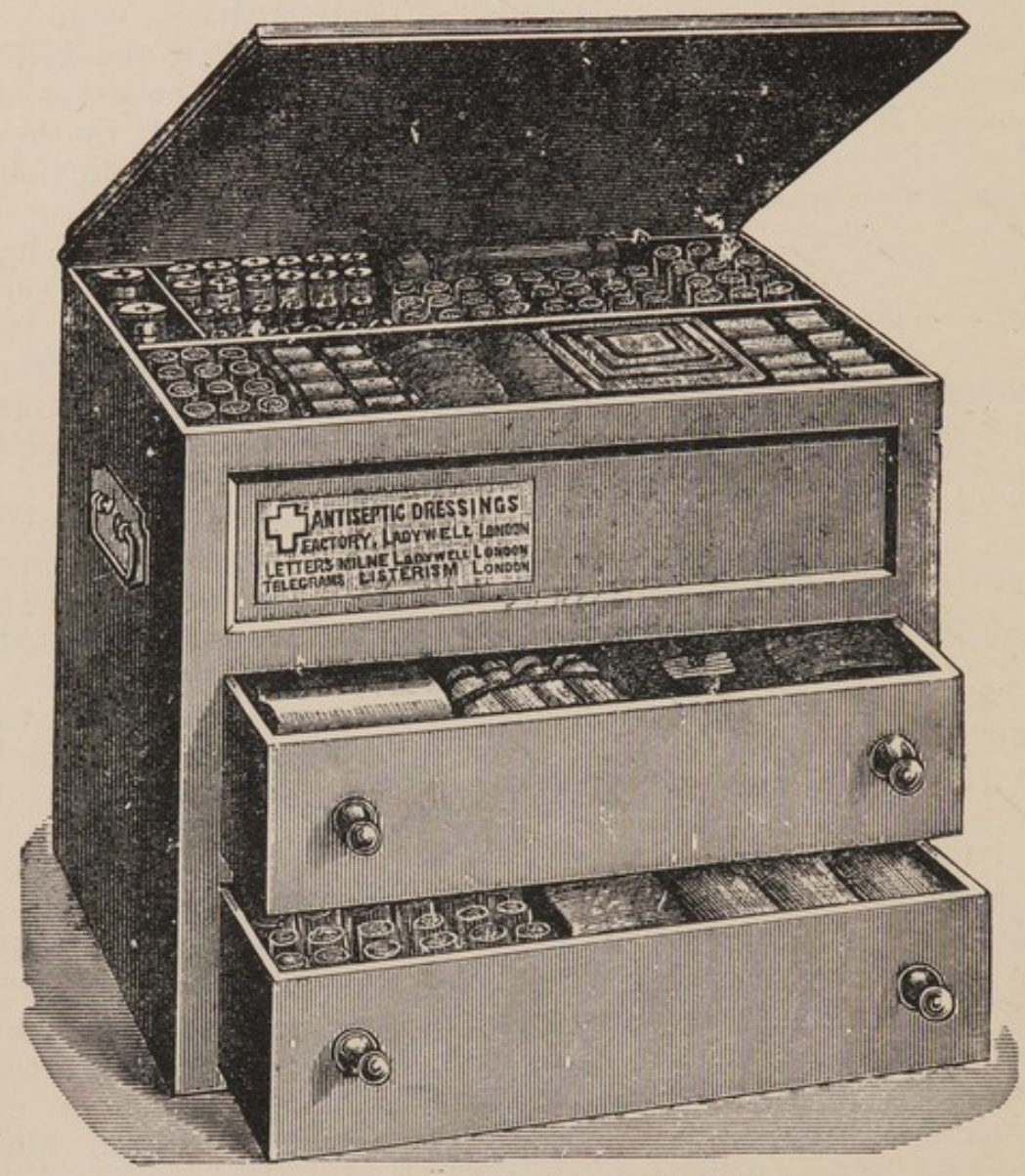


Fig. 121.—Milne's ambulance stock box.

frequently required, Mr. John Milne, of the Antiseptic Dressing Factory, Ladywell, London, has prepared an ambulance stock box (Fig. 121), containing a variety of dressings of antiseptic gauze, with wool, lint, plaster, sponges, catgut sutures, and all necessaries for the immediate treatment of accident cases. It is made in three sizes, sufficient for the dressing of 300, 100, and 30 cases respectively. The small size costs only £5. The St. John Ambulance

Association also supplies, at a very reasonable rate, "First Aid" Chests and Ambulance Hampers containing all requisites.

Emergency Antiseptics.—For ambulance purposes, where carbolic acid and corrosive sublimate may not readily be procurable, some of the following emergency antiseptics may be employed :—

1. *Alcohol.*—This may be used in the form of whisky with an equal bulk of water ; or in the form of methylated spirits similarly diluted.

2. *Turpentine.*—This is a most reliable antiseptic, and with it the *surface* of a wound may be washed. It is particularly useful for disinfecting the skin round a wound.

3. *Acetic acid* in the form of vinegar may be used either pure or diluted with an equal bulk of warm water.

4. *Condy's fluid,* or a solution of permanganate of potash, may be used in the strength of two table-spoonfuls to a pint of warm water—that is, in sufficient quantity to make the water of a dark violet colour. Crystals of permanganate of potash may be used instead of Condy's fluid. The permanganate salt may also be had in a very handy form in the shape of pellets, similar to Messrs. Burroughs, Wellcome & Co.'s mercuric soloids.

5. *Common salt* may be used as a solution, a dessert-spoonful of salt being added to a tumbler of warm water.

6. *Tincture of iodine* may be applied directly to a wound ; if it is to be used as a lotion it should be diluted with an equal bulk of water.

Antiseptic Treatment in Ambulance Cases.—It is of great importance that the ambulance student approach the treatment, not only of severe injuries like compound fractures, but also of small and seemingly unimportant wounds, with a due sense of the danger to the patient, which may be caused by insufficient care during the first-aid treatment of the injury. It should be remembered that even such a small thing as the prick of a dirty needle may in a debilitated patient cause a large abscess, and subsequently blood-poisoning. No boil or blister, however innocent looking, should be punctured with an unclean needle or pin, as this is too often the starting point of severe wounds. One should not be content with simply washing the wound with a disinfectant. One must also see that one's hands are clean before applying lotion to a wound, and also that suitable precautions are taken by proper dressings to prevent the entrance of organisms to a wound which has so far been rendered pure by antiseptic washing. The trained ambulance pupil should, if possible, and it will be so in a certain proportion of wound cases, wash his hands well with warm water and soap, and rub them with turpentine, or rinse them in a carbolic solution (1 to 40) before attending to the wound. He should then select, for applying the lotion, a piece of clean absorbent or cotton wool, or a clean handkerchief. An absolutely new sponge may

also be used with safety, but *a sponge that has been in use for household purposes should on no account be employed to wash the wound.* The mops or sponges should, if possible, be *boiled* in water before using. The wound being thoroughly washed with the best antiseptic at hand,

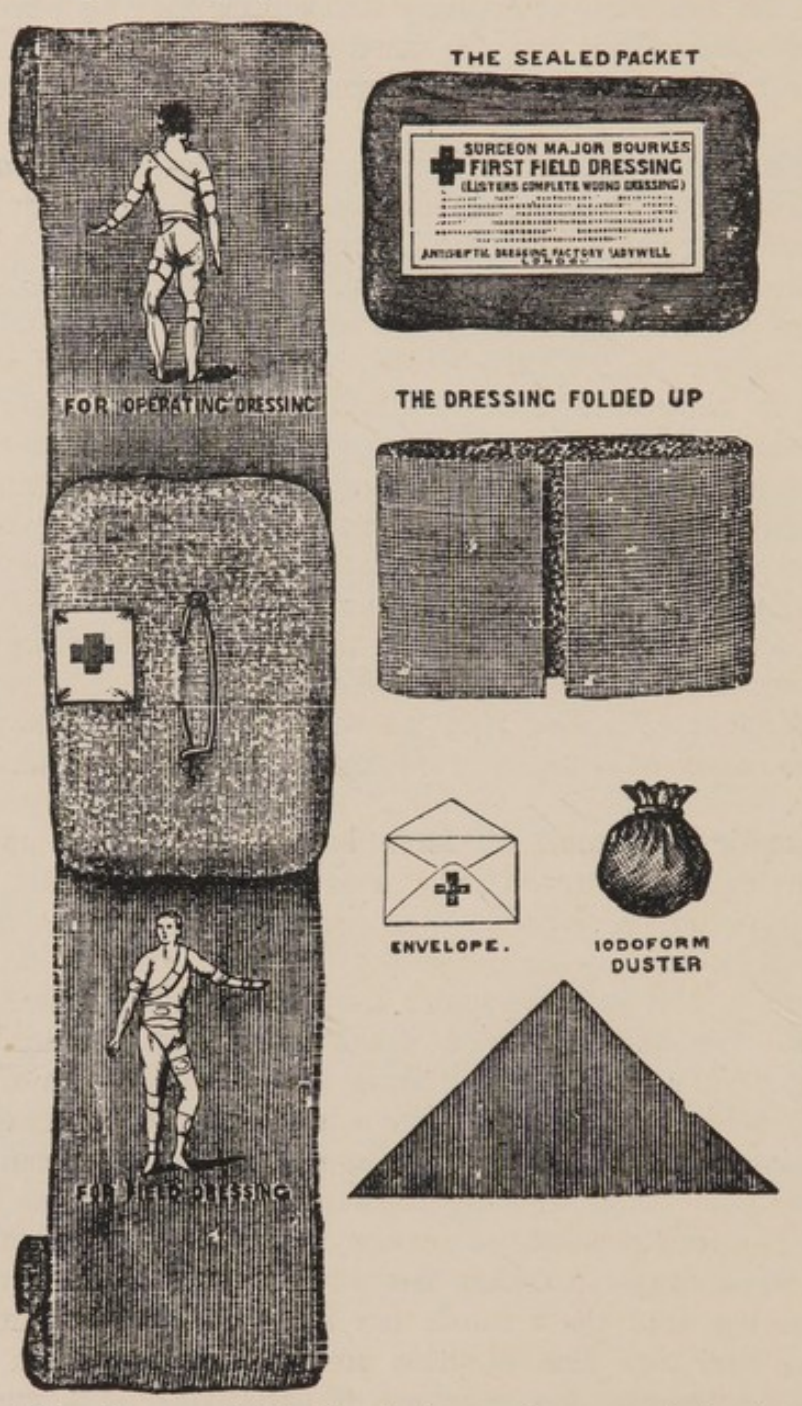


Fig. 122.—Surgeon-Major Bourke's complete wound dressing.

a pledget of cotton wool, soaked in a disinfectant solution, should then be left over the wound until a suitable dressing can be prepared. Suitable emergency antiseptic dressings may be made from boric lint, or ordinary lint soaked in a 1 to 40 solution of carbolic acid or in tincture of iodine, and applied over and fixed to the wound by a triangular bandage. Masses of cotton wadding soaked in the

solution may be applied over the lint, or directly to the wound if no lint be procurable. In place of cotton wadding, clean handkerchiefs similarly soaked may be used. Carbolised tow is also of great service in a case of street accident. In a large town most of the dressings mentioned above may be procured at very short notice, and can readily be applied if the patient be taken for first-aid treatment, as frequently happens, to a chemist's shop. In the country, or where none of the above dressings can be readily got, a clean handkerchief, piece of linen, or mass of cotton wool, previously boiled, if possible, and then soaked in whisky, turpentine, or tincture of iodine, will serve admirably as an antiseptic dressing, and may be relied on to serve its purpose till the patient can be seen and properly attended to by a medical man.

Reference may here be made to a complete wound dressing (Fig. 122) proposed by Surgeon-Major Bourke, A.M.S. It is a first dressing, which is simple, light, and complete in its requirements, and can be used, not only in surgical practice, but also with equal success in first-aid cases. It consists of layers of Alembroth wool enclosed in Alembroth gauze, forming a pad 5 inches long and $3\frac{1}{2}$ inches wide. To this an Alembroth bandage about $1\frac{1}{2}$ yards long is attached about its centre, and forms with the gauzed wool a pocket, in which is placed a small bag of iodoform. A safety-pin completes the dressing. The whole is enclosed in air-proof parchment, with directions as to use. It is prepared for use on the battlefield, but is of great service, and should be at hand, at railway depôts, surgeries, police stations, collieries, iron foundries, etc.

POISONED WOUNDS.—Poisoned wounds will be best dealt with under the following subdivisions :—

1. The true poisoned wound.
2. Stings.
3. Snake bites.
4. Horse bites.
5. Dog bites and cat bites.

1. The **true poisoned wound,** as exemplified by a wound received at a *post-mortem* examination or by a puncture with a dirty needle, is characterised by the formation of matter in the part, owing to the local irritation of the poison, and by a tendency for the products of decomposition to be absorbed into the system and to cause blood-poisoning. Round such a wound there is great inflammation, reddening of the skin, and swelling. The part is very tender, and causes great uneasiness to the patient. From absorption from the wound the patient is greatly fevered (see Fig. 204, p. 189). Such a wound, as a rule, tends to suppurate or form matter. A very common form of the poisoned wound is a whitlow, where matter is formed in and around the tendon-sheath of a finger or thumb. The lymph-

atics absorb the poison and become inflamed and sore ; the lymphatic glands enlarge and become tender, and frequently an abscess forms in the arm-pit. In addition to the risk of blood-poisoning there is also the chance of erysipelas or other wound disorder attacking the already greatly weakened patient. Erysipelas or "the rose" is a very infectious and dangerous form of wound disorder, and requires isolation of the patient and strict antiseptic treatment of the wound.

Treatment.—Such wounds should be prevented, if possible, by washing at the time of infliction with a strong disinfectant, as described under the antiseptic treatment of wounds. A poisoned wound if actually in progress should be attended to at once, drained of its matter, thoroughly disinfected, antiseptically dressed, and the absorption of poison arrested. It is the greatest possible mistake even for a trained ambulance pupil to attempt treatment of these collections of matter by continued poulticing or by puncturing the part with a needle or pin to "let it out." It should be attended to at once by a medical man. If any foreign body, as a piece of glass, or part of a broken needle, be left in the wound, it should be removed as soon as possible.

2. **Stings.**—A sting from a bee or a wasp is treated by removing the sting, if it can be seen, by washing the wound with a disinfectant solution, and applying a small dressing. The affected part should be rested as far as possible. Where the stinging has taken place over a large surface, and particularly in a small child, stimulants should be given, as shock is likely to supervene.

3. **Snake Bites.**—In snake bites, as in every poisoned bite, the indications for treatment are twofold :—(1) The prevention of the poison from entering the system generally, and (2) the destruction of the poison already in the wound, and, if necessary, of the parts affected by it. The poison is prevented from entering the system by a ligature or tourniquet applied tightly round the limb between the wound and the heart. The constricting band so applied should not be loosened till all risk of absorption of the poison is past, the same precautions, however, being observed in the use of the tourniquet as were mentioned under hæmorrhage—viz., that the tourniquet should not be left on indefinitely, from the risk of mortification owing to the blood supply being cut off, but should be every now and then slackened for a minute or two and then re-applied. The poison in the wound should then be destroyed by washing the part *thoroughly* with a strong antiseptic solution, or, failing that, with one of the emergency disinfectants detailed above—*e.g.*, whisky, turpentine, or strong carbolic acid solution. The wound may, if necessary, be freely scarified with a knife so as to allow the escape of the poisoned blood pent up in the part by the ligature. The wound may also be cauterised in a severe case with a red-hot iron or with nitrate of silver (lunar caustic), if it be at hand. The poison may

very efficaciously be removed by sucking the wound, and this may be done with perfect safety if the operator has no cracks about the lips or tongue, through which absorption might take place. In the case of bites about the chest, neck, or face, where no tourniquet can be applied, sucking, disinfection, and cauterisation are the only means at disposal. In cases of snake bite large doses either of alcohol in the form of whisky or brandy, or of ammonia in the form of sal volatile (a teaspoonful in water frequently repeated) are given internally. Medical aid should be procured as soon as possible.

4. **Horse Bites.**—Horse bites, which are inflicted through the clothes in most cases, are simply contused wounds, and are to be treated as such, but where the skin is torn or the tissues lacerated, the wound should be carefully disinfected and dressed, and the part rested.

5. **Dog Bites.**—Dog bites are to be treated on the same principle as snake bites, and with as great care, lest the animal may have been rabid. It should be remembered that a rabid dog—*i.e.*, one suffering from "rabies" or "rage"—has in his saliva a poison, which, entering the wound at the time of its infliction, tends, after a variable time, to produce in man the disease known as hydrophobia or "fear of water," so called from one of its constant and prominent symptoms. A dog suspected to be rabid should not be destroyed immediately after the accident, but should be chained up and watched, so that it may be ascertained whether it be actually suffering from this disease. Though it is not so common, still it is the case that rabies attacks cats, and that hydrophobia may follow a cat bite. It is well that the ambulance pupil should know the signs by which a rabid dog may be recognised. These will best be gathered from Mr. Youatt's description of the condition in his work on *Canine Madness*. His description is as follows :—

"The disease manifests itself under two forms :—The *furious* form, characterised by augmented activity of the sensorial and locomotive systems, a disposition to bite, and a continued peculiar bark. The animal becomes altered in habits and disposition, has an inclination to lick or carry inedible substances, is restless, and snaps in the air, but is still obedient and attached. Soon there are loss of appetite and the presence of thirst, the mouth and tongue swollen ; the eyes red, dull, and half closed ; the skin of the forehead wrinkled ; the coat rough and staring ; the gait unsteady and staggering ; there is a periodic disposition to bite, the animal in approaching is often quiet and friendly, and then snaps ; latterly, there is paralysis of the extremities ; the breathing and deglutition become affected by spasms ; the external surface irritable, and the sensorial functions increased in activity and perverted ; convulsions may occur. These symptoms are paroxysmal, they remit and intermit, and are often excited by sight, hearing, or touch.

"The *sullen* form is characterised by shyness and depression,

in which there is no disposition to bite and no fear of fluids. The dog appears to be unusually quiet, is melancholy, and has depression of spirits; although he has no fear of water, he does not drink; makes no attempt to bite, and seems haggard and suspicious, avoiding society and refusing food. The breathing is laboured, and the bark is harsh, rough, and altered in tone; the mouth is open from the dropping of the jaw; the tongue protrudes, and the saliva is constantly flowing. The breathing soon becomes more difficult and laborious; there are tremors and vomiting and convulsions."

As in the case of snake bite, there is much less risk to the patient if the bite has been inflicted through his clothing, as the poison may be partially or wholly removed from the fang of the tooth by the clothing. Bites on exposed parts, and particularly on the face, are for this reason most liable to be followed by rabies.

A patient bitten by a dog known to be rabid is to be treated exactly on the same lines and with as great care as one bitten by a venomous snake. If the dog is not absolutely known, but is suspected, to be rabid, the treatment should be as careful as in the first case. Where, however, the dog is known to be quite free of rabies, all that is required is the disinfection of the wound. The first thing to do in every doubtful case is to apply a tourniquet. The wound should then be thoroughly washed with an antiseptic solution, preferably Condy's fluid or tincture of iodine, and dressed. The subsequent treatment is exactly similar to that of snake bite. It is a popular but utterly unfounded belief that if a non-rabid dog bite a person, that person will afterwards develop hydrophobia if the dog itself at any subsequent time become rabid. The destruction of the dog, if compassed only to prevent such an impossible contingency, is quite unwarrantable.

CHAPTER VIII.

INSENSIBILITY AND FITS.

FAINTING — HYSTERIA — APOPLEXY — ALCOHOLIC INTOXICATION — EPILEPSY —CONVULSIONS AND UNCONSCIOUSNESS DUE TO KIDNEY DISEASE— CONCUSSION AND COMPRESSION OF THE BRAIN—SHOCK AND COLLAPSE— SUFFOCATION.

WHEN a person is found lying unconscious, either in the open air or in a public room or bedroom, it is the duty of an ambulance pupil to find out **the cause** of the unconsciousness, and to render the appropriate first aid.

To do this successfully and with confidence, the student must be aware of the conditions which cause insensibility, of the points of difference in their symptoms, and of the immediate treatment. The patient, being insensible, can, of course, give no information as to the cause or nature of his attack, and so the ambulance pupil is absolutely dependent on his own observations of the surroundings and conditions of the patient, and on any information he may be able to obtain from bystanders or friends, for the facts by which he may recognise the special cause of insensibility. Insensibility may be either partial or complete. It is due to the brain being deprived of its natural supply of blood by hæmorrhage or otherwise, to the brain being compressed by injury or the bursting of a blood-vessel inside the skull, or to the action of certain narcotic drugs upon the nervous system. Each of these conditions can be recognised partly from the history of the case, but mainly from the symptoms present. Insensibility is sometimes simulated by beggars and others. These malingerers or pretenders can generally be detected if a careful examination be made. One of the best tests of insensibility is to touch the clear part of the eye with the tip of the finger. This is borne by the insensible patient without any movement of the eyelids or evidence of pain. No malingerer will stand this, but will immediately show signs of consciousness by closing the eyelids or turning away the head on this test being applied. Most of these cases of pretended insensibility can be cured either by giving a stimulant (which is what the patient wants, and which should not be given) or, what is far better, by fairly rough treatment, and, *par excellence*, a cold douche in obstinate cases.

The conditions which give rise to insensibility will best be taken up in the following order :—

I. Fainting (syncope).
II. Hysteria—Hysterical fit.
III. Apoplexy.
IV. Alcoholic intoxication.
V. Epilepsy, or falling sickness.
VI. Opium poisoning.
VII. Convulsions and unconsciousness due to kidney disease.
VIII. Concussion and compression of the brain.
IX. Shock and collapse.
X. Suffocation.

I. **Fainting (Syncope).**—Syncope, fainting, or swooning is due to failure of the heart's action, and to an imperfect supply of pure blood to the brain. Excessive hæmorrhage is a frequent cause of this. It is often due to some disturbing cause, a nasty smell, disgusting sight, and sometimes to the sight of blood. The patient feels giddy and sick, and becomes unconscious for a short time. The face is pale, the pulse imperceptible. Gradually the circulation is restored, and the pulse, colour, and consciousness return.

Treatment.—The principles of treatment are (1) to keep the head low, so as to allow the return of blood to the brain ; and (2) to stimulate the patient, and improve the circulation.

The patient should accordingly be placed with the head on the same level as the rest of the body, all tight clothing about the body and neck should be loosened, and cold water should be sprinkled on the face. Smelling salts (ammonia) or burnt feathers may be held before the nose. As soon as the patient is able to swallow, she (for it is generally a lady that requires ambulance treatment for this condition) should have a glass of water, or a little whisky, brandy, or sal volatile. She should be allowed to lie for some time with the head low, until all feeling of faintness has passed off. If the fainting take place in a crowded lecture-room or church, it may be sufficient to make the patient incline the head till it is on a level with the knees. If this is not at once successful, the patient should be gently led or carried out into the open air.

II. **Hysteria—Hysterical Fit.**—Hysteria is the name given to a morbid mental condition, of which one of the chief signs is the so-called " hysterical fit " or " the vapours."

The patient—generally a nervous young woman—begins to cry and sob without any apparent cause, or to laugh and cry alternately, and in slight cases the " hysterics " may go no further than this. In severe cases there may be slight convulsive attacks, and the patient may appear to be unconscious. The breathing is quickened, the eyelids are closed, the eyelids quiver, but the patient, if closely watched, will be seen to take notice of what is going on around. The hysterical patient, in severe attacks, falls down apparently

unconscious, but unlike the epileptic *never hurts herself.* It should be stated that hysteria is not a mere simulation of disease, but that there is really at the bottom of it a diseased or disordered condition of the patient's nervous system. It is stated above that hysteria generally occurs in nervous and delicate young women, but it is worthy of mention that a similar condition is found in males, and that it is not unknown in boys, and has been found in debilitated and overworked men of middle age. In males the condition is known as hypochondriasis.

Treatment.—The condition is a nervous one, in which the woman has a profound craving for sympathy. She is not, perhaps, in good health, but she wishes to make the most of her ailment, and to get people to notice it. There will generally be found in the room in such cases a number of sympathising lady friends, who should be dismissed after the nature of the fit has been disclosed. The patient should then be treated firmly, and should be led to understand that her true condition is recognised. No sympathy should be extended to her. The more sympathy and attention the patient gets the longer and more severe will the fit be. A little cold water may be thrown on the face, after which the ambulance pupil may leave the room, slamming the door, and letting the patient understand that no further attention will be paid to her. She will speedily recover, but may lapse into another fit if too much notice be taken.

III. **Apoplexy.**—A patient who is suffering from apoplexy or "apoplectic fit," or who, in popular language, has had "a shock

Fig. 123.—Dilated pupil of apoplexy.

Fig. 124. — Normal pupil.

Fig. 125. — Pin-hole pupil of opium poisoning.

Fig. 126.—Dilated pupil of belladonna poisoning.

of paralysis," is rendered unconscious by a disturbance of the circulation within the brain cavity, by the plugging or the "bursting" of a blood-vessel, either on the surface or in the substance of the brain.

Symptoms.—The signs by which an apoplectic seizure may be recognised are the following :—

The face is usually flushed, the breathing is deep, slow, and stertorous, and the face and the whole surface of the body may perspire freely. The patient, who is generally an elderly person, cannot be roused. The eye is insensitive to light and to touch. One side of the body is paralysed and lies helpless. If you lift the paralysed arm or leg it falls back a dead weight. If you pinch, tickle, or prick the palm of the hand or sole of the foot on the paralysed

side it will not be withdrawn, while on the other side it is slowly pulled up.

The body is paralysed on the side opposite to the apoplexy, for if the blood-vessel has burst on the right side of the brain, the left arm and leg will be found insensitive and paralysed. This is due to the crossing of the nerves in the medulla oblongata, those from the right side of the brain passing to the left side of the body. The pupils are unequal; one dilated, the other normal; or one or both pupils may be contracted (see Figs. 123 and 124).

Treatment.—1. Loosen all tight clothing about the neck and chest.

2. Place the patient in bed *with his head raised.* If he has been attacked by this condition in the street, he should be carried home on a stretcher, and the head should be kept *higher* than the feet.

3. Towels wrung out of cold water should be applied to the head and back of the neck, and be changed every three or four minutes.

4. Hot bottles should be applied to the feet, but with the precautions above-mentioned (see p. 60).

5. Medical aid should be at once summoned.

6. No stimulant should be given.

An apoplectic seizure is sometimes simulated by malingerers, but the pupils will be found to be equal, and pain will be felt on pinching the skin of the limbs, the part being speedily withdrawn.

IV. **Alcoholic Intoxication.**—Extreme alcoholic intoxication is very difficult to distinguish from apoplexy. In any case of complete insensibility and helplessness, even where the patient has become unconscious in a public-house, or has the odour of an alcoholic beverage, and where one might actually suspect intoxication, he should not be left to "sleep off" his supposed carouse, but should be carefully watched and cared for till his condition is exactly ascertained. Apoplexy has often been mistaken for alcoholic intoxication, and, most unfortunately, treated by isolation in a prison cell. Policemen are specially to be warned against this error, by which many a dying patient has been treated with the scant ceremony usually meted out by the force to a "drunk."

The pupils in profound alcoholism are generally dilated, and both sides of the body are equally powerless. The patient will wince when the clear part of the eye is touched by the tip of the finger, showing that insensibility is not complete.

Treatment.—In extreme cases of intoxication, where the condition cannot be immediately distinguished from apoplexy, the first-aid treatment for the latter condition should be carried out.

In less serious cases, where there is no reason to suspect anything but intoxication, an emetic may be administered, or the person may be left to "sleep off" the effects of his indulgence. Hot coffee or tea may in either case be given afterwards.

V. **Epilepsy, or Falling Sickness.**—Epilepsy or falling sickness is the name given to a condition due to disease of the brain, and characterised by the frequent recurrence of "epileptic fits," of which "convulsions" and unconsciousness form the most prominent symptoms.

Symptoms of Epilepsy.—An epileptic patient usually has "a warning" that a fit is coming on by a peculiar cold or creeping sensation, by a feeling of numbness, or by profuse sweating. He utters a sharp shrill cry, and falls down unconscious, with the muscles rigid. After two or three seconds the convulsive stage is reached, and the arms and legs are then jerked or twitched violently towards the body. There is also twitching of the eyes and of the muscles of the face, and chattering of the teeth. Foaming at the mouth is usually present, the foam being occasionally streaked with blood, from the tongue being bitten. The convulsive stage lasts for a few minutes, and is followed by a period of partial unconsciousness, which may pass off in a minute or two, or continue for half an hour. A patient after an epileptic fit feels much exhausted, and generally falls into a deep sleep.

Epileptiform convulsions are convulsions very similar to those of epilepsy, and are due, not to disease of the brain, but to temporary irritation of the nervous system. They are frequently found in children during the teething stage from the age of six months to two years, and are due to irritation of the nervous system caused by the eruption of the teeth. "Teething fits" are not to be neglected, and should be attended to as described under epileptic fits, with the addition that the child should be placed in a warm bath. A medical man should be called in at once, as the condition is often a most dangerous one.

Treatment of Epilepsy.—The first-aid treatment consists in preventing the patient from hurting himself during the convulsive stage. This is secured by placing a piece of wood between the teeth to prevent biting of the tongue, and by gently holding the patient to protect the arms and legs from being dashed against furniture, etc., during the convulsions. Tight clothing round the neck should be loosened, and after the fit is over the patient should have beef tea, or warm tea or coffee.

No epileptic workman should be allowed to climb a ladder, or do carpenter or slater work on a roof, lest he be attacked by a fit whilst in a dangerous position. A strong fire-screen should always be in position in the room where an epileptic patient lives, as many horrible burning accidents have happened to epileptics from the want of such a simple precaution.

VI. **Opium Poisoning.**—Opium poisoning is here selected as a typical example, and as the most commonly found form of narcotic poisoning producing insensibility and simulating the conditions above described. Opium poisoning is caused by the eating or

smoking of solid opium, or by its being swallowed in the form of morphia, laudanum (tincture of opium), or chlorodyne. The most prominent symptoms are langour, passing on to drowsiness and complete insensibility. The condition of the pupil, or "black of the eye," is of great assistance in recognising this condition. In opium poisoning the pupil is greatly diminished in size, and looks not larger than a hole made by an ordinary pin in a sheet of paper. It is for this reason known as the "pin-hole" pupil (see Fig. 125). Additional assistance in coming to a decision will be got if the bottle from which the laudanum or chlorodyne has been taken be found and for this the patient's pockets and the room should be carefully searched.

Opium poisoning may sometimes be confused with apoplexy. The distinctive points are the history of the case, and specially the "pin-hole" pupil of opium poisoning. Moreover, in opium poisoning both sides of the body are equally helpless, and the patient is not at first so insensible as not to be able to withdraw the hand or foot when the skin of these parts is pinched or pricked.

Treatment.—The treatment in opium poisoning consists first of all in removing the poison from the stomach before it is absorbed into the system. A stomach pump in the hands of a medical man is the best means to effect this, but much may be done by the administration of emetics, which cause the patient to vomit and to evacuate the poison along with the contents of the stomach. If possible, strong emetics should be procured from the chemist in the form of sulphate of zinc (20 grains), ipecacuanha powder (20 grains), ammonium carbonate (20 grains), or ipecacuanha wine ($\frac{1}{2}$ ounce). The last should be given in teaspoonful doses every five minutes until vomiting occurs. If the special emetics mentioned cannot be speedily procured, or, in any case, till the time of their arrival, one of the following handy emetics may be employed :—

(*a*) Large draughts of warm water.
(*b*) Salt and water, a tablespoonful to the tumblerful.
(*c*) Mustard in water, one teaspoonful to the tumblerful.
(*d*) Tickling the back of the throat (see Chap. XI. on Poisoning).

Having brought about vomiting, one must next prevent, as far as possible, the action of the poison already absorbed. Thus, in the case of strychnine one should restrain the patient, and prevent him injuring himself in the throes of the convulsive seizures. In opium poisoning *the* thing to aim at, at this stage, is to prevent the patient from going to sleep. He should, therefore, not be allowed to lie down, but should be kept continually on the move, supported on either side by attendants, and best by two active policemen. He should further be stimulated if necessary by throwing cold water over his head and chest, and by flogging him on the back,

arms, and hands with wet towels. During the intervals of this active treatment, strong coffee should be given.

VII. **Convulsions and Unconsciousness due to Kidney Disease.**—Convulsions and unconsciousness may come on suddenly in the course of Bright's disease—an affection in which the kidneys are inflamed. Unconsciousness resulting from this cause is known as uræmic coma, from the fact that it is due to a poisonous substance known as "urea," which is in health excreted by the kidneys, but which the diseased kidney has not power to get rid of, and which, therefore, accumulates in the blood and affects the brain (1) by causing excitement to the nervous system, as is shown by the convulsions; or (2) by depressing the nervous system and causing stupor.

Treatment.—A patient known to be suffering from kidney disease suddenly becoming unconscious should be placed in bed between warm blankets, with hot bottles packed round him to encourage sweating. Medical aid should be got as soon as possible.

VIII. **Concussion and Compression of the Brain.**—Concussion of the brain is caused by a severe blow or fall on the skull, and the prominent sign is that the patient is "stunned," and unconscious. The insensibility may pass off in a few minutes, but in severe cases will continue, and may prove fatal. In compression the brain is pressed on by effused blood or by a piece of bone driven in upon it, as in the condition already described as "depressed fracture" of the skull. The signs are, in addition to the history of the accident, a gradually deepening unconsciousness, inequality of the pupils, deep stertorous breathing, and loss of power in the limbs. The symptoms, in short, are very similar to those already described under "fracture of the base of the skull" (see p. 60).

Treatment.—The treatment is similar to that of basal fracture of the skull, and consists in :—

(*a*) Keeping the patient in bed, with the head raised.
(*b*) Application of cold to the head by towels wrung out of cold water, and changed every few minutes.
(*c*) Loosening all tight clothing about the head, chest, and abdomen.
(*d*) Application of warmth to the feet in the shape of hot bottles well covered with flannel to prevent burning in an insensible patient.
(*e*) *Stimulants should not be administered.*

IX. **Shock and Collapse.**—The history of a severe wound or burn in the one, or of severe hæmorrhage in the other, will help one to recognise insensibility as due either to shock or collapse. The special symptoms and treatment of these conditions are detailed under shock and collapse, to which the student is referred (*vide* pp. 79 and 81).

X. **Suffocation.**—Insensibility is a symptom of suffocation from choking, or from the inhalation of poisonous gases or chloroform. For the symptoms and treatment of this condition the reader is referred to the chapter on Suffocation (Chap. X.).

CHAPTER IX.

ASPHYXIA AND DROWNING.

DROWNING—PHENOMENA OF DROWNING—TREATMENT OF THE APPARENTLY DROWNED — ARTIFICIAL RESPIRATION — SYLVESTER'S METHOD — DR. MARSHALL HALL'S METHOD—DR. HOWARD'S METHOD—PROFESSOR SCHÄFER'S METHOD—ARTIFICIAL RESPIRATION IN YOUNG CHILDREN—THE LABORDE SYSTEM.

ASPHYXIA or suffocation is the name given to the condition which is brought about when respiration is seriously interfered with or stopped. It may be caused by pressure on, or blocking of, the air passages, as in strangulation, drowning, and choking; or by the inhalation of poisonous gases instead of pure atmospheric air, as in poisoning by coal gas. In asphyxia there is a congestion of venous blood on the right side of the heart.

Drowning.—Drowning is the most common form of asphyxia, and is caused by obstruction of respiration from immersion in water, by the water covering and entering the mouth, nostrils, and air-passages, and preventing air being drawn in.

Phenomena.—The person may sink and rise to the surface a few times, drawing fresh breaths every time that his head is above water. Inspiratory efforts are ultimately made under water, with the result that water is sucked partly into the stomach and partly into the lungs, and with the water are carried foreign bodies floating in it, such as straws, particles of sand, etc. The water at length fills up the bronchial tubes completely, and from consequent inability to draw in air the person becomes asphyxiated. The face becomes swollen and livid from the congestion of venous blood on the right side of the heart. There is ultimately a convulsive stretching of the whole body and respiration ceases.

As the word "asphyxia" means "pulselessness," it is worthy of notice that in that sense it is not a correct name for the condition produced in drowning, *as the heart goes on beating to the last, and in fact for some seconds after the complete stoppage of respiration.* It is on this fact that the first-aid treatment of drowning depends for its efficacy. It should be remembered that the heart will go on beating for at least four minutes after submersion. Cases are recorded in which persons have been resuscitated after five minutes' total submersion, but, as a rule, great difficulty is experienced in bringing round a person who has been two minutes *under water.*

This, of course, does not refer to the actual time in the water, as a person may be fifteen minutes in the water and the heart be still beating, if during part of the time the person has been floating on the surface owing to buoyancy of the clothes, or to a partially successful attempt at treading water or swimming. No treatment will be of any value if the heart has stopped beating, but it is often difficult in such cases even with a stethoscope and a trained ear to decide that the muscle of the heart has ceased contracting, and that the circulation of the blood has absolutely stopped.

Treatment of the Apparently Drowned.—This divides itself into three parts, and should be carried out in the order indicated below :—

1. The removal of the sources of obstruction to the breathing.
2. The re-establishment of the respiratory movement by artificial respiration.
3. The promotion of circulation and warmth.

1. *The Removal of the Sources of Obstruction to the Breathing.*—This is secured by attending to the following three points :—

(*a*) The removal of water from the air passages by tilting the head backwards, or by turning the patient on his face for a second or two.

(*b*) The removal from the mouth and throat of mud, straws, or other foreign bodies by a handkerchief or finger.

(*c*) The pulling forward and fixing of the tongue. The patient being insensible, the tongue falls backwards, and allows the epiglottis or cartilaginous valve which is attached to it to close down over the entrance to the larynx, and so to prevent respiration.

The tongue should be kept forward by any of the three methods now to be detailed :—

(1) After the tongue is pulled forward it may be retained in position by an elastic band passed over it and fixed under the jaw.

(2) A piece of string may be tied over the tongue and under the lower jaw.

(3) The lower jaw may be pressed forward by a thumb placed behind its angle. The tongue being attached to the jaw will be carried forward by the forward movement of the jaw.

The measures detailed above should be very quickly carried out, and no time should be wasted before beginning the second and essential part of the treatment—viz., artificial respiration. Spectators should not be allowed to crowd round the person lest they obstruct the free passage of air, or hamper the movements of the operator and his assistants. The second and most important part of the treatment—viz., the re-establishment of the respiratory movements—should then be begun.

2. *The Re-establishment of the Respiratory Movements by Artificial Respiration.*—Artificial respiration aims at copying the inspir-

atory and expiratory movements of respiration, by pulling air into the chest and expelling it at regular intervals, and at the same rate as obtains in health.

The average rate of breathing in an adult is about seventeen times per minute, or, roughly speaking, every four seconds. The inspiratory and expiratory phases, then, of a single respiration, take each about two seconds to run their course.

There are different methods of performing artificial respiration. One of the best known and most reliable methods, and one which every ambulance pupil should learn and practise is the method introduced in 1857 by Dr. Henry Sylvester.

Sylvester's Method of Artificial Respiration.—Having cleared the air-passages and taken steps to prevent the falling back of the

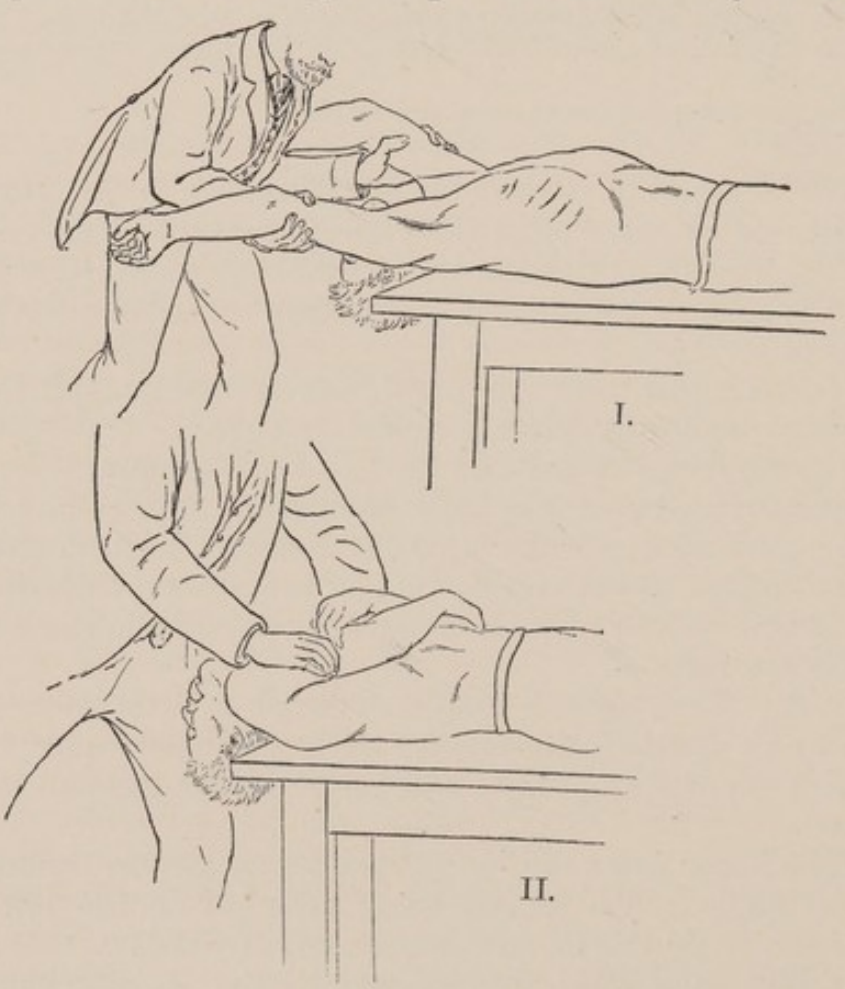


Fig. 127.—Sylvester's method of artificial respiration. I. Inspiration. II. Expiration.

tongue, the ambulance pupil places himself at the patient's head, in the position shown in Fig. 127. As quickly as possible he loosens all tight clothing about the neck, chest, or abdomen of the patient, unfastening braces, waist band, or corset, and slitting up, if necessary, as time is precious, the tight parts of clothing with a pen-knife. He then begins to imitate the natural respiratory movements in the

following way :—Inspiration is copied by drawing the patient's arms up above his head, as shown in Fig. 127. The drawing up of the arms pulls upon the ribs and produces a vacuum in the chest, into which air is sucked. The expiratory phase is copied by pressing down the patient's arms, and particularly the elbows, firmly against the ribs. This lateral compression of the chest tends to force out the air lying in the air sacs and bronchi. These artificial inspiratory and expiratory movements have to be conducted alternately at the proper rate and in correct ratio. To carry out Sylvester's method of respiration properly, the plan of procedure is as follows :—The arms should be grasped at the elbows and drawn slowly upwards till they occupy the position shown in Fig. 127. The operator should then slowly count "one," "two," and then bring the arms down smartly to the patient's sides, pressing them firmly against the chest wall, so as to compress the thorax laterally. No undue force must be employed, as it is possible by rough handling to fracture the ribs. Again, allowing an interval by counting slowly, "one," "two," he should repeat the first movement, and so on. The object of counting is to give one some idea of the proper speed, because in rendering first aid in such a case the person doing artificial respiration is apt to become excited, and to pump away at the patient's chest at the rate of thirty or forty times a minute, instead of imitating the natural rate of breathing, which is approximately fifteen times per minute. Artificial respiration has often to be continued for a considerable time—even an hour or more—before natural breathing is re-established. It should not be discontinued until it is absolutely certain that the heart has stopped beating. It may be some considerable time before the patient gives the first indication of recovery, which is generally a deep sighing inspiration ; when that has been heard the operator may feel satisfied that his labours will be crowned with success, and he must then endeavour to make the artificial respiration correspond with the natural though feebly established breathing of the patient. The artificial inspiration and expiration should never be allowed to hinder or counteract the natural movements of the chest. It should, when breathing is partially established, exactly correspond with the similar phase of the respiratory act—*i.e.*, compression of the chest should coincide with natural expiration, raising of the arms with natural inspiration. It is recommended also that cold water be dashed on the face and chest, and ammonia salts held to the nose to encourage breathing.

Other methods of artificial respiration have been described. The oldest plan is that of Dr. Marshall Hall, in which expiration is produced by laying the body face downwards over a folded coat or pillow, when the chest will be compressed antero-posteriorly by the weight of the body, and air will be forced out. This may be assisted, if necessary, by pressing with the flat of the hand on the patient's back. The body is then turned on its side, when expansion

will take place, owing to the cessation of the compression, and air will be sucked in and the inspiratory phase of respiration be imitated. The objection to this method, however, is that one side of the chest is alone compressed, and that expansion of the lung can take place only on the upper and non-compressed side. The turning of the body to produce expansion and respiration must, of course, be done slowly, so as to imitate natural breathing. It is a method far inferior to Dr. Sylvester's. Another method recently recommended by Dr. Howard, of New York, less fatiguing than Dr. Sylvester's method and equally reliable, consists in kneeling astride the patient and compressing the chest with a hand on either side. By throwing the operator's weight forwards on the patient's chest-wall, the ribs and breast bone are thrust backwards, and so respiration is produced. The operator then throws himself back into the upright position still kneeling, taking his hands off the chest, thus releasing the chest-wall from pressure and allowing it to expand, and by its expansion to draw air into the chest.

Professor Schäfer's Method of Artificial Respiration.—This is one of the most reliable methods for restoring animation in the apparently drowned. The method is a simple one, and consists in promoting expiration by downward pressure on the lower part of the back and sides of the chest, while inspiration is produced by relaxation of the downward pressure. For the best description of his technique, Professor Schäfer referred me to the instructions issued to the Metropolitan Police by the late Mr. Clinton T. Dent, F.R.C.S., who kindly gave me permission to use the illustrations given in the text.

Instructions.—Immediately after removal from the water, lay the patient face downwards with the arms extended and the face turned to the side. Kneel astride the patient (Fig. 128), or kneel on one side of the patient (Fig. 129).

Place the hands on the small of the patient's back, one on each side, with the thumbs parallel and nearly touching (Figs. 128 and 129).

Bend forward with the arms straight, so as to allow the weight of the operator's body to fall on the wrists, and thus make a steady, firm, downward pressure on the lower part of the back (the loins), as shown in Figs. 128 and 129. (This part of the operation should occupy the time necessary to count, slowly—*one, two, three.*)

Immediately after making the downward pressure, swing the body backwards, so as to relax the pressure, but without lifting the hands from the patient's body (Figs. 130 and 131). (This part of the operation should occupy the time necessary to count, slowly —*one, two.*)

Repeat the forward and backward movements (that is, the pressure and the relaxation of pressure) without any marked pause

[*To face p.* 104.

Fig. 128.—Schäfer's method of artificial respiration. Expiratory phase (operator kneeling astride patient).

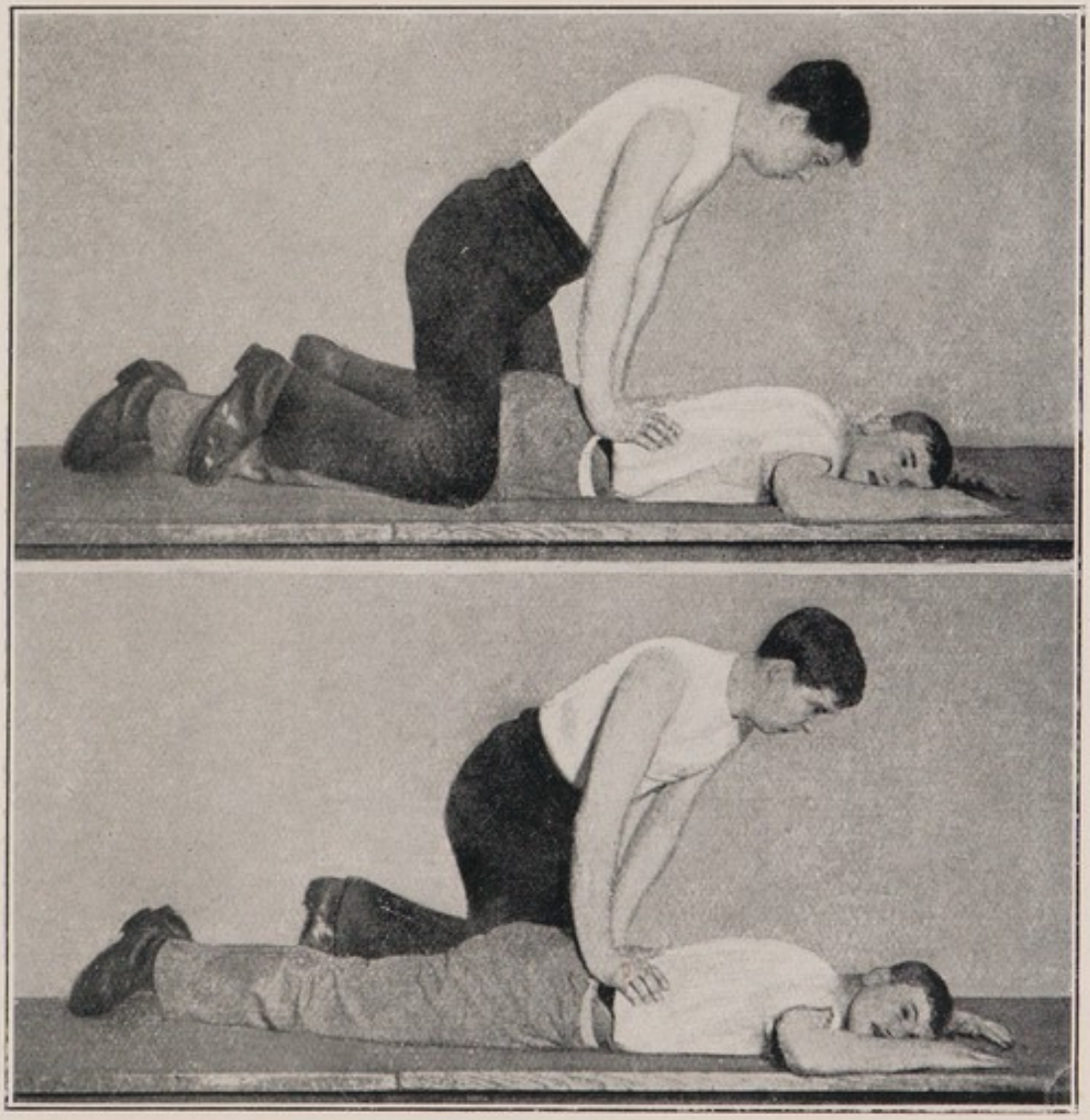


Fig. 129.—Schäfer's method of artificial respiration. Expiratory phase (operator kneeling at one side of patient).

[*To face p.* 104.

Fig. 130.—Schäfer's method of artificial respiration. Inspiratory phase (operator kneeling astride patient).

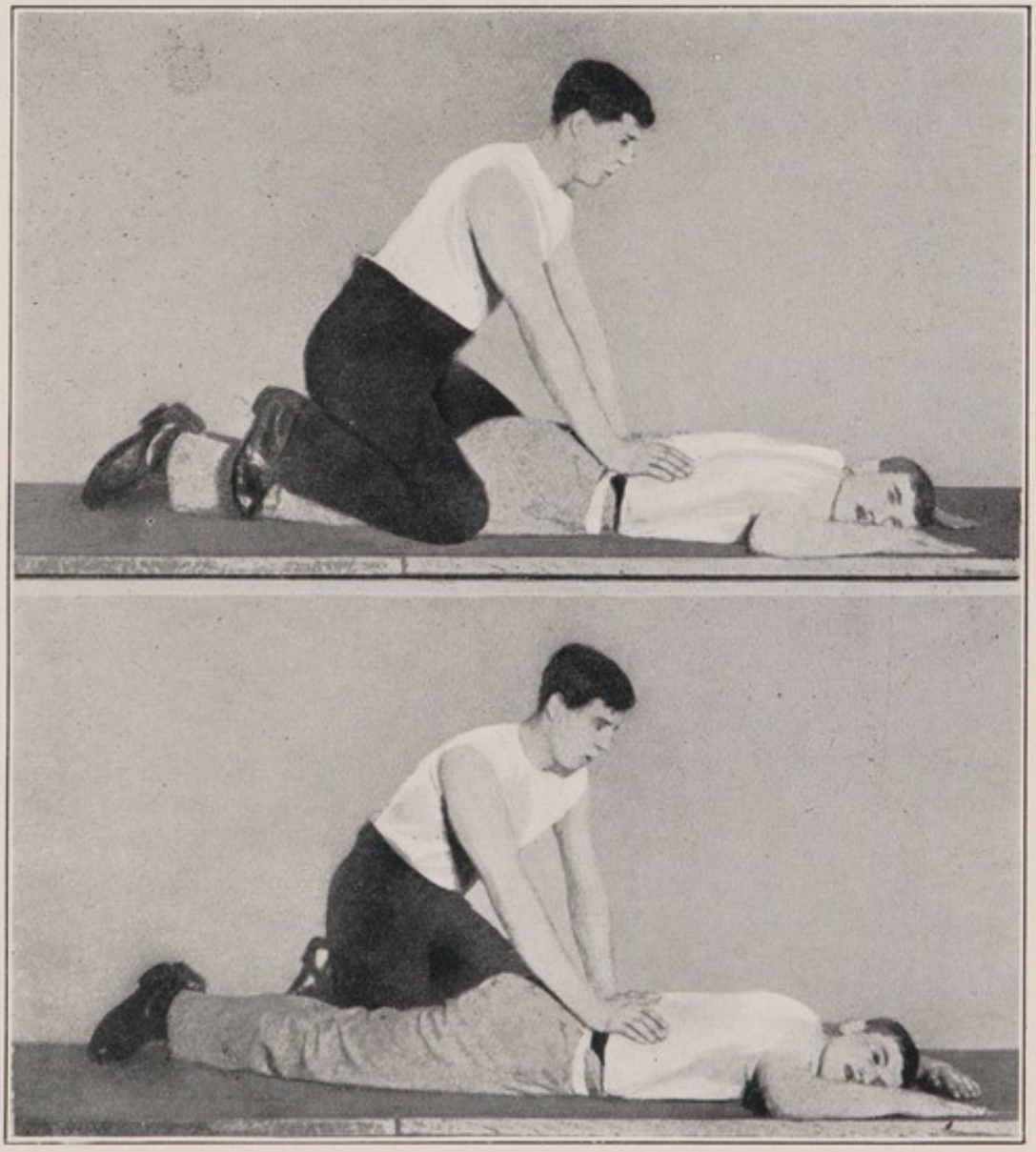


Fig. 131.—Schäfer's method of artificial respiration. Inspiratory phase (operator kneeling at one side of patient).

between the movements. The downward pressure forces the air out of the lungs, and the relaxation of pressure causes the air to be drawn in again.

