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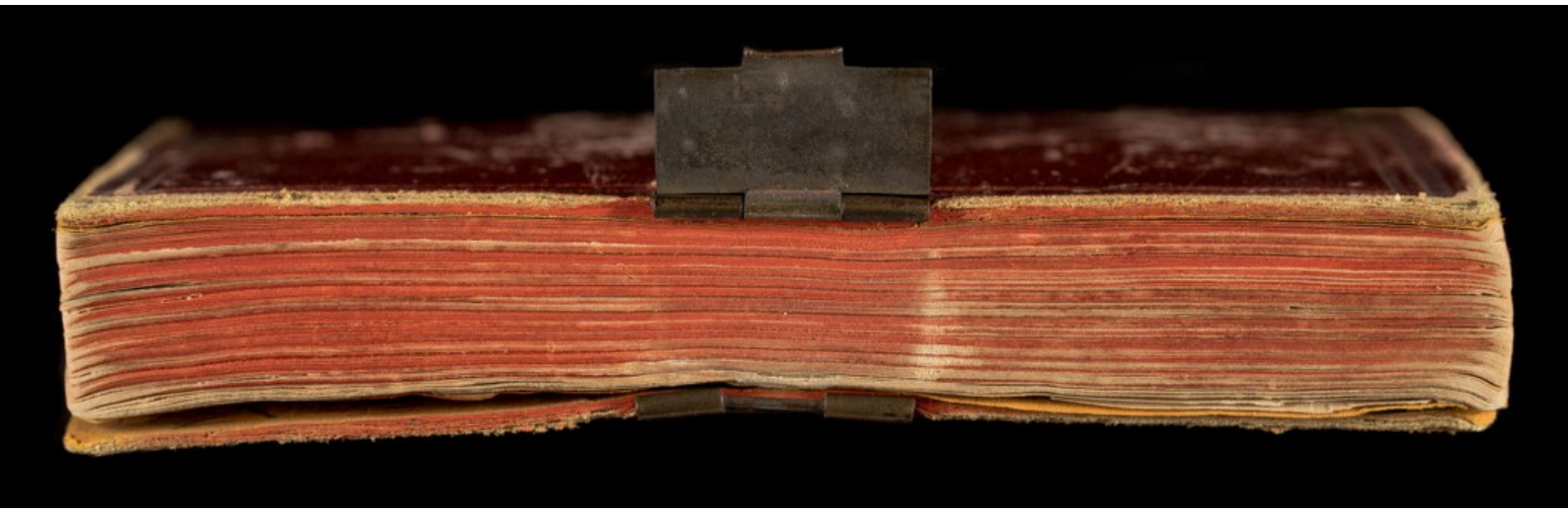

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The bones of the body are 242 in number. They are jointed or articulated with each other in such a manner as to form a framework, which is called a skeleton. The bones determine the general shape and proportions of the body, give attachment to the muscles, and form levers on which the muscles act to move the body from one position to another. They also form cavities for containing important organs.

The skeleton may be divided for description into the head, the trunk, and the upper and lower extremities.

The bones of the head include those of the skull and face, the more important of which are the following:—

Cranium (*the Skull*).—The cranium is made up of eight pieces, intimately united together, and forming a strong bony case for the protection of the brain. In front is the *frontal* bone, behind is the *occipital* bone, at the sides are

the two *temporal* bones, above and at the sides are the *parietal* bones, and forming the base are the *sphenoid* and *ethmoid* bones.

The frontal bone, in connexion with the temporal, sphenoid, and the bones of the face, form sockets for the eyes.

The temporal bones contain the apparatus for hearing, protected in strong bony canals. The occipital bone is articulated to the spinal column, and here has a hole through which the spinal cord passes from the brain into the canal in the spinal column.

Superior Maxilla (*the Upper Jaw*).—The upper jaw constitutes the greater part of the face, and enters into the formation of the eye-sockets and nasal cavities. It is fixed and firmly united to the bones of the skull and the other bones of the face, and contains the upper row of teeth.

Inferior Maxilla (*the Lower Jaw*).—The lower jaw is horseshoe shaped, and forms the chin and lower part of the face. It contains the lower row of teeth, and is moveable for the purpose of mastication.

Malar Bone (*the Cheek Bone*).—This is a small bone, placed at each side of the face, and forming the cheek. It enters into the formation of the orbit.

Nasal Bones (*the Bones of the Nose*).—These are two small bones, forming the bridge of the nose.

The *Bones of the Trunk* are the following:—

Vertebræ (*Bones of the Spine*).—The spine is made up of a number of pieces, each called a vertebra. These are divided into three portions, the cervical, seven in number, in the neck; the dorsal, twelve in number, in the back; and the lumbar, five in number, in the loins. The vertebræ form a column to preserve the erect position of the body, and a bony canal for the protection of the spinal cord.

Costæ (*the Ribs*).—The ribs are twelve in number on each side, and are divided into seven true and five false. They are articulated to the dorsal vertebræ behind, and attached to the sternum in front by cartilages. The true ribs are more liable to fracture than the false ribs, being less yielding.

Sternum (*the Breast Bone*).—This is a flat bone placed in the front of the chest. At each side it has attached to it the cartilages of the ribs, and at its upper end it has articulated to it the clavicles. The sternum with the ribs and dorsal vertebræ forms the chest or thorax.

Sacrum (*the Rump Bone*).—This bone forms the lower end of the spinal column, and is continuous with the vertebræ. It forms the back part of the pelvis, and articulates above with the last lumbar vertebra, at the sides with the nameless bones, and has attached to it below a small string of bones called the coccyx. It is curved, with the concave side forwards, and following this curve runs the rectum, or lower part of the great gut.

Ossa Innominata (*the nameless bones*).—These are two bones of irregular shape, one on each side, forming the sides and front of the pelvis. They are attached to the sides of the sacrum behind, and to each other in front. Each is made up of three parts, the *ilium*, the *ischium*, and the *pubis*.

The two nameless bones, with the sacrum and coccyx, form the basin-shaped cavity at the lower part of the trunk, called the pelvis.

The *bones of the upper extremity* are the following :—

Clavicle (*the Collar Bone*).—The clavicle is a bone placed on each side at the upper part of the chest. Its inner end is articulated to the sternum, and its outer to the scapula. Its use is to support the shoulder, and keep it out from the chest.

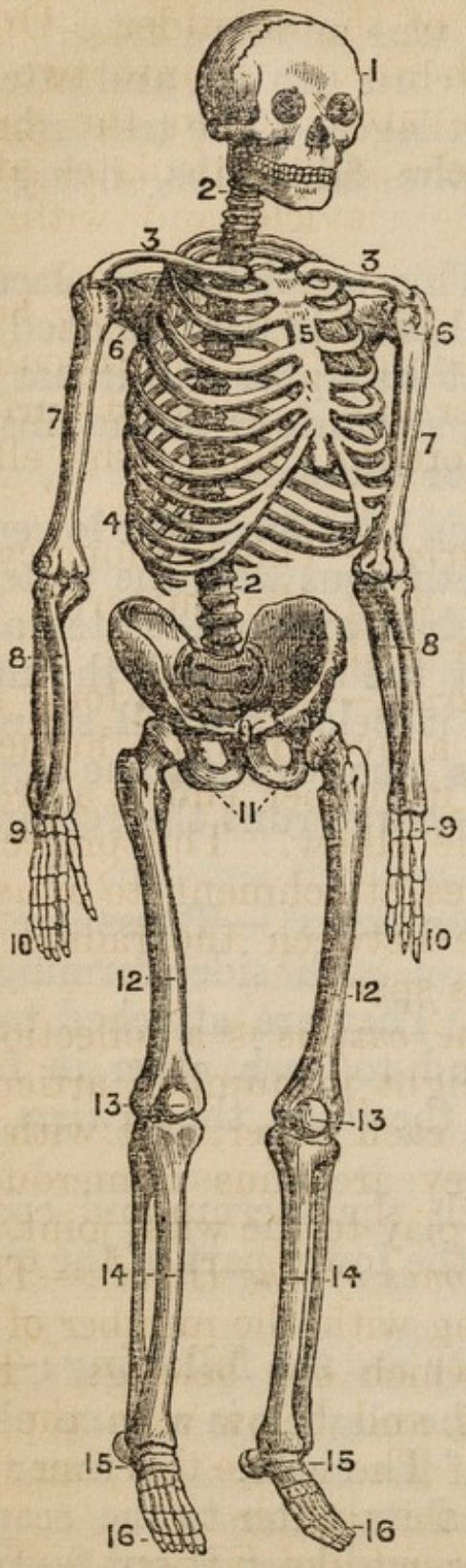

FIG. 1.

SKELETON OF HUMAN BODY.

1. Cranium, or skull.
2. Spine formed of vertebræ.
3. Clavicle, or collar-bone.
4. Costæ, or ribs.
5. Sternum, or breast-bone.
6. Scapula, or shoulder-blade.
7. Humerus, or arm-bone.
8. Radius and ulna.
9. Carpal bones.
10. Phalanges, or finger-bones.
11. Pelvis.
12. Femur, or thigh-bone.
13. Patella, or knee-cap.
14. Tibia and fibula.
15. Tarsal bones.
16. Metatarsal bones and phalanges.

Scapula (*the Shoulder-blade*).—This is a flat bone of triangular form, placed at the back of the shoulder. On its outer surface runs a ridge which divides it into two unequal portions. The scapula is attached to the spinal column and ribs by strong muscles, and articulates at its upper and outer angle with the clavicle and with the humerus.

Humerus (*the Bone of Upper Arm*).—This is a long bone, having at its upper end a rounded head, which articulates with the scapula, and at its lower end a grooved surface, which, with the bones of the forearm, forms the elbow joint.

Radius (*the outer Bone of Forearm*).—This is a long cylindrical bone, articulating above with the humerus, and having at its lower end the bones of the wrist.

Ulna (*the inner Bone of Forearm*).—This is a long irregularly shaped bone, articulating above with the humerus, and below with the radius. At its upper end is a projection, which forms the point of the elbow. This projection is called the olecranon, and gives attachment to muscles coming from above. The space between the radius and the ulna is called the interosseous space.

Carpus (*the Wrist Bones*).—The carpus is a collection of small bones of irregular shape, eight in number, articulating with the radius above, with each other, and with the heads of the bones below. They are thus numerous in order to give greater mobility or play to the wrist joint.

The Metacarpal Bones (*the Bones of the Hand*).—These are five in number, corresponding with the number of the thumb and fingers, to each of which one belongs. They articulate above with the carpus, and below with the first bones of the thumb and fingers. The whole together form the palm of the hand and ball of the thumb.

Phalanges (*the Bones of the Thumb and Fingers*).—These are fourteen in number, and are disposed two to the thumb, and three to each of the fingers.

The bones of the lower extremity are the following :—

Femur (*the Thigh Bone*).—This is a long bone of cylindrical form. Its upper end is rounded and forms a ball and socket joint with the nameless bone. On its upper end is a large protuberance, called the *great trochanter*, for the attachment of muscles. At its lower end the femur enters into the formation of the knee joint.

Patella (*the Knee-Cap*).—This is a small irregularly oval bone, roughened on its front surface for the attachment of tendons of muscles, and smooth on its inner surface where it works over the lower end of the femur like a cord in the groove of a pulley. It protects the knee-joint from injury.

Tibia (*the Shin Bone*).—The tibia is the larger of the two bones of the leg and is situated on the inner and front part of the limb. It is sharp-edged in front, and being there covered only by the skin, is very often injured by blows or knocks against hard substances. The tibia enters into the formation of the knee-joint above, and of the ankle joint below. On its lower end is a prominence called the *internal malleolus*.

Fibula (*the outer Bone of the Leg*).—This is smaller than the tibia, and is situated on the outer side of the limb. At its upper end it is articulated to the tibia. At its lower end it is also articulated to the tibia, and enters into the formation of the ankle joint. On its lower end is a prominence called the *external malleolus*.

Tarsus (*the Ankle Bones*).—The bones of the ankle are seven in number, of various irregular forms, each articulating with the one next to it. The upper one articulates with the tibia and fibula to form the ankle joint; the lowermost four articulate with the bones of the foot. One of the tarsal bones projects backwards to form the heel, and acts as a lever for the attachment of muscles to move the foot. This projecting bone is called the *calcaneum*.

Metatarsal Bones (*the Bones of the Foot*).—These are five in number, and form the broad part of the foot. Above they articulate with the four lowermost bones of the tarsus. Below they articulate with the bones of the toes.

Phalanges (*the Bones of the Toes*).—These are fourteen in number as in the hand, and are disposed in a similar manner, viz., two to the great toe, and three to each of the others.

The Muscles of the Body.

The muscles constitute the flesh or lean part of meat. They surround the bones and make up the great mass of the body. Muscles are made up of fibres, which have been divided into two classes, striped and unstriped. The former obey the will and are called voluntary, the latter are not subject to the will, and are called involuntary. The voluntary muscles are found round the bones of the body, the involuntary in the muscular layer of the stomach, intestines, &c.

"By the action of the nervous system, acting through the will or otherwise, the masses of flesh, called muscles, are made to contract or shorten themselves, and by this contraction or shortening, the levers to which they are attached, are made to approach or recede from each other. The whole phenomena of locomotion, of muscular action generally, and of the voice, depend upon this single phenomenon, the contraction or shortening of muscular fibre, under the influence of the will, or when acted upon by excitants."

The Heart and Bloodvessels.

The apparatus for the circulation of the blood comprises the heart, the arteries, the veins, and capillaries.

The Heart.—The heart is a hollow muscular organ placed in the left side of the chest. When natural it is about the

size of the fist of the person to whom it belongs. It is covered on its outside by a smooth serous membrane, and fixed in a fibrous bag lined with the same; which arrangement allows the heart to move freely without impediment.

It is made up of four cavities, two auricles and two ventricles. These are arranged, an auricle and a ventricle, one above the other, on the right side, and an auricle and a ventricle on the left side. The auricle and ventricle of each side communicate directly with each other, but have no direct communication with the auricle and ventricle of the other side. The two ventricles form the front and lower part of the heart, while the two auricles form the back and upper part.

One set of vessels, called veins, proceed to the heart and empty their contents into the auricles; another set of vessels, called arteries, proceed from the heart and come from the ventricles.

Arteries.—These, as has been stated, proceed from the ventricles of the heart. They are plain elastic tubes, which divide and give off branches to the various parts of the body, and terminate in tubes, called capillaries, so small that they cannot be seen by the naked eye. Arteries carry red pure blood from the heart, with the exception of the pulmonary artery, which carries dark venous blood. All arteries are continuations, or branches, of two great arteries—namely, the pulmonary artery, and the aorta.

The Pulmonary Artery.—This arises from the *right* ventricle of the heart, proceeds upwards for about an inch and a quarter, and divides into two branches. These are named the right and left pulmonary arteries.

The right passes into the right lung, the left into the left lung.

The pulmonary artery, as it leaves the ventricle of the heart, is furnished with three valves, which allow the blood to be propelled from the heart, but prevent its returning.

The right and left pulmonary arteries when they enter the lungs divide into innumerable branches, which form a fine network of vessels on the walls of the air-cells.

The pulmonary artery is unlike all other arteries in that it comes from the right side of the heart, and carries dark venous blood.

The Aorta rises from the *left* ventricle of the heart, in front of the auricle. It first proceeds upwards, then curves over towards the left side of the spine, along which it descends behind the midriff into the abdomen, until it reaches the fourth lumbar vertebra. Here it divides into two branches, called the right and left common iliac arteries.

The curved part of the aorta near the heart is called the arch, that part which is in the chest the thoracic aorta, and the part in the belly the abdominal aorta.

The commencement of the aorta, like the pulmonary artery, is furnished with three valves, which prevent the blood returning to the heart.

In its course the aorta gives off a number of branches, the principal of which will now be described.

Arteria Innominata, the nameless artery.—This arises from the arch of the aorta on a level with the second rib. From its origin its proceeds upwards to terminate behind the joint of the sternum and clavicle on the right side. Here it divides into the right carotid and right subclavian arteries. It is a short thick trunk, varying from an inch to an inch and a half in length.

The Common Carotid Arteries.—On the right side, as has been stated, the common carotid is a branch of the nameless artery. On the left side it arises from the arch of the aorta. They ascend in the neck, one on each side of the windpipe, and terminate about an inch below the angle of the lower jaw. Each here divides into two branches, called the internal and external carotid arteries. In their course they

lie close to the spine, which thus presents a hard substance, against which they can be pressed to stop bleeding. In front they are near the surface, and can be felt throbbing at either side of the windpipe.

The deep jugular vein lies on the outer side of the carotid artery.

Internal Carotid Artery.—This is a branch of the common carotid. It ascends deep in the neck to a hole in the base of the skull, and there entering, distributes its branches to the brain and its membranes.

External Carotid Artery.—This is the outer branch of the common carotid. It runs up towards the ear, behind the angle of the jaw, and gives off branches to the parts about the windpipe, the tongue, the teeth, and the back and side of the head. The *facial* branch runs over the lower jaw, and goes to supply the lips and face; the *occipital* branch runs round the back of the head, and supplies the parts thereabouts; and the *temporal* branch, running upwards in front of the ear, over the temple, where it may be felt throbbing, divides into a number of branches.

The Subclavian Artery.—On the right side this is a branch of the nameless artery, but on the left it rises from the aorta. It runs outwards, crosses the first rib, which it grooves, and passes behind the clavicle into the upper part of the axilla, or armpit. In its course it can easily be pressed, behind the middle of the clavicle, against the first rib. The subclavian vein lies in front of this artery.

The Axillary Artery.—This is a continuation of the subclavian. It descends across the armpit until it reaches the inside of the arm. In this course it is very near the surface, and gives off a number of small branches to the side of the chest. It is accompanied by the axillary vein.

The Brachial Artery.—This is a continuation of the axillary. It commences at the lower part of the armpit,

passing downwards and forwards until it reaches the front of the elbow joint. Here it divides into two branches.

In its course it is accompanied by two large veins.

At the upper part of the arm it lies on the inner side of the bone, and is very near the surface. This part is therefore selected for compressing the artery either by hand or tourniquet.

The Radial Artery.—This is the smaller branch of the brachial. It runs downward from the bend of the elbow, along the radius, to the wrist. It here winds outwards towards the back of the joint, and sinking into the space between the metacarpal bones of the thumb and forefinger, enters the palm of the hand, and forms what is called the deep palmar arch. It is accompanied by two veins.

In the upper part of its course the radial artery is deep-seated. Approaching the wrist it is near the surface; and this is the point selected for feeling the pulse.

The Ulnar Artery.—This is the large branch of the brachial. It descends along the ulnar side of the forearm, passes over the wrist, and enters the palm of the hand, which it crosses, and ends by forming what is called the superficial palmar arch. At the upper part of its course it is deep, at the wrist it is near the surface, and can be felt throbbing on the lower part of the ulna. The palmar arch gives off branches to the fingers, called digital arteries.

The Common Iliac Arteries.—The aorta, after giving off innumerable branches to the organs of the chest and abdomen, divides at about the fourth lumber vertebra into the right and left common iliacs. Each of these proceeds outwards towards the brim of the pelvis, and divides into two branches, called the internal and external iliacs.

Each common iliac has a large accompanying vein.

Internal Iliac Artery.—This is the inner branch of the common iliac. It runs down into the cavity of the pelvis, gives off branches for the supply of the various organs

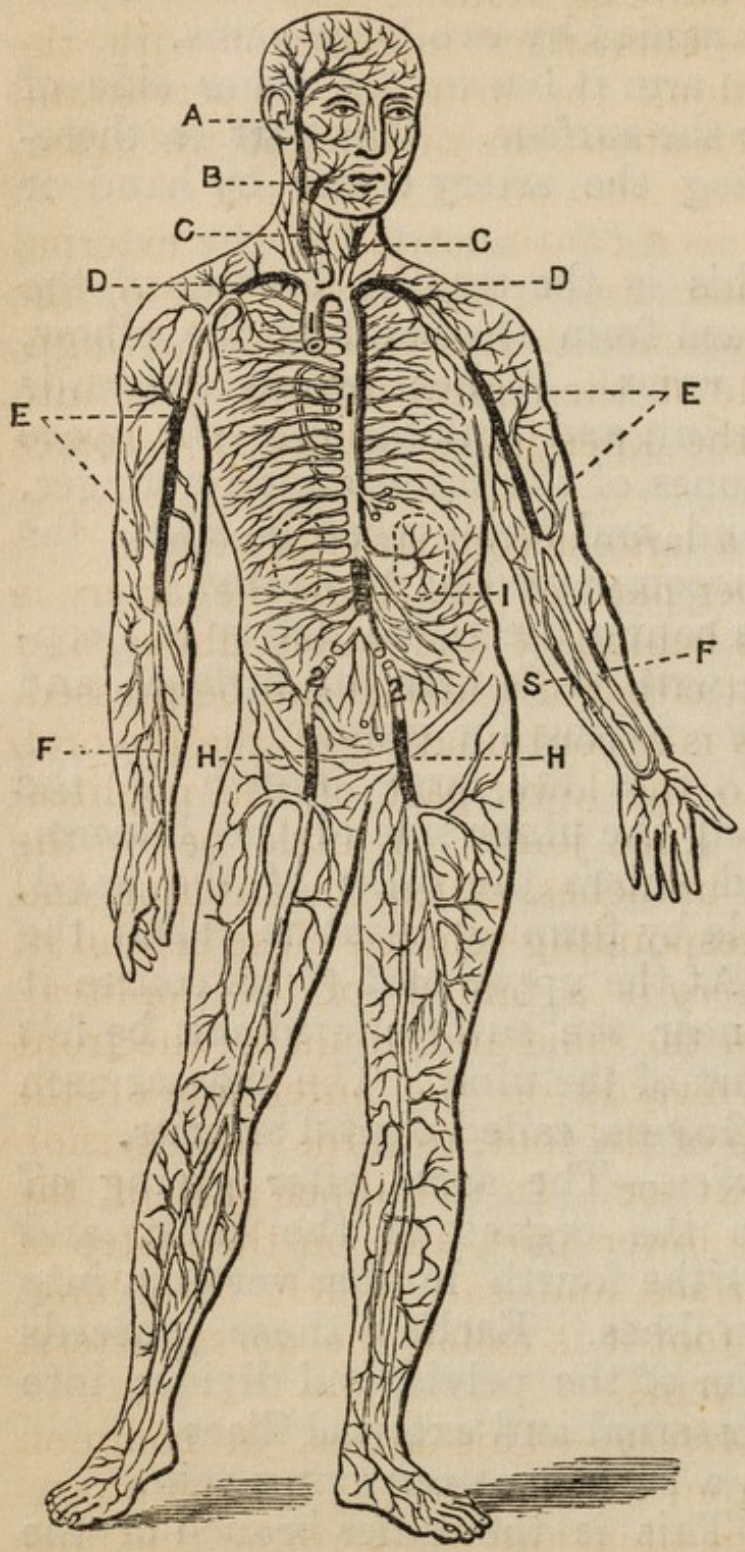

FIG. 2.

ARTERIES OF THE BODY.

1. Thoracic Aorta.
2. Iliac arteries.
A. External carotid.
B. Internal carotid.
C. Common carotid.
D. Subclavian artery.
E. Brachial artery.
F. Radial artery.
H. Femoral artery.
I. Abdominal aorta.
S. Ulnar artery.

therein, and the large mass of muscles forming the buttocks. It has one accompanying vein.

External Iliac Artery.—This arises in common with the last-named artery, runs along the brim of the pelvis, and passes out of the abdomen about the middle of the groin. It has a large accompanying vein on its inner side.

Femoral Artery.—This is a continuation of the external iliac. It commences where the artery passes out of the abdomen in the groin, whence it descends in the thigh, winding round the inside of the femur, until it gets into the ham at the back of the knee joint, where it becomes the popliteal.

On its inner side runs a large accompanying vein.

At the groin and upper part of the thigh the artery is near the surface, and has behind it the pubis above, and femur lower down, against either of which it can be pressed.

Popliteal Artery.—This is a continuation of the femoral. It runs from the upper to the lower part of the popliteal space at the back of the knee joint. A little below the knee it divides into two branches, called the anterior and posterior tibials. Its corresponding vein lies close behind it.

The Anterior Tibial Artery is a branch of the popliteal. It passes forward between the tibia and fibula to the front of the leg, and runs downwards on the outer side of the shin-bone, over the instep of the foot, towards the division between the great and next toe. In the upper part of the leg it is deep, but in the lower part, and on the instep of the foot, it is near the surface, and can be felt throbbing. On the upper part of the foot it is called the *dorsal* artery. It has two corresponding veins.

The Posterior Tibial Artery.—This arises, in common with the anterior tibial, from the popliteal. It runs downwards along the back of the tibia, and winds round the inner ankle into the sole of the foot. Here it divides into two branches, called the *plantar* arteries, which run forwards

through the sole of the foot to supply the toes. Near its origin it gives off a large branch to the outside of the leg, called the peroneal. The posterior tibial has two corresponding veins.

The Peroneal or Fibular Artery.—This Artery, arising from the posterior tibial, descends along the back part of the fibula, and terminates at the outer ankle.

Like the other arteries of the leg it has two corresponding veins.

Veins are tubes furnished generally with valves. They commence by small vessels, called capillaries. These, by uniting with each other, soon form branches, and these running into each other form large vessels proceeding towards the heart.

Veins may be divided into two sets of vessels, the superficial and the deep-seated. The superficial run close under the skin, and may readily be seen, especially if pressure be made to prevent the blood passing towards the heart.

Some of these superficial veins receive special names. In the upper extremity a vein which runs up the centre of the forearm is called the *median,* one on the inside of the arm the *basilic,* and one on the outside of the arm the *cephalic.* In the lower extremity a large vein runs up the inner side of the limb from the ankle to the upper part of the thigh, and is called the *saphena,* and in the neck at each side is a vein called the *external jugular.*

The deep seated veins generally accompany arteries, either one or two to each artery, and, as a rule, take the names of the artery with which they run. Some, however, receive special names, as the venæ cavæ, the internal jugulars, &c.

Veins carry dark, impure blood towards the heart, with the exception of the pulmonary veins, which carry red, pure blood from the lungs to the heart.

Capillaries.—These are small hair-like vessels which connect the arteries with the veins.

Circulation of the Blood.—The right auricle of the heart receives the dark, venous blood from the veins, and discharges it into the right ventricle. The right ventricle, as soon as it is full of blood, contracts, and propels it through the pulmonary artery into the lungs. The blood is here distributed in the network of arteries on the cell walls, and by the action of the air breathed into the lungs is oxidized, and changed from impure, dark, venous blood into pure bright red, arterial blood. Being thus changed, it is conveyed from the lungs by the pulmonary veins to the left auricle. This discharges it into the left ventricle, which, as soon as it is full, contracts, and propels the blood into the aorta, and thence by its numerous branches it is distributed throughout the whole body.

The blood having nourished the various parts of the body, and having become impure and dark in colour, is now conveyed back to the right auricle of the heart by the veins.

The cavities of the heart in a healthy man contract between seventy and seventy-five times in a minute; and the pulse is caused by the contraction of the left ventricle and the propulsion of the blood through the arteries.

The Nervous System.

"The nervous system is divisible into two chief portions, a centre and a periphery. The centre is composed of the brain and spinal marrow; the periphery of the nerves. But this latter may be subdivided further into two portions, namely, cerebro-spinal nerves and sympathetic nerves; the former in direct communication with the brain and spinal marrow; the latter indirectly connected with these."

The brain is one of the most important and delicate organs in the body. It is protected by a bony case, the

cranium, enveloped by membranes, and bathed with fluid, In connexion with the brain nine pairs of nerves are given off; these are called cranial nerves.

The spinal marrow runs from the brain along the bony canal in the spinal column as far as the loins. Like the brain it is enveloped in membranes, and bathed with fluid. From each side of it the spinal nerves proceed to the various parts of the body.

The cerebro-spinal nerves arise from the brain and spinal marrow. They present the appearance of white cords. These divide and communicate freely with each other, and at last terminate in the organs by loops.

The sympathetic system of nerves is a series of ganglions, or knots, connected with each other, and arranged along the front and sides of the spinal column. These ganglions, or knots, give off filaments to connect them with the cerebro-spinal nerves, and to accompany arteries and veins.

The sympathetic system of nerves is said to preside over the nutrition of the body, the secretions, excretions, &c.

The Important Organs of the Body.

The lungs are two spongy, cellular masses, contained within the cavity of the thorax, or chest, one on the right, the other on the left side. They are each covered with a smooth membrane called the pleura, which is continued from them to line the inside of the chest walls. This arrangement allows a free gliding motion to take place between the lungs and chest walls.

The structure of the lungs is made up of branches of the bronchial tubes, air cells, arteries, veins, and nerves.

The object of the function of the lungs is to expose the venous blood to the action of the air during its passage through them, and by its means to convert it into arterial blood.

The passage of air to the lungs is by the windpipe and bronchial tubes. The windpipe commences at the back of the mouth, at a part called the fauces, and descends in front of the gullet and spinal column. The upper part is called the *larynx*, and contains the apparatus for forming the voice; the lower part is called the *trachea*. The trachea at its lower end divides into two branches, one going to the right lung, the other to the left; these are called the *bronchial tubes*.

The stomach is a musculo-membranous bag, situated immediately below the diaphragm, in the upper centre and left part of the abdomen. It is for the reception of food and drink, and is lined with mucous membrane, which secretes the gastric juice to aid in digestion. The opening into it from the mouth is by a musculo-membranous tube called the *œsophagus*, or gullet, having at its upper end, communicating with the mouth, a pouch somewhat of a funnel shape, called the *pharynx*. From the stomach leads the small intestine.

The intestine is a tube leading from the stomach to the anus, and is divided into two parts—the small and the large intestine. These are mostly convoluted upon themselves, the former, however, much more so than the latter. They are lined throughout with mucous membrane, which is continuous with that of the stomach. The small intestine contains a number of glands which form secretions to aid in digestion. The coats of the intestines, besides blood-vessels and nerves, contain a great number of absorbent vessels, for the purpose of taking up the nutritious portion of the food (called chyle) and conveying it into the circulation, to be converted into fresh blood for the nourishment of the body.

The ducts from the gall-bladder and the pancreas open into the small intestine a short distance from the stomach.

The lower part of the large intestine is called the *rectum*, and the external opening from it the *anus*.

The liver is a large body placed immediately below the midriff, and extending round under the cartilages of the ribs on the right side as far back as the spine. On its lower surface is a bag called the gall-bladder, for storing up the secretion from it, and from this bag a tube leads out into the small intestine at a short distance from the stomach. The secretion from the liver is called bile.

The spleen is a solid vascular organ, situated in the abdomen below the midriff, under the cartilages of the false ribs on the left side. The use of the spleen is not known; it has no duct leading from it.

The pancreas is a solid body of a greyish white colour, lying across the spinal column at the back of the stomach. It secretes a fluid which aids in digestion, and which it discharges into the small intestine near the stomach, sometimes by a duct of its own and sometimes by uniting with the bile duct from the gall-bladder.

The Kidneys and their Appendages.—The kidneys are two solid dark red bodies, situated in the loins, one on each side of the spinal column, enveloped in fat. The left is situated somewhat higher than the right, and is usually the larger of the two. They are supplied by a large artery each, and are for the purpose of secreting the urine. From each kidney to the bladder a tube runs which conveys the urine, as it is secreted, from the kidney to the bladder. Above the kidneys are placed two small bodies called the supra-renal capsules. Their use is not known.

The bladder is a bag situated in the cavity of the pelvis for the reception and accumulation of the urine previously to its being ejected from the body. When full it rises somewhat above the front of the pelvis (the pubis), and may be felt by the hand. The urine enters from the kidneys by two

tubes called the *ureters*, and is discharged by a tube leading from the bladder through the penis, which is called the *urethra*.