Continue the movements at the rate of about twelve per minute until natural respiration has recommenced.

When natural respiration is fairly resumed, cease the artificial movements. Watch the patient closely, and, if natural respiration ceases, repeat the pressure and relaxation of pressure as before.

The movements of artificial respiration should be commenced the moment the patient is removed from the water, and no time should be wasted in removing or loosening clothing.

When natural respiration has commenced, the patient should be allowed to lie in a natural position on one side, and the treatment for the promotion of warmth and circulation may be proceeded with.

The movements of artificial respiration are of the first consequence. If the operator is single-handed, he must attend to these alone until natural breathing is restored. If other assistance is at hand, warm wrung-out flannels, hot bottles, etc., may be applied between the thighs, and to the arm-pits and feet, but the movements of artificial respiration must not be interfered with.

After natural breathing is restored, the wet clothing may be removed, and a dry covering substituted. This must be done without disturbing the patient, who should be allowed to lie quiet, and be watched for at least an hour, and encouraged to sleep.

The patient should not be allowed to go home until certified by a medical man as fit to be removed.

Artificial Respiration in Young Children.—In young children, where the chest-wall is easily compressible, artificial respiration may be very readily and easily carried out by compressing the chest-wall from front to back by a hand placed over the breast-bone and middle area of the chest. Inspiration is produced as in Dr. Howard's or Professor Schäfer's method by releasing the pressure and allowing the chest-wall to spring back into its natural position. If by this means natural respiratory movements are not readily induced, Dr. Sylvester's method should at once be had recourse to. Schultze has recommended that in infants artificial respiration should be carried out by seizing the child by the shoulders and holding it up with its legs dangling in the air. The child is then thrown over so that its head is down and its feet up, and in this way the chest is compressed. It is then tilted over into the first position when the chest expands.

The Laborde system of artificial respiration is also worthy of notice. It can be carried out with less trouble than any of the other methods, and is said in certain cases to be more efficient.

The principle of this method consists in exciting respiratory movements by pulling rhythmically on the tongue. The mouth being cleared, the tongue is seized and is pulled forwards and held for a second in that position, when it is again allowed to slip back into the mouth. These rhythmical tractions on and relaxations of the tongue should be made at the rate of fifteen to twenty times per minute.

Reference may here be made to the excellent work done by the Life Saving Society of Great Britain. The Life Saving Society has, as one of its main objects, the promotion of technical education in life-saving and resuscitation of the apparently drowned. In addition to encouraging the teaching and practice of swimming, it has also prepared, for the instruction of the members of classes conducted under its auspices, a regular *drill* in life saving, artificial respiration, and resuscitation. Different methods of rescuing the drowning are taught, first by "land drill" and then in the water, and the classes are then put through Sylvester's, Marshall Hall's, and Howard's methods of artificial respiration in succession. A handbook of this drill has been issued, and may be had on application to the Secretary of the Life Saving Society, 3 Clarendon Square, London, N.W. The excellent combination of the teaching of the different plans of rescue, along with the methods of resuscitation, accounts in some degree for the splendid results obtained by the Life Saving Society.

3. *The Promotion of Warmth and Circulation.*—This is of importance, and should be attended to as soon as possible during the performance of artificial respiration. The obstructed circulation in the venous system may be assisted by chafing the hands and feet, and by rubbing the arms and legs from below upwards. The work should be entrusted to two or three assistants. As soon as possible warm dry clothing should be procured for the patient. He should be put into bed between warm dry blankets, with hot bottles to his feet and under his arm-pits. Stimulants should now be administered to him ; the best is hot coffee.

The following excerpt from the Aberdeen Police Reports shows what may be done by skilful and timely treatment on the part of an ambulance student. Many similar cases might be cited. Report anent case of immersion at Regent Quay :—

J. F., Sergeant, Aberdeen City Police, states—

About 11.10 p.m., on 4th June, 1891, while on duty on Regent Quay along with Constable T., I was informed that a man had fallen into the water. I at once went to the place, and saw a man, J. F., labourer, residing in V. Street, being pulled out of the water on to the quay. He appeared to be lifeless, and I was informed that he had been five minutes in the water. I turned him on his face at once, pulled out his tongue, and wiped his mouth with my finger. I then took off his coat, folded it into a pad, and turned the man on to his back, placing the coat under his shoulders, and stretched him to full length. I then slackened the clothes about his neck and breast and started artificial

respiration (Dr. Sylvester's method), which I continued for fifteen minutes, when the patient commenced to breathe. I kept it up for a few minutes longer until the breathing became stronger. He was then carried into a shop near by, and his wet clothes taken off, and wrapped up in warm clothes, after which I commenced to rub his limbs upwards to cause circulation. By this time Dr. M. arrived, and stated that everything had been done for the man that could have been done, and that he was out of danger and could be removed to the Police Office, where he was conveyed on a stretcher, and placed in a bed with hot blankets around him, and bottles of hot water placed under his arm-pits and to the soles of his feet. About two hours afterwards he had quite recovered.

CHAPTER X.

SUFFOCATION.

ATTEMPTED HANGING OR STRANGULATION—CHOKING—BLOCKING OF THE LARYNX FROM SWELLING OF ITS MUCOUS MEMBRANE—CAUSES—DIPHTHERIA AND CROUP—SUFFOCATION DUE TO THE INHALATION OF POISONOUS GASES—POISONING BY CARBONIC ACID—POISONING BY CARBONIC OXIDE GAS—POISONING BY THE VAPOUR OF CHLOROFORM—TREATMENT OF SUFFOCATION DUE TO POISONOUS GASES.

SUFFOCATION is caused either by physical means—*e.g.*, pressure on or blocking of the larynx or windpipe, or by the inhalation of poisonous gases instead of pure air. The signs of suffocation caused by physical means are in addition to the history of the case, prominence of the veins of the neck and face, blueness of the face, insensibility, and, occasionally, convulsions. The patient in accidental cases generally complains of a sense of fulness in the head, and of ringing in the ears. Suffocation produced by physical means may be either accidental or suicidal. In cases of hanging or strangulation it is, as it meets the ambulance student, generally a case of attempted suicide.

The most common ways in which suffocation is caused by obstruction to the passage of air into the lungs may be divided, for the sake of description and treatment, under the four following heads :—

1. **Attempted Hanging or Strangulation,** where the obstruction to the passage of air is caused by the pressure of a cord on the windpipe. In attempted hanging the patient will be found suspended by a cord, scarf, or similar material. In strangulation the neck is encircled by a ligature which is causing the asphyxia.

Treatment.—In attempted hanging the patient should be immediately cut down or released by having the cord loosened or cut from the neck. In strangulation the ligature should be similarly released or cut. A free current of air should be allowed to pass over the patient's face ; the window or door of the room should be opened, or the person may be carried into the open air. All tight clothing round the neck should be loosened, as well as the braces and waist band of the patient. Cold water should be dashed over the neck, head, and chest to excite respiration. Failing immediate recovery, artificial respiration should be resorted to at once. As in all cases where artificial respiration has to be performed, no unnecessary crowding of spectators or assistants should be allowed.

2. **Choking.**—Choking is caused by a morsel of food or a foreign body—*e.g.*, a plate of false teeth—accidentally swallowed being sucked into the larynx during respiration, the valve-like epiglottis having failed to shut down properly so as to cut off the air-passages from the mouth during the act of swallowing. The foreign body usually lies partly in the mouth and partly in the larynx.

Treatment.—It should be extracted, if possible, by "clawing" with a finger put far back in the throat beyond the base of the tongue, the finger being protected against biting by a gag or piece of wood placed between the back teeth. The irritation of a finger in the back of the throat may of itself cause vomiting, during which the patient may be relieved. The popular remedy of "thumping the back" is occasionally of service. In cases of complete obstruction, where the foreign body cannot be removed, it is often necessary to open the windpipe by the operation of tracheotomy as the patient's only chance, and for that reason it is advisable that in a case of choking a medical man should be summoned at once, and warned as to the possibility of such an operation being required.

3. **Blocking of the Larynx from Swelling of its Mucous Membrane.**—The mucous membrane of the larynx, either from accident or in disease, is apt to swell and become œdematous, and in severe cases the swelling is so great that the upper part of the voice-box is entirely blocked and the ingress of pure air by inspiration is considerably, if not entirely, checked. This is sometimes found in the disease known as laryngitis or inflammation of the mucous membrane of the larynx, and requires speedy treatment. It will occasionally happen that first aid has to be rendered in such a case pending the arrival of the doctor. The condition is fairly easily recognised by the following signs:—The patient complains of pain in breathing, in speaking, and in swallowing. He is hoarse and cannot speak above a whisper. There is pain on pressing over "Adam's apple," the patient looks pale and anxious, and gradually the difficulty in breathing increases until in severe cases well marked signs of suffocation set in. Till the arrival of a medical man the following measures may be employed:—A sponge wrung out of very warm water should be placed over the larynx, and frequently re-heated and applied lightly. The sponge should be replaced after a little by a mass of heated cotton wool, which is fixed in position by a triangular bandage. The patient should be kept in bed in a room heated to a temperature of 60 to 70 degrees. Inhalations of steam may be given with a regular inhaler (see Fig. 133), or with one extemporised from a jug with a towel folded round its upper part to act as a face piece (see Fig. 132). Water just "off the boil" should be used for the purpose of inhalation, and the patient may inhale the vapour of steam for five minutes at a time. If ipecacuanha wine be at hand, it may be given in four- or five-drop doses every half-hour.

More commonly, however, the ambulance pupil is called to render assistance in cases where the mucous membrane of the larynx has become swollen and inflamed from accidental causes. The most common cause is found in the case of a young child who has sucked the spout of a kettle containing boiling water. This swelling of the larynx is also found in cases of poisoning by corrosive acids or strong alkalies, where it is due to the irritation caused by the charring and burning of the mouth. Blocking of the larynx from these causes is a most serious condition, and requires immediate medical assistance. Whether the cause be the swallowing or the inhalation of irritants, the patient should have a light bran or meal

Fig. 132.—Jug inhaler.

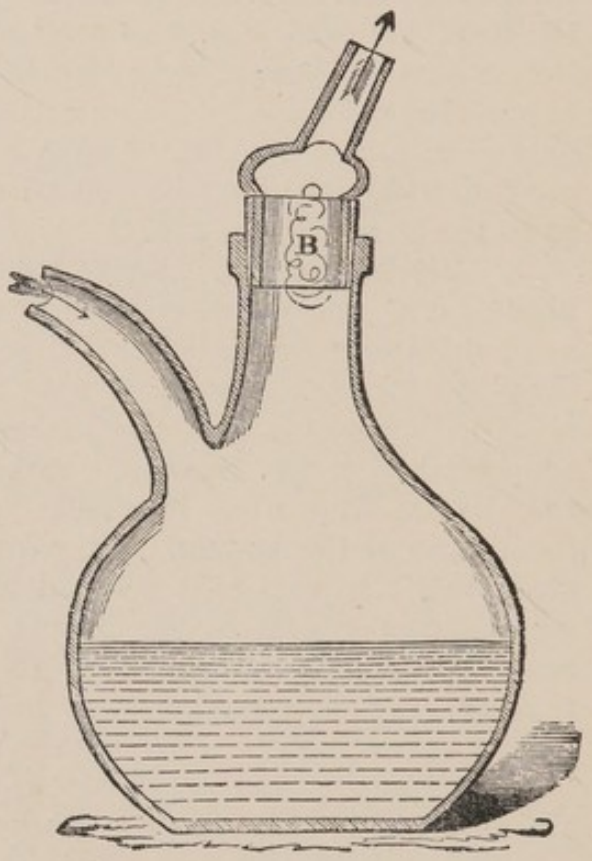


Fig. 133.—Regular inhaler.

poultice, warm compress of wadding, or a sponge wrung out of hot water laid over the larynx. He should be made to gargle the throat with demulcent fluids, as white of egg, milk, salad oil, or olive oil. In such cases symptoms of shock are generally present and require treatment.

4. **Diphtheria and Croup.**—In diphtheria and croup, obstruction to the inspiration of air is caused by a whitish membrane, which is formed by the disease, and which tends to invade the air-passages. In such cases, if symptoms of suffocation show themselves, it is expedient that a message be immediately sent to the medical attendant with a statement of the change in the patient's condition. In severe cases of impending suffocation due to these diseases it is

very often necessary to perform the operation of tracheotomy—*i.e.*, to make an opening in the windpipe below the larynx and to admit air into the lungs through a tube fixed in the wound so made. The doctor, therefore, should be told of the change in the patient's condition so that he may bring with him the necessary instruments for performing this emergency operation. In the country, where the doctor's arrival cannot be expected for some time, relief may be given to the patient by applying over the larynx a warm sponge or dry poultice of bran or heated cotton wool. Inhalations of steam may also be given by the ordinary or the extemporised inhaler, and it is also recommended that a moist atmosphere be maintained in the room in either of the following ways :—

If a bronchitis kettle (see Fig. 134) be at hand it should be arranged

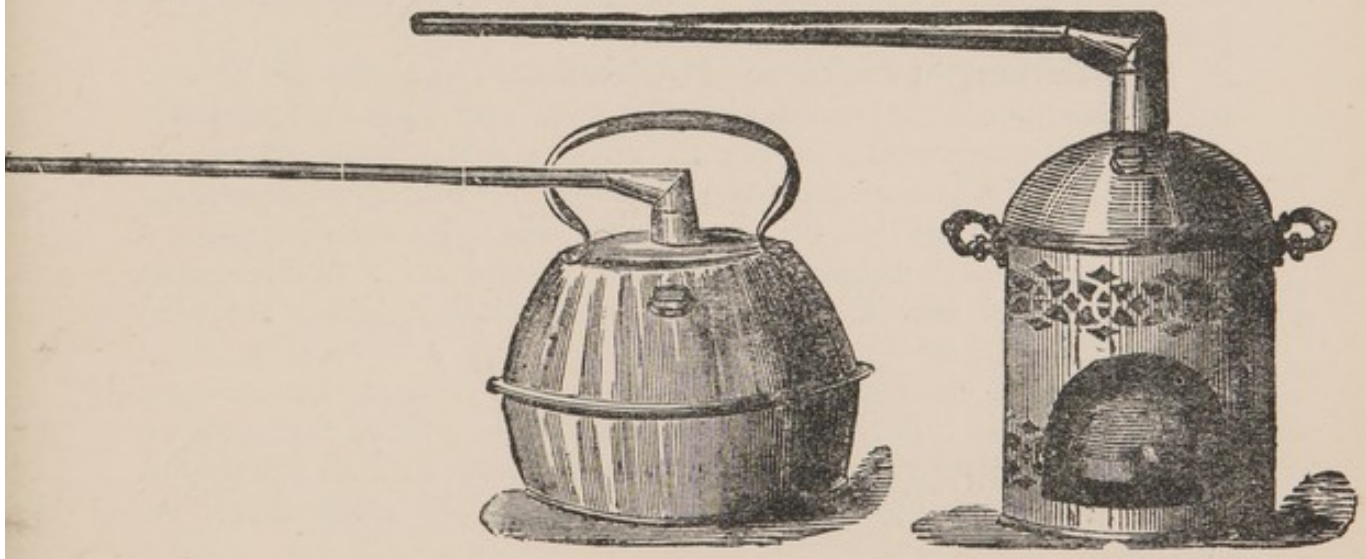


Fig. 134.—Bronchitis kettles.

so as to play steam over the head of the bed. The steam may be kept playing over the patient by arranging a " tent bed " by means of a blanket spread on a clothes'-screen and arranged round the upper end of the bed. A bronchitis kettle may be extemporised from an ordinary kettle which is placed on the fire, the steam from it being conveyed to the patient's bed, which is placed near the fire, by means of a long tube of linoleum or brown paper attached to the spout of the kettle.

SUFFOCATION DUE TO THE INHALATION OF POISONOUS GASES.—The following are the most common accidents under this head :—

(*a*) **Poisoning by Carbonic Acid Gas (CO_2).**—This may occur in an over-crowded, non-ventilated room, in a closed-up underground passage or well, in the gallery of a mine (" choke damp "), or in a room that is on fire. A historical instance of poisoning by carbonic acid gas is to be found in the case of the Black Hole of Calcutta, where, in the year 1756, 146 prisoners were confined for a

night in a room 20 feet square, with the result that 123 of the number died before morning.

(*b*) **Poisoning by Carbonic Oxide Gas (CO).**—Carbonic oxide gas is inhaled most commonly in the form of coal-gas. Coal-gas poisoning is not an uncommon accident, and is generally due to a person accustomed to lamps and not to gas, having blown out the gas on going to bed. Several cases of gas poisoning have come under the writer's notice. Most of these occurred to country people accustomed to the use of paraffin lamps, who had on coming to town used gas for the first time. The blowing out of the lamp flame had become with them so much a matter of routine, that the gas was blown out without a thought of the consequences. Coal-gas poisoning also occurs from leakage from gas pipes, or from the imperfect turning of the stop-cock on a bracket. Coal-gas is occasionally inhaled by suicides.

(*c*) **Poisoning by the Vapour of Chloroform.**—Chloroform poisoning is either accidental or suicidal. In accidental cases it is generally due to the overturning of the chloroform bottle when the grasp of the hand of a person using the inhalation for toothache or asthma becomes relaxed on his becoming insensible. In suicidal cases a large quantity will usually have been poured on a handkerchief or towel placed over the face. The sensational incidents recorded in novels, of persons having been immediately sent to sleep by a drop or two of chloroform on a handkerchief held on the face are quite misleading. It requires, as a rule, two or three teaspoonfuls of chloroform poured on a towel, drop by drop, and an inhalation period of four or five minutes, to put a healthy adult under its influence.

Treatment of Suffocation due to Poisonous Gases.—In all these cases the patient should be immediately withdrawn into the open air from the poisonous atmosphere in which he is lying. The rescue of such a patient is often a matter of extreme difficulty, particularly in the case of suffocation in a room that is on fire. The best means of rescue then is to crawl in on hands and knees, with a handkerchief tied loosely over the nose and mouth, and to keep the face as near as possible to the floor, for that is the place where the pure air will be, the heated air containing poisonous gases being lighter and rising to the roof. Groping in this way till you reach the suffocated person, whose probable position you should have ascertained beforehand, you seize him, and, rising, carry or drag him into the fresh air (see Fireman's Lift, p. 136). In poisoning by coal-gas do *not* light a match to find the suffocated person, but make a rush to the window of the room and pull it up, or smash three or four panes. Thereafter, get the patient at once into the open air. In suffocation by chloroform vapour, pull off the towel or handkerchief and any other clothing soaked with chloroform, and get the person into another room or into the open air.

In all these cases loosen all tight clothing about the neck, chest, and abdomen of the patient. Dash cold water on the head, neck and chest, and if recovery do not take place at once, start artificial respiration, and continue it till the arrival of a medical man. If the patient be insensible, the tongue should be pulled forward and fixed, as in the treatment of the apparently drowned.

CHAPTER XI.

POISONING.

CLASSES OF POISONS—NEUROTIC POISONS—IRRITANT POISONS—KINDS OF NEUROTIC OR NERVE POISONS—I. NARCOTIC POISONS: OPIUM, BELLADONNA, CHLORAL, ETHER, ALCOHOL, PRUSSIC ACID—II. IRRITANT POISONS: (1) ACIDS: SULPHURIC ACID, NITRIC ACID, HYDROCHLORIC ACID, OXALIC ACID, TARTARIC ACID, CARBOLIC ACID—(2) ALKALIES: CAUSTIC SODA, CAUSTIC POTASH, LIME, AMMONIA—SYMPTOMS OF POISONING BY ALKALIES—SYMPTOMS AND TREATMENT OF POISONING BY ACIDS AND ALKALIES—(3) IRRITANTS PROPER: ARSENIC, IODINE, PHOSPHORUS, MERCURY, NITRATE OF SILVER, SUGAR OF LEAD—SYMPTOMS AND TREATMENT OF POISONING BY IRRITANTS PROPER—SPECIAL POISONS.

ON the early recognition of cases of poisoning, and the immediate application of first-aid methods, the success of the after-treatment depends. A general description of the symptoms and treatment of poisoning will be followed by a detailed account of the management of cases of poisoning by some of the more commonly used drugs. For reference in cases of emergency, the treatment is summarised in tabular form on page 119.

There are two great classes of poisons :—

I. Neurotic poisons.
II. Irritant poisons.

Neurotic poisons act on the nervous system either by depressing it, as in opium, or by exciting it, as in strychnine poisoning. Irritant poisons cause a fatal issue, not only by their corrosive or irritant action on the parts with which they come in contact, but also by the shock which they produce. The symptoms of poisoning will vary according to the class of poison used. When there is any doubt as to the identity of the poison in cases of poisoning, whether accidental or suicidal, the ambulance pupil should remember that considerable assistance may be got from the history of the case and his observation of the surroundings. In suicidal cases there will be a history of mental depression and melancholia, or of morbid mental excitement, during which the patient may have threatened to make away with himself. In doubtful cases valuable information will be got from observation of the position of the patient, of the appearance of his mouth and throat, of the condition of his pupils, of the presence or absence of vomiting, and of the nature of the vomit, and of the extent and duration of the unconsciousness. The presence of a bottle of poison beside the patient is also of im-

portance, as also the odour in the room, which, in cases of poisoning by prussic acid or chloroform, is so distinctive as to be absolutely diagnostic of the cause of the patient's condition.

Poisons will be dealt with under the two great classes of **neurotics** and **irritants** :—

I. *NEUROTIC OR NERVE POISONS.*

There are two sub-classes of neurotic poisons :—

1 **Narcotic Poisons**—*e.g.*, Opium.—These are also known as cerebral poisons because they act on the brain.

2. **Convulsants**—*e.g.*, Strychnine.—These are also called spinal poisons because they act on the spinal cord, and the most prominent symptom of their action is the presence of convulsions.

1. NARCOTICS.—The prominent symptom is langour, passing on to drowsiness and complete insensibility. A marked sign of narcotic poisoning is the condition of the pupil or "black of the eye," which in poisoning by opium is greatly diminished in size, and looks in severe cases no larger than a pinhead. This is known as the "pinhole pupil," and is one of the chief signs of poisoning by opium or one of its preparations (see Fig. 135). In poisoning by belladonna, on the other hand, the pupil is very much enlarged (see Fig. 136).

Fig. 135.—Pinhole opium pupil.

Fig. 136.—Dilated belladonna pupil.

The narcotics which chiefly claim attention are :—

(*a*) **Opium.**—Opium may be taken by the mouth in the form of solid opium, morphia, laudanum (tincture of opium), or chlorodyne, or hypodermically by an injection of morphia. In the statistics of suicidal poisoning, opium heads the list as the poison most commonly used. It is worthy of note that a very small dose of opium may be fatal to infants and young children, and cases are recorded where two drops of laudanum administered to a baby have caused a fatal result. The common practice of giving narcotics to fretful children to make them sleep is a very dangerous one, and cannot be too strongly deprecated.

(*b*) **Belladonna** (*Deadly Nightshade*) taken in the form of belladonna berries, or as tincture or liniment of belladonna.

(*c*) **Chloral,** taken in the form of the salt (chloral hydrate), or as syrup of chloral.

(*d*) **Ether** and **alcohol,** in excessive doses.

(*e*) **Prussic acid.**

2. CONVULSANTS.—Convulsants first excite the nervous system (causing convulsions), and finally depress it. In addition to convulsions, lock-jaw is occasionally present. The most commonly used convulsant is strychnine taken either in the form of the powder, or liquor of strychnine, or as nux vomica beans or powder.

Treatment of Poisoning by Neurotics.—The first and most important part of the treatment consists in the removal of the poison from the patient's stomach before it is wholly absorbed into the circulatory system. This must be followed by an attempt to counteract by " antidotes " or otherwise, as far as possible, the poison which has been absorbed.

Removal of the Poison from the Stomach.—This is carried out by the physician by the administration of emetics or " vomits," by the use of the stomach pump, or by the injection under the skin of a drug which causes vomiting. Till the arrival of the medical man, it is the duty of the ambulance pupil to use what means he has at his disposal in order to cause the poisoned patient to vomit. This may be carried out by tickling the patient's throat with the finger, and by administering one or other of the following " handy emetics," while some of the stronger and more certain ones detailed below are being procured from the chemist :—

Emergency Emetics.—(1) *Large Draughts of Warm Water* have a certain power of causing vomiting.

(2) *Salt and Water.*—A tablespoonful of common salt dissolved in a tumblerful of water may be given, and repeated if necessary.

(3) *Mustard in Water*—Mustard mixed in water, in the proportion of one teaspoonful of mustard to the tumblerful of water, may be given, and repeated every five minutes till vomiting occurs.

(4) *Common Salt.*—Dried salt may be given as a powder in teaspoonful doses.

(5) *Ipecacuanha Wine.*—This is a domestic medicine, and is often at hand. To an adult a teaspoonful should be given every five minutes till vomiting occurs. In the case of a child, fifteen drops may be given every ten minutes.

Where a chemist is near, any of the following drugs should be sent for in case the emergency emetics are not sufficiently powerful in their action :—

(1) *Sulphate of Copper* may be given in 6-grain doses. The best way is to order 20 grains of sulphate of copper from the chemist, to dissolve it in a wine glassful of water, and to give a teaspoonful of the mixture every five minutes.

(2) *Sulphate of Zinc.*—The doses of sulphate of zinc used to cause vomiting in an adult are from 10 to 30 grains. A teaspoonful (1 drachm) of sulphate of zinc may be procured from the chemist, and dissolved in a wineglassful of water. A teaspoonful of this mixture may be given every ten minutes till vomiting occurs.

(3) *Ipecacuanha Wine*, if not at hand, may be procured from a

neighbour, or from the nearest chemist. An ounce of the wine should be asked for, and it should be given in doses as mentioned under Emergency Emetics.

(4) *Ipecacuanha Powder* may be given in 20-grain doses in one ounce of water.

(5) *Carbonate of Ammonia*, if at hand, may be tried in 20-grain doses.

The Counteracting of the Poison already Absorbed.—Having brought about vomiting, one must next, as far as possible, moderate the action of the poison already absorbed. One must not allow the patient to remain in the drowsy condition into which he has fallen, as it gradually deepens until death occurs. The patient should not be allowed to lie down, but should be kept continually on the move, supported on either side by attendants. He should be walked for an hour at a time round the room, or along a lobby, and best by two active policemen, whose assistance may be got in town in such a case. If the constant motion does not prevent the patient from sleeping and from dragging his feet on the floor, he should be further stimulated by throwing cold water over his head and chest and by flogging him on the bare back, arms, and hands with wet towels. One of the best antidotes to opium poisoning is strong black coffee, which should be given during the intervals of the active treatment detailed above. If coffee cannot be procured, a strong infusion of tea may be given instead. In poisoning by prussic acid, cold water poured on the head and spine often proves of great service, and artificial respiration may have to be resorted to. In strychnine poisoning the patient should be restrained to prevent him from injuring himself in the throes of the convulsive seizures. The convulsions of strychnine poisoning are often so severe that it is necessary for the medical attendant to check them by giving the patient inhalations of chloroform, or by administering bromide of potash or chloral by the mouth.

II. *IRRITANT POISONS.*

Irritant poisons may be divided into three great classes :—

1. Acids.
2. Alkalies.
3. Irritants proper.

1. **Acids.**—The acids which are most commonly found as the causes of poisoning are :—

(*a*) Sulphuric acid (oil of vitriol).
(*b*) Nitric acid.
(*c*) Hydrochloric acid (spirit of salt).
(*d*) Oxalic acid taken in the form of the powder as used for domestic purposes, such as the cleaning of brass, or in the form of the binoxalate of potash (salts of sorrel).

(*e*) Carbolic acid.
(*f*) Tartaric acid.
(*g*) Acetic acid.

2 **Alkalies.**—The most important are :—

(*a*) Caustic soda.
(*b*) Caustic potash.
(*c*) Lime.
(*d*) Ammonia.

Symptoms of Poisoning by Acids and Alkalies.—The main symptoms of poisoning by acids and alkalies are due to their strong corrosive action. They char and burn the tissues, and cause shock to a very marked degree. They stain, irritate, and may even destroy the parts with which they come in contact. The lips are generally found to be burned and stained. The colour of the stain depends on the poison used. Oil of vitriol causes a black staining, nitric acid a yellowish colour, while a white colour is found in poisoning by hydrochloric acid and most of the strong alkalies. The mouth is swollen and painful, and in parts corroded. The gullet and stomach may be similarly affected. Intense shock is usually present. The patient will probably have vomited, and if so the vomit should be preserved for examination by the medical attendant on his arrival. The vomit may contain blood and shreds of charred mucous membrane. The patient usually complains of cramp, of pains in the stomach, and of thirst, and may have convulsions.

Treatment of Poisoning by Acids and Alkalies.—Soothing and demulcent drinks should be administered *at once*. The best of these are milk, white of egg, white of egg in milk or gruel, olive oil, salad oil, or mucilage. The next part of the treatment consists in giving an antidote or corrective to neutralise the action of the poison. Alkalies are antidotes to acids—acids to alkalies. The emergency alkalies to be used in cases of poisoning by acids are lime water, chalk in water, wall plaster, carbonate of soda in water (a tablespoonful to the tumblerful), soap suds, whiting, and magnesia.

The common emergency acids given as antidotes to alkalies are acetic acid in the form of vinegar, citric acid in the form of lime juice, and tartaric acid.

Emetics or vomits are dangerous in cases of poisoning by acids, and should *not* be given. Medical aid should be summoned, and suicidal patients are on no account to be left without attendants. Shock, if present, should also receive its proper treatment (p. 81).

3. **Irritants Proper.**—In this class are included poisons which have a strong irritant action, but which have not the corrosive action of acids and alkalies. The following are the most important of these :—

TABLE OF COMMON POISONS AND THEIR TREATMENT.

			Treatment.
I. **NEUROTIC POISONS,**	1. NARCOTICS,	(*a*) Opium, laudanum, morphia,	Emetics, active exercise.
		(*b*) Belladonna,	Strong coffee, stimulation.
		(*c*) Chloral,	Emetics, sal volatile and very warm water.
		(*d*) Ether and alcohol,	Emetics, cold water to head and spine.
		(*e*) Prussic acid,	Artificial respiration.
	2. CONVULSANTS,	(*a*) Strychnine,	Emetics, restraint and protection from injury during convulsions, 10 grs. of chloral or bromide of potash if convulsions severe.
		(*b*) Nux vomica,	
II. **IRRITANT POISONS,**	1. ACIDS,	(*a*) Oil of vitriol,	Milk, white of egg, olive oil or salad oil, followed by alkalies—*e.g.*, chalk or wall plaster, lime water, carbonate of soda, water, whiting, soap suds, magnesia.
		(*b*) Nitric acid,	
		(*c*) Hydrochloric acid,	
		(*d*) Oxalic acid,	
		(*e*) Carbolic acid,	
		(*f*) Tartaric acid,	
	2. ALKALIES,	(*a*) Caustic soda,	Milk, white of egg, olive oil, or salad oil, followed by acids—*e.g.*, acetic acid (vinegar), citric acid (lemon juice), tartaric acid.
		(*b*) Caustic potash,	
		(*c*) Lime,	
		(*d*) Ammonia,	
		(*e*) Carbonate of potash,	
	3. IRRITANTS PROPER,	(*a*) Arsenic,	Emetics, perfect quiet.
		(*b*) Iodine,	Carbonate of soda in water, boiled starch.
		(*c*) Phosphorus,	Emetics, magnesia. No oils to be given.
		(*d*) Mercury,	Milk, raw eggs.
		(*e*) Nitrate of silver,	Strong solution of salt.
		(*f*) Sugar of lead,	Emetics, tablespoonful of Epsom salts in warm water.

(The poisons less frequently met with are detailed at the end of this chapter.)

(*a*) **Arsenic.**—Arsenic may be taken in the form of a white powder or as coloured arsenic, or in the medicinal form of Fowler's solution (liquor arsenicalis). Arsenic is also present in fly-papers. The prominent symptoms are irritation of the eyes, throat, and stomach, palpitation of the heart, a rapid pulse, general restlessness, and delirium.

(*b*) **Iodine.**—Iodine is sometimes accidentally taken in the form of tincture, or liniment.

(*c*) **Phosphorus.**—Ordinary phosphorus is very poisonous. One or two heads of matches may be sufficient to poison a child. The heads of safety matches being made from allotropic phosphorus are non-poisonous. Rat-paste also contains phosphorus. The vomit of a patient poisoned by phosphorus will be luminous in the dark.

(*d*) **Mercury.**—Mercury is sometimes the cause of poisoning in the form of perchloride of mercury (corrosive sublimate), a substance which has been already described as a very strong antiseptic, and which is much in use for the washing of wounds.

(*e*) **Nitrate of Silver** (lunar caustic).—A patient poisoned by this has black stains about the mouth, and his vomit is also black.

(*f*) **Sugar of Lead.**—Sugar of lead, if taken in a poisonous dose, shows itself by colic, vomiting, cramp, and paralysis.

Treatment of Poisoning by Irritants Proper.—In poisoning by any of the substances coming under the class of irritants proper it is not, as a rule, desirable to give strong emetics, but vomiting may be brought about by tickling the back of the throat, or by giving the patient large draughts of warm water, which will not only act as a diluent of the poison, but will also cause its rejection from the stomach. Any of the demulcents mentioned under the corrosive poisons may be given, such as milk, white of egg, olive oil, salad oil, or mucilage. In poisoning by phosphorus, however, oil should *not* be given. In poisoning by nitrate of silver the best antidote is a strong solution of common salt frequently administered. In poisoning by sugar of lead a teaspoonful of Epsom salts should be given. In poisoning by iodine carbonate of soda should be given along with boiled starch. In poisoning by arsenic a teaspoonful of sal volatile may be given, and, if necessary, artificial respiration may be resorted to. Medical aid should be summoned, and, in the event of a doctor not being readily procurable, the antidotes mentioned above may be administered. Should he, however, be at hand the antidotes mentioned under the special poisons should be procured and made ready for administration. Shock is very commonly present in poisoning by irritants proper, and requires treatment.

The poisons less frequently met with are as follows :—

1. **Aconite** (Monk's-hood) is used as the tincture to reduce fever, or as the liniment to lessen pain.

Symptoms in poisonous doses.—Tingling and heat in the mouth and throat followed by numbness. Pupils dilated. Vomiting. Signs of collapse.

Treatment.—Absolute rest in recumbent position. Emetic. Hot bottles. Stimulation. Artificial respiration if necessary.

2. **Antimony,** in the form of tartaric emetic, acts as an irritant, while butter of antimony has a corrosive action.

Symptoms.—Weakness, vomiting, purging, and collapse.

Treatment.—Emetic. Hot bottles. Stimulation. Tannic or gallic acid or very strong tea as an antidote.

3. **Camphor** may be swallowed accidentally in the form of camphor liniment.

Symptoms.—Characteristic odour. Excitement, giddiness, headache, convulsions, and collapse

Treatment—Emetics. Hot bottles. Stimulation.

4 **Cantharides** (Spanish fly) is used as a blistering fluid.

Symptoms.—Irritation of mouth, vomiting, purging, irritation of kidneys and bladder, blood in urine, convulsions.

Treatment—Emetics. Egg and milk drinks.

5. **Conium** (hemlock) used medicinally.

Symptoms.—Muscular weakness. Disordered vision. Dilatation of pupils. Failure of respiration.

Treatment.—Emetic. Tannic acid or strong tea. Stimulation.

6. **Digitalis** (foxglove), used as a heart tonic.

Symptoms.—Pulse very slow and full, or may be imperceptible at wrist. Heart can be felt to be beating very fast. Headache. Vomiting. Cramps.

Treatment.—Emetic. Tannic acid or very strong tea. Hot bottles.

7. **Hyoscyamus** (henbane), used as a sedative in mixtures and pills.

Symptoms.—Excitement or unconsciousness. Dilated pupils.

Treatment.—Emetics. Strong coffee.

8. **Lead Poisoning.**—Acute poisoning from accidental swallowing of paint, red or white lead, or sugar of lead.

Symptoms.—Abdominal colic, vomiting, and purging. Cramps, convulsions, and collapse.

Treatment.—Emetic. Large dose of Epsom salts as an antidote. Demulcent drinks. Castor oil.

9. **Mushrooms** of the poisonous variety.

Symptoms.—Sickness, vomiting, purging, collapse, and paralysis.

Treatment.—Emetics. Hot bottles. Warm fomentations to abdomen. Stimulants. Castor oil.

10. **Nicotine Poisoning,** from the excessive use or accidental swallowing of tobacco or nicotine.

Symptoms.—Sickness and vomiting, muscular weakness. Collapse. Convulsions.

Treatment.—Hot bottles. Hot fomentations to abdomen. Very strong tea. Artificial respiration if breathing laboured.

11. **Ptomaine Poisoning** occurs from the ingestion of tainted food. The poisonous substances present in such food are known as ptomaines, and cause vomiting, purging, collapse, muscular weakness, and occasionally convulsions.

Treatment.—Emetics. Hot bottles and hot fomentations to abdomen. Stimulation. Castor oil.

CHAPTER XII.

BURNS, SCALDS, FROST-BITE, AND SUNSTROKE.

BURNS AND SCALDS—DEGREES OF BURNS—BURNS FROM GUNPOWDER—BURNS FROM LIGHTNING AND ELECTRICITY—BRUSH BURN—BURNS OF THROAT AND LARYNX—BURNS FROM CORROSIVE ACIDS AND ALKALIES—TREATMENT OF BURNS AND SCALDS—FROST BITE—TREATMENT—SUNSTROKE AND HEAT STROKE—SYMPTOMS AND TREATMENT.

Burns are produced by the action of dry heat or scorching; **Scalds** by the application of moist heat, generally in the form of boiling water.

Degrees of Burns.—Burns are, according to the classification of Dupuytren, a French surgeon, divided into six degrees, which, roughly speaking, may be described as follows:—

1*st Degree.*—A mere reddening of the surface.

2*nd Degree.*—Vesication or blistering, where the epidermis or superficial layer of the skin has been elevated from the *cutis vera* or "true skin" by serum.

3*rd Degree.*—Where the blister has burst, and the burn extends right down to the true skin.

4*th Degree.*—Where the whole thickness of the true skin is burned through.

5*th Degree.*—Where the charring involves the subcutaneous tissue and muscles.

6*th Degree.*—Where the part is burned down to the bone.

Burns from Gunpowder.—The surface of the body is frequently scorched by the explosion of a gunpowder charge or the firing of a blank cartridge close to the body. In such a case there may, in addition to the ordinary appearance of a burn, be considerable bruising and laceration. It frequently happens that grains of gunpowder are forcibly driven into the skin, so as to blacken it entirely. Where the face is the part affected, in addition to this scorching and blackening of the skin from the ingraining of gunpowder, a complication often exists in a similar affection of the cornea, or clear part of the eye, which may end in extensive inflammation and ulceration of the cornea and outer coats of the eye. Where grains of powder have been driven into the skin it is advisable, particularly in the face, to remove them as far as possible by washing with warm water and soft soap, or with warm water having in solution either soda or carbonate of soda. The part should be gently sponged and rubbed with the solution until as much as possible of the gunpowder staining has been removed, or until

the patient complains of feeling the rubbing very painful. The part should then be treated with Carron oil or smeared with cold cream, as described below. Where the eyes have been injured, a little olive oil should be poured between the lids, and the eye should be covered by a layer of cotton wool soaked in Carron or olive oil.

Burns by Lightning. — The skin is scorched, and its surface frequently shows " arborescent " or tree-like markings. The injured person feels very sick, and suffers from shock, for which he has to be treated. A soothing dressing should be applied to the injured part.

Burns from Electrical Currents of High Tension.—Death is generally the result of such an accident, but if the patient be fortunate enough to escape this, there is great prostration and shock, which requires its appropriate treatment.

In cases of accidental contact with electric light wires, a condition of suspended animation may be produced, owing to an arrest of respiration. Artificial respiration should then be resorted to (see pp. 128 and 129).

Brush Burn.—Brush burn is the name given to an irritation or excoriation of the skin, caused by excessive friction of the surface, such as might be produced by rubbing tender skin forcibly with a nail brush, or by having the surface of the body brought in contact with machinery in motion. It is treated by washing the part with warm water, and smearing over it olive oil, Carron oil, vaseline, or cold cream (oxide of zinc ointment).

Burns of the Throat and Larynx.—The throat and larynx are generally burned either by corrosive acids swallowed accidentally, or in the case of children by sucking the spout of a boiling kettle. There is great danger from the resultant swelling, and the patient should be treated on the lines laid down on page 110.

Burns from Corrosive Acids and Alkalies.—In chemical works and pharmacies it is not uncommon for the hands, and occasionally other exposed parts of the body, to be burned by corrosive acids or alkalies. When vitriol or any of the other strong acids is the cause of the injury, relief is speedily obtained by dusting whiting over the part. Thereafter the ordinary treatment for burns may be carried out. Vinegar should be used as the first application in burns caused by caustic lime, soda, or potash. When the eye is burned by an acid, lime-water should be used as a lotion, followed by the instillation of olive oil, while for alkaline irritants weak vinegar may be similarly employed.

Treatment of Burns and Scalds.—(1) The initial stage of first-aid treatment in burning accidents very often consists in extinguishing the flames. Flames burn only in the presence of air, and are as surely extinguished by the exclusion of air as by the application of cold water. The most common form of accident is for a lady's dress to catch fire. In such a case air should be excluded by wrapping a hearth-rug, mat, table-cover, rug, or coat tightly round the body

over the burning part of the dress. The lady herself, if she has sufficient presence of mind, may anticipate or assist the means above recommended by immediately throwing herself on the ground and rolling on the burning dress. Cold water may also be used to extinguish the flames.

(2) A most important part of the treatment is the removal of clothing from the burnt part. This should be done most carefully, *and on no account should a blister be broken.* The clothing should be cut off, a trouser leg or coat sleeve being divided along the seam. The stocking or sock will generally be found to be adherent to the blistered skin below, and should be removed first by dividing it along its whole length *on the side away from the burn*, and then by soaking the adherent part with oil, and gently drawing on it. If soaking with oil is not sufficient, the best plan is to immerse the limb in a bath of cold water, and so float off the adherent portion of the dress.

"Never break a blister" is a golden rule in the treatment of burns. The old plan of pricking them with needles is an unwarrantable interference, a source of danger, and has nothing to recommend it.

(3) The third stage of the treatment consists in the *exclusion of air* and the *use of soothing applications.* Air may be prevented from reaching the part by immersing it in a bath of cold water, or by dusting flour on it, and covering it with a thick layer of cotton wadding. Painting the surface with ink, whitewash, or collodion also eases the pain. Procure from the chemist as soon as possible six ounces of **Carron oil,** which is the oil used in burning accidents at the Carron Iron Works, near Glasgow, and consists of a mixture of equal parts of linseed oil and lime water. An equally useful preparation is the liniment of lime, which may be got from any chemist. It consists of equal parts of olive oil and lime water. If neither of these can be procured, ordinary olive or salad oil may be employed. The oil should be poured from the bottle over the burned part, which should then be dressed with lint soaked in the oil, and covered with a layer of cotton wadding and a bandage.

When carbolic acid has been accidentally swallowed or applied to the skin, great relief may be got by applying vinegar to the burned mucous membrane or skin. Professor Carleton also advises its use as an antidote in carbolic acid poisoning, equal parts of vinegar and water being administered.

(4) As has already been mentioned, shock is very likely to be induced in the case of an extensive burn. It should be prevented, or treated if already present, by the use of stimulants, etc. (see under Shock).

Frost-Bite naturally falls to be considered along with burns, as it is a similar condition, caused, however, by excessive cold.

From the prolonged action of cold a part becomes cold, white, and insensitive, owing to its circulation being interfered with. As in burning, frost-bite causes redness, then blistering, and finally mortification of the exposed part. Frost-bite occurs generally in the extremities of the body—in the hands, feet, ears, and nose. This condition may come on in exposed parts, such as the ears and nose, without the person being aware of it. It is easily recognised by the blanched appearance of the part. When the patient's attention is drawn to it, he will find the ear or nose to be cold and devoid of feeling. If it continue for some time, the circulation becomes absolutely stopped, and the frost-bitten part, from the want of nutrition, rapidly dies; it mortifies and becomes gangrenous. In cases of prolonged exposure the condition may be so severe as to leave no hope of saving the part, which either sloughs off or has to be amputated.

Treatment.—In ordinary and even in severe cases of frost-bite, most satisfactory results will be got by the use of the following measures promptly applied:—Take the patient into a room with no fire in it; rub the frost-bitten part with snow continuously for a considerable time (even an hour or more). Alternative plans are bathing it with iced water, or shampooing it with cloths wrung out of cold water. By this means the circulation in the part will be gradually but surely restored. Stimulants (alcoholic or otherwise) may be given after a time.

The way *not* to do it is to take the patient into a warm room, set him close to the fire, and use warm applications. Under such treatment, mortification is almost sure to occur, as the reaction is too great.

Sunstroke is the name given to a condition produced by exposure to intense heat, and attended by grave brain symptoms. Similar exposure causes **heatstroke,** but while sunstroke is caused *directly* by the heat of the sun, heatstroke is more common in the stoke-holes of engine-rooms (particularly those of steamers passing through the Red Sea), or in crowded and unhealthy barracks, where other factors come into play than solar heat. Heatstroke is also known as **heat-apoplexy.**

Symptoms.—Drowsiness, faintness, and collapse, sighing and irregular respiration. The face is pale, pulse slow, pupils dilated. The temperature in heatstroke often runs high—*e.g.*, from 107° to 109° F. (98·4° being "the normal"). The mortality from this condition is very high, and in a certain proportion of cases death occurs instantaneously.

Treatment.—The treatment consists in the immediate application of **cold.** Cold water should be dashed over the head, neck, and chest. Ice may be applied to the head in an ice-bag. Cloths wrung out of iced water and frequently changed, are also of service.

CHAPTER XIII.

ACCIDENTS FROM ELECTRICITY.

COMMON ELECTRICAL ACCIDENTS—APPARENT DEATH—METHOD OF RESUSCITATION—THE NECESSITY OF STEADY PERSISTENT EFFORT—BREAK CIRCUIT—DANGER OF TOUCHING THE BODY OF THE INJURED PERSON—SEND FOR A MEDICAL MAN AT ONCE—HOW TO PLACE THE BODY—MEANS OF RESUSCITATION—THE USE OF OXYGEN—STIMULANTS TO BE AVOIDED—THE NECESSITY OF DELIBERATION—INSTRUCTING THE STAFF—HOW TO DEAL WITH LIVE WIRES OR BROKEN TROLLEY WIRES.

IN large towns where electricity is employed for lighting, heating, and traction, accidents are fairly common, and vary from slight burns up to apparent death from electric shock.

The following are the more common accidents in connection with electric apparatus, cables, conductors, dynamos, etc. :—

(*a*) A slight burn may be produced from short-circuiting at the terminals of a small switch or lamp holder or by the "blowing" of a fuse. This is to be treated on ordinary lines as a burn.

(*b*) When a workman puts a metal tool across two bare conductors of opposite polarity, the tool having less carrying capacity, or by bearing imperfectly on the "mains," forms an arc with resulting flash. Severe burning and electric shock may be caused in this way.

(*c*) An accident may occur in disconnecting the electric circuit in a dynamo or other piece of apparatus in which there is a good deal of magnetic induction—*e.g.*, in a broken shunt. This is all the more serious as it causes great shock from the current being at very high pressure.

(*d*) If the insulation of a dynamo armature at a generating station breaks down, injury to bystanders may result from fused copper or solder being violently thrown out while the machine is in motion.

(*e*) A tram trolley wire breaking at a pressure of 500 volts should not be grasped or pulled aside with the naked hand. The hand should be insulated with dry cloth or coat, or preferably with india-rubber gloves, which are usually provided in cars for this purpose. The best thing to do is to keep the trolley wire in contact with the earth by pressure with the foot or with a walking stick, so as to allow the current to pass back to the generating station, where an automatic switch will fall and break off the current. On no account should the wire be lifted.

(*f*) If a trolley wire falls on the handrails of a car an automatic switch should fall at the station and cut off the current. Whether it do so or not, no passenger should take hold of any metal part of a car on which this accident has happened.

(*g*) It has often happened that a man has taken hold of a "live" wire and has been unable to release his grasp. What should be done is to "earth" the wire when the pressure is much reduced and the injured person can be detached from the wire.

To some of the accidents above mentioned the patient will appear to have succumbed from electric shock, and the first-aid student should be able to recognise this condition and apply the proper treatment, which cannot be better given than in the following summary from the *Electrical Review*.

Apparent Death.—In some cases where persons receive electric shocks, death is only apparent, and animation may be restored if efforts at resuscitation are not too long delayed.

Method of Resuscitation.—The method of resuscitation resorted to should be that known as artificial respiration.

The Necessity of Steady Persistent Effort.—Steady persistent effort is one of the essential conditions of successful attempts to restore animation. Disappointing though the results may be, it is better to prolong the operation rather than discontinue it at too early a stage, unless a medical man pronounces life to be extinct. In case of severe shock, respiration is seldom established under one hour, while three hours may be necessary to restore normal breathing.

Break Circuit.—Break the circuit at once if there be an interrupter close at hand, if not, lose no time but proceed.

Danger of Touching the Body of the Injured Person.—Do not touch the man's body with bare hands, but if india-rubber gloves are not at hand pull him off the cable by his coat tail, if his clothes are not wet; or fold your coat or some such dry article into two or three thicknesses and, using this as a pad, take hold of the body and pull it away from the circuit; or a broom handle may be used to raise the body, or detach the wires from it.

Send for a Medical Man at once.—No time should be lost in sending for a qualified medical man, but in the meantime the following efforts should be made to restore animation:—

How to Place the Body.—Having pulled the body away from the cable, free the neck from clothing, and treat the case as one of drowning, as follows:—The body should be at once placed upon the back and the clothes loosened. A roll made of a coat or anything else convenient should then be placed under the shoulders. It should be sufficiently large to prop up the spine so that the head drops backwards.

Means of Resuscitation.—Open the mouth, and taking hold of the front part of the tongue with the fingers (covered with a towel

or handkerchief, if one be available) draw the tongue forwards and gradually let it go back. Do this about fifteen times a minute ; be sure the root of the tongue is acted upon and drawn forward. If the teeth are clenched and you cannot get them apart with your fingers, gently separate them with the handle of a pocket-knife, or by means of a small piece of wood or cork.

At the same time that these rhythmical tractions are made upon the tongue, another operator should kneel (or, if the patient be laid on a table, stand) behind the patient's head (*cf.* Fig. 127). He should grasp the forearms just below the elbow, draw the arms upwards and outwards towards himself with a sweeping movement, making the elbows almost touch the ground on either side of the patient's head, holding them there for two or three seconds. The arms may then be returned to their position alongside the chest and strong pressure made against the ribs. After two or three seconds the arms should be again carried above the head, and both up and down movements should be repeated at the rate of ten or fifteen times per minute ; the arms being extended above the head when the tongue is drawn forward by the other operator, and the arms brought down when the tongue is allowed to recede.

Circulation may be aided by rubbing the body or striking it with a wet towel.

The Use of Oxygen.—When it is possible to procure a cylinder of oxygen, inhalation may be attempted. The best arrangement would be a cylinder fitted with the usual stopcock and furnished with two tubes. One tube should be connected to a bottle half-filled with water ; the other tube, provided with a cone mouthpiece, passing from the bottle to the patient. To use the oxygen, place the cone over the patient's face and turn on the stopcock until the gas is seen to bubble freely through the water in the bottle. Efforts at artificial respiration should be kept up while the gas is being administered in order to aid its entrance into the lungs.

Stimulants to be avoided.—Stimulants should not be administered unless recommended by a medical man.

The Necessity for Deliberation.—It should be borne in mind that to be successful the foregoing operations should be carried out deliberately and methodically. There should be no haste, but the operations should be executed vigorously.

Instructing the Staff.—The only way of carrying out these suggestions is to know them thoroughly. Members of electrical works' staff should carefully instruct themselves beforehand, and much good might result if they occasionally practised the method here prescribed.

ACCIDENTS DUE TO FALLEN TROLLEY WIRES.

Methods of Dealing with Fallen Wires.

General Instructions.—Should a trolley wire or its suspension break, or a telegraph or telephone wire fall and come in contact with a trolley wire, the fallen wires should not be interfered with unless it is necessary to do so to prevent injury or to save life. The current should at once be cut off from the section by means of the switches in the feeder pillars, and notification of the accident sent to the power station. Many feeder pillars are in telephonic communication with the power station, so that help can be summoned when the current is cut off. If a wire, as it lies in the street, is an obstruction to traffic, it may be pulled on one side by means of a stick, such as a walking stick with a hooked handle, or it may be moved by a person wearing india-rubber gloves. As the wire, especially if thin, may be hot, the rubber gloves should be protected by using a silk scarf, cloth cap, or similar article, in addition.

If the fallen wire is in contact with anyone, and it is necessary to remove it at once to save life or prevent injury, the following precautions must be observed :—

1. Never touch the trolley wire, nor any person or metallic substance in contact with it, with bare hands or damp gloves.

2. The wire or the person in contact with it may be safely handled by using india-rubber gloves, dry clothing, dry rope, or a dry stick. It is most important that the article used should be dry, as damp material will act as a conductor. A dry india-rubber mat, such as is often used in cabs, carriages, or at shop doors, forms an excellent insulator, and a person standing on such a mat can handle the trolley wire freely, though it is best not to use the bare hands. A dry mackintosh is an excellent material to use when handling the trolley wire.

3. If it is not possible to get the person out of contact with the trolley wire, or to cut off the current at once, the fallen wire may be forced into contact with the tramway rails by the use of a dry wooden pole or a large piece of dry wood. This will result in a short-circuit, accompanied by a very violent flash ; the fallen wire should, however, be held firmly in contact with the rails, and the person in contact with the wire released. If cutting appliances with insulated handles are available, the trolley wire may be cut at a point between the victim and the overhead portion of the wire.