CHAPTER II.

BANDAGES AND BANDAGING.

BANDAGES may be divided into three classes—*roller* bandages, *triangular* bandages, and *special* or *compound* bandages.

ROLLER BANDAGES.

Texture.—Roller bandages are made of unbleached calico, flannel, or silk, torn or woven into strips, which vary in breadth and length according to the part for which they are required.

Breadth and Length.—For the fingers the breadth is about three quarters of an inch, for the head and upper extremity two and a half inches, and for the body and lower extremity three inches. For the fingers the length is from a yard to a yard and a half, for the head and upper extremity three to six yards, for the lower extremity and body six to eight yards.

Rolling a Bandage.—Before applying a bandage it is necessary that it should be neatly and firmly rolled. It is rolled either with a single head or a double head.

To roll a Bandage with a Single Head.—One end of the bandage, being folded four or five times upon itself, is made into a small roll, which is seized by the fingers of both hands, one end placed opposite the division between the first and middle fingers of each hand, and both thumbs placed on the top of it; while the unrolled bandage, coming

from the upper side of the roll over the fingers, is spread out on the floor in front of the person about to roll it. The thumbs now, by an alternate movement, make the roll revolve inwards on its own axis, while the fingers hold it fixed in position between the two hands (see Fig. 3).

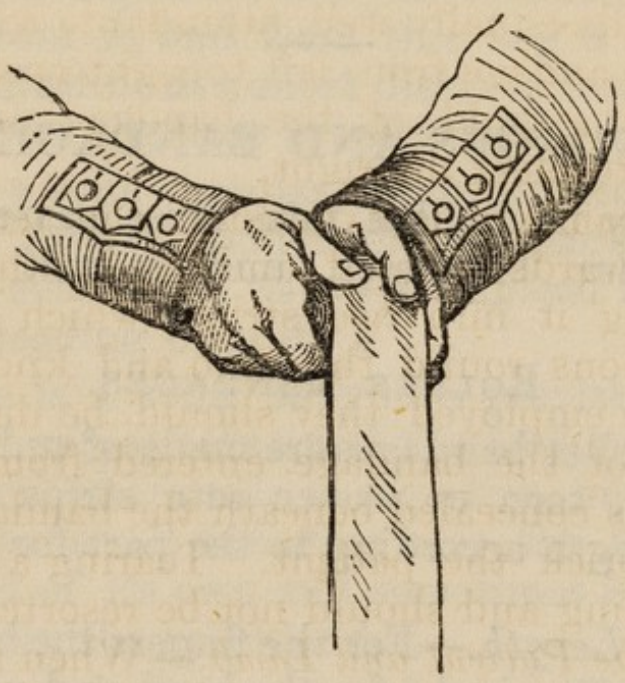

FIG. 3.—ROLLING A BANDAGE.

This movement is continued until the whole of the bandage is wound tightly and evenly round the original roll. The end should then be fastened by a stitch, pin, or thread, to prevent it unrolling.

To roll a Bandage with a Double Head.—The bandage should first be marked at its centre, rolled from one end to this mark and fastened, and then rolled in like manner from the other end.

Application of a Single-headed Bandage.—The bandage is held in the right hand, with its axis across the palm and the free end towards the fingers. The free end is then taken between the finger and thumb of the left hand and

laid on a point of the circumference of the part about to receive the bandage, the outer side of the roll towards the part on which it is to be applied; and being here fixed, the application of the bandage is continued in the direction desired. It is customary to bandage from the inside of the limb in all cases, but as this necessitates the power of using both hands equally well, attendants will find it more convenient to bandage from left to right over the limb, the left hand taking hold of the bandage underneath and carrying it up to meet the right.

When the bandage is exhausted the terminal end is folded once inwards on itself and fixed either by stitches, pins, or tearing it into two strips, which are carried in opposite directions round the limb and knotted together. When pins are employed they should be directed parallel to the length of the bandage, entered from the free end, and their points concealed beneath the bandage, care being taken not to prick the patient. Tearing a bandage is an untidy proceeding and should not be resorted to.

Position of the Patient and Limb.—When about to apply a bandage the patient should be placed either lying down or sitting, the limb raised and placed in that position, whether straight or bent, which it is intended to occupy when the bandaging is completed, and so supported by an assistant.

Position of Bandager and Assistant.—The bandager should place himself opposite the limb to be bandaged, either standing or sitting as may be most convenient. The assistant's position is at the side of the limb, which he should support with both hands.

Turns of a Bandage.—In bandaging a limb, owing to its irregular form, it is necessary, in order to make the folds of the bandage fit closely and support the parts evenly and prevent undue pressure at any given point, to employ a variety of turns. On parts where the limb is of nearly

uniform thickness, as above the ankle, below the knee, and on portions of the arm, the *simple spiral* is employed. On those parts where the circumference increases, as the calf of the leg, the thigh, the forearm, and the upper arm, to prevent the bandage bagging at the lower edge of the folds. the *reverse spiral* is had recourse to. At the joints—the ankle, knee, elbow, &c.—especially when they are bent, the *crucial* or *figure of* 8 is used.

The simple spiral covers the part to which it is applied by turns, each of which overlaps the preceding one to the extent of from one-half to two-thirds of the width of the bandage employed, and proceeds regularly and spirally round and round the part. (See Fig. 4.)

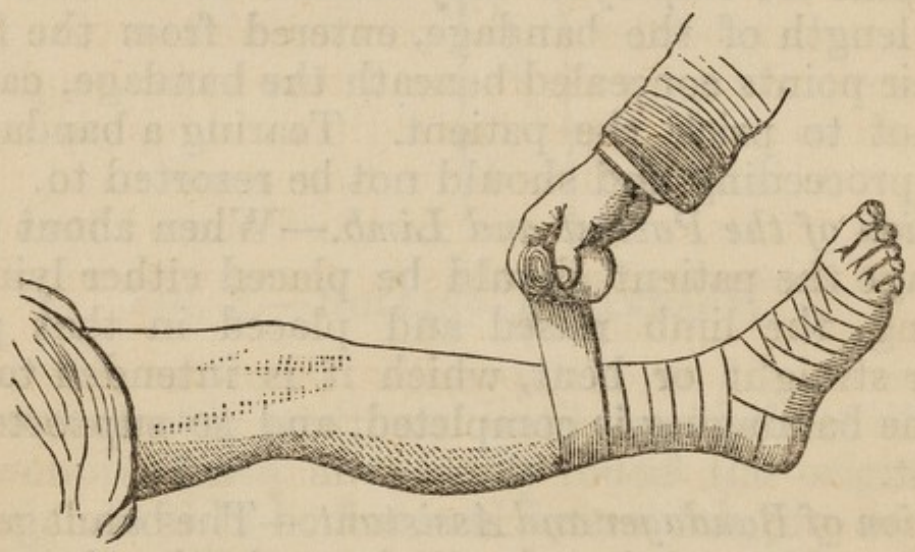

FIG. 4.—SIMPLE SPIRAL.

The reverse spiral is like the former, except that the bandage is turned back upon itself each time as it is carried round the limb. Making a reverse turn of a bandage is always attended with some difficulty to a beginner, and requires considerable practice before it can be accomplished with facility.

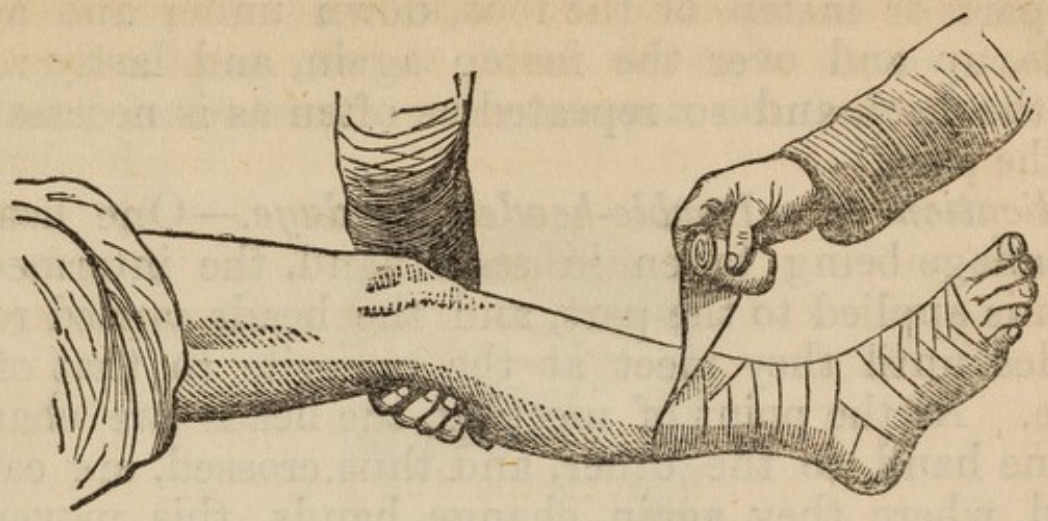

FIG. 5.—REVERSE SPIRAL.

The thumb or forefinger of the left hand should be placed upon the upper border at the part where the turn is to be commenced, while the right hand turns the bandage back upon itself so as to make the fold pass obliquely across the bandage. When the thumb or finger has fixed the upper border, the bandage in the right hand should be held quite slack, and the reverse will thus be made with much greater facility than if held tightly.

The reverses should, if possible, be at the side of a limb, on the soft muscular part, and not over a prominent bone, such as the shin-bone, as they may cause uneven and undue pressure on such parts, which it is well to avoid. (See Fig. 5.)

The Crucial, or Figure of 8.—The crucial bandage is that formed by crossing the turns of the bandage one over the other, so as to represent the figure 8. It is generally employed at the bends of joints, and where the increase in size of a part is too great and sudden for the reverse spiral to effect the close fitting of the bandage. It is always used when carrying a bandage over the ankle joint. The end of the bandage is first made fast, then carried over the

upper part or instep of the foot, down under and across the sole, up and over the instep again, and lastly round above the heel, and so repeated as often as is necessary to cover the part.

Application of a Double-headed Bandage.—One head of the bandage being taken in each hand, the intermediate portion is applied to the part, and the heads carried round the sides until they meet at the opposite to that of departure. At the point of meeting, the heads are changed from one hand to the other, and thus crossed, are carried forward, where they again change hands, this movement being continued as often as is necessary. The terminal ends are fastened in the ordinary manner.

Triangular Bandages.

As the use of this class of bandages is confined almost entirely to field purposes, the subject will be better considered under the head of "First Assistance to Wounded."

Special or Compound Bandages.

To this class of bandage no general description is applicable. Each bandage will therefore have to be described separately when considering those for the different parts of the body.

Bandages for the Different Parts of the Body.

Bandages for the head and face are the following, viz. :—

The Circular Bandage.—To apply this a single-headed roller, commencing on the forehead, is carried round the head immediately above the ears, and being fastened with a pin at the point where it commenced, is varied in its course upwards or downwards, so as to pass over the spot where it is necessary either to retain dressings or make pressure. To prevent the circular turns slipping upwards over the

top of the head, the bandage is fastened at one side over the temple by a pin or stitch, brought down under the chin and fastened over the temple on the opposite side. (See Fig. 6.)

FIG. 6.—CIRCULAR BANDAGE.

This bandage cannot well be employed for any part of the top of the head, but will answer to retain a dressing or compress either on the front, side, or back of it.

Knotted Bandage.—This bandage is employed, when it is necessary to make pressure, for the purpose of arresting hæmorrhage from a wound on the side of the head.

A compress being laid upon the wound, one head of a double-headed roller is taken in each hand, and the part of it between the two heads placed over the compress. This done, the ends are carried horizontally round the head, and being crossed at the opposite side, one is carried under the chin while the other is brought over the top of the head to the point of starting. Here, over the compress, the ends of the bandage are crossed and carried again horizontally

round the head to the opposite side, thence under the chin and over the top of the head to the point of starting, and so on as often as may be required. (See Fig. 7.)

FIG. 7.—KNOTTED BANDAGE.

Capeline Bandage.—This bandage is employed where it is necessary to retain dressings, a blister, or an ice-bag on the head.

To apply it, one head of a double headed roller being taken in each hand, the middle is laid on the forehead and the ends carried round the temples, above the ears, to the back of the head. Here they are crossed, one being continued horizontally round the head, and the other, the undermost one, brought straight over the top of the head

to the forehead, where it is crossed and bound down by the horizontal turn. Thence it is taken back, over the top of the head, by the side of and partly overlapping that already applied, to the back of the head, where it is again crossed and bound down by the horizontal turn. This is repeated backwards and forwards, each succeeding fold being placed nearer to the sides of the head, until it is quite covered, when the ends are secured by a pin or stitch. (See Fig. 8.)

FIG. 8.—CAPELINE BANDAGE.

Four-tailed Bandage.—This belongs to the special class of bandages, and is principally employed in fracture or other injury of the jaw or face.

It is made by taking a piece of bandage, about three feet in length and three inches in breadth, making in its centre a slit three inches long, distant one-third the breadth of the bandage from the one border and two-thirds from the other, and slitting it down at each end to the extent of about ten inches.

In applying it the chin is passed through the slit in the centre of the bandage, the narrower portion at the side of the slit being in front, two of the tails or slit ends are carried back and tied at the nape of the neck, and the other two carried upwards and tied on the top of the head.

Thoracic or Chest Bandages.—The bandages for the chest and upper part of the trunk are the following :—

The thoracic bandage is frequently employed to fix the walls of the chest in cases of fractured ribs, and also for the purpose of retaining dressings in position.

One end of a single-headed roller, either of flannel or calico, eight yards in length, is laid over the sternum, and carried from left to right round the chest, as close under the armpits as possible, and being fastened in front by a pin or stitch, is continued, in spiral, partially overlapping turns, down to the lower margin of the ribs, there fastened at one side by a stitch, and thence taken over the opposite shoulder to the lowermost turn of the bandage, behind where this end is made secure. A few stitches may be used to fasten this brace-like portion to each of the other turns of the bandage in front and behind.

Oblique bandage is employed to retain dressings in the axilla or on the shoulder. If for the left axilla, one end of a bandage being laid on the front of the chest, it is carried down under the axilla, across the back, over the opposite shoulder, and fastened by a pin or stitch in front. The bandaging is continued over this first turn as often as may be required, and finally fastened by a pin or stitch. If for the right axilla the bandage is carried from the chest over the left shoulder, across the back, and down under the arm-pit.

Bandages for the pelvis and lower part of the trunk consist of the spica, the T, the perinæal, and the suspensory. To these may be added the truss, although the latter can scarcely be considered as a bandage.

Spica or Groin Bandage.—This is a bandage in every-day use for retaining dressings or poultices on one or both groins.

To apply it. If the right side be affected the end of a single-headed roller is laid on the thigh of that side, and two turns made round it as a fastening. The bandage is then carried across the lower part of the belly to the opposite haunch, across the back, down along the affected groin, between the legs, and round the thigh, and so repeated as often as may be necessary. (See Fig. 9.)

FIG. 9.—SPICA BANDAGE.

If the left side be affected, after it is attached round the left thigh, the bandage is taken first up along the affected groin to the haunch of that side, then across the back,

and returned across the belly and passed round the thigh, being exactly in the reverse direction to that taken in applying it to the right side.

If required for both groins, sometimes the same bandage is continued from one side to the other, but it is better to bandage each groin separately as above described.

The T Bandage.—This bandage is used for retaining dressings on the perinæum and about the anus.

A roller bandage being passed round the body just above the hips for two or three turns, is fastened by a pin or stitch in front, and then carried downwards by the side of the scrotum, between the legs, and up to meet the circular turn behind.

It is next passed under the circular turn, and carried again between the legs to the front, and so repeated as often as necessary. It is lastly fixed to the circular turn by a pin or stitch.

Perinæal Bandage.—This bandage belongs to the class special, and is employed in the treatment of fractures of the lower extremities by means of the long splint. It will be described under the head of fractures.

Suspensory Bandage.—This is used for suspending the testicles, and also belongs to the special class of bandages.

It consists of a band to go round the hips, and a bag to contain the testicles. The band is buckled round the hips, and the testicles placed in the bag, with the penis through the opening in front.

Trusses.—The truss is an appliance used in the treatment of hernia, or, as it is commonly called, rupture. To understand its use it is necessary to know what rupture is.

By rupture is meant the protrusion of a portion of the contents of the abdomen, generally the intestine, through an opening in the abdominal wall under the skin, where it lies in a sac in the form of a soft tumour, varying in size according to the quantity of intestine protruded. In men

it generally occurs in the inguinal region, either on the left or right side, at the lower part of the belly. The protruded intestine, if allowed to pursue its course, pushes its way under the skin, along the cord to the side of the testicle in the scrotum. The danger to be apprehended is that the intestine may be pressed on and constricted, or, as it is called, strangulated, and if so, death is very frequently the result.

In the treatment, the object in view should be the returning the protruded intestine into the abdomen, and the preventing its re-escape. For the latter purpose the truss is employed.

To return the intestine the patient should be made to lie on his back on a bed, with his thighs drawn up towards his belly. One hand narrows the neck of the tumour while the other manipulates and presses on its base until the contents are felt to slip away from the hand into the abdomen.

The intestine should always be returned before applying the truss; for if the truss press upon the protruded intestine, strangulation may be produced.

The intestine being thus returned, the truss, either right or left sided, according to the side on which the rupture occurs, should be passed round the hips of the patient, the pad placed over the opening in the abdominal wall, and there secured by buttoning the circular strap and perinæal tape.

It should be seen that the truss fits in such a manner as to prevent the gut escaping under it when the patient gets up.

Bandages for the upper extremity are required for various purposes, but it should be borne in mind that, as a rule, none should be applied when the bones of the forearm are broken, for reasons which will be explained when treating of fractures.

In bandaging either an upper or a lower extremity it is necessary to employ a combination of the simple spiral, reverse spiral, and crucial turns, according to the rules already laid down.

Bandage for a Finger or Thumb.—It is necessary to apply bandages to the fingers, not only for the purpose of retaining dressings upon them, but also to prevent them swelling when bandaging the forearm or arm.

The end of a bandage three-quarters of an inch in breadth is attached to the wrist by a couple of turns, then carried over the palm or back of the hand to the root of the finger or thumb, and by two widely separated simple spirals round it to its point, next back again by regular simple spirals until the finger is completely covered, and lastly over the back or palm of the hand to the wrist, where, after a turn or two, the ends are secured, either by a stitch or by tying them both together. (See Fig. 10.)

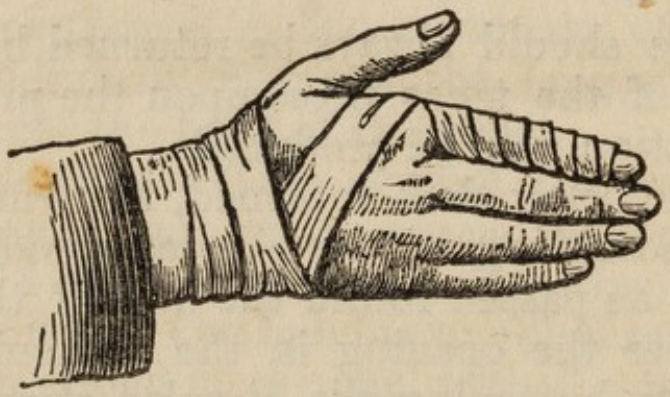

FIG. 10.—FINGER BANDAGE.

Bandage for the Hand and Wrist.—A single-headed bandage is attached by a couple of turns to the wrist. It is then carried round the hand as near the fingers as possible, and back to the wrist by the figure of 8, repeating this until the hand is covered. A turn or two is then taken round the wrist, and the end of the bandage secured. (See Fig. 11.)

Bandage for the Forearm.—A bandage about four yards in length is required for the forearm. Having bandaged the hand and wrist as above described, the bandage is continued by simple spirals to where the forearm commences to increase in size, from which point the reverse spiral turn is employed till close to the elbow, where the end of the bandage is secured. (See Fig. 11.)

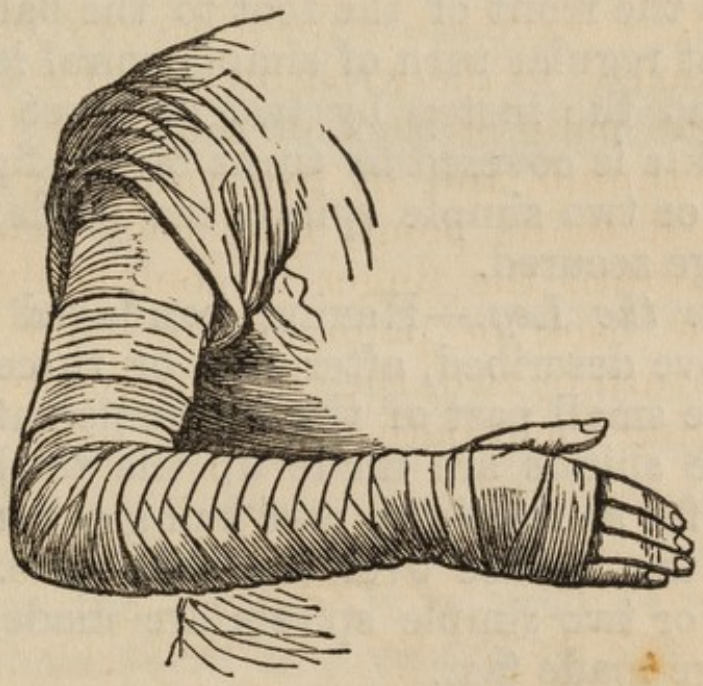

FIG. 11.—BANDAGE FOR UPPER EXTREMITY.

Bandage for the Elbow and Arm.—Having commenced with a bandage six yards or even more in length, and bandaged as far as the elbow as above described, and the arm being placed in the position it is intended to occupy when the bandaging is completed, the elbow is covered by the crucial turn repeated as often as necessary. Immediately above the elbow one or two turns of simple spiral are taken, after which the reverse spiral is employed up the thick part of the arm to the armpit, and the end of the bandage secured in the usual manner. When much pressure is exercised by this bandage, each finger should be bandaged separately to prevent swelling.

Bandages for the lower extremity consist of bandage for the foot and ankle, bandage for the leg, bandage for the knee, and bandage for the thigh.

Bandage for the Foot and Ankle.—The limb being held by an assistant, and the bandager standing opposite to and facing it, a single-headed roller bandage is attached by a couple of turns immediately above the ankle, and then carried across the front of the foot to the balls of the toes, where the first regular turn of simple spiral is made. It is next taken up the instep by two or three reverse spiral turns, the ankle is covered by turns of the figure of 8, and above it one or two simple spirals are made, and the end of the bandage secured.

Bandage for the Leg.—Having bandaged the foot and ankle as above described, after two or three simple spiral turns over the small part of the leg immediately above the ankle, reverse spirals are made up the thick part of the leg nearly as far as the knee, care being taken not to make the turns of the reverse over the shin-bone. Just below the knee one or two simple spirals are made, and the end of the bandage made fast.

Bandage for the Knee.—In bandaging the knee, all the parts below it being first covered as described under bandage for the leg, the crucial is made to cover the knee by as many turns as may be requisite, one loop of the figure 8 being made round the leg close below the knee, and the other round the thigh immediately above it, the cross being on the front of the knee-cap. A couple of turns of simple spiral are made above the knee, and the terminal end of the bandage secured.

Bandage for the Thigh.—During the application of this bandage the leg should be well raised and supported by an assistant.

The limb having been first bandaged as far as and a little above the knee, and a couple of turns of simple

spiral made at that part, the thigh is covered by reverse spiral turns quite to the top, and two turns of the spica are added, which check any tendency on the part of the bandage on the thigh to slip downwards. The end of the bandage is then made fast. (See Fig. 12.)

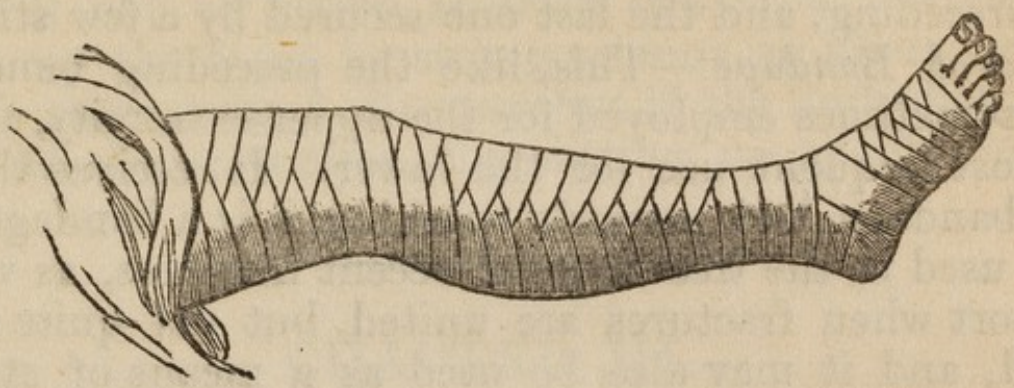

FIG. 12.—BANDAGE FOR LOWER EXTREMITY.

Bandages common to different parts.—These are the many-tailed bandage and the starch bandage.

Many-tailed Bandage.—Although in most frequent use for the lower extremity this bandage is also sometimes employed for the upper. It is used as a substitute for the spiral where there is a wound or sore which requires dressing, or where it is desirable to avoid the movement attending the application of an ordinary roller bandage. It is most frequently employed in cases of compound fracture of the leg, and fractures of the thigh both simple and compound.

To make a many-tailed bandage: a strip of bandage of the length of the part of the limb it is required for is laid on a board or tray; other strips, each six inches longer than the circumference of the limb, are laid at right angles across it, each succeeding strip overlapping the preceding by two-thirds of its breadth. These are all stitched at their centres to the longitudinal strip.

To apply it: the limb being raised, the board or tray with the bandage spread out upon it is passed under it,

care being taken that the strip last laid on shall be towards the part of the limb remote from the body. The limb is now lowered and laid upon the bandage, and the strip last laid on is carried round it and on its front, and so each strip in succession, the succeeding overlapping and fixing the preceding, and the last one secured by a few stitches.

Starch Bandage.—This, like the preceding bandage, is also sometimes employed for the upper extremity, although in most frequent use for the lower. It receives the name of a bandage, but, properly speaking, it is a bandage splint. It is used in the treatment of recent fractures, as well as a support when fractures are united, but not quite consolidated, and it may also be used as a means of steadying fractures in transport.

The materials necessary for its application are calico bandages sufficient to put on two layers, cotton wool, some strips of pasteboard, strips of sticking plaster and starch, and boiling water or dextrine and cold water.

The starch is prepared in a basin, in the same manner as is done by laundresses, by pouring boiling water upon it and beating the mixture thoroughly with a spoon. The pasteboard is cut into strips about two inches in breadth, and softened by pouring boiling water upon them in a basin or tray, and enough bandage to put on one layer is unwound, saturated with the starch mixture, and re-rolled.

The limb, being washed, and held by an assistant in a natural position, is evenly enveloped by a thin layer of cotton wool, having first applied a strip of sticking plaster up the front to prevent the scissors injuring the skin when the bandage is being slit up. The bandage is then neatly applied in the spiral manner (if in the lower extremity, from the toes up to the perinæum, and in a neat spica round the groin), rubbing in the starch mixture as the proceeding advances. Strips of pasteboard are now

placed round the limb at those parts where strength is required, and another spiral bandage applied over the whole, and starch rubbed in as it is applied.

A splint is applied, and sand-bags are placed round the limb, to prevent displacement until the starch has dried, which will not be before at least two days. When dry it is cut up the front by strong scissors, or pliers, or by a penknife run along a director, but if the limb shows any symptoms of constriction, the slitting up should not be delayed.

CHAPTER III.

FRACTURE OF BONES, THE PREPARATION OF PADS AND SPLINTS, AND THE APPARATUS TO BE GOT IN READINESS TO PUT UP EACH KIND OF FRACTURE.

In treating of this subject it would be out of place, and foreign to the object in view, to enter into details which belong to the province of the medical officer. The matter can therefore only be dealt with in a manner calculated to instruct the attendant in the duties which specially belong to him as a nurse.

Fractures are divided into two great classes, according as they are accompanied or not by wounds of the soft parts; *simple*, where the bone is broken without an open wound connected with the broken fragments, *compound*, where, in addition to the bone being broken, there is a wound of the soft parts communicating with the broken fragments. Either of these classes may present an important variety named *complicated*, where, associated with the fracture, there is injury of some organ, vessel, or other important part.

Simple fractures are much less dangerous and much more manageable than either of the two succeeding forms of injury. In the process of repair what is called *callus* is thrown out round the broken ends of the bone, and if movement be prevented by a suitable apparatus, this consolidates and renders the part as strong as it had been formerly in from four to eight weeks.

Compound fractures are much more dangerous than the simple fractures. The repair of the injury, instead of being a question of weeks, may extend over months, even years, limb and life being endangered. Air enters the wound, imflammatory action sets in, suppuration follows, which weakens and exhausts the patient, and the progress of repair is retarded.

Complicated fractures may be more serious than either of the preceding. The complication may become more dangerous to life than the fracture itself. The brain may be pierced by pieces of the skull, the chest may be opened, the lungs may be pierced by the broken ends of the ribs, the arteries or the veins of the thigh, leg, or arm may be opened or torn across by the sharp points of the broken bone.

The simple fracture may be converted into a compound or a complicated fracture by rough handling and bad management on the part of attendants. Therefore, in lifting and laying patients with fractures, attendants cannot be too cautious so as to prevent the less serious kind of injury being converted into either of the other two more serious. When lifting a patient one attendant should give his undivided attention to the fractured limb. He should pass one hand under the limb above the fracture, the other hand under the limb below the fracture, and thus making a bed of the palms of his hands for the limb to rest upon, raise it in such a way as to keep it straight and prevent bending or movement at the seat of injury.

Treatment of fractures.—The object in view is the union of the broken bone and the restoration of the limb to a useful undeformed condition. To accomplish this it is necessary to replace the broken fragments of bone in their natural position, and to retain them in that position until nature by its healing power throws out callus, binds them together, and repairs the injury. To effect the first step the surgeon has recourse to various measures with which it is not necessary to make the attendant acquainted. To effect the second step a variety of apparatus is necessary which it will be the duty of the attendant to prepare and which will presently be described.

During the treatment certain mishaps are liable to occur to which it may be well to direct attention. 1st, if the bandages be put on soon after the occurrence of the injury, swelling may take place, and the bandages become so tight that the limb may become strangulated, the circulation stopped, and mortification take place; 2nd, pain may occur from the pressure of the splint or some other part of the apparatus, or from the weight of the limb resting on an isolated spot, as, for instance, on the heel with the long splint; 3rd, sloughing and bed sores may occur; and 4th, retention of urine may take place.

For the first twenty-four hours after a fractured limb has been put up it should be frequently looked at, and should it be found that the toes or fingers have become swollen, blue, numb, and cold, no time should be lost in informing the medical officer in order that he may undo the bandages.

When pain occurs it may often be relieved by the judicious use of a small pad, some cotton wool or tow, by the relaxation of a fold of the bandage, or a slight change in the position of the limb.

Bed sores should always be guarded against, and much may be done to prevent them, by the use of pillows, the

removal of wet or damp, and crumbs, or other irregularities in the bed.

It frequently happens that patients are unable to pass urine, this inability arising partly from their position, and partly from the shock of the injury. Under such circumstances the medical officer should be at once informed of the fact, in order that the urine may be drawn off.

In fractures of the lower extremities the bed pan and urinal should always be had recourse to, and the greatest care should be taken that no displacement takes place, as is most likely to occur if the bed pan be used in an awkward manner.

Apparatus for the Treatment of Fractures.