CHAPTER XIV.

REMOVAL OF FOREIGN BODIES FROM THE EYE, EAR, NOSE, THROAT, AND TISSUES.

REMOVAL OF FOREIGN BODIES FROM THE EYE—FROM UNDER THE LOWER LID—FROM UNDER THE UPPER LID—FROM THE CORNEA OR CLEAR PART OF THE EYE—REMOVAL OF FOREIGN BODIES FROM THE EAR—DIFFICULTIES—TREATMENT—REMOVAL OF FOREIGN BODIES FROM THE THROAT—REMOVAL OF FOREIGN BODIES FROM THE TISSUES.

REMOVAL OF FOREIGN BODIES FROM THE EYE.—Foreign bodies, or "fires" as they are popularly called, have not uncommonly to be removed from the eye. They consist of particles of dust or granite, chips of steel, etc. They are found in different positions, and require special methods of treatment, according to their position and fixity.

The three most common positions for the foreign body to lodge are under the lower lid, under the upper lid, and on the clear part of the eye or cornea. The patient's sensations generally guide you as to the exact position of the foreign body; when the cornea is the seat of the injury you will most clearly fix the exact position of the foreign body by throwing the light of a candle or lamp flame obliquely over the front of the eye. The methods of treating foreign bodies in these three positions are as follows :—

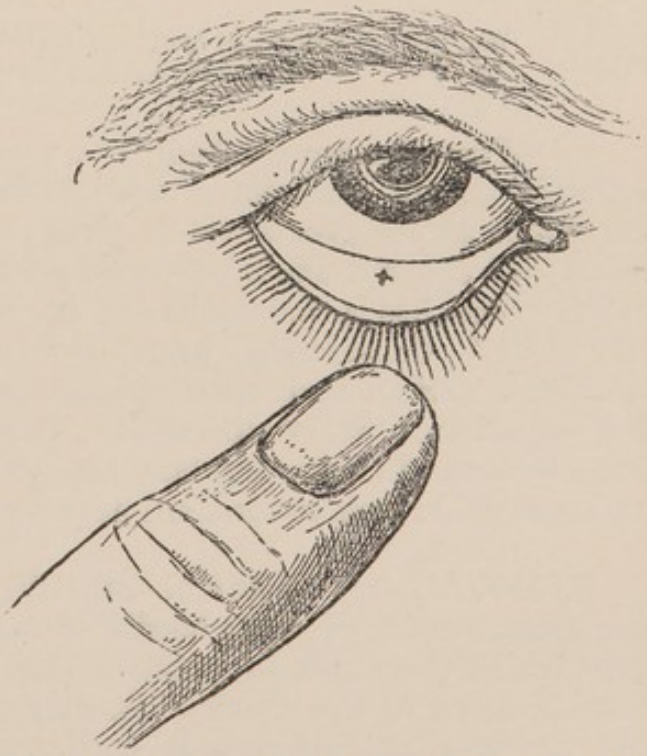


Fig. 137.—Method of removing foreign body from lower lid.

(*a*) **Beneath the Lower Lid.**—Pull down the lid (as in Fig. 137) with the thumb or finger, and take off the foreign body with the corner of a handkerchief.

(*b*) **Beneath the Upper Lid.**—If the foreign body lie in the position shown in Fig. 138, the method of removal is to evert, or turn the lid over a match or probe, so as to bring its under surface to the front, when the object is wiped off with the corner of a soft handkerchief. If, however, the "fire" lie high up behind the lid, at the upper junction of lid and eyeball, it cannot be reached in this way, and what should be done is to evert the lid as described above, and, with a camel's-hair brush, or the corner of a silk handkerchief, sweep out the recess behind the lid. A drop of cocaine solution placed in the eye takes away the pain.

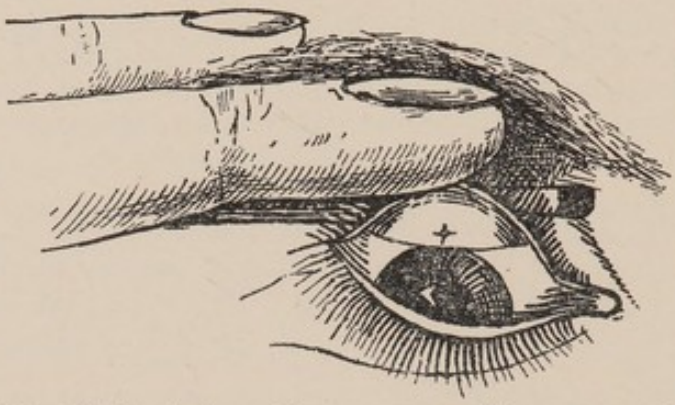


Fig. 138.—Method of everting upper eyelid over a match to remove foreign body (+).

(*c*) When the foreign body is a sharp one, as a chip of granite or steel, it, not uncommonly, sticks in front of the pupil on the clear part of the eye, where it gives rise to great pain and annoyance. No attempt should then be made to remove it, even by the artisan who has a reputation in his workshop for the treatment of "fires." Considerable injury is often done to the eye by the unskilful, daring, and often dangerous surgery of a well-meaning but injudicious fellow-workman. After a few drops of olive oil have been run in below the lids, the eye should be bandaged and the sufferer should seek medical aid at once at hospital or home.

REMOVAL OF FOREIGN BODIES FROM THE EAR.—These generally consist of peas, beads, or beans which have been introduced into their ears by young children. The ear canal from the outside down to the drum is curved, with the convexity upwards, but the cartilaginous outside portion can be straightened out by pulling the ear upwards and backwards. The foreign body often lies on the down side of the convexity of the curve (Fig. 139). The foreign body should *not* be removed by seizing it with pincers, as such an attempt, even in skilful hands, is often fraught with considerable injury to the walls and drum of the ear. The best method is to wash out the ear with warm water thrown in forcibly by a syringe, the recoil from the drum acting on the foreign body from

behind and forcing it out. This, however, is best left to the medical attendant.

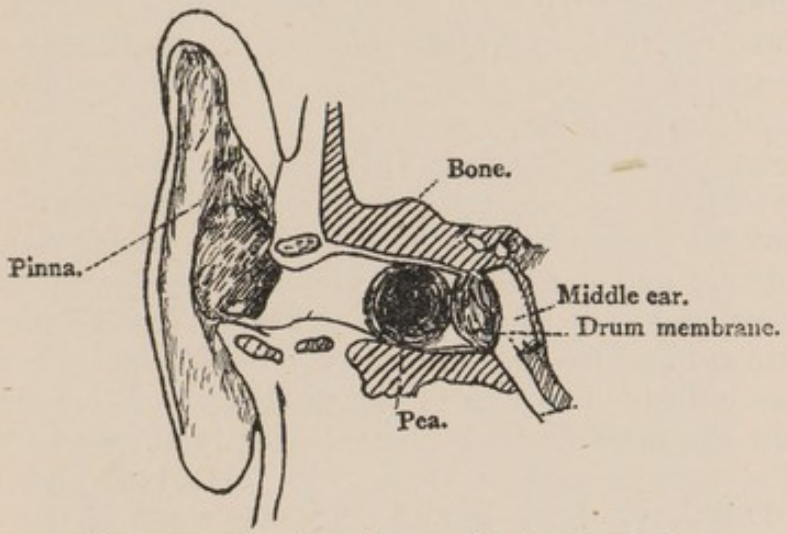


Fig. 139.—Section of ear, with foreign body.

REMOVAL OF FOREIGN BODIES FROM THE NOSE.—These bodies are similar to the last-mentioned. They may be removed by blowing the nose forcibly, or if firmly stuck should be left to the medical attendant. The presence of a foreign body in the nose is not such a serious matter as to require the ambulance pupil's interference, and medical assistance can always be waited for.

REMOVAL OF FOREIGN BODIES FROM THE THROAT.—These consist of fish-bones stuck in the palate, tonsils, or back wall of the pharynx. The mouth should be examined under a good light, and if the spicule of fish-bone be seen, it should be removed by pincers or sugar-tongs, or by brushing the throat with a camel's-hair brush. Where the fish-bone has stuck in the gullet and cannot be easily removed, Schliep recommends that vinegar be given to the patient. The acetic acid in the vinegar softens a small fish-bone in fifteen or twenty minutes if repeated doses be given, and the foreign body is then said to cause less pain and to be more easily removed.

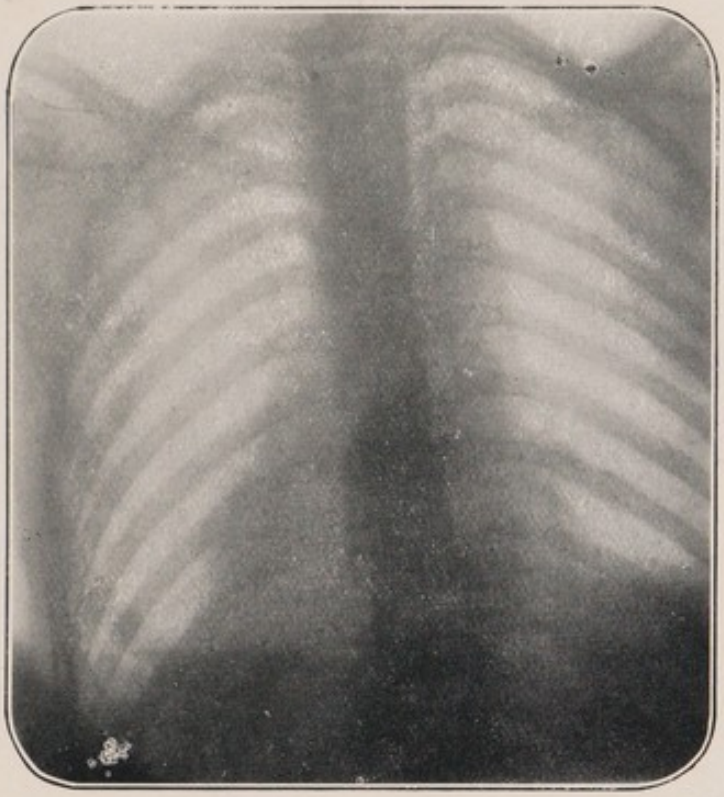
Coins, pins, plates of false teeth, etc., stuck in the gullet should not be interfered with lest further injury be inflicted. They have often to be localised by Roentgen rays.

REMOVAL OF FOREIGN BODIES FROM THE TISSUES.—Needles, broken knitting-wires, pieces of glass, etc., which have been run in under the skin, should be removed at once if the end be seen, by catching and extracting them with pincers or sugar-tongs. If a needle has broken off short under the skin, the part of the broken needle left outside the body should be kept for the information of the medical man, who should be at once summoned.

The exact position of metallic foreign bodies in the tissues can most accurately be determined by the Roentgen skiagraphy. The "new photography" is very serviceable where needles, pieces of glass, pellets, and bullets lie imbedded in the tissues, as steel, lead, and glass are impervious to the X-rays, and throw deep shadows on the photographic plate.

The accompanying skiagram (Fig. 144) was taken for me in the early days of X-ray photography by Sir James Mackenzie Davidson. The patient was a gentleman who had been accidentally shot at a grouse drive, and consulted me about the pellets lodged in his hand. These could not be exactly localised on examination, but the shadowgram showed two of them to be lying in the soft parts, while a third was imbedded in one of the phalanges of the index finger. The ring on the little finger is very distinctly shown in the photograph. The four skiagrams (Figs. 140, 141, 142, and 143) were taken by Dr. J. R. Levack, and illustrate some of the conditions above-mentioned.

When any of the accidents above described happen in the country at a distance from medical advice, it is advisable in sending a message to the doctor that the nature of the case should be distinctly stated, as he has generally to bring with him special instruments for the removal of the foreign body. A proper message in such a case often saves a great deal of time.



Skiagram (Fig. 140).—Coin stuck in gullet a little above diaphragm.

Skiagram (Fig. 141).—Needle in hand.

[*To face p.* 134.

Skiagram (Fig. 142).—Skiagram showing outline of stomach after a bismuth meal. The coin marks the relative position of the navel.

Skiagram (Fig. 143).—Gunshot wound of burglar's foot, showing numerous pellets.

[*To face p.* 134.

Fig. 144.—Skiagram taken in the early days of Roentgen rays, showing three leaden pellets imbedded in the hand.

CHAPTER XV.

AMBULANCE TRANSPORT AND STRETCHER DRILL.

PRINCIPLES OF TRANSPORT—MODES OF TRANSPORT—SEATS—TWO-HANDED SEAT—THREE-HANDED SEAT—FOUR-HANDED SEAT—CLASS EXERCISE ON THE HAND SEATS—STRETCHERS—THE REGULATION STRETCHER—THE LOWMOOR JACKET—THE NORTON STRETCHER—WORTHINGTON'S STRETCHER—FURLEY-HEADLEY STRETCHER—EXTEMPORISED STRETCHERS—THE GREATCOAT OR COAT STRETCHER—SPARY'S RUG AND POLE STRETCHER—THE RIFLE STRETCHER—THE PLANK STRETCHER—THE POLE AND ROPE STRETCHER—THE HAMMOCK STRETCHER—THE UMBRELLA STRETCHER—STRETCHER BEARERS—THE MILITARY AMBULANCE WAGGON (REGULATION AND EXTEMPORISED)—THE CIVIL AMBULANCE WAGGON—THE MOTOR AMBULANCE—THE "TORTOISE" WAGGON—THE BROUGHAM AMBULANCE—EXTEMPORISED AMBULANCE WAGGON—CACOLETS AND LITTERS—THE FURLEY-HEADLEY LITTER—THE ASHFORD LITTER—THE BICYCLE AMBULANCE—THE AMBULANCE TRAIN—THE RAILWAY AMBULANCE WAGGON—EXTEMPORISED RAILWAY WAGGONS—STRETCHER DRILL—PREPARING STRETCHERS—LIFTING AND LOWERING PREPARED STRETCHERS—MARCHING WITH PREPARED STRETCHERS—LOADING AND UNLOADING STRETCHERS WITH REDUCED NUMBERS: WITH THREE BEARERS: WITH TWO BEARERS—ADAPTED STRETCHER EXERCISE—GENERAL RULES FOR THE PROPER CARRIAGE OF STRETCHERS.

THIS most important part of "First Aid" instruction is expected to be mastered only by the male members of an ambulance class, while the subjects treated in Chapter XVI., under the title of "After-treatment of Ambulance Patients," are intended for lady students. There has been a tendency within recent years to teach members of all ambulance classes **Military** stretcher drill, and if this is once understood, it can readily be adapted to civil stretcher exercises. The author has, therefore, incorporated the stretcher-drill exercises of the Royal Army Medical Corps in this chapter, as he has found this by far the best means of teaching stretcher work to policemen and other members of ambulance classes. He has also indicated the method of adapting these exercises to civil practice. The stretcher drill, described and illustrated below, is similar to the ambulance drill of the St. John Ambulance Association. The original military stretcher drill is first described and fully illustrated, and the recent changes are specially noted.

The principles of transport are to keep safe and at rest a patient who has had the appropriate "First Aid" treatment applied, and to carry him forward as steadily as possible without vertical or lateral movement.

MODES OF TRANSPORT.—These are various, and will be taken up *seriatim* :—

1. **The Fireman's Lift**—where only one bearer is available.
2. **Hand Seats**—where two bearers are available.
3. **Stretchers**—where two or more bearers can be obtained—
   - (*a*) Regulation.
   - (*b*) Norton.
   - (*c*) Worthington.
   - (*d*) Furley-Headley.
   - (*e*) Extemporised.
4. **Ambulance Waggons**—
   - (*a*) Military—Horsed and Motor.
   - (*b*) Civil—Horsed and Motor.
   - (*c*) " Tortoise " Waggon.
   - (*d*) The Brougham Ambulance.
   - (*e*) Extemporised.
   - (*f*) The Travois or Ambulance Sled.
5. **Cacolets and Litters**, including the Furley-Headley Litter, the " Red Cross " Ambulance, the " Simplex " Ambulance, and the Bicycle Ambulance.
6. **Railway Ambulance Waggons and Ambulance Trains.**

1. **The Fireman's Lift.**—This method, which is used by men of the fire brigades, consists in throwing the patient over one shoulder and holding him securely in position by his legs and one of his arms. It is particularly serviceable in removing an insensible patient from a room on fire. This is carried out by the bearer stooping down in front of the patient, grasping his right forearm with the left hand, then dragging the patient on to his shoulders, his legs being fixed by the bearer's right arm. The bearer then rises to the erect position, and has the patient balanced on his shoulders and fixed by his legs and right arm.

2. **Hand Seats.**—Two " bearers " are required, who should be strong men, and, as far as possible, of equal height. There are three kinds of hand seats :—

- (*a*) The Two-handed Seat.
- (*b*) The Three-handed Seat.
- (*c*) The Four-handed Seat.

(*a*) *The Two-handed Seat* is suitable for lifting patients from the ground. It is the only form of hand-seat now used in military ambulance work. It is formed by two bearers, who face each other, and interlock the fingers of their right and left hands respectively so as to form the seat, while they cross the disengaged arms so that their hands lie on each other's hips, as shown in Fig. 145, to form a support behind the patient's loins.

The method of lifting a patient from the ground by the two-handed seat is shown in Fig. 146, where the bearers stoop down

Fig. 145.—Method of forming two-handed seat (fingers interlocked). (For description of "hook-grip" see p. 137).

[*To face p.* 136.

Fig. 146.—Method of lifting by two-handed seat.

To face p. 137.]

Fig. 147.—Method of carrying by two-handed seat.

To face p. 137.]

Fig. 148.—Method of forming three-handed seat.

Fig. 149.—Method of forming four-handed seat.

To face p. 137.]

Fig. 150.—Method of carrying by four-handed seat.

and form the seat under the patient, who fixes himself firmly in position by grasping their shoulders.

The method of carrying a patient by the two-handed seat is shown in Fig. 147. A seat which is more firm and less tiring for the bearers can be formed by using the "hook-grip" instead of simply interlacing the fingers as in Fig. 145. The "hook-grip" is formed as follows:—The bearer on the left of the picture bends the fingers of the right hand at the second joint, the back of the hand being uppermost. The bearer on the right of the picture bends the fingers of the left hand at the second joint, back of the hand downwards. The two bearers then hook their hands together, each placing the disengaged hand upon the other's hip.

(*b*) *The Three-handed Seat* is suitable only for carrying a patient who is able to raise himself on to it, and who has not to be lifted from the ground. It is formed by the bearer to the left in Fig. 148, and whom we shall call No. 1, grasping his own left forearm with his right hand, while bearer No. 2 grasps with his left hand the right forearm of No. 1, No. 1 at the same time with his left hand grasping No. 2's left wrist. The right hand of No. 2 is then placed on the left shoulder of No. 1, so as to form a back support. This seat cannot be formed like the two-handed seat under the patient, but is used only to carry one who is able to support himself while being lifted.

(*c*) *The Four-handed Seat* cannot be used in lifting patients from the ground.

It is formed by both bearers grasping their own left wrists with their right hands, and then grasping each other's right wrists with their left hands, backs uppermost (see Fig. 149).

The method of carrying by the four-handed seat is shown in Fig. 150.

Class Exercise on the Hand Seats.—(1) Divide the class into two lines, each line to be numbered from the instructor's left to right, and to face the instructor. The odd numbers are the right files, the even numbers the left files. Each member should be about one pace distant from his neighbour.

(2) Go through the formation of the seats in the following order, and by the following words of command:—

"*Form Two-handed Seat!*"

This will be done in the way described previously, the students turning inwards and forming the seat.

"*As you were!*"

Each member of the class will now turn, facing the instructor.

"*Form Three-handed Seat!*"

"*As you were!*"

"*Form Four-handed Seat!*"

"*As you were!*"

(3) A part of the class should then be told off as patients, or boys may be used for the purpose. There should be a patient for each two bearers. The patients take up their position in front of the bearers, being seated on the ground in the practice of two-handed seats, and standing in the case of three- and four-handed seats.

The following orders should then be given :—

"*By Two-handed Seats, lift Patients!*"

"*Advance!*" "*Retire!*" "*Advance!*" "*Lower Patients!*"

"*As you were!*"

"*By Three-handed Seats, lift Patients!*"

"*Advance!*" "*Retire!*" "*Advance!*" "*Lower Patients!*"

"*As you were!*"

"*By Four-handed Seats, lift Patients!*"

"*Advance!*" "*Retire!*" "*Advance!*" "*Lower Patients!*"

"*As you were!*"

One bearer may himself conduct the transport of a patient by allowing him to rest his weight on his shoulder, while he himself aids by taking the patient round the waist and helping him along. He may even lift and carry the patient in the ordinary school-boy pick-a-back style.

3. **Stretchers.**—(*a*) The *Regulation Stretcher* has poles 7 feet 9 inches in length, to which is fastened by copper nails a sheet of tanned canvas, 6 feet long, and broad enough to give the stretcher a total width of 1 foot 11 inches. The poles are fastened together at either end, just inside the handles, by a traverse or flat-jointed wrought-iron bar.

Each stretcher has a small pillow and a couple of strong leather slings (Fig. 151). In the new pattern (mark ii.) the slings are made of tanned web, and instead of a buckle there is a grip-plate.

In mark ii. the stretcher is fitted with steel U-shaped runners instead of wheels.

The stretcher can be closed for ease in transport (Fig. 152). It may have a special jacket—known as the "Lowmoor jacket"—fitted to it for use in mines, ships' holds, etc., where it is desirable to fix a patient firmly on a stretcher which has at first to be carried vertically till the patient arrives on terra firma (see Fig. 186, p. 167).

(*b*) The *Norton Stretcher.*—This stretcher was invented by the late Surgeon-Lieut.-Colonel A. T. Norton, commandant of the Volunteer Medical Staff Corps, and is most ingenious and serviceable. The stretcher has the advantage of being useful both as stretcher and bed, and is, therefore, particularly useful for military ambulance work at manœuvres or on active service. It is fitted with collapsible legs and telescoping handles. The canvas is adjusted

by means of two rods, which are easily detachable, thus permitting the canvas to be cleaned or disinfected (see Figs. 153 and 154).

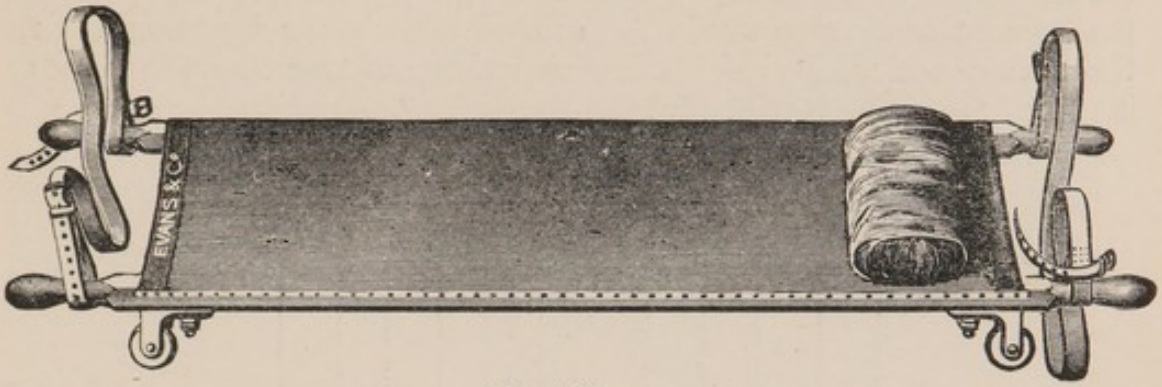


Fig. 151.

Fig. 152.

Figs. 151 and 152.—Regulation stretcher (open and closed). (Old pattern.)

(*c*) Surgeon-Major Worthington, of the Canadian Volunteer Militia, has recently described an improved stretcher of his own invention for hospital, ambulance, and military use. This stretcher has the special advantage of being made under the patient instead of the patient being lifted on to it. As first used it consisted of eight pieces of pine, six of them being 30 inches in length, 4 inches

Fig. 153.—Showing Norton stretcher bed folded.

Fig. 154.—Showing it as a bed.

in breadth, and $\frac{1}{4}$ inch thick; the other two 3 inches in breadth, $\frac{3}{4}$ inch thick, and the length of the patient's bedstead, inside measurement. The ends and edges are rounded and made perfectly smooth. The short pieces are passed under the patient from side to side at regular intervals from head to feet. The long pieces are than carefully inserted under the ends of the short ones. The apparatus can be put together in a minute, and is lifted by a person at each

corner. Dr. Worthington believes that for field use the above put together in sets with a wooden pin to be dropped into a hole at each corner would be more serviceable and in every respect better than the present army stretcher. It is fitted with hooks for slinging in the ambulance waggon. The accompanying illustration (Fig. 155) is copied from the *British Medical Journal.*

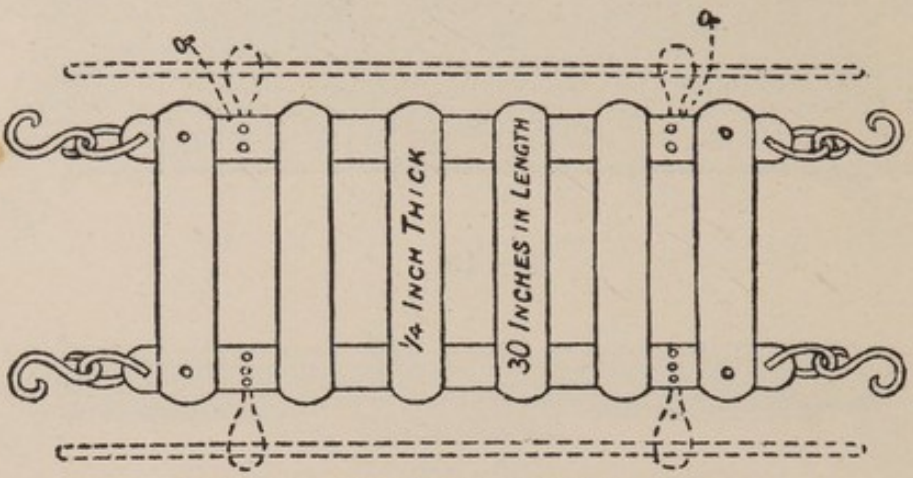


Fig. 155.—The Worthington stretcher.

(*d*) The "Furley-Headley" stretcher (Fig. 156) is made of two poles and a canvas bed with a wide hem down each side through which the poles are passed. The poles are kept apart by galvanised iron jointed traverses. At each end of the traverse is a U-shaped piece of iron into which the poles fit, and attached to the traverses are short legs with roller feet. This arrangement allows the poles and traverses to be removed; a patient can thus be left with only the canvas between his body and a bed or operating table.

Fig. 156.—The "Furley-Headley" stretcher.

(*e*) An *Extemporised Stretcher* may be made in a variety of ways:—

(1) The *Greatcoat* or *Coat Stretcher* is made by taking two coats or greatcoats, and through their sleeves, turned inside out, passing two clothes-poles or strong broom handles. The coats are then buttoned down the middle, and the appearance of the stretcher is shown in Fig. 157. This stretcher may be made with greatcoats, jackets, or waistcoats. It requires two greatcoats, three ordinary jackets, or five waistcoats.

(2) The *Rug and Pole Stretcher* may be made by rolling two clothes-poles into a rug, beginning at the sides, until the width of rug left between the two poles is about 20 inches. The appearance

[*To face p.* 140.

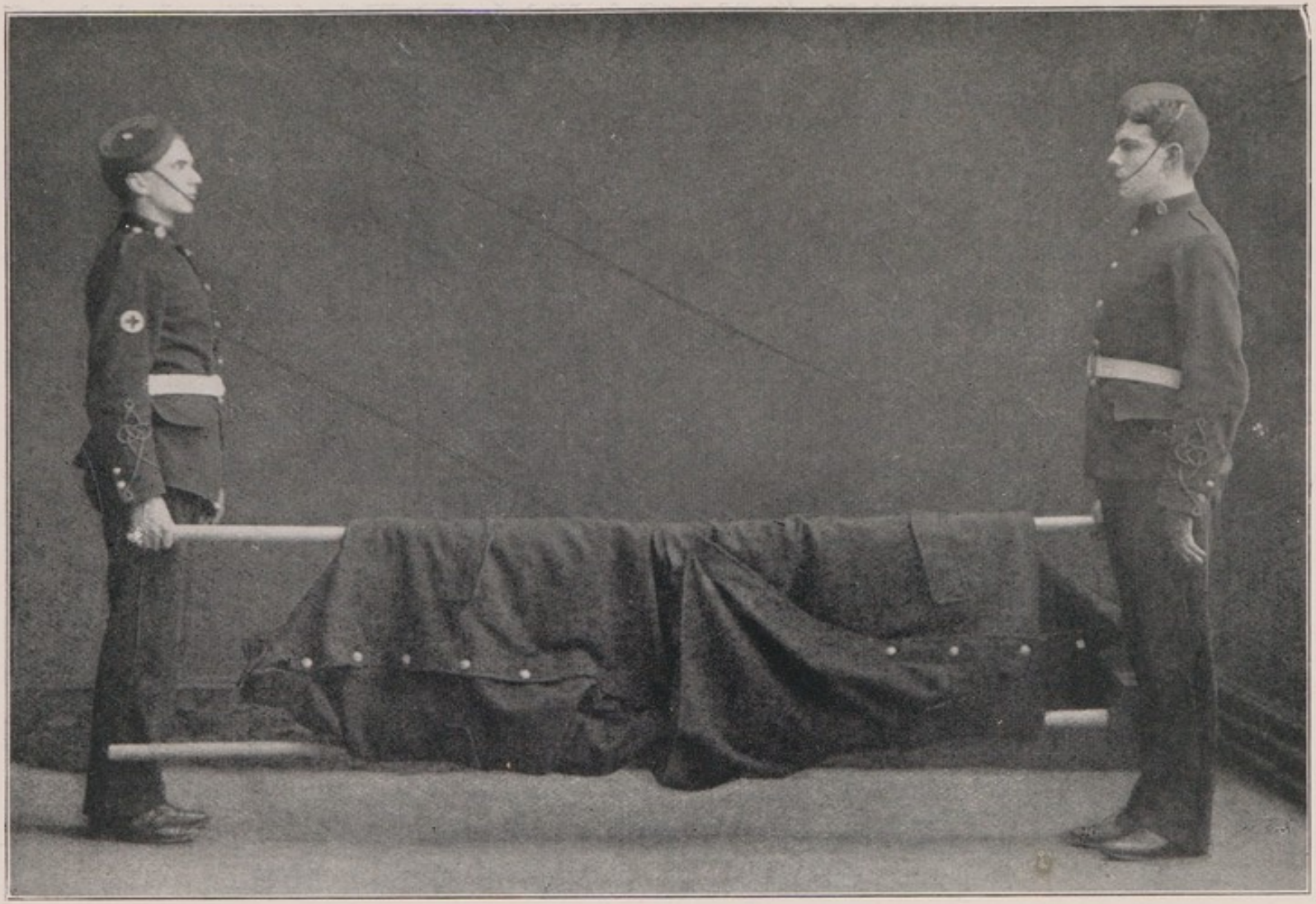


Fig. 157.—The greatcoat or coat stretcher.

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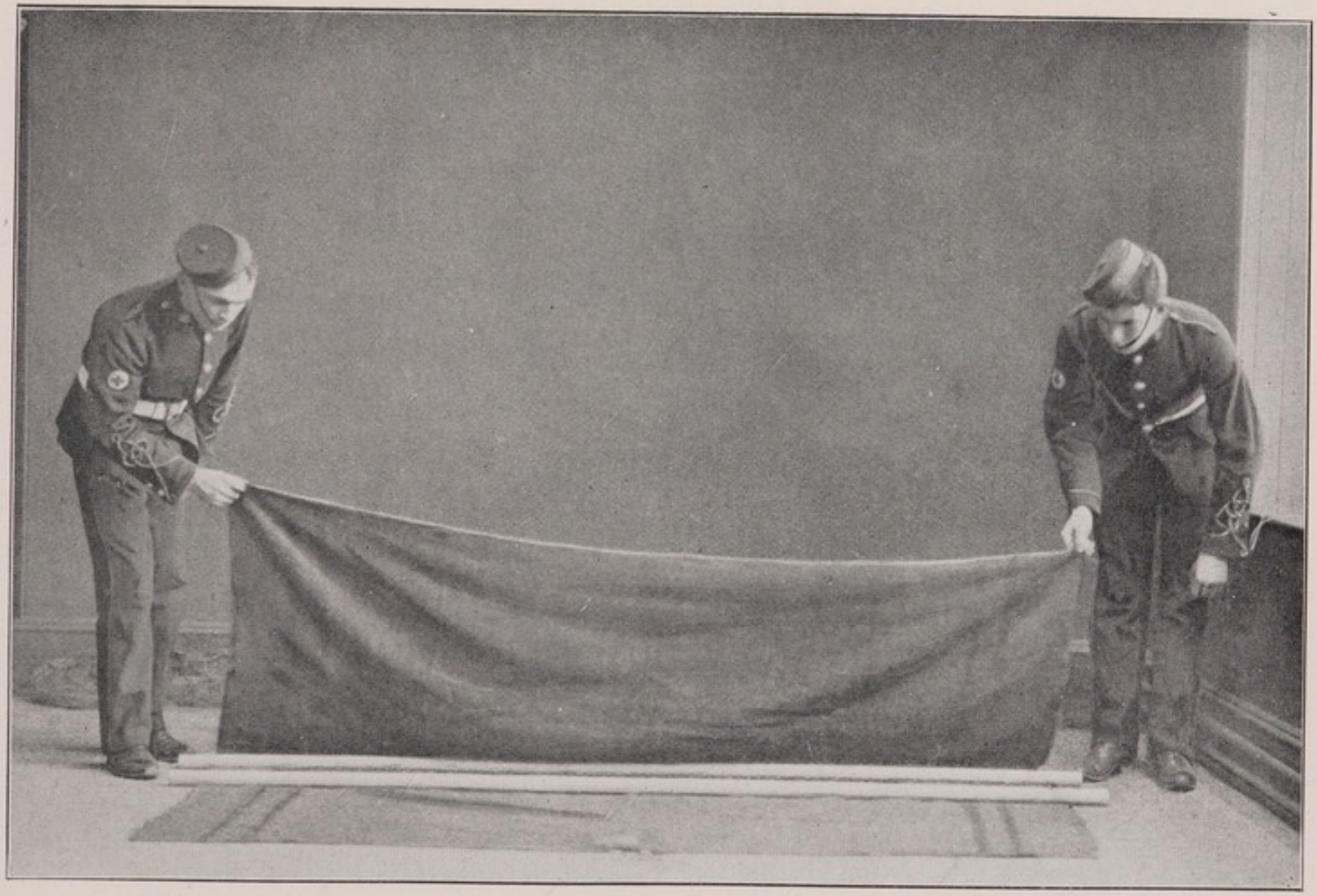

Fig. 158.—The rug and pole stretcher (Spary's method).

[*To face p.* 141.

Fig. 159.—Method of carrying by Spary's stretcher.

To face p. 141.]

Fig. 160.—Stretcher made from blanket and two rifles with fixed bayonets.

of such a stretcher, and the method of carrying it, are shown in Figs. 158 and 159.

(3) The *Rifle Stretcher* is made in an exactly similar way to the last, only two rifles are used instead of the poles (Fig. 160).

The method shown in the figure was suggested by Staff-Sergeant Spary, R.A.M.C., who used rifles with fixed bayonets. The method is very simple, and is described as follows :—"Spread a blanket on the ground, lay two rifles parallel to one another, each 10 inches from the centre of the blanket, both muzzles pointing in the same direction, trigger guard outwards; turn a fold of the rug 6 inches wide over the ends of the butts, fold the right side of the rug over the rifle on that side to the rifle on the opposite side, then similarly fold the left side. A stretcher is thus formed consisting of three folds of blanket, the ends at which the butts are being the head end." It is carried as shown.

(4) A *Plank Stretcher*, consisting of a broad plank of wood, or a narrow door, may be used for carrying the patient. The plank may be supported by the hands directly, or ropes may be placed from side to side across it near its ends, and the stretcher carried by four bearers holding the ends of the ropes at the sides.

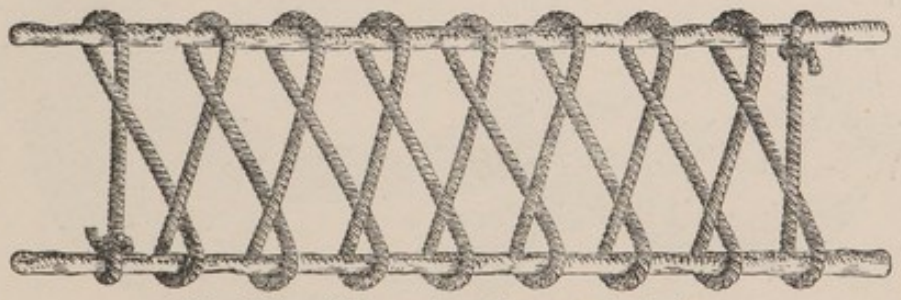

Fig. 161.—The pole and rope stretcher.

(5) The *Pole and Rope Stretcher* consists of two strong poles, and a body formed of a long strong rope, wound from side to side alternately round each pole (Fig. 161). The *rifle and puttee stretcher* is made in a similar fashion, two rifles being used as poles, and puttees taking the place of the rope.

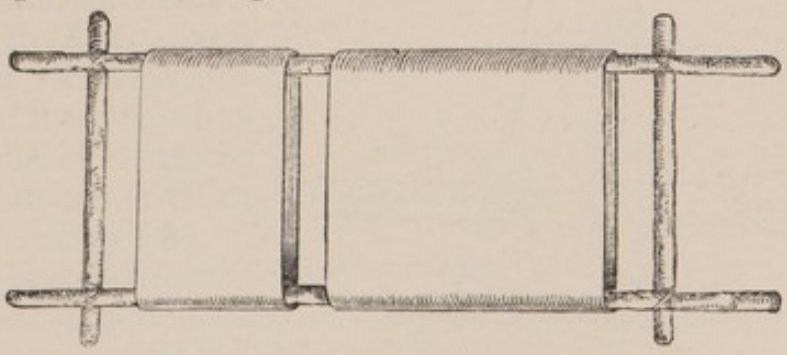

Fig. 162.—The extemporised canvas stretcher.

(6) A stretcher may be made by nailing to two suitable rollers a piece of tent canvas, sacking, or strong cloth (Fig. 162).

(7) The *Hammock Stretcher* (Fig. 163).—In suitable cases a patient may be carried in a hammock, which is attached at either

Fig. 163.—The hammock stretcher.

end to a long strong pole. The pole is supported on the shoulders of two bearers. Anyone who has seen the Portuguese hammock-bearers in Madeira using this means of transport will agree as to the ease and comfort it affords, and recognise its suitability for many ambulance cases.

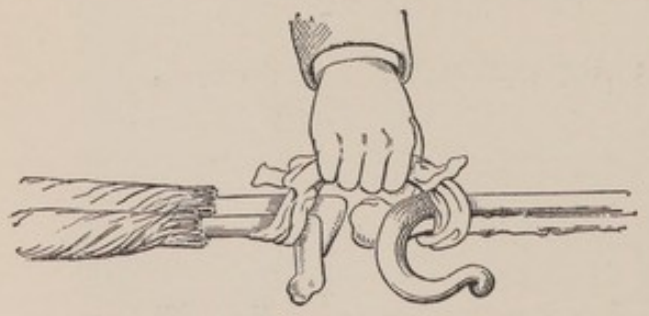

Fig. 164.—The umbrella stretcher.

(8) *The Umbrella Stretcher.*—Where no suitable stretcher poles are at hand, they may be extemporised as shown in Caird and Cathcart's *Surgical Handbook*, and illustrated in Fig. 164, where walking-sticks and umbrellas are made to serve the purpose of poles by being loosely bound together. A

"coat" stretcher is then made over these, as described above, and two extra assistants are required to support the stretcher poles at their middle, where they join. No attempt should be made to bind the umbrellas firmly together, as they cannot in that way be made sufficiently secure. The only duty of the two extra bearers is to support by the bandage or handkerchief the jointed middle of the extemporised stretcher poles.

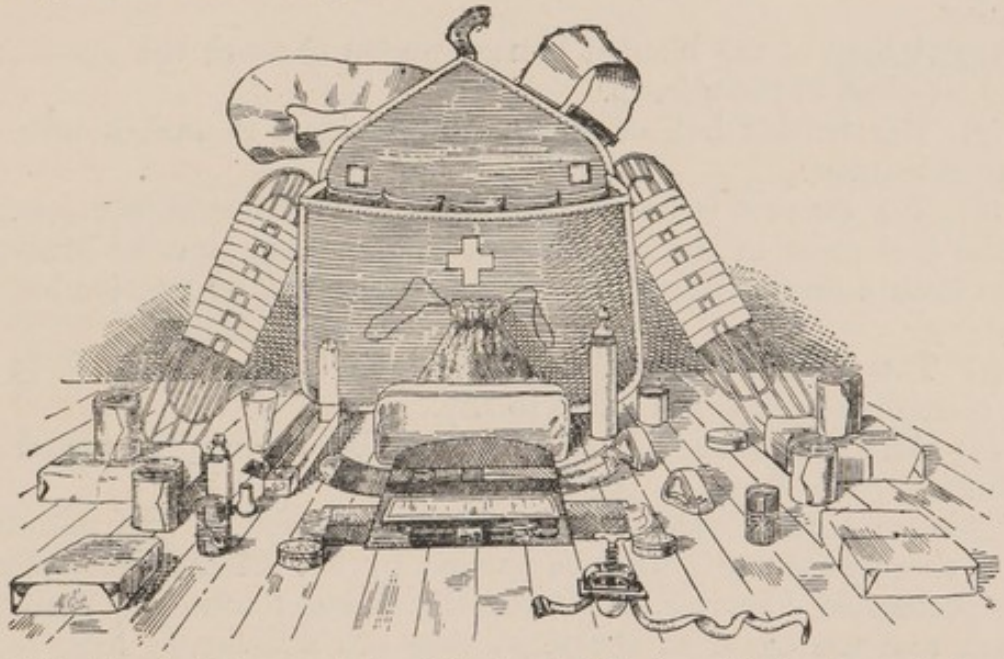

Fig. 165.—Surgical haversack (weight about 5 lbs.) containing bearer's dressing case,* improved; morphia injection (in stoppered bottle and boxwood case), ½ oz.; sal volatile (in stoppered bottle and boxwood case), 2 ozs.; graduated horn cup, No. 1; lint, antiseptic, 4 ozs.; loose-wove bandages, antiseptic, No. 4; triangular bandages, antiseptic, No. 6, boric wool, 2 ozs.; isinglass plaster, 12 yards 1-inch tape, 1 tin; plaster, adhesive, 6 yards 1-inch tape, 2 tins; sponges, in waterproof bag, No. 2; identification tallies, 1 book; tourniquets, field, No. 2; tourniquets, screw, small, No. 1; tourniquets, Esmarch's web, No. 2; wax candle and matches, 1 tin box; wire arm splints, with tapes and buckles, 2 pairs.

(9) *Stirrup and Blanket Stretcher, an Improvised Blanket Stretcher for Mounted Troops.*—In the *Militär-Wochenblatt* of April 30th, 1910, Oberstabsarzt Blau describes his "Sattelzeugtrage," a modification of Petsche's blanket stretcher. He gives the following directions:—

(*a*) Four men are ordered to unscrew the balls on the tops of their helmets or to take off their sword-knots.

(*b*) Sword-knots are to be double-knotted and the tassel passed through the remaining loop to form a firm ball.

* Contents of bearer's dressing case:—Clasp knife, long-bladed; scissors, strong; dressing forceps; spatula, plated; probe and director combined, plated; needles, common, 6; pins, large, 12; skein of thread; half-curved needles, plated, 6; harelip pins, 6; safety pins, 6; sulphuro-chromic gut; skein of worsted; worsted needles, 2; Morocco leather case; water bottle, with drinking cup and strap, complete.

(*c*) The blanket is next taken from the wounded man's horse, or from a horse which has been killed.

(*d*) Four stirrups with stirrup leathers are taken if possible from the off artillery horses.

(*e*) At each of the four corners of the blanket is placed a helmet ball or knotted sword-knot; the stirrups with leathers are placed alongside with the foot-piece of the stirrup directed towards the blanket.

(*f*) A loop of the blanket is next pulled through the opening in the foot-piece of the stirrup.

(*g*) The helmet ball or knotted sword-knot is pushed into the loop of blanket.

(*h*) The blanket is now pulled back again through the opening of the foot-piece in the stirrup and at the same time so arranged as to form a firmly fitting cap for the helmet ball or knotted sword-knot.

(*i*) The helmet ball will now be found to give a firm hold on the blanket, and it is not liable to slip.

(*j*) All the four stirrup grips to be thoroughly tested by pulling.

This improvised stretcher should be prepared in five minutes; for a short distance it may be carried by the stirrup irons alone; it is preferable, however, to let out the stirrup leathers to their full length and use them as slings, as they are sufficiently long to be placed over the opposite shoulder. By using the stirrup leathers as slings, two bearers (instead of four), one at either end, can carry a patient; the slings can also be used for suspending the stretcher in an ambulance waggon. With four bearers using the slings one can take either end, and by fixing two more stirrup leathers in the middle of the sides of the blanket, the other two can support the body of the patient and prevent the blanket from sagging; if the fifth and sixth stirrups are not available, the third and fourth bearers can cross hands under the blanket, and in this way materially assist in carrying the patient.

(10) *Improvised Military Stretchers for Hand Carriage and Railway Transport.*—Two methods of improvisation have been described by Colonel H. E. R. James, and are suitable for Voluntary Aid Detachments, as they require few tools and the materials are to be found in most farmyards. The first is an emergency stretcher, which takes very little time to make; it is intended only for hand carriage, and cannot be used as a bed. The second takes more time to make; it can be used for carriage by waggon or rail, and as a temporary bed.

The first stretcher (Fig. 166), for hand carriage only, has a triangular frame, which is lashed together with yarn. A quadrangular frame so constructed is very much less rigid, and more liable to collapse.

Fig. 166.

Extemporised Stretcher made of hop poles & corn sacks

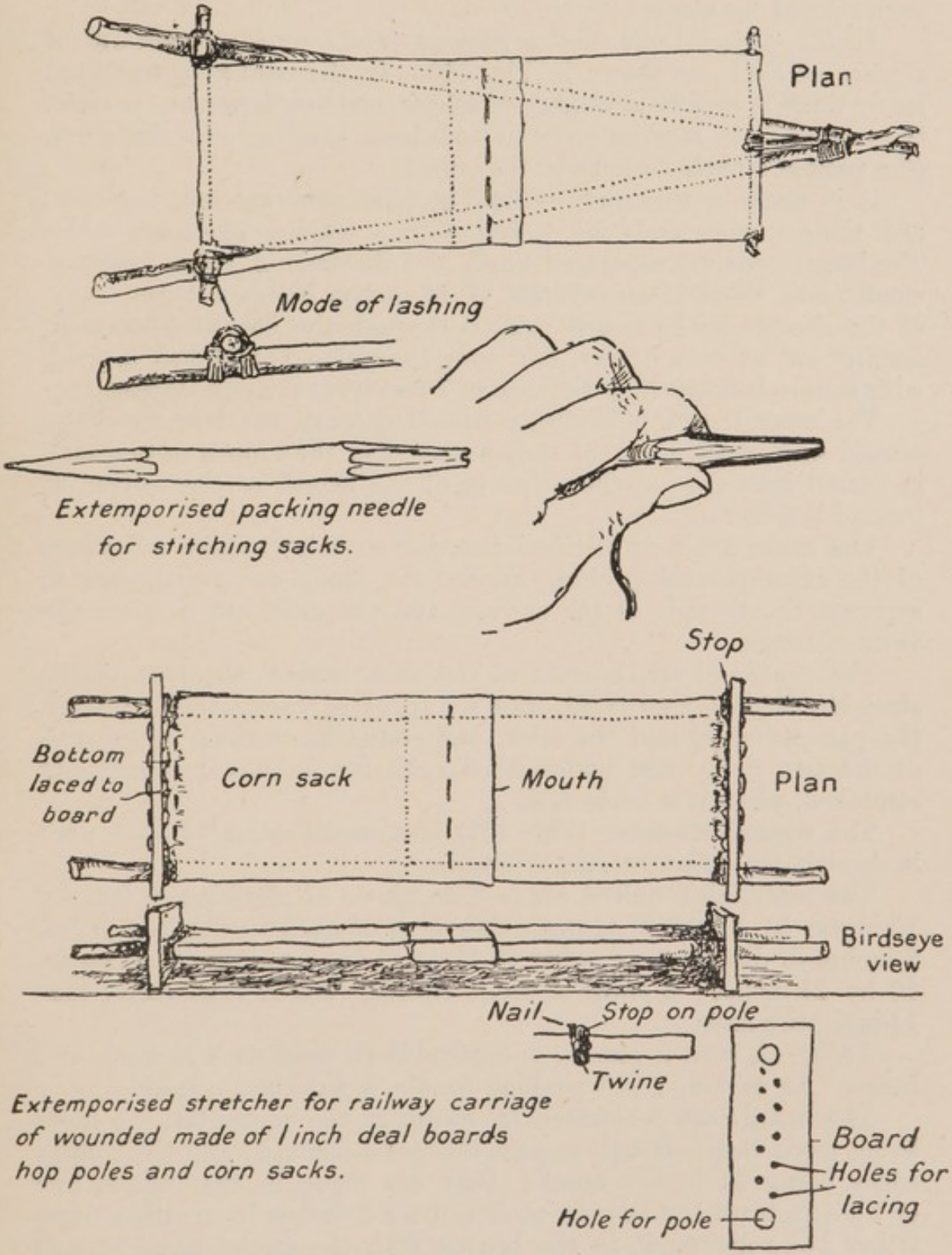

Fig. 167.

(From the *Journal of the Royal Army Medical Corps.*)

The requisites for No. 1 are: Two hop-poles or stack-props, 2½ to 2 inches in diameter, not less than 9 feet long. Two lighter sticks, 1 inch at least in diameter, and 36 inches long. Two corn sacks, 40 inches by 24 inches (ordinary size). Five yards of rope yarn (tarred for choice).

Tools.—A jack-knife, and a packing needle extemporised out of a piece of stick, as shown in Fig. 166. In the case of a fractured leg or thigh it may be necessary to add transverse battens to prevent the canvas from sagging and the limb from bending over the poles, (the patient's heels lie outside the poles).

It is made in this way:—The two long poles are laid together, and their smaller ends are lashed with a lashing 1½ inches wide. The larger ends are separated until, at a distance of 7 feet from the small ends, there is an interval of 28 inches between them. One of the shorter sticks is now passed through the bottom of a sack, coming out at each corner, laid over the poles, and lashed to each with square lashings at a distance of 7 feet from the end lashing.

The second stick is similarly passed through the bottom of the second sack, coming out at each corner, and the mouth of one sack is passed into that of the other until the length of the canvas so formed is 6 feet.

The sacks are now stitched together in this position by means of the extemporised packing needle, the sharp end being used to separate the threads of the canvas, and the cleft end to push the twine through.

The centre of the bottom of the sack nearest the foot of the stretcher is now perforated, and six turns of yarn passed through the perforation, round the stick, and round the lashing at the end of the two poles, and pulled hard until the canvas is thoroughly stretched, when it is made fast.

The second stretcher (Fig. 167) is a modification of that used in Austria for railway transportation.

The materials required are:—Two pieces of planking, 3 feet by 10 inches by 1 inch, if of deal, thinner if of hard wood; two poles, 2 inches in diameter, tapering to 1¾ or 1½ inches; two grain sacks, 40 by 24 inches; 6 yards of stout twine or tarred rope-yarn; four 1½-inch wire nails.

Tools.—A saw, a gimlet, a centre-bit (if possible 2 inches), and brace. An extemporised packing needle, a hammer, a knife.

The boards are perforated by means of the centre-bit, the holes being made large enough to pass the poles through, and their outer edges being 24 inches apart; they are made in the middle line of the length of the boards, their centres 5 inches from either edge. Other holes are made in the boards with the gimlet large enough to pass the twine through easily; ten holes are enough, alternately above and below a line passing through the centres of the larger holes, the two rows of five being 1 inch apart. Holes are made in

[*To face p.* 147.

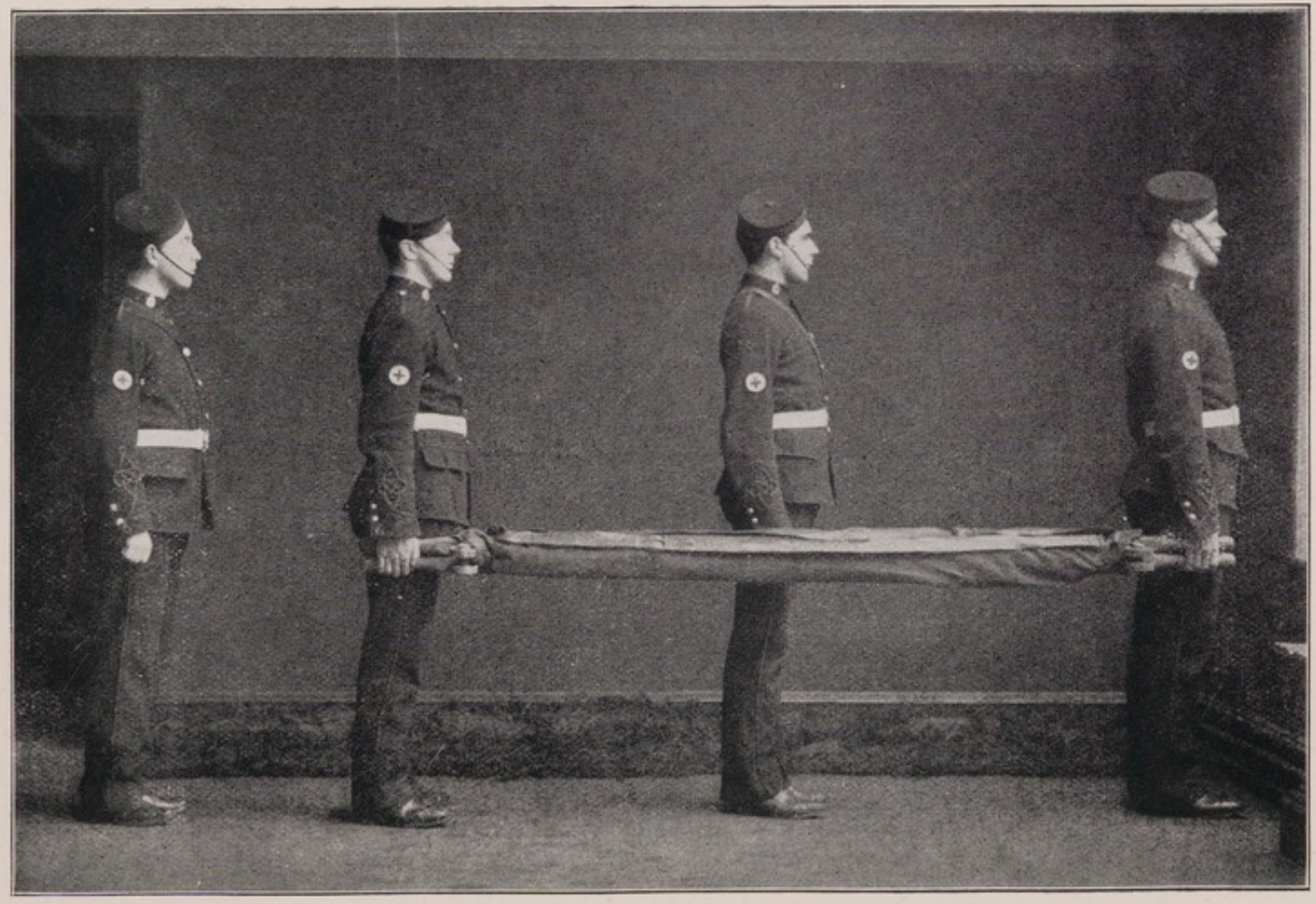

Fig. 168.—Arrangement of stretcher bearers.

the corners of the two sacks large enough to allow the poles to pass through. The two poles are now passed through one of the boards, and one sack is drawn bottom first over them, the poles being passed first through the holes in the corners of the sack so as to be inside it.