For this purpose numerous articles are necessary, splints of various kinds and shapes, pads to suit them, bandages, &c. The apparatus provided in military hospitals for the treatment of fractures is contained in a long box called "Box of Fracture and Dislocation Apparatus."

The following is a list of the contents of this box :—

Iron double inclined plane.
Jointed thigh splint.
Set of japanned leg splints.
Iron extension splint.
Jointed elbow splint.
Ellis's clavicle apparatus.
Pistol shaped splint.
Set of lined splints.
6 pasteboard splints.
1 lb. gutta-percha.
4 yds. gutta-percha tissue.
2 lbs. dextrine.
1 lb. plaster of Paris.
24 hand-loom bandages.
Arm sling.
Leg sling, new pattern.
Dislocation apparatus.
1 lb. cotton wool.

Splints are of shapes suited to the limb injured and are of wood, iron, plaster of Paris, gutta-percha, pasteboard, and starch. The wooden and iron splints for the most part will be found in the "Box of Fracture and Dislocation Apparatus" in a state of readiness. The plaster of

Paris, gutta-percha, pasteboard, and starch splints have however to be specially made for each case of fracture, and it may not be out of place here to give a description of how this is done, though in most cases the surgeon will prepare them himself.

Plaster of Paris splint.—This may be made by one of two methods.

First method. The following articles should be got in readiness :—

1. Plaster of Paris.
2. Flannel.
3. Water.
4. A calico roller bandage.
5. A basin and spoon.
6. A waterproof sheet to protect the bed.

Beforehand the plaster should be tested to ascertain if it will set. For this purpose mix a little with water in a gallicup and allow the mixture to stand for five or six minutes, in which time if the plaster be good it will set firmly. If it will not set firmly then it has absorbed moisture from the atmosphere until it has lost its power of setting. This property may be restored by carefully subjecting the plaster to a dry heat so as to raise its temperature to between 260° and 300° F. This may be done by putting the plaster on a shovel or a pan over a fire or baking it in an oven. While it is being heated it should be carefully stirred, and its temperature should not be allowed to rise above 300° F., otherwise crystalization will take place which will spoil it.

The flannel should be thin and of a size sufficient to envelop the limb.

The broken bone being set, the piece of flannel is to be cut of shape and size fitted to envelop the limb, with the exception of a longitudinal space of about an inch in breadth between the two edges. This done, the calico

roller bandage should be wound spirally round the limb, so as to cover it completely and prevent the hairs sticking in the plaster. These steps being taken, equal parts of plaster and water should be quickly and thoroughly blended together by stirring, and in this mixture should be immersed, with the hands, the piece of flannel about to be used. When the flannel is well saturated and its surface completely covered with plaster, it should be withdrawn from the basin, the folds and creases quickly pressed out of it, and then at once applied and pressed to the limb so as to fit, without, however, permitting the edges to join each other. In this position it should be held steadily until the plaster has set, which will generally not occupy longer than five minutes. (See Fig. 13.) The object of

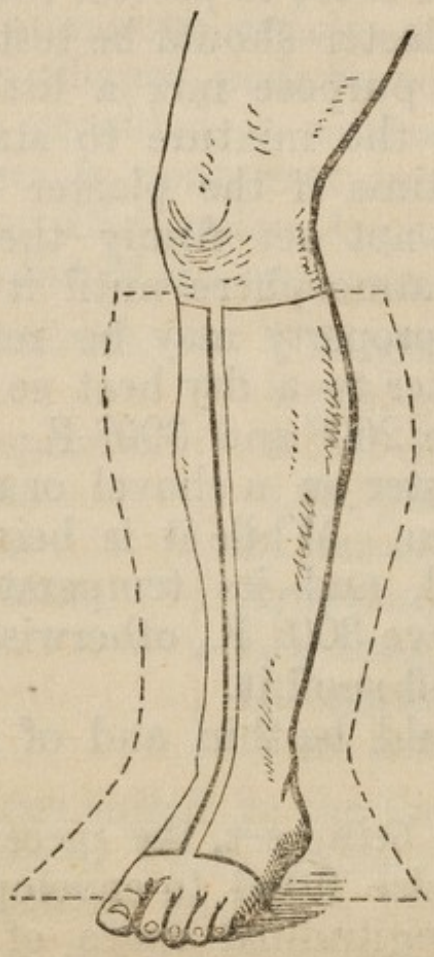

FIG. 13.—FIRST METHOD. PLASTER OF PARIS SPLINT.

keeping the edges apart is to leave a narrow open space up the whole length of the splint to allow for the occurrence of swelling.

Should the splint, after the plaster has set, be considered not to have sufficient strength and firmness, another layer may be applied over it exactly in the same way as the first. The roller bandage being slit up the front of the limb on a director where the edges of the flannel do not meet, another roller may be applied lightly over the whole.

Second method. The following apparatus should be got in readiness to apply the splint by this method :—

1. Flannel sufficient, when doubled, to envelop the limb and overlap to the extent of two inches.
2. Six pins, each three inches long, bent to a right angle three-quarters of an inch from the head.
3. Plaster of Paris, fresh.
4. Water.
5. A basin and spoon.
6. A needle and thread.
7. A roller bandage.
8. A waterproof sheet to protect the bed.

The piece of flannel is doubled and cut of shape and size not only to envelop the limb, but to overlap to the extent of about two inches. The two folds of flannel are then stitched together in a seam along the centre, lengthwise. This done, the limb is laid on the flannel along the seam, and the broken bones being replaced in their natural position, the inner fold of flannel is brought up and its edges pinned together along the upper or front part of the limb, so as to envelop it tightly and evenly. In pinning the edges, the pins should be so inserted that their heads will not be covered by the plaster, otherwise there will be difficulty in withdrawing them when the splint is completed.

The accompanying sketch shows the inner fold of flannel adjusted to the limb and pinned, and the outer fold spread out; also a bent pin. (See Fig. 14.)

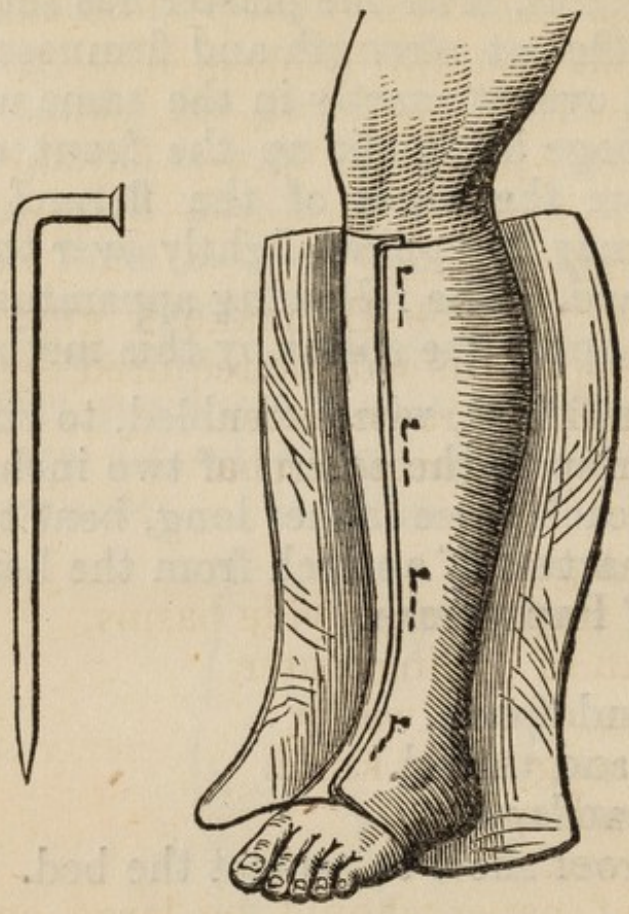

FIG. 14.—SECOND METHOD. PLASTER OF PARIS SPLINT.

The next step is to mix the plaster of Paris with water, using about equal quantities of each. When the mixture thus formed begins to show signs of setting, it should be turned out of the basin into the angles at each side of the limb, between the two folds of flannel. The outer fold is then brought up round the limb over the layer of plaster, and its edges being brought together and held tightly in that position, the plaster thus retained between the two folds of flannel should be pressed and smoothed with the hand so as to form a well-fitting case for the limb.

When setting of the plaster has taken place, the pins are withdrawn, the edges of the flannel trimmed off, and a roller bandage, or a few straps with buckles, applied round the whole.

By this method a splint is formed in two parts, hinged to each other by that part of the flannel where the seam is. One side or both can be let down without disturbing the fractured limb, when it is necessary to expose it for dressing a wound or other purpose.

Gutta-percha Splint.—To make a gutta-percha splint, the following apparatus will be required :—

1. A sheet of brown paper.
2. A sheet of gutta-percha.
3. Lint.
4. Bandages.
5. Two trays or two wide basins.
6. A can of boiling water.
7. A can of cold water.
8. A strong sharp knife.
9. A brad-awl.
10. A towel.

The sheet of paper should be large enough to cut a pattern of the splint for the limb to which it is to be applied. Any other kind of paper will do as well as brown.

The sheet of gutta-percha should be a quarter of an inch thick, and large enough to admit of a splint being cut according to the pattern.

The lint is for lining the splint, and should be sufficient for this purpose.

The bandages to be provided will be according to the part to which the splint is to be applied.

The trays or basins should be wide enough to allow the sheet of gutta-percha to be completely immersed in the water.

A pattern of paper is cut by fitting it to the limb. The gutta-percha is then cut with the knife to the size and shape of the paper pattern.

The cold water is put into one tray and the boiling water into the other, with the towel laid in it, with its edges over the sides. The gutta-percha is then laid on the towel and completely covered by the boiling water. The limb being set and in position, the gutta-percha is withdrawn by means of the towel and plunged for a moment into the cold water, then moulded to the shape of the limb. This done, it is removed, perforated with the brad-awl, and lined with the lint.

Pasteboard Splints.—To make pasteboard into splints, the following apparatus will be required :—

1. A sheet of brown paper.
2. A sheet of pasteboard.
3. A sharp knife.
4. A can of boiling water.
5. A tray or wide basin.
6. A towel.

A pattern of the splint is cut by fitting the brown paper to the limb to which the splint is to be applied. Next the pasteboard is cut of the size and shape of the pattern. The tray is then prepared with the hot water and towel, and the pasteboard laid on the towel, completely covered by the water, is allowed to soak until it has become soft and pliant, when it is withdrawn by means of the towel and moulded to the limb.

Starch Bandage.—The manner of making this will be found fully described under the head of Bandages.

Pads are of great importance in the treatment of fractures, and, though a supply may be kept ready in store, it will generally be necessary to make them for each case. They should be a little larger than the splints to be employed, otherwise the edge and ends of the splints will

come in contact with the skin. Their thickness will vary from a quarter of an inch to an inch, and they should be uniform and free from lumps and inequalities. Ticking, calico, or what is better suited, old sheeting, is used as a covering, and either hair, cotton, tow, or wool is employed as stuffing. To prepare a pad, a piece of old sheeting is folded double and cut to the shape required, and a little broader than the pad is intended to be made, to allow for the narrowing caused by the stuffing. It is then opened out and the stuffing well teased and laid evenly over one-half of it in a layer of the required thickness; the other half is now folded over it, and the edges being brought together are whipped along with a needle and thread. A few stitches may be put in at intervals along the centre of the pad to keep the stuffing from shifting. Another method of making a pad is to sew the cover into a bag, leaving one end or a part of the side open, then turning it inside out; the stuffing is introduced through the opening. In this method the seam being inside, the pad appears neater, but the objection to it is that the padding is liable to get into lumps and be uneven.

Fractures of the different Bones.

Fracture of the Lower Jaw.—This bone may be broken in various situations, but near the centre is the most frequent place for the injury to occur.

Apparatus to be got in readiness :—

1. A sheet of brown paper.
2. A sheet of gutta-percha.
3. Lint.
4. A four-tailed bandage.
5. Some strong silk ligature thread.
6. Two pieces of cork.
7. Two basins.

8. A can of boiling water.
9. A can of cold water.
10. A towel.
11. A strong sharp knife.
12. A brad-awl.

The sheet of gutta-percha should be a quarter of an inch thick, and large enough to cut a splint according to the pattern.

The two pieces of cork should be wedge shaped, each an inch in length, half an inch thick at the base, and three-quarters of an inch broad.

Fracture of the Ribs.—Apparatus to be got in readiness :—

1. Diachylon plaster.
2. An eight yard bandage.
3. A can of hot water.

The plaster should be spread on leather and cut into strips two inches wide, and long enough to reach from the spine to the breast bone. A sufficient number of strips to cover the whole of the injured side should be prepared.

The bandage may be of calico, and should be at least three inches wide, or it may be of flannel, and should then be four or five inches wide.

Fracture of the Clavicle or Collar-bone.—Fracture of this bone is of frequent occurrence, and it may take place at any part. The principle of the treatment consists in supporting the weight of the arm, and keeping the shoulder out from the chest.

Apparatus to be got in readiness :—

First method :—

1. Axillary pad.
2. Two eight-yard bandages.
3. A needle and thread.

The axillary pad should be wedge-shaped, six inches long, four inches broad, and two inches thick at the base,

with two pieces of broad tape, each two feet long, stitched to its sides to tie over the opposite shoulder.

Second method :—

1. Ellis's clavicle apparatus.
2. An arm sling.

Ellis's clavicle apparatus (Fig. 15) consists of a padded crutch (2), a shoulder belt (1), and a thoracic belt (3).

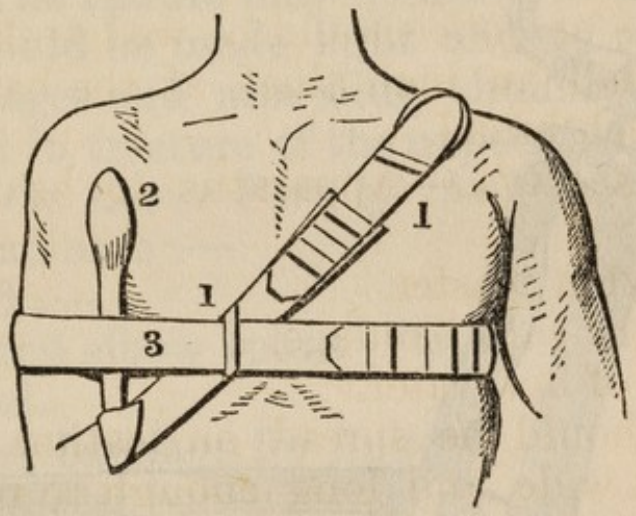

Fig. 15.

The arm sling may be made of a triangular bandage or of a handkerchief.

Fracture of the Humerus.—Fracture of this bone may be divided into three classes, according to the position of the injury, and the apparatus employed in their treatment varies according to its position, viz., fracture of the upper part, fracture of the middle part, and fracture of the lower part.

Fracture of the Upper Part of the Humerus.—Apparatus to be got in readiness :—

1. Rectangular or iron extension splint (Fig. 16).
2. A lined splint.
3. Two pads.
4. Roller bandage for fingers.
5. Two roller bandages for arm.
6. An arm sling.

The pads should be made to suit the splints. That for the iron extension splint should be light and thin, of the same shape as the splint, but a little broader. The two roller bandages for the arm should be each 2½ inches broad and six yards long.

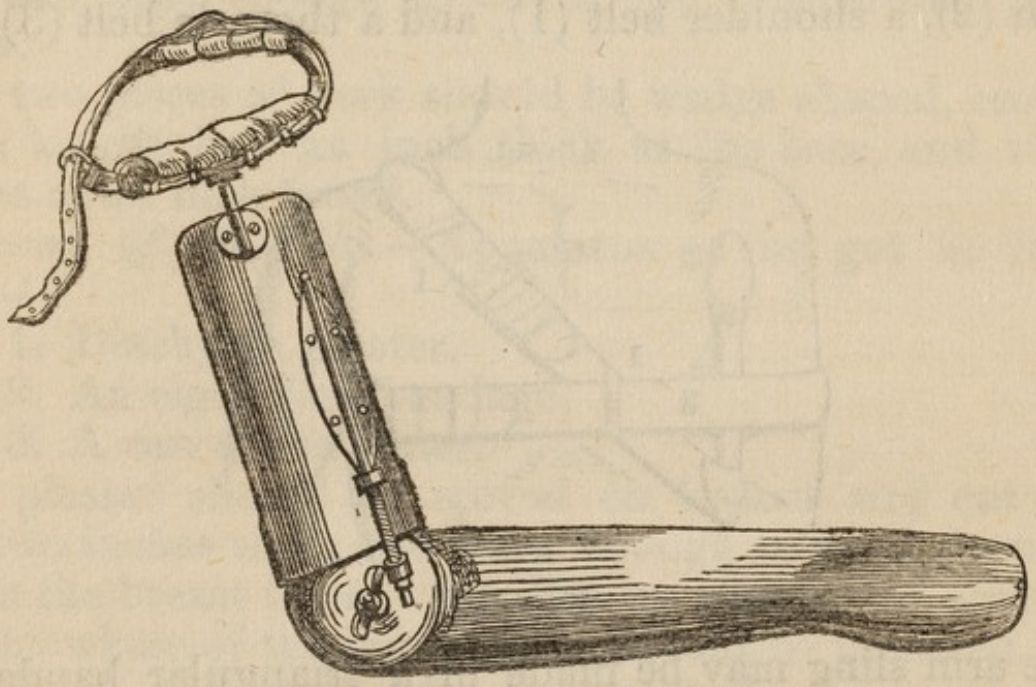

FIG. 16.—RECTANGULAR OR IRON EXTENSION SPLINT.

The bandage for the fingers should be ¾ of an inch broad and four yards long, or it may be in five pieces, each a yard in length.

The arm sling may be made of a triangular bandage or of a handkerchief.

Fracture of the Middle of the Humerus.—Apparatus to be got in readiness.

1. Four lined splints.
2. Four pads.
3. Roller bandage for fingers.
4. Two roller bandages for arm.
5. Arm sling.

Lined splints are of different lengths. In selecting them, that for the outer side of the arm should be long enough to extend from the point of the shoulder to the elbow; that for the inner side, from the armpit to the elbow; that for the back from the shoulder to the point of the elbow; and for the front, the shortest of the four, from the shoulder to the bend of the elbow when the arm is bent at a right angle. The splints may be fitted to the sound arm.

The pads should be made light and to suit the splints, while the bandages and arm sling should be the same as those described in fracture of the upper part of the humerus.

Fracture of the Lower Part of the Humerus.—Apparatus to be got in readiness :—

First method :—

1. Jointed elbow splint (Fig. 17).
2. A pad.
3. Roller bandage for fingers.
4. Two roller bandages.
5. Arm sling.

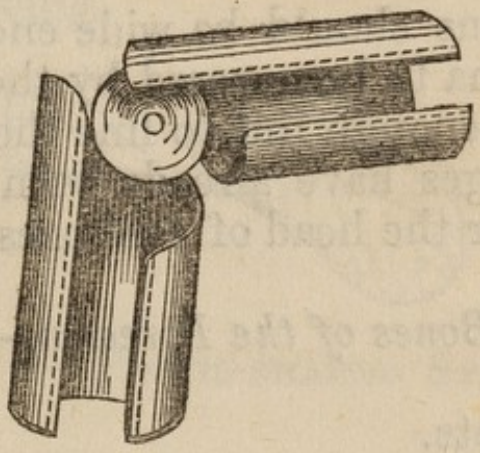

Fig. 17.—Jointed Elbow Splint.

The jointed elbow splint will be found in fracture box. The pad for it should be thin and sufficiently broad to line the whole inside of the splint, or it may be in three parts.

The bandages and arm sling have already been described in fracture of the upper part of humerus.

Apparatus to be got in readiness :—

Second method :—

1. A sheet of gutta-percha.
2. Two trays or wide basins.
3. A can of boiling water.
4. A can of cold water.
5. A strong sharp knife.
6. A towel.
7. A brad-awl.
8. Lint.
9. Bandages for fingers.
10. Two roller bandages for arm.
11. Arm sling.
12. A sheet of paper.

The sheet of gutta-percha should be $\frac{1}{4}$ of an inch thick, and long enough to extend from the armpit down over the elbow to the wrist about 18 inches, and broad enough to nearly surround the limb.

The trays or basins should be wide enough to allow the sheet of gutta-percha to be covered by the water.

There should be enough lint to line the splint.

The roller bandages have already been described, as also the arm sling under the head of fractures of the upper part of humerus.

Fractures of the Bones of the Forearm.—Apparatus to be got in readiness :—

1. Two splints.
2. Two pads to suit the splints.
3. An interosseous pad.
4. A six-yard roller bandage.
5. An arm sling.

The two splints are not in the box of fracture apparatus. They have to be made for the purpose. They should be

straight boards, about ¼ of an inch thick, and a little broader than the forearm. That for the back should be long enough to extend from the elbow to the knuckles, and that for the front from the front of the elbow when bent to the ball of the thumb.

The two pads for the splints should be a little thicker towards the lower ends.

The interosseous pad is made by folding a piece of lint, and should be six inches long, one inch broad, and ½ an inch thick.

The bandage and arm sling have been described under the head of fracture of the upper part of humerus.

Colles's Fracture.—This is a fracture of the lower end o the outer bone of the forearm.

Apparatus to be got in readiness :—

1. Pistol-shaped splint (Fig. 18).
2. A pad to suit the splint.
3. A roller bandage.
4. An arm sling.

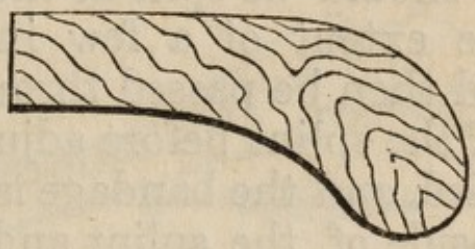

FIG. 18.—PISTOL-SHAPED SPLINT.

The splint will be found in the fracture box. The pad should be made of the same shape as the splint, a little thicker towards its lower end. The bandage should be six yards long and 2½ inches broad.

A triangular bandage or a handkerchief will make the arm sling.

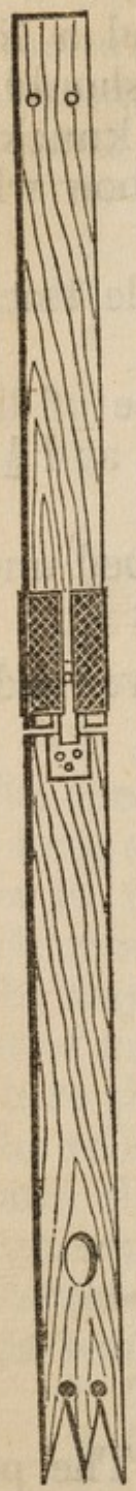

FIG. 19.
LISTON'S
LONG SPLINT.

Fracture of the Thigh.—Apparatus to be got in readiness :—

1. Liston's long splint. (See Fig. 19.)
2. Three lined splints.
3. Pads to suit splints.
4. Two roller bandages.
5. A perineal bandage.
6. Four straps.
7. Some cotton wool.
8. A piece of washed leather.
9. A wire cradle.

Liston's splint will be found in the fracture box. It should be straightened, and the brass slide pushed over the joint to fix it.

The three lined splints should be long enough to extend from the groin to the knee.

The pads should be made to suit the splints, and tied on to them by pieces of tape.

The roller bandages should be eight yards in length and three inches in breadth; one roller should be split at the end into two tails to the extent of a few inches. These tails should then be passed through the holes at the top of the splint before adjusting the pad to it and tied, and the bandage is then carried along the inside of the splint and fastened by a pin temporarily at the notches in the lower end.

The perineal bandage is prepared by folding a handkerchief or a triangular bandage, stuffing its centre with a little cotton wool, and covering it at this point to the extent of 10 or 12 inches, with oiled silk to prevent its absorbing perspiration.

The straps should have strong buckles, and be sufficiently long to go round the limb with the splints.

If straps are not available, four pieces of roller bandage, each a yard long, will answer the purpose.

The cotton wool should be in a sheet, and is for going round the heel and instep of foot. The wash leather is for the same purpose, and should be about four inches broad by 12 or 15 long.

Fracture of the Bones of the Leg. — In fracture of the bones of the leg, either McIntyre's splint or iron side splints may be employed. The former is most commonly used where the fracture is complicated with a wound of the soft parts which requires dressing.

Apparatus to be got in readiness :—

First method :—

1. McIntyre's splint (Fig. 20).
2. Two pads to suit the splint.
3. Three roller bandages.
4. A board.
5. A couple of screws.
6. A gimlet.
7. A screw driver.

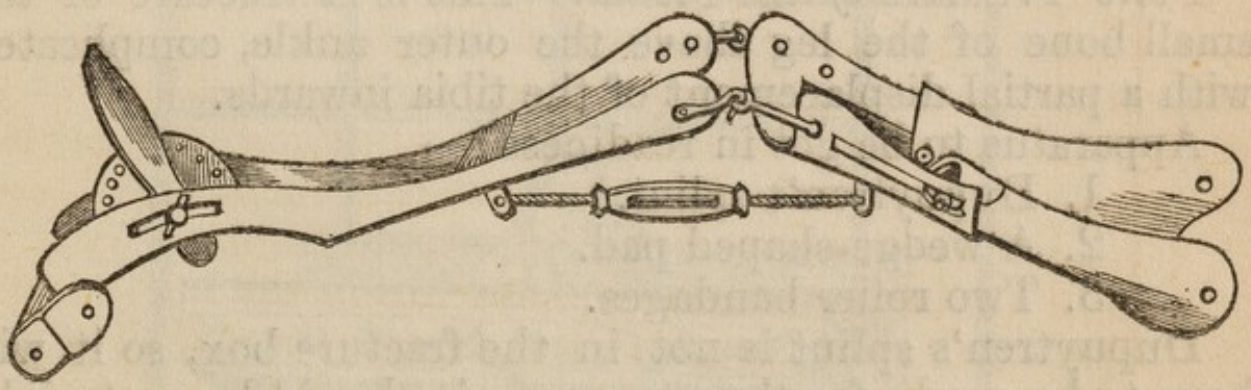

FIG. 20.—MCINTYRE'S SPLINT.

McIntyre's splint will be found in the box of fracture apparatus. It may have a screw to bend or straighten it, as shown in the illustration, or it may have a key for the purpose.

One broad pad should be made to line the splint throughout, and another small pad to cover the foot-piece.

The bandages should be each eight yards long and three inches wide.

The board should be an inch thick, and from six to 12 inches wide, and long enough to extend from one side of bed to the other, but not so long as to project.

Second method :—

1. Two side splints. (See Fig. 21.)
2. Two pads.
3. Four straps.
4. Salter's cradle. (See Fig. 22.)

The side splints will be found in the box of fracture apparatus, and may be of iron or wood. That with the foot-piece is for the outside of the limb, and that without a foot-piece for the inside.

The pads should be made of the same shape as the splints. The straps with buckles will generally be found with the splints. Salter's cradle is packed in pieces, and should be put together for use.

Potts' Fracture of the Fibula.—This is a fracture of the small bone of the leg above the outer ankle, complicated with a partial displacement of the tibia inwards.

Apparatus to be got in readiness :—

1. Dupuytren's splint.
2. A wedge-shaped pad.
3. Two roller bandages.

Dupuytren's splint is not in the fracture box, so it will have to be made for the purpose. It should be a straight board $\frac{1}{4}$ of an inch thick, three inches broad, and long enough to extend from a little below the knee to four inches beyond the sole of the foot.

The pad should be wedge-shaped, two inches thick at the thick end, and long enough to extend from the knee to the inner ankle.

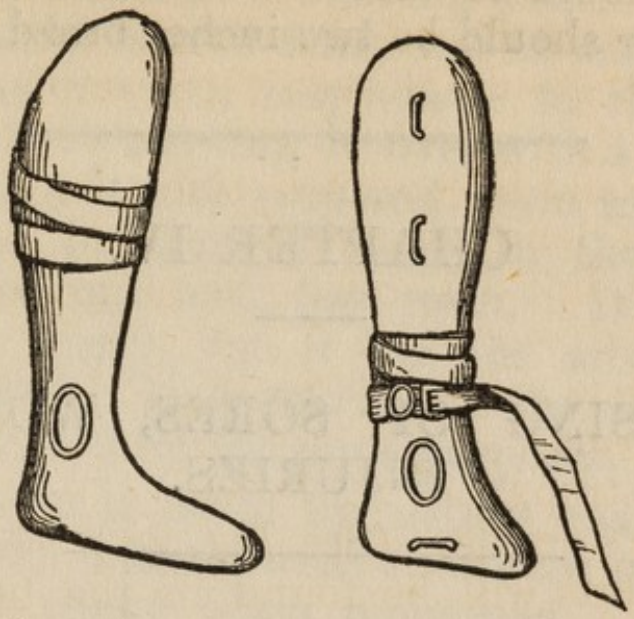

FIG. 21.—IRON SIDE SPLINTS.

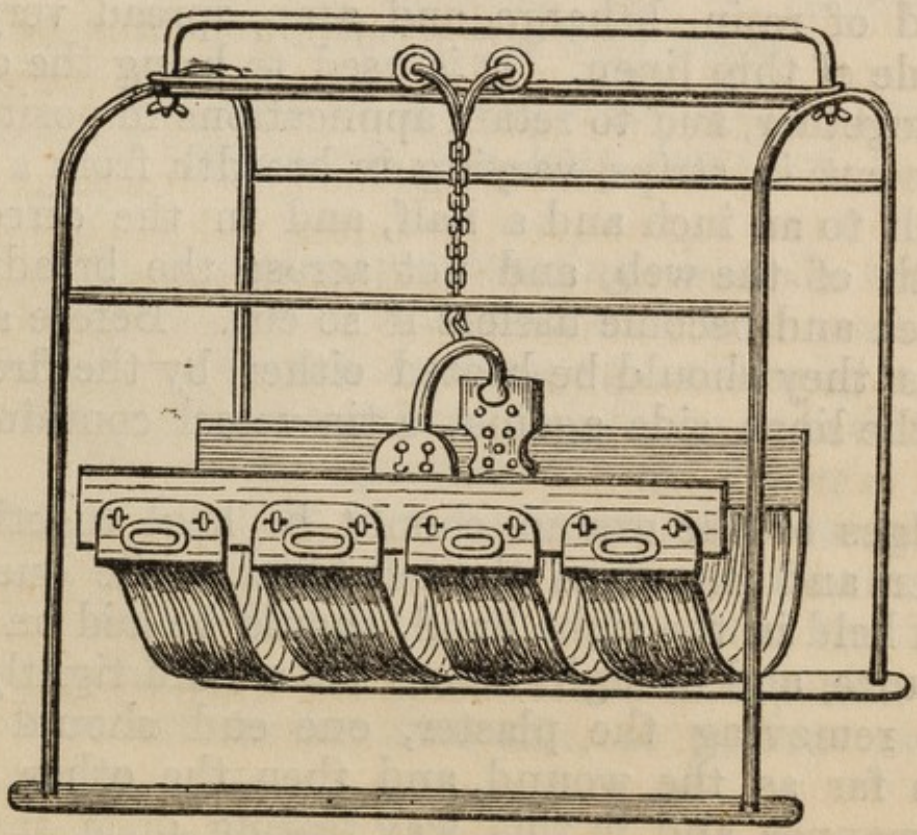

FIG. 22.—SALTER'S CRADLE.

One roller should be three inches wide and three yards long; the other should be two inches broad and four yards long.

CHAPTER IV.

THE DRESSING OF SORES, WOUNDS, AND INJURIES.

Apparatus generally employed in Dressing.

Sticking plaster, called adhesive plaster, or resin plaster, is generally used as part of a dressing. It consists of a compound of resin, litharge, and soap, spread very thinly on one side of thin linen. It is used to bring the edges of wounds together, and to retain applications in position. It should be cut in strips, varying in breadth from a quarter of an inch to an inch and a half, and in the direction of the length of the web, and not across the breadth, as it will stretch and become useless if so cut. Before applying the strips they should be heated either by the fire, or by holding the linen side against a tin vessel containing hot water.