The second sack is now passed over the poles mouth first, and the poles are passed through the holes in its corners, and then through the holes in the second board.

The boards are now adjusted so that they are square with the poles and parallel with one another at 6 feet 2 inches distance. The poles are marked with chalk or pencil where the inner edges of the board cut them, and at this point a nail is driven for half its length and twine is wound round to form "stops," which may be further helped by wedging to keep the boards apart. The spare ends of the poles are now cut so that they project 9 inches beyond the boards. The mouth of the sack is now drawn over that of the other so as to form a continuous canvas 6 feet long, each end formed by the bottom of each sack being 1 inch short of touching the board. Stitches of twine are passed through both thicknesses of both seams to keep them in this position. Finally a lacing is made to fix the bottoms of the sacks to the boards, the twine being passed through the holes in the boards, and through two thicknesses of the sack's bottom.

The stretcher so formed is not perfectly rigid, and owing to the poles being round the boards may twist upon them, if the stretcher is not evenly carried, but if properly stoppered and wedged, this will not be found troublesome, and the lacing at head and foot keeps the frame square.

Stretcher Bearers.—There should be four bearers to each stretcher. The bearers standing in their relative positions by the side of a stretcher are numbered from before backwards, as follows :—

No. 1.—At the patient's feet, with the toes in line with the front end of the poles.
No. 2.—At the centre of the poles.
No. 3.—At the patient's head, with the heels in line with the rear end of the poles.
No. 4.—One pace in rear of No. 3.

The arrangement of the bearers is shown in Fig. 168.

Bearers Nos. 1 and 3 should carry the stretcher as level as possible, and to do so with a loaded stretcher they march slowly, with their knees bent, and with a short 20-inch step. No. 1 moves off with his left foot, No. 3 with his right, so as to prevent the lateral swing, which would take place were they to keep step.

The duties of Nos. 2 and 4 bearers are to look after the general welfare of the patient, to carry the patient's accoutrements or property, and to render him the necessary first aid treatment. No. 4 is in command of the stretcher squad. If Nos. 1 and 3 become tired,

their places are taken by Nos. 2 and 4. The duties of these bearers are further mentioned below under Stretcher Drill (*q. v.*). In army stretcher drill (Fig. 194), the No. 2 bearer is provided with a large water bottle, while the No. 4 carries a surgical haversack, which contains tourniquets, splints, bandages, dressing-case, drugs, etc. Fig. 165 shows the surgical haversack and its contents.

4. **Ambulance Transport.**—(*a*) The *Military Ambulance Waggon* (Fig. 169) is a large, strongly-built carriage, with a cover, curtains, and hood of canvas. It is fitted with a corn-locker and water-tank, and is mounted on strong steel springs. It provides accommodation for six or seven wounded men, two inside on stretchers, two on the box in front, and two or three on the tail board behind. The converted Mark V. Waggon is constructed to accommodate four patients on stretchers (two stretchers on the floor and two on the rails, which

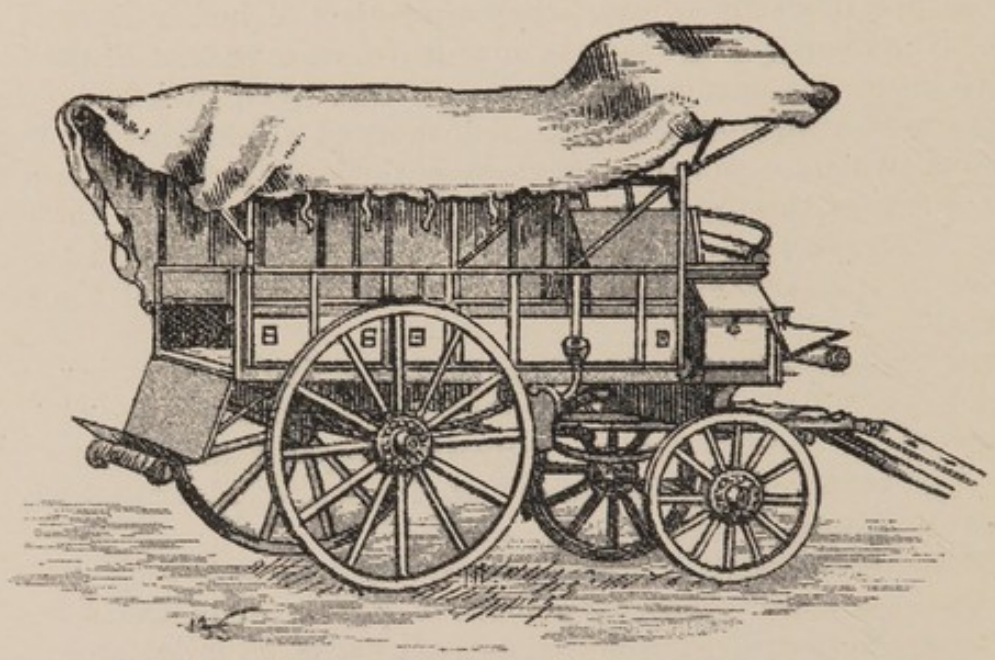

Fig. 169.—Military ambulance waggon (old pattern).

fold down on the forward seats), or twelve patients sitting (six on each side), or two on stretchers on the rails resting on the seats, and four sitting on the seats at the rear end.

The *Mark I. Light Ambulance Waggon*, suitable for use with cavalry units is constructed to carry two patients on stretchers, or eight sitting, six inside and two outside.

The Galloping Ambulance.—This ambulance was designed by Captaid Avery, R.A.M.C. (T.F.) with a view to filling the want of stretcher bearers with mounted troops. The endeavour has been to construct a light strong carriage easily adjustable to any mounted horse, and capable of keeping up with cavalry through any sort of country.

As will be seen from the accompanying illustration (Fig. 170), the ambulance is a two-wheeled contrivance. The body consists

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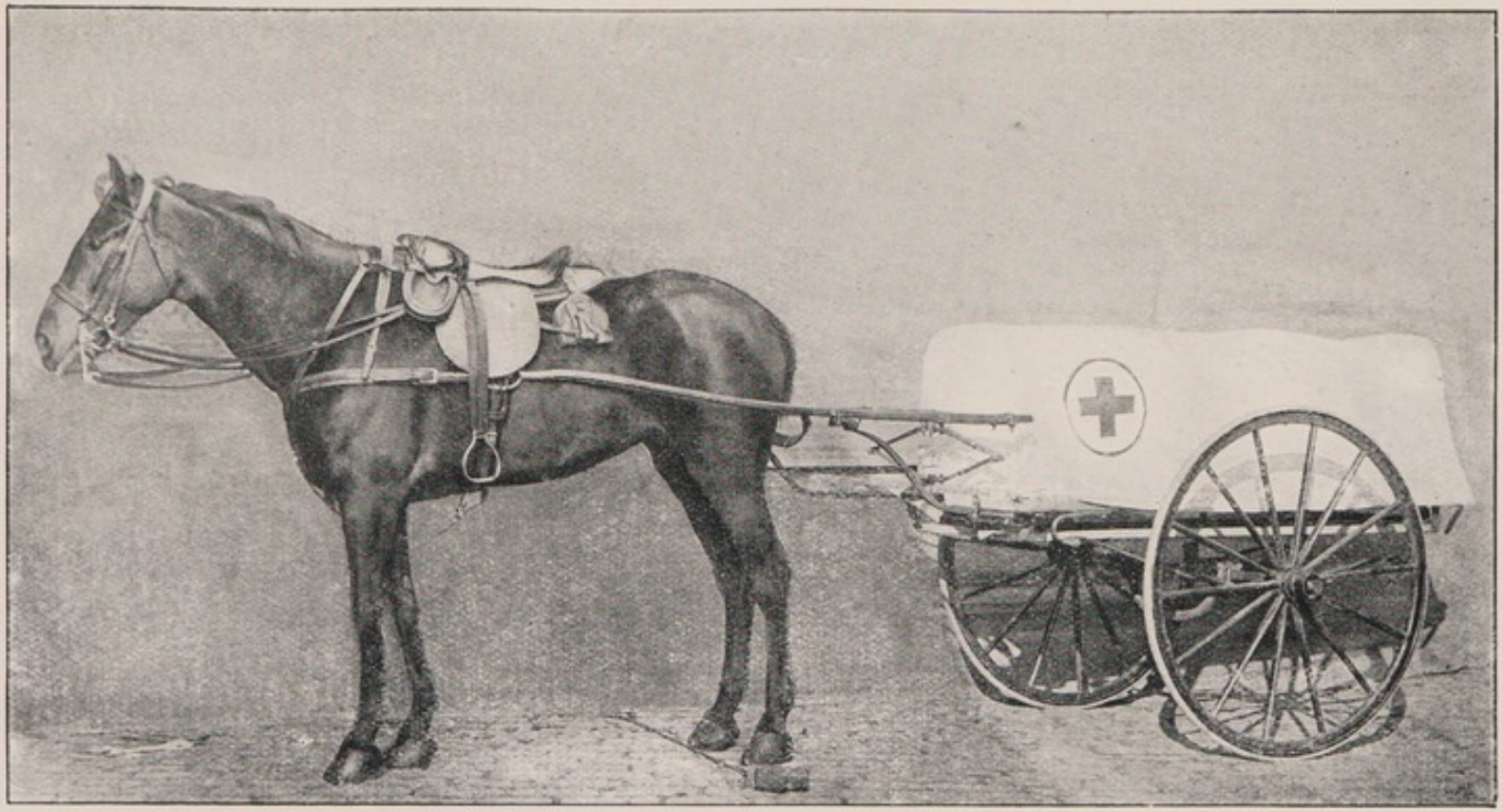

Fig. 170.—Galloping Ambulance, or "Rapid Transit Ambulance." (From the *R.A.M.C. Journal.*)

of a platform fixed to a crank axle by long springs between 46-inch wheels. This platform is 2 feet 3 inches from the ground, and is arranged to carry an ordinary service stretcher. The forepart consists of a pair of short shafts, which are attached to the body by an arrangement of springs adapted to prevent the side-to-side motion caused by the action of the horse. The shafts reach as far forward as the saddle flaps, where they are held in position by a girth strap, breastplate, and belly-band.

The body is covered by a canvas hood. The weight is about 3 cwts. Length over all, 12 feet. Track, 4 feet 1 inch. Surgical dressings, splints, water bottle, etc., are carried. It is quite easy for the driver, having placed a wounded or helpless man on a stretcher, to transfer him from the ground to the platform of the carriage single-handed.

It is a very comfortable conveyance, and has proved itself capable of negotiating rough country.

Military Motor Ambulances.—In addition to the ordinary ambulance fitted on a motor chassis, the French and German armies have made satisfactory trials of large and very fully equipped motor ambulances, in which the wounded soldier can be operated on in the field if necessary, before being transported to the nearest clearing or stationary hospital. The French motor ambulance is really a mobile field hospital, and has an up-to-date operating-room, which is fitted with X-ray apparatus, as well as instrument cases and sterilisers. Serious cases requiring immediate operation can be dealt with in the immediate neighbourhood of the battlefield, and are thus placed in a much better condition for standing the trying journey to the nearest military hospital in the rear. The large German motor ambulance is divided into two rooms, one to be used as a small hospital ward, the other fully fitted up as an operating-theatre, with all necessary appliances, including incandescent gas lighting, gas stoves, and high-pressure steam heating and sterilising plant.

It is probable that these mobile infirmaries will be found of great service in the warfare of the future.

Extemporised Motor Ambulances.—The method of transforming an ordinary motor omnibus into an extemporised motor ambulance has been worked out and described by Colonel H. E. R. James in the *Journal of the Royal Army Medical Corps.* Colonel James measured one of the newest standard bodies of the omnibuses in use in London, and gives the following directions for its conversion into a motor ambulance to carry four patients on stretchers.

The internal dimensions that matter are as follows :—Length 11 feet 3 inches, width at level of seat 4 feet 6 inches, width halfway between seat and roof 5 feet 6 inches, height (approximate) 5 feet 8 inches, width of door 2 feet, width of seat 1 foot 4 inches.

The accompanying diagram (Fig. 171) shows the general arrangement.

There is a brass arm half-way along the seat which forms an obstruction ; the handrail to the steps leading to the roof is also an inconvenience to the carrying in of stretchers. The seat and back are usually cushioned in two sections on each side.

The *structural alterations* required are :—

(1) The removal of the brass arm which divides the seats.

(2) *Possibly* the removal of the handrail to admit the stretchers.

The arm can be removed with a screwdriver. A screw-wrench is necessary for the hand rail. The *extraneous apparatus* necessary is :—

(1) Four battens or bars of ash, or oak—two of 4 feet 6 inches by $2\frac{1}{2}$ inches by 2 inches ; two of 6 feet by $2\frac{1}{2}$ inches by 2 inches.

(2) Eight 2-inch by $\frac{1}{4}$-inch iron screws.

(3) Four stretchers with slings.

(4) Twenty yards of $\frac{3}{4}$-inch circumference cord for lashings.

Tools.—Screw-wrench, a screwdriver, a $\frac{3}{16}$-inch gimlet, a jack-knife.

The method of adaptation :—

(*a*) It is intended to suspend two stretchers from transverse supporting battens or bars whose ends pass through the ventilating apertures and rest upon the frames of the apertures. The weight to be carried is two stretchers, each 35 lbs. = 70 lbs. ; two patients, say, 170 lbs. each = 340 lbs. (410 lbs.). This weight is distributed over four frames, each taking 103 lbs. The frames are of 1 inch square ash, and strongly mortised into the uprights. The two end ventilators on each side are opened, the restraining straps being detached. The two longer battens are thrust through the apertures and rest on the frames near the uprights. A screw is driven (leaving 1 inch projecting) into the underside of each batten at each end half an inch from where it cuts the outer edge of the aperture. The eight slings of the four stretchers are made into closed loops, four round each batten, by the method shown in the diagram, or supplementary loops may be formed from $\frac{3}{4}$-inch rope (see Fig. 172).

(*b*) The two remaining stretchers are to be laid upon two transverse battens, whose ends rest upon seat cushions laid across the seats. Screws should be screwed half their length into the upper faces of the batten to stop the stretchers from slipping inwards.

Lashings should be used as necessary.

(1) To steady the upper stretcher the point of purchase should be taken from the strap rails.

(2) To prevent the lower stretchers from slipping lengthways a purchase may be taken from the stanchion that supports the seat. Enough rope is allowed to form suspension loops in case slings should be wanting, four thicknesses are considered sufficient to support each pole.

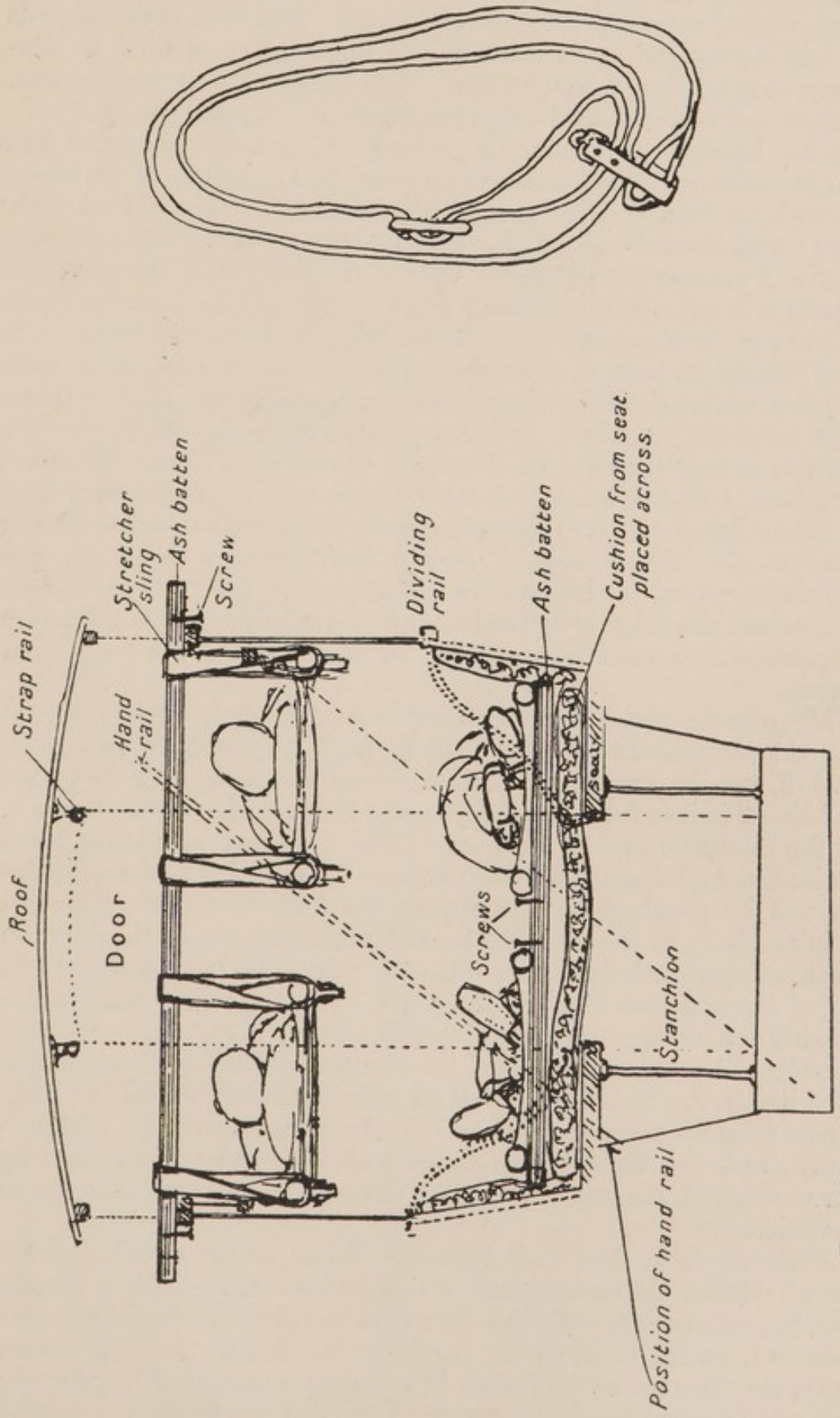

Fig. 171.—Ambulance waggon improvised from motor omnibus. (From the *R.A.M.C. Journal.*)

Method of Loading.—The upper battens are to be placed in position first, and suspension loops formed. Next the lower battens are laid across the seats beneath the upper ones to form a temporary support for the stretcher. The upper tier is first loaded, commencing with the near side stretcher.

Four bearers are necessary to load. When the stretcher has been brought up to the omnibus opposite to the centre of the door, and with its long axis in continuation of that of the omnibus, Nos. 2 and 4 turn inwards, and with No. 3 take the weight of the stretcher, and No. 1 mounts the platform. Nos. 2, 4, and 3 raise the stretcher, keeping it longitudinal until its foot clears the handrail, if the handrail has not been removed, No. 1 steadying it in this position while No. 3 disengages and mounts the platform. No. 1 now takes both the poles, and assisted by the remainder in supporting the stretcher, backs into the omnibus, and No. 2 mounting the platform, the stretcher is lifted in until the hind end of the poles clears the rail—when Nos. 1 and 3 bring it completely in and lay the poles upon the lower battens, No. 1 stepping over them as he backs up the omnibus. No. 2 now enters. Nos. 1 and 3 mount the seats, and raise the stretcher till its handles come opposite the prepared loops. No. 2 passes the loops over the handles and a lashing is placed under the runners and over the handles, so as to secure the loop from slipping.

The off-side upper tier stretcher is next loaded. When this is done the lower battens are placed in their proper positions, as in Fig. 172, on the two cushions laid across the seats—the foremost one being 9 inches from the front end of the interior of the omnibus, and the hindmost one 6 feet in rear of it. The near-side stretcher is first loaded and finally the off-side one. Some nicety of manipulation will be required in introducing the last stretcher. Room is left in the body of the omnibus for one sitting-up patient in addition to the waggon orderly. The kits and rifles can be placed on the floor of the omnibus between the seats. The top will accommodate probably ten sitting-up cases (fifteen in all).

Note.—The loading will be greatly facilitated by the removal of the handrail. This is mounted on stanchions secured to the steps by square-headed screws. These can be unscrewed with a screw-wrench, and the bolts which connect it with the top rail having been unscrewed, the whole comes off in one piece without damage to the vehicle.

Motor Lorry as Motor Ambulance.—While motor omnibuses will be available for the conveyance of sick and wounded only in certain areas, motor lorries are in constant use in the field for the conveyance of stores from rail-head to the troops at the front. As they return empty, they form a useful means of ambulance transport, if properly fitted and adapted for this purpose. That this can be readily carried out has been shown by Colonel H. E. R. James, whose article in

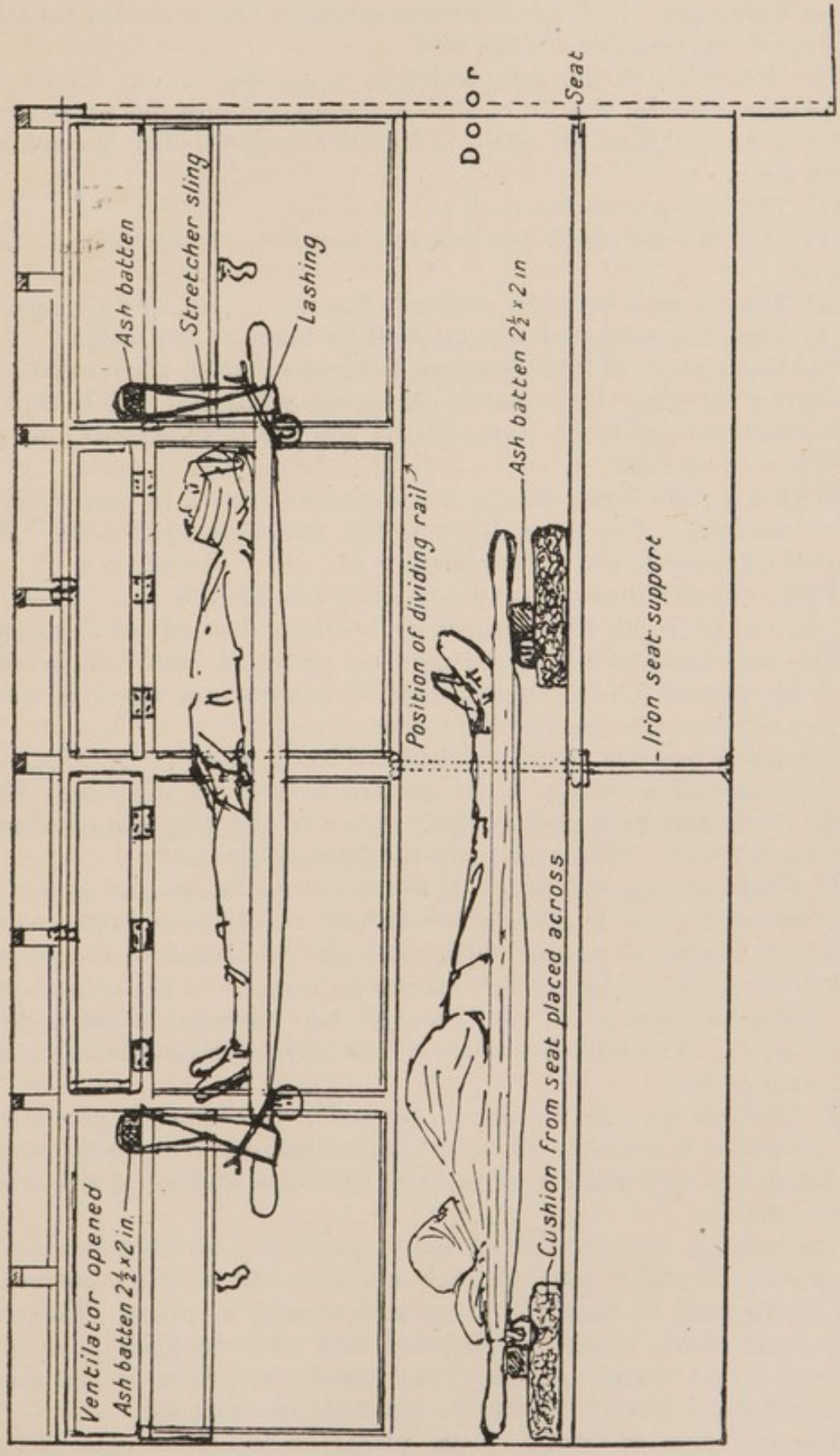

Fig. 172.—Improvised motor omnibus. (From the *R.A.M.C. Journal.*)

the *Royal Army Medical Corps Journal* is quoted below. The attention of Voluntary Aid Detachments is specially drawn to this method of improvising transport in the field.

The intention of this adaptation is to provide motor lorries of the pattern used by the Army with a simple and portable apparatus that will enable them to carry sick with comfort. The important points are :—

(1) That the apparatus shall not be bulky.

(2) That its use shall not demand structural alterations to the vehicle.

(3) That it shall be fairly resilient, but not excessively springy.

(4) That the fullest advantage shall be taken of the space.

For the purpose of this account it is supposed that, when emptied, the lorries carrying the stores of the clearing hospital will be fitted up for the carriage of the wounded by the use of apparatus always carried in or on them.

Within certain limits weight is not a consideration in these heavy motor vehicles. The 3-ton lorry is the one here spoken of. Its internal dimensions are approximately $12 \times 6 \times 2\frac{1}{2}$ feet.

This adaptation requires two pairs of ash bars, 3×2 inches in section, and of length to fit transversely within the body of the lorry.

The bars forming the upper pair are provided with iron hooks, which are fastened to the under sides by screws, and which fit over the top edges of the sides of the lorry.

The lower pair are raised by blocks of wood, of $3 \times 2 \times 9$ inches, which have spikes on the under surface to prevent slipping. The blocks have their long axes at right angles to the supports to which they are screwed. They rest upon the floor of the lorry.

The bars are approximately 6 feet long, and each pair supports three stretchers, the handles of which rest on the bars close to the traverse. Blocks of proper width are lightly fastened to the upper surface of the bars, to prevent lateral movement of the stretchers. The combined spring of the bars and the stretcher handles will absorb shock. The stretcher slings will be used to fasten the stretcher to the supports.

To give shelter, an awning of tarpaulin or canvas is provided, and four iron stanchions to carry longitudinal and transverse spars are fitted into two iron loops, each on the outer surface of the sides of the lorry.

The awning is supported by spars on the top of the stanchions, the screws of which pass through holes in the awning, butterfly nuts being used to keep the spars and awning in place. The circumference of the awning is provided with twelve eyelet holes and lanyards to tie where necessary, and staples are fixed to the sides and ends of the lorry to which the lanyards are fastened.

The two tiers of stretchers are placed in the front part of the lorry, the front stretcher handles being close to the front wall.

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Fig. 173.—Civil ambulance waggon.

The front transverse supports are placed comformably to this, and the rear ones in such a position that the stretchers are firmly supported. The traverses of the stretchers are included in the turns of the slings which fix the stretchers to the supports

The floor of the space in rear of the stretcher may be covered with sacks of straw for the accommodation of sitting-up wounded and the waggon orderly; the arms and equipment of the wounded will be placed here.

The apparatus consists of:—

Four bars of ash, 3 × 2 inches × 6 feet, two of them with iron hooks of $1\frac{1}{8} \times \frac{3}{8}$ inches iron, two of them with blocks 9 × 3 × 2 inches, which can be turned lengthways to the bar when not in use.

Four iron stanchions, 4 feet in length, $\frac{3}{4}$ inch iron, shaped, and with male screw at end. Four butterfly nuts to fit screws.

Two ash spans of 1 × 1 inch, 8 feet long, with flat-iron ends or iron bars (round) $\frac{3}{8}$ inch, perforated or looped in the case of iron, being used to fit over the screw at the end of each stanchion. Two similar ones, approximately 6 feet 4 inches, but according to the width of lorry.

Eight flat-iron square loops provided with 1-inch screws fastened to outer side of lorry receive the lower ends of the stanchions.

Twelve iron staples of $\frac{1}{2}$-inch opening and $1\frac{1}{2}$ inches long, to drive into side of lorry to fasten awning.

An awning of about 16 × 13 feet, shaped and fitted with eyelet holes at edges and lanyards to fix it to the staples.

The apparatus would pack into a space of—

Extreme length, ...	8 feet.
Extreme thickness, ...	1 × 1 foot.

It would lie under the stores and not appreciably interfere with the space, or could be fastened to the outside of the lorry.

The apparatus could be fitted immediately the stores were emptied out while moving along the road. This should not take more than a quarter of an hour under the most unfavourable circumstances.

The cost would be small.

(*b*) The *Civil Ambulance Waggon* is built on the same principle as the military, and is usually fitted to carry three or four patients on stretchers. The ambulance waggons used by the St. John and St. Andrew's Ambulance Associations, and in hospital work, are examples of this form of ambulance transport at its best.

Fig. 173 shows the arrangement of an ambulance waggon made by Messrs. R. & J. Shinnie, Coachbuilders, Aberdeen. This ambulance carriage, which is a model one, has many advantages. The body is hung low, with one step only between floor and ground for easy access with patient. The interior is well lighted with four embossed glass windows, and has a drop lamp from roof, similar to that used in railway carriages, for use at night.

Ventilation is obtained by venetians on each side and in the doors, and can be regulated by closing with hinged covers.

Accommodation is ample for two patients on stretchers. One stretcher can be hung from the roof, there being fixtures at the side and jointed rods from roof which hook the stretcher at each end, every bearing being muffled with rubber and leather to prevent noise. The other stretcher is on india-rubber tyred bicycle wheels, and rolls easily in a tramway-grooved way along the floor. At one side folding seats are arranged for three persons, either patients who can sit, or attendants in charge. There is room also for one person beside the driver. The stretcher for suspending is also provided with india-rubber tyred wheels, which can be removed if necessary. At the further end inside is a locker for holding splints, instruments, or other surgical appliances. At the front a small window opens for easy communication with the driver.

The springs of the carriage are of finest steel laminated, and with rolled ends, in which are rubber tubes to prevent the possibility of noise being caused by metal rubbing against metal.

The axles are Collinge patent, adapted for smoothness in running, and the hind axle is cranked down to allow the body to be near the ground.

The wheels are tyred with india-rubber, so that the carriage rides along the roughest roads silently.

A brake to retard the carriage in descending steep roads is worked from the driver's seat.

The stretchers are furnished each with a hair mattress and pillow, and with girth shoulder straps.

Lamps are fixed to sides of the carriage.

The whole carriage is light, easy running, and well furnished inside and out.

The Civil Motor Ambulance is undoubtedly *the* ambulance of the future. The desiderata in a first-grade motor ambulance are (*a*) a strong chassis mounted on special springs; (*b*) a powerful and reliable engine; (*c*) a well-fitted and easily disinfected body; (*d*) comfortable accommodation for two or more patients and attendants; (*e*) easy access to the ambulance and modern appliances for loading and fixing stretchers in position; (*f*) suitable heating, lighting, and ventilation, and cupboards for storage of emergency first-aid apparatus, medicines, water, etc.; (*g*) means of ready communication between the chauffeur and the nurse or attendant in the ambulance; and (*h*) a moderate cost.

These requirements are amply fulfilled by the "Napier Ambulance," which is supplied by Napier Motors, Limited, 14 New Burlington Street, Regent Street, London, W. That the Napier ambulance is in every way reliable may be seen from the two photographs (Figs. 174 and 175), and the description of the ambulance as supplied to me by the makers.

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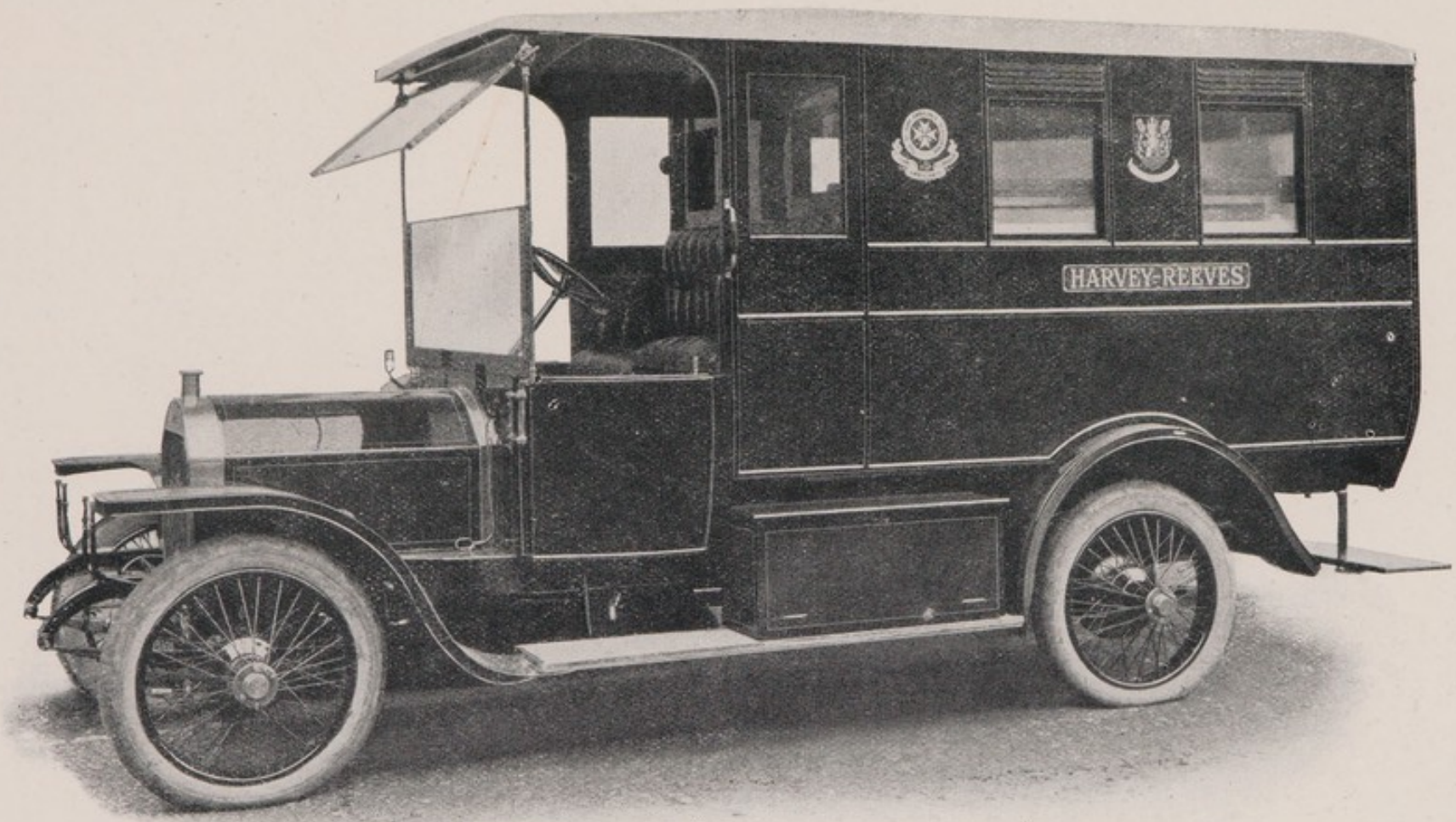

Fig. 174.—16-20 H.P. Napier motor ambulance.

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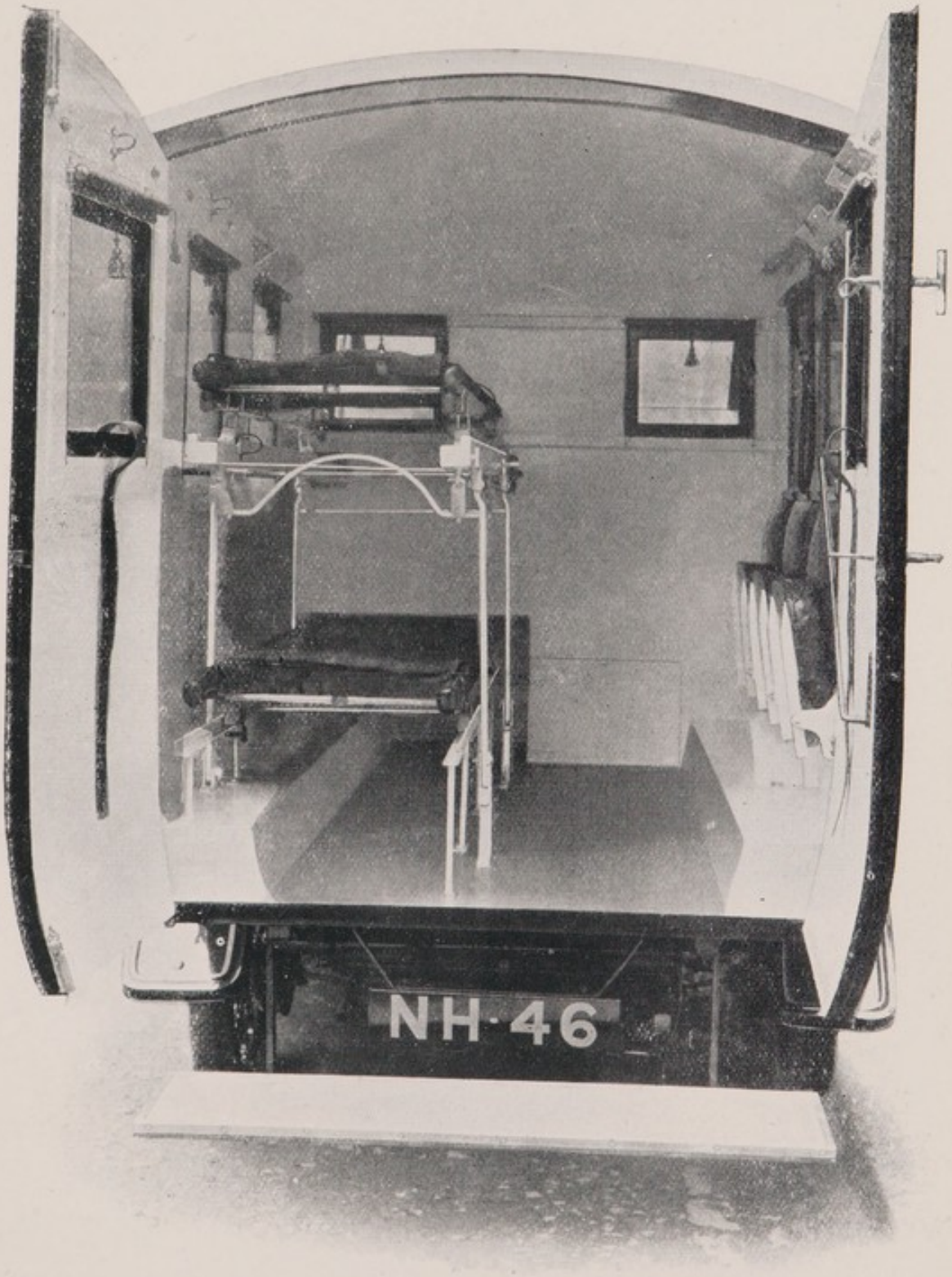


Fig. 175.—16-20 H.P. Napier motor ambulance (interior).

(*a*) *Chassis* is the Napier standard 15-cwt. model, and is mounted on specially long and flat springs to give the maximum comfort.

(*b*) *Engine* is the Napier standard 16-20 H.P. four-cylinder engine, with certain alterations in the steering and change-speed levers to accommodate the special type of body, which is designed after the latest plans adopted by the Metropolitan Asylum Board.

(*c*) *Body* is handsome and roomy, with ready access by wide doors at the back of the ambulance, and the interior of the vehicle is painted in velure, which can be washed. Drop windows are fitted to the back doors and sliding windows in the front of the body.

(*d*) *Accommodation.*—Two patients can be carried on stretchers, and also two sitting patients and an attendant. There are three seats of the spring-up type on one side of the car.

(*e*) *Stretcher Arrangements.*—There are two stretchers of standard type, the bodies of canvas on wooden poles, and the slings made of webbing. One of the stretchers has fixed handles, the other is collapsible. The stretchers are mounted on brackets. The bottom stretcher is supported on two angle irons about a foot above the floor of the ambulance, and is fitted with castors, which enable it to run freely along the angle guides. Two small blocks are fitted when the stretcher is in place to keep it stationary. The top stretcher, which is placed some distance above the lower one, is mounted on a stretcher gear, which is made to hinge down; this stretcher gear is held in the upright position by means of pegs which are easily removed, and this allows the stretcher gear to be lowered and pulled towards the rear of the ambulance when it is desired to load or unload the upper stretcher. The upper stretcher is seldom in use, but its handling is much simplified by this shifting gear.

(*f*) *Heating.*—There is a special heater fitted at the front end of the body inside, the heat being obtained from the exhaust pipe of the engine.

Lighting.—The vehicle is fitted with an electric-lighting set, and carries powerful head-lights. Two ordinary roof lamps with movable shades are fitted inside. A portable electric light, which is carried on the dash-board, can be used for locating tyre or other troubles on the road.

Ventilation is by the drop and sliding windows, and by Louvre ventilators, which are fitted on the sides and rear with regulating flaps, which can be adjusted at will.

A *Medicine Cupboard* is fitted on the floor at the front of the ambulance under the driver's seat, with access from the interior of the car. The large box shown on the running board (Fig. 174) is used for carrying splints and other emergency apparatus.

(*g*) There is a *speaking tube* between the attendant and the driver, and the sliding window behind the driver's head is an additional means of communication.

(*h*) The *cost* of the 16-20 H.P. Napier ambulance, chassis, body, stretcher gear, etc., complete, is £500.

(*c*) The "*Tortoise*" *Waggon*, the invention of Captain Alfred Savill Tomkins and the late Surgeon-Colonel Norton, V.M.S.C., consists of a specially fitted ambulance waggon, which carries cooking and hospital equipment. The tortoise hospital tent is carried on the outside of the waggon, as shown in Fig. 176, and if desired can be

Fig. 176.—"Tortoise" waggon with "tortoise" tent folded. As a rule the waggon is made to act as a central support for the tent.

removed from, and pitched without the waggon. This tent is well ventilated, and is lighted by windows in the roof and in the walls, into which light glass frames may be slipped. The "Norton" stretcher bed is used in connection with this waggon. I have seen the "tortoise" waggon and tent in use at Aldershot, and was much impressed with the compact, portable, and complete nature of this field hospital. It has been in use in the French and German Army Medical Services.

(*d*) *The Brougham Ambulance.*—In view of the many improvements which medical science has effected in the carrying out of measures to meet the increasing demand for more healthful sanitation in populous districts by Hospital Boards and Parochial Authorities, the ambulance brougham may be cited as a suitable means of transport for persons suffering from injury or infectious disease to suitable institutions for their special treatment.

Those having charge of Belvidere Hospital, Glasgow, have large experience in those conveyances, and have had recently constructed, by Mr. Clark, Coachbuilder, Aberdeen, an ambulance brougham of the most improved pattern, which is a distinct advance on the ordinary cab or carriage used as an ambulance. This ambulance is constructed throughout with special regard to the purpose for

which it is intended, and is in every way adapted for the conveyance of accident and fever cases with expedition, and with a minimum of inconvenience to the patient. The room inside is abundant, the doors being extra wide; the light is also subdued, and the greatest ease of motion is obtained; there is perfect ventilation, and all woollen material in the shape of lining, etc., which is likely to hold and communicate the germs of infection, is excluded.

In cases of fever in the crowded parts of towns it is impossible to use stretchers in the removal of patients from their houses; they have, therefore, to be carried by the persons removing them. It is then that the convenience of this make of ambulance is felt. As it has a door on each side, the patient can easily be transferred from the attendant's arms through those side doors, and laid gently down on the bed prepared inside to receive him.

This ambulance being also supplied with a large door behind, a loaded stretcher can be pushed in from behind when necessary, there being accommodation between the seats for carrying a patent folding stretcher.

The exterior appearance of the ambulance brougham being so like our street cab (as its name implies), it may be driven to a house door without attracting more than the ordinary attention given to any other vehicle, which removes the feeling of disinclination that people often have to enter an ordinary ambulance.

As an inside lining for the ambulance brougham when it is to be used for fever cases, the maker strongly recommends the parchmentised veneer. When this material is varnished it is proof against disease or dirt; it is not affected by any of the ordinary disinfectants; it is much lighter than wood in general; and perfectly noiseless. It is particularly suitable for the trying climates of the east, does not warp or split, and can be made to any curve or shape. Mr. Clark is, I believe, the first coachbuilder who has applied this material to the purpose of carriage building.

(*e*) An *Extemporised Ambulance Waggon* may be prepared from an ordinary farm cart or lorry. It should have its floor well covered with straw, hay, or bags of chaff, on which the patient is laid. If a stretcher be placed in such a conveyance, it should be firmly lashed to it by ropes to prevent jolting.

A cab will often be of service, but it is *the* worst form of conveyance for a case of fractured leg or thigh. A patient suffering from such an injury should be carried on a stretcher or lorry, if an ambulance waggon cannot be got. Such a patient cannot be lifted into or out of a cab without risk of serious injury.

A very handy and serviceable ambulance waggon can be extemporised from a *Scotch Hay-cart.*

Improvised Ambulance Waggon.—An important part of the duties of male Voluntary Aid Detachments is to improvise means of transport from vehicles which may be at hand in farmyards, hiring

establishments, country inns, etc. The most suitable and available are lorries and farm carts, and the following method of adapting a Scotch hay-cart for this purpose has been described by Colonel H. E. R. James in the pages of the *Royal Army Medical Corps*

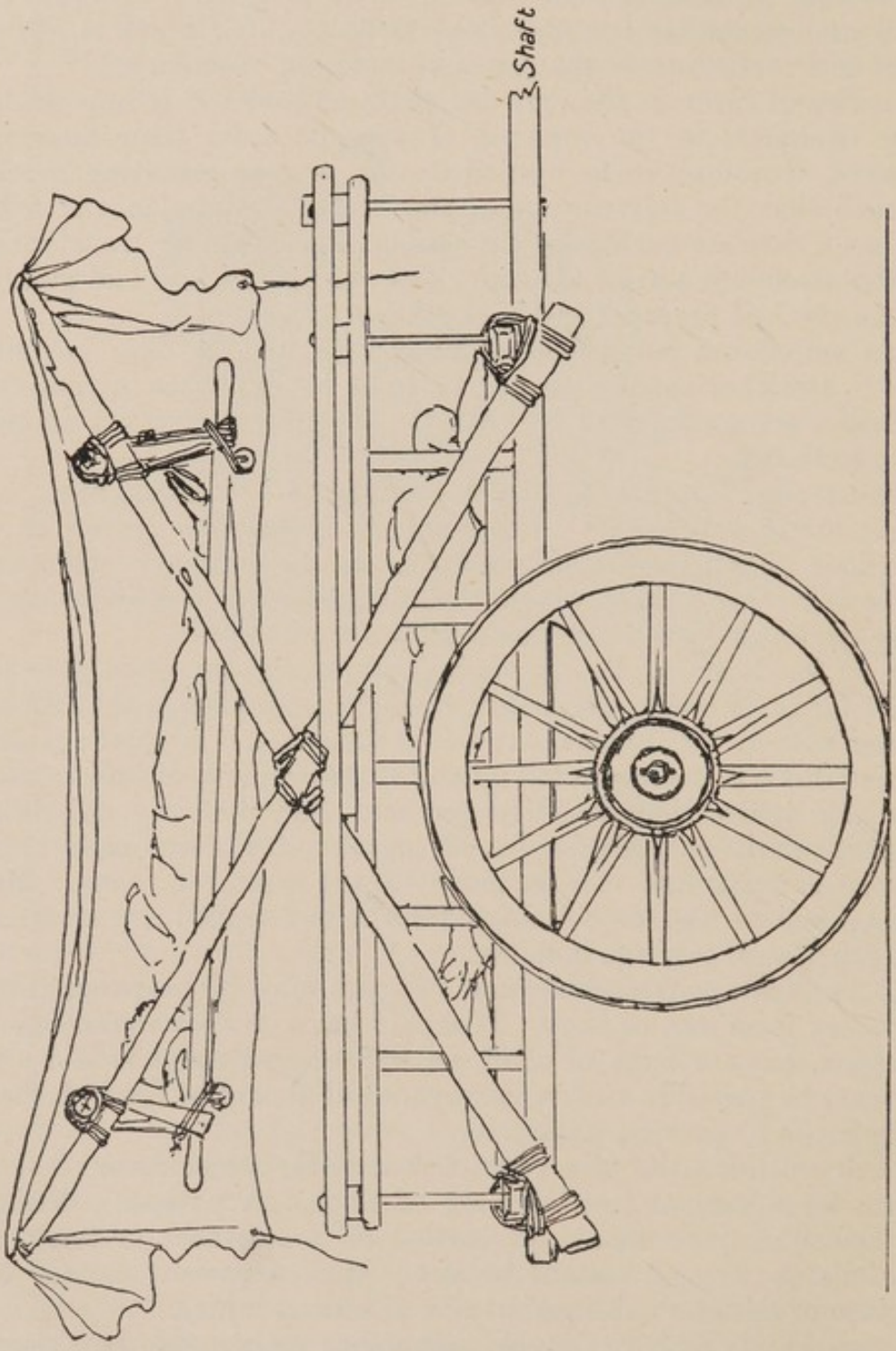
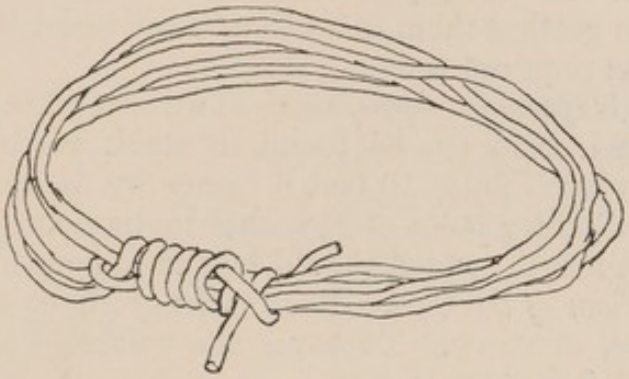


Fig. 177.—Scotch hay-cart as ambulance (side view). (From the *Royal Army Medical Corps Journal*.)

Journal. The method is a German one, and may be applied to any large vehicle of this type. Its essential point is the formation of extemporised springs to promote easy transit. As will be seen from the illustration (Fig. 177), the suspensory apparatus consists of four

poles, in two pairs, which are crossed about their centres, and rest upon a transom across the top of the cart's body, which takes the downward thrust. The lower ends pass under, and are lashed to the projecting ends of the lower transoms at the ends of the cart,



Suspension-loop formed from rope.

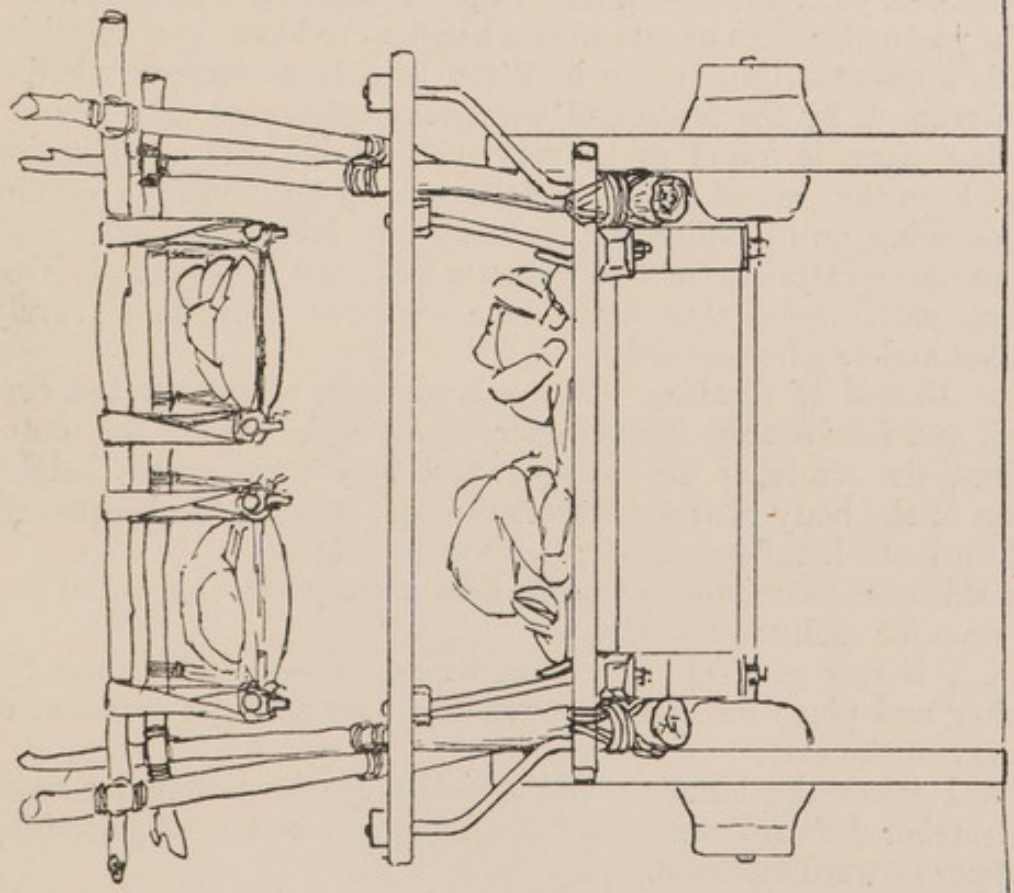


Fig. 178.—Scotch hay-cart (end view). (From the *R.A.M.C. Journal.*)

which take the upward thrust. Lighter transverse poles are lashed to the upper surfaces of the crossed poles, the distance between them in plan being 6 feet. Looped stretcher strings and rope (see Fig. 178) are placed round the transverse poles (four on

each), and the stretchers are suspended from them. "Square" lashings are used. The loops are secured from slipping by lashings passed above the handles, and below and behind the runners of the stretchers. In this pattern of cart two lying-down wounded men can be laid upon the floor, but without stretchers. There is also some difficulty in getting them in as they must assist themselves.

The apparatus required is :—

(1) *For the Suspension Apparatus.*—Two stretchers with slings, 20 yards of $\frac{3}{4}$-inch cord (to be found in stack yards), four stack props, which are larch poles 10 feet 6 inches by $3\frac{1}{2}$ inches, tapering to $2\frac{1}{2}$ inches, two lighter poles of $2\frac{1}{2}$ inches in diameter, not less than 5 feet 6 inches in length, which should be cut to length after lashing.

(2) *For the Floor of the Cart.*—Four sacks of about 3 feet 6 inches by 2 feet, 48 lbs. of straw. To cover the wounded a tarpaulin of dimensions about 8 feet by 12 feet.

Tools.—A yard measure, a tenon saw or billhook, a jack-knife.

The particular form of cart shown happens to have every requisite for this apparatus, but it can be fitted to a farm waggon wanting in this respect, by the placing of temporary transoms. The amount of spring given is found to be very comfortable, the combination of that from the crossed poles, the transverse poles, and the stretcher handles being quite sufficient to absorb any ordinary shock. The floor accommodation is for two patients less gravely wounded. One of these carts would thus carry four wounded men—two gravely wounded and two less severely.

The Method of Loading.—The wounded on stretchers are first loaded, and four bearers are necessary. As in the case of the motor omnibus, the stretcher has to be raised to a considerable height, the top of the body of the cart, where it is rested and subsequently lifted until the handles can be put into the loops.

In this case two loops are formed from stretcher slings, and two from rope for each stretcher.

No. 1 bearer gets into the cart, while the remainder raise the stretcher and place its handles upon the upper hinder transom of the body of the cart.

No. 1 takes the handles, and assisted by the remainder eases the stretcher forward until its front handles can be supported by the upper forward transom.

No. 3 now gets into the cart, No. 4 keeping the rear end of the stretcher raised, and Nos. 1 and 3 raise the stretcher to a level with the loops. No. 2 now gets up, and places the loops over the handles.

During the loading it is desirable that the shafts should be propped, and the length of the suspension loops should be so adjusted that the stretcher is horizontal. The two wounded for the floor of the vehicle are helped in in any way that is convenient.

(*f*) *The Travois or Ambulance Sled.*—In country where wheeled transport cannot be used, the stretcher may be swung on and lashed

to a frame of wood with attachments of malleable iron. The frame consists of two long side poles with cross-bars, and the rear ends of the poles rest on the ground, while the anterior ends are lashed to two shafts, between which a horse is yoked. If one side pole

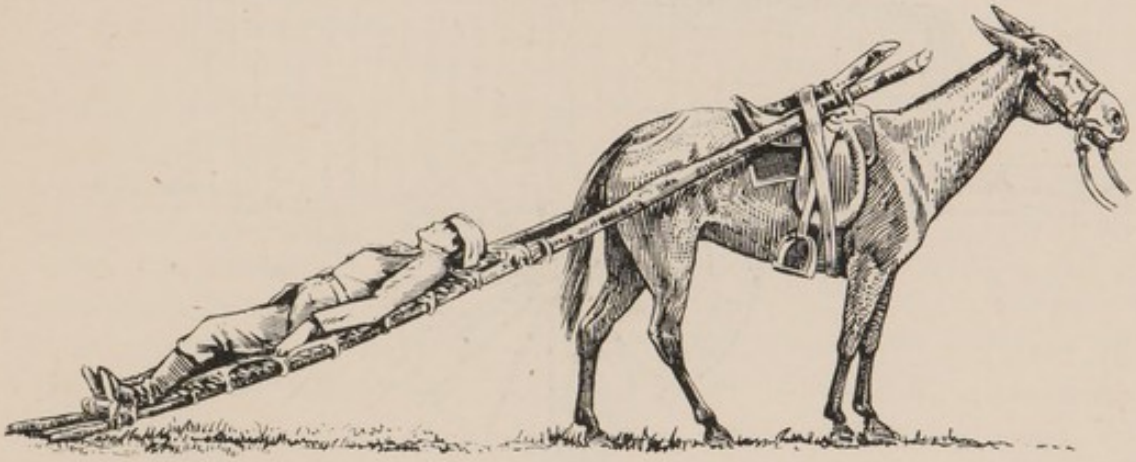


Fig. 179.—Improvised wheelless ambulance (Travois or ambulance sled).

is shorter than the other, the shock in passing over stones and inequalities of the ground is considerably lessened. Wheelless conveyances of this type are used in the United States Army.

5. **Cacolets and Litters.**—Wounded men are sometimes carried on mules either on seats (cacolets) fixed to either side of a strong

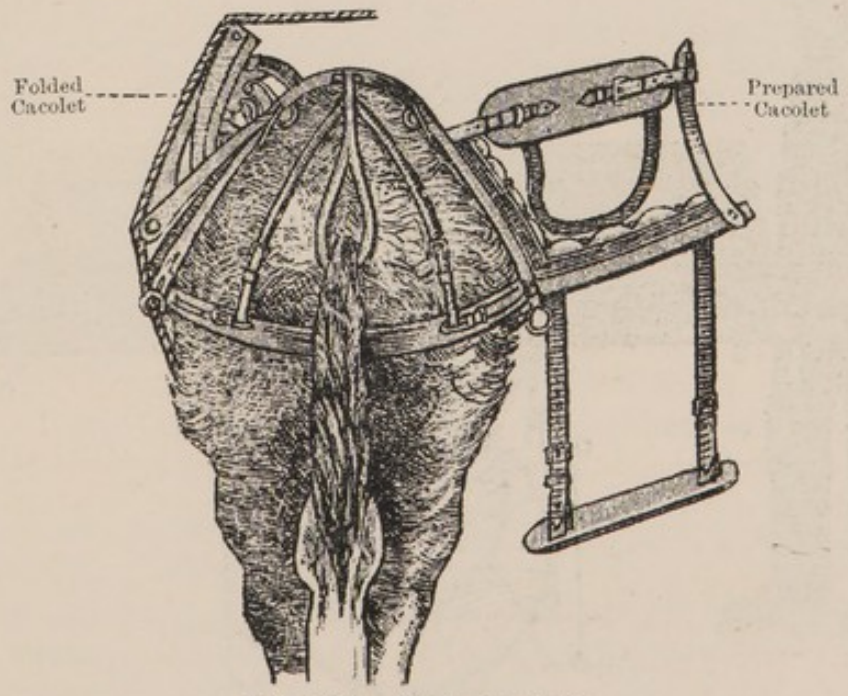


Fig. 180.—Mule cacolets.

pack saddle, or on beds (litters) similarly attached. These are principally used in guerilla or desert warfare, where it is difficult for waggons to be brought to the scene of action.

Mule cacolets (folded and unfolded) are represented in Fig. 180.

Hand litters are occasionally employed, and consist of stretchers fixed on wheels. They are occasionally found of service by the police. Fig. 181 shows the arrangement of a simple hand litter.

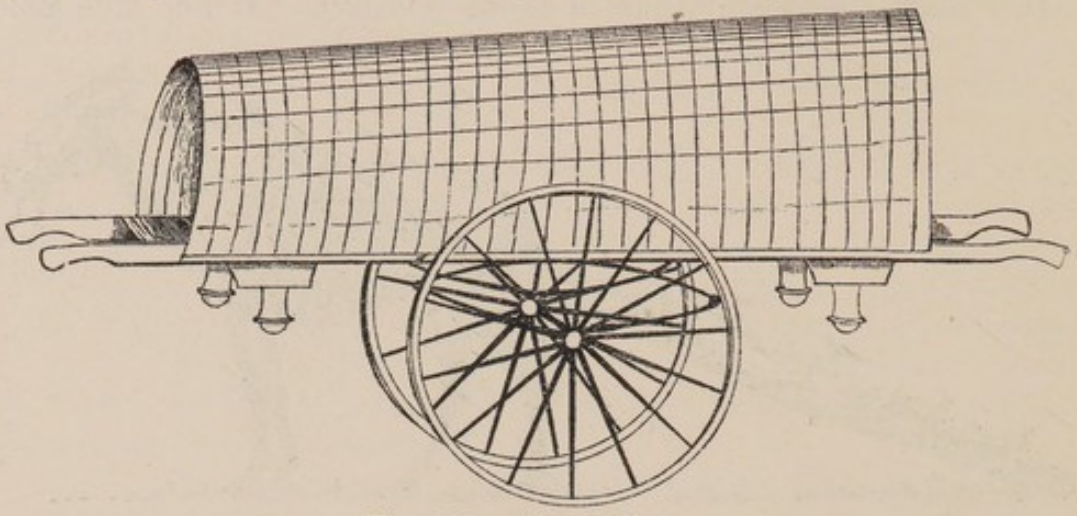


Fig. 181.—Simple litter.

Along with litters may fittingly be described the special civil hand ambulances which are now so commonly in use. Foremost among these may be mentioned the "Furley-Headley" litter, manufactured by the Military Equipment Stores and "Tortoise"

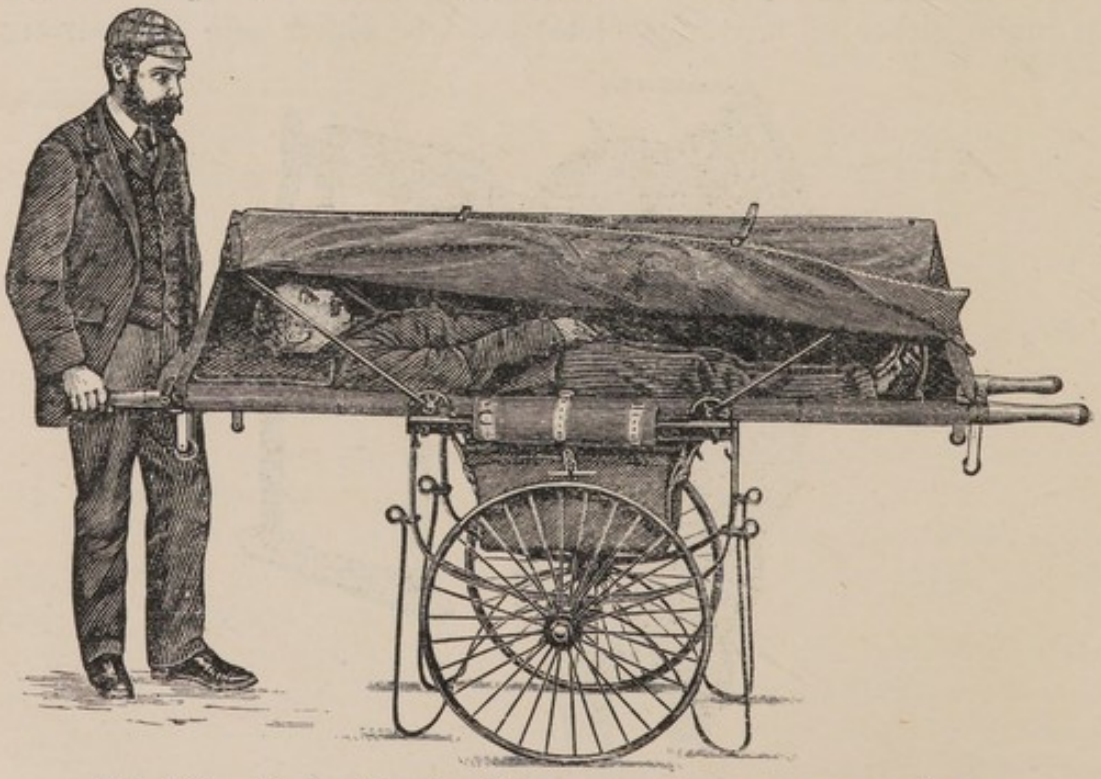


Fig. 182.—Furley-Headley litter arranged to carry one patient in a recumbent position.

Tent Company, 61 Pall Mall. This vehicle consists of the "Furley-Headley" stretcher already described (see Fig. 156) and a wheeled carriage. The carriage is supported on two cycle wheels with india-

rubber tyres, or, if preferred, on wooden wheels with iron tyres. The stretcher is carried on supports fixed to the springs. The legs of the vehicle are fastened to the axle, and are kept down when the carriage is stationary, or fixed up by small iron stops when it is in motion. The stretcher is supported on the carriage and rests on ribbed india-rubber, which prevents slipping. Thus arranged, the litter is suitable for the carriage of one patient in the recumbent position (Fig. 182), but when persons slightly injured have to be carried to home or hospital, the litter can be so arranged as to carry one or two patients seated. Poles are then passed through the canvas, leaving the centre of the canvas free. Two supports used for the cover in the recumbent position are brought up in the middle of the litter, and the canvas crossing this forms the back support for the patient, while strips of canvas hung on the poles at either end are used as foot rests (see Fig. 183).

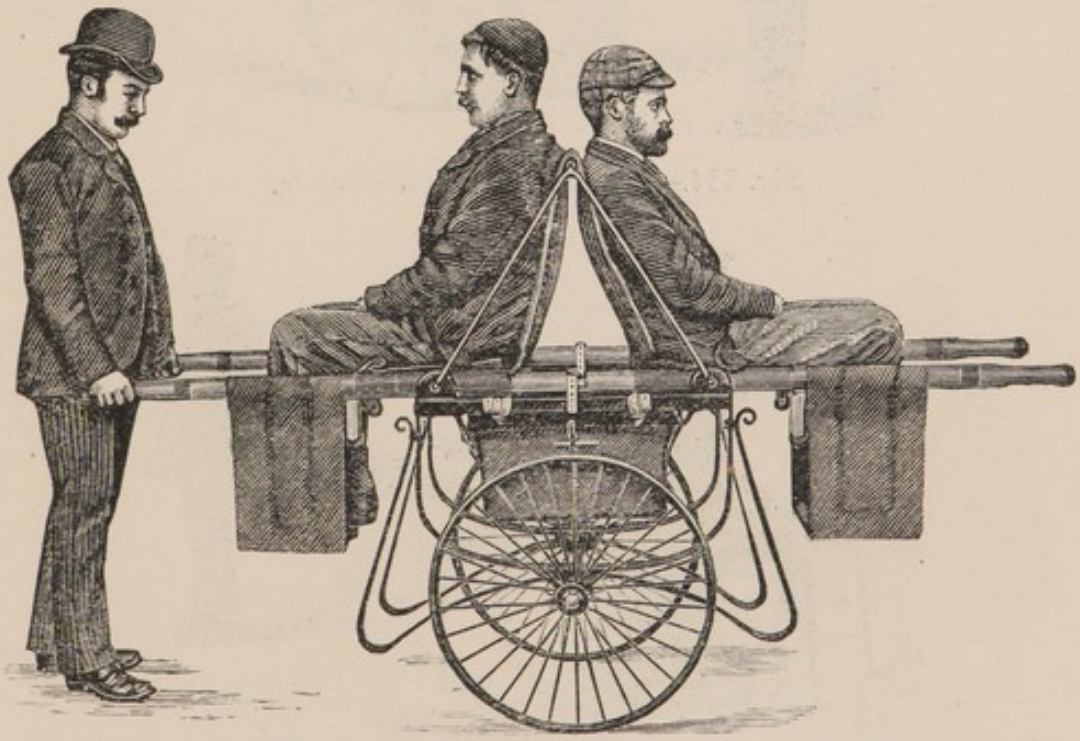


Fig. 183.—Furley-Headley litter arranged to carry two patients seated.

Mr. John Carter, New Cavendish Street, Portland Place, has patented the "Red Cross" ambulance, which is described as the simplest, lightest, easiest, and most perfect three-wheeled ambulance in the market. The carriage is fitted with india-rubber tyred bicycle wheels, and the vibration is almost nil. It has a self-guiding front wheel, which is a great advantage in turning sharp corners in hospital corridors. The framework can readily be taken to pieces and disinfected. The stretcher, which can be folded up for transport like a military stretcher, is raised at the head end to form a pillow, and has a canvas cover. A special advantage claimed for this

ambulance is that the stretcher needs only to be placed on the under carriage, when it is automatically and instantly fixed without the aid of special catches. It can also be used with great advantage in railway ambulance work, as patients can be wheeled straight into a guard's van without the least disturbance.

The Ashford litter (Figs. 184 and 185), which is used by the

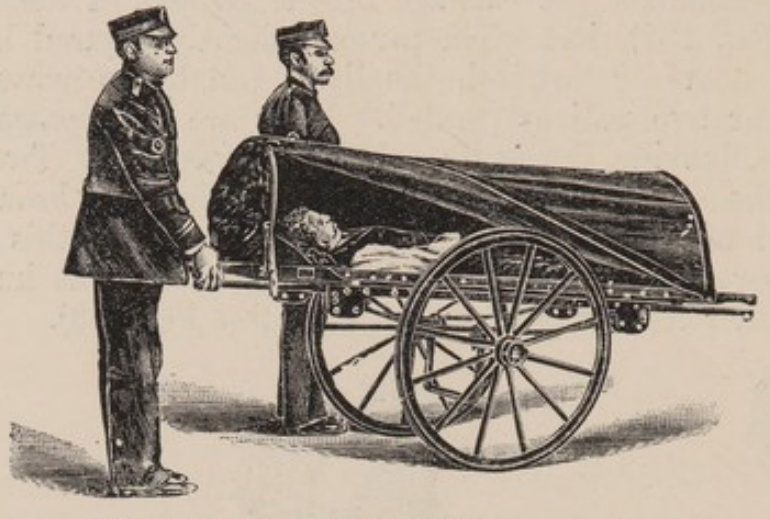


Fig. 184.—The Ashford litter *en route*.

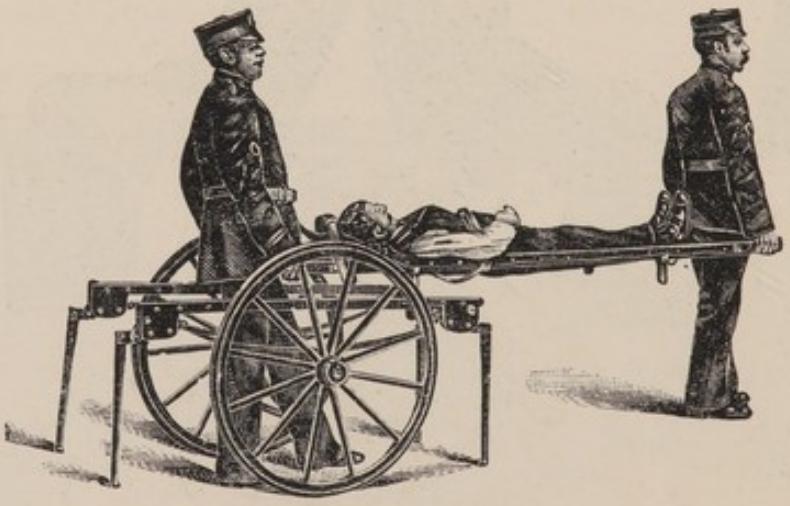


Fig. 185.—The Ashford litter after arrival at depôt.

St. John Ambulance Association, consists of a two-wheeled under-carriage with elliptical springs and a folding cover. By the axle being cranked the stretcher can be carried between the wheels instead of being lifted over them. The litter is light, and can be carried with the patient in it over rough ground. The handles of the litter are used as leg-supports when the litter is at rest.

Military cyclist corps are now so well equipped that they carry with them a bicycle ambulance (see Fig. 187). In the bicycle ambulance the stretcher is carried on safety bicycles, as shown in the woodcut. A patient can be transported safely, and with great speed and comfort, to the nearest dressing station or field hospital.

Fig. 186.—Lowmoor jacket, for use in mines, ships' holds, etc., to secure a patient on a stretcher which can then be placed in an upright position. (See p. 138.)

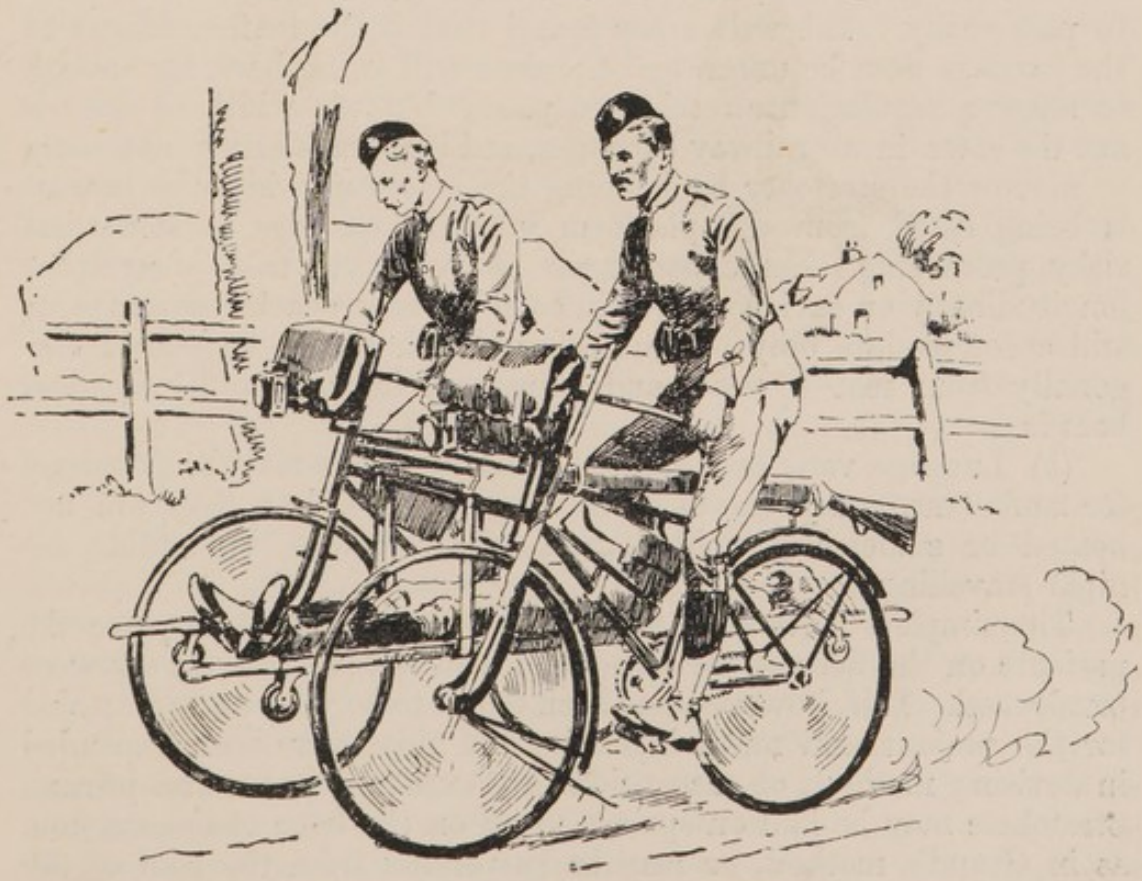


Fig. 187.—The bicycle ambulance.

6. **Railway Ambulance Waggons and Ambulance Trains.**—The ideal method of conveying sick and wounded by rail is in ambulance trains, where the vehicles have been specially designed and fitted for the purpose. A military ambulance train consists of a number of vehicles so arranged as to allow easy entrance of stretchers, and ready access from carriage to carriage for the supervising staff and nurses. One coach is also fitted up as a dispensary and dressing-room, and there is a kitchen and nurses' accommodation. Some of the coaches are fitted with swinging cots, and the comfort of the sick is catered for in every possible way in this hospital on wheels. The objection to these trains is that they are very expensive to fit up and to run, and that they can take only a limited number of sick and wounded. To be ussful they require a clear line, and this can hardly be looked for in time of war, where troop and supply trains generally get precedence. Regular ambulance trains have to be supplemented by temporary ambulance trains of passenger coaches, or by composite trains of ordinary passenger carriages, in which the "sitting-up" patients are accommodated, and goods waggons fitted with special or improvised apparatus for the steady carriage of stretchers.

(*a*) *Passenger Coaches* have this disadvantage that, unless the train is a corridor one, proper supervision of the sick and wounded is impossible. Moreover, it is difficult to place stretchers on the seats, as the carriage doors are not sufficiently wide to allow a stretcher to pass easily. The writer has found that if the leather hinges of the carriage door be unscrewed the door will swing back far enough to allow a regulation stretcher to pass; but the width of door is not the same in all railway carriages, and it is occasionally necessary to narrow the stretcher by bending the traverses while the patient is being lifted from the platform into the carriage, a somewhat risky proceeding. Some passenger carriages will take a stretcher longitudinally on each seat, but in corridor trains each compartment will accommodate only one stretcher, which has to be placed diagonally from seat to seat, and supported in the middle by deal boards.

(*b*) Luggage vans and covered goods waggons may be fitted up for ambulance purposes in a variety of ways, but they are not heated or sufficiently lighted, and are, therefore, unsuitable for night travelling.

The simplest method of utilising goods waggons is to place the patients on the floor of the waggon, which is covered with straw or brushwood. This, however, has been found to be very uncomfortable for the patient, and much ingenuity and time have been expended in devising methods of suspension to prevent vibration and jarring. Stretchers may be laid on springs fitted on the floor of the waggon, as in Grund's method, or may be suspended from the roof of the waggon by strong springs, as in the Hamburg system. Transverse

bars may be fixed in a goods waggon and stretchers slung from these on strong springs, as in the Hunsdiecker system, but, as far as comfort is concerned, spring suspension has been found to be inferior to rope suspension, which deadens or absorbs shock to a marked degree. Spring suspension requires special apparatus and vehicles fitted for the purpose. The ideal method is one which will allow goods waggons, which have been sent to rail-head with stores, to be fitted up there with emergency suspension apparatus for the conveyance of sick and wounded on the return journey to the base. Collapsible frames for the suspension of stretchers and various forms of rope suspension have been invented for this purpose, and may be used as described below.

Goods Waggons may be utilised in various ways :—(1) If stretchers are not available, the patients may be laid on the floor of the waggon on specially prepared beds made of sacks filled with straw, peat, brushwood, or other resilient material. Each sack will take 12 lbs. of straw, and measures 3½ feet by 2 feet. The sacks are laid transversely to the patients (Fig. 190), and three sacks will form a comfortable bed for two patients. The sacks should be tied together at the corners, to prevent them from working loose. A patient laid on loose straw or brushwood soon works through it, and finds himself on the bare boards of the floor.

(2) If only a limited number of stretchers is available, the floor space may be utilised as described above, and a row of stretchers be suspended above them by one of the plans detailed below.

(3) Goods waggons may be fitted with ready-made apparatus, as in the French Brechát-Desprez-Ameline system, or the German frame which is known by the name of Linxweiler. These consist of frames which can be taken to pieces and readily fitted to goods waggons when required, and on the framework tiers of stretchers can be laid. A similar but less expensive apparatus, and one that can be readily fitted up on an emergency, is the Wolff-Hohmann framework, which is made from uprights and cross-beams of deal, from which the stretchers are slung. This frame does not require to be bolted to the floor.

(4) Goods waggons may be fitted with brackets to carry stretchers (as in Fig. 188), where the Italian and Austrian methods are illustrated. The Italian method consists in using wrought-iron brackets. There are two uprights of 5 feet 8 inches by 5 inches by 2½ inches, which are bolted with 6-inch bolts, one above and one below, to the side of the waggon, leaving a gap of 2 inches by interposing blocks so as to permit shifting of the bracket. The uprights are perforated to receive the legs of the bracket, which are screwed by a nut on the outer side of the upright. Each stretcher is supported by two brackets, and three tiers of stretchers can be placed in the waggon.

The Austrian method, as shown in Fig. 188, B, is partly a bracket and partly a suspension method. It throws a great strain on the sling, and also on the traverse, which requires to be lashed to prevent collapse of the stretcher.

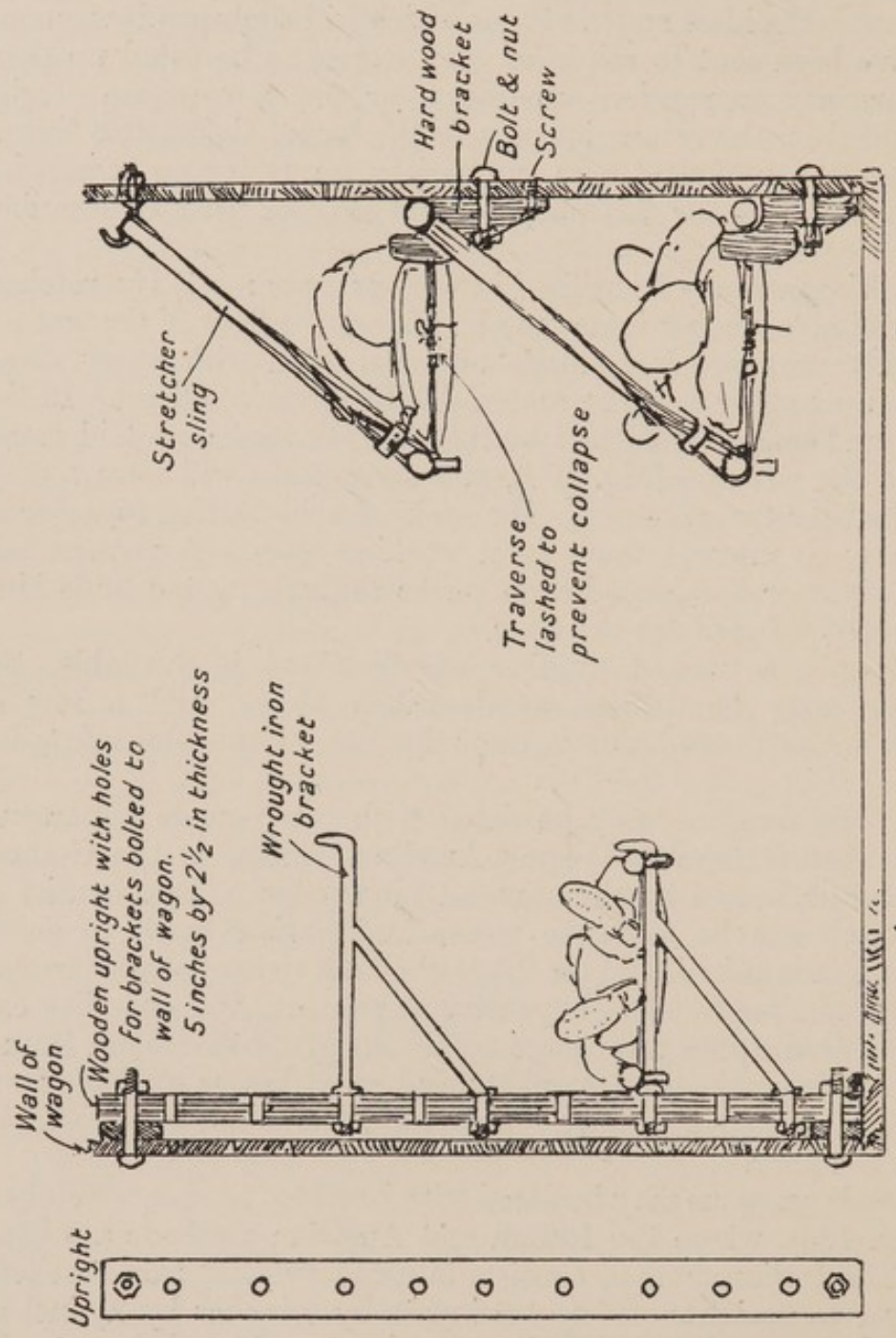


Fig. 188.—Goods waggon fitted with brackets. A, Italian system. B, Austrian system. (From the *R.A.M.C. Journal.*)

(5) A goods waggon may be fitted with a cross-beam, from which the stretchers are suspended, as in the Port system (Fig. 189), and this is more secure than where the stretchers are suspended from the roof.

In Fig. 189 the transverse beam is shown too low. There should be 3 feet at least between the under surface of the stretcher and the

floor, to make room for wounded men lying on sacks on the floor, two tiers being thus obtained.

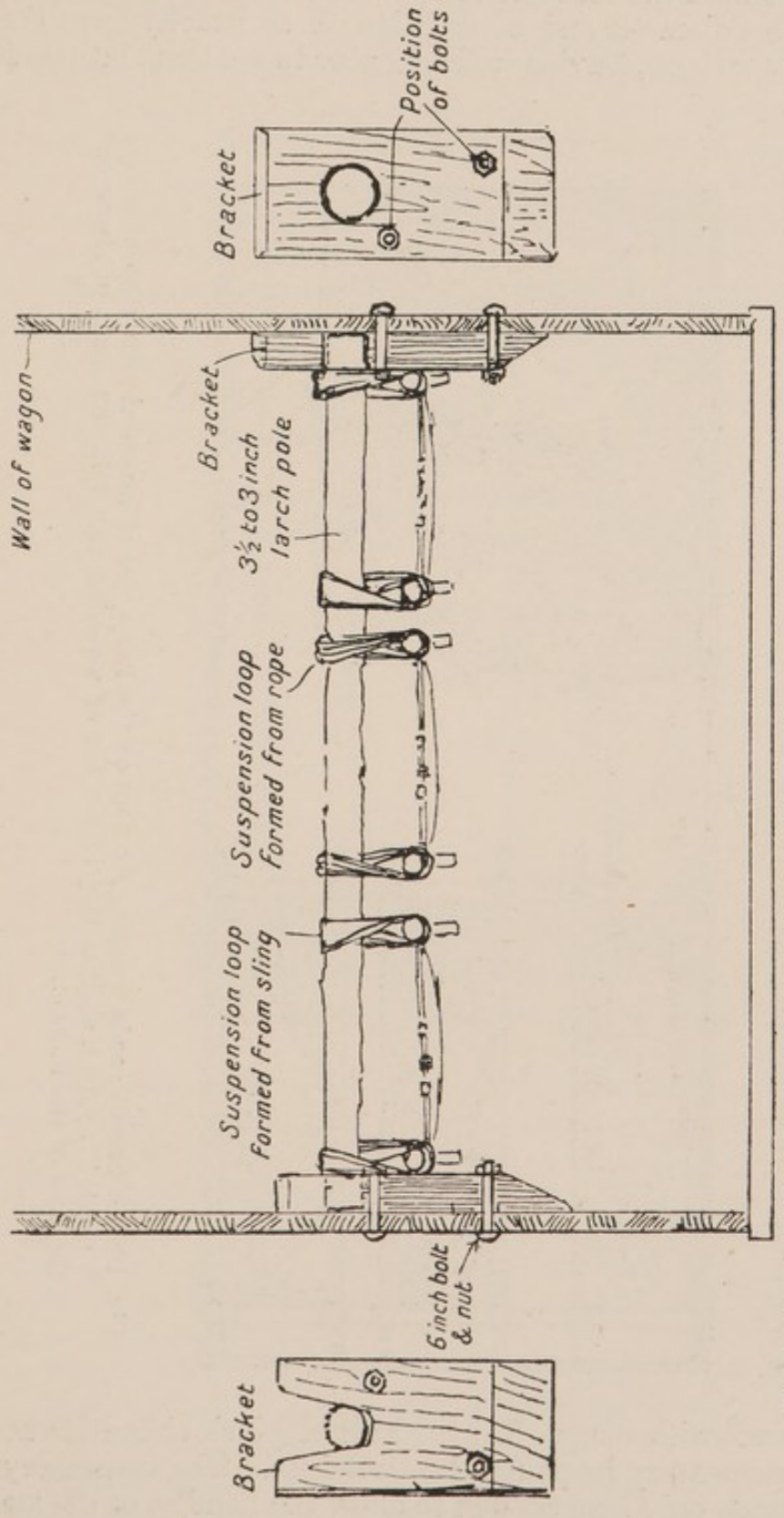


Fig. 189.—Port's system of suspending stretchers from cross-beam fixed in covered goods waggon. (From the *R.A.M.C. Journal.*)

The fittings required per van are—eight brackets of wood, preferably elm, 1 foot 6 inches by 9 inches by 3 inches, four of them

perforated with a hole 3½ inches in diameter to receive one end, and four slotted to receive the other end of the pole; sixteen 6-inch bolts with nuts to hold the brackets to the wall; four larch or fir poles of 3 to 3½ inches diameter and of such length as exactly to fit the diameter of the waggon, leaving sufficient play to get them into position.

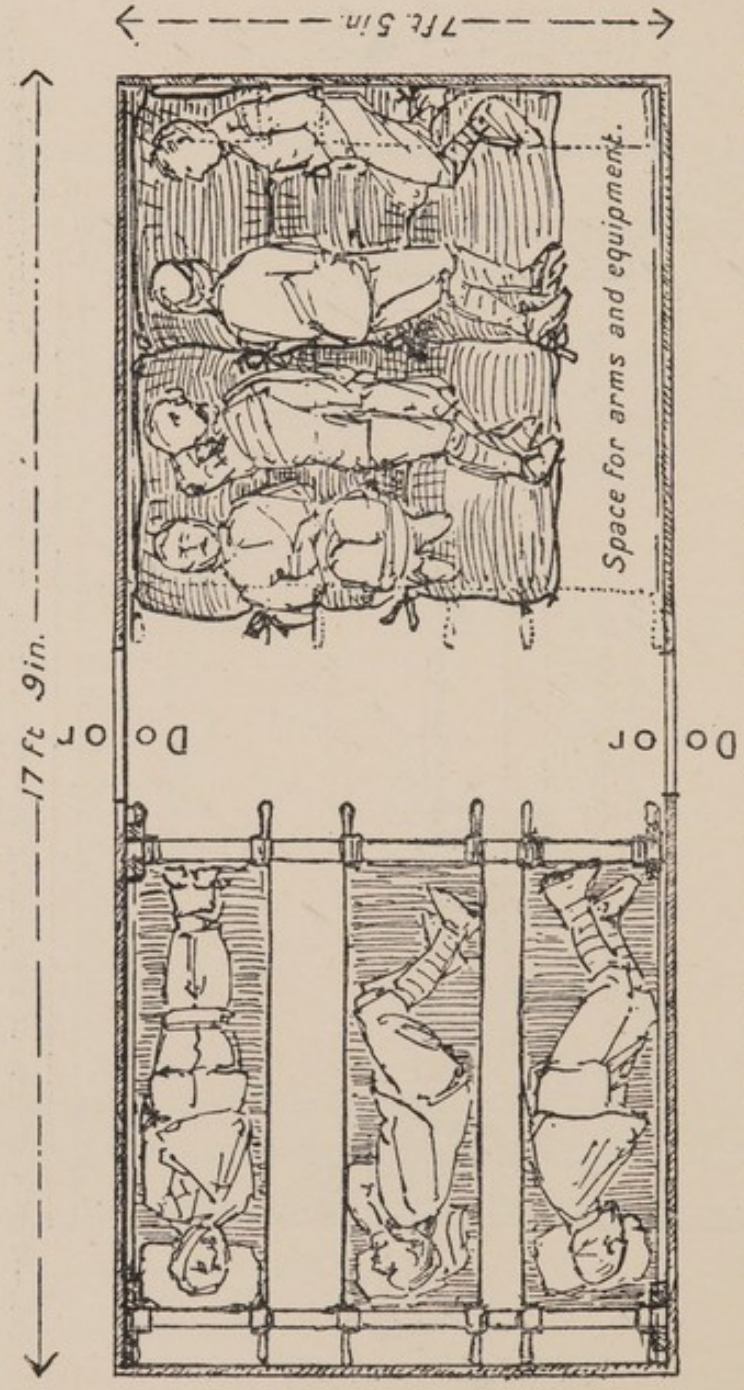


Fig. 190.—Covered goods waggon, showing on the left a tier of wounded men suspended by "Port's" method, and on the right a tier of wounded men lying on sacks of straw on the floor of the waggon.

Six stretchers with slings. Thirty yards of ¾ inch circumference cord to make suspensory loops for the stretchers. The suspensory loops must be made only long enough to allow the handles of the stretcher to be introduced into them when they are in position round the pole. One tier only is thus suspended.

The floor space beneath the suspended stretchers is prepared as mentioned by the laying down of sacks of straw or other material to break shock (see Fig. 190). Six sacks of 3 feet 6 inches by 2 feet, each filled with 12 lbs. of straw, and with their contiguous corners tied together, may be placed on each half of the floor, their long axes parallel to that of the waggon, leaving an alley-way from door to door. Upon each group of six sacks four wounded men may lie. There is space between their feet and the opposite wall in which to lay arms and equipment. For this, twelve sacks, 144 lbs. of straw, and 5 yards of rope yarn will suffice.

(6) The classical method of suspension of stretchers in goods waggons is known by the name of Zavodovski, and consists in the fixing of strong rope cables across the roof of the waggon, from which loops of rope depend for the reception of the stretcher handles. It is difficult to procure a cable suitable for the purpose, and the

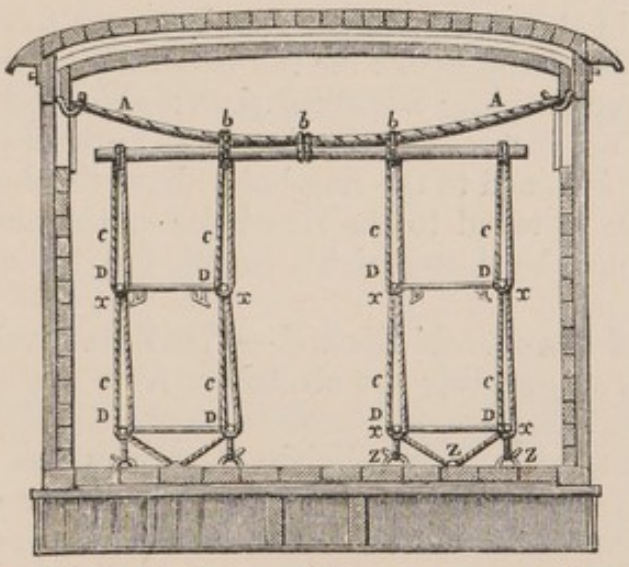


Fig. 191.—Plan of railway ambulance waggon (Zavodovski).

method lacks somewhat in stability; anyone who has worked with stretchers in a waggon fitted according to Zavodovski's description will agree that even with the ring-bolt attachments and secure lashing too much movement is permitted. As an emergency plan, and one suitable for practice by Voluntary Aid Detachments, the directions given below are worthy of careful consideration.

To fit up a covered goods waggon on this plan, the following materials are required :—

(*a*) Four cables, 9 feet long and 1 inch thick, ringed at each end, with a metal collar-shaped band to strengthen the ring.

(*b*) Eight large iron hooks.

(*c*) Sixteen stout looped ropes of the thickness of drag ropes, tied in the centre to form supporting loops for the handles of the upper tier of stretchers.

(*d*) Thirty-two ring-bolts.

(*e*) Four solid circular poles, 6 feet long and 2 inches thick.

(*f*) Twenty-eight stout cords for lashings.

(*g*) Eight military stretchers with handles are required to equip the waggon.

With the materials enumerated above the waggon is fitted up as follows :—Two hooks are fixed on the beam of the door on either side, 3 feet apart from each other, and 1 foot to the inner side of the edge of the door-bolts. The remaining four hooks are fixed at the same height, two at each end of the waggon opposite each other and 1 foot from the end of the vehicle. The four cables (A) rest on these hooks, the centre of the cable being firmly fixed to the centre of the pole (*b*). The sixteen loops (*c*) are attached, four to each pole, to support the eight stretchers (D), and are looped on to the poles by passing one end through the other. Twenty-four ring-bolts are fixed in the floor, six under each pole, one beneath each end of the pole, the remainder 9 inches apart, but arranged so as to leave 2 feet in the centre. Four ring-bolts are fixed immediately on the inner side of the hooks on the beam above the doors. The twenty-eight cord lashings are fixed thus :—The twenty-four cords (Z), 5 feet long, are fastened to the ring-bolts in the floor ; two cords, 12 feet long, are fastened to the ring-bolts above the door ; two cords, 12 feet long, are fastened to the ring-bolts at the end of the poles. The lashings must be drawn tight, to prevent the swaying of the stretchers.

(7) *Improved Zavodovski Method.*—The Zavodovski system can be improved by suspending the stretchers from a transverse beam, as shown in Fig. 192.

Two tiers of stretchers, in all eight stretchers, can be suspended, leaving an alley-way between them under ordinary circumstances. Under stress four additional wounded, twelve in all, can be accommodated in the central spaces, but no space is then left between the stretchers. The method is well described in the *Royal Army Medical Corps Journal*, and it has certain advantages over the Zavodovski plan in that the weight is more firmly supported and excessive lateral movement is prevented. The study of the method is commended to Voluntary Aid Detachments, as only the simplest fittings are required.

For the fitting of eight stretchers the following articles are required :—

Sixteen 2-inch diameter screw rings, $\frac{3}{8}$ inch thick ; eight wooden brackets (elm if possible), four perforated and four slotted, with $3\frac{1}{2}$-inch holes ; sixteen 6-inch bolts and nuts ; four larch or fir poles not less than $3\frac{1}{2}$ inches diameter, of lengths to fit the waggon ; 60 yards of 3-inch hemp rope in four 15-yard lengths ; 80 yards of small $\frac{3}{4}$-inch rope, 25 yards tarred-rope yarn. Twenty-two round ash pegs, $3\frac{1}{2} \times 1$ inch.

In all cases the longitudinal distance between the supports,

whether brackets or beams and ropes, should be 6 feet, the length of the canvas of the stretcher. The method of preparing this apparatus

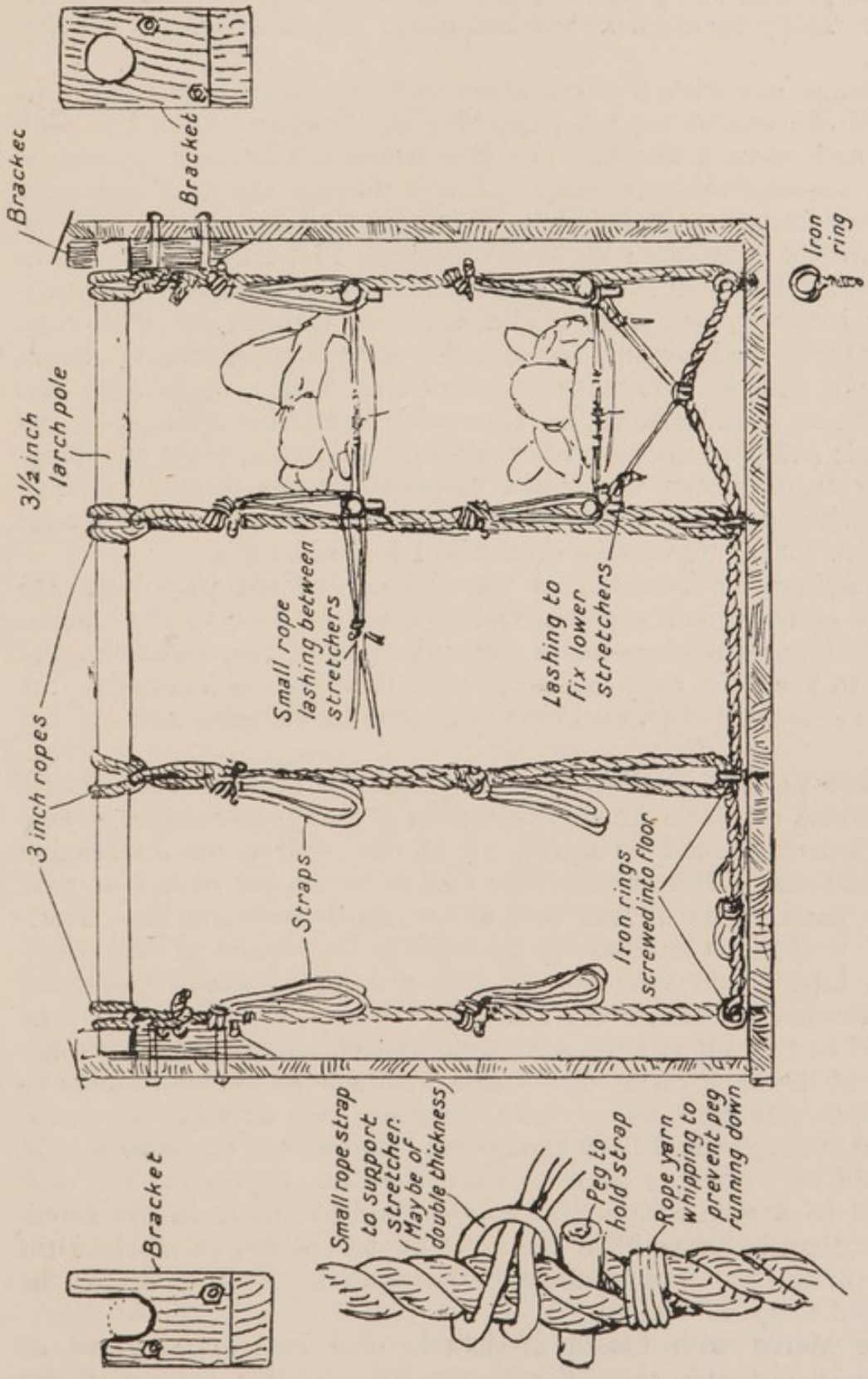


Fig. 192.—Improved Zavodovski method. Covered goods waggon fitted to carry eight men on stretchers. (From the *R.A.M.C. Journal*.)

is as follows :—The iron rings are secured into the floor at the intervals shown in the diagram, the end rows 12 inches from the end of the

van and the centre ones 6 feet from them. The brackets are next bolted in position, the upper edge of the hole and slot for the ends of the pole being 3½ inches below the junction of the roof with the wall. The poles are next put into place. The 2-inch ropes are now rove.

Commence with a clove hitch and two turns round the rope round one end of the pole, touching the bracket. Take the slack end and reeve it through the ring below the bracket, passing it from the wall side inwards. Reeve it through the next ring from without inwards. Bring it up vertically and fasten it round the bar with a clove-hitch 24 inches from the first knot. Bring down the slack end, pass it from without inward through the ring vertically below it, and from within outwards through the next ring, bring up to the beam and fasten with a clove-hitch as before. Reeve through the two last rings and fasten off with a clove-hitch and two turns round the rope. Now with a marline spike open the strands and pass the pegs where shown in diagram, place whippings below them, fasten the straps suspension loops formed of small rope with slip-knots above them. The apparatus is now ready for the stretchers. The straps should be 1 foot in length.

Lashings, as indicated in the diagram, should pass from the centre of the 3-inch rope where it crosses the floor to the handles of the lower stretcher—these stop vibration of the stretchers, and help to keep the rope taut—and also between the handles of the upper stretchers of parallel tiers to control lateral movement.

STRETCHER DRILL.—To carry out this drill the class should be divided into detachments or squads of four bearers each. These detachments should be drawn up in line, four paces intervening between each. Military stretcher drill is carried out with four, five, or six bearers, but as four bearers are usually sufficient for "First-Aid" work, it is unnecessary to describe the details of drill where extra bearers are available for lifting wounded and for carrying accoutrements, rifles, etc. The No. 3 bearer of each detachment should be told off to fetch a stretcher, which he should place to the right of his detachment on its side with the wheels or runners to the right. If there be only one stretcher, each detachment should be put through the drill in succession. Members of the class should be told off to act as patients when they are required. The drill should be carried out at first on the lines laid down in the Royal Army Medical Corps Drill Book, as quoted below, or in the Drill Book of the St. John Ambulance Association. It may readily be adapted to special classes.

To March with Closed Stretchers.—The bearers, arranged as shown in Fig. 165, step off with the left foot, the handles of the stretcher being carried in the right hands of the No. 1 and No. 3 bearers.

[*To face p.* 177.

Fig. 193.—"Prepare Stretchers!" (The right hand shouldbe across.)

In the following descriptions, when the most modern military stretchers are in use, for the word "wheels" read "runners," and for the word "buckle" read "grip-plate." (See under "Regulation Stretcher," p. 138).

To Prepare and Close Stretchers.

"*Prepare Stretchers!*" "*Close Stretchers!*"

Bearers will next be taught how to prepare stretchers for use, for which purpose the company, having lifted stretchers, will be extended at intervals of four paces, and ordered to "*Lower Stretchers!*"

On the command "*Prepare Stretchers!*" (Fig. 193) Nos. 1 and 3 of each detachment turn to the right, kneel down on the left knee, unbuckle the transverse straps, and separate the poles, right hand across, passing a hand under the *traverse*, to make certain of its being perfectly straight. They then arrange the slings on the handles of the poles as follows:—The sling is doubled on itself once, with the tongue of the buckle outside; the loop of the sling is then passed over the near handle and the free ends placed over the opposite handle. The whole then stand up and turn to the left simultaneously, those on the left working by the stretcher detachment on the right, the front rank man of which will give the time by raising his disengaged arm. Nos. 2 and 4 stand fast while this is being done.

"*Close Stretchers!*"—When this order is given, Nos. 1 and 3 of each detachment turn to the right, kneel down on the left knee, remove the slings from the handles, and place them on the ground beside them. They then bend inwards the jointed *traverse*, and raise the canvas so as to prevent its falling between the poles as these are approximated. As soon as this has been done, Nos. 1 and 3 face each other, and rise, lifting the stretcher between them, and resting the poles between their thighs, with the rollers to the right of the company; they then proceed to roll the canvas tightly round the poles, towards the right of the company, and to spread out the slings evenly on the top of the roll, a transverse strap at either end; the transverse strap is now passed through the loop of the other sling, then round the poles and canvas, and buckled off tightly, the slings being on the top of the pole. Nos. 1 and 3, slightly stooping now, take hold of the stretcher with the right hand, with the back of their hands to the right of the company, and looking to the right detachment for time they rise erect, and after a slight pause all turn to the front, Nos. 1 and 3 retaining hold of the handles of the stretcher.