The edges of the wound should be held together with the finger and thumb of the left hand, while one end of the strip, held in the right hand, should be laid on the skin at a distance, and brought across the wound tightly.

When removing the plaster, one end should first be raised as far as the wound, and then the other end in a similar manner, and in this way tearing open the wound will be avoided.

Before the application of sticking plaster to any part of the body it should be well dried, and all hairs be shaved off. Any of the plaster which may adhere to the skin will be readily removed by rubbing it over with a little olive oil, and then washing it with soap and warm water.

Soap Plaster is prepared much in the same way as sticking plaster, but with less resin. It therefore does not adhere so firmly, but it has the advantage of not irritating the skin. It is applied in the same manner as sticking plaster, and for the same purposes.

Isinglass Plaster is made by coating one side of a thin silk material with a transparent substance named isinglass, which becomes sticky when moistened. It is employed for bringing together the edges of wounds. It is rendered sticky by moistening the coated side with a damp sponge, care being taken not to rub the sponge more than once over it, otherwise the isinglass will be removed. It is easily removed by moistening it with water.

Bandages are used to retain dressings in position, and their mode of application has been described in the foregoing chapter.

Oiled Silk is made by saturating thin silk with an oil, which renders it impervious to water. It is used to prevent the escape of moisture from dressings, either by evaporation or by contact with the patient's clothing or bedclothes. It is also used as a "protective" in Lister's antiseptic dressing, but for this purpose it requires to be specially prepared, by coating it over with copal varnish, and covering it with a thin layer of dextrine and starch.

Gutta-percha Tissue is a thin semi-transparent substance used as a substitute for oiled silk, to prevent evaporation from dressings.

Oiled paper is also sometimes used as a substitute, but it tears easily, and is not very effective.

Lint is almost invariably used for dressings by British surgeons. It is a soft linen woven material, with a nap on one side. It should always be cut with scissors and not torn, as it will pull into shreds if the latter be attempted.

The side on which the nap is should be placed next the skin, and on this side all ointments should be spread; but on this point there is difference of opinion.

Lint may not be at all times available, therefore it may not be out of place to give a method by which it can always be made to meet such an emergency. Mr. Bridgman of Norwich has given the following very concise directions:—

"Take a strip of linen, old or new, about six or eight inches long, and of any convenient width—say from one to two, or three inches, to constitute the foundation of the future piece of lint. In this state the strands are too hard and too harsh to be tolerated upon an abraded surface, therefore they require to be softened and scraped up into a pile or nap. To do this, place the strip on the knee, over a piece of thick soft cloth, such as coats are made of, or on a pad covered with this substance, and then with a common table knife commence to scrape the fibre of the linen until it has acquired a woolly appearance. There is some little knack in doing this, but it is soon acquired by practice. The knife should be not too sharp, but with rather a roughish edge. It should be grasped firmly in the right hand (while the strip is held tightly by the left), and with the thumb a little in advance pressed well down, the blade may be made to work on it as on a pivot. The blade should be placed diagonally to the angle formed by the crossing of the threads, and then pressed firmly down, and by a kind of grinding motion extending through not more than an eighth of an inch the upper parts of the threads will be cut or torn and pushed up into a nap."

Charpie is almost universally used for dressing purposes by continental surgeons. It is composed of ravellings, or shreds, torn or scraped from linen, and is of two kinds, viz., torn or rough charpie, and scraped charpie.

Torn or rough charpie is prepared by taking pieces of old soft linen or lint, varying in size from two to four or six inches square, according to the kind required, whether short, medium, or long. Tear the linen in pieces in preference to cutting it. Take each piece firmly in the left hand, unravel it thread by thread with the forefinger and thumb of the right hand, and mix the whole up softly, removing all knots, hard threads, and lumps.

Scraped charpie resembles soft flocculent down in appearance, and is prepared by scraping old soft linen. Take a piece of linen, stretch it in the most convenient way, so as to keep it on the strain, and scrape it with a knife, collecting the down thus removed; mix it softly, removing all lumps.

The linen from which charpie is made should be soft and scrupulously clean. If it is at all soiled, it should be previously thoroughly washed with boiling water and soap.

Charpie when packed should be kept in boxes, free from damp and moisture.

Oakum was used in the American war as a substitute for lint and charpie, and was found to possess so many advantages that it is likely in future to be extensively employed in military surgery.

The material is old rope, shredded in prisons and workhouses, and carded by machinery. It is of a bright brown colour, with a tarry odour.

A little of the oakum thus prepared is teased and drawn into a suitable shape for covering the wound, and applied in the same manner as charpie. It absorbs the discharge from wounds, and being impregnated with tar, acts as a disinfectant to destroy any bad odour arising from them.

Antiseptic gauze. This material is coarse gauze impregnated with a solution of carbonic acid in paraffin and resin. It is used in Lister's antiseptic dressing.

Cotton wool, or Medicated Cotton, is the raw material from the seeds of the cotton plant, purified, bleached, carded, and rolled into sheets or flakes. It is a white, soft, downy material, employed for stuffing the pads for splints, sometimes in dressings, also to envelop any part which exhibits an uneven surface in order to equalize the pressure of bandages upon such parts. In the application of the starch bandage it is used to prevent, by its yielding properties, the constriction of the limb by the contraction of the bandage in drying.

Tow is the fibre of flax or hemp teased and loosely carded into sheets, and done up in rolls. It is employed to absorb discharge from wounds, as a substitute for sponges in washing wounds, and as a material upon which poultices are spread before applying them; for which latter purpose, however, old pieces of rag may be used if at hand. It is also used for stuffing pads for splints.

Sponges are employed in dressing wounds as a means of conveying water to the part, and to remove by patting or dabbing any matter which may adhere to the surface of the wound. Their use, however, for dressing purposes is in many cases objectionable. They are expensive, and so have to be repeatedly used, while they are difficult to keep clean, and may be the means of conveying poisonous matter from one wound or sore to another. Tow and oakum, from their cheapness, answer the purpose better, as they can be destroyed or thrown away after use.

Sponges are also used in operations in order to absorb the blood, which would otherwise hide the parts from the view of the operator. When used for this purpose they should be soaked in water, as cold as can be obtained, and

then squeezed thoroughly dry before applying them to the wound.

Whenever sponges are employed for any purpose great care should be taken to cleanse them thoroughly, by washing in several relays of water, to which some disinfecting fluid has been added.

Water is employed in dressing to cleanse the wound or sore from discharge and other substances which may be adhering to it. It should in all cases be scrupulously clean, and, where possible, the supply abundant.

The temperature at which water is applied to wounds varies according to the nature and state of the injury, and ranges from ice cold to blood heat. This, however, and the manner of applying it, will be described hereafter when speaking of the manner of preparing wounds to receive dressings.

Water is also used as a dressing of itself, in water dressing, evaporating dressing, and irrigation, and its use is described under those heads. It is also employed in fomentations.

Basins for dressing purposes should be of a size large enough to contain sufficient water to thoroughly wash the

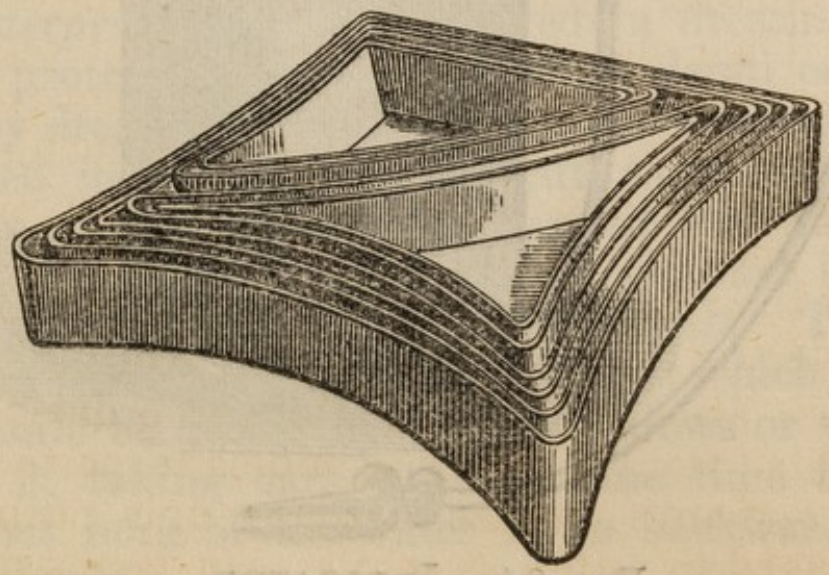

FIG. 23.—ANGULAR TRAYS.

wound. One is placed below the part to be washed in such a position as to catch the water as it flows off the wound, while another contains the fresh water which is being allowed to trickle over the wound. The angular trays which have lately been introduced into the service by Surgeon-Major Fitzgerald, are far superior to basins for catching the refuse water or discharge. From the shape of their sides they can be made to fit against any part of the body and thus catch the discharge without being placed underneath the part. These trays are very light and portable, one fitting inside the other, or as it is called "nested." (Fig. 23.)

By the use of two basins the water applied to the wound is kept constantly fresh and free from contamination by discharge, &c. from the wound, and the risk of conveying

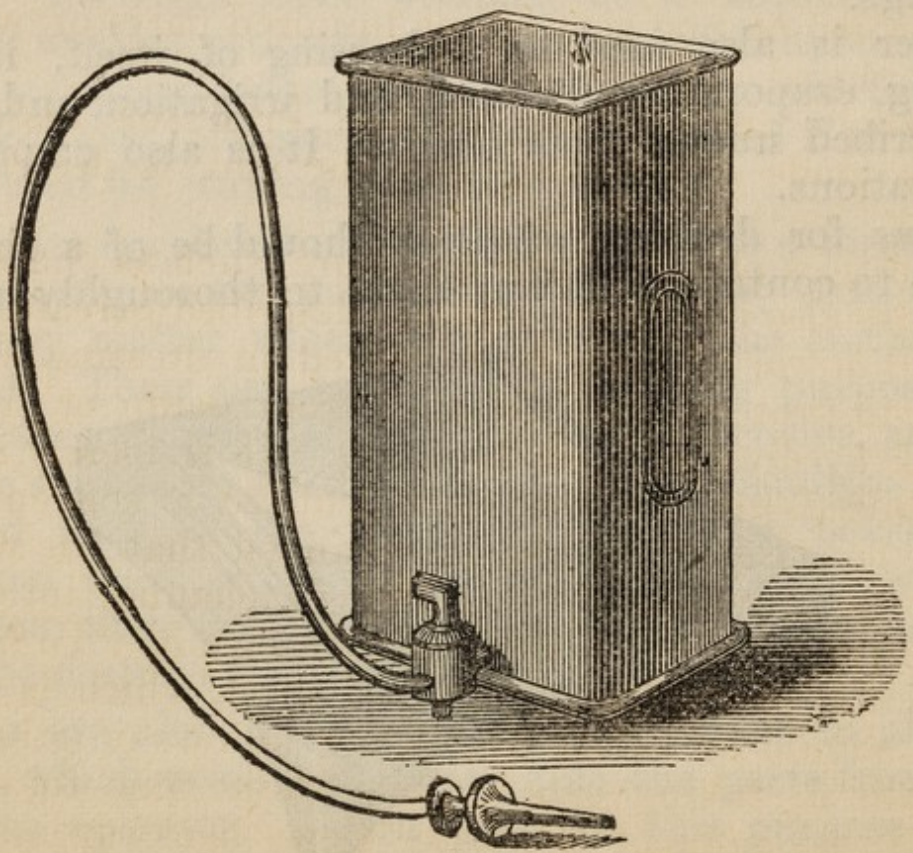

FIG. 24.—IRRIGATOR.

contagious matter from the wound to the hands of the attendant is greatly diminished.

Basins, after being used, should be emptied and thoroughly washed (with hot water, if possible), and with the addition of some disinfecting fluid.

Irrigator.—The irrigator, as shown in the accompanying Figure 24, has lately been introduced into the service from the Germans. It is a tin vessel fitted with a stop-cock, a tube, and nozzle.

Disinfectants.—In wounds which give off an offensive odour some one or other of the disinfectants now in common use should be added to the water with which they are washed, and the washing of the wound continued until the offensive smell is destroyed. For this purpose either carbolic (phenic) acid, in the proportion of one part to two hundred parts of water, or Condy's fluid in the proportion of one part to one hundred parts of water may be employed.

Carbolic acid is also used in Professor Lister's antiseptic mode of dressing wounds, and is described elsewhere.

Poultices of a deodorizing nature, such as charcoal poultice, are also employed, and are described hereafter.

A *Waterproof sheet* is employed in dressing wounds in order to protect the bedclothes from damp or from being soiled by dressings or discharge. It is merely a piece of vulcanized india-rubber cloth, cut to a convenient size, and when used should be so arranged that the water spilt on it is conveyed by a gutter or channel into a vessel placed by the side of the bed to receive it. To insure this the centre part of the waterproof sheet, which is under the limb, should be raised by placing pillows or other articles beneath it, taking care at the same time that it is so placed that none of the water flows backwards under the patient's body.

In the absence of a waterproof sheet, an ordinary cotton or linen sheet, folded in several thicknesses, should be placed in a similar manner under the part to be washed, in order to absorb the moisture.

Dressing-tray.—A tray, either of tin or wood, is employed for the purpose of containing the materials and appliances necessary in dressing wounds. Thus each article will be by the bedside of the patient when it is needed.

Scissors.—A pair of strong sharp scissors is necessary to cut up clothing, and to cut lint, sticking plaster, and other dressing materials.

Dressing case.—A case for the use of nurses has lately been introduced into the service. It is made by Messrs. Evans and Wormull, 6, Dowgate Hill, London. It contains a pair of scissors, a pair of dressing forceps, a strong knife, a spatula, a probe and director, needles, pins, and thread.

Spray producer.—This instrument is used in applying Lister's antiseptic dressing. The drawing (Fig. 25) is taken from one by the maker, Mr. J. Gardner, Edinburgh. The directions given for use are the following:—"To " maintain a satisfactory cloud of spray, the uncovered ball " (A) should be fully and frequently worked until the net- " covered ball (B) is distended; and the distension should " be kept up throughout the operation by less frequent, " though complete compressions. This method lessons " considerably the fatigue of working.

"Work the bellows with the right hand by alternate " compression and relaxation, as usual. Hold the bottle " in the left hand and compress the india-rubber tube (C) " against the side of the bottle until the net-covered ball " is well distended; then compress the short india-rubber " tube (D) at the top of the instrument with the thumb, " whilst the jet of liquid is regulated with the right hand

" by means of the stop-cock (E) according to the volume
" and coarseness of the spray required.
" If the jets (F) become obstructed, remove them from the
" instrument, and pass carefully through them (after loosen-
" ing the screw (G) from the broad end) one of the needle
" wires supplied with the instrument. The wire guard (H)
" secures the india-rubber stopper while the instrument is
" in use."

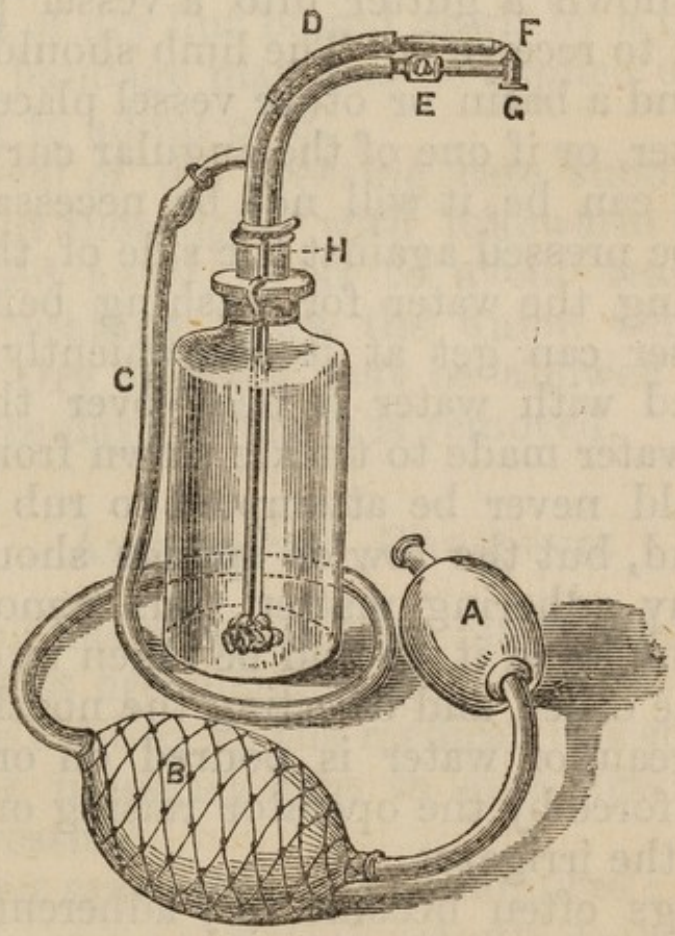

FIG. 25.—LISTER'S ANTISEPTIC SPRAY PRODUCER.

PREPARATION OF THE PART BEFORE THE APPLICATION OF A DRESSING.

Washing.—To wash a recently inflicted wound cold water should be employed, as it has a tendency to stop the bleeding, while warm water favours it; but in the case of

old wounds or ulcers, warm water at a temperature of about 98° is better suited, being more grateful to the feelings of the patient, and being more effective in softening hardened dressings, and cleansing a foul surface. Some disinfecting fluid should be added to the water when the discharge is offensive.

In washing a wound or sore the bed should be protected by a waterproof sheet, so arranged that any water falling on it will run down a gutter into a vessel placed by the side of the bed to receive it. The limb should be raised by an assistant, and a basin or other vessel placed under it to receive the water, or if one of the angular curve sided trays be used as it can be, it will not be necessary to place it under, it can be pressed against the side of the part. The basin containing the water for washing being placed so that the dresser can get at it conveniently, the tow or sponge charged with water is held over the wound or sore, and the water made to trickle down from a height on to it. It should never be attempted to rub the surface of a sore or wound, but the tow or sponge should be patted on it, and any adhering matter thus removed. If the irrigator be employed it should be taken in one hand and the tube in the other, and directing the nozzle towards the wound the stream of water is poured on or into it, with much or little force by the operator raising or lowering the hand holding the irrigator.

Old dressings often become very adherent and stiff by blood and discharge, and no small amount of patience is necessary to soften and saturate them thoroughly, but no attempt should ever be made to drag them away by force. The old dressings are to be thrown into the bucket, and removed from the ward as soon after as possible.

Hairs in the vicinity of a wound always give rise to trouble in the removal of dressings, therefore as a precautionary measure the part about to be dressed should, in

the first instance, be cleanly shaved, or the hair closely clipped.

Kinds of Dressings.

Dry dressing is generally used as the first application to wounds. It consists of plaster and dry lint. The edges of the wound should be brought together as nearly as possible by strips of plaster, and over these should be placed a couple of folds of dry lint bound down by a few more strips of plaster. A bandage may also be applied over the whole if in a position to admit of it.

In the removal of dry dressing care should be taken to saturate the lint thoroughly with lukewarm water while it is gently pulled away, so as to avoid tearing open the wound, and breaking down the union which may have taken place. Dry dressing may be allowed to remain on for two or three days before it is removed.

Antiseptic Dressing.

This dressing has recently been introduced by Professor Lister. The first dressing, owing to various complications, will have to be applied by the medical officer, so, therefore, it will only be necessary here to give directions for continuing the dressing.

The following apparatus will be required:

1. A "spray producer," the bottle filled with the following lotion.
2. Carbolic acid lotion (1 to 100).
3. A small basin containing some of the preceding lotion.
4. A "guard" consisting of a piece of linen or lint.
5. A "protective" of prepared oiled silk, cut of a size a little larger than the wound it is meant to cover.

6. A pad of "antiseptic gauze," consisting of eight folds of gauze, and large enough to extend six or eight inches at each side of the wound.
7. A piece of thin macintosh, the same size as the pad of gauze, and placed between its seventh and eighth folds.
8. An "antiseptic gauze" roller bandage.

An assistant should work the "spray producer" and direct a cloud of spray over the part, while the dresser having dipped his fingers in the carbolic lotion, as well as all instruments employed, should remove carefully and quickly the old dressing. This done he should take the "guard," or piece of linen, saturate it in the lotion and cleanse the wound. All this time the whole part should be enveloped in a cloud of spray. If the spray should cease from any cause the piece of linen or guard should be laid over the wound. The wound being cleansed the protective should be dipped in the lotion and laid over the wound, completely covering it. Over this should be laid the pad of antiseptic gauze, with the macintosh between its two outer layers; and lastly the gauze bandage should be applied so as to keep the whole dressing firmly in its place.

The dressing will require to be changed as soon as a discharge appears from under the pad of gauze.

Water dressing is the most frequently used of all dressings in ulcers and wounds, and it is of the greatest importance that a thorough knowledge of the mode of applying it should be acquired, inasmuch as most lotions are applied after the same manner.

The application consists of lint, saturated with water and covered over with oiled silk, gutta-percha tissue, oiled paper, or some other waterproof material, to prevent evaporation or the escape of moisture into the surrounding bedclothes.

The lint should be double (the two plain sides towards one another, the nap side to the wound), and of a size according to the surface to be covered. The waterproof material should be cut a little larger than the lint. Care should be taken that none of the lint projects from under the edge of the covering, for if such be the case the water will escape into the bandage and clothes, leaving the lint dry and sticking to the wound. Over the whole may be placed a common roller bandage.

Water dressing should be renewed twice in every twenty-four hours, or more often if there be much discharge.

Evaporating dressing consists of a single fold of lint, saturated with water or some lotion, placed over the injured part and freely exposed to the atmosphere to favour evaporation. The object in view is the production of cold by evaporation, and consequently a low temperature of the injured part. The lint should be of considerable size and kept constantly wet, and the limb to which it is applied should be placed on a waterproof sheet, under a cradle, and completely uncovered by bedclothes.

Irrigation is a stream of water conducted over an injured part to prevent inflammation. It is had recourse to frequently for stumps after amputation. The simplest mode of effecting it is by placing a basin or other vessel containing water near the patient's bed, on a little higher level than the injured limb. From this a skein of worsted or cotton thread, one end in the water and the other on a piece of wet lint laid over the part to be irrigated, conducts the water in a constant, trickling stream. Care should be taken to saturate the cotton first in the water, otherwise the current will not be established, also to see that it contains no grease. The irrigator used for washing wounds may also be employed for this purpose. A waterproof sheet should cover the bed, so arranged that the excess of water

may be conducted along a channel into a vessel placed by the side of the bed.

Ointment Dressing.—Ointments are of various kinds and are frequently used in the wards of an hospital as dressings for ulcers and wounds. When used, ointment is spread with a spatula in a thin layer on one side of lint.

The lint thus prepared is applied to the part and maintained in position by a few cross strips of plaster, and, if necessary, a roller bandage. Once a day will be sufficient to dress an ulcer, except when the discharge is profuse, when it may be necessary to renew the application twice or even three times during that period. Simple ointment is usually kept in wards for general use, and is employed to prevent applications sticking to the surface of a sore.

Linseed-meal poultice is made from linseed-meal, with boiling water, and spread upon tow or rag. Linseed-meal, boiling water, a little olive oil, some tow, a basin and spoon, are necessary for its preparation.

The tow, being neatly teased, is placed on a table or board and spread out to the required size. The required quantity of boiling water is then put into the basin, already scalded out, and the meal added, a little at a time, and beat up with a spoon until the whole is well mixed and of a proper consistency. The pulp thus formed is next turned out of the basin upon the tow, and neatly and smoothly spread with a spoon in a layer about three-quarters of an inch thick, leaving a margin of tow uncovered about one inch in breadth. A little olive oil is now to be spread over the surface to prevent it sticking to the skin, and the margin of tow being rolled up, the application is ready.

When applying a poultice one edge should first be laid on the skin, distant half its breadth from the centre of the sore or swelling, and the rest of it gently lowered until it covers the part. A light bandage should then be applied over it to retain it in position and prevent it falling off.

A poultice should be considerably larger than the sore or swelling to which it is applied, and should be renewed at least twice a day. Care should be taken not to apply a poultice too hot to a tender surface.

Bread poultice is sometimes used. It is made from the inside part of a loaf. The bread is put into a small basin, boiling water poured upon it, and being allowed to stand for a little time, the water is strained off and the whole beaten up into a pulp and treated in the same way as the linseed meal poultice just described.

Charcoal poultice is frequently used for foul ulcers and sloughing sores. The materials necessary for its preparation are charcoal in powder, ½ oz.; crumb of bread, 2 ozs.; linseed meal, 1½ ozs.; boiling water, 10 ozs.

The bread is first soaked in the boiling water, next the linseed meal added, and the whole beat up into a soft pulp; lastly, half the charcoal is well mixed with the pulp, over which, when spread, the remainder of the charcoal is to be sprinkled.

Strapping is used for ulcers of the legs, inflamed joints, and swelled testicles.

Sticking plaster, soap plaster, or diachylon spread upon leather, may be used for the purpose of strapping. The straps for the legs should be one inch and a half in breadth and at least six inches longer than the circumference of the limb. In the application the last applied strap should overlap the one preceding it to the extent of one third of its breadth. Straps for a swelled testicle should be in breadth not more than one inch, and the length will depend upon the size of the organ. All hair should first be cleanly shaved off whether in the case of a leg or testicle, to facilitate the removal of the plaster when necessary to do so, and to avoid their sticking to the plaster.

Strapping for ulcers of the leg.—The following are the directions given by Mr. Heath:—"The heel being raised

" upon a stool, the operator, facing the patient, passes a " well warmed strap under the limb, and applies the middle " of it to the back of the leg, then brings the ends over " the sides of the limb and crosses them in front, the " direction of the ends being upwards so as to accommodate " the inequalities of the limb, and to enable the strapping " to lie perfectly smooth without snipping. The next strap " is put on in the same way, but is made to overlap the " first for a third of its width, and so on throughout.

" In drawing the ends of the straps forward, care must be " taken to exercise sufficient, but not too great, traction, " lest the patient should be unable to bear the pressure and " the whole thing have to be undone.

" In removing strapping from a limb or joint, it saves " both time and trouble to pass a director beneath it and " lay it open with a pair of scissors, and to remove the " whole at once instead of pulling off each strap sepa- " rately."

To strap a joint the above directions will apply. The strapping should extend from some distance below the joint to some distance above it. Plaster spread upon leather is better suited for joints and easier applied, inasmuch as the leather does not so easily crease by the movements of the joint.

Strapping for testicles.—The following are the directions given by the same author for this operation:—" It is " essential to shave off all hairs from the pubis and scrotum " of the affected side, and the operator, sitting in front of " his patient (who should stand with his back against a wall) " is then to grasp the enlarged testis with his left hand " and separate it from its fellow, pushing it well down to " the bottom of the scrotum. A narrow strip of wash- " leather plaster is then to be applied immediately above " the testicle as tightly as it can be borne, so as to prevent

" the organ slipping up again, and this strip should go
" twice round.

" Strips of ordinary strapping, half an inch wide, are then
" to be cut, of sufficient length to reach from the ring of
" wash-leather vertically over the testis, and back to the
" same point on the opposite side, and these should be
" applied all round so as to envelop the testis completely.
" The simplest way is to apply one or two strips in front
" first, and then similar ones at right angles, and afterwards
" to fill in the intervals. A long strip of plaster, half an
" inch wide, is then to be wound horizontally over the
" straps, beginning from as near the bottom of the testicle
" as convenient, and carrying it up over the original wash-
" leather ring, so as to envelop the testis and keep all the
" vertical straps from slipping.

" In a day or so the testicle will be found to have shrunk,
" so that the strapping forms a loose bag around it, and
" will require a repetition of the application."

CHAPTER V.

THE ADMINISTRATION OF MEDICINES AND THE APPLICATION OF EXTERNAL REMEDIES.

Medicines are administered with the view of producing some beneficial effect upon the system, and the doses are so apportioned, and the hours of administration so regulated, that the greatest possible amount of advantage may be gained. Therefore it is obvious that without attention to the prescribed doses, the regular hours of repeating the doses, and the proper mode of administration, the object in view will not be obtained, and the anticipation of benefit will be frustrated.

The repetition of the dose of a medicine is ordered at intervals which will be shown in the following table.

Table showing the hours at which medicines are to be given :—

When ordered every Four Hours.	When ordered Four Times Daily.	When ordered Three Times. Daily.	When ordered Twice Daily.	When ordered Morning and Evening.	When ordered Daily.
2 o'clock Morning.					
6 o'clock Morning.	6 o'clock Morning.				
10 o'clock Forenoon.	10 o'clock Forenoon.	10 o'clock Forenoon.	10 o'clock Forenoon.	10 o'clock Forenoon.	10 o'clock Forenoon.
2 o'clock Afternoon.	2 o'clock Afternoon.	2 o'clock Afternoon.			or at
6 o'clock Evening.		6 o'clock Evening.	6 o'clock Evening.		
10 o'clock at Night.	Bed Time.			Bed Time.	Bed Time.

The necessity, however, for the strict observance of the prescribed periods for repeating the doses of medicines, except when orders are given to the contrary, is not intended to extend to the night when the patient is asleep. It would be improper to rouse a patient from his sleep to give him his medicine, but the moment he awakes it should be given to him, and the period of repetition commenced from that time.

All medicines should be carefully labelled with the name of the patient, the nature of the medicine, and the directions for use. Much injury has been done and many lives lost

from time to time, by the inattention of those entrusted with the administration of medicines in neglecting to read the label before giving medicine to patients. Either an overdose has been given, or that which was intended for external application has been administered internally, or the medicine prescribed for one person has been given to another. All these mistakes might have been avoided had the label been looked at before giving the medicine. It cannot therefore be too forcibly impressed on the minds of sick-attendants, that they should acquire the habit of carefully reading the label to ascertain, first, the name of the patient for whom it is ordered, secondly, the nature of the medicine, and, thirdly, the quantity to be given.

Where the label is written on the lids of pill boxes care should be taken that the lid of one box does not get transferred to another box.

A bottle containing medicine should not be left uncorked longer than is absolutely necessary, as very frequently the active principle is volatile and is thus lost. For the same reason, the dose should be swallowed as soon as possible after it is poured out.

When pouring out medicine from a bottle, the bottle should be held with the label side upwards; and it may be looked upon as an invariable rule that the bottle is to be well shaken before pouring out any of its contents.

If a medicine be intended to produce any obvious effect, such should be looked for and observed by the attendant, in order that a correct report may be made by him to the medical officer at his next visit.

Medicines and remedies are prescribed in the following various forms:—

Mixtures are from one to 16 ounces in quantity, and directed to be administered in drops, spoonfuls, ounces, or wine-glassfuls, either so many times a day, or with an

interval of so many hours between the doses, in accordance with the foregoing table.

A graduated minim glass measure is used for measuring out the dose when a mixture is ordered in drops. The size of a drop depends upon the nature of the fluid and the shape of the lip of the bottle from which it falls; thus to preserve the amount of a uniform quantity, the minim measure is used in preference to dropping. A glass measure graduated in drachms and ounces, is used for measuring the other quantities in which mixtures are prescribed.

The following table should be committed to memory to assist in the use of the glass measure.

Table of measure for the administration of fluid medicines :—

60 minims are 1 fluid drachm.
8 drachms „ 1 fluid ounce.
20 ounces „ 1 fluid pint.
1 drachm is 1 teaspoonful.
2 drachms are 1 dessertspoonful.
4 drachms „ 1 tablespoonful.
2 ounces „ 1 wineglassful.

Draughts are in quantity from half an ounce to two or three ounces, and generally directed to be taken at one time; but it not infrequently happens that half may be ordered to be taken at one time and the remainder to follow.

Pills are round masses, from two to five grains each in weight, and are administered either one, two, or three at a time at the hours directed.

In giving a pill to a patient it frequently happens that he has great difficulty in swallowing it. The pill is also frequently broken up in the mouth, and, contrary to what might be expected, the smaller the pill the greater the difficulty. The usual mode of swallowing a pill is by laying it on the tongue and taking a mouthful of water,

which is swallowed with a gulp and passes down nearly as a solid body carrying the pill with it. When the mind, however, is impressed with the difficulty of swallowing it, and the mouth is not closed and shaped so as to mould the fluid into a suitable form, the fluid passes while the pill is retained between the tongue and palate. A very good method is to make the patient take a mouthful of some fluid and lean back his head, then drop the pill into his mouth and direct him to swallow the fluid with a gulp. But it may happen that he is so impressed with the difficulty that he will still separate the pill from the fluid. In such a case make him shut his eyes while the pill is dropped in, after deceiving him a few times by pretending to drop it in, and directing him to swallow.

Powders may vary in quantity from a grain to a drachm or more. When small, the best plan of administering them is to make the patient lean back his head and open his mouth and, having shaken the powder off the paper upon the back of his tongue, give him some water, tea, or other simple fluid to wash it down. If large, it is mixed with water and given to the patient out of his mug, care being taken that the whole of the powder is administered. To effect this it should be stirred with a spoon until the instant of putting the vessel containing it to his mouth.

Seidlitz and other effervescing powders are given by dissolving the contents of the blue paper in six ounces of water, into which put the contents of the white paper and stir quickly with a spoon. The draught so prepared should be drunk off while effervescing.

A bolus is a soft mass of medicine generally dispensed on paper. It should be scraped off the paper on to the point of a spatula or knife, and having made the patient open his mouth, place it upon the back of his tongue and wash it down with some fluid.

Electuary is a form of medicine not frequently had recourse to in military hospitals. The medicine is generally made up with molasses or honey and is in a thick state contained in a mug or pot and is ordered to be given in tea or other spoonfuls at intervals according to the table of the hours at which medicines should be given.

An emetic is ordered either in powder, draught, or mixture. It is given for the purpose of causing vomiting. When administered, half a pint of lukewarm water should be given to the patient after each time of vomiting, until it comes off clear. This encourages the action of the medicine.

A vessel should always be got ready previous to administering an emetic, as vomiting comes on suddenly, and the bedclothes and ward floor will be dirtied before one can be procured.

An enema or clyster is either medicine or nourishment in a fluid state administered by the anus. It varies in quantity from one to twenty ounces. It should be heated until it has a temperature of 98°, about equal to that of the blood, by setting the basin containing it in some hot water. It is injected into the lower part of the intestine by means of various kinds of apparatus. Those most generally in use are the plain metal syringe, capable of containing a pint; the india-rubber bag, holding from four to eight or ten ounces (see Fig. 26); and the pump, called the "enema apparatus." (See Fig. 27.)

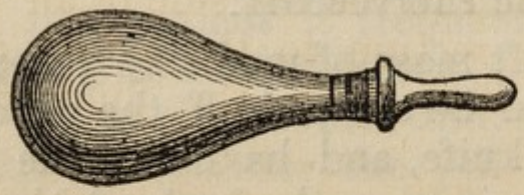

Fig. 26.

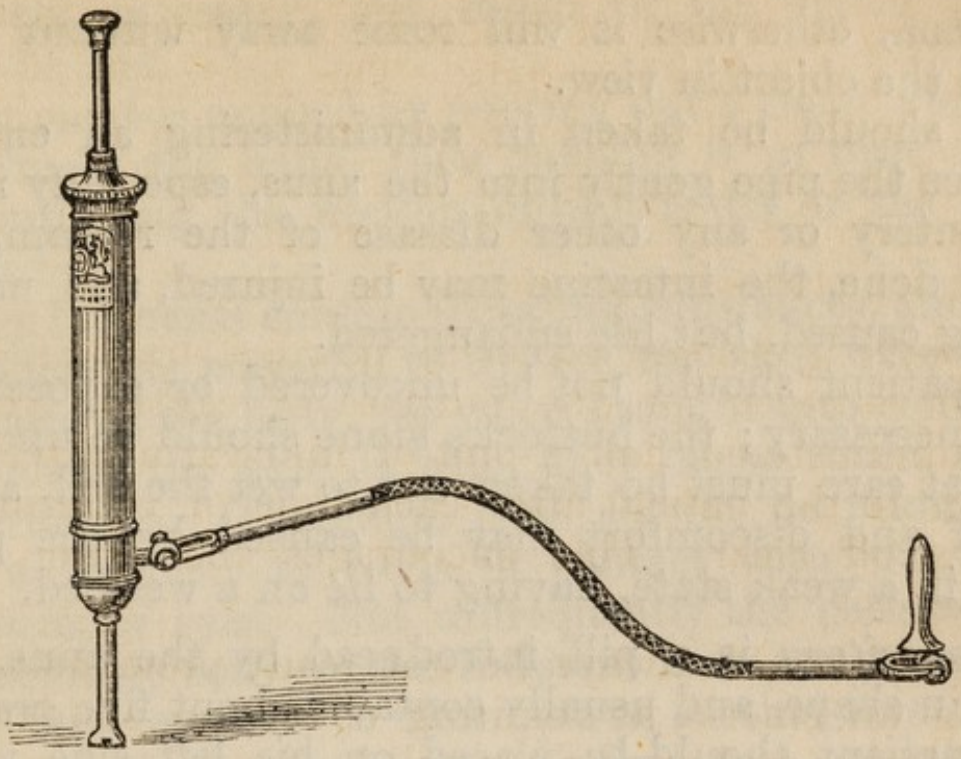

FIG. 27.—ELAM'S ENEMA APPARATUS.

Where the quantity of the enema is large, either the metal syringe or the enema apparatus must be used, but where it is small, the india-rubber bag or a small metal syringe should be employed, and especially in cases of dysentery.

The patient should be placed on his left side, his buttocks brought out nearly to the edge of the bed, and a waterproof sheet or folded cloth placed under him. The pipe or nozzle, well oiled, of the apparatus should then be carefully introduced in a slightly forward direction into the anus, and thus entered, pushed with a slight inclination backwards and to the left side in an upward direction in the line of the rectum to the extent of about two and a half inches. This done, the fluid should be slowly forced up.

The patient should be directed to resist the inclination to strain, which immediately follows the introduction of

the enema, otherwise it will come away without having effected the object in view.

Care should be taken in administering an enema to introduce the pipe gently into the anus, especially in cases of dysentery or any other disease of the rectum, as, if roughly done, the intestine may be injured, and not only suffering caused, but life endangered.

The patient should not be uncovered or exposed more than is necessary; the buttocks alone should be uncovered, and great care must be taken not to wet the bed, as much mischief and discomfort may be caused by the patient, already in a weak state, having to lie on a wet bed.

A suppository is a pill introduced by the anus. It is conical in shape, and usually contains about five grains.

The patient should be placed on his left side, with his buttocks uncovered, and near the edge of the bed, then taking the suppository with its base on the point of the oiled index finger of the right hand, push it gently up the anus in the direction described under the head of enema, point foremost, to the extent of about two inches, or until the finger is inserted up to the second joint.

Lotions are washes used externally as dressings.

The bottle containing a lotion should be well shaken before the lotion is used, and the quantity required for use poured into a gallipot.

The mode of applying a lotion will depend upon its nature, and will be explained under the head of dressings.

Liniments are for external use, and to be rubbed into some particular part.

Great care is necessary in the use of liniments, the majority of them containing poisonous drugs.

A liniment requires to be well shaken before use, and, as many liniments contain volatile ingredients, the bottle should not be allowed to remain uncorked longer than is

absolutely necessary, lest much of the active principle should be lost.

A liniment is applied by pouring out a small quantity in the palm of the hand, then rubbing it in over the part, and continuing the friction until it is dry or the liniment absorbed.

Many liniments contain irritating substances, and though not sufficiently powerful to irritate the skin over the ordinary parts of the body, yet when brought into contact with parts where the skin is thin, they cause much smarting and irritation. Therefore, care should be taken not to allow a liniment to come in contact with the scrotum, perinæum, or eyes. Not unfrequently the patient himself unconsciously conveys the liniment from the part to which it has been applied to these parts, so that it is necessary for the orderly to caution him against such an occurrence.

An orderly, after rubbing in a liniment, should always carefully wash his own hands.

Injections are lotions introduced into the urethra by means of a syringe. The syringe may be either of metal or glass, but glass alone should be used when the injection contains nitrate of silver or other caustic preparations, as such substances act upon metal and are decomposed.

The patient, as a rule, injects himself, and therefore it will be necessary for the attendant to instruct him in the mode of performing the operation effectively.

The patient, having first made water in order to clear away the discharge out of the urethra, places a chamber utensil before him, on a chair if out of bed, or between his legs if in bed. He then fills the syringe from a gallipot containing the injection, and having done this, he places the first finger of his right hand in the ring or on the knob on the head of the piston, while he holds the barrel firmly between the thumb and three remaining fingers. Next, grasping the top of the penis between the fingers

and thumb of the left hand, he inserts the nozzle of the syringe into the urethra, where it is held by the fingers and thumb, and slowly presses down the piston so that the injection is forced into the urethra, being prevented from escaping along the side of the syringe by the pressure exerted by the fingers and thumb of the left hand.

The syringe should now be withdrawn, and the injection, after having been retained in the urethra for a few seconds, is allowed to escape into the utensil. If a sufficient quantity has been injected it will escape with a jerk, and this should be borne in mind as it may squirt into the eyes of the patient, if he be in a stooping position.

There is frequently a dread on the part of the patient of forcing the injection into the bladder, but such is not likely to happen, and, even should it occur, decomposition would take place by its mixture with the urine, and no harm result.

It frequently happens that this dread prevents patients forcing the injection as far back into the urethra as the disease has extended.

A gargle is a wash for the mouth and throat. The patient should take a mouthful of the gargle, throw back his head, and set the fluid in motion by breathing through it, at the same time taking care not to swallow it. This should be repeated as often during the day as may be directed by the prescriber.

A collyrium is a wash for the eyes. The eyes may be simply washed with it, and in doing so it should be allowed as much as possible to go within the eyelids, or the eye bath may be used, which is a small glass made for the purpose, or the douche may be employed. This latter instrument is an india-rubber bag with a wooden top which fits closely round the eye. Lint may also be wetted with it and laid over the eyes as *evaporating dressing*, or it may be applied as *water dressing* with lint and oiled silk.

In using a collyrium, every patient should have his own appliances, and retain them exclusively for his own use.

Drops are frequently put into the eyes.

A solution of nitrate of silver is often employed for this purpose; it is therefore necessary to be careful not to allow it to come in contact with linen or clothes, as it leaves a dark unsightly stain which is indelible.

A quill should be cut the shape of a pen without the nib, and a small hole made at the upper part of the barrel, which converts it into a kind of syphon.

The quill being introduced into the bottle containing the solution, the fore-finger is then placed on the hole, and it is withdrawn containing a portion of the fluid. The patient either lies on his back on the bed, or holds back his head, and the end of the quill being held over the eye, air is allowed to enter through the hole, and the fluid drops off the end of the quill into the eye, or the patients' head being thrown back, the lower eyelid is drawn downwards with the finger, and the drops allowed to fall into the space between the lower eyelid and the eyeball.

Ointments are greasy applications generally spread upon lint or old linen as dressings for sores or wounds.

A piece of lint is first cut of the size required, laid on a table or other flat surface, and the ointment spread on the nap side of it in a thin layer by means of a spatula or knife. The piece of lint so prepared is laid over the part and retained in position by a few cross strips of plaster, a few turns of a bandage, or both combined.

Mercurial or blue ointment is seldom used as a dressing (except for keeping open a blister), but is frequently rubbed into the skin with the view of producing a mercurial effect upon the system.

For this purpose the ointment, in such quantity as may be directed, is rubbed on the inside of the thighs or on the armpits of the patient once or twice daily with the palm of

the hand, which should be placed flat upon the part, and gentle and steady friction continued until the ointment is exhausted.

Tartar-emetic ointment is not used for dressing, but for the purpose of counter irritation.

A quantity of it (as ordered) is rubbed into the part for which it is prescribed (generally over the chest or abdomen), once or twice daily, until a crop of pustules appears.

After using either of the two last-named ointments, the hands should be carefully washed with soap and water, and care should be taken in the case of tartar-emetic ointment that it does not come in contact with those parts of the body where the skin is thin, as the scrotum, perinæum, and the flexures of joints.

Caustics are frequently used for touching sores and producing eschars. Those most commonly in use are nitrate of silver, nitric acid, potassa fusa, and sulphate of copper.

Nitrate of silver is in sticks, and is kept for use in a quill or caustic-holder. It should be washed, and dried with a piece of lint, cotton wool, or blotting paper after being used, and should not be placed in contact with any metal, as such decomposes it, nor should it be allowed to touch linen or the hands, as it produces a dark stain.

It is occasionally necessary to point a piece of caustic. To effect this it should be rubbed on a piece of wet lint until it is ground to a point. It should never be attempted to cut or scrape it.

Nitric acid is generally applied by means of a piece of wood, one end of which is pared off thin and flat.

Sulphate of copper, or bluestone, is used in crystals. The crystal should be ground on a fine stone to a chisel point, and tied in a quill or in a cleft cut in the end of a piece of wood.

A sinapism, or mustard plaster, is used as a counter irritant, and is frequently applied over the chest or abdomen to relieve pain.

For the chest a piece of stiff brown paper, about 15 inches square, is taken, some mustard is then put into a small basin, and cold or lukewarm water being poured upon it, the whole is well beaten up with a spoon, and the paste thus prepared is spread over the paper in an even layer. This is laid on the chest and smoothed over, and pressed to the skin with the hand. It is allowed to remain on for from 15 to 20 minutes, and, if the mustard be good, a burning sensation is produced, and the skin is reddened.

While the plaster is on, a basin of warm water with a sponge should be got in readiness to wash off the mustard which adheres to the skin after the plaster is removed.

Boiling water or vinegar should not be used in making a sinapism, as they destroy the active property of the mustard. Care should be taken that the mustard is fresh and good, which may be known by the pungent fumes given off in mixing it.

A piece of thin tissue paper or fine muslin may be laid over the sinapism when prepared, so as to intervene between the mustard and the skin, and thus avoid the inconvenience of the mustard adhering, and do away with the subsequent washing of the part, which in some cases may not be desirable.

Mustard poultice is frequently employed when the severe action of the sinapism is not required. To prepare it, take—

Mustard in powder	- 1 part.
Linseed meal -	- 1 part.
Boiling water -	- 4 parts.

Mix the linseed meal gradually with the water, next add the mustard, stirring it constantly while doing so. It is spread upon tow or rag in the same manner as linseed-

meal poultice, and is allowed to remain on from four to 12 hours.

Blisters are applied to the skin to produce vesication or watery blebs.

Blistering ointment is spread upon stiff brown paper or sticking plaster of the size ordered, and so sent up from the surgery.

The plaster so prepared is held for a moment before the fire, if in cold weather, and then being laid on the skin, a few strips of adhesive plaster are laid over it to retain it in position and prevent it slipping. A bandage may be loosely applied over the whole for greater security, but should not be so tight as to prevent the plaster being raised by the accumulation of fluid in the blebs underneath it.

Unless directions be given to the contrary, the blister should be removed and the part dressed after a lapse of 12 hours.

The bandage and strips of plaster being loosened, the blister is gently raised from one side and removed. Several openings are then made in the blebs with a pair of scissors, and a vessel placed in a position to receive the fluid which escapes.

This done, a dressing of simple ointment spread upon lint is applied, and renewed twice or three times daily until the surface is healed.

Occasionally, when the blister is removed and the blebs have not risen well, a soft linseed-meal poultice is applied, which has the effect of making them rise.

It is sometimes necessary to increase the effect of a blister by not allowing it to heal up at once; in other words, to keep it open. In this case it will be dressed in a similar manner, except that the old skin should be completely removed, and in place of simple ointment, such

other ointment will be spread upon the lint as may be ordered. This will be continued until orders are given to allow the sore to heal, when simple ointment is to be applied as first described.

Fomentations are applications of hot water, either simple or medicated by the addition of some drug.

Hot-water Fomentation.—Two pieces of flannel, each a couple of yards in length, or two pieces of spongio-piline, are immersed in a bucket of hot water, placed by the side of the patient's bed; one piece is fished out, and by means of a wringer, consisting of two pieces of wood and a piece of stout canvas, or by means of a jack-towel, the water is thoroughly wrung out of it, and it is placed, as quickly as possible, on the part to be fomented, and covered by a piece of waterproof sheeting. While this is on, the second piece is wrung out and prepared to replace the first as it cools.

The wringer will prevent the attendant's hands being scalded, and, by means of its use, the application will be much hotter and more effective.

Care should be taken to wring the water thoroughly out, so as not to wet the patient's bed.

Turpentine fomentation is applied in the same manner as the hot-water fomentation, but with the addition of a small quantity of oil of turpentine sprinkled over the flannel or spongio-piline each time after being wrung out.

Sponging is employed in febrile diseases to reduce the heat of the surface of the body by means of evaporation. Either cold or tepid water may be used.

The patient being undressed, a large wet sponge is rapidly passed over the different parts of the body until the temperature is lowered by the evaporation of the moisture left upon the skin by the sponge.

Baths.

The hot bath has a temperature of from 98° to 105° F. The hot water should be first put into the bath, and cold water added (if necessary) until the proper temperature is reached, as shown by the thermometer.

It may be regarded as an invariable rule that, whatever description of bath is ordered, the original temperature should be maintained during the whole time the patient remains in it; therefore the temperature should be taken at periods of six or seven minutes by the thermometer, and hot water added to replenish the lost heat, care being taken not to scald the patient in doing so. The thermometer must always be employed to determine the temperature of a bath, as no test is more fallacious than that of the sensations.

The patient is placed in the bath, the whole body being immersed with the exception of the face and head.

Exhaustion and faintness may sometimes be produced by a hot bath; therefore it is necessary to watch weakly patients, and not allow them to remain in sufficiently long to produce these effects, and to remove them immediately they appear faint. The average time which a patient should remain in a hot bath is from 10 to 15 minutes. When taken out of the bath, the body should be rubbed quickly dry with a towel, and with as little exposure to draughts as possible.

The bath may either be fixed in a bath room, or it may be moveable, in which case it can be brought to the patient's bed-side.

The warm bath has a temperature of from 92° to 98° F., and is administered in the same manner as the hot bath.

When no directions are given with regard to the time the patient is to remain in the bath, 20 to 25 minutes may be regarded as the average period.

The tepid bath has a temperature of from 85° to 92° F., and is administered in the same manner as the warm bath.

The cold bath may be said to have a temperature of from 56° to 65° F., but this greatly depends upon the weather.

The body and the head should be immediately submerged on entering the bath, and as much movement as possible maintained while the patient remains in it. The period for remaining in should not exceed five or six minutes, for, if longer, the temperature of the body becomes so lowered that reaction will be slow in setting in.

The hip bath is employed where certain reasons prevent the immersion of the whole body, and where it is intended specially to influence the organs or parts about the lower portion of the trunk. Thus only the hips and lower part of the trunk are immersed, in a bath made for the purpose.

Hot, warm, tepid, or cold water may be employed for the hip bath.

In preparing the bath it should be borne in mind not to fill the vessel more than one-third full, otherwise when the patient sits down in it, there will not be room and the water will overflow.

The pediluvium or foot bath is one in which only the feet and legs are immersed. The water should be as hot as the patient can bear it, and the original temperature should be maintained throughout by the addition of hot water from time to time.

The vessel should be so full as to permit the water to reach nearly as high as the knees. A blanket may be thrown over the patient as he sits with his feet in the bath.

The average time to remain in is from twenty-five to thirty minutes.

When taken out the feet and legs should be quickly dried, and wrapped in the bedclothes, or stockings drawn on.

*Compound sulphur bath.** Take of

Precipitated sulphur - - -	2 ounces.
Hyposulphite of soda - - -	1 ounce.
Dilute sulphuric acid - - -	½ fl. ounce.
Water - - - -	30 gallons.

The water, being made tepid, should be put into a wooden bath, and the other ingredients mixed with it thoroughly. The bath may be employed both locally and generally.

*Alkaline bath.** Take of

Carbonate of soda - - -	4 ounces.
Water - - - -	30 gallons.

Mix thoroughly. This is used both generally and locally.

*Acid bath.** Take of

Nitric acid - - - -	1½ fl. ounce.
Hydrochloric acid - - -	1 fl. ounce.
Water - - - -	30 gallons.

Mix thoroughly. Used both generally and locally.

*Mustard bath.** Take of

Mustard in powder - - -	2 ounces.
Water - - - -	4 gallons.

Mix thoroughly in a foot bath. Used as a pediluvium, or foot bath.

Simple vapour bath.—This is most readily applied by the apparatus of Messrs. Evans and Stevens as shown in the drawing. (See Fig. 28.)

Directions for use.—Lift off the whole of the upper part of the apparatus from the base, put nearly ¼-pint of spirits of wine into the centre, between the wicks, then take off the

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* These ingredients will be dispensed in the surgery, and sent to the ward for use by the attendant.

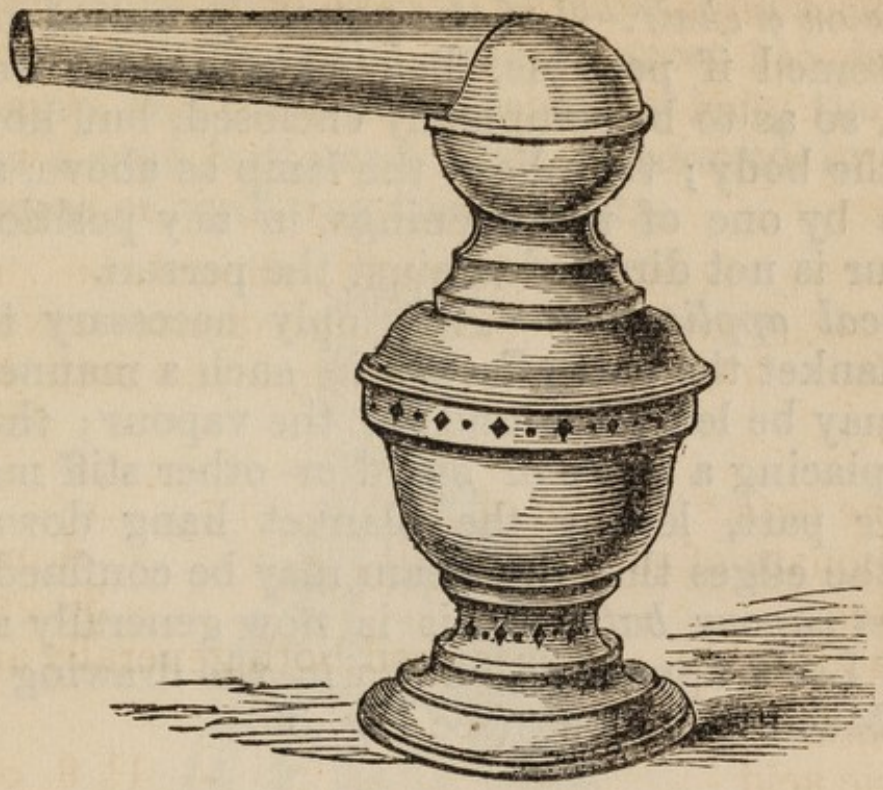

FIG. 28.

head of the boiler and pour in water nearly up to the middle, (the water should be hot if possible to save time and expense,) replace the head, and put the boiler back into the outer case; now light the wicks, and put on the whole of the upper part again, place the apparatus into the required position as described below; when the bath is no longer required, the boiler may be removed, leaving the outer jacket on the base, and the flame blown out.

For application to a person in bed.—Let the bedclothes be raised up by any simple means, so as to form a chamber for the vapour, then place the apparatus upon a stool or any other article to raise it to the required height, then light the lamp and place the boiler over it in its place, insert the tube under the bedclothes so that the vapour may enter *above* the body. The bedclothes should be carefully tucked in all round the edges and the neck of the person, that there may be no opening for the steam to escape.

For use on a chair.—Let the person be seated on a chair, cane-bottomed if possible, then covered with one or two blankets, so as to be completely enclosed, but not hanging close to the body; then light the lamp as above, and insert the tube by one of the openings, in any position so that the vapour is not directed against the person.

For local application.—It is only necessary to enclose with a blanket the part affected in such a manner as that a space may be left all round for the vapour; this may be done by placing a piece of board or other stiff material on the upper part, letting the blanket hang down, but so fixed at the edges that the steam may be confined.

Calomel vapour bath.—This is now generally applied by means of Lee's apparatus, shown in the drawing (see Fig. 29) and Macintosh cloak (see Fig. 30).

FIG. 29.—THE REGISTERED CALOMEL VAPOUR BATH.

Directions for use.—Place the quantity of calomel upon the small plate, at the top of the apparatus A. Fill the receiver B, *one quarter full*, with boiling water. Then fill

the small measure with spirits of wine, which pour into lamp C, which will burn the time required (15 minutes). Light the lamp and place it between the legs, the patient sitting upon a cane bottomed chair, enveloped in a cloak, for the purpose of confining the vapour.

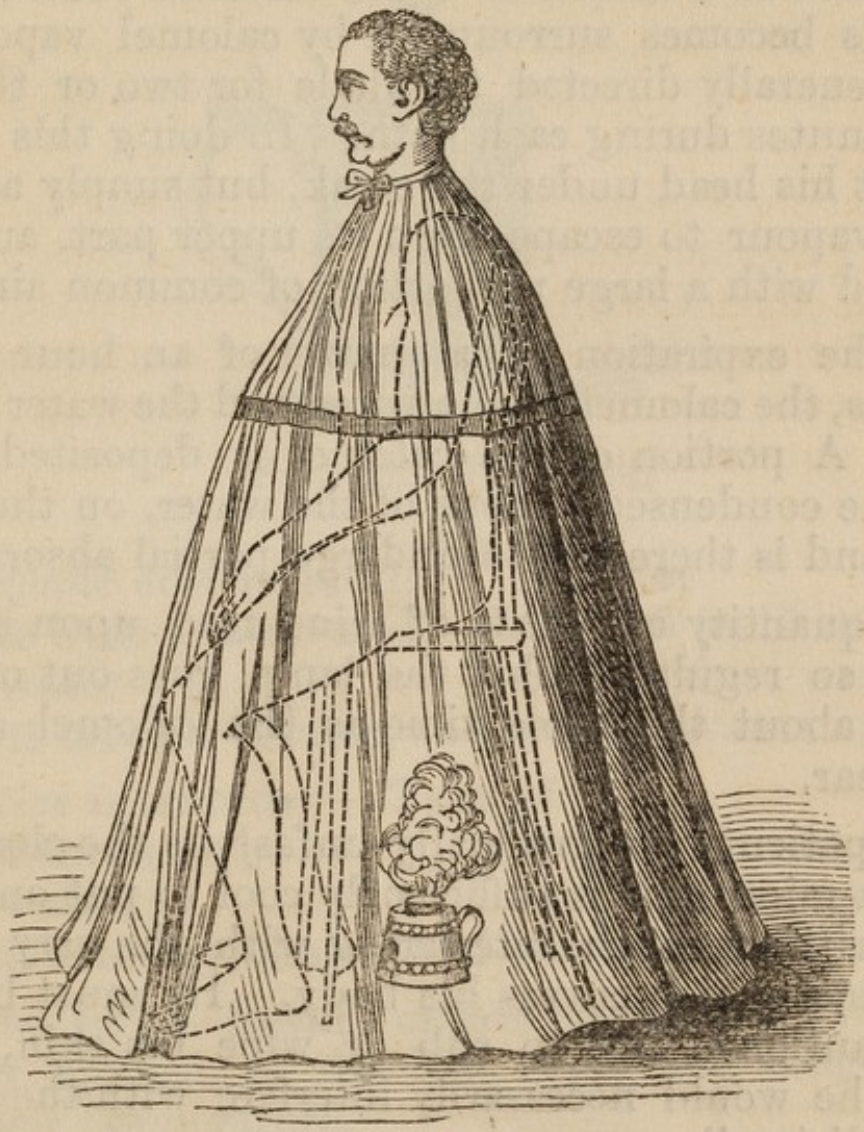

FIG. 30.

The following are Lee's directions, and remarks as to its use.

" In this apparatus there is only one lamp, which sublimes
" the calomel and boils the water at the same time. In the
" centre of the top, immediately over the lamp, is a small,

" separate, circular, tin plate, upon which the calomel is " placed. Around this is a circular depression which may " be one third filled with boiling water. The apparatus is " then placed on the ground and the lamp lighted. The " patient sits over it with an American cloth cloak, a " Macintosh or a moleskin cloak fastened round his neck. " He thus becomes surrounded by calomel vapour, which " he is generally directed to inhale for two or three sepa- " rate minutes during each bath. In doing this he should " not put his head under the cloak, but simply allow some " of the vapour to escape from its upper part, and breathe " it mixed with a large proportion of common air.

" At the expiration of a quarter of an hour or twenty " minutes, the calomel is volatilized and the water has boiled " away. A portion of the calomel is deposited, together " with the condensed vapour of the water, on the patient's " body, and is there left to undergo partial absorption.

" The quantity of spirits of wine used upon each occa- " sion is so regulated that the lamp goes out of its own " accord about the same time as the calomel and water " disappear.

" The patient now gradually unfastens the cloak, and in " about a minute he is sufficiently cool to put on his night " dress, without much interfering with the very fine layer " of calomel which covers his body. He must be particu- " larly cautioned not to rub or wipe his skin, as, by so " doing, he would necessarily interfere with the action of " the medicine."

Inhalations.

Hot water inhalation.—Put hot water into an inhaler (see Fig. 31), and let the patient inhale the vapour arising from it through the tube placed at the top of the inhaler.

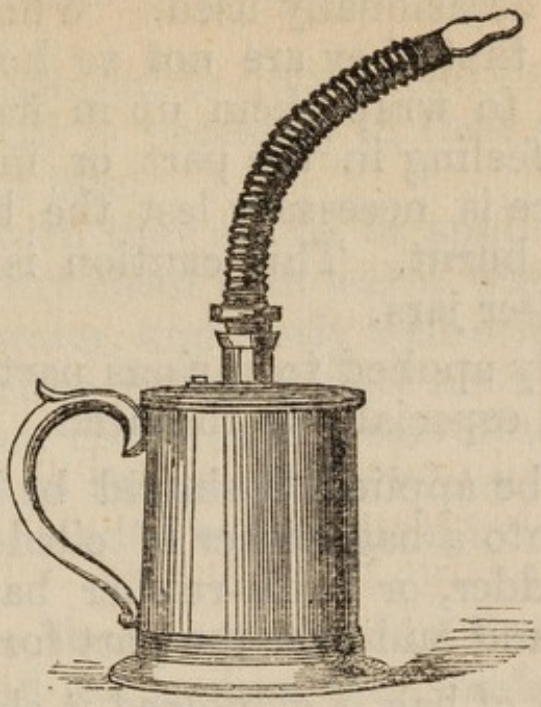

FIG. 31.—INHALER.

*Hydrocyanic acid inhalation** Take of

Dilute hydrocyanic acid -	10 to 15 minims.
Hot water - - -	10 fluid ounces.

Mix, put into an inhaler, and let the patient inhale.

*Turpentine inhalation.** Take of

Oil of turpentine - - -	1 fluid ounce.
Hot water - - -	4 fluid ounces.

Mix, put into an inhaler, and let the patient inhale.

Hot water jars.—Bottles or jars containing hot water are frequently applied to the feet, legs, and other parts to restore their temperature.