To repeat the exercise, the order "*Lower Stretchers!*" will be given, and the company then directed to prepare them as before.

The method of marching with folded stretchers is shown in Fig. 168.

To Lift and Lower Prepared Stretchers.

"*Lift Stretchers!*" "*Lower Stretchers!*"

The principal point to be attended to in lifting and lowering prepared stretchers is unity of action on the part of Nos. 1 and 3 bearers of each detachment; No. 3 must be habituated from the first to work simultaneously with No. 1, to wait for No. 1 should the latter not be ready to lift or lower as soon as he is, or to call out "*Stand fast!*" should No. 1 be in advance of him, and then "*Go on!*" when ready. When the men, standing to prepared stretchers, are directed to lift them, it will be done in the following manner, at first by numbers, then judging the time :—

"*Lift Stretchers!*" Nos. 1 and 3 of each detachment stoop down; each grasps a doubled sling at its centre with the forefinger and thumb of the right hand, removes it from the handles, and stands up again; they each take a side pace to the right between the handles of the poles; they then each place a sling over their shoulders, dividing it equally, and with the buckle end over the right shoulder.

"*Two!*"—They stoop, slip the loops of the slings over the ends of the poles, commencing with the left, separate the slings with the knees, and then firmly grasp the poles; after a short pause the word "*Three!*" is given by the instructor, upon which Nos. 1 and 3 of each detachment steadily raise the stretcher off the ground, and stand up, holding the stretcher at the full extent of the arms; during the operation No. 3 must closely conform to the movements of No. 1, so that the horizontal position of the stretcher may be maintained throughout.

"*Adjust Slings!*" (Fig. 194).—No. 2 takes two paces forward, and Nos. 2 and 4 turn about together. They adjust the slings over the shoulders of Nos. 1 and 3, so that they lie below the collar of the coat behind and in the hollow of the shoulders in front, if necessary adjusting the length of the slings by means of the buckles. No. 2 takes two paces to the rear, and Nos. 2 and 4 then front together. Directly Nos. 2 and 4 see that Nos. 1 and 3 have stood up, No. 2 takes two paces to his front and turns to the right-about. No. 4 turns to the left-about, and both men then adjust the slings on the neck and shoulders of Nos. 1 and 3 respectively, taking care not only that the sling is well below the level of the collar of the frock, but that it lies accurately in the hollow of the shoulder in front. As soon as these points have been attended to No. 2 returns to his place, and Nos. 2 and 4 turn about together, the whole working by the right stretcher detachment, which will look to the left of the company and give the time.

NOTE.—The order "*Adjust Slings!*" need not be given if Nos. 1 and 3 have adjusted the slings correctly when lifting stretchers.

"*Lower Stretchers!*" (Fig. 195).—On the caution "*Lower!*"

[*To face p.* 178.

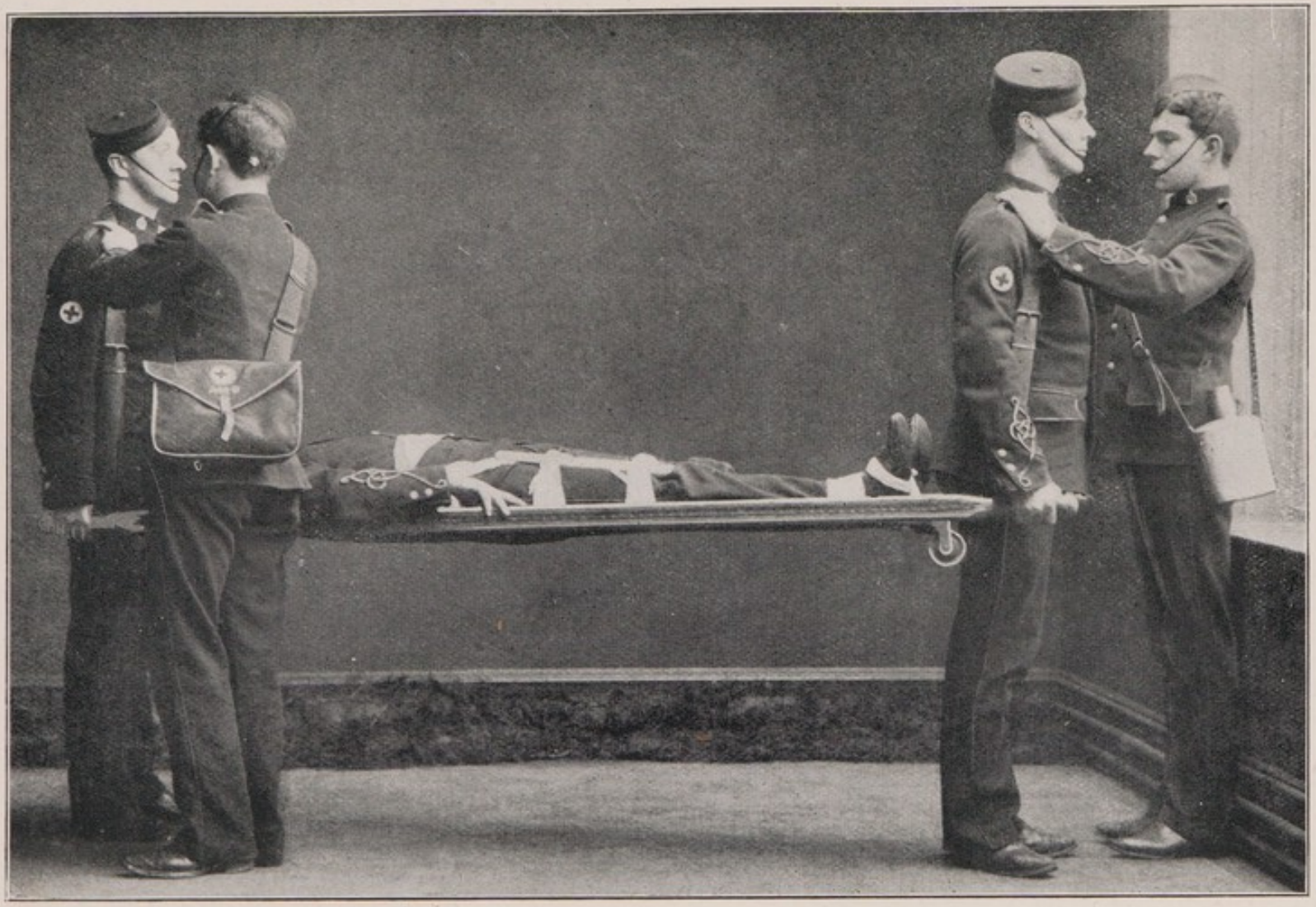


Fig. 194.—"Adjust slings!" (See Note in text.)

[*To face p.* 178.

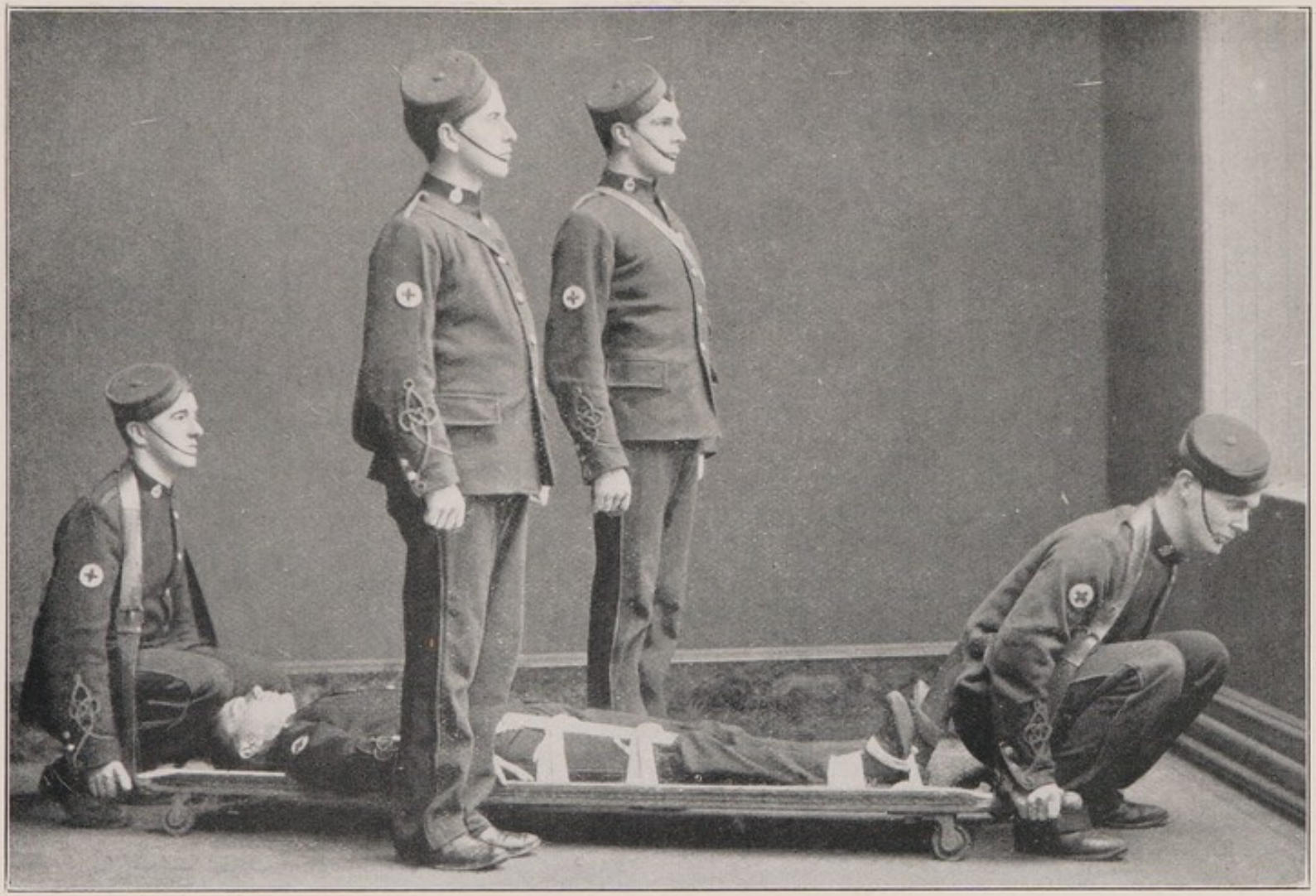


Fig. 195.—"Lower Stretchers!"

Nos. 1 and 3 of each detachment prepare to stoop; and on the word "*Stretchers!*" both men lower the stretcher very cautiously on the ground, No. 3 again conforming to the movements of No. 1. They then proceed to slip the loops of the slings off the ends of the poles; stand up, remove the slings from their shoulders, double them, and hold them in the right hand in the manner above described —viz., at their centre, between the forefinger and thumb of the right hand, buckle to the front, and hand close to the side. On the word "*Two!*" Nos. 1 and 3 stand to stretchers, stoop down, arrange the slings on the handles, and stand up again.

To March with Prepared Stretchers.

"*Company by No. — Squad!*" "*Advance!*" "*Retire!*"
"*Right (or left) incline!*" "*Halt!*"

The main purposes to be kept in view in marching with a stretcher are as follows:—First, the mode of progression of the bearers should be so regulated as to avoid any impulse being thereby communicated to the stretcher. This can be best accomplished by the *broken step*, a short pace not exceeding 20 inches, allowing no springing from the fore part of the foot, and by keeping the knees well bent while the advance is being made. To prevent lateral swing, No. 1 moves off with his left foot, No. 3 with his right. And secondly, the stretcher must be maintained on all occasions in the horizontal position, or in a position as near to the horizontal as possible, the inclination downwards, in the latter case, being towards the feet of the patient, so as to ensure the greatest amount of safety to the person who is being carried upon it. Men of the same height are, therefore, selected to act together as bearers; and, on sloping ground, the general rule for the bearers is to carry the foot end of the stretcher foremost down hill, but the head end foremost up hill. The exceptions to this rule are mentioned on p. 184.

"*Company by No. — Squad!*" "*Advance!*"—The squad on which the Company will dress in marching is to be named.

Nos. 1, 2, and 4 step off with the left foot, No. 3 with the right, in quick time, taking a short pace of 20 inches, knees bent, feet raised as little as possible (see Fig. 200). The instructor should see that the squad named marches straight on the point given, and that the remainder preserve their interval and alignment.

"*By No. — Squad!*" "*Retire!*"—Each squad will move round on the circumference of a circle of which its No. 3 is the centre. No. 3 will mark time, turn gradually in the direction named, and the whole move forward when square.

"*By No. — Squad!*" "*Advance!*"—Each squad will resume the original direction by a movement similar to that detailed for retiring.

"*Halt!*" The whole detachment halts.

Moving to a Flank.

"*Right (or left) incline!*"

"*Right (or left) incline!*"—Each squad will move round on the circumference of a circle of which its No. 3 is the centre, one-eighth to the right (or left). No. 3 will mark time, turn gradually in the direction named, and the whole will move forward when facing in the new direction.

If the incline is repeated the squads will be in file, moving direct to the flank indicated with an interval of one pace between them.

On the command "*Advance*" or "*Retire*" the original direction will be resumed, turning to the left in advancing and to the right in retiring for a right incline and the opposite for a left incline.

The *broken step* requires much practice and frequent repetition before the proper carriage of wounded men on stretchers can be secured.

To Load and Unload Stretchers.

"*Take Post!*" "*Advance!*" "*Lower Stretchers!*"

"*Prepare Stretchers!*"

"*For Loading!*" { "*Prepare!*" / "*Lower!*" }

or

"*Load Stretcher!*" { "*Lift!*" / "*Lower!*" } (new drill).

"*Lift Stretchers!*" "*Advance!*" "*Halt!*" "*Lower Stretchers!*"

"*For Unloading!*" { "*Prepare!*" / "*Lower!*" }

or

"*Unload Stretcher!*" { "*Lift!*" / "*Lower!*" } (new drill).

To place a patient on a stretcher involves three separate operations, viz. :—

(1) The patient must be lifted off the ground by the bearers of the detachment.

(2) The stretcher must then be laid on the ground immediately under the patient by one of the bearers.

(3) The patient must then be lowered on the stretcher by three of the bearers (Nos. 1, 2, and 3), assisted by the fourth (No. 4).

The most essential point in conducting the lifting and laying is **unity of action** on the part of the bearers to whom it is entrusted, including as it does the proper distribution of the power (the bearers' hands and arms) under the weight. No. 1 supports the neck and chest; No. 2 the loins and hips; and No. 3 the lower limbs. It must be distinctly understood by the bearers that, although each

[*To face p.* 181.

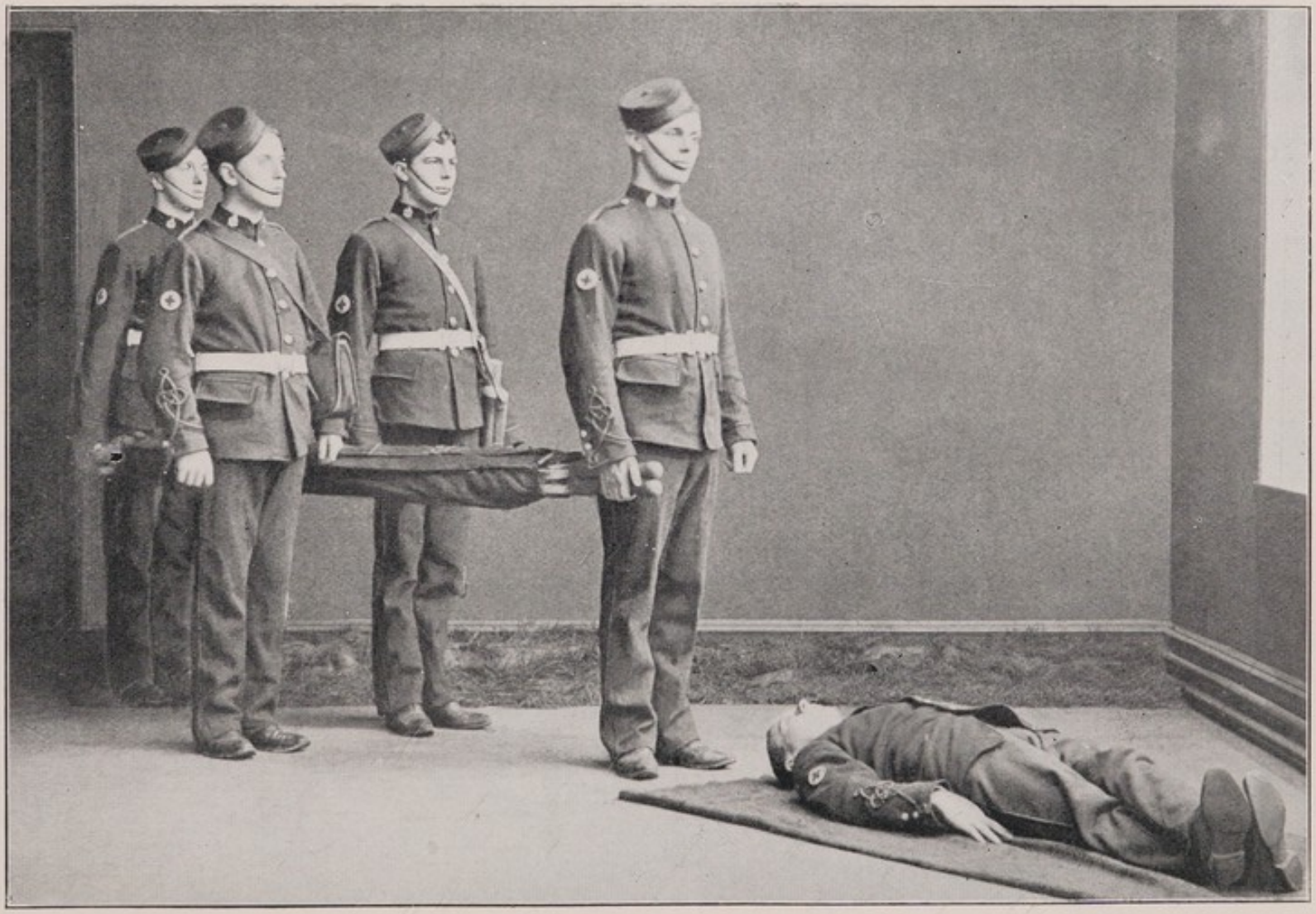


Fig. 196.—"Take Post!" "Advance!"

[*To face p* 181.

Fig. 197.—"For Loading!" "Lift!" Or "Load Stretcher!" "Lift!" (new drill).

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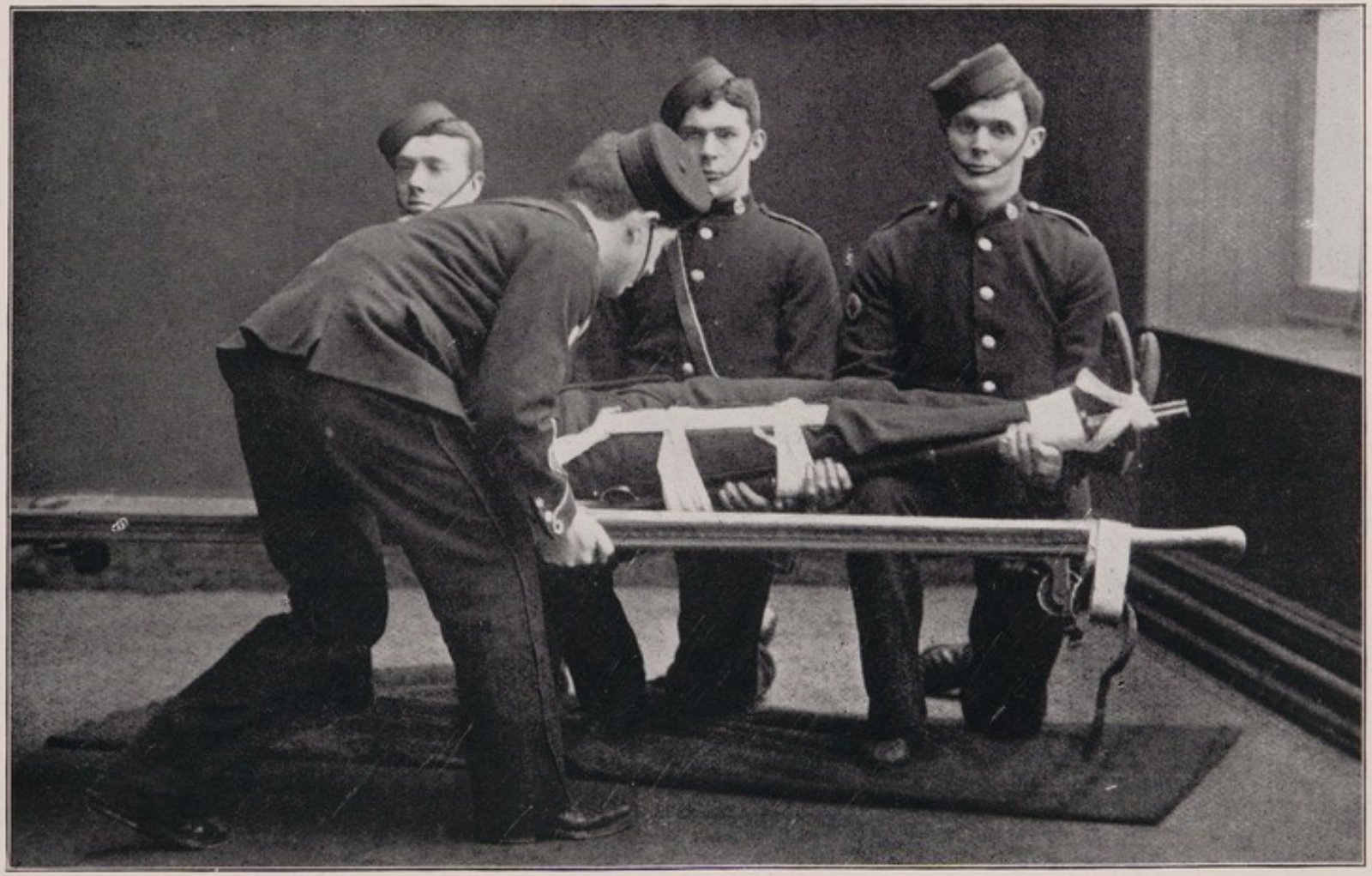

Fig. 198.—"For Loading!" "Prepare!" Or "Lead Stretcher!" "Lift!" (new drill).

[*To face p.* 181.

Fig. 199.—"For Loading!" "Lower!" Or "Load Stretcher!" "Lower!" (new drill).

man is to raise a certain part of the weight of the patient's body, all must act in concert, else the patient's injuries and sufferings may be seriously aggravated by want of attention to this point.

A party of patients, proportionate to the number of stretcher squads, will be extended to four paces, marched ten paces in front of the company, and directed to lie down with their heads towards the company.

"*Take Post!*" "*Advance!*" (Fig. 196).—Each stretcher squad moves off by the nearest way towards its corresponding patient, the No. 4 placing himself on the right of the centre of his stretcher as the squad disengages. Each squad halts when the No. 1 arrives one pace from the patient's head, Nos. 2 and 3 covering correctly in a line with the patient.

"*Lower Stretchers!*"—As before detailed.

"*Prepare Stretchers!*"—As before detailed (Fig. 193).

In military stretcher drill the order "*Collect Wounded*" is first given, when each stretcher squad doubles by the shortest route to the corresponding patient, and halts without further word of command when one pace from the head of and in line with the patient. No. 4 gives the orders "*Lower Stretcher*" and "*Prepare Stretcher,*" and, while Nos. 1 and 3 prepare the stretcher, No. 4 and No. 2, with extra bearers if available, render first aid to the patient.

"*For Loading!*" "*Prepare!*" or "*Load Stretcher!*" (Figs. 197 and 198).—Nos. 1, 2, and 3 advance to the left side of the patient, No. 4 to his right, No. 1 halting opposite the knees, Nos. 2 and 4 opposite the hips, and No. 3 opposite the shoulders. The whole then turn inwards together.

"*Two!*"—On the word "*Two*" the bearers kneel on the left knee and take hold of the patient, No. 1 passing his hands and forearms beneath the patient's legs, hands wide apart. Nos. 2 and 4 pass their hands and forearms beneath the patient's hips and loins, No. 3 passes his left hand across the patient and under his right shoulder, the right hand beneath the left shoulder of the patient.

"*Lift!*" (Fig. 197).—On the word "*Lift*" all slowly lift the patient off the ground and rest him on the knees of Nos. 1, 2, and 3, No. 4 disengages, doubles to the centre of the stretcher, grasps a pole in each hand, left hand across, lifts the stretcher and places it directly beneath the patient (Fig. 198), kneels on the left knee and again assists in supporting the patient.

In lifting the patient off the ground, No. 4 will give special instructions as to the care of the injured part. If the injury be a severe one, it is the duty of No. 4 to attend personally to the injured part, and he may direct another bearer to replace him if necessary.

"*Lower!*" (Fig. 199).—The patient is lowered slowly and gently on to the centre of the canvas, the bearers disengage, stand up and front, No. 1 stepping forward and No. 3 stepping back to place themselves opposite the handles of the stretcher.

Bearers turn to front after rising.

The stretchers may now be lifted and the company practised in marching with loaded stretchers (Fig. 200), after which the company will be halted, the stretchers lowered and unloaded as detailed below.

"*For Unloading!*" "*Prepare!*" or "*Unload Stretcher!*" (Fig. 201).—The whole turn inwards together, No. 1 placing himself opposite the knees, and No. 3 opposite the shoulders of the patient; they kneel on the left knee and take hold of the patient as described for loading.

"*Lift!*"—On the word "*Lift!*" the patient is lifted and supported as before. No. 4 grasps the stretcher as described, and lifting it clear of the patient, carries it forward, placing it on the ground one pace clear of the patient's feet. He then rejoins his squad and resumes the support of the patient.

"*Lower!*"—The patient is gently lowered to the ground, the bearers disengage, stand up, turn to their front and march straight forward to their position at the stretcher, where they halt.

To Load and Unload Stretchers with Reduced Numbers.—*With Three Bearers.*—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 an 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; the other two bearers raise the body—kneeling down, on opposite sides of the patient near his hips, facing each other, they pass an arm under his back and under his thighs, and lock their fingers, thus securing a firm grasp preparatory to lifting the trunk.

With Two Bearers.—When only two bearers are available, the stretcher will similarly 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, 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 one of the improvised seats described

[*To face p.* 182.

Fig. 200.—Marching with loaded stretcher.

[*To face p.* 182.

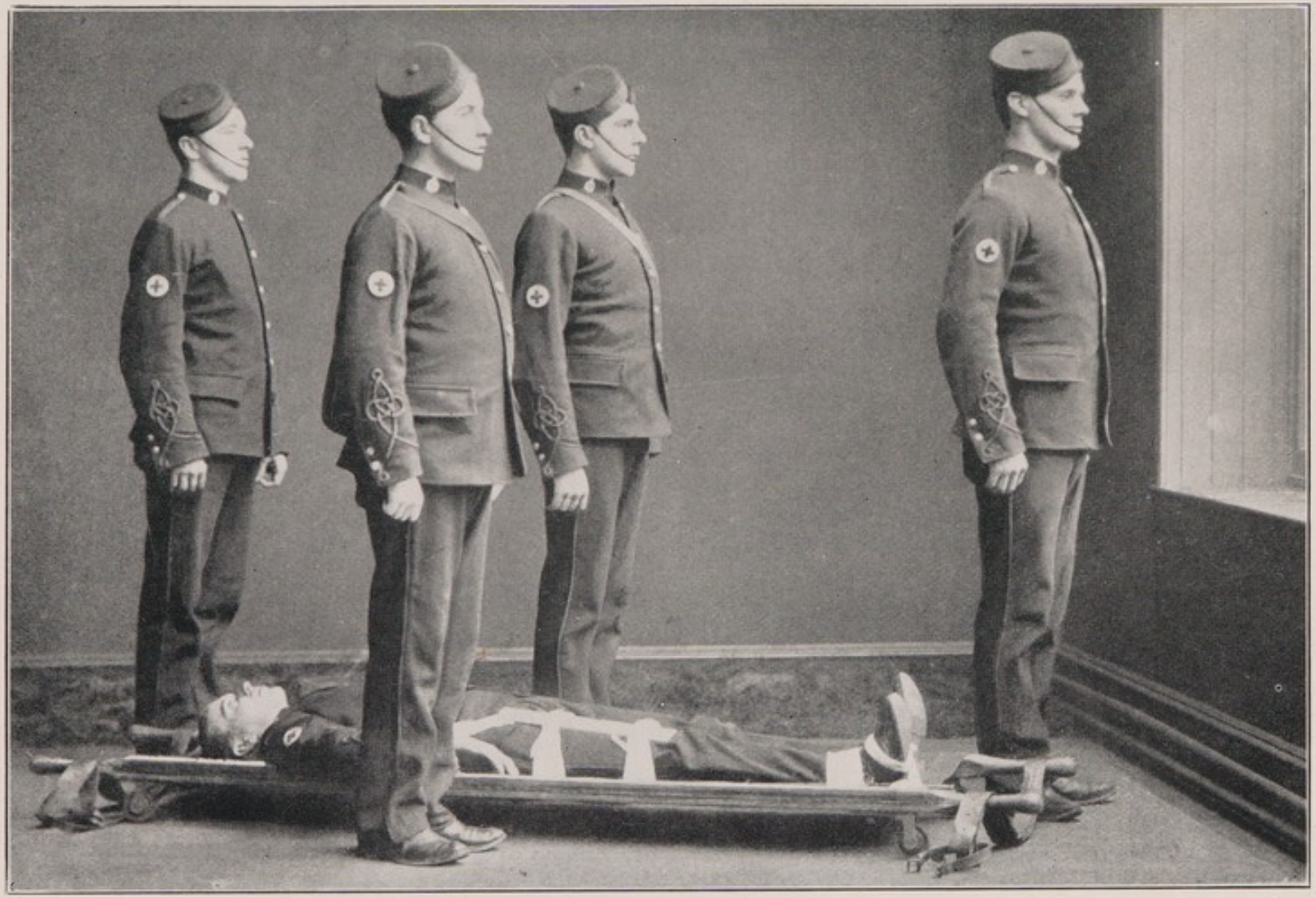

Fig. 201.—"For Unloading!" "Prepare!" Position before turning inwards for unloading.
Or "Unload Stretcher!" (new drill).

on pp. 136 and 137, provided, however, that there are no symptoms of shock present; in the latter case, method (*a*) must be resorted to.

Adapted Stretcher Exercise.—Patients being told off, the detachments, or each detachment in succession, may be put through the following exercise, which should be carried out on the principles detailed above :—

Take post at the head of patient !
Lower stretcher !
For loading, lift patient !
Lower patient !
Lift stretcher !
Adjust slings !
March !
Halt !
Lower stretcher !
For unloading, lift patient !
Lower patient !
Fold up stretchers !

General Rules for the Proper Carriage of Stretchers.—These rules cannot be better laid down than in the words of Professor Sir T. Longmore in his *Treatise on Ambulance*, which are now quoted :—

"(1) When slings are used to assist the bearers in carrying stretchers, care should be taken at starting that they are buckled, so that the parts supporting the poles are all at equal distances from the *surface of the ground*.

"(2) As most ground over which wounded have to be carried is likely to present irregularities of surface, it becomes an important matter for bearers to practise the carriage of stretchers, so as to acquire a facility of keeping the stretcher level, notwithstanding the ground is uneven. Bearers trained and habituated to this duty perform it with ease and dexterity, irrespective of differences in their own respective heights; while those who have not practised it are not unlikely to cause considerable distress to the person carried, when they have to carry him up and down hill, in consequence of their deficient training. 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. The art can readily be acquired by practising the carriage of the stretcher up and down steps. In this practice the front and rear bearers should occasionally change their respective positions. A bearer should also be carried on the stretcher in turn, so as to be made practically aware of the effects of even and uneven carriage.

"(3) If the ground over which the conveyance has to pass presents a general ascent, and the bearers are of different heights, then the rear or No. 3 bearer should be the taller and stronger man, for his greater height and the greater strength of his arm will be useful in supporting and raising the stretcher up to the level of the end carried by the foremost man. The weight of the stretcher will naturally be thrown in the direction of the man on the lower level.

"(4) If the ground presents a general descent, the front or No. 1 bearer should be the taller and stronger, for the same reasons as

those just given as regards the No. 3 bearer under the opposite circumstances mentioned in Rule 3.

"(5) A sick or wounded person on a stretcher should be carried, if the ground be tolerably level, with his face looking towards the direction in which the bearers walk. The front or No. 1 bearer then supports the end of the stretcher at which the patient's feet are placed; the bearer near the patient's head is the rear bearer.

"(6) If the bearers have to carry the stretcher up hill, the leading bearer should support the end of the stretcher on which the patient's head is placed, excepting in the case mentioned under Rule 7. Each bearer will turn to the right about to carry this out.

"(7) If the bearers have to carry the stretcher down hill, the rear, No. 3, bearer should support the end on which the patient's head is placed. The reverse position should be assumed by the bearers, both as regards going up hill and going down hill, in case the patient being carried is suffering from a recent fracture of the thigh or leg.

"The patient's comfort and welfare will be best consulted as a general principle by the arrangements named in Rules 6 and 7. Although under all circumstances the level position should be sought for as much as possible, still, if the slope of the ground be such that it cannot be attained, it appears desirable that the inclination downwards should be towards the feet rather than towards the head of the patient. But with regard to the exception named, the reverse position of the patient is directed, in order to prevent the weight of his body pushing the upper end of the broken bone down upon the helpless and motionless portion of the limb below the seat of fracture.

"(8) No attempt must be made to carry a helpless patient over a high fence or wall if it can possibly be avoided; it is always a dangerous proceeding. The danger is, of course, increased in proportion to the height of the wall or fence. But even if the wall be not much higher than one over which the bearers can step, the stretcher must be made to rest upon it, to the inconvenience and probable pain of the patient, while each bearer in succession gets over the obstruction; and it is better even to avoid this inconvenience, provided the avoidance does not entail great delay. If the fence or wall be high, either 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 readily practicable, the patient should be carried to a place where a gate or opening does already exist, notwithstanding the distance to be traversed may be increased by the proceeding. It is better that the transportation should be somewhat delayed than the safety of the patient's limbs or life risked.

"(9) In crossing a ditch, dyke, or hollow, the stretcher should be first laid on the ground near its edge. Nos. 1 and 2 then descend.

The stretcher with the patient upon it is afterwards advanced. Nos. 1 and 2 in the ditch supporting the front end of the stretcher, while its other end rests on the edge of the ground above. While thus supported, Nos. 3 and 4 descend. All the Nos. now carry the stretcher to the opposite side, and the fore part now being made to rest on the edge of the ground while the rear part is supported by Nos. 3 and 4 in the ditch, the Nos. 1 and 2 are left free to climb up. The stretcher is now pushed or lifted forward on the ground above, and rests there, while Nos. 3 and 4 climb up. The bearers then carry the stretcher on.

" (10) On no account should a stretcher be carried on the shoulders of two or four bearers. The evil of such a proceeding is not only that it is difficult to find several bearers of precisely the same height, so that a level position may be secured, but also that the wounded or sick person, if he should happen to fall from such a height owing to the helpless condition in which such a patient usually is, is not unlikely to sustain a serious aggravation of the injuries he may be suffering from. Moreover, one of the bearers of a stretcher ought always to have his patient in view, so as to be aware of hæmorrhage, fainting, or other change requiring attention taking place, and this cannot be done when the patient is carried on the shoulders. The height, too, is calculated to cause the patient uneasiness and fear of falling off, which is also desirable to avoid. For all these reasons, notwithstanding that bearers will often attempt to carry a patient on a stretcher upon their shoulders, from the weight being borne more easily in that position, or with a view of relieving a fatigued condition of the arms, the practice should be strictly forbidden."

CHAPTER XVI.

THE AFTER TREATMENT OF AMBULANCE CASES.

BED AND BEDDING—THE SICK ROOM—VENTILATION OF THE SICK ROOM—DRESSINGS—WATERPROOFS AND DRAW SHEETS—PATIENT'S TEMPERATURE—APPLICATION OF HEAT AND COLD—CRADLES—BED-SORES—ADMINISTRATION OF MEDICINES—OBSERVATION OF THE PATIENT.

No course of ambulance lectures is complete without some account being given of the after-treatment of accident cases. Such treatment usually falls into female hands, and the matter dealt with in this chapter is intended to fill in ladies' ambulance classes the place which is taken in male classes by stretcher drill and ambulance transport.

1. **Bed and Bedding.**—The bed should be placed, if possible, in the centre of the room in which the patient is to lie, so that it may be approached on either side, and be in a suitable position for removal of the patient from a stretcher.

The bed may afterwards be shifted to a more convenient position.

The bed should be prepared for the reception of the patient. A straw mattress is usually the best, and is an essential in the treatment of leg and thigh fractures. No fracture of the thigh or leg can be kept in proper position on a feather bed or other soft mattress into which the limb sinks.

Hot bottles should be placed in the bed.

Hot bottles should be rolled in flannel in every case. Great care must be taken in applying hot bottles to unconscious patients, who cannot complain if the heat be excessive, and may be severely burned if proper precautions are not taken.

If shock or collapse be present the bedding should be arranged so that the patient may be laid between blankets.

2. **The Sick Room.**—The patient's own room should be chosen if possible, but if it be an upstairs room, and the patient have to be carried on a stretcher, a room on the ground floor may be selected. All useless furniture should be removed.

The sick room is best ventilated by raising the lower sash for a few inches, and supporting it by a piece of board which has been made to fill the gap exactly. Ventilation then goes on between the upper and lower sashes without any sensible draught, and the air in the room can in this way be kept sweet and moist (see Fig. 202).

The room should be kept at a temperature of 60° to 65° F.

3. **Dressings, etc.**—For an accident case which requires dressing, the following requisites should have been obtained :—

Basins, nail brushes, hot water (in kettle), cold water (in jug), carbolic acid, tincture of iodine, cotton wadding, lint, and bandages. If there be time all water should be boiled before using, and lint, gauze, or cotton wool, which are to be used as mops or dressings applied directly to the wound, should be sterilised by boiling.

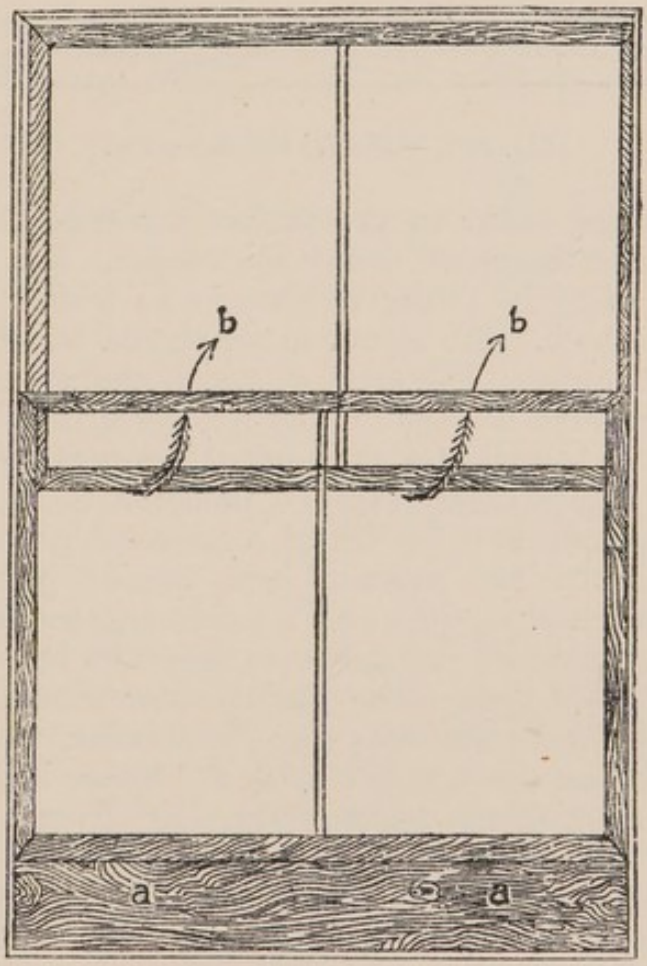

Fig. 202.—Method of ventilating room between upper and lower sashes of window.

If a fracture has to be "set," suitable splints should be in readiness, previously well padded with cotton wool.

Emergency disinfectants and dressings (see under the Antiseptic Treatment of Wounds) may have to be prepared according to the nature of the accident.

If the case be one of poisoning, the emergency emetics and antidotes suitable to the particular case should be procured at once and laid out neatly on a table in the sick room.

4. **Waterproofs and Draw-sheets.**—Where there is likely to be soakage of blood from a wound, a waterproof or Mackintosh sheet should be placed below the part. If this be not at hand, a "draw-

sheet" will do equally well. It is made of a folded bed-sheet placed below the part, and so arranged as to be gradually drawn through as it is soiled, so that a clean part may be brought below the patient while the soiled part is folded up.

5. **Patient's Temperature.**—This should be ascertained every few hours to see if fever be present, and if so, to what extent. In ordinary cases it is taken morning and evening. The temperature is ascertained by the clinical thermometer (see Fig. 203), the bulb

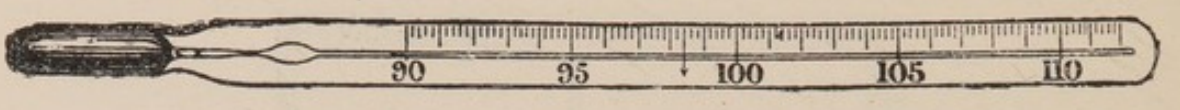

Fig. 203.—Clinical thermometer.

of which is placed either in the patient's arm-pit next the skin, in the groin, or in the mouth below the tongue. The latter method should not be used in young children, who may bite and break the glass of the bulb. The thermometer should be left *in situ* from three to five minutes. The level at which the mercury stands in the stem should then be read off and registered on a clinical chart. The arrow at 98·4° indicates the normal temperature of the body in health. A clinical chart may be prepared to show a morning and evening temperature by ruling a piece of paper in the way shown on p. 189. The morning and evening temperatures are indicated on the chart by dots, and the dots are then joined by lines. The normal temperature (indicated on the chart by a thick line) is 98·4° Fahr., or 37° Cent. The thermometer should be placed in a vessel containing a little weak carbolic solution, and should have the mercury shaken down to the mark 97° before being again used. Fig. 204 is a copy of the temperature chart from a hospital case of poisoned wound of hand and forearm, and shows high fever at night and a gradual fall of temperature as the absorption from the poisoned wound decreased under antiseptic treatment.

6. **Application of Heat and Cold.**—Heat is applied either by poultices, fomentations, or hot bottles.

Poultices.—Dry poultices consist of a layer of heated cotton wadding applied next the skin and covered by a piece of oiled silk to keep in the heat. They are very suitable for application to parts such as the front of the neck, where the weight of an ordinary poultice is not well borne. Moist poultices are made either of linseed or oatmeal. A linseed or oatmeal poultice is made by adding to boiling water a sufficient quantity of meal to make the poultice thick enough to be spread with a knife, and too thick to run off when laid on a sloping surface. The poultice, mixed in a bowl, is then spread with a large warm knife or spatula over a handkerchief or piece of flannel, an edge of an inch wide being left all round. This edge is then turned down over the meal so as to leave a square

of uncovered poultice surface. The meal surface of the poultice should then be applied next the skin, and to prevent the meal from

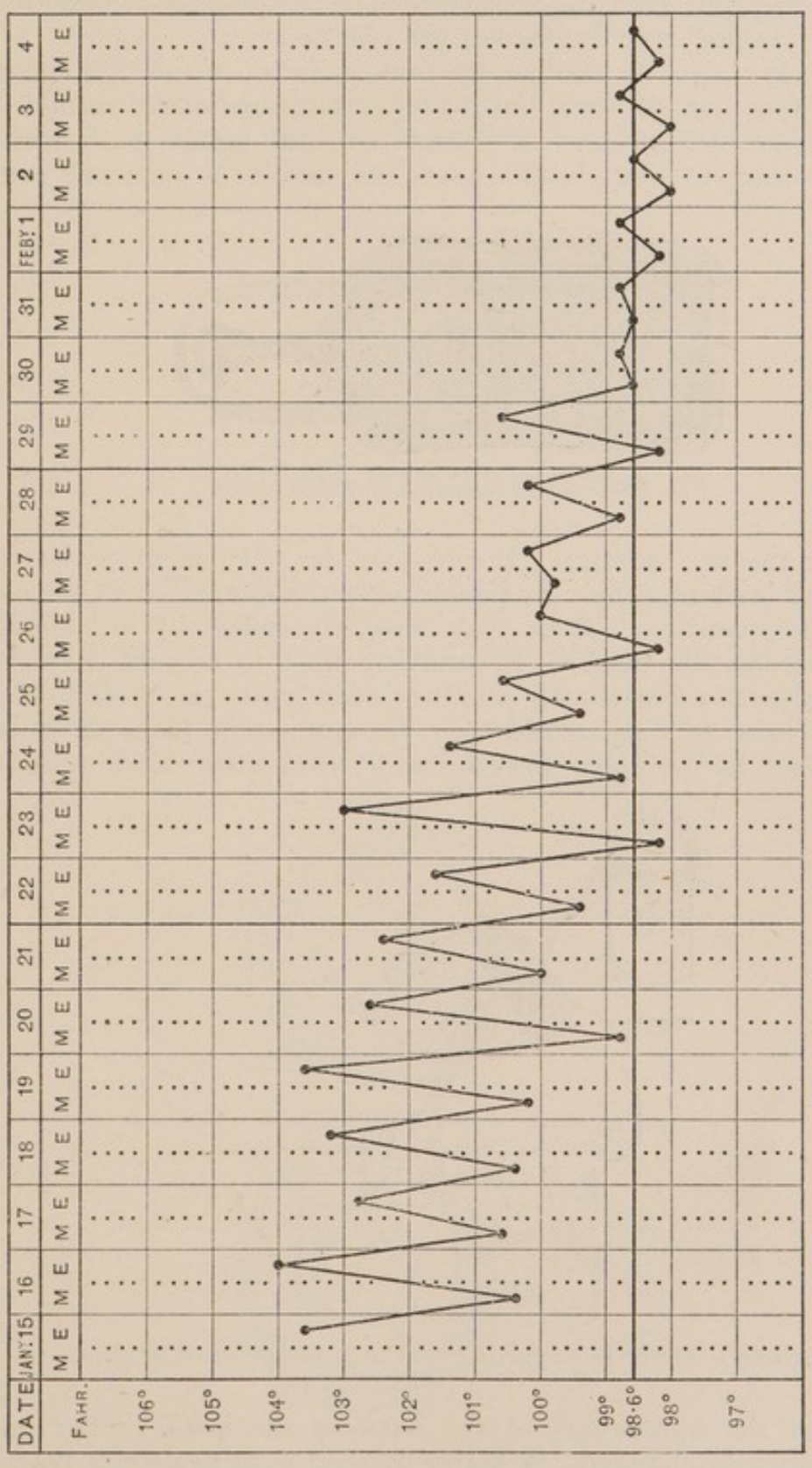

Fig. 204.—Temperature chart of patient suffering from poisoned wound of arm and forearm. The line drawn at 98·6° indicates the temperature regarded by some as that of the body in health. The normal temperature is usually taken as 98·4.

sticking to the skin a little oil is smeared over its surface before application. The heat of the surface should be tested with the

back of the hand before it is applied to the patient. Such a poultice should be changed about every two hours If much pain be complained of, as in cases of sprains, a teaspoonful of laudanum may be sprinkled over the face of the poultice.

Heat may also be applied by fomentations, which are flannel cloths wrung out of very hot water. A fomentation should be covered over with a layer of flannel, or, still better, with water-proof sheeting, to keep in the heat. It should be changed every

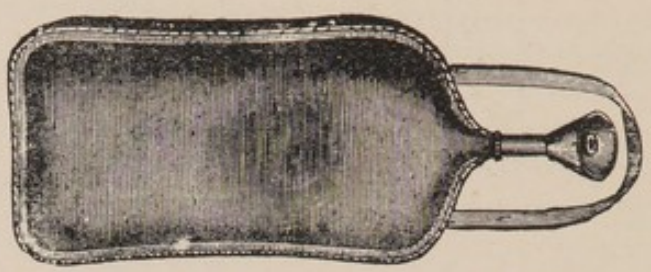

Fig. 205.—India-rubber hot-water bottle.

fifteen or twenty minutes. If the pain be very great a dessert-spoonful of laudanum may be poured over the flannel, as in the case of anodyne poultices. Heat may also be applied by hot bottles. A very serviceable method of applying heat to a joint is to lay over it an india-rubber bottle filled with hot water (see Fig. 205).

Application of Cold.—Cold may be applied in cases of injury to the head by wringing towels out of cold water and applying

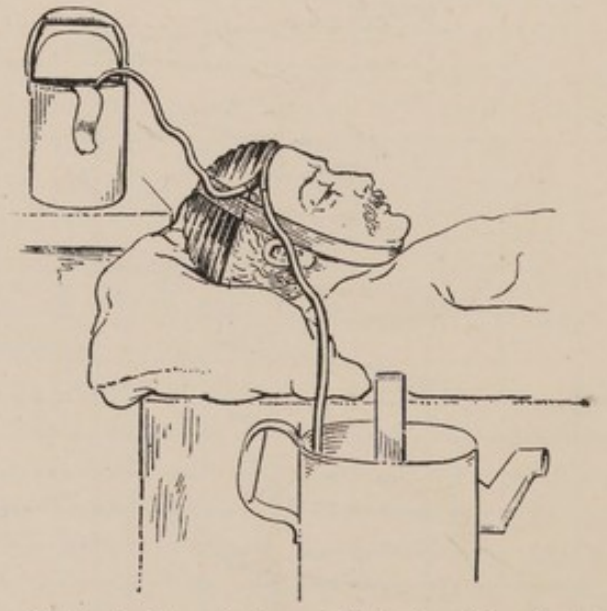

Fig. 206.—Method of applying cold to head by Leiter's tubes.

them over the upper part of the back of the head. They have to be frequently changed. A better method is to procure a bladder and to lay it half-filled with ice or cold water on the top of the patient's head.

For the continuous application of cold to the head nothing is better than Leiter's block tin tubes, which fit the head like a cap, and through them a constant stream of cold or iced water is kept circulating. The ordinary way of using these tubes is shown in Fig. 206.

7. **Cradles.**—Cradles are employed to take the weight of bed-clothes off an injured limb or foot. The hospital cradle is shown in Fig. 207. A cradle may be extemporised by putting the arm

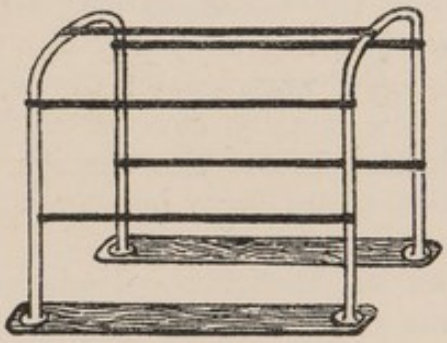

Fig. 207.—Cradle.

or leg through a hat-box, the end of which has been knocked out. Another way is to support the bed-clothes on a three-legged stool, or to put a gimlet through the bed-clothes and lift them off the part by strings fastened to the gimlet and attached to the top and foot of the bed.

8. **Bed-sores.**—Bed-sores occur in debilitated patients on de-

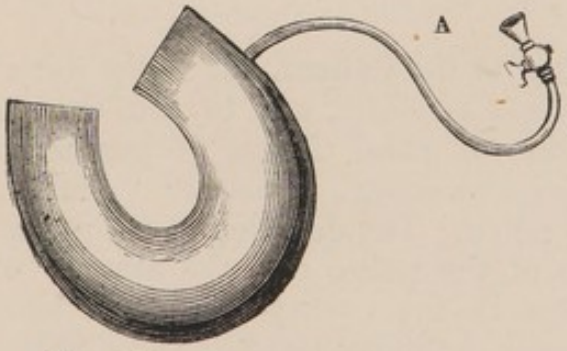

Fig. 208.—Horse-shoe air cushion.

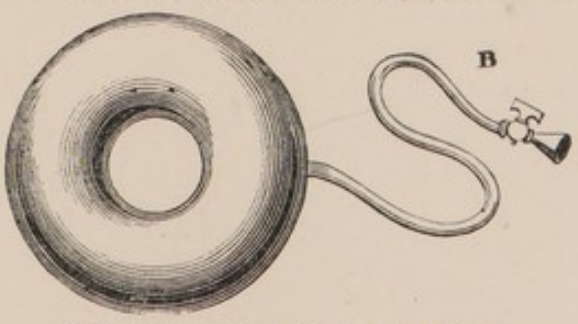

Fig. 209.—Circular air cushion.

pendent parts pressed on by lying, and particularly over the sacrum, shoulder-blade, and outer and upper parts of the thigh. The skin

over a part threatening to break out into a bed-sore becomes hot, red, and painful. It should be attended to at once by bathing the part with weak whisky in water, or spirit lotion, and by dusting over it a soft powder like starch, or smearing over it zinc ointment or cold cream. If the skin be already broken, the parts should be washed with warm water and covered with zinc ointment on lint. It has been recommended to cover a bed-sore with a thick batter made of white of egg, flour, and brandy. This dries over the irritated spot and protects it. Collodion may be similarly employed. An air or water pillow (see Fig. 208) may also have to be procured, and used to diminish the pressure on the irritated and inflamed spot. Air cushions are usually covered with a flannel or linen wrapper, which is heated before the cushion is placed under the patient. In bad cases where large bed-sores are present or likely to occur, water-beds are employed.

9. **Administration of Medicines.**—Medicines should be given regularly at the time ordered. The following terms are usually employed in directing the dosage :—

	♏ i.	= one minim or a drop.	
	gr.i.	= one grain.	
	ʒi.	= one drachm = one teaspoonful.	
	ʒij.	= two drachms = one dessertspoonful.	
	ʒiv.	= four drachms	= one tablespoonful.
or	℥ss.	= half-an-ounce	
	ʒviij.	= eight drachms	= one wineglassful.
or	℥i.	= one ounce.	