The bottles or jars when filled with boiling water should be carefully corked, and wrapped in a roll of flannel or fold of the blanket and thus applied to the part.

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* The ingredients will be dispensed in the surgery, and sent for use in the ward by the attendant.

Hot bricks are occasionally used. When employed, care should be taken that they are not so hot as to burn the clothes, and also to wrap them up in flannel; and where there is want of feeling in the part, or insensibility of the patient, great care is necessary lest the heat be too great and the part be burnt. This caution is also necessary in the use of hot water jars.

Ice is frequently applied to various parts of the body, for cooling purposes, especially to the head.

When it is to be applied, it should be broken into small pieces, and put into a bag, either of oiled silk, or vegetable parchment, a bladder, or india-rubber bags specially made for the purpose, and laid over the part for which ordered.

Whatever kind of bag is employed it should not be more than half filled, in order that it may be accommodated to the shape of the part to which it is applied, and lie close upon it.

When applied to the head, the bag of ice may be retained in its place by a piece of bandage passed over it, under the chin, and tied. A four-tailed bandage reversed, answers the purpose well. The hair is usually cut very short or shaved before ice is applied.

Sometimes the application of ice to a part causes such intense pain that the patient is unable to endure it.

In this case a towel placed between the ice bag and the skin will afford relief.

The water from melting ice will remain cold as long as any of the ice remains unmelted but afterwards the temperature rapidly rises to that of the part with which the bag is in contact. It should therefore be removed as soon as the ice is melted.

The bag should be carefully tied, to prevent the escape of the water on to the bed, and as a further precautionary

measure the pillow should be protected by oiled silk or a waterproof sheet.

Leeches are employed to draw blood locally.

Some little skill is necessary in their application, otherwise they will not bite.

The part to which they are to be applied should first be washed thoroughly clean with warm water and soap, then with clean cold water, and lastly well dried.

The leeches before being applied should be well cleaned and dried between the folds of a soft cloth; and when they are to be applied to the mouth or where the temperature is high, it is recommended to put them into tepid water for a few minutes.

To apply them, the box containing them may be inverted over the part, and the leeches, thus confined, readily bite if the part has been properly prepared.

Another very ready method of applying them is first to place the number intended to be used in a hollow in a towel folded like a napkin, then to turn the towel, with the leeches in the hollow, upon the part prepared for their reception, and thus with the towel over them confine them with the hand until they bite, when the towel may be removed. Each leech may also be taken in the fingers and its head directed towards the spot where it is wished to bite, and in this way it will often take hold when all other methods have failed.

If either of these methods cannot be pursued, as when it is necessary to apply them in the mouth, or to confine them to a very small space, then a glass tube, into which each leech is put separately with its head towards the small end should be brought in contact with the part, and there retained until the leech bites.

Leeches, when full, drop off spontaneously. They should never be pulled off, as their teeth are apt to be left in the wound and cause inflammation.

The part should now be well bathed with warm water to favour the bleeding from the bites, and after this, if more blood still is required to be withdrawn, a soft poultice may be applied.

It occasionally happens that leech bites bleed profusely and exhaust the patient, consequently it should be seen that all bleeding has ceased before leaving the patient for the night. Should bleeding continue longer than is desirable, pressure upon the leech bites with the points of the fingers, or a small compress tied firmly on them, will usually arrest it. Should all these means fail to arrest the hæmorrhage, the medical officer should be at once informed of the circumstance.

Leeches are occasionally kept for use a second time, and to preserve them a small quantity of salt is dusted over them, which has the effect of making them disgorge the blood; they should then be washed with clean cold water changed three or four times.

They should be kept for use in a vessel half filled with water and covered with perforated leather or stiff paper. The water in which they are kept should be changed every five or six days.

CHAPTER VI.

THE MANAGEMENT OF HOSPITAL WARDS, THE NURSING OF HELPLESS PATIENTS, AND THE OBSERVATION OF THE SICK.

Management of Wards.

Arrangement.—Every attendant in charge of a ward is responsible for its proper management. The furniture should be neatly and systematically arranged, and the utensils and other articles kept each in its appointed place. By this being done, not only will the ward present a neat and tidy appearance, but, from the attendant knowing where each article is placed, much confusion will be avoided, and time saved, in looking for it when required.

Cleaning floor.—Each morning the floor of a ward will require to be well dry-rubbed and afterwards swept, and it is often advisable to sweep it previous to using the dry-rubber. Much depends upon the manner in which this is done. If a floor be well dry-rubbed every day it will smooth and polish the surface of the boards and prevent the dust from adhering to them, thus obviating the necessity of washing them so often as would otherwise be the case, which in itself is a matter of great importance to the welfare of the sick.

In using the long scrubber the following are the main points to be attended to,—that the scrubber be forced firmly and evenly along the floor in the direction of the grain of the wood, that the stroke be not too long, and

that each successive stroke of the scrubber partly covers the previous one. After the floor has been thoroughly rubbed over it will require to be swept clean, and in doing this there are a few points to be attended to, viz., that the brush is not jerked but pushed smoothly so as to raise the dust as little as possible, and in place of sweeping the dust over the floor from the one end of the ward to the other, it should be collected in small heaps, each being put into the dust-pan until the whole of the floor is swept, when it can be put into the dust-box for entire removal from the ward.

When the floor of a ward requires washing, the attendant should never do so without the medical officer being first consulted, lest the moist exhalation from the damp floor should be injurious to some of its occupants. A dry day should be chosen for the purpose, and the washing ought to be done as early as possible in the day. Before commencing, the floor should be swept clean, and the attendant should have a hand scrubber, two pieces of old blanket or flannel (one to put the clean water on the floor and the other to mop up the dirty), two buckets of hot water, in one of which some soap and soda is placed for applying to the floor, and the other is to be kept to wring the flannel in after it has mopped up the dirty water. Leaving dirty water marks on the floor should be avoided, and the whole should be wiped as dry as possible. Where the floors are polished they require to be first swept and then polished with beeswax and a long scrubber. To apply the beeswax it should be lightly rubbed on the scrubber or on a piece of flannel bound over the scrubber, and thus applied to the floor. When anything is spilt upon the floor it should be carefully wiped up and the surface cleaned with a little hot water and soda, and dried and brushed.

Cleaning windows.—The woodwork of windows should be cleaned by washing it with warm water and soap. The

glass itself is cleaned by rubbing over it a mixture of whitening and water, about the consistence of cream, and when dry, polishing it with a clean thoroughly dry duster. This mode of cleaning is not always necessary. If the glass be wiped over daily with a duster it will generally suffice to keep it in good order. The cloths used should be free from nap or fluff.

Cleaning walls.—The walls of wards should be frequently dusted, and cobwebs removed, where they have accumulated, This may be done by tying a duster over the top of a long hair broom and with it sweeping them down.

Cement walls will, in addition to dusting, require to be occasionally washed with hot water and carefully dried.

Cleaning stoves.—In cleaning a stove care is required that in cleaning one thing another is not dirtied. A useful thing to prevent this is a thin strip of wood held in the one hand against the surrounding wall, while the brush is used with the other. The blacklead should be made into a thin paste and applied with the small round brush over every part that is to be blacked. When the blacklead is dry on the stove, the polishing brush is to be used briskly until it shines in every part. The ends of the fire-irons are cleaned in the same way as the stove. The bright parts are rubbed with bath brick and a piece of leather or coarse cloth.

The best time for cleaning a fire-place is before the fire has been lighted, but as this can seldom be done, it should be cleaned immediately afterwards before it gets hot. When a stove is pretty clean and only wants a little more polishing, a little of the dry lead dusted on and brushed with the polishing brush will serve the purpose.

Cleaning paint-work.—The paint-work of a ward will require to be occasionally scrubbed with hot water and

soap. Soda should not be used as it soon destroys the paint.

Cleaning ward furniture, &c.—Tables and forms should be scrubbed with hot water and soap. Tumblers and such articles are best washed in cold water, it gives them a better polish and does not crack them. Mugs, basins, and such like must be washed in hot water. Vessels of tin and white metal are best cleaned by washing them with hot water to remove the grease, and then polishing them with whitening. In washing knives and forks the blades only should be placed in hot water. Coal-scuttles and brasses should be polished with a paste made of finely powdered bath brick and water, and rubbed with a piece of leather or coarse cloth. When the brasses are very dirty they should be washed with hot water before being polished.

Dusting.—Every ward should be dusted, at least, once in the day. In doing this great care is necessary, for if a dry duster be flipped about, as is usually done, it merely raises the dust into the air to be again deposited in the same place or elsewhere. The duster should be slightly damp, and every article requiring to be dusted should be wiped over with it. By this means the cloth will take up the dust and not drive it from one place to another.

Emptying slops.—Slops should not be allowed to remain in the wards longer than is absolutely necessary. All ward slops, such as the contents of chamber pots, bed urinals, bed pans, expectoration cups, washings of sores and wounds, and water used for washing bedridden patients, should be thrown down the ward sink, where such is provided,* but where this does not exist they must be

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* By ward sink is meant, not the flat slate sink with the two taps over it at which mugs, glasses, &c. are washed, but a sink having a pan somewhat similar to a W.C. pan with a tap over it specially provided for the purpose of receiving ward slops.

thrown down the W.C., care being taken in doing so not to soil the seat. Old dressings, such as lint, poultices, tow, plasters, &c. should not on any account be thrown down the sink or watercloset as the pipes are liable to become stopped up. Such articles should be removed to the dust cart or dust heap and either buried or burnt. The utensils from which slops have been emptied must be well washed by running water freely into them from the tap, using disinfecting fluid when necessary, and afterwards dried. Cloths used for this purpose must receive special attention and be employed for this use alone.

Heating.—The stoves in use in military hospitals are either set in the wall similarly to ordinary stoves, or made to stand in the centre of the room. The fires should be properly built up before lighting, and afterwards so replenished with fuel as at all times to be bright and cheerful, and not allowed, as is too often the case, from their having been too long neglected and then heaped up with a large quantity of coal, to become a mere spark, half smothered in cinders and coals. The temperature of the ward should be kept as near 60° F. as possible, and sudden alterations of heat and cold should be avoided as far as practicable.

Lighting.—Where gas is burned in wards it should not be kept higher than is necessary to give sufficient light, as the combustion of the gas renders the air impure, and the greater the quantity burned, the more impure will the air become. Besides, too bright a light is often distressing to patients.

Ventilation.—By this is meant keeping the air of an apartment pure. If the air of a ward be not constantly changing, it becomes loaded with impurities given off from the lungs, from the skin, and from the excretions of the occupants, and from combustion.

The effect of an atmosphere thus rendered impure is to favour the development of fevers, the spread of gangrene,

erysipelas, &c., to retard the healing of sores and wounds, and to lower generally the health of patients.

The principle to be kept in view is, that the air within the ward shall be, as nearly as possile, as pure as that on the outside of the building, without the temperature being lowered below the proper standard. To effect this the air of the ward must be constantly changing, fresh air entering as impure air escapes; so there must be both inlets and outlets. In hospitals the inlets are so arranged that the amount of air entering by them can be regulated by opening or closing them. They are also placed that the air as it enters is diffused over the apartment, and currents of air with a high degree of velocity, *i.e.*, draughts, are not poured upon the occupants. Sheringham's ventilators placed in the walls, and Moore's louvre ventilators in the windows, are the inlets most generally employed. Galton's stoves also have a channel communicating with the outer air, and opening into the wards, by which air, heated in its passage, is admitted into the ward. In Sheringham's and Moore's ventilators the amount of air entering may be regulated by opening or closing them. The current is directed upwards, so that it is diffused and does not come directly on to the occupants, and in the Sheringham ventilator this diffusion is still more effectually secured by the top being covered by perforated zinc.

The outlets are generally placed in the ceiling, and lead into a shaft, the greater the length of which the greater will be the draught. The chimney also acts most efficiently as an outlet.

By means of these several openings, an interchange of air is constantly carried on. The air within, as it becomes heated, rarefied, and impure, ascends and passes away through the outlets, while the pure air from without, being colder and consequently heavier, rushes in through the inlets to supply its place. Thus a continuous current is

established irrespective of the movements of the external air. Where these means of ventilation are insufficient, they may be supplemented by drawing the window sashes down from the top, but not raising them from the bottom.

Making Beds.—The comfort of a patient depends much upon the manner in which his bed is made. Care should therefore be taken to keep it as comfortable as possible. Before making up the bed, the whole of the bedding should be thoroughly aired, and afterwards well beaten, particular care being taken to remove all lumps and irregularities from the mattress. A bed is very apt to become sunken and hollow in the centre. This is generally caused by the lacing of the sacking getting slack. The defect should be at once remedied by tightening the cord.

These preliminaries being attended to, the mattress is laid on the sacking, a blanket laid evenly over the mattress, and the bolster placed on the blanket at the head of the bed. The sheet is next laid over the blanket and bolster, and neatly tucked under the latter. Both blanket and sheet being smoothed and without folds or wrinkles, should then be tucked firmly and neatly under the edges of the mattress. This tends to keep them smooth, and prevent them getting into folds. The pillow should be placed on the bolster, having first been well shaken, beaten, and made soft. The over sheet should now be laid on, also the blankets and counterpane, and having tucked them in round the sides and at the foot of the mattress, they should be neatly folded down at the head.

Preparing Air-bed.—When an air-bed is required to be used, it is laid on the top of the ordinary hair mattress, the smallest of the three divisions of the bed being laid towards the head of the bedstead. Each division or compartment of the bed being distinct and separate from the others, will require to be filled separately.

To fill them, insert the nozzle of the small round bellows provided for the purpose into the inlet tube, and turn the ferrule on the inlet tube to the left until it stops. This opens the inlet, and at the same time attaches the bellows. The compartment is then filled by pumping with the bellows in the ordinary way. When the division is filled the inlet is closed by turning the ferrule to the right until it stops. This closes the inlet and at the same time detaches the bellows. The remaining compartments are filled in a similar manner. The compartments should not be filled too full, or the bed will be hard and unyielding. They should just contain sufficient air to render them soft and elastic. As air-beds usually leak, the bellows should be kept at hand and fresh air forced in occasionally to replace that lost by leakage. At least two under-blankets should be laid on to absorb perspiration, and the bed made up in the usual way.

Preparing Water-bed.—When a water-bed is required, the ordinary hair mattress is allowed to remain, and the waterproof bed-tick is laid on the top of it, with the funnel or opening by which it is filled towards the foot of the bedstead. The foot of the bedstead should be raised four or five inches by a couple of bricks under the feet. By this the water when poured in will run towards the head of the bed. One person taking charge of the inlet, and having placed in it a large tin funnel, holds it firmly in an upright position. The water being now got ready in sufficient quantity, and with a temperature about 70° F., should be poured from a jug or can with a lip or pipe, until the bed is about three-fourths filled. The mouth of the inlet should now be secured (the funnel being removed), and the bed made up in the ordinary manner, using, as in the case of the air-bed, at least two under-blankets to absorb perspiration.

Cold water must not be used to fill a water-bed, as it

takes a considerable time to get warm through, and is liable to chill the patient; at the same time, the water must not be too hot, or it will injure the india-rubber material of which the bed is made. The bed must not be more than three-fourths filled, as, if more water be put in, it becomes hard and unyielding, and does not accommodate itself to the shape of the body.

Both on air and water beds the sheet and blankets beneath the patient will require frequent changing, as they quickly become wet from perspiration, which the waterproof material of the bed does not allow to escape.

Preparing Bed for Operations.—In all cases of operations, and where there is a discharge of any kind from a patient, the bed should be prepared in the following manner:—A waterproof sheet, or what is better, as being more pliant, a piece of German cloth, a yard wide, and a yard and a half or two yards long, should be laid across the bed where it is necessary to protect it, and over this piece of waterproof a draw-sheet is placed. The *draw-sheet* is made by folding an ordinary cotton or linen sheet lengthways to nearly the same breadth as the waterproof cloth used. One end is tucked in under the mattress, and the other rolled up on the opposite side of the bed. When the part of the draw-sheet under the patient gets soiled, it may be withdrawn a little towards one side of the bed, and thus a dry part can be constantly kept under the patient without the necessity of each time it is soiled replacing it by a fresh sheet. In cases of amputation, where, to support the stump, pillows are used, precautions should be taken to keep them dry by covering them with waterproof material of some kind.

The Nursing of Helpless Patients.

Patients may be helpless from a variety of causes; from weakness, from paralysis, from injury. When helpless,

from whatever cause, it is of great importance that attendants should be acquainted with the readiest, easiest, and safest methods of lifting and laying them. When patients are weak, or have been a long time in bed, it should be borne in mind the tendency there is to faint when any attempt is made to get into the erect position. Thus, when lifting or laying such patients, they should be as little as possible removed from the horizontal position. This consideration is taken into account in the methods recommended for performing the following offices for helpless patients :—

Lifting and laying a helpless Patient.—There are numerous mechanical contrivances for lifting patients, but these not being provided for military hospitals, need not here be described. There are, however, various simple methods by which attendants can lift patients, and from these three may be selected for description.

First method by three attendants. One attendant takes up a position at each side of the patient, while the third takes up a position near to and at the same side as the injured limb, should such exist. The three attendants now stoop down. The third attendant takes charge of the injured limb, and giving it his undivided attention, prepares to lift it, while the other two, each passing one hand under the back of the patient at the lower part of the shoulder-blades, lock them with each other, and passing each his other hand under the thighs close up to the buttocks, lock them with each other in a similar manner. All being now ready, the patient is steadily raised and carried in the horizontal position to wherever it is desired to remove him.

Second method by two attendants. Where Captain Russell's stretcher is provided, a patient may be lifted by two attendants. This stretcher consists of two poles connected by strips of webbing and two cross-bars. To use it one pole is removed, and the other, with the webbing attached

to it, is laid by the side of the patient. The looped ends of the strips of webbing are passed under the patient, and the pole, which has been removed, passed through the loops. The cross-bars being put into proper position, one attendant takes hold of the handles at each end, and carries the patient as if on an ordinary stretcher. When the patient has been laid down, one pole is removed, and the strips of webbing thus set free withdrawn from under the patient.

Third method by four attendants. A patient can be lifted with great ease and comfort by four attendants, two poles six feet long, and the under sheet. One pole is placed at each side of the patient, and the sheet firmly rolled round it, also the under blanket, should the former not be considered sufficiently strong. The four attendants take up a position, two at each side, facing the patient. Each grasps with one hand the end of one of the poles surrounded by the sheet, and with his other hand the pole near its centre. Being thus prepared by a well-concerted action, the patient is steadily raised and carried as if on a stretcher, feet foremost, over the foot of the bed, to wherever it is desired to remove him.

Remaking Bed for helpless Patients.—To remake the bed for a helpless patient, a second bed may be prepared to take the place of the one in use, or a temporary bed may be prepared for the reception of the patient while the one that has been used is being made up. In either case the patient will have to be lifted from one bed and laid on the other. The new bed should be placed by the side of the old one, but sufficiently distant to allow a space between the two for attendants to move freely. The patient may be lifted by any one of the three methods just described, and being carried feet foremost over the foot of the old bed so as to clear it, he is carried head foremost over the foot of the new bed, the attendants walking along the sides of the bed, and lowered steadily into his proper place.

Changing Sheets.—The under sheet may be changed by any one of the following methods :—

First method. Roll up lengthwise half of the dirty sheet, and push the roll as far under the side of the patient as possible. Next roll up one half of the clean sheet and spread the other half over the side of the bed from which the dirty sheet has been removed, and tucking it under the mattress, place the roll alongside the roll of the dirty sheet. This done, gently raise the patient at the opposite side and turn him over the rolls of sheets. Then take away the dirty sheet and unfold the clean one, and tuck it neatly under the mattress, when the patient may be turned into his old position.

Second method. Raise the patient partly into the sitting posture, and roll the dirty sheet from the head of the bed downwards, and push the roll as close under the buttocks as possible. Next roll up crosswise half the clean sheet, and lay the roll by the side of the roll of the dirty sheet, and spread the other half over the pillow and that part of the bed from which the dirty sheet had been removed. Now lay the patient down, and raising the lower extremities and buttocks, draw away the dirty sheet, unfold the clean one, spread it out, and tuck it in under the mattress.

Changing a Draw-sheet.—The draw-sheet will require to be frequently changed, in addition to a fresh part of it being brought under the patient when one part becomes soiled.

To bring a fresh part under the patient, the buttocks of the patient should be raised by two attendants, each passing a hand and locking them under the thighs, and when thus raised gently pulling the folded sheet without the waterproof towards one side.

To change the draw-sheet, both the folded sheet and the waterproof should be removed ; this may be done in the

same way as the first method for changing an ordinary sheet, or the patient may be raised by two attendants as just described, and the dirty removed and the clean slipped in.

Raising helpless Patients in Bed.—Weakly patients frequently require to be raised in the bed. This may be done by pillows, by a bed with a head-lift, or by a head-lift, which can be slipped in under the mattress and worked by a sack and pinion. When pillows are used they should not be piled one on top of the other under the patient's head, as this has only the effect of raising the head and pressing the chin forward on the chest, a position which is very irksome to the patient, and obstructs, rather than otherwise, his breathing. The pillows should be placed under the patient's back as well as his head. A sloping elevation should be made, commencing at the small of the back, and rising gradually to where a pillow is placed for the head to rest upon.

When the upper part of the body is raised by any of the methods described, there is a great tendency for the patient to slip down towards the foot of the bed. A foot-board with a pillow for the feet to rest against will prevent this, but often the patient cannot bear his feet against the board. Under such circumstances an air or water pillow, either horse-shoe shaped or circular, with a hole in centre, may be put under the buttocks of the patient, and tied by two tapes to the head or sides of the bed, and thus a fixed obstruction will be opposed to the buttocks slipping down.

Feeding helpless Patients.—When it is necessary to give food, or drink, or medicine to a patient, the head and, if possible, the upper part of the body should be raised. For fluids, a feeding cup may be employed. (See Fig. 32.) Where this is not provided, a spoon, a glass, or mug may be used. When the latter are used, the precaution should

be taken of only half filling them. If a vessel of this kind is too full, the fluid is sure to be spilt.

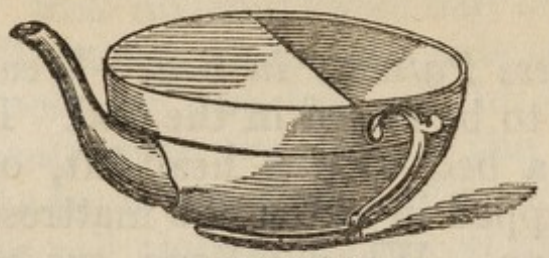

FIG. 32.—INVALID FEEDING CUP.

The Bed-pan for helpless Patients.—The bed-pan is an article in constant use in hospitals. It should be used with the greatest care, and with as little disturbance as possible to the patient, especially when injury necessitates its use. There are two kinds of bed-pans in use, the circular and the slipper (see Fig. 33). When the circular

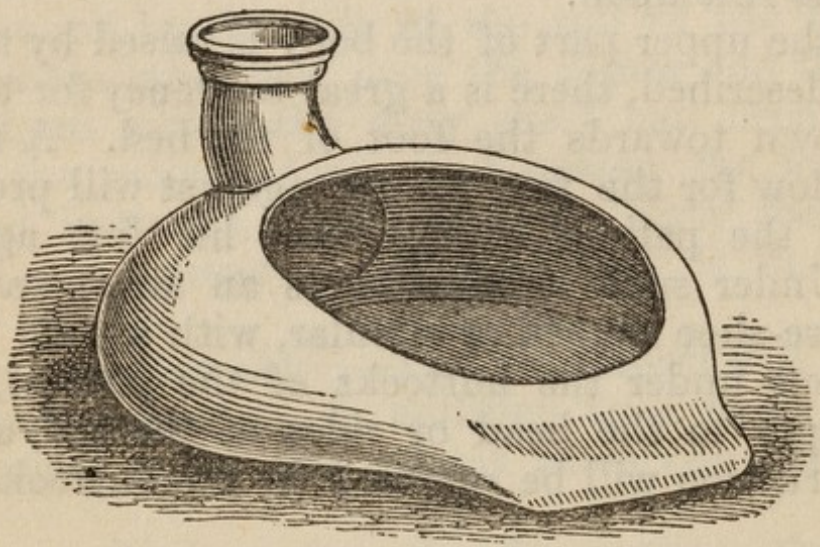

FIG. 33.—SLIPPER BED-PAN.

bed-pan is used, the patient will have to be lifted by two or three attendants, in the same way as already described under the head of lifting a helpless patient, first method; and the pan slipped in under him. With the slipper bed-

pan, the patient should be raised at one side, and the thin edge shoved in under the buttocks.

Observation of the Sick.

An attendant well acquainted with his duties ought to be able to note every change which may occur in the symptoms of a patient, whether favourable or otherwise, during the absence of the medical officer. Symptoms are the signs of disease on which the medical officer has to depend to determine its nature, its severity and danger, the treatment, and the probability of recovery. It will thus be understood how important it is that the attendant on the sick should be something more than a mere machine, and how necessary it is that he should be both well informed and observant.

General Appearance.—The appearance of the patient will very often show whether he has changed for the better or worse. The expression of the face may be that of pain, it may be that of anxiety, or it may be vacant. On the other hand, it may be calm and more hopeful. The colour may be bright red, it may be congested and dark, or it may be pale. The lips may be crimson, purple, or white and bloodless. The nose may look pinched. The cheeks may be sunken and the temples hollow. The eye may be glassy and staring, or it may be dull and heavy. The patient may lie in a listless careless manner, or he may be restless and tossing about; or again, he may be picking at the bedclothes, and his movements tremulous and uncertain.

The position in which he lies should also be noticed; whether he lies on his back or on his side, with his legs drawn up or stretched out.

Intelligence, Manner, Temper.—Patients suffering from disease often show mental derangement. This is called delirium. It may be boisterous, or it may be low and

muttering. It may be slight so that the patient can be recalled to himself and for a time speak rationally, or it may be severe that it will be impossible to arouse him from it. In it the patient may see objects and hear sounds which do not exist, and speak and act as if these sights and sounds were real. It occurs more frequently during the night than in the day-time.

A close watch should be kept on delirious patients, lest they should get out of bed and escape from the ward, throw themselves out of the window, or do themselves or others some bodily injury.

The manner of a patient should be observed. It may be excited, depressed, or in some way differing from his ordinary manner.

The temper also of a patient may vary. At one time he may be irritable, peevish, and easily annoyed, while at others he may be quiet, good tempered, and easily pleased.

The Tongue.—The symptoms presented by the tongue are most important as indications of the state of the system, but as these can be noted by the medical officer at his visit, it is unnecessary here to enter into them.

Sleep.—It should be noted how long the patient sleeps; whether his sleep is disturbed, whether it is sound and calm, with or without heavy breathing. It sometimes happens that a patient will report that he has not slept "a wink" all night, when in reality he has slept uncommonly well; so that it becomes necessary not to rely too much upon the patient's statement with regard to sleep.

Pain is an accompaniment of most diseases. It varies much in its nature and modes of occurrence. It may come and go or be continuous, or it may wander about or be fixed, or it may moderate for a time and again come on with great severity. It also varies much in degree, from mere uneasiness to agony. It may be slight, severe, violent, or excruciating. In each of these degrees it may

have various characters. It is said to be dull, aching, smarting, burning, tingling, or throbbing. The statements of the patients have to be relied on as regards the existence of pain, but its degree may be generally judged of from the expression of the countenance and the tone of the voice.

The time of attack, the duration, the cessation, the degree, and character of the pain should all be carefully noted.

State of the Skin.—The condition of the skin should be watched, especially in febrile diseases; whether it is dry, moist or perspiring, hot or cold, pale, red, or shrunken. The skin, from being cold, may become hot, then moist and perspiring. The hours at which each of these changes occurs should be carefully noted. The temperature is taken by means of the thermometer.

The thermometer mostly employed is a straight self-registering one (Casella's, Hawksley's, or Maw's, Fig. 34).

FIG. 34.—THERMOMETER.

It does not require to be read while in position, but may be removed and read when convenient. The index of the thermometer consists of a small piece of mercury detached from the column in the stem of the instrument, which must be set before commencing to take an observation.

To set the index it must be brought down into the clear part of the stem just below the lines indicating the degrees. This is done by taking bulb firmly in the hand, and then by a rapid swing of the arm the index will come down the stem. This swing is to be repeated until the top of the index is below the lines which indicate the degrees.

When the index has been set, the bulb of the instrument may be applied in the armpit, or between the thighs, or

any part where it can be completely covered by the soft parts, and being retained in position for any length of time over three minutes, the instrument is to be carefully and gently removed, when the top of the index, *i.e.*, the end farthest from the bulb, will denote the maximum temperature during the period the instrument has been in contact with the part.

The patient should be at perfect rest in bed for at least one hour before the observation is made, and should lie on the side at which it is intended to introduce the instrument. In taking the observation in the arm-pit care should be taken that the bulb does not get into the hollow where it will not be closely surrounded by the soft parts.

The medical officer generally records the temperature, but as he may at times entrust this duty to the attendant the accompanying form is given, with which he should familiarize himself.

Associated with the condition of the skin is the occurrence of shivering, or rigor, a symptom which should never be overlooked. Any rash or eruption making its appearance on the skin should also be carfully noted.

Pulse.—The pulse is as a rule taken by the medical officer, but for filling up the foregoing return it may be entrusted to the attendant. A regular pulse in the lying down position, without any excitant, should be from 70 to 75 beats per minute. It is generally taken at the wrist by placing the points of the fingers over the radial artery and counting the number of beats by the second hand of a watch in a minute. In disease the number of beats may increase to 140 or even 160 in the minute.

Respiration.—The symptoms presented by respiration are of the highest importance as signs, not only of disease of the lungs and heart, but also of any febrile state of the system generally. Respiration consists of inspiration and expiration, and in the natural condition occurs from 18 to

W.O. Form 293.

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Register Folio

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Record of Temperature, Pulse, Respiration, Excreta.

in the case of Ætat Disease Termination
Service Ward Register Folio

Dates of Observations																
Days of Disease																
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	·6														
	·4														
	99° ·2														
37°	·8														
	·6														
Normal	98° ·2														
Temperature.	·8														
	·6														
	·4														
36°	97° ·2														
	·8														
	·6														
	·4														
	96° ·2														
Pulse per minute															
Respirations per minute															
Urine ozs. in 24 hours															
reaction of															
Specif. gr. of															
Colour of															
Clear or Turbid															
Urea (amount)															
Sugar in															
Albumen in															
Solids in															
Microscopic Sediments															
Stools, number and character.															

20 times in a minute. In diseased conditions it may be frequent or slow, rapid or prolonged, forcible or feeble, spasmodic, wheezing, or stertorous. It may be difficult or laboured so that the patient cannot lie down.

To register the number of respirations, a watch with a second hand should be taken in one hand, while the other hand is placed flat over the pit of the stomach, and the number of heaves counted in a minute.

Associated with disturbed respiration may be sneezing, coughing, hiccough, or a blue and congested state of the face and upper part of the body.

Cough is a symptom of some irritation in the air-tubes, and has for its object the removal of some matter interfering with respiration. It may occur occasionally, incessantly, or in paroxysms. It may be dry, without expectoration, or moist, with expectoration. It may be short and hacking, harsh, or hollow. It may occur at some particular time of the day or night and not at other times. Whatever character it may present should be carefully noted.

Expectoration is the act of coughing up matters from the air passages. The matter expectorated is named *sputa*. Every patient who expectorates should be provided with a spitting cup. The sputa may be watery and frothy, yellow, thick, and purulent, rusty, streaked with blood; or it may consist for the most part of blood and then constitutes *hæmoptysis*.