10. **Observation of the Patient.**—It is the duty of the attendant to watch the patient carefully, and to note any change in his condition. Complaints of pain, change of posture or any particular attitude, sweating, vomiting, rigors or "shakes," should all be watched for and noted. The duration of sleep, the condition of the tongue, the rate of the pulse, and the amount of fluid and solid nourishment taken in the twenty-four hours should be set down neatly on a special chart prepared for the purpose. Such information is often of great assistance to the medical attendant.

CHAPTER XVII.

VOLUNTARY AID DETACHMENTS AND THEIR WORK.

DEFINITION—MEDICAL SERVICE OF A TERRITORIAL DIVISION—FIELD AMBULANCES—CLEARING HOSPITALS—REST STATIONS—GENERAL HOSPITALS—COMPOSITION AND TRAINING OF VOLUNTARY AID DETACHMENTS, AND OF ST. JOHN COUNTY COMPANIES—THE GENEVA CONVENTION.

VOLUNTARY Aid Detachments are composed of men trained in "First-Aid" and in the management and improvisation of ambulance transport, and of ladies trained in first-aid, home nursing, and hygiene. They form part of the technical reserve, and have been organised to fill the gap which exists in the Medical Service of the Territorial Force between the Field Ambulance, which operate in the immediate rear of the fighting force, and the General Hospitals at the base or far end of the Lines of Communication. They will provide *personnel* for the clearing hospitals, the stationary hospitals, the rest stations on the railway lines, and the ambulance trains, and to be of service they must be thoroughly organised, trained, and equipped. That an immense amount of work would fall to these volunteer agencies can be demonstrated most clearly by considering the provision which would have to be made for the sick and wounded on mobilisation of the Territorial Force. If the establishment of the Territorial Force be taken as 300,000, probably 1,000 sick would have to be attended to daily, and arrangements would have to be made for the daily hospital treatment of 2 per cent. of the force, or 6,000 men. In the event of a general engagement, it is probable that only three-fifths of the force (or 180,000 men) would be engaged at one time. Of these 3,600 would be killed in action, 12,600 would require hospital treatment, and 1,800 would be only "slightly wounded" and fit to return to duty in a few days. Of the 12,600 men "severely wounded" and requiring hospital treatment, a large proportion might be treated in the stationary hospitals, but 5,000 at least would eventually have to be sent to the base. All these sick and wounded would have to be handled by Voluntary Aid Detachments, and, as the work must be carried out in conjunction with and under the direction of the Royal Army Medical Corps of the Territorial Force (R.A.M.C., T.F.), it is desirable that members of these detachments should be familiar with the scheme of medical aid provided for a Division of the Territorial Army. The author has prepared a diagram (Fig. 210) showing

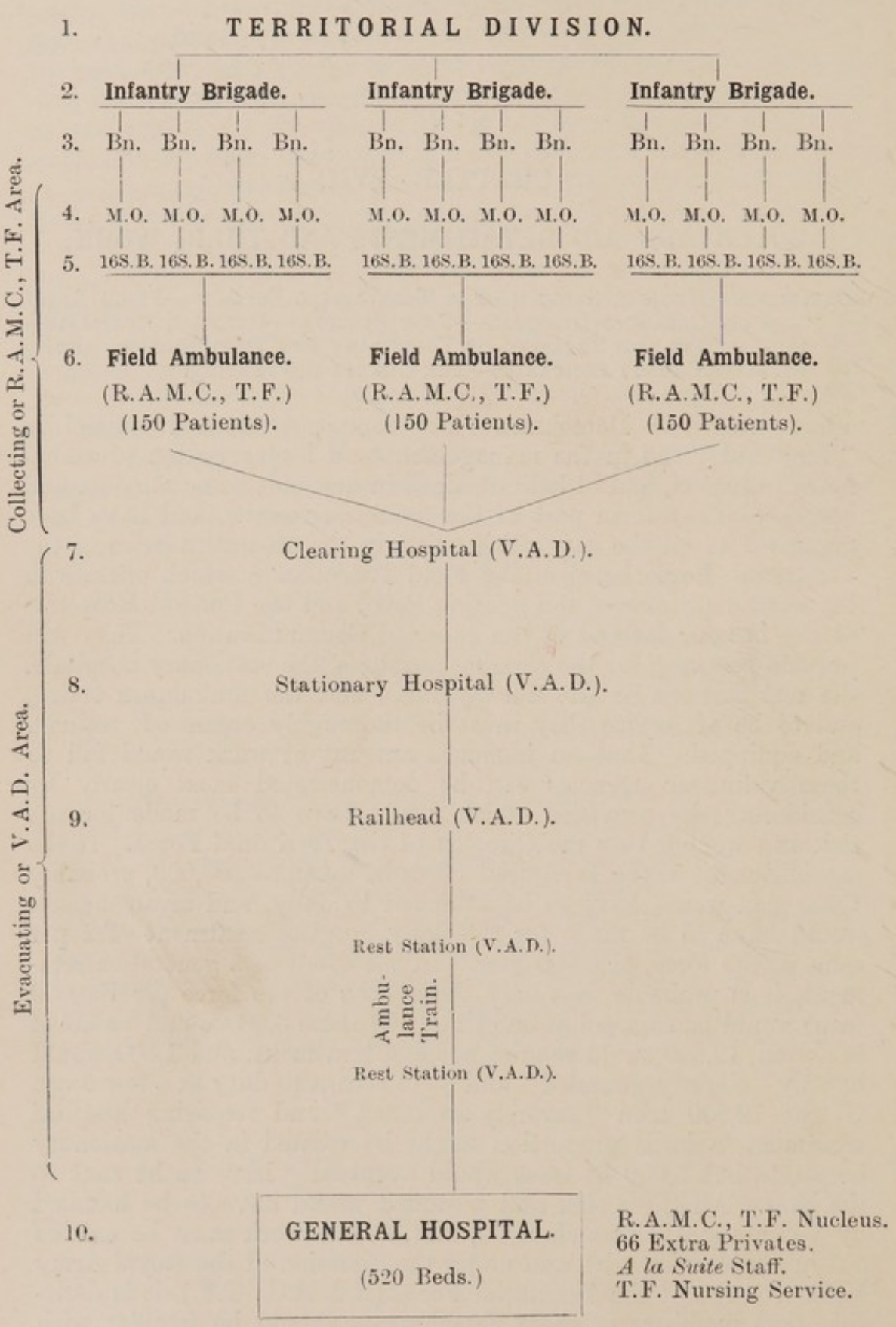

Fig. 210.—Diagram of Medical Service of a Territorial Division.

(*a*) the composition of a Territorial Division; (*b*) the distribution of the medical aid in the collecting area or R.A.M.C., T.F. area, which extends from the front to the clearing hospital, and in which the work is carried out by the Royal Army Medical Corps of the Territorial Force; and (*c*) the evacuating area, or V.A.D. area, which extends from the clearing hospital, along the lines of communication to the general hospital at the base. For the sake of clearness the numbers placed opposite the territorial units and V.A.D. hospitals and stations in the diagram will be followed in the description.

The medical service of the division is under the command of the Assistant Director of Medical Services (A.D.M.S.), or Administrative Medical Officer (A.M.O.), as his original title was, a Colonel of the Army Medical Service, who is on the staff of the General Officer commanding the Division (G.O.C.).

(1) **A Territorial Division** (of which there are fourteen in the Territorial Army) consists of three Brigades of Infantry (12,000 men), along with Divisional Troops—Royal Field Artillery, Royal Engineers, Army Service Corps, and Royal Army Medical Corps—bringing the total strength of the Division up to about 19,000 men.

(2) **A Brigade of Infantry** consists of four battalions (Bn. = Battalion).

(3) **A Battalion of Infantry** may be taken as 1,000 strong.

(4) **The Regimental Medical Service** consists of a **Medical Officer** (M.O.), detailed from the Royal Army Medical Corps, and attached to the battalion for duty. He is allowed a lance-corporal to act as orderly, and a private to drive the cart containing the medical equipment of the battalion. Attached to the battalion to assist in the purification of water and disinfection, etc., are four privates of the Royal Army Medical Corps, while the battalion provides from its own ranks one N.C.O. and eight men to act as sanitary police and to assist in the removal or destruction of camp refuse.

(5) The M.O. has under his command 16 regimental stretcher bearers (16 S.B.), provided by the battalion to which he is attached; bandsmen of the battalion act as stretcher bearers, and are specially trained in first-aid and stretcher drill by the M.O. Pipers of Highland regiments are not available for this purpose, as they have to play their companies into action.

Regimental stretcher bearers are not protected under the Geneva Convention (*q.v. infra*). They are not employed exclusively in the care of the sick and wounded, and are, therefore, not entitled to wear the "Geneva Cross" or "Red Cross" armlet—the badge of neutrality—as men of the Royal Army Medical Corps and members of Voluntary Aid Detachments, duly authorised and holding identity certificates, can do.

(6) **A Field Ambulance** is *the* medical unit, and its duty is the collection and removal of sick and wounded from the battlefield. There are three field ambulances in a territorial division—one to

each brigade. At regimental "Aid Posts," which should be under cover, a field ambulance takes over sick and wounded from the Regimental Medical Service through its "Bearer Division," which also searches for and attends to wounded, and transfers all cases back to a "Dressing Station," or emergency field hospital, which is pitched and worked by the "Tent Division" of the field ambulance. Slightly wounded cases are marched back to the Divisional "Collecting Station." Each field ambulance has an operating tent, and sufficient bell tents to accommodate 150 patients, and has nine fully qualified medical officers belonging to the R.A.M.C., a quarter-master, and 220 other ranks. The field ambulance (T.F.) provides its own transport drivers (with the exception of three privates of the Army Service Corps), and has on charge ten ambulance waggons for the transport of sick and wounded, general service waggons for the carriage of medical and surgical panniers and other medical equipment, and forage and water carts.

The Essential Requirement of a Field Ambulance is Mobility.—It is necessary that it should be so fully equipped, trained, and provided with transport as to be able to move forward rapidly with an advancing force, to attend with all speed to the wounded, and to evacuate these to the rear, and, above all, to be able to pack up and move with the fighting force after an action. Ambulance waggons, therefore, cannot proceed far to the rear with the wounded; they must rejoin their unit the same day.

(7) **Clearing Hospital** is the name given to a unit which is organised to evacuate the sick and wounded from the field ambulances, and to pass them on to the rear, or return slightly wounded cases to the front as soon as possible. There is no such unit in the Territorial Force, and it has to be provided by V.A.D.s. Such an hospital will be housed either in tents or improvised buildings, halls, barns, schools, farmyards, etc. Nominally a clearing hospital should provide accommodation for 200 sick, but as there is only one to each division, it must be capable of expansion, as a much larger number of casualties may have to be dealt with.

In the Territorial Force the clearing hospital is not provided with equipment, transport, or personnel, and it is here that the important duties of the Voluntary Aid Detachments begin.

The V.A.D.s will have to prepare buildings for hospital use, to extemporise operating rooms, wards, and beds, and to improvise ambulance waggons from hay-carts, lorries, motor omnibuses, motor lorries, and the ordinary and motor waggons of the Army Service Corps which are returning empty to rail-head, as already described.

From this point back to the base the care of the sick and wounded is entirely in the hands of V.A.D.s.

(8) **A Stationary Hospital,** of which there are two to a division, has accommodation for 200 sick nominally, and is placed near rail-head, or on the lines of communication. It takes over the sick

and wounded from the clearing hospital, and passes them on to the base, or returns convalescent cases to the front. Like the clearing hospital, it will have to be improvised by V.A.D.s from suitable buildings, and may be broken up into smaller hospitals of 50 beds each.

(9) **Ambulance Trains and Rest Stations.**—From rail-head the sick and wounded are conveyed back to the general hospital at the base in ambulance trains. These will have to be improvised by V.A.D.s, as described in the chapter on Ambulance Transport (*q.v.*).

The Women's Detachments may assist in the care of the wounded travelling in the ambulance trains, but their most important duty is to take charge of rest stations on the railway line, where sick and wounded are tended and fed during breaks in a long railway journey, or removed for nursing to wards improvised in suitable buildings near the railway station.

(10) **General Hospital** is the name given to a hospital of 520 beds at the base, to which the sick and wounded of the division are evacuated. It will be located in a large city with a Medical School, and as the ordinary Civil Hospitals will not be available, being required for the civil population of the town and district, the general hospital will be housed in buildings suitable for the purpose. These have already been surveyed, and large halls and schools, with accommodation for the nursing staff and up-to-date cooking and lavatory accommodation, have been selected for the purpose by the military authorities.

The administrative staff of the hospital consists of three officers and 43 men of the Royal Army Medical Corps, T.F., who have put in their annual training at Netley, Aldershot, or Woolwich, and are conversant with the working and administration of a large military hospital (R.A.M.C., T.F. nucleus). Sixty-six extra privates will be enlisted on mobilisation to bring the *personnel* up to war strength.

The services of selected physicians and surgeons of civil hospitals in the city in which the general hospital is located will be available on mobilisation. These form the *a la suite* staff.

A Territorial Force Nursing Service has been organised, and a full staff of trained nurses has been enrolled for service in each general hospital. The matrons of this T.F. Nursing Service have opportunities of attending courses of instruction in military nursing at Netley, Aldershot, Woolwich, and other large military hospitals.

From the description given above, it will be seen that the Voluntary Aid Detachments operating in the rear of a territorial division will be spread over a large area of country, and will have different duties to perform according to the part of the area in which they are working. The main duties of the Women's Detachments will consist in assisting in the preparation of farm and village buildings as stationary hospitals, in the nursing of sick and wounded in these

hospitals and in ambulance trains, and in the management of the rest stations at selected points on the railway line. The male detachments will have to act as stretcher bearers between the advance posts and the clearing hospital, to assist in the improvisation of buildings—schools, church halls, barns, and cottages—for clearing and stationary hospitals, to improvise stretchers, ambulance waggons, motor ambulances, and railway ambulance waggons, as already fully described in Chapter XVI. (*q.v.*).

The Main Duty, therefore, of Male Voluntary Aid Detachments is Improvisation.—As their work is mainly concerned with ambulance transport, it seems desirable that a proportion of the members of each detachment should be specially trained workmen—wheelwrights, farriers, carpenters, saddlers motor mechanics, and chauffeurs.

The sphere of action of Voluntary Aid Detachments, and their exact relation to the Medical Units of the Territorial Force, with which they have to co-operate, are clearly shown in Plates I. and II. (Figs. 211 and 212), which the author, when Administrative Medical Officer of the Highland Division (T.F.) prepared for this purpose. Plate I. shows diagrammatically the medical aid which would be required by a Brigade of the Territorial Army in the field. Each of the four infantry battalions of the brigade has its own stretcher bearers under the command of the Regimental Medical Officer. The wounded are tended by the regimental stretcher bearers, and by the stretcher squads of the field ambulance, which takes over all the brigade casualties.

The field ambulance of the Royal Army Medical Corps consists of three sections, A, B, and C, and each of these is divided into a *Bearer Division* in front and a *Tent* or *Hospital Division* in the rear. The bearer division with its stretcher squads and ambulance waggons transports the wounded to the *Dressing Station*, where they are handed over to the surgeons and men of the tent division, which has pitched and prepared operating and hospital tents for the accommodation of 150 patients.

From the dressing station to the rear the evacuation and care of the wounded have to be undertaken by Voluntary Aid Detachments. In this connection the diagram shows first a *Clearing Unit*, proposed by the author to consist of selected V.A.D.s, which have been specially organised and trained in the improvisation of stretchers, ambulance waggons, railway waggons, etc., as described in the chapter on Ambulance Transport. These detachments should have in their ranks wheelwrights, farriers, carters, blacksmiths, and other specialised operatives, whose services would be useful in the preparation and management of extemporised transport. Other selected V.A.D.s would form "*Aid Posts*," to afford temporary shelter and refreshment for the wounded on their way back to the *Clearing Hospital*, which would have been prepared and staffed, as already described,

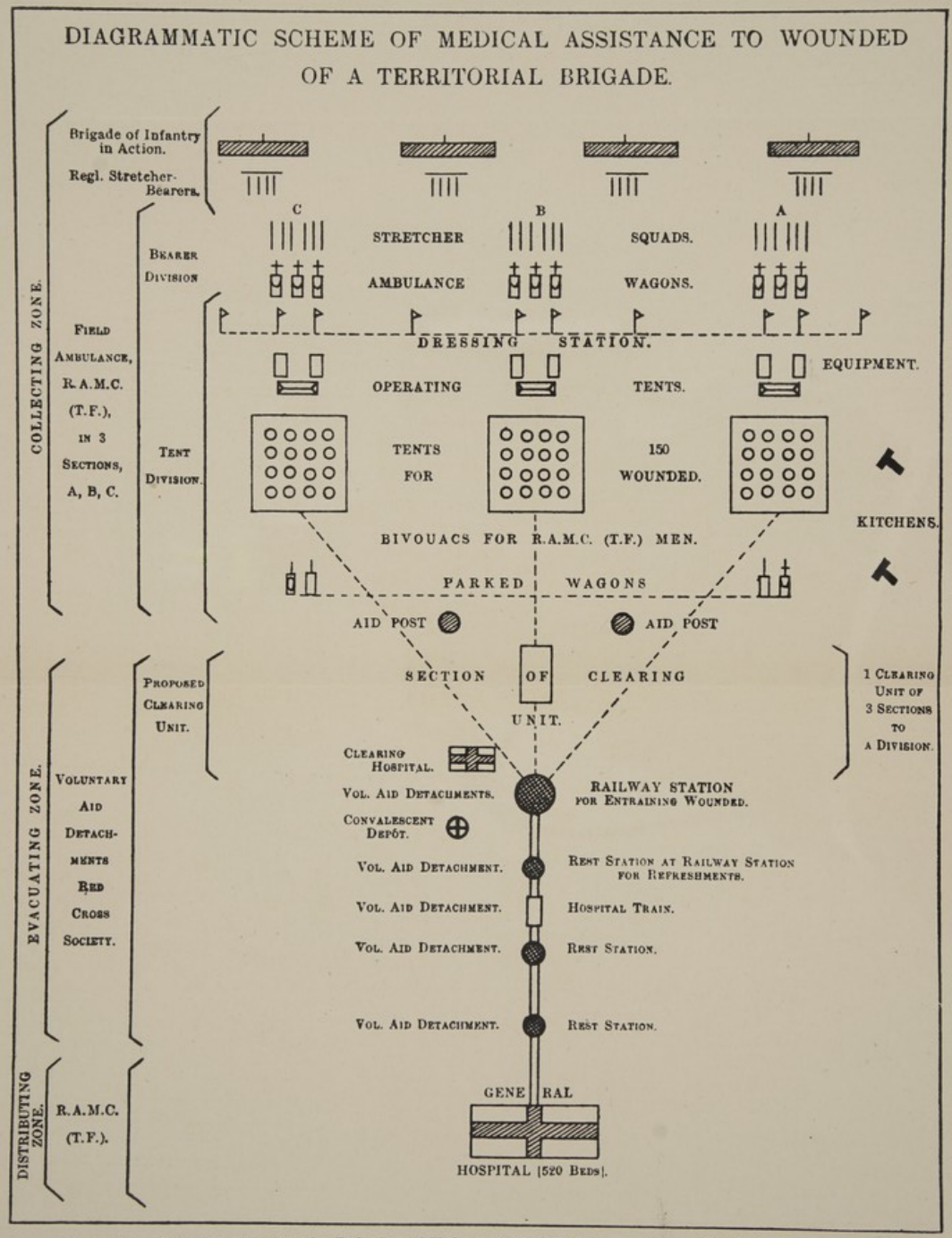

Fig. 211.—Diagram showing the Relation of Voluntary Aid Detachments to a Field Ambulance of the Royal Army Medical Corps (Territorial Force).

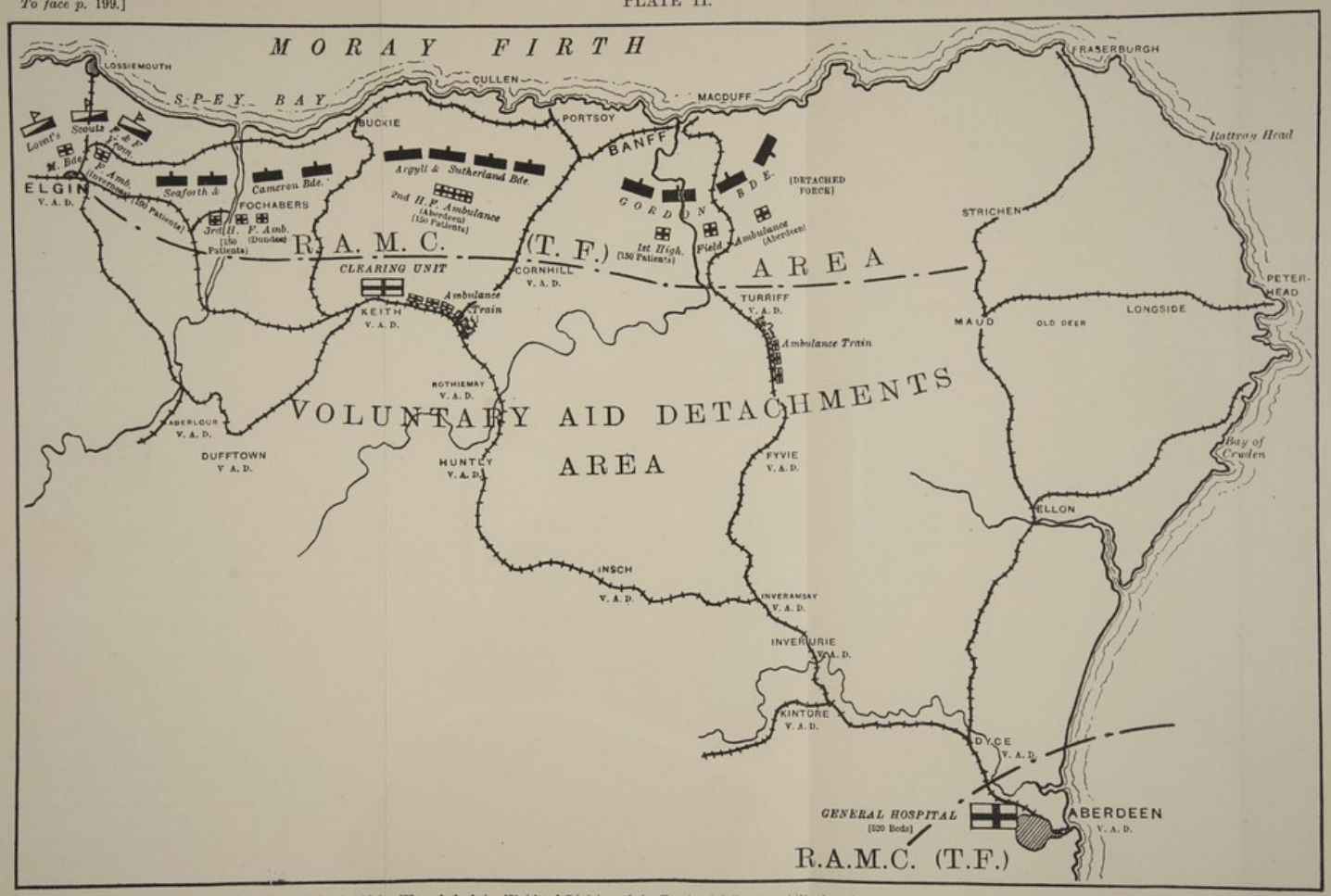

Fig. 212.—Scheme of Medical Aid for Wounded of the Highland Division of the Territorial Force mobilised to defend the shores of the Moray Firth against a raid.

by competent male and female Voluntary Aid Detachments. The wounded on the *ambulance trains* would be nursed and watched by members of the Female Detachments, and to these ladies would also fall the work of providing refreshments at the *Rest Stations* on the railway line. If the journey by rail is a long one, arrangements will have to be made to detrain the wounded into suitable buildings, where they can be dressed, rested, and fed. On arrival at the town in which the general hospital is located assistance would have to be given by V.A.D.s in detraining the wounded and in conveying them to the various buildings which had been fitted up for hospital purposes. There the wounded are handed over to the officers and men of the R.A.M.C. (T.F.), who do the administrative work of the hospital, which is staffed by civilian physicians, surgeons, and nurses, who have been chosen for this purpose by the War Office, and who form part of the *Technical Reserve*.

To show how this would work out in actual practice, the author has taken as a concrete instance the case of the Highland Division and Highland Mounted Brigade of the Territorial Force drawn up on a wide front to oppose a landing on the shores of the Moray Firth (see Plate II., Fig. 212). One of the four general hospitals proposed for Scotland is located in Aberdeen, and there accommodation would be provided for 520 sick and wounded. The chain of medical assistance from the front to Aberdeen is shown in Plate II. The Highland Mounted Brigade, consisting of Lovat's Scouts and the Fife and Forfar Yeomanry, posted on the left flank of the defending force, is attended by the Highland Mounted Brigade Field Ambulance from Inverness, which has *personnel*, light ambulance waggons, and equipment sufficient for 100 patients. Further along the coast are the three Infantry Brigades, which form the Highland Division, along with the Field Artillery, Engineers, and Army Service Corps, which are not included in the plate. Each brigade of four battalions has a field ambulance attached, as below :—

Seaforth and Cameron Brigade,	3rd Highland Field Ambulance (Dundee), 150 patients.
Argyll and Sutherland Brigade,	2nd Highland Field Ambulance (Aberdeen), 150 patients.
Gordon Brigade, . . .	1st Highland Field Ambulance (Aberdeen), 150 patients.

The Field Ambulance Area merges into the Voluntary Aid Detachment Area some miles to the north of Keith, and there aid posts would be established, while the town of Keith, where four railway lines debouch to the front, would be the most suitable point for the clearing hospital. Ambulance trains would run to Aberdeen from Keith on the left and from Turriff on the right, and Voluntary Aid Detachments would be posted at various rest stations on these lines—*e.g.*, Huntly, Insch, Turriff, Fyvie, and Inverurie. The main

work of the male detachments would be at and to the north of Keith and Turriff; that of the female detachments on the ambulance trains and at the rest stations on the railway lines.

The Training, Work, and Personnel of Voluntary Aid Detachments.—To undertake important work of the nature indicated above, members of Men's and Women's Voluntary Aid Detachments must undergo a thorough course of training in first-aid, in home nursing and hygiene, and in the improvisation of ambulance transport and material. The War Office issued in 1911 a "Scheme for the Organisation of Voluntary Aid," and since then the British Red Cross Society (Scottish Branch) has issued a pamphlet on "The Organisation of Voluntary Aid in Scotland," and the St. John Ambulance Association has published an "Explanation of the Organisation, Objects, and Duties of St. John Ambulance County Companies." For the information of Voluntary Aid Detachments, these are quoted below.

THE BRITISH RED CROSS SOCIETY (SCOTTISH BRANCH).

Organisation of Voluntary Aid in Scotland.

The Secretary of State for War issued in 1909 to Secretaries of Territorial County Associations in Scotland a Scheme for the Organisation of Voluntary Aid for Sick and Wounded in the event of war in the Home Territory.

The scheme proposed to make use of the existing Organisation of the British Red Cross Society, and to develop it on a large scale, so that it shall comprehend every district in Scotland.

The help of the St. Andrew's Ambulance Association has been secured for the preliminary training of candidates wishing to take part in the work.

In Scotland the whole responsibility of organising Voluntary Aid Detachments has been handed over to the Scottish Branch of the British Red Cross Society, which has adopted the Brigade system for organising these detachments, designating the whole as the "Scottish Territorial Red Cross Brigade."

PREAMBLE.

1. The following scheme has been formulated with the object of showing how voluntary aid may be organised to supplement the territorial medical service in the event of war in the home territory. It has been arranged on lines similar to those followed by certain foreign countries where organisations for the relief of sick and wounded in war have reached a high standard of efficiency. The number of voluntary aid societies which already exist in our midst is evidence that the necessity for such an organisation is fully recognised by the inhabitants of the United Kingdom. However, as these societies have no connection with one another, they are liable to act independently, with the result that their various spheres of action frequently overlap in some directions, whilst in others they do not extend wide enough, thus causing a serious loss in efficiency.

Voluntary aid should, therefore, be co-ordinated.

2. In this scheme a county system has been adopted, because it is the one upon which the Territorial Force is organised, and which the British Red Cross Society has adopted as the basis of its constitution.

Objects in View.

3. It is well to indicate here more fully the reasons for formulating this scheme. They are as follows :—

The medical organisation of the Territorial Force is sufficiently complete to meet the immediate requirements of the combatant troops on the march and in action, as it provides medical establishments and units which accompany the troops. It also provides general hospitals ; but, inasmuch as it lacks some of the medical units which are to be found in the expeditionary force of the Regular Army, and in all armies on the Continent, it is incomplete.

The units which it lacks are—

(*a*) Clearing hospitals.
(*b*) Stationary hospitals.
(*c*) Ambulance trains.
(*d*) Other formations.

4. The functions of the above units may be summarised as follows :—

(*a*) **A clearing hospital** is a mobile unit which receives the sick and wounded from the field ambulances, and transfers them, by various methods, to the stationary hospital which may become established at various points on the lines of communication, and to the ambulance trains. It is important that field ambulances should not be encumbered with casualties, otherwise the mobility of the fighting troops is interfered with.

(*b*) **Stationary hospitals** are hospitals established at various points on the lines of communication, and necessarily are temporary, their location varying with the lines up which reinforcements are proceeding, or down which casualties are being forwarded.

(*c*) **Ambulance trains** are of various kinds—

(i.) *Permanent Ambulance Trains.*—These are trains built in accordance with specifications already in existence, and will be used solely for transporting serious cases. They consist of special ambulance coaches fitted with tiers of cots, coaches for the medical officers, nursing sisters, and remaining *personnel*, treatment room, dispensary, kitchen, etc.

(ii.) *Temporary ambulance trains*, which are made up of the ordinary vehicles equipped with some arrangement for carrying sick and wounded, such as vans fitted with the Zavodovski, or other special apparatus, and which, when so fitted, are kept for this special purpose during the progress of hostilities. They are intended for the conveyance of the less seriously wounded, and to supplement the permanent ambulance trains.

(iii.) *Improvised Ambulance Trains.*—These are composed of vehicles which have brought up troops and stores to the front, and are improvised on the spot for the transport of sick and wounded on the return journey. The improvised arrangements are dismantled after disposal of the casualties, and the vehicles used again for the transport of troops and stores. These trains would only be employed after severe engagements resulting in a great influx of wounded.

(*d*) **Other Formations.**—Under this heading may be mentioned entraining stations, rest stations, private hospitals, and convalescent homes—

(i.) *An entraining station* is the point on the line of railway where the sick and wounded are loaded on ambulance trains.

(ii.) *A rest station* is a place where sick and wounded are halted on their way from the front for the purpose of, it may be, resting for the night, or merely for the issue of food or light refreshments, or where dressings may be changed and urgent cases attended to.

On railways the station buildings may be utilised and fitted up as a small hospital with facilities for housing, say, from 1 to 50 patients, with cooking, dispensing, and other arrangements. The extent of these arrangements must depend largely on the military importance of the place at the time.

(iii.) *Private Hospitals.*—These institutions may be of any size, but should be complete in every respect for the treatment of either surgical or medical, or both classes of cases.

(iv.) *Convalescent homes* will be required for providing accommodation for convalescent officers and men who, requiring no further active medical or surgical treatment, are fit for discharge from hospital, but not to return to duty.

The expenses in connection with the upkeep of both private hospitals and convalescent homes should be met entirely by private funds. Schemes for these institutions may be made out and forwarded to the various County Associations for their information, and that of the British Red Cross Society.

5. The medical service of the Territorial Force has no establishment for carrying out the duties in connection with the above-named organisations. This scheme has been devised with the object of giving to those members of the civil population, who, from motives of patriotism and sympathy for the sick and wounded, are desirous of offering their services for the performance of these various duties, an opportunity of allowing themselves and their efforts to be organised and co-ordinated efficiently, so that the sick and wounded may derive the fullest possible benefit.

6. The duties, then, connected with this work would be somewhat as follows :—

(i.) The preparation of country carts and other vehicles for the removal of patients lying down.

(ii.) The improvisation of stretchers, etc., for the transport of very severe cases by hand.

(iii.) The conversion of country houses, farms, public buildings, or, in fact, whole villages or small towns into temporary hospitals for the care and shelter of sick and wounded, until they can be placed on railway trains for conveyance to general hospitals.

(iv.) Similar utilisation of local resources for the care of trivial cases of sickness or wounds in the vicinity of active operations.

(v.) The formation of rest stations along lines of evacuation, either by road, rail, or water, where sick and wounded may receive rest and refreshment, or, if necessary, accommodation over night ; or where they may be made comfortable while waiting to be loaded on trains, or after they are taken off trains.

(vi.) The provision of a *personnel* for accompanying the sick and wounded in transit.

(vii.) The fitting out of empty goods vans or other rolling stock for the transport of sick and wounded by rail.

(viii.) The collection and distribution of material for clearing hospitals and rest stations, and the management of depôts of such material.

Formation of Voluntary Aid Detachments.

7. In order to provide a *personnel* that will be available for any or all of the duties indicated in the foregoing paragraphs, Voluntary Aid Detachments will be organised in each county. They will be of two classes, consisting respectively of men and women. A suitable composition is as follows :—

MEN'S DETACHMENT.

1 Commandant.
1 Medical Officer.
1 Quartermaster.
1 Pharmacist.
4 Section Leaders.
48 Men (divisible into 4 sections of 12 men each).

NOTE.—The object of having four sections is to enable small places in rural districts to organise single sections, four of which will be combined to form a complete detachment.

WOMEN'S DETACHMENT.

1 Commandant (man or woman, and not necessarily a doctor).
1 Quartermaster (man or woman).
1 Trained Nurse * as Lady Superintendent.
20 Women, of whom 4 shall be qualified as cooks.

8. All candidates for Men's Voluntary Aid Detachments, with the exception of pharmacists, ex-soldiers Royal Army Medical Corps (Regular, Special Reserve, or Territorial), ex-sick berth attendants Royal Navy, persons who hold the certificate of the Medico-Psychological Association of Great Britain and Ireland, cooks and carpenters (the two latter categories not to exceed four and two, respectively, per detachment), should be in possession of a first-aid certificate, or undertake to produce such certificate within twelve months from the date of enrolment. Should they fail to do so, they will be liable to be removed from the detachment.

9. All candidates for Women's Voluntary Aid Detachments, with the exception of trained nurses, persons who hold the certificate of the Medico-Psychological Association of Great Britain and Ireland, and cooks (cooks not to exceed four per detachment), should be in possession of a first-aid and a home nursing certificate, or undertake to produce such certificate within twelve months from the date of enrolment, otherwise they are liable to be removed from the detachment.

10. Candidates who, on enrolment, do not possess the above-mentioned certificates will be considered as "on probation."

11. No first-aid certificate will be recognised unless the course of instruction has been given by a duly qualified medical practitioner, and the examination carried out by another qualified medical practitioner, and the body granting such certificates is one approved by the War Office.

The following bodies are approved by the War Office for the purpose of granting certificates in " first-aid " :—

(*a*) The St. John Ambulance Association.
(*b*) The St. Andrew's Ambulance Association.
(*c*) The National Fire Brigades' Union.
(*d*) The National Health Society.
(*e*) The London County Council.

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* By the term " trained nurse " is meant a nurse who has completed a three-years' course of training in the service of a general hospital with a minimum number of 100 beds having a nurses' training school attached, and who, having qualified in the examinations of the institution, has received a certificate to this effect.

(*f*) The Provincial County Councils or School Boards in Scotland where the conditions as regards instruction and examination laid down in paragraph 11 are complied with.
(*g*) The Midland Counties Union of Educational Institutions.
(*h*) The British Red Cross Society.
(*i*) University of London, King's College for Women.

The above list is provisional, and may be added to from time to time.

12. No home nursing certificate will be accepted unless the course of instruction has been given by a duly qualified medical practitioner, or a trained nurse, as may be found the more convenient; the examination, however, must be conducted either by a qualified medical practitioner, or by a matron of a training school, both of whom must be distinct from the instructors of the class.

13. The Men's Detachments must be thoroughly trained as stretcher bearers, and to a certain extent as male nurses. A certain proportion of clerks, carpenters, and mechanics would be especially useful. The principal duties of the *personnel* would consist in carrying sick and wounded by stretchers, and, when necessary, in preparing means of transport by road or rail, in converting local buildings or whole buildings into temporary hospitals, and in disinfecting buildings, etc.

14. The Women's Detachments would be employed chiefly in forming railway rest stations for preparing and serving meals and refreshments to sick and wounded, during transit by railway, and in taking temporary charge in the evacuation stations or temporary hospitals of severe cases unable to continue the journey. They should, therefore, be trained, not only in cooking and the preparation of invalid diets, but also in the method of arranging small wards for patients in suitable buildings, preferably near a railway station, and in such nursing as is necessary for the temporary care of patients until they can be transferred to the general hospital. Detachments, or a certain proportion of a detachment, may be employed for duty in ambulance trains.

15. Each detachment as it is formed and approved by the County Director will be registered by the War Office. The numbering of detachments from one onwards will be adopted for each County, odd numbers will be given to Men's, and even numbers to Women's Detachments as raised.

16. Voluntary Aid Detachments form part of the Technical Reserve.

Inspections.

17. Every officially recognised Voluntary Aid Detachment will be inspected annually by a deputy director of medical services, assistant director of medical services (Regular or Territorial), medical inspector of recruits, or other officer of the Royal Army Medical Corps, detailed by the general officer commanding-in-chief of the command in which the detachment has its headquarters. In certain cases an inspecting officer may be specially detailed by the War Office.

Procedure on Mobilisation.

18. In the event of a general mobilisation for home defence, Voluntary Aid Detachments would not be called upon to serve until their services were actually required. Although members of Voluntary Aid Detachments undertake no responsibility, and are under no obligation to leave their homes or even join their units if called upon to do so, yet it is believed that, in the event of their being requested, volunteers, in sufficient numbers to meet all requirements, would be forthcoming. The following are suggested as general principles upon which preparations for mobilisation should be based :—

(i.) A suitable number of Voluntary Aid Detachments, according to requirements, would be directed by the War Office, through the County Associations, to place themselves at the disposal of the army medical authorities. The first detachment to be employed would be the detachment nearest to the area of active operations; and other detachments in the vicinity should, according to circumstances, be held in immediate readiness for service.

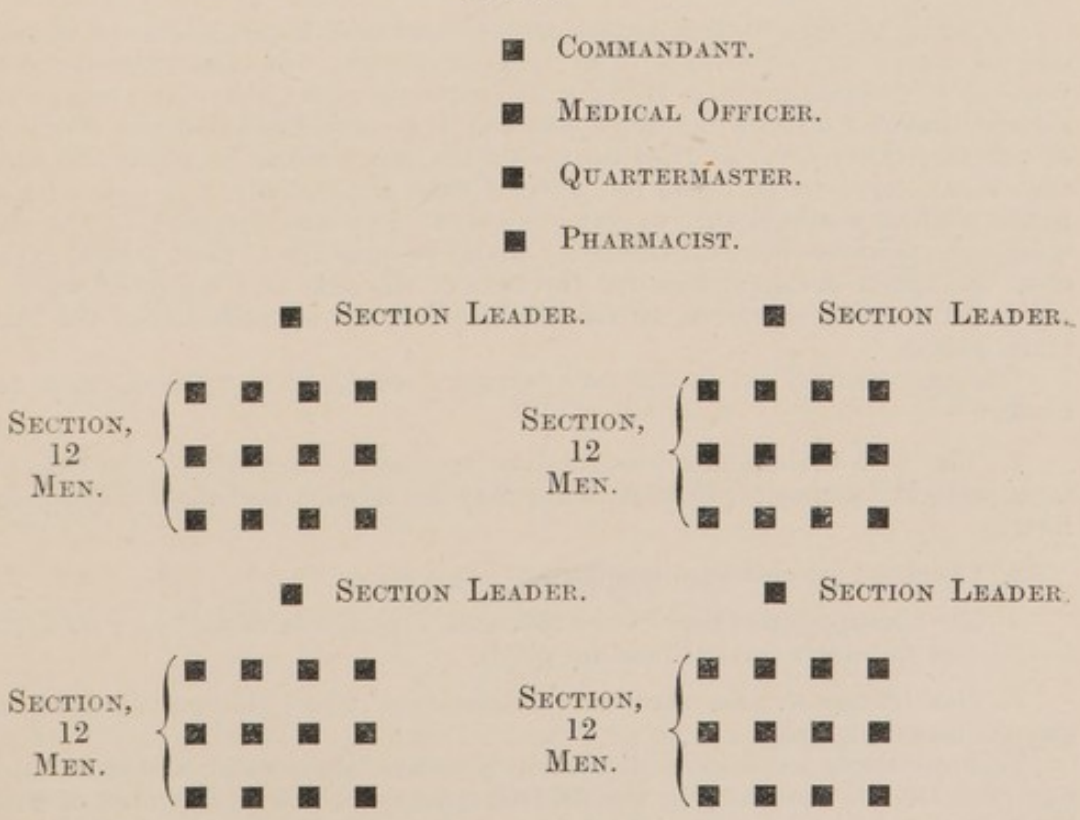
(ii.) Detachments not so employed, or held in readiness, would be available at different places throughout the country where their services might be required for carrying on the functions of rest stations, for transporting the sick and wounded from railway stations to the general and other hospitals, for providing *personnel* to ambulance trains, etc.

(iii.) Each member of a detachment when called up for service will be provided with an identity certificate and a "brassard" or arm badge bearing the Geneva cross.

The identity certificate and brassard will be issued by a responsible officer of the Army, and both must bear the same number and stamp; otherwise the wearer of a brassard will not be "protected."

(iv.) Detachments employed in the area of active operations, and in ambulance trains, would, if necessary, be rationed and housed by the military authorities; but detachments doing duty in the immediate vicinity of their homes, where no active operations are in progress, will be expected to feed and house themselves.

Composition of the Voluntary Aid Detachments.



NOTE.—Preferably an ex-officer of any branch of His Majesty's Army, retired and not liable to recall, should be selected for the position of Commandant.

WOMEN.

- COMMANDANT
  (Man or woman, not necessarily a doctor).
- QUARTERMASTER
  (Man or woman).
- TRAINED NURSE as LADY SUPERINTENDENT.

20 WOMEN, of whom 4 should be qualified Cooks.

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NOTE.—By the term "trained nurse" is meant a nurse who has completed a three-years' course of training in a general hospital (with a minimum of 100 beds) having a nurses' training school attached, and who, having qualified in the examination of the institution, has received a certificate to that effect.

ST. JOHN AMBULANCE COUNTY COMPANIES.

Explanation of the Organisation, Objects, and Duties of St. John Ambulance Companies.

An Army of 300,000 men, known as the Territorial Forces, liable to be called out for active service in case of invasion or attack, has been created for the purpose of defending Great Britain. Experience shows that the average sick rate per diem of a force in a European country operating under the conditions of our Territorial Army is 2 per cent.—that is, there would be 6,000 men a day who would have to be cared for, even if only temporarily. In case of a set battle, such as would be sure to occur in a short time after invasion, any prudent military responsible medical authority would prepare for at least 30,000 casualties. Adequate arrangements for the care of the sick and wounded when on active service are, therefore, an essential part of the organisation of the Territorial Forces.

Efficient medical aid in our own territory would be comprised under four heads :—

1. The field ambulances (designed for rendering First Aid in the field and forming field hospitals where patients may be treated for about twenty-four hours).

2. The fixed general base hospitals.

3. The transport and care of the sick and wounded between the field ambulances and the fixed general base hospitals.

4. The transport and care of convalescents when discharged from the general base hospitals.

To meet these conditions, the military authorities have arranged to collect and care for the casualties in the field of operations and on the field of battle by their own official agency (the field ambulances), and they have fixed upon the general hospitals and arranged for their conduct themselves, with a certain amount of voluntary assistance. But the transport and care of the sick and wounded between the field ambulances and the general hospitals they have

left entirely to voluntary aid to be given under military guidance. To voluntary aid are also to be confided the transport and care of the convalescents when discharged from the general hospitals.

Now an essential point for consideration is, that in the whole of this chain of work, every link of it must be fully and efficiently done, or the unnecessary suffering of the Territorial Forces on service will be unlimited. There is a great deal of work to be done, and at first sight a bewildering variety of it, but given a sufficient number of volunteers willing to become efficient, and, what is equally important, to maintain their efficiency, the work is not difficult to organise, nor is it too difficult for any willing individual to learn.

St. John Ambulance Companies are to consist of men or women specially trained for these duties, and it is essential that as many of these Companies as possible be raised throughout the country. Once it is formed, a company will be trained and kept trained by its own officers, and its efficiency will be tested by periodical inspections by the military authorities.

The responsibility of the organisation of voluntary aid in connection with the Territorial Force rests with County Associations* in their respective counties.

The duties that will have to be learnt by the members of St. John Ambulance Companies will be as follows in general terms :—

1. The preparation of country carts and other vehicles for the removal of patients lying down.

2. The improvisation of stretchers, etc., for the transport of very severe cases by hand.

3. The conversion of country houses, farms, public buildings, or, in fact, whole villages or small towns into temporary hospitals for the care and shelter of sick and wounded until they can be placed on railway trains for conveyance to general hospitals.

4. Similar utilisation of local resources for the care of trivial cases of sickness or wounds in the vicinity of active operations.

5. The formation of rest stations along lines of evacuation, either by road, rail, or water, where sick and wounded may receive rest and refreshment, or, if necessary, accommodation over night; or where they may be made comfortable while waiting to be loaded on trains, or after they are taken off trains.

6. The provision of a *personnel* for accompanying the sick and wounded in transit.

7. The fitting out of empty goods vans or other rolling stock for the transport of sick and wounded by rail.

8. The collection and distribution of material for "clearing hospitals"† and rest stations, and management of depôts of such material.

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* A County Association is a body formed under the Territorial Force Scheme, and its function is to raise its quota by voluntary enlistment, and hand it over equipped and complete when required for the General Officer Commanding in Chief of the Command in which the association is situated to train and handle in the field.

† Clearing hospitals are the organisations connecting the field ambulances with railway lines.

Each local company is to be organised on the following system :—

MEN'S COMPANY.

1 Commandant.
1 Medical Officer. (The Medical Officer may also be the Commandant.)
1 Hon. Secretary, who will act as Quartermaster and Storekeeper.
1 Pharmacist.
4 Section Leaders.
48 Members, including, where practicable, carpenters (or joiners, or mechanics), cooks, and clerks.

A men's company is divided into four sections, each composed of one Section Leader and twelve members as its normal strength. In each section should be included as many carpenters (or joiners or mechanics), cooks, and clerks as are locally available.

WOMEN'S COMPANY.

1 Commandant (man or woman).
1 Medical Officer (man or woman, who may also be Commandant).
1 Hon. Secretary (who will act as Lady Superintendent and Storekeeper, and should be, where practicable, a trained nurse).*
4 Section Leaders.
20 Members, including four cooks and as many nurses as possible.

A women's company is divided into four † sections, each composed of one Section Leader and five members, including one cook and as many nurses as are locally available.

It will be in the discretion of the Commandant of a company of either sex to train supernumerary members up to the number locally necessary to replace casualties, and maintain the company always at full strength.

The men's companies must be thoroughly trained as stretcher bearers, and to a certain extent as male nurses. The principal duties of the *personnel* would consist in carrying sick and wounded by stretchers, and, when necessary, in preparing means of transport by road or rail, in converting local buildings or whole villages into temporary hospitals, and in disinfecting buildings, etc.

The women's companies would be employed chiefly in forming railway rest stations, for preparing and serving meals and refreshments to sick and wounded during transit by railway, and in taking temporary charge, in the evacuation stations or temporary hospitals, of severe cases unable to continue the journey. They should, therefore, be trained, not only in cooking and the preparation of invalid diets, but also in the method of arranging small wards for patients in suitable buildings, preferably near a railway station, and in such nursing as is necessary for the temporary care of patients until they can be transferred to a general hospital. Sections may be employed for duty in ambulance trains.

These duties are of a military medical character, and will have to be taught by the officers of companies.

It is quite clear that most of the officers and all the men and women composing the companies will not be fitted to learn the military medical duties

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* A nurse who has completed a three-years' course of training in a General Hospital having a nurses' training school attached, and who, having qualified in the examinations of the institution, has received a certificate to that effect.

† If desired a women's company may be divided into two sections, each with one Section Leader and ten members, including two cooks and nurses.

above described unless they have had some preliminary training. The necessary qualification, therefore, for enrolment in a company is the first-aid certificate of the St. John Ambulance Association or the St. Andrew's Ambulance Association, and, in the case of women, the Association's Home Nursing certificate in addition. A number of persons holding these certificates already exist, but in order to secure a sufficient *personnel*, local classes of instruction can be formed by any responsible lady or gentleman under the system of the St. John Ambulance Association.

When a company is complete and has been registered by the War Office, the free grant of material specified in Appendix C of pamphlet Ref. T.B. 9 (*a*) will be issued, together with arm-badges and certificates of enrolment, which are supplied gratis to members of a registered company.

The training of companies is comprehensively dealt with in the Training Manual which will shortly be published by the St. John Ambulance Association.

Particulars regarding the formation of classes and St. John Ambulance Companies can be obtained on application to the Assistant Secretary, Territorial Branch, St. John Ambulance Association.

ST. JOHN AMBULANCE COUNTY COMPANIES.

Before enrolment in a St. John Ambulance County Company, men must be in possession of the first-aid certificate of the St. John Ambulance Association or of the St. Andrew's Ambulance Association, and women, the first-aid and home nursing certificates of either of these associations.

Classes under the regulations of the St. John Ambulance Association can be arranged locally to enable persons to qualify for enrolment in a company. Full particulars of such classes can be obtained on application to headquarters.

The duties involved in membership are :—

Each member will be required to attend a minimum of twelve monthly trainings under the officers of the company to which he or she belongs ; pass an annual re-examination in first aid for the voucher, medallion, or label of the St. John Ambulance Association, and be present at the annual company inspection.

The cost of maintaining a company depends upon local circumstances, and will vary in different localities. If accommodation for training purposes is available, the working expenses of the company would be about £5 a year. Funds could be raised by local entertainments, displays, etc., arranged by the members of a company.

The grant of material made by the St. John Ambulance Association to each company on registration is sufficient to enable it to commence its training, and as improvisation of the various medical apparatus forms an important part of the training, no great expense need be involved.

Uniform, if adopted, must conform to the standard pattern approved by the Ambulance Department of the Order of St. John, and will, as a rule, fall to the charge of the individual member, the arm-badges only being supplied free by the association.

Geneva Cross.—As a compliment to Switzerland, the heraldic emblem of the Red Cross on a white ground formed by reversing the Federal Colours was taken by the Geneva Convention of 1864, and was retained by the Geneva Convention of 1906, as the emblem and distinctive sign of the Medical Service of Armies. This emblem is to be shown on the flags, armlets, and medical material. The " Geneva Cross," or Red Cross, and the words " Red Cross," do not belong to Voluntary Aid Societies by right, as is popularly thought,

and cannot be used by them unless they are authorised by the State to assist the medical service of an army in the field. The members of duly recognised Voluntary Aid Detachments shall then wear fixed to the left arm a brassard or armlet with a red cross on a white ground, delivered and stamped by a competent military authority, and accompanied by a certificate of identity.

Ambulance vehicles improvised by V.A.D.s should be protected by having the emblem painted on them, as ordinary waggons can be captured by an enemy, and the material of Voluntary Aid Societies, though private property, can be taken on requisition.

Hospital ships are also regarded as neutral, and are distinguished by being painted white with a green strake extending from stem to stern-post.

Geneva Convention.—The sufferings of the sick and wounded in the Crimean War, and at the Battle of Solferino in the Franco-Italian War of 1859, drew attention to the necessity for international regulations for the amelioration of the conditions of warfare, for the neutralisation of medical units and of field hospitals and their *personnel* while on active service, and for their protection by a distinctive badge. The first Convention (or temporary international treaty) was signed at an International Conference at Geneva on August 22nd, 1864, by Plenipotentiaries acting on behalf of twelve European nations and Persia, and was accepted at a later date by practically every civilised power except the United States. Similar Conferences were held in Paris in 1867 and at Berlin in 1869, and in 1868 additional articles were signed, whereby hospital ships were given the same neutrality as field hospitals and their *personnel*. In 1899 the Peace Conference at the Hague arranged that the benefits of the Geneva Convention should be extended to naval warfare. The Geneva Convention of 1864 has been superseded by the Geneva Convention of July 6th, 1906, a translation of which is given below. Members of Voluntary Aid Detachments, who are specially safeguarded in the Convention of 1906, should be familiar with the conditions under which they may have to serve, and their attention is drawn specially to Articles 10, 11, 12, 16, and 20.

TRANSLATION OF GENEVA CONVENTION OF 6TH JULY, 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 an enemy are prisoners of war, and the general provisions of international law concerning prisoners is 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, etc., 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 recognised 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 authorisation 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 recognised 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 authorised 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 are 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 action 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 *proces 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.

CHAPTER XVIII.

ORGANISATION AND MANAGEMENT OF AMBULANCE CLASSES.

(1) Classes conducted under the Auspices of the St. John Ambulance Association, London—Syllabus of Instruction—Syllabus of Instruction on Home Nursing—Syllabus of Instruction for Junior Classes—Examinations. (2) Classes conducted under the St. Andrew's Ambulance Association, Glasgow—Syllabus of Lectures on First Aid and on Home Nursing and Hygiene. (3) Private Ambulance Classes—The Author's Method of dividing the Subjects lectured on, and of arranging the Practical Work to follow each Lecture—Detailed Account of the Management of Practical Work.

In this chapter the author proposes to furnish information for the starting of ambulance classes under the premier Ambulance Associations. He also indicates the arrangements which he has found, after considerable experience, the most suitable for the thorough teaching of practical ambulance work.