If the sputa be not kept for the medical officer's inspection, the attendant should observe its quantity and character, and when the matter brought up is blood, he should be careful to observe whether the patient coughs it up, vomits it, or brings it up from the back of the throat, the mouth, or the gums.

Urine.—The quantity and character of the urine and the manner of passing it vary in disease. The patient may

pass it more frequently than usual, with or without pain, in a large or small stream, even in drops, or he may be unable to pass it at all, a condition which is called *retention of urine.*

The quantity may be increased or diminished or even suppressed altogether. The colour may vary from that of water to blood colour. There may or may not be a deposit. All of which should be observed. It is usual for some urine to be kept for the medical officer's inspection and examination. It should be kept in a thoroughly clean vessel.

State of bowels.—The stools should be observed as to number, colour, consistence, and nature; and whether or not there is pain, griping, or straining accompanying the act of passing them.

Appearance of wounds and sores.—The discharge should be noticed as to quantity, colour, consistence, and whether it has increased or diminished since last dressing the sore or wound, whether it contains any foreign body, pieces of bone, &c., and whether it is offensive in smell.

The colour of the surface of a wound may be red, grey, or dark. The edges may be swollen and puffy, surrounded by a red blush. Blood may ooze from it. All these conditions should be carefully noted and reported to the medical officer. A foreign body such as a piece of cloth, bullet, a piece of bone, or such like should be carefully preserved.

Appetite and thirst.—Any variation in the appetite, whether for better or worse, or any peculiarity should be noted, also any partiality. Patients often take a dislike to some particular article of food, or express a wish for some other. Their wishes in these respects should be consulted as far as possible. Thirst or desire for drink should always be attended to and gratified as far as it can be.

CHAPTER VII.

THE IMMEDIATE TREATMENT OF THE APPARENTLY DROWNED, OF MEN WHEN SEIZED WITH FITS, AND OTHER CASES OF EMERGENCY.

Restoration of the apparently Drowned.

The following are the directions published by the Royal National Lifeboat Institution, and now generally adopted,

I.

Send immediately for medical assistance, blankets and dry clothing, but proceed to treat the patient *instantly* on the spot, in the open air, with the face downwards, whether ashore or afloat; exposing the face, neck, and chest to the wind, except in severe weather, removing all tight clothing from the neck and chest, especially the braces.

The points to be aimed at, are: first, and *immediately*, the RESTORATION OF BREATHING, and secondly, after breathing is restored, the PROMOTION OF WARMTH AND CIRCULATION.

The efforts to *restore breathing* must be commenced immediately and energetically, and persevered in for one or two hours, or until a medical man has pronounced that life is extinct. Efforts to promote *warmth* and *circulation* beyond removing the wet clothes and drying the skin must not be made until the first appearance of natural breathing. For if the circulation of the blood be induced before

breathing has recommenced, the restoration to life will be endangered.

II.—To restore Breathing.

To clear the throat.—Place the patient on the floor or ground with the face downwards, and one of the arms under the forehead, in which position all fluids will more readily escape by the mouth, and the tongue itself will fall forward, leaving the entrance into the windpipe free. Assist this operation by wiping and cleansing the mouth.

If satisfactory breathing commences, use the treatment described below to promote warmth. If there be only slight breathing, or no breathing, or if the breathing fail, then—

To excite breathing.—Turn the patient well and instantly on the side, supporting the head, and excite the nostrils with snuff, hartshorn, and smelling salts, or tickle the throat with a feather, &c. if at hand. Rub the chest and face warm, and dash cold water, or cold and hot water alternately, on them.

If there be no success lose not a moment, but instantly—

To imitate breathing.—Replace the patient on the face, raising and supporting the chest well on a folded coat or other article of dress.

Turn the body very gently on the side and a little beyond, and then briskly on the face, back again; repeating these measures cautiously, efficiently, and perseveringly about fifteen times in the minute, or once every four or five seconds, occasionally varying the side.* (Fig. 35.)

On each occasion that the body is replaced on the face, make uniform but efficient pressure with brisk movement,

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* By placing the patient on the chest the weight of the body forces the air out; when turned on the side this pressure is removed, and air enters the chest.

on the back between and below the shoulder blades or bones on each side, removing the pressure immediately before turning the body on the side. During the whole of the operations let one person attend solely to the movements of the head and of the arm placed under it.* (Fig. 36.)

The result is *respiration* or *natural breathing*, and, if not too late, *life*.

Whilst the above operations are being proceeded with, dry the hands and feet; and as soon as dry clothing or blankets can be procured, strip the body and cover or gradually reclothe it, but taking care not to interfere with the efforts to restore breathing.

III.

Should these efforts not prove successful in the course of from two to five minutes, proceed to imitate breathing by DR. SYLVESTER'S method, as follows:—

Place the patient on the back on a flat surface, inclined a little upwards from the feet; raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder blades.

Draw forward the patient's tongue, and keep it projecting beyond the lips; an elastic band over the tongue and under the chin will answer this purpose, or a piece of string or tape may be tied round them, or by raising the lower jaw, the teeth may be made to retain the tongue in that position. Remove all tight clothing from about the neck and chest, especially the braces.

To imitate the movements of breathing.—Standing at the patient's head, grasp the arms just above the elbows, and draw the arms gently and steadily upwards above the head, and *keep them stretched* upwards for two seconds. (Fig. 37.) (*By this means air is drawn into the lungs.*) Then turn

* The first measure increases the expiration, the second commences inspiration.

FIG. 35.—INSPIRATION IN DR. MARSHALL HALL'S METHOD.

FIG. 36.—EXPIRATION IN DR. MARSHALL HALL'S METHOD.

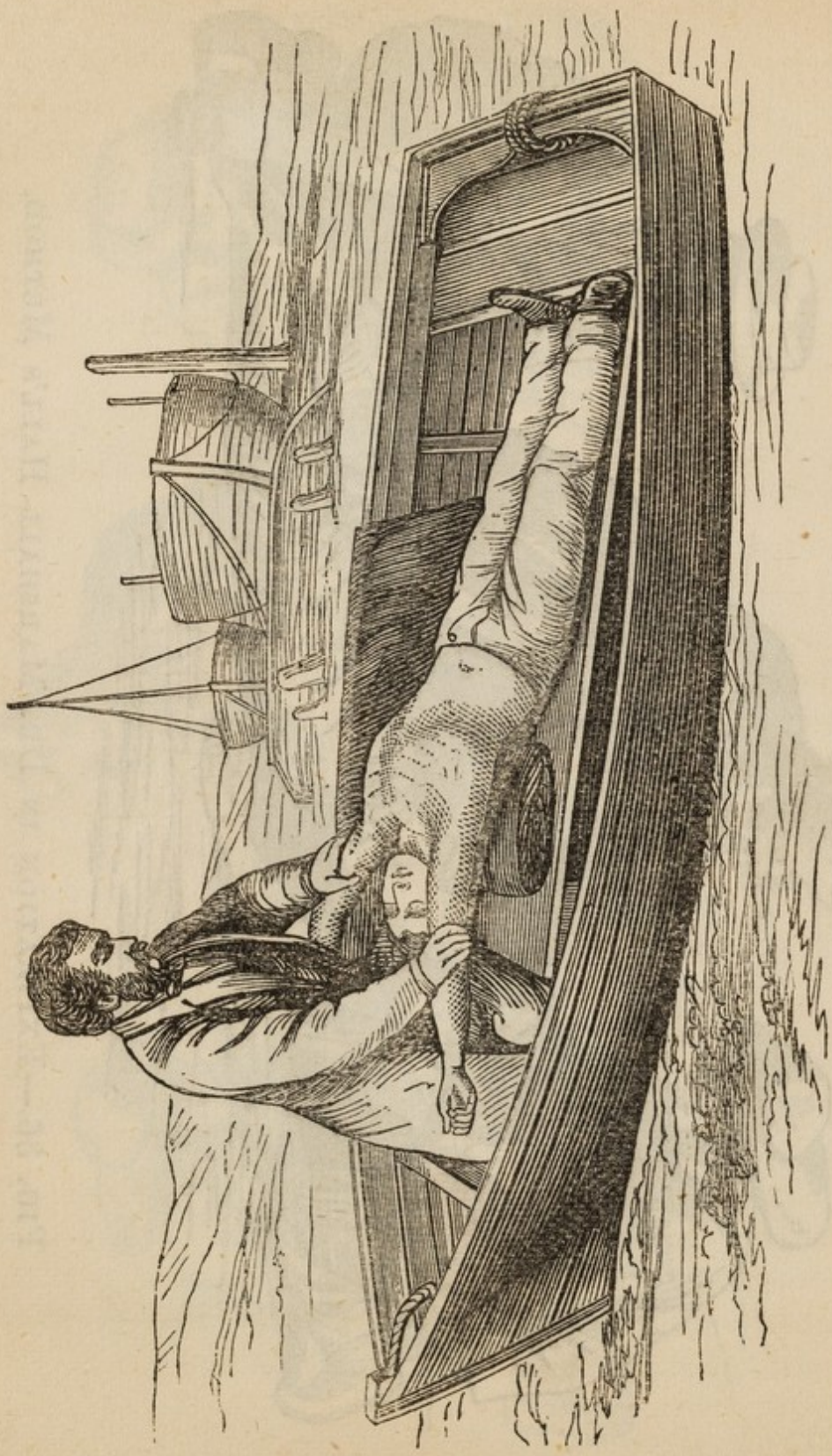

FIG. 37.—INSPIRATION IN DR. SYLVESTER'S METHOD.

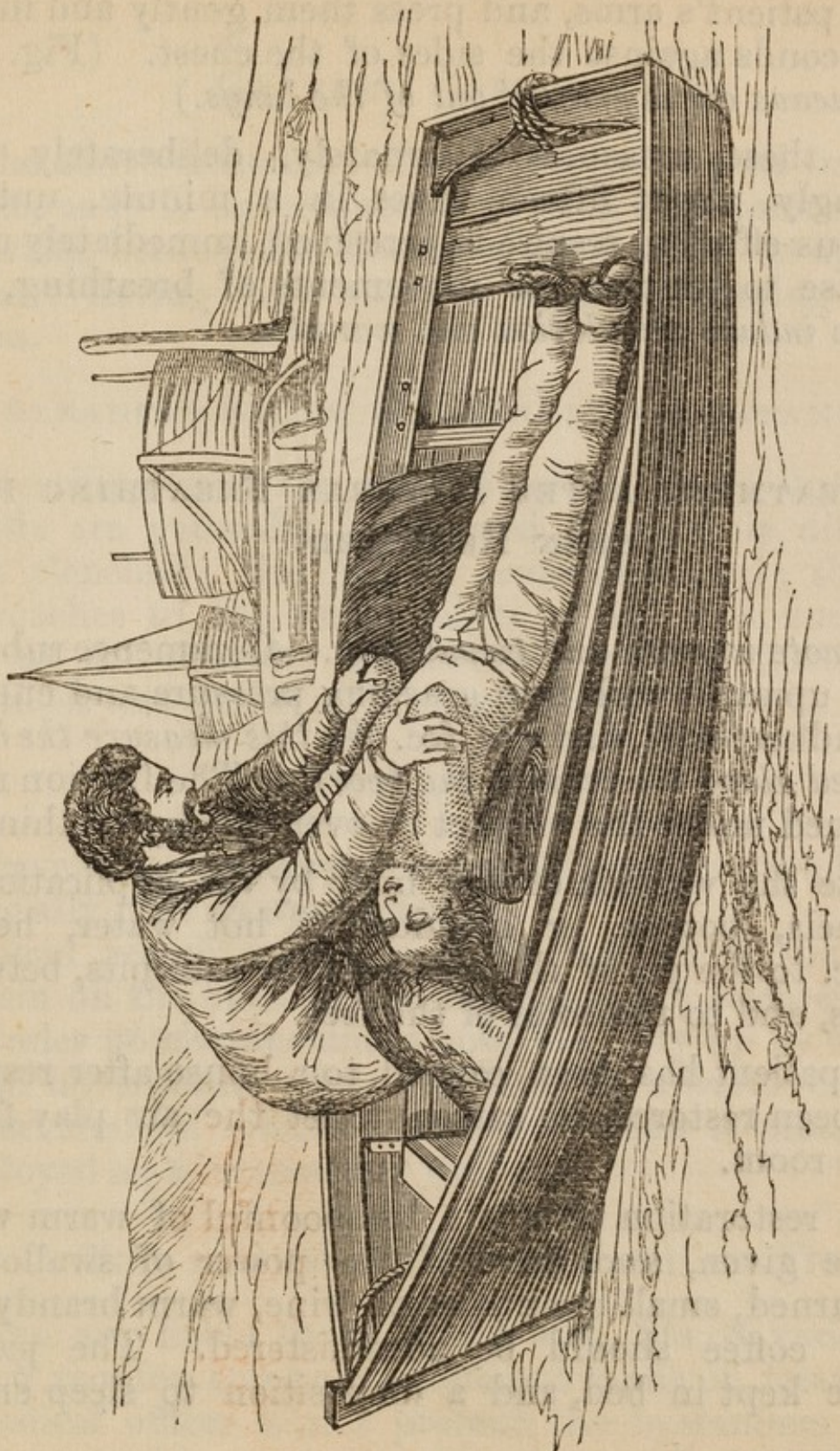

FIG. 38.—EXPIRATION IN DR. SYLVESTER'S METHOD.

down the patient's arms, and press them gently and firmly for two seconds against the sides of the chest. (Fig. 38.) (*By this means air is pressed out of the lungs.*)

Repeat these measures alternately, deliberately, and perseveringly, about fifteen times in a minute, until a spontaneous effort to respire is perceived, immediately upon which cease to imitate the movements of breathing, and proceed to *induce circulation and warmth.*

IV.—Treatment after Natural Breathing has been Restored.

To promote warmth and circulation.—Commence rubbing the limbs upwards with firm grasping pressure and energy, using handkerchiefs, flannels, &c. (*by this measure the blood is propelled along the veins to the heart*). The friction must be continued under the blanket or over the dry clothing.

Promote the warmth of the body by the application of hot flannels, bottles, or bladders of hot water, heated bricks, &c. to the pit of the stomach, the arm-pits, between the thighs, and to the soles of the feet.

If the patient has been carried to a house after respiration has been restored, be careful to let the air play freely about the room.

On the restoration of life a teaspoonful of warm water should be given, and then, if the power of swallowing have returned, small quantities of wine, warm brandy and water, or coffee should be administered. The patient should be kept in bed, and a disposition to sleep encouraged.

General Observations.

The above treatment should be persevered in for some hours, as it is an erroneous opinion that persons are irrecoverable because life does not soon make its appearance, persons having been restored after persevering for many hours.

Appearances which Generally accompany Death.

Breathing and the heart's action cease entirely; the eyelids are generally half-closed, the pupils dilated; the jaws clenched; the fingers semi-contracted; the tongue approaches to the under edges of the lips, and these, as well as the nostrils, are covered with a frothy mucus. Coldness and pallor of surface increases.

Cautions.

Prevent unnecessary crowding of persons round the body, especially if in an apartment.

Avoid rough usage, and do not allow the body to remain on the back unless the tongue is secured.

Under no circumstances hold the body up by the feet.

On no account place the body in a warm bath, unless under medical direction, and even then it should only be employed as a momentary excitant.

The immediate Treatment of Fits.

Men are liable to be seized with fits of various kinds which require somewhat different kinds of treatment. If a medical officer is not present the bystanders should at once proceed to treat the patient according to the nature of the fit with which he is seized.

Fainting fits occur in patients of almost any age, and are generally caused by over exertion in hot weather, heated rooms, or by getting into the upright position when weak from disease. It is distinguished by the patient sinking down prostrated, generally insensible, remaining quiet, without convulsions. The face and lips are pale, and the surface of the body cold, often covered with a clammy perspiration.

Lay the patient in the lying down position on his back with his head low, loosen the clothes especially about the neck and chest. Admit fresh air freely. Sprinkle cold water about the face and neck. Apply hartshorn or smelling salts to the nose. When able to swallow, administer stimulants, such as a little brandy and water or wine.

Epileptic fits occur at all ages, their causes are usually constitutional. The patient falls down with a scream, is insensible, generally has violent convulsions; throws his arms and legs about, foams at the mouth, and often bites his tongue, making it bleed.

Lay him in the lying down position on the ground or on a bed on his back, with his head slightly raised. Loosen the clothes about the neck and chest. Admit fresh air freely, and employ sufficient restraint to prevent him injuring himself, without pressing on his chest. To do this the attendants should take care not to stand opposite the patient's feet lest he kick out and cause injury in his struggles, and also in holding the head be careful not to allow the fingers to get into his mouth. If sufficient attendants be at hand for the purpose, the best method of holding him is for one to grasp each leg above the knee and above the ankle, and press them firmly downwards to the ground, and the two others to grasp each a hand and the point of the shoulder, while the fifth holds the head firmly between both hands.

Apoplectic fits occur mostly in elderly and stout persons. The patient falls suddenly, generally insensible. The face is red and the breathing loud and snorting. It is very often mistaken for drunkenness.

Loosen clothes about the neck. Raise and support the head and upper part of the chest. Admit fresh air. Apply cold water to the head. Give *no* stimulants.

Sunstroke occurs in hot climates or summer weather. The patient falls suddenly, generally insensible, the face red, sometimes convulsions.

Raise the head and upper part of body. Carry at once into the shade. Remove the clothes from the neck and upper part of the body. Douche the head, neck, and chest with cold water. Admit as much fresh air as possible. Avoid crowding round the patient. Give no stimulants.

Drunken fits.—The symptoms are generally well known. Place the patient on *his side* with head slightly raised. Do not allow him to lie on his back or on his face. Remove all constrictions from about the neck and upper part of the chest. Induce vomiting by tickling the throat with a feather. If able to swallow, give lukewarm water to drink.

CHAPTER VIII.

THE NAMES AND USES OF THE DIFFERENT SURGICAL INSTRUMENTS AND APPLIANCES.

Bistoury.—A long narrow knife, used for slitting up sinuses, straight, curved, sharp-pointed, and blunt or probe-pointed.

Bistoury, Hernia.—A long narrow knife, blunt except about an inch a little way from the point, used for operating on rupture.

Blow Pipe.—A tube used for inflation in *post-mortem* examinations.

Bougie.—An instrument used for dilating stricture.

Capital Case.—A surgeon's case for containing the instruments necessary for performing capital operations.

Case, Capital.—See Capital Case.

Catheter.—A tube for passing through the urethra into the badder, made of silver or gum elastic, of various sizes, numbered from 1 to 12 or 14, containing a wire called a stylet.

Caustic Holder.—A case for holding nitrate of silver; must be made of gutta-percha or some metal, such as silver, which the caustic will not corrode.

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

Director.—An instrument with a groove, in which to slide a knife.

Elevator.—An instrument for raising depressed pieces of bone.

Enema Apparatus. — An instrument for administering glysters.

Extractor, Coxeter's Bullet. — An instrument, with a scoop and pin, for extracting bullets.

Forceps, Dieffenbach's.—A small spring clip to fasten on an artery to stop bleeding.

Forceps, dissecting.—Plain forceps, used for dissecting purposes.

Forceps, dressing.—Forceps with scissor handles, used for removing old dressings from wounds and sores.

Forceps, Ferguson's clawed.—A strong forceps, with claws, used for gripping bone where much force is required.

Forceps, Gouge.—A strong forceps, cutting at the points, so as to gouge bone.

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

Forceps, Liston's Spring Artery.—Forceps for taking up arteries fixed by a spring catch with hooked points.

Forceps, Necrosis.—A strong forceps for pulling away dead bone.

Forceps, Savigny's Bullet.—An instrument with separate blades, used for extracting bullets.

Forceps, Syme's Spring Artery.—Forceps for taking up arteries, fixed by a spring with straight points.

Gouge.—A grooved chisel for gouging bone.

Hare-lip Pins.—Long steel pins for bringing the edges of wounds together.

Hernia Director.—A steel instrument, with a groove, used in the operation for rupture.

Knives, Amputating.—Large knives for cutting off limbs, generally of three sizes; large for amputation of the thigh, medium for the leg, small for the arm.

Knife, Tenotomy.—A small narrow knife for cutting tendons under the skin.

Lachrymal Probes.—Small silver probes for introducing into the tube or duct leading from the eye to the nose.

Lachrymal Styles.—A button-headed silver instrument for passing into the duct leading from the eye to the nose.

Lancet.—An instrument used for bleeding, vaccinating, and opening abscesses.

Lancet, Gum.—An instrument, sharp at the point, used for lancing the gums.

Laryngoscope.—An instrument for examining the throat and larynx.

Needle, Aneurism.—A curved instrument, with an eye near the point, used for passing a ligature round an artery.

Needle, Cataract.—A needle in a handle, without an eye, used in the operation for cataract.

Needle, Liston's.—A curved needle in a handle, the eye near the point, used for sewing wounds.

Needle, Simpson's.—A curved needle in a handle, used for sewing wounds with silver wire.

Needle, Surgical.—Curved needles of various sizes.

Ophthalmoscope.—An instrument for examining the eyes.

Pliers, wire.—A sharp strong instrument for cutting wire and pins.

Pocket Case.—A case to fit in the pocket, in which the surgeon carries his instruments.

Post-mortem Case.—A case for containing instruments used for examining bodies after death.

Probang.—A flexible instrument for passing down the gullet.

Probe.—A silver wire instrument for probing wounds.

Saw, Amputating.—A saw used for sawing the bone in amputations of a limb.

Saw, Butcher's.—A framed saw, the invention of Surgeon Butcher, used for the same purposes as the amputating, but more especially for excision of joints.

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

Scalpel.—A short knife, of different sizes, with a curved edge, used for cutting and dissecting.

Scarificator.—An instrument with a number of lances, used for scarifying the skin in the operation of cupping.

Scissors, Bowel.—A pair of scissors, with a hook, used for slitting up the intestines in *post-mortem* examinations.

Spatula.—A blunt knife for spreading ointments.

Staff.—An instrument for introducing through the urethra into the bladder in performing the operation for stone.

Stethoscope.—An instrument for examining the chest.

Stomach Pump.—An apparatus used for pumping into and out of the stomach.

Syringe, Hydrocele.—A glass syringe, made to fit on the canula, so as to inject the sack of a hydrocele when it has been tapped.

Tenaculum.—A sharp hook for taking up arteries or anything which may require hooking up.

Tourniquet.—An instrument for making pressure to stop bleeding. Of two kinds, the screw and the field tourniquets.

Tracheotomy Tubes.—Two curved silver tubes, one fitting inside the other, used for putting into the windpipe when an opening has to be made in it.

Trephine.—A circular saw, used in operations on the skull.

Trocar and Canula.—A sharp pointed instrument and sheath for tapping collections of water. Large for tapping the belly or chest, small for tapping hydrocele.

Trocar and Canula, exploring.—A very fine instrument for searching for fluid in swellings.

CHAPTER IX.

THE FIRST ASSISTANCE TO BE RENDERED TO WOUNDED ON THE FIELD OF ACTION.

It frequently happens in great battles that large numbers of men are wounded at nearly the same time, so that it is impossible for immediate assistance to be given to all by the medical officers of the forces engaged. Therefore it becomes necessary that others who have to do with the care and removal of the wounded should possess a knowledge sufficient to enable them to render such *immediate assistance* as may be required to give safety and comfort to the sufferers until medical aid can be obtained.

The performance of this duty will principally fall to the lot of the "bearer detachment" of the Army Hospital Corps. The following is proposed as the organization and equipment of this detachment:—

A detachment of bearers will be divided into companies, a company into sections, and a section into files. A file will consist of three men of as nearly as possible the same height, and will be styled a stretcher-party. A section will be formed of four files, and will, when practicable, be in charge of a serjeant. A company may be composed of four or any number of sections, and will be commanded by an executive officer. A detachment may be composed of any number of companies.

Each bearer will be equipped with—1 valise, 1 haversack, 1 sword bayonet, 1 water bottle, and 1 dressing pouch containing 1 winged screw tourniquet, 4 triangular bandages, 1 piece of tape, 2 ozs. tow or oakum, 2 ozs. lint, sticking plaster, oiled silk, and a pocket dressing case containing

1 pair of scissors, 1 pair dressing forceps, 1 strong knife, 1 spatula, 1 probe and director, 1 doz. pins, 6 sewing needles of sizes, and 1 skein of sewing thread (see Fig. 39).

FIG. 39.—BEARER CARRYING HIS KITS AND DRESSING POUCH.

Each file or stretcher-party will be equipped with 1 stretcher containing a complete set of field splints, as shown in figures 59, 60, 61, and 62.

When a man falls wounded in the field, the order of procedure should be to seek for the position of the wound;

to remove clothing so as to expose it; to see if there be hæmorrhage, and if so to take immediate steps to arrest it; to loosen all belts, accoutrements, &c. likely to cause constriction; to administer such stimulants or drinks as may be available; to apply a temporary dressing, or, in cases of fractured limbs, such appliances as may be necessary to prevent pain and further mischief being done by the sharp ends of the broken bone in transport to the first line of surgical assistance; and by the best mode of lifting and laying the wounded, to place him either in a place of safety or on a conveyance.

To seek for the Wound.—If the wounded man be unable, from weakness or insensibility, to explain where he is hurt, the attendant will be guided to the position of the wound by torn clothing, the appearance of bleeding, or by the patient clutching the injured part.

To Expose the Wound.—Having ascertained the position of the wound, the attendant should completely expose it before attempting to dress it. At the same time he should be very careful not to expose more of the patient's body than is absolutely necessary, in order that the vital force may not be diminished from a lowering of the temperature of the body.

In the lower extremity the trousers should be ripped up the seam to a short distance above the wound; and where much bleeding is taking place, as high up as will enable the attendant to get at the femoral artery in the groin or upper part of the thigh, and apply pressure upon it if necessary. If the boot and sock require to be removed, they should be cut open, and no attempt made to pull them off, lest in doing so the injury be aggravated.

In the upper extremity the sleeves of the coat and shirt should be ripped up the seams to a little above the wound; and where much bleeding is taking place as high as the

FIG. 40.—WINGED SCREW TOURNIQUET ON THIGH.

FIG. 41.—PRESSURE BY HANDS ON FEMORAL ARTERY.

arm-pit, so as to enable the attendant to get at the brachial artery, and apply pressure upon it if required.

In the body the wound may be laid bare by unbuttoning the coat, shirt, trousers, &c. The clothes, however, should not be removed from the body unless absolutely necessary, as wounded are very susceptible of the effects of cold.

To arrest Bleeding.—When the wound has been laid bare, it will be seen whether bleeding is taking place or not. If so, no time should be lost in having recourse to some of the measures for arresting the flow of blood, as every movement is of the greatest importance as regards the

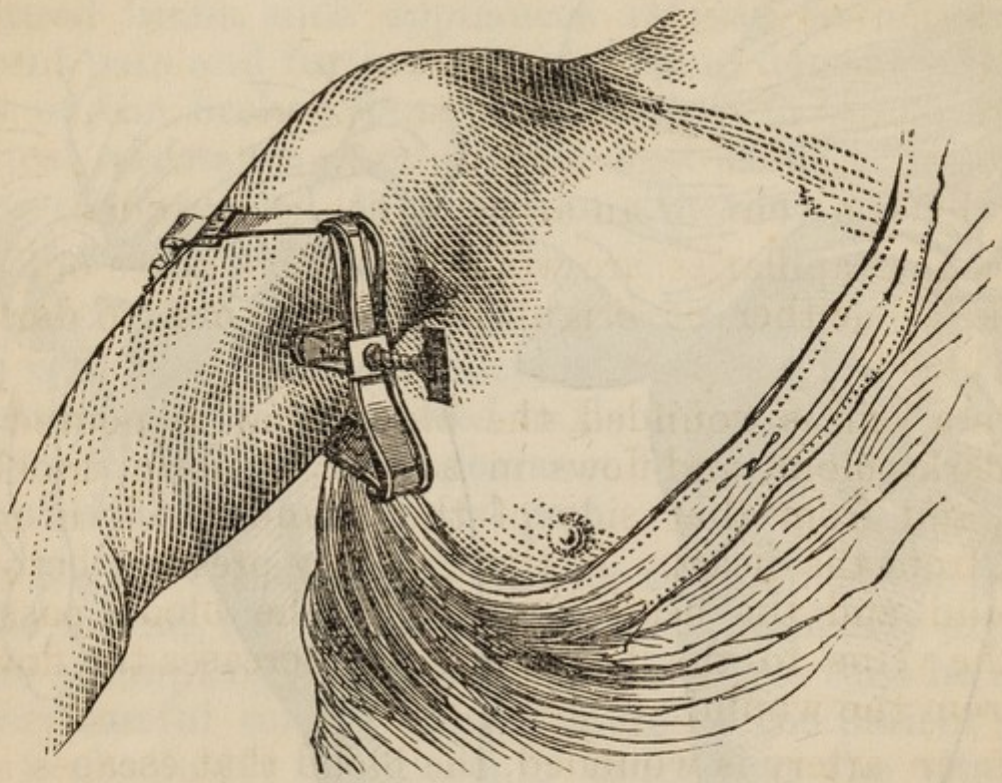

FIG. 42.—WINGED SCREW TOURNIQUET ON ARM.

life of the wounded. It is computed that no less than one-fifth of the deaths which occur on a battle-field are attributable to hæmorrhage. It will therefore be seen how important it is to be thoroughly acquainted with the means at our disposal for arresting this bleeding, which is so destructive of life, not only in such a large number of cases, but in such a short space of time.

The blood—the fluid on which life depends—is always in motion, circulating through the body in the arteries, veins, and capillaries. Forced along these arteries by the heart, which acts as a pump, the blood travels with great

rapidity, and finds its way into the capillaries in the most remote parts of the body. It is then taken up by the veins and carried back to the heart, from thence it passes to the lungs to be purified, and back again to the heart, to be again forced along the arteries to the remote parts of the body.

When there is a lesion or wound of any of the vessels in which the blood circulates, bleeding takes place, in large or small quantity, in proportion to the size of the vessel injured, and varies in character according as to whether it is a capillary, a vein, or an artery which is wounded.

When the capillaries are wounded, blood oozes out of a mixed kind, neither so bright as arterial, nor so dark as venous blood.

When a vein is wounded, the blood that is poured out is of a dark colour, and flows in a slow, uniform, trickling stream, and from that side of the wound which is most remote from the heart. If there be any pressure between the wound and the heart it prevents the blood passing along the veins to the heart, and so increases the flow of blood from the wound.

When an artery is wounded, the blood that escapes is of a bright red colour. It spouts out in a quick, jerking stream or jet, and comes from that side of the wound which is nearest the heart. The force of the jet of blood will depend upon the size of the artery. When a large artery is wounded, such as the femoral or carotid, a few moments are sufficient for life to be destroyed.

Bleeding from an artery is called *arterial* hæmorrhage, while that from a vein is called *venous* hæmorrhage, and that from the capillary is called *capillary* hæmorrhage. Arterial hæmorrhage is more dangerous than venous, and more difficult to arrest, and capillary bleeding is less dangerous than either. The characters of each should be noted, so as to be able to distinguish the one from the

other, with a view to the means to be adopted in the treatment.

If the bleeding be capillary, washing the wound with cold water will generally make vessels contract and stop the bleeding. Where this cannot be had recourse to a pad of dry lint placed over the wound and kept in place by a bandage moderately tight will generally be sufficient, or the "graduated compress," to be hereafter described.

If the bleeding be *venous*, all constriction or pressure between the wound and the heart should be removed; the patient should be placed in an inclined position, lying down if possible, and, if the wound be in any of the extremities, the limb should be raised. If the bleeding still continue, the wound may be stuffed with pieces of dry lint, charpie, or old linen, and a compress placed over it, in the form of the "graduated compress," to be hereafter described. It should never be attempted to heap a quantity of cloths over a bleeding wound, as such cannot exercise any pressure, and may do a great deal of harm by concealing the bleeding going on beneath them.