I. CLASSES CONDUCTED UNDER THE AUSPICES OF THE ST. JOHN AMBULANCE ASSOCIATION, LONDON.

Where it is intended to form an ambulance class it is usual to call a preliminary meeting, and at this meeting a class secretary and a lecturer are appointed. The class secretary should communicate with the Chief Secretary of the St. John Ambulance Association, St. John's Gate, Clerkenwell, London, E.C., from whom full particulars and copies of the regulations of the Association may be procured. The St. John Ambulance Association curriculum includes three examinations spread over two years. Members of male classes have to pass an examination in First Aid, and two re-examinations in two succeeding years, for each of which a certificate is granted, and after the third examination the candidate, if he passes, is entitled to the medallion of the Association. Ladies substitute for the first re-examination in First Aid an examination in Nursing. Members of boys' brigades and others too young to join the adult classes are now admitted to junior classes, for which a special course of instruction has been drawn up.

Examination papers in First Aid set by the author for examinations conducted under the regulations of the St. John Ambulance Association are given in the appendix.

A synopsis of the lectures in First Aid, in Nursing, and for junior classes conducted under the St. John Ambulance Association is given below.

Detached Male or Female Classes.

These are Classes for Instruction, either in First Aid to the Injured or Home Nursing for either sex (**mixed Classes of males and females, however, being under no circumstances whatever allowed**), formed in suburbs of London, in country towns and villages, and abroad, where no regular centre of the association exists. Such classes are under the immediate control of the Central Executive Committee, and the amount due for the cost of the same should be sent to the Chief Secretary, St. John's Gate, Clerkenwell, London, E.C.

The usual way to form a detached class is for the lady or gentleman undertaking to do so to collect a suitable number of names, charge the pupils an entrance fee sufficient in amount to cover the expenses as per page 4, and those incurred locally for hire of room, gas, fuel, local printing, postage, etc. It is generally advisable to hold a preliminary meeting, at which the objects and benefits of the instruction to be given can be explained. The Chief Secretary will forward the necessary stores on receipt of formal order, stating number and sex of pupils. From twenty-five to thirty is the best number for a class. It is not desirable to have more than thirty, or the instructor cannot devote sufficient time to each pupil, and the expenses will be increased. The amount to be charged for entrance fee must be regulated by the sum total of the expenses mentioned below. *In those cases when a fee* (£5 5*s. per course of five lectures*) *is paid to the lecturer, the entrance fee must be increased proportionately.* A fee will have to be paid for a lecturer detailed from London or elsewhere at a distance, and, of course, travelling expenses.

In the case of classes for sailors, soldiers, policemen, firemen, railway employés, working people, and others who can only afford to pay a nominal entrance fee, the balance of expenses must be defrayed from outside sources; subscriptions should be invited, and employers of labour should always be asked to contribute towards the expenses of classes attended by their employés. **The Education Department (under the Evening Continuation School Scheme), the Science and Art Department, and County and County Borough Councils have power to make grants in aid of classes held in connection with the Association.**

It is not necessary for a lecturer to be detailed by the Chief Secretary, as a local medical practitioner may lecture, provided the authorised official syllabus of the association is adhered to. Female lecturers are not allowed, unless their names are (as in the case of men) on the Medical Register, published under the direction of the General Council of Medical Education and Registration of the United Kingdom.

At nearly all the Association's "Centres," and to many "Detached Classes," local medical men voluntarily lecture gratuitously.

The name of a medical practitioner must not be advertised as lecturer without his or her authority.

Course of Instruction.—For either course this consists of five lectures, with an interval of not less than a week between each. The syllabus (see Paper 58, for the First Aid; and Paper 60, for the Nursing Course) can be divided into more lectures than five at option. Each lecture lasts about two hours, as much time as possible being devoted to practical work (for the First-Aid Course, bandaging, application of splints, artificial respiration, etc., and for the Nursing Course, the application of the roller bandage, changing sheets, reading the thermometer, etc.). *In the case of a female class a small boy should be hired for demonstration of bandaging.*

About a week after the last lecture the examination takes place, and to

prevent disappointment, *a clear fortnight's notice* **on the printed form supplied,** *stating probable number of candidates, should be given to the Chief Secretary, of a convenient day, hour, and place* (*a choice of two or three days is preferable*) *for examination.* There are numerous examiners in all parts of the country, so that one is not necessarily sent from London. Certificates are awarded to the successful candidates. **Except as provided by the Medallion and Label Regulations, no lecturer may examine his own class,** and a request for any particular examiner for certificates will not, unless under exceptional circumstances, be entertained.

Examiners for certificates are always detailed by, and paid fees and expenses through, the Chief Secretary. If an examiner were to accept payment through any other channel, the examination would be thereby cancelled.

An account for examiner's fees, lecturer's fees (when paid), and travelling expenses (rail, cab, etc.), together with any balance due for stores, will be sent after the examination, **and the amount must be remitted to the Chief Secretary before issue of certificates.**

Secretaries of detached classes are recommended to ascertain during the course the full Christian names of the pupils, as they will probably thereby save themselves much trouble and correspondence when the extract from the examiner's report is forwarded for verification of spelling of names.

Class attendance sheets can be obtained on application; also for the information of lecturers and secretaries, instructions showing how the examiner will conduct the examination.—(*Paper Ref. No.* 80.)

Full particulars as to the formation of "Corps and Divisions of the St. John Ambulance Brigade," and of the "County Companies" of the "Territorial Branch" for certificated pupils, will be furnished on application. It is earnestly hoped that those who have obtained certificates will use their utmost endeavours to form such units, thereby affording to themselves opportunities of keeping up the knowledge acquired, and of giving their fellow creatures a maximum of the benefits resulting from a thorough acquaintance with the teaching of the St. John Ambulance Association.

Colonial and Foreign Classes.

In the case of "Detached Classes" held in India and the Colonies and elsewhere abroad, local arrangements can be made for the payment of the lecturer and examiner, without forwarding their fees to St. John's Gate. Both must be members of the medical profession, and the latter should hold, if possible, some official position, military or civil. The examiner's report, on the proper printed form, must be sent to St. John's Gate, by the local secretary (names in full and correctly spelt), and on receipt of remittance for "Incidental Expenses" (as per page 4), certificates will be issued. The official syllabus must, of course, be adhered to, and classes examined as per Paper 80.

In India, all graduates and licentiates of any University recognised by the State are eligible for appointment as Instructors, subject to approval, and Military Assistant Surgeons specially recommended by their Medical Superiors shall also be eligible. Hospital Assistants in Native Regiments are allowed to lecture on the Junior Course (Syllabus 40), but the examination must be conducted by the Medical Officer himself.

Expenses per "Class."

A "Class" consists of 30 *of one sex and under. Thus, if the number of pupils be over* 30 *and not exceeding* 60, *the charges are doubled; over* 60 *and not exceeding* 90 *trebled, and so on.*

PAYMENTS TO BE MADE TO THE ASSOCIATION.

1. Lecturer's Fee (*per class*) when paid, . . .	£5	5	0
2. Examiner's Fee (*per class*), ...	1	1	0
3. Incidental Expenses—Cost of Certificates, Printing, Postage, Stationery, etc. (*per class*), . .	0	10	6

N.B.—This low charge for "Incidental Expenses" barely covers outlay, and it is, therefore, hoped that all classes in a position to do so will forward a donation, which will be duly acknowledged in the Annual Report.

4. Lecturer's and Examiner's First-class Railway and Travelling Expenses, including cabs to and from Railway Stations in London and elsewhere, and Hotel Bills (if any). } *as per Account rendered.*
5. Stores (*see below*).

First-Aid Course.

MATERIAL (First-Aid Course), viz.:—Large Physiological Diagrams for Lecturer's use, comprising the Human Skeleton, the Arterial and Venous System, the Heart and Circulation of the Blood, Fractures (Simple and Compound), Dislocations (price, per set of six, 15s.)—may be hired for a course of lectures, for a fee of 5s., or with the addition of Splints, Tourniquet, and plain Triangular Bandages, for a fee of 10s.

N.B.—It is essential that all material lent on hire on "sale or return" should be returned undamaged, as otherwise the full value will have to be charged.

In the case of Male Classes, a stretcher, which must be purchased (being always useful in cases of accident), unless already supplied, will also be required. Price £1 17s. 6d. If with telescopic handles, for use in mines, collieries, railway carriages, etc., £2 5s.

In addition to the material sent on hire referred to above, a supply of books, bandages, etc. (according to the number attending the class), will be forwarded to the lady or gentleman in charge "*on sale* (*at the prices quoted*) *or return.*" These articles can, with the exception of the stretcher, be paid for at the end of the course, when the books, etc., left unsold, will be taken back if undamaged, and allowed for in full.

ADULT COURSE.

SYLLABUS OF INSTRUCTION—FIRST-AID TO THE INJURED.

First Lecture.

A. Principles of first-aid.
B. A brief description of the human skeleton and of the muscles.
C. Fractures—causes, varieties, signs, and symptoms.
D. Treatment of fractures—general rules.
E. The triangular bandage and its application.

Second Lecture.

A. Treatment of fractures (continued).—Details of treatment.
B. Dislocations, sprains, strains—signs, symptoms, and treatment.
C. The heart and blood-vessels. The circulation of the blood.
D. Hæmorrhage and wounds—general rules for treatment.
E. The triangular bandage and its application.

Third Lecture.

A. Hæmorrhage and wounds (continued).—Details of treatment.
B. Internal Hæmorrhage—signs, symptoms, and arrest.
C. Hæmorrhage from special regions—signs, symptoms, and arrest.
D. Bruises, burns and scalds, bites and stings, frost-bite.
E. Foreign bodies in the eye, nose, and ear.
F. The triangular bandage and its application.

Fourth Lecture.

A. The nervous system.
B. The organs and mechanism of respiration—artificial respiration.
C. Insensibility.
D. Poisoning.

Fifth Lecture (for Males only).

A. Improvised methods of lifting and carrying the sick or injured.
B. Methods of lifting and carrying the sick or injured on stretchers.
C. The conveyance of such by rail or in country cart.

Fifth Lecture (for Females only).

A. Preparation for reception of accident cases.
B. Means of lifting and carrying.
C. Preparation of bed.
D. Removing the clothes.
E. Preparation for surgeon.

NOTE I.—The subject of poisons should be treated in a general manner; the common poisons classified, and only their general symptoms, effects, and treatment taught.

NOTE II.—The last half hour of each lecture should be devoted to practical work, such as the application of bandages and splints, lifting and carrying wounded on stretchers.

NOTE III.—There should be an interval of a week between each lecture. A candidate for examination must attend *at least* four out of the five lectures.

NOTE IV.—Male classes must pass in that system of stretcher exercise most suitable for the locality.

NOTE V.—As little time as possible is to be spent on instruction in anatomical and physiological details. Lecturers and examiners are particularly requested to remember that it is "First Aid" that has to be taught and tested, and not anatomy and physiology.

Mixed classes of men and women are on no account permitted.

Pupils under sixteen years of age can only be examined on the "Junior" Course (Section A, Syllabus 40) (*q.v. infra*).

"ST. JOHN HOME NURSING COURSE."

SYLLABUS OF LECTURES.

Lecture I.—The Sick Room.

Introductory remarks—Selection, preparation, and cleaning of room—Bed and bedding—Furnishing—Warming and ventilation.

The roller bandage, and its application.

Lecture II.—Infection and Disinfection.

Infectious and non-infectious cases—Quarantine of patient—History of a fever case—Disinfecting and disinfectants.

The roller bandage, and its application.

Lecture III.—Details of Nursing.

The nurse—Regulation of visitors—Management of nurse's own health—Washing and dressing patients—Bed making—Changing sheets—Lifting helpless patients—Sick diet—Administration of food, medicines, and stimulants.

The roller bandage, and its application.

Lecture IV.—Details of Nursing (*continued*).

Observation of the sick—Rigors—Sleep—Pain—Posture—Skin—Appetite—Vomiting—Cough—Expectoration—Effects of remedies, etc.—Temperature taking—Baths—Bed-sores—Delirium—Nursing sick children—What to prepare for physician's and surgeon's visits.

The roller bandage, and its application.

Lecture V.—Application of Local Remedies.

Poultices—Fomentations—Blisters—Ointment—Leeches—Padding splints—Bandaging—Personal and family hygiene—Management of convalescents.

Note.

The home nursing course can be commenced by the successful candidates in the first-aid course as soon as the result of the examination is published, and those pupils who pass the home nursing examination at the end can count the same as equivalent to an examination towards the medallion.

Similarly when the home nursing course is taken first, the first-aid course can be commenced by the successful candidates as soon as the result of the home nursing examination is published, and those pupils who have passed *both* examinations can count both towards the medallion.

The passing of two examinations in First-Aid shall be a *sine quâ non* for part qualification for the medallion, the second of these two first-aid examinations being held not less than one year from the date on the first-aid certificate.

In all cases the third examination for the medallion must be on First-Aid, and subsequent re-examinations for the label must also be on that subject, on the conditions named in paragraph 4 of Paper 62.

Home nursing classes for men only can be arranged in the same manner as for women, this syllabus being used by the lecturer. *Mixed classes of men and women are on no account permitted.*

No lecturer may examine his own class for certificates.

N.B.—A candidate for examination must have attended at least four out of the five lectures.

SYLLABUS OF INSTRUCTION FOR JUNIOR CLASSES.

(*A*) *Junior Course in First-Aid.*

A short description of the bones, muscles, and arteries.

Uses of the circulation and respiration.

Difference between arterial, venous, and capillary bleeding, and methods for stopping each.

Position of main arteries.

Signs of a broken bone, and methods of treatment.

Making temporary splints.

How to treat persons in fits, fainting, scalded or burned, or whose clothes are on fire.

How to treat the apparently drowned or suffocated.

Ways of carrying an injured person.

Mode of using the triangular bandage.

(*B*) *Junior Course in Home Nursing.*

How to prepare a room for a sick person, and to ventilate it and heat it.
How to prepare the bed for a sick person, and to change the sheets.
Washing and dressing a sick person.
Dressing wounds—making and applying poultices and ointments.
The proper way of feeding sick persons and children.
Hints on giving medicines to patients.
Applying the roller bandage to leg and arm.

Note I.—The number of lectures into which this syllabus may be divided, and the method of sub-division, are left to the discretion of the lecturer, but he must not give less than six lectures.

Note II.—The application of bandages should be practised at the end of each lecture. At the end of the course an examination will be held, which will be of a thoroughly practical character, and will be conducted by an examiner other than the lecturer, as in the case of other classes.

Note III.—Mixed classes of both sexes are not allowed; and the lecturer must, of course, be a properly qualified medical practitioner, as usual.

EXAMINATIONS.

The local secretary should provide the following material:—

(*a*) *Men's Classes.*—A good supply of bandages, material for temporary splinting, and a stretcher.

(*b*) *Women's Classes* (*First-Aid*).—A good supply of bandages, material for temporary splinting, and, if practicable, two boys, who have not acted as models during the lectures, for every ten candidates.

(*c*) *Nursing Classes.*—A good supply of roller and triangular bandages, and material for making poultices, a bedstead or couch with bedding or sheets, two boys for every ten candidates. It is desirable that different boys as models should attend at the examination, as cases have not infrequently been noticed where the models have given information (erroneous or otherwise) to candidates.

Pens, ink (or pencils), and paper.

A list of candidates, with Christian and surname, should be given to the examiner.

The number of candidates to be examined at one time should not exceed thirty.

Two rooms should be provided whenever possible.

The examination shall be written and practical, but the examiner may omit the written part, if the local secretary give to the examiner satisfactory reasons in writing three days before the date of the examination.

No candidate who is unable to pass in the practical part shall receive a certificate.

No candidate who has failed shall be allowed to present himself or herself at another examination without attending a fresh course of lectures.

CANDIDATES WILL BE EXAMINED PRACTICALLY IN THE FOLLOWING SUBJECTS:—

"First-Aid Classes."—The neat and quick application of the triangular bandage to any part of the body.

The arrest of hæmorrhage by pressure of the fingers on the main arteries of the limbs.

The application of splints and bandages for any fracture. Performing artificial respiration.

Improvising stretchers,
Placing patients upon stretchers,
Carrying stretchers,
Carrying patients without stretchers,
} For male classes only.

Male classes must pass in that system in the "*Stretcher Exercises*" most suited to the locality. Lecturers are requested to bear in mind the necessity of instruction in this subject, as ignorance thereof will result in failure in the examination. (These exercises are included in Shepherd's handbook.)

"**Nursing Classes.**"—The neat and quick application of the triangular bandage to any part of the body, and as regards the roller bandage, to the following parts:—Thumb, hand, arm, elbow, foot (including heel), ankle, leg, figure-of-eight to knee joint, spica for the shoulder and hip, the breast, capelline, and the four-tailed bandage for the jaw.

Reading ordinary bath and clinical thermometers.

Recording patient's temperature.

Making poultices.

Changing sheets.

Lifting patient for food, etc., or on and off the bed.

In both classes the written examination shall consist of questions on subjects mentioned in the syllabus of lectures.

II. CLASSES CONDUCTED UNDER THE ST. ANDREW'S AMBULANCE ASSOCIATION, GLASGOW.

Secretaries of Scotch classes to be held under the St. Andrew's Ambulance Association, Glasgow, should communicate with the Secretary, 176 West Regent Street, Glasgow.

REGULATIONS FOR FIRST-AID CLASSES.

1. **Formation.**—The usual way to form a class is, for the lady or gentleman undertaking to do so, to collect a sufficient number of names, and send an application, on Form No. 1, to the General Secretary at the Head Office, or if there is a committee in charge of the district where the class is proposed to be held, to the Local Secretary, who, if the class be sanctioned, will supply *matériel*, and in due course send an examiner. Each class must consist entirely of one sex.

2. **Secretary.**—Each class appoints a Class Secretary, who transacts all the business of the class, enrolling members, collecting fees, selling material required by members, paying all the expenses of the class, and keeping a correct list of attendances. The necessary books and forms required by the Class Secretary will be provided by the Association. The Class Secretary will be vouched for on attached Form No. 1.

3. When the class has been examined the Class Secretary will send his class roll books and cash statement, together with any balance of funds in his hands, and also all lecturer's stores and other stores not sold, to the General Secretary at the Head Office, or the Local Secretary, and obtain a receipt. Certificates and medallions will not be issued until this regulation is complied with.

4. **Lecturer.**—Any medical practitioner (duly qualified) may lecture, provided he adheres to the authorised syllabus of the Association.

5. **Meeting-Place.**—Classes usually meet in a school-room, church hall, institution, or similar building, which should, if possible, be obtained free, or at a reduced rent.

6. **Size.**—No class will be held of less than 20 members, except by special arrangement, and it is considered advisable that none should exceed 32 in

number. The reason for this latter limitation is that it is not possible for one person to personally supervise, in the practical work, a large number. Should the lecturer, however, be able to procure assistance in the practical work, the class may be proportionally increased.

7. **Fees.**—While it may be sometimes necessary to sanction *free* classes, or to allow individual members of a class to be taught free, the Association consider that a charge should always be made according to the social position of those forming the class, and they would recommend that the scale of fees for a course of lectures should range from 2s. 6d. to 10s. 6d. The members of each class should pay the same fee. Certificated pupils attending a second or subsequent course of lectures must pay the class fee. All fees are payable in advance. These fees do not include *matériel*, which must be purchased by the members themselves. In the case of classes held under the Evening Continuation School Scheme of the Education Department or under County Councils, all details as to fees, lecturer, examination, etc., will be arranged directly between the Clerk of the School Board or County Council concerned (or other Managers) and the General Secretary at the Head Office in Glasgow, or where a Local Committee exists with the Local Secretary. In no case will the amount to be received by the Association for each pupil be less than 2s. 6d.; or where the class numbers less than 20, £2 10s. for the class. Examiners are always detailed by and paid fees and expenses through the Association. Should an examiner accept payment through any other channel, the examination would be thereby cancelled.

8. **Syllabus.**—The number of lectures to be delivered, the subjects to be taught, and the order thereof are contained in Schedule A.

9. **Matériel.**—The following *matériel* for lecturer's use will be supplied on loan free of charge :—

Set of five large diagrams, comprising—

(1) Skeleton ; (3) Muscles ;
(2) Blood-vessels ; (4) Nerves ;
(5) Contents of abdomen.

Skeleton (for second lecture only).
8 pieces splints.
Stretcher (for last two lectures and examination only).
Elastic web tourniquet.
12 Plain triangular bandages.

These should be returned (carriage paid) immediately when done with, either to the Head Office, Glasgow, or when classes are held under a Local Secretary, to him.

10. Members of the class should furnish themselves with the following articles, which may be purchased from the Class Secretary :—

1. An illustrated triangular bandage, 6d.
2. Ambulance Handbook, 2s.
3. Manual of Stretcher Drill, 6d.

A supply of these will be sent to the Class Secretary. All remaining unsold at the termination of the class must be returned immediately (carriage paid).

11. **Examination.**—The examination, which takes place at the completion of the course, may be written, or oral, or both combined. Each candidate will be required to satisfy the examiner as to competency in both the theoretical and practical portions of the syllabus.

12. **Attendances.**—No pupil can be presented for examination for the certificate or medallion until he has attained sixteen years of age, and unless he has attended at least eight lectures in each course.

13. **Certificates.**—Ordinary certificates will be issued free of charge to those passing the examination. Pocket certificates, in leather, may also be had, price 6d. each.

14. **Arm Badges.**—Arm badges may be purchased by holders of certificates, price 6d., 1s. 3d., and 2s. each. Celluloid badges for button-hole, 2d. each.

15. **Mercantile Marine.**—Officers in the mercantile marine who have obtained the certificate of the association are allowed by the Board of Trade to have an endorsement to that effect placed upon their certificates.

16. **Medallions.**—Certificated pupils attending a second course of lectures on first-aid in any session following that in which they obtained ordinary first-aid certificates will receive the higher certificate of the medallion, on passing the necessary examination. A re-examination voucher will be awarded to pupils who attend a third or subsequent course of lectures and pass a third or subsequent examination. A period of as nearly as possible twelve months should elapse between each examination after the first.

17. Certificates issued by the St. John Ambulance Association and by the army and navy will be recognised as if the same had been issued by this Association.

18. Recipients of bronze medallions will be allowed to purchase duplicates of the same in silver or gold at the following prices:—*Silver*, 3s.; *Gold*, 9-ct., 15s., and 18-ct., 32s. 6d. Before receiving the duplicate, the bronze medallion must be returned, as no member can hold both.

19. Certificates and bronze medallions that have been lost may be replaced on satisfying the General Secretary of the loss and paying a fee of one shilling.

It must be clearly understood that the object of the Association is not to rival, but to aid the medical man, and the subject-matter of instruction given at the classes has been defined with the view of qualifying the pupil to adopt such measures as may be advantageous pending the arrival of the medical practitioner.

SCHEDULE A.

SYLLABUS OF FIRST-AID LECTURES.

First Lecture.

A. Introductory remarks, explaining clearly the scope and object of lay help in ambulance work, special attention being drawn to the need for it, as well as the usefulness and simplicity of it.

B. Short sketch of the general anatomy of the human body, including a brief description of the functions of digestion, absorption, circulation, respiration, excretion, secretion, and innervation.

C. Uses of a bandage—Of the two kinds of bandage, the roller not needed for ambulance work—Description of Esmarch's triangular bandage, pointing out (1) its advantages, (2) method of folding and fastening it, (3) its application in different ways—Hints as to the "first dressing" of wounds by ambulance pupils.

Second Lecture.

A. Short account of the skeleton, with brief description of the structure and varieties of the joints.

B. (1) *Fractures.*—Their varieties, causes, symptoms, and dangers—Their temporary treatment and the apparatus necessary for it. (2) *Dislocations.*—

How they differ from fractures, and the first aid in such cases—No necessity for immediate reduction, and the dangers of attempted reduction by non-professional persons.

C. Illustrations of the temporary treatment of the following *simple* fractures :—(1) Collar bone, (2) upper arm, (3) forearm, (4) hand, (5) thigh, (6) leg, (7) foot, (8) lower jaw.

Third Lecture.

To be devoted to practical work, when the members of the class will exercise themselves in the use of the triangular bandage and the temporary treatment of the different fractures mentioned in the previous lecture.

Fourth Lecture.

A. (1) General description of the circulation of the blood, and the mechanism by which it is carried on—(2) Distinction between arterial, venous, and capillary hæmorrhage—(3) Names of the main arteries of the body, with their situations —(4) Points where arterial circulation may be arrested by pressure—(5) Dangers of hæmorrhage.

B. General treatment of hæmorrhage :—I. *Internal hæmorrhage*—First-aid in cases of (1) bleeding from the nose—(2) spitting of blood—(3) vomiting of blood. II. *External hæmorrhage*—(1) Application of cold, either by water or exposure to air—(2) Elevation of part—(3) Local pressure—(4) Distant pressure on main artery supplying wound, either by hand or tourniquet—(5) Three kinds of tourniquet : elastic, screw, and improvised.

C. Show mode of applying elastic or screw tourniquet, and making an improvised one—Give illustrations of arrest of hæmorrhage from (1) scalp, (2) neck, (3) arm-pit, (4) upper arm, (5) forearm, (6) hand, (7) thigh, (8) ham, (9) leg, (10) foot—Give illustrations of temporary treatment of a *compound* fracture, with hæmorrhage in upper or lower extremity.

Fifth Lecture.

To be devoted to practical work, when the members of the class will exercise themselves in the arrest of hæmorrhage in various situations, and in the temporary treatment of *compound* fractures.

Sixth Lecture.

A. Short account of respiration, its object and mechanism.

B. Fainting, its causes, symptoms, and treatment—Immediate treatment of those apparently drowned, or suffocated by (1) hanging, (2) poisonous gases, (3) choking—First-aid in cases of (1) burns and scalds, (2) bites by animals possibly rabid, (3) tears from machinery, (4) crushed and bruised parts, (5) stabs.

C. Show mode of performing artificial respiration (Sylvester's method), and also the temporary treatment of fractured ribs.

Seventh Lecture.

To be devoted to practical work, when the members will exercise themselves in performing artificial respiration, and in the arrest of hæmorrhage from supposed cases of ruptured varicose veins, stabs, tears from machinery, and gunshot wounds.

Eighth Lecture.

A. Short account of the digestive and nervous systems.

B. Symptoms and first treatment of shock or collapse.

C. First-aid in cases of (1) those stunned by a fall or injury to head, (2) convulsions, (3) epilepsy, (4) sunstroke, (5) persons found insensible, (6) suspected poisoning, (7) frost-bite, (8) lime in eye, (9) supposed death.

Ninth Lecture.*

A. Removal of the injured by means of stretchers, special attention being directed to (1) the proper carriage of the stretcher, (2) the manner of placing it, (3) the loading and unloading it, (4) the position of the patient on it, (5) suggestions as to overcoming difficulties on the road, (6) hints as to the conveyance of stretchers by rail or country carts.

B. Short account of some of the improvised methods of removing injured persons when no stretchers or regular conveyances are available, as by the two-handed, three-handed, and four-handed seats.

C. Give illustrations as to how to prepare and fold up a stretcher.

Tenth Lecture.*

Stretcher drill in presence of and under direction of lecturer.

REGULATIONS FOR HOME NURSING AND HYGIENE CLASSES.

1. **Formation.**—The usual way to form a class is, for the lady or gentleman undertaking to do so, to collect a sufficient number of names, and send an application to the Secretary at the Head Office, or if there is a committee in charge of the district where the class is proposed to be held, to the Local Secretary, who, if the class be sanctioned, will in due course send an examiner.

2. **Secretary.**—Each class appoints a Class Secretary, who transacts all the business of the class, enrolling members, collecting fees, paying all the expenses of the class, and keeping a correct list of attendances. The necessary books and forms required by the Class Secretary will be provided by the Association. The Class Secretary will be vouched for on Form, No. 1 (*N*).

3. When the class has been examined, the Class Secretary will send the class roll books and cash statement, together with any balance of funds on hand, to the Secretary at the Head Office, or the Local Secretary, and obtain a receipt.

4. **Lecturer.**—Any medical Practitioner (duly qualified) may lecture, provided he adheres to the authorised syllabus of the Association.

5. **Meeting-Place.**—Classes usually meet in a school-room, church hall, institution, or similar building, which should, if possible, be obtained free, or at a reduced rent.

6. **Size.**—No class will be held of less than twenty members except by special arrangement.

7. **Fees.**—While it may be sometimes necessary to sanction *free* classes, or to allow individual members of a class to be taught free, the Association consider that a charge should always be made according to the social position

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* In women's classes lectures on sick nursing may take the place of these lectures.

of those forming the class, and they would recommend that the scale of fees for a course of lectures should range from 2s. 6d. to 10s. 6d. The members of each class should pay the same fee. All fees are payable in advance. In the case of classes held under the Evening Continuation School Scheme of the Education Department, or under County Councils, all details as to fees, lecturer, examination, etc., will be arranged directly between the Clerk of the School Board or County Council concerned, and the General Secretary at the Head Office in Glasgow; or where a Local Committee exists, with the Local Secretary. In no case will the amount to be received by the association for each pupil be less than 2s. 6d. (or £2 10s. for a class numbering less than 20). Examiners are always detailed by, and paid fees and expenses through, the Association. Should an examiner accept payment through any other channel, the examination would thereby be cancelled.

8. **Syllabus.**—The number of lectures to be delivered, the subjects to be taught, and the order thereof, are contained in Schedule B.

9. **Matériel.**—The following *matériel* for lecturer's use will be supplied on loan free of charge :—

Set of five large diagrams, comprising—

(1) Skeleton; (3) Muscles;
(2) Blood-vessels; (4) Nerves;
(5) Contents of abdomen.

8 Pieces splints.
Elastic web tourniquet.
12 Plain triangular bandages.

These should be returned (carriage paid) immediately when done with, either to the Head Office, Glasgow, or when classes are held under a Local Secretary, to him.

Members of the class are expected to lend blankets and sheets, and a bedstead should be improvised from a table, boards or trestles, etc. Other materials, such as linseed, mustard, safety-pins, spoons, and bowls for mixing poultices, and paper or cloths on which to spread them, should also be provided by the pupils.

10. Members of the class should furnish themselves with the following articles, which may be purchased through the Class Secretary :—

(1) Hand-book on Home Nursing and Hygiene, ... 1s.
(2) Illustrated Triangular Bandage, ... 6d.
(unless already in possession of the pupil).
(3) Clinical Thermometer, ... 1s. 6d., 2s., and 2s. 6d.
(4) Bath Thermometer, ... 1s., 1s. 8d., and 2s. 6d.

Pupils will find it useful to provide themselves with a nurses' wallet, fitted with instruments, which may be obtained through the Class Secretary. Prices, 15s. and 21s.

The members of the class will also find a roller bandage winder useful. These are supplied at 2s. 6d. each. Six yards of 54-inch unbleached calico, torn into strips, 2 inches wide, will give 27 roller bandages; or bandages of various sizes, ready rolled, may be purchased from the Association.

A supply of articles Nos. 1 and 2 will be sent to the Class Secretary. All remaining unsold at the termination of the class will be returned immediately (carriage paid).

The other articles will be supplied to the Class Secretary on payment.

The Association does not hold itself responsible for damage done to thermometers in transit.

11. **Examination.**—The examination, which takes place at the completion of the class, may be written or oral, or both combined.

12. **Attendances.**—To qualify for examination for the home nursing and hygiene certificate a pupil must either

(1) Hold a first-aid certificate recognised by the Association, and have attended at least eight lectures, or

(2) Have attended at least nine lectures, of which one must be a lecture embodying the following subjects :—

A general outline of the structure and formation of the human body, including a brief description of the bones, muscles, arteries, and veins, the functions of the circulation, respiration, and nervous system, also the triangular bandage and its application.

13. **Certificates.**—Ordinary certificates will be issued free of charge to those passing the examination.

14. **Medallion.**—Certificated pupils attending a second course of lectures on home nursing and hygiene in any session following that in which they obtain ordinary home nursing and hygiene certificates, will receive the higher certificate of the medallion, on passing the necessary examination. A period of, as nearly as possible, twelve months should elapse between each examination.

SCHEDULE B.

SYLLABUS OF LECTURES ON HOME NURSING AND HYGIENE.

NOTE.—*Each lecture will usually last for three-quarters of an hour. After the lecture a quarter of an hour should be devoted to questions and explanations, and half an hour to practical work.*

Lecture I.

THE SICK ROOM AND ITS REQUIREMENTS.—Introductory remarks. Nurse's relation to patient and doctor. The sick room : its selection, preparation, temperature, and furnishing. Bed and bedding : water bed, air pillow, bed rest, changing sheets.

Practice ½ hour—Preparing beds, changing sheets.

Lecture II.

OBSERVATION OF THE SICK.—As to expression, state of skin, posture, pain, sleep, appetite, and thirst. The temperature and how to take it. The pulse, the breathing, the excretions.

Practice ½ hour—Use of clinical thermometer.

Lecture III.

MANAGEMENT OF PATIENT.—Washing and dressing patient, lifting helpless patient. Invalid diet : its nature, preparation, and administration.

Practice ½ hour—How to roll bandage ; bandaging.

Lecture IV.

The roller bandage. The bandaging of different regions of the body. Immovable bandages (plaster of Paris, starch) : their use and how to make them. The care of fractures : splints, antiseptics, dressings. Preparations for operation : the patient, the room, the table, instruments and dressings.

Lecture V.

Cough and expectoration. Bed sores. Medicine and stimulants: their administration. Baths. High temperatures: their treatment. Cold bath and cold pack.

Practice ½ hour—Measuring medicine; preparing baths: bandaging.

Lecture VI.

External Remedies (*continued*).—Fomentations, poultices, blisters, leeches, cold compress, application of ice.

Nursing of Children.—Signs of disease. Diarrhœa. Rickets. False croup.

Practice ½ hour—Making fomentations, poultices, etc.

Lecture VII.

Fever.—Its cause and course. The nursing of measles, whooping-cough, scarlet fever, enteric fever, smallpox, vaccination, diphtheria, and rheumatic fever.

Practice ½ hour—Bandaging.

HYGIENE.

Lecture VIII.

The House.—Its situation and construction. Air, ventilation. Bad air and tuberculous disease. Consumption: its mode of infection; prevention. Show effects of respiration on air—(1) blow into lime water; (2) breathe on a slate; (3) blow into a weak solution of Condy's fluid.

Practice ½ hour—Modes of reducing high temperature; of disinfecting fever patient and sick room.

Lecture IX.

Food.—Its classification. Mixed and varied diet essential. Food at different ages. Beverages: tea, coffee, alcohol.

Water.—Its source. Rain and well water. Daily allowance and uses. House refuse and drainage.

Practice ½ hour—Bandaging.

Lecture X.

Personal Health.—The constitution as opposed to disease. Cleanliness, clothing, exercise and rest, smoking, regular living. *For Females only.*—The hygiene of the nursery, food, cleanliness, clothing.

Practice ½ hour—Revision of practical points in medical nursing.

In addition to the above, a pupil who does not hold a first-aid certificate will be required to attend a lecture embodying the following subjects:—

A general outline of the structure and functions of the human body, including a brief description of the bones, muscles, arteries, and veins; the functions of the circulation, respiration, and the nervous system; also the triangular bandage and its application.

III. UNATTACHED AMBULANCE CLASSES.

The arrangement which the author has found most convenient for lectures and practical work in classes not conducted under the auspices of the St. John or St. Andrew's Ambulance Associations is detailed below :—

Lecture I.

(1) Outlines of the anatomy and physiology of the human body, omitting the sections dealing with circulation and respiration, which are taken up under hæmorrhage and suffocation respectively. A lantern lecture forms an excellent opening to a " First-Aid " course ; a series of slides illustrating " The Human Body " can easily be obtained on hire, and are most useful at centres where anatomical diagrams and plates cannot be obtained.

(2) The triangular bandage and its uses.

Practical Work to follow Lecture I.—At the end of Lecture I. the student should examine carefully the specimens on the lecture table. A meeting for practical work should be held either immediately after the lecture, or, what is preferable, at a special meeting set apart for it to be held at an hour before the succeeding lecture. At the practical meeting following the first lecture the student should have demonstrated to him the different parts of the skeleton, should handle the individual bones and make himself familiar with their shape and names. He should also have pointed out to him the position of the diaphragm, the position of the more important organs of the abdomen and thorax, the interior of the skull, and the position of the brain and spinal cord.

After such demonstration, which may be conducted by the lecturer alone or with trained assistants, the student should be practically instructed in the application of the triangular bandage. In a small class each student should be provided with a live model, and boys are generally in attendance for that purpose. In a large class the best arrangement is to divide the class into two sections, which should face each other in two lines, each line alternately acting as models.

The lecturer or his assistant should, in the first case, go over the bandages in the same order as in the lecture, and in the first application, the description of the special bandage the student is to practise should be to read to him slowly, he at the same time following the description point by point in his bandaging. When more proficient he should be asked to apply in quick succession the different bandages, no aid being given to him by description or otherwise. The lecturer should, after the application of each bandage, pass along the lines and make an examination, the mistakes in application being pointed out. The student should also be instructed to practise at home the application of the bandage, and in that way proficiency will soon be attained.

Lecture II.

Fractures, dislocations, and sprains, and their treatment.

Practical Work to follow Lecture II.—The student, at the second practical meeting, should be again instructed in the application of the triangular bandage. He should also examine the specimens of fracture, and the various forms of extemporised splints shown at the preceding lecture. He should then have demonstrated to him the method of applying splints to the more important fractures, and should himself " put up " such fractures as the instructor may choose, and particularly those of the collar bone, arm, forearm, leg, and thigh. If time permit, he should be examined orally on the kinds, symptoms, and treatment of fractures.

Lecture III.

(1) The circulation of the blood and the anatomy of the main blood-vessels.
(2) Hæmorrhage and wounds, and their treatment.

Practical Work to follow Lecture III.—The classes should be provided with live models, and divided into two sections as before. The student should be asked to apply the important triangular bandages, and to " put up " the more important fractures. He should then have demonstrated to him the position of the main blood-vessels of the body, and should be asked to point out their position on his model *vis-à-vis*.

Digital compression and application of the tourniquet for the arrest of arterial hæmorrhage should next be practised. The lesson should conclude with a demonstration of the method of arresting hæmorrhage from the large superficial veins.

Lecture IV.

(1) Drowning and suffocation, and their treatment; (2) poisoning; (3) burns; and (4) removal of foreign bodies from the eye, ear, nose, throat, and tissues.

Practical Work to follow Lecture IV.—The student should again be taken over the lines of the main vessels of the body, and should practise the application of digital pressure, and of the tourniquet to the large arteries.

Each student should then be afforded an opportunity of practising on a model Sylvester's and Schäfer's methods of artificial respiration. He should then be examined orally on the symptoms and treatment of the important poisons, and in the method of removal of foreign bodies from the eye, ear, etc.

Lecture V.

(1) Insensibility and fits, and their treatment; (2) ambulance transport (for males only); (3) after treatment of ambulance cases (for females only).

Practical Work to follow Lecture V.—The female section of the class should devote their last meeting to the practice of bandaging. The male section of the class should have one or two hours' stretcher drill, and practice in hand-seats and fireman's lift.

In addition to the above lectures and demonstrations of practical work, oral examinations may be given during the course, and form a good means of preparation for the candidate before examination. The candidate should also be asked to do one of the written papers in the Appendix.

EXAMINATION PAPERS IN FIRST AID.

PAPER I.

Time—One Hour and a half.

I. Describe generally the circulation of the blood. How would you distinguish venous, arterial, and capillary hæmorrhage ?

II. How would you distinguish between the following :—

(*a*) A fainting fit and an epileptic fit ?
(*b*) A simple and compound fracture ?
(*c*) Apoplexy and alcoholism ?

III. State shortly the proper treatment for the following conditions :—

(*a*) Broken collar bone.
(*b*) Stab wound of artery of arm-pit.
(*c*) Poisoning by opium.
(*d*) An apoplectic seizure.

IV. What are the differences between inspired and expired air ? Describe a method of artificial respiration.

V. Poisoning by oil of vitriol. To what class of poisons does this belong ? Give its signs and " first-aid " treatment.

PAPER II.

Time—Two Hours.

I. Mention the more common materials to be found in any house that you might find it necessary to ask for in applying first aid to

(*a*) A case of bad scalding.
(*b*) A fracture of forearm.
(*c*) A compound fracture of the thigh.
(*d*) A case of poisoning by opium.
(*e*) A case of poisoning by vitriol.

II. How would you recognise and treat respectively :—

(*a*) A fainting fit ?
(*b*) An epileptic fit ?
(*c*) An attack of apoplexy ?

III. The driver of a traction engine has fallen from his seat, and has had his left leg run over by the waggon behind the engine. You have been a witness of the accident, which has occurred on a lonely country road. Enumerate in order the points to be attended to :—

(*a*) In ascertaining the nature of his injuries.
(*b*) In treating the same.
(*c*) In removing him from the scene of the accident to his own home.

IV. Bleeding from an artery. State :—

(*a*) Its characteristics.
(*b*) Its treatment.
(*c*) The lines of the main arteries of the upper and lower extremities, and the methods of their compression.

V. What special cares would you take in carrying downhill on a stretcher a patient suffering from

(*a*) Apoplexy ?
(*b*) A fainting fit ?
(*c*) A simple fracture of the thigh ?

Practical examination follows.

PAPER III.

Time—Two Hours.

I. How would you check bleeding

(*a*) From an artery in the upper part of thigh ?
(*b*) From an artery at the wrist ?
(*c*) From an artery in the arm-pit ?
(*d*) From a burst varicose vein of leg ?

II. You are called to render first aid to a person found lying unconscious, state briefly :—

(*a*) The possible causes of the insensibility.
(*b*) How you would distinguish between them.
(*c*) The treatment of each condition.

III. In a case of compound fracture of both leg bones (tibia and fibula), state :—

(*a*) The special dangers of the accident, and the methods of their prevention and treatment.
(*b*) How you would render first aid.
(*c*) The precautions you would observe in getting the patient carried downhill on a stretcher.

IV. How would you set about resuscitating a boy who has fallen from a boat into deep water, has been in the water five minutes, and is quite unconscious when rescued, but whose heart is still beating ?

V. State what you know about the following :—

(*a*) Comminuted fracture.
(*b*) Tourniquet.
(*c*) Femur.
(*d*) Temporal artery
(*e*) Pinhole pupil.
(*f*) Antidote.
(*g*) Diaphragm.
(*h*) Pulmonary artery.
(*i*) Crepitus.

VI. Detail the methods of improvising a stretcher, and the instructions you would give to four men (not trained in first-aid methods) as to the lifting, carrying, and laying down of a patient with fractured thigh on such a stretcher.

Ladies will substitute the following for Question VI. :—

VI. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a stab wound of main artery of thigh).

Practical examination follows.

PAPER IV.

Time—One Hour and a half.

I. How would you render first-aid to

(*a*) A man with a broken collar bone ?
(*b*) A man bleeding from a stab through the main artery of the thigh ?
(*c*) A lady who has fainted in church ?
(*d*) A man seized with a fit of apoplexy in the street ?
(*e*) A boy scalded through his dress by boiling water ?

II. Distinguish bleeding from an artery from bleeding from a vein. How would you treat each ?

III. How would you set about resuscitating a boy who has fallen from a boat into deep water, has been in the water five minutes, and is quite unconscious when rescued, but whose heart is still beating ?

IV. How would you make sure that a bone has been broken ? What is the difference between a simple and compound fracture ?

Practical examination follows.

PAPER V.

Time—One Hour and a half.

I. What are the different varieties of bleeding ? Give the treatment of each.

II. Detail the method of rendering " first aid " to a boy scalded through his stocking by boiling water.

III. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a compound fracture of the thigh, where an amputation may have to be done).

IV. How would you distinguish a fainting from an epileptic fit, and drunkenness from an attack of apoplexy ? Give the treatment of each.

V. State what you know about the following :—

(*a*) Tourniquet.
(*b*) Diaphragm.
(*c*) Femur.
(*d*) Pinhole pupil.
(*e*) Dislocation.
(*f*) Sylvester's method of artificial respiration.
(*g*) Pulmonary artery.
(*h*) Normal temperature of body, and the proper temperature of a sick room.

VI. How would you distinguish a dislocation from a fracture near the joint ?

Oral and practical examination follows.

PAPER VI.

I. In a case of compound fracture of the tibia state

(*a*) The special dangers of the accident.
(*b*) How would you render "first-aid?"
(*c*) The precautions you would observe in carrying the patient down-hill on a stretcher.

II. What are the varieties of bleeding, their characteristics, and their treatment?

III. Describe *in detail* a method of performing artificial respiration.

IV. State shortly the proper treatment for the following conditions:—

(*a*) Broken collar bone.
(*b*) Stab wound of artery of arm-pit.
(*c*) Poisoning by opium.
(*d*) An apoplectic seizure.

V. What are the main points to attend to in carrying a patient on a stretcher? Describe how to improvise a stretcher.

Oral and practical examination follows.

PAPER VII.

I. State briefly what you know about the following:—

(*a*) Arterial bleeding.
(*b*) Tourniquet.
(*c*) Brain and nerves.
(*d*) Diaphragm.
(*e*) Tibia.
(*f*) Function of respiration.
(*g*) Pinhole pupil.
(*h*) Sylvester's method of artificial respiration.
(*i*) Capillary.
(*j*) Pulmonary artery.

II. How would you distinguish between the following:—

(*a*) A fainting fit and an epileptic fit?
(*b*) A simple and compound fracture?
(*c*) Venous and capillary bleeding?
(*d*) Apoplexy and alcoholism?

III. Give the "first-aid" treatment for

(*a*) A large scald of back.
(*b*) Poisoning by laudanum.
(*c*) Poisoning by strong nitric acid.
(*d*) Fracture of lower jaw.
(*e*) A bite of leg (dog rabid).
(*f*) Fracture of thigh bone.

IV. Give an account of the improvised method of lifting and carrying the sick and injured.

Oral and practical examination follows.

PAPER VIII.

Time—One Hour and a half.

I. In the case of compound fracture of both leg bones (tibia and fibula), state

(*a*) The special dangers of the accident.
(*b*) How you would render "first-aid."
(*c*) The precautions you would observe in carrying the patient down-hill on a stretcher.

II. How would you check bleeding

(*a*) From an artery in the foot?
(*b*) From an artery in the upper part of the thigh?
(*c*) From an artery at the wrist?
(*d*) From an artery at the arm-pit?
(*e*) From a burst varicose vein of leg?

III. In the case of a person becoming suddenly unconscious, state briefly

(*a*) The possible causes.
(*b*) The points of distinction.
(*c*) The treatment of each.

IV. Detail the method of rendering "first-aid" to a boy scalded through his stocking by boiling water.

V. Describe in detail a method of performing artificial respiration.

Practical examination follows.

PAPER IX.

Time—Two Hours.

I. Bleeding—

Describe the treatment of bleeding:—

(*a*) From the artery of the arm-pit.
(*b*) From an artery in the palm of the hand.
(*c*) From the temporal artery.
(*d*) From a burst varicose vein of leg.

II. Broken collar bone—

(1) How is this injury recognised?
(2) How would you render "first-aid"?

III. Artificial respiration—

(1) Describe fully a method of performing artificial respiration.
(2) For what conditions has artificial respiration to be performed?

IV. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a fracture of the thigh).

V. Enumerate some of the more common extemporised splints which might be used in the treatment of a fractured forearm, and describe the method of their application.

VI. How would you distinguish a fainting from an epileptic fit? Give the treatment of each.

Only five questions to be answered.

PAPER X.

Written Examination.

I. Describe and distinguish between

(*a*) The different kinds of fracture.
(*b*) The different forms of fits causing insensibility.
(*c*) The different varieties of bleeding.

II. Describe fully the method you would adopt to resuscitate a person apparently drowned.

III. Give the " first-aid " treatment for

(*a*) A compound fracture of thigh.
(*b*) Poisoning by laudanum.
(*c*) Insensibility and intoxication.
(*d*) Fracture of skull.
(*e*) Extensive scald of forearm.
(*f*) Bleeding from radial artery at wrist.

IV. How would you prepare a bed for the reception of a case of fractured thigh ?

PAPER XI.

Final Examination.

I. Describe the course of the blood from the time it leaves the right ventricle of the heart till it reaches the palm of the hand.

II. In the following cases explain

(*a*) What the patient is suffering from.
(*b*) The methods by which you may render " first-aid."

(1) A young lady suddenly becomes unconscious in a tramway car. There is extreme pallor of the face and lips, and the pulse can hardly be felt. There are no other symptoms save that before becoming unconscious she complained of feeling giddy and out of sorts.

(2) A servant, in dusting the top of a book-case, fell to the ground with her left leg doubled below her. On examination you find the leg to be quite helpless. There is distinct crepitus and marked deformity, and a small portion of the tibia is protruding through the skin.

(3) A young servant girl, fresh from the country, is found unconscious in her bedroom in the early morning. Gas has evidently been escaping in the room for some hours. She is flushed, with a pulse of 90, and her respirations are 28 per minute.

III. State what you know about the following :—

(*a*) The normal temperature of the human body.
(*b*) The treatment for poisoning by opium.
(*c*) The treatment for a dog bite (the dog supposed to be rabid).
(*d*) The different kinds of nerves.
(*e*) The treatment for bleeding from the main artery of the arm and leg respectively.

Oral and practical examination follows.

PAPER XII.

I. What is the arrangement of the bones forming the chest? What dangers may arise from a fractured rib?

II. Name and give the arrangement of the bones of the lower limb (omitting the bones of the foot). What treatment would you adopt in the case of compound fracture of the leg bones?

III. Describe generally the circulation of the blood. How would you distinguish venous, arterial, and capillary hæmorrhage?

IV. Describe Sylvester's method of artificial respiration. What after-treatment would you adopt in a case of apparent drowning?

V. (*a*) What methods would you adopt to control severe hæmorrhage from a wound in the palm of the hand?

(*b*) At what points would you apply digital compression for hæmorrhage of the femoral artery, the radial artery, and the facial artery? What is the general principle involved?

VI. What treatment would you adopt in

(*a*) An apoplectic fit?
(*b*) An ordinary fainting fit?
(*c*) A poisoned bite?
(*d*) A case of scalding?

PAPER XIII.

I. What is a splint, and for what purpose is it used? Mention the different forms of emergency splints.

II. What "first-aid" assistance would you render in the case of a man found insensible in a room full of smoke?

III. What are the most dangerous forms of fracture and of hæmorrhage? Give reasons for your answer.

IV. Give the treatment for a case of cut-throat.

V. What is shock? What are the appearances seen in this condition? What is its treatment?

PAPER XIV.

I. Give the treatment for a wound in the sole of the foot with considerable arterial hæmorrhage.

II. Define an emetic, and state the simple emetics which are usually at hand.

III. Give the "first-aid" treatment for

(*a*) A fracture of the forearm.
(*b*) A fractured collar bone.
(*c*) Poisoning by opium.

IV. What are the differences between inspired and expired air? Describe a method of artificial respiration.

V. What kind of blood is to be found in

(*a*) The left ventricle.
(*b*) Pulmonary artery.
(*c*) Right auricle.

PAPER XV.

I. Describe the circulation of the blood.

II. Describe the method and the points at which you would apply digital pressure to the large arteries of the arm and leg.

III. In a case of insensibility, by what signs would you recognise which of the following conditions it was due to :—

(*a*) Alcoholism ?
(*b*) Poisoning by laudanum ?
(*c*) Apoplexy ?

IV. What are the main points to attend to in carrying a patient with a fractured leg on a stretcher ? How would you extemporise a stretcher ?

PAPER XVI.

I. Give the signs and treatment of
(*a*) A broken thigh-bone.
(*b*) A fracture of the base of the skull.

II. Give the signs by which you would recognise an epileptic from an apoplectic fit.

III. What points distinguish arterial from venous bleeding ?

IV. What is a styptic ? Mention the most important ones, and state how they are to be used.

V. Poisoning by oil of vitriol—To what class of poisons does this belong ? Give its signs and " first-aid " treatment.

PAPER XVII.

Time — One Hour.

State what you know about
(1) The heart and circulation of the blood.
(2) Arterial hæmorrhage, and its treatment.
(3) Fractures of the forearm, and their treatment.
(4) Apoplexy, and its treatment.
(5) The methods of preparing splints and stretchers.

PAPER XVIII.

Time — One Hour.

State what you know about
(1) The nervous system.
(2) Burns, and their treatment.
(3) Fracture of the collar bone, and its treatment.
(4) Opium poisoning, and its treatment.
(5) Bed-sores, and their treatment.

PAPER XIX. (FOR JUNIOR CLASS).

I. State the points of difference between arterial, venous, and capillary bleeding. Give the lines of the large arteries of the arm and forearm. How would you treat bleeding from a forearm artery?

II. How would you make temporary splints for a broken leg? What are the signs of a broken bone?

III. Give shortly the treatment of a bad scald of hand.

IV. What is the "first-aid" treatment of a fainting fit?

PAPER XX.

I. State what you know about the skull and its contents.

II. What is meant by artificial respiration? how is it carried out, and in what cases is it of service?

III. What examination would you make in order to determine the condition from which the patient is suffering in the following cases:—

(*a*) A young man is thrown from a gig, and falls upon his right hand, which is outstretched to break the fall. He is found supporting the right elbow with his left hand, and his right arm is disabled.

(*b*) A gentleman, aged 70, suddenly becomes unconscious, and falls down in the street. You find his breathing to be slow and deep, and his pulse normal in rate, and strong.

(*c*) A young man, known to have been depressed and melancholic for some weeks, is found lying unconscious in bed. An empty bottle, marked "poison," is found in his bedroom.

IV. Give the "first-aid" treatment for the following:—

(*a*) A severe burn of the hand.

(*b*) A fainting fit.

(*c*) A compound fracture of the forearm.

(*d*) Hæmorrhage from—

(1) A cut femoral artery.

(2) A burst varicose vein of leg.

(3) A cut-throat wound.

V. Describe in detail the methods of removing foreign bodies from the eye.

PRACTICAL EXAMINATIONS IN BANDAGING.

(A) Apply the following with the triangular bandage :—

(*a*) Bandages and splints for fractured forearm.

(*b*) A chest bandage.

(*c*) Shoulder bandage.

(B) Apply the following :—

(*a*) A tourniquet on the brachial artery.

(*b*) A bandage for a fractured lower jaw.

(*c*) A large arm sling.

(C) Apply the following :—

(*a*) A bandage for wound of palm of hand.

(*b*) An elbow bandage.

(*c*) A small arm sling.

(D) Apply the following :—

(*a*) Bandage for fractured collar bone.

(*b*) Head bandage (capeline).

(*c*) Large arm sling.

(E) Apply the following :—

(*a*) A bandage to cover the shoulder.

(*b*) A bandage to take in the foot.

(*c*) A tourniquet to arrest absorption from a poisoned bite of the hand.

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