If the bleeding be *arterial*, the means for arresting it may be divided into those employed at the seat of injury, and those at a distance from it on the main artery leading to it. When it is ascertained from the character of the bleeding that it is arterial, no time should be lost in placing the face of the thumb on the bleeding point, within the wound, and making firm pressure on it, aided by the fingers and thumb of the other hand, if necessary. This pressure should be maintained, and the escape of blood prevented, until some of the other, more permanent, means can be employed or medical assistance be procured.

This means of pressure may be replaced by a graduated compress, or by a ligature.

To apply a graduated compress, a piece of lint or other material is lightly folded to about the size of the point of

the finger. This is slipped under the thumb on the bleeding point, and pressed there until another piece, a little larger, is placed on the top of it; and so on, until the pile so formed rises above the surface or edges of the wound, cone-shaped, with its point or apex on the wound in the vessel, its base rising above the surface of the part where the wound is situated. A small pad should now be placed on the base of the cone, and a bandage tightly applied.

To tie a Ligature.—The edges of the wound should be lifted up, and if a vessel be seen spouting, a tenaculum should be thrust through it; and it being pulled out, a strong thread should be passed round it, below the tenaculum, and tied in a double knot. If a second or more vessels be seen spouting, they should be hooked up and tied in a similar way. This, however, is difficult to do except where the limb is carried away. The artery then will be easily found and known by its throbbing, and should at once be secured by a ligature

Pressure at a distance from the wound, on the main artery, may be made either by the hand or by means of a tourniquet, and the position of exercising such pressure will vary according to the nature and situation of the wound. The object in view is to cut off the supply of blood from the wounded part.

If the wound be on one of the lower extremities, the points selected are the upper and inner part of the thigh, and the groin where the femoral artery emerges from the abdomen. Here the artery has little covering, and behind it are bones against which it can be compressed. See Fig. 40.

If the wound be on one of the upper extremities, the point selected is the upper and inner part of the arm, over the brachial artery, just below the armpit, where the vessel has little more covering than the skin, and has beneath it the hard bone, against which it can be compressed. (See

Fig. 42). If the wound be in the axilla, the point selected for pressure is on the subclavian artery as it passes over the first rib, behind the middle of the collar-bone. If the wound be on the face, head, or upper part of the neck, the position selected is a point at the side of the windpipe, over the common carotid artery, corresponding to the side of the body on which the wound is situated. Here the vessel has little covering, and behind it is the spinal column, which affords a firm substance against which it can be compressed.

To press with the Hands.—The limb should be grasped with both hands, one thumb placed over the other on the course of the artery, and firm pressure made until the flow of blood through the artery is stopped, which will be known by observing the wound. (See Fig. 41.)

The course of the artery will be known by its pulsation, and thus the point for pressure will be selected. Pressure will be in vain if it is not applied directly over the vessel.

To press by a Tourniquet.—The ordinary tourniquets supplied are of two kinds, the field tourniquet and the screw tourniquet, and now the winged screw tourniquet is being introduced.

The field tourniquet consists of a strap, a pad, and a roller buckle. The pad is placed over the artery and the strap brought round the limb through the buckle. Then steadying the pad in its place with one hand, the strap is tightened with the other, and buckled.

The screw tourniquet consists of two plates, a thumb-screw, a pad, and a strap or girth. The screw should be unscrewed until the plates are brought together, the pad beneath the plates is then placed over the artery, the strap carried round the limb, and buckled, without being so tight as to constrict the limb and stop the return of the blood by the veins. The screw is then quickly twisted, which

has the effect of separating the plates, and so making the requisite pressure, by tightening the strap round the limb.

The winged screw tourniquet designed by Surgeon-Major Moffitt is much like the screw tourniquets last described, but it has two wings extending out at each side which bear off the pressure from the limb and keep it from being constricted. (See Fig. 43.)

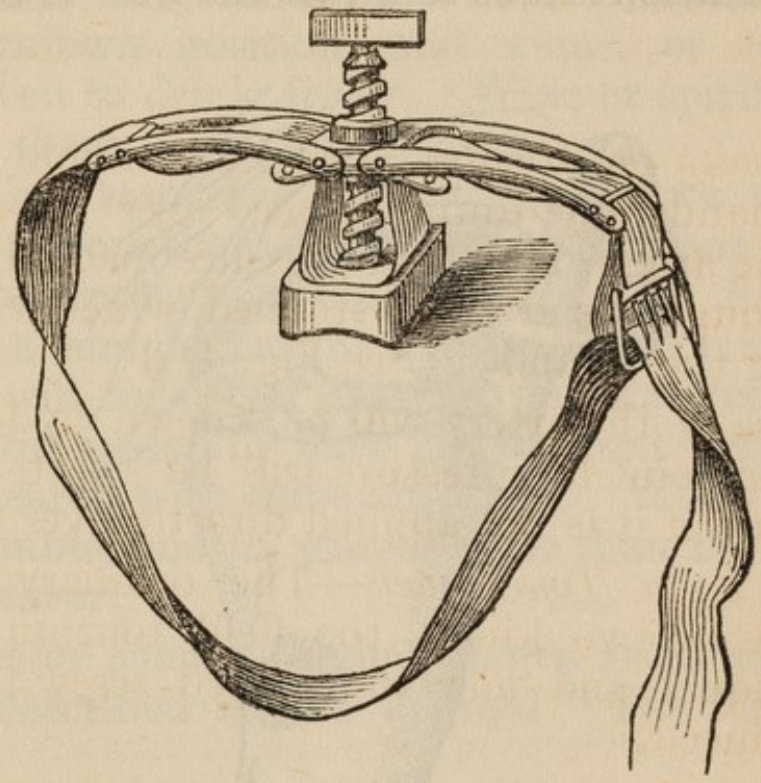

FIG. 43.—THE WINGED SCREW TOURNIQUET.

It may often happen that no tourniquet is available, then it will become necessary to improvise one.

A substitute for the strap may be made of a piece of bandage or a handkerchief; for the pad or compress, of a roller bandage or a smooth stone; and for the buckle or screw, of a piece of stick, a ramrod, bayonet, or sword. The substitute for a pad being placed over the artery, the bandage or handkerchief should be passed once or twice round the limb, and tied securely over the pad. It must not,

however, be tied tightly on the limb, but sufficient space must be left to admit whatever is used for twisting. The twister is then passed between the bandage and the skin (if available, a piece of thin board, bark, or stiff leather being first placed between the stick and the skin to prevent the latter being pinched), and twisted, until by tightening the handkerchief or bandage, the pad is pressed upon the artery with sufficient force to arrest the flow of blood. (See Fig. 44.)

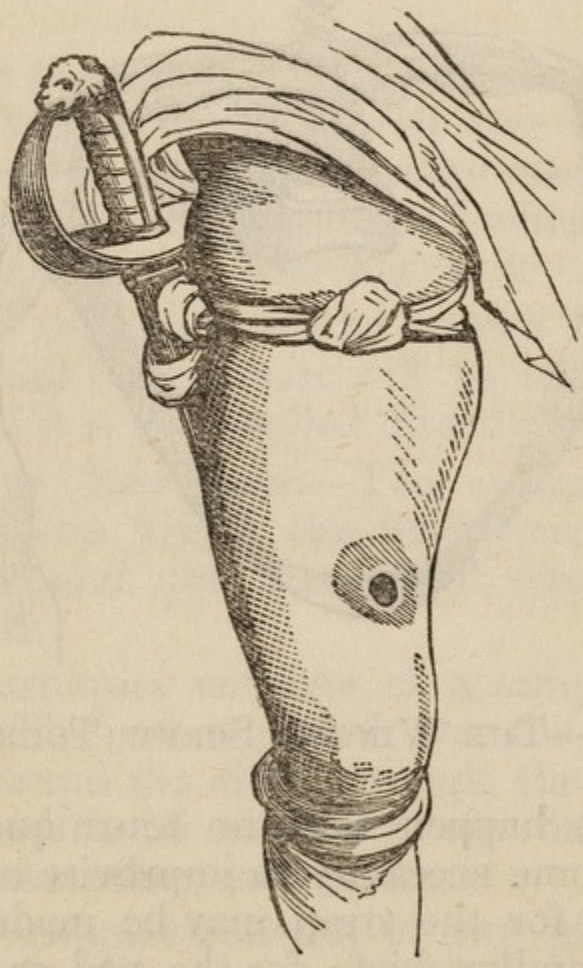

FIG. 44.—IMPROVISED TOURNIQUET.
From Erichsen's Surgery.

To remove Constrictions.—The braces, the collar of the shirt or tunic, the waistband of the trowsers, tightly laced boots, and straps or accoutrements, are the things most

likely to cause constriction. These should be at once loosened, lest by their pressure they increase the flow of blood from the wound by impeding the venous circulation, or obstruct the breathing.

To administer Drinks and Stimulants.—Wounded often become faint, and when there is much loss of blood, experience unquenchable thirst.

In such cases, they should be kept as much as possible in the lying-down position, and water, or other fluids, should be given to drink freely. Wine or spirits should be added where there is much weakness.

To apply a Temporary Dressing.—Before removing a wounded man from the field, it is essential that some dressing should be applied to the wound. This first dressing must be of a simple nature and such as can be rapidly applied. It will consist of lint and the triangular bandage.

The lint will generally have to be used dry, but it may be wet or smeared with some ointment. When used dry it should be double, and in pieces larger than the wound it is intended to cover.

The triangular bandage is that known as Esmarch's bandage. It is described in his manual "The First Dressing

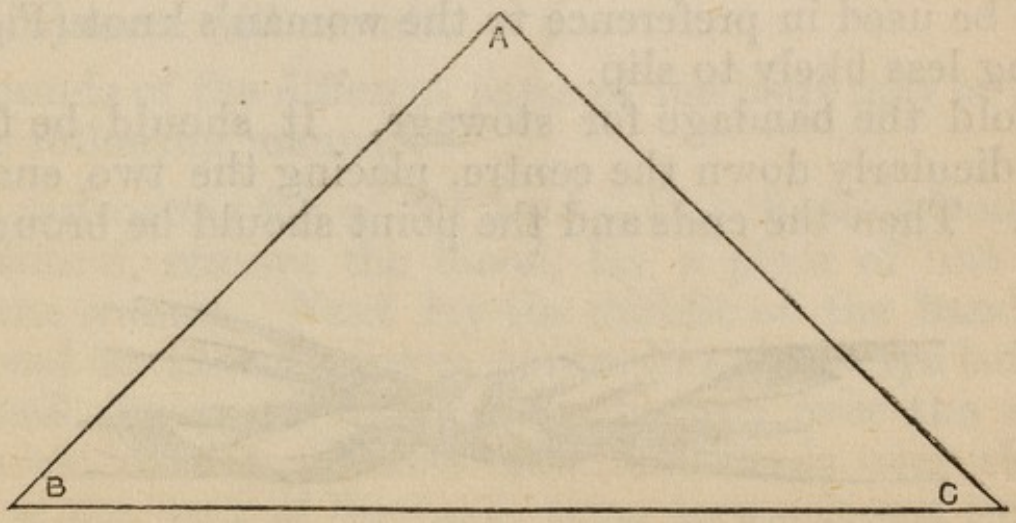

FIG. 45.—TRIANGULAR BANDAGE.

" on the Battle Field," from which I have extracted the following directions and illustrations as to the method of using it :—

The bandage is a triangular piece of linen or calico (Fig. 45) made by taking a piece of either of these materials 33 to 36 inches square and cutting it diagonally, that is to say, from one corner to the other, into two pieces.

Of the three borders of the outspread cloth the longer reaching from *b* to *c* in the diagram is called the lower, the two others the side borders.

Of the three corners the upper one opposite to the lower border may be named the point, the side ones the ends.

The mode of using the bandage will vary according to the part of the body to which it may have to be applied. But generally speaking it may be said to be applied either folded as a neck handkerchief or unfolded.

To fold it as a neck handkerchief it may be folded broad or narrow : having spread out the bandage, commence by carrying the point over to the lower border, and still working from the direction of the point, when it is required broad, fold it twice, and when narrow three times.

The bandage is fastened either by pinning the ends together or by knotting them. The sailor's knot (Fig. 46) should be used in preference to the woman's knot (Fig. 47) as being less likely to slip.

To fold the bandage for stowage. It should be folded perpendicularly down the centre, placing the two ends together. Then the ends and the point should be brought to

FIG. 46.—SAILOR'S KNOT.

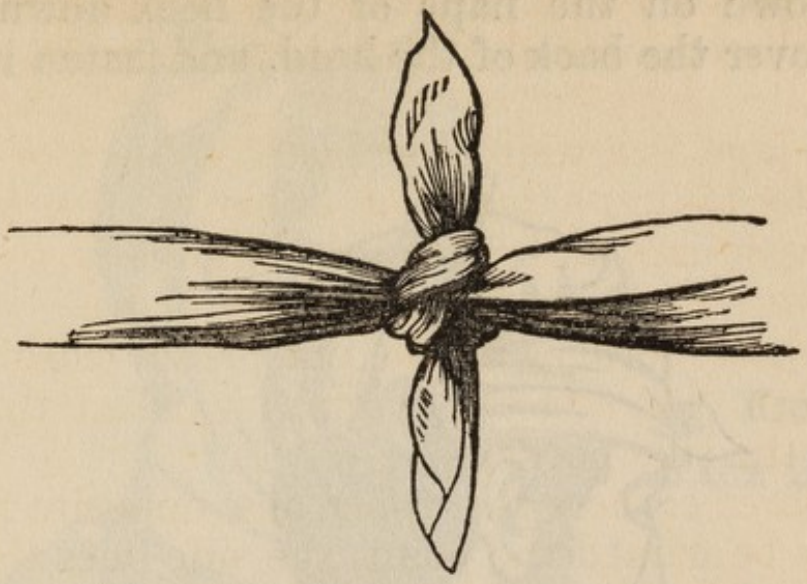

FIG. 47.—WOMAN'S KNOT.

the centre of the lower border or base of the perpendicular line, thus forming a square. This should be folded in half and till it assumes the form of a small packet six inches by three.

Before applying the dressing all blood and dirt should be removed from about the wound, either by wiping with some tow or by washing with cold water, should it be available. The hairs should also be cut away if time and circumstances will permit.

Wounds of the different parts of the body may be dressed in the following manner.—

Wound on the top of the head.—Cut the hair from about the wound, remove the blood, lay a piece of lint double over the wound. Next lay the middle of the bandage on the head so that the lower border lies crossways before the forehead, the point hanging downwards over the nape of the neck. Carry the two ends backwards over the ears, cross at the back of the head, bring forwards and tie on the forehead (Fig. 48). Then stretch the pointed portion

hanging down on the nape of the neck downwards, and turn it up over the back of the head, and fasten it on the top with a pin.

FIG. 48.—HEAD BANDAGE.

Wound on forehead, side, or back of head.—Having cleansed the wound and laid on the lint, fold the bandage *narrow*, lay its centre over the wound, and carrying the ends backwards, tie at the opposite side of the head; or if the bandage be long enough, the ends may be crossed at the opposite side, carried forward, and knotted in front.

Wound of the jaw or side of face.—Having cleansed the wound, and laid on the lint, fold the bandage narrow, place the centre under the chin, carry the ends upwards one at each side, and tie on the top of the head (Fig. 49).

Wound of the eyes or front of face.—Apply the bandage in the same way as the foregoing (Fig. 50).

FIG. 49.
FACE BANDAGE.

FIG. 50.
EYES BANDAGE.

Wound of the chest.—The wound being cleansed, and a piece of lint laid over it, place the middle of the bandage on the chest with the point over one shoulder, carry the two ends round the chest, and knot at the opposite side. Next draw the point over the shoulder downwards, and tie or piece it to one of the ends (Figs. 51 and 52).

FIG. 51.—CHEST BANDAGE.

Wound of shoulder.—Cleanse the wound and lay on it a piece of lint. Lay the centre of the bandage on the point of the shoulder with the point up the side of the neck, and the lower border lying on the middle of the upper arm. Carry the two ends round the arm and crossing them on its

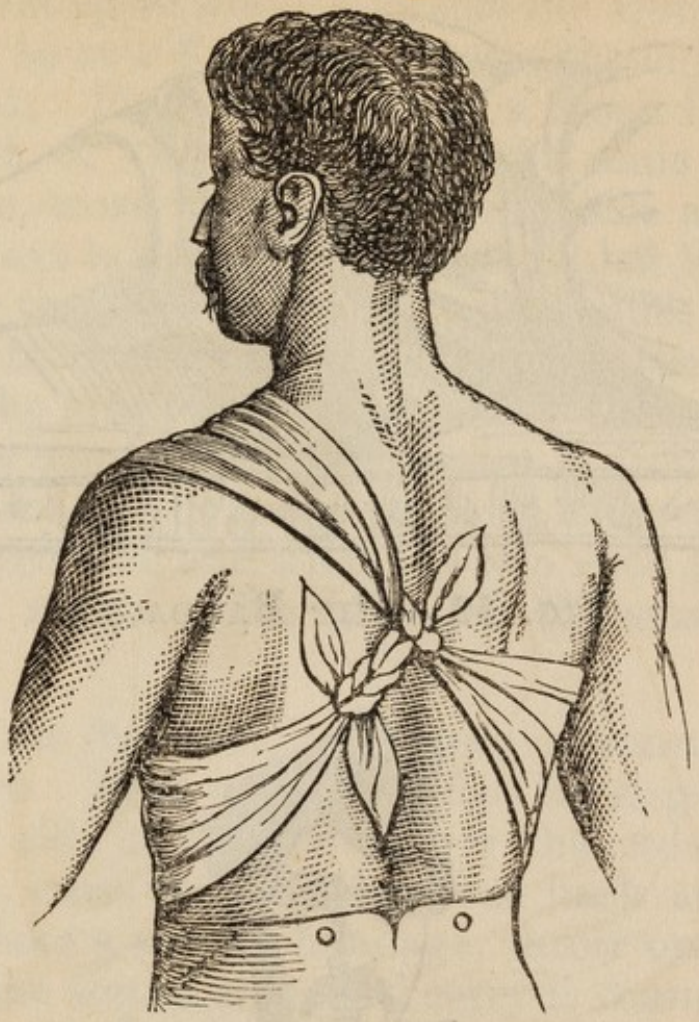

FIG. 52.—CHEST BANDAGE.

inner side, carry them back and tie on the outside. Take a second bandage, fold it and make an arm sling of it; then draw the point of the shoulder bandage under the sling, fold it back on itself, and fasten with a pin on the top of the shoulder.

Wound of the hip.—Cleanse the wound and lay on it a piece of lint. Fold one bandage narrow and tie it round the lower part of the belly for a waistbelt. Lay the centre of a second bandage on the wound with the point upwards, pass the ends round the upper part of thigh, cross and carry to the front, and knot them together. Next pass the point under the waistbelt and fasten it with a pin (Fig. 53.)

FIG. 53.—HIP BANDAGE.

FIG. 54.—ARM BANDAGE AND SMALLER ARM SLING.

Wound of the upper arm.—Cleanse the wound or wounds, as there will be two if the ball passes through, lay on each a piece of lint. Place the centre of a broad folded bandage on the front of the limb, carry the ends round to the opposite side, cross them, carry them back and knot them together. Next take a second broad folded bandage, throw one end over the shoulder at the sound side, carry it round the back of the neck so as to be visible at the opposite side. Then bend the arm carefully and carry the wrist across the middle of the bandage hanging down in front of the chest. This done carry up the hanging down end over the shoulder at the wounded side and knot the two ends together at the nape of the neck. This is called the smaller arm sling (Fig. 54).

Wound of the fore-arm.—Cleanse the wounds, lay on each a piece of lint. Take a broad folded bandage, lay its centre on the outer side of the limb, carry the ends round to the opposite side, cross them, carry them back and knot them together. Take a second bandage, throw one end over the shoulder at the sound side, and carry it round the back of the neck so as to be visible at the opposite side, where it is to be held fast, place the point behind the elbow of the injured arm and draw down the end in front of the patient. Next bend the arm carefully and place it across the chest on the middle of the cloth. Then carry the end hanging down upwards over the shoulder of the wounded side, and knot to the other end at the nape of the neck. This done draw the point forwards round the elbow and fasten it with a pin.—This is called the larger arm sling (Fig. 55).

Wounds of the hand.—Cleanse the wound and lay a piece of lint on each wound. Take a bandage, spread it out, and lay the wrist on the lower border with the fingers towards the point. Next turn the point over the fingers and carry it up on the wrist. This done carry the ends round the

wrist, fixing the point, cross them, carry back again, and knot together (Fig. 56).

FIG. 55.—LARGER ARM SLING.

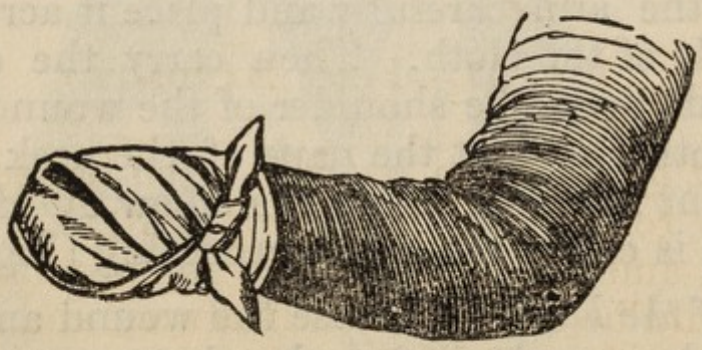

FIG. 56.—HAND BANDAGE.

Take a second bandage and support the forearm in the larger arm sling.

Wounds of the thigh, knee, or leg.—Cleanse the wound and lay a piece of lint on each wound. Take a broad folded bandage, lay the centre of it on the front of the limb, carry the ends round and cross at the opposite side, carry them back, and knot them together.

Wound of the foot.—Cleanse the wound and lay on each wound a piece of lint. Take a bandage, spread it out and place the sole of the foot on its centre with the toes in the direction of the point. Draw the point upwards over the toes and instep of the foot. Then carry the ends forward round the ankle, cross on the instep, carry them downwards, and knot them together on the sole of the foot (Fig. 57).

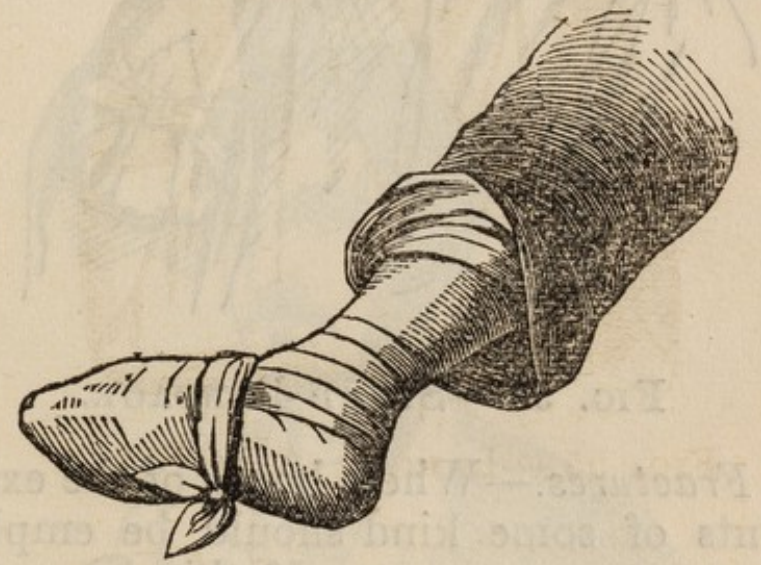

FIG. 57.—FOOT BANDAGE.

A limb shot off.—When, as will often happen, a limb is torn away by round shot, the artery will, as a rule, be seen hanging out, and will be known by its throbbing or pulsating. It should be secured by a ligature, and a tourniquet should be applied moderately tight, close to the end of the stump, which will have the effect of preventing the trickling of blood, and of controlling muscular spasms. Next take a bandage, lay its lower border under the limb above the

end of the stump, then draw the pointed portion upwards over the stump, and carrying the ends round the limb tie them together, so as to fix the point. (Fig. 58.)

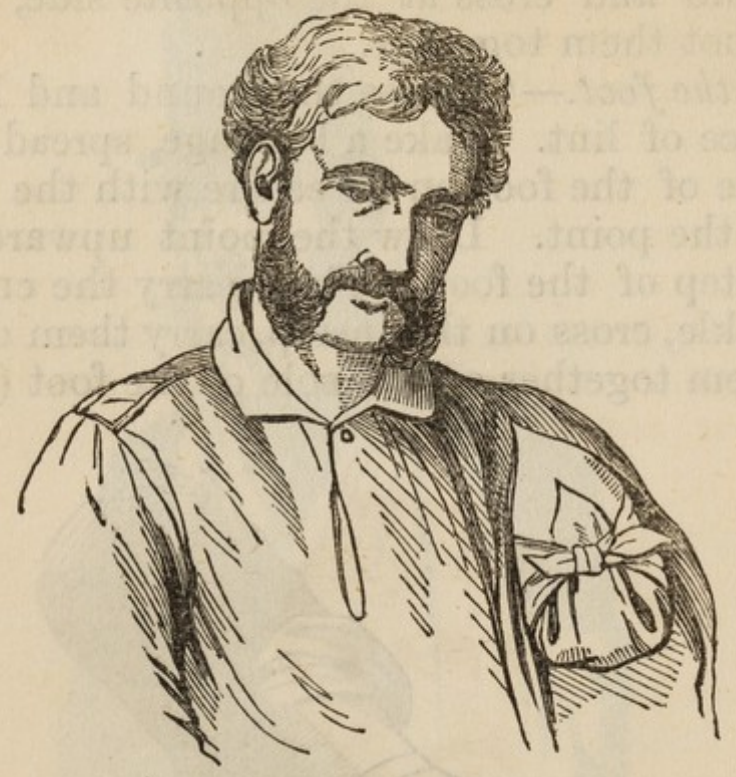

FIG. 58.—STUMP BANDAGE.

To secure Fractures.—Where bones of the extremities are broken, splints of some kind should be employed to fix them, and prevent movement. If this be not done great suffering is caused to the patient during transport, and the injury may be so aggravated as to lessen considerably the chances of recovery.

Light and portable splints designed by Surgeon-Major Moffitt, and manufactured by Messrs. Evans and Wormull, 6, Dowgate Hill, London, are likely to be adopted for this purpose.

The splints are in two sets, one set (the shorter of the two) is for fractures of the upper extremity—the upper arm and fore-arm,—and the other set (the longer of the two)

is for fractures of the lower extremity—the thigh and leg. They are complete in straps and pads.

In time of war it is intended that each stretcher or litter should be furnished with these two sets of splints, and that they should be strapped on to pieces of webbing, sewn on the canvas of the stretcher, at each side of where the patient's feet rest, or pockets might here be provided for them.

The following are the directions for applying them.

Fracture of the Upper Arm.—Rip the sleeves of the coat and shirt up their inner seams, as far as the arm-pit, apply a suitable first dressing to the wound, should such exist, make extension of the limb, and replace the broken fragments in their natural position. Now, having bent the

FIG. 59.—FIELD SPLINTS ON ARM.

elbow to a right angle, place the short splint on the inside of the arm, the long one on the outside, and buckle the straps sufficiently tight to prevent movement. If time and circumstances permit apply a roller bandage from the fingers up to the elbow. That done, carry the fore-arm across the chest and support the hand and wrist in the lesser arm-sling. (See Fig. 59.)

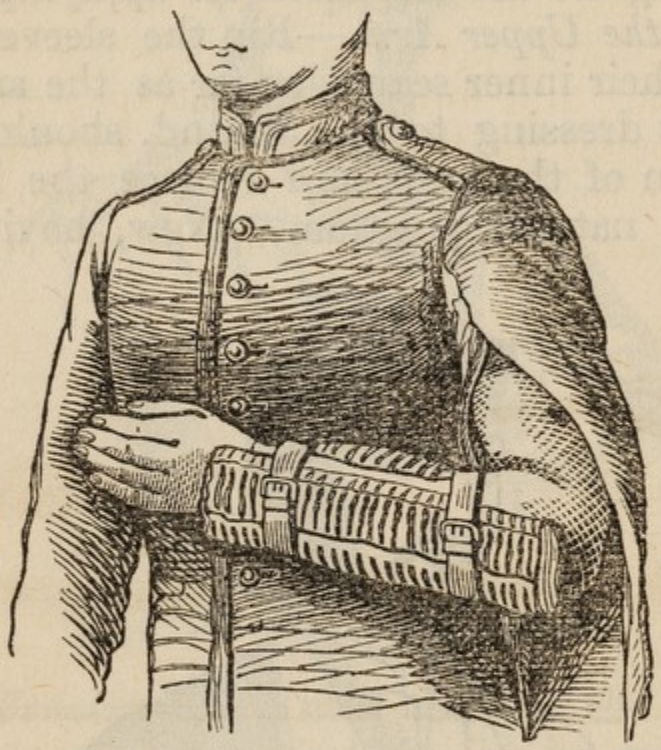

FIG. 60.—FIELD SPLINTS ON FORE-ARM.

Fracture of the Fore-Arm.—Rip the coat and shirt sleeves as high as the elbow, apply a suitable first dressing to the wound, should such exist, make extension of the limb, and replace the broken fragments in their natural position. Now, bend the elbow to a right angle, place the short splint on the inside, and the long one on the back of the fore-arm and buckle the straps sufficiently tight to prevent movement. This done carry the hand across the chest, and support the

whole of the fore-arm in the larger arm-sling. (See Fig. 60.)

Fracture of the Thigh.—Lay the patient on his back, rip the trousers up the outer seam, as high as the hip; apply a suitable first dressing to the wound, should such exist, and make extension until the limb is the same length as the sound one, and the broken fragments are replaced in their natural position. Now, place the short splint—one end close up into the perineum—on the inside, the long one on the outside, and buckle the straps,—the lower one immediately below the knee, the upper round the hips, and the two middle round the thigh. If time and circumstances permit, apply a roller bandage from the toes up to the knee. (See Fig. 61.)

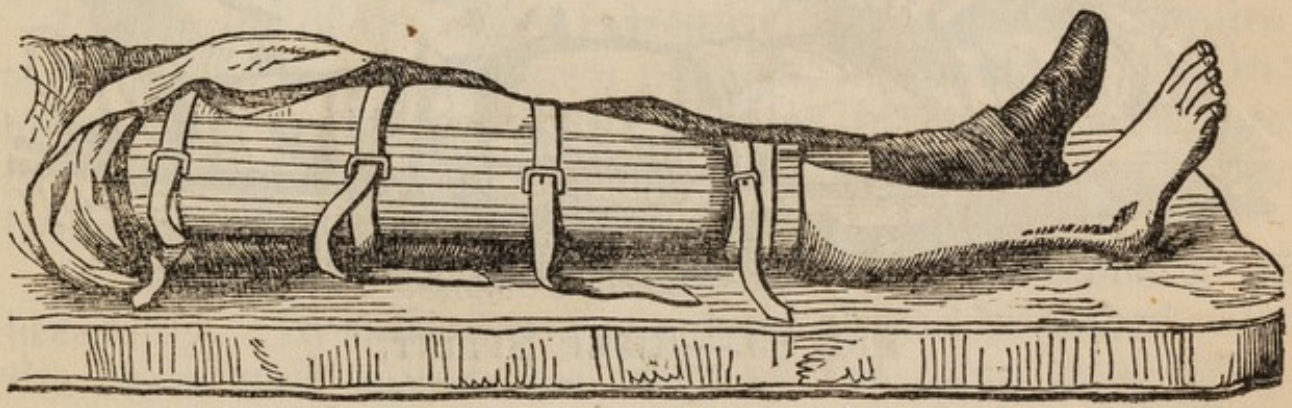

FIG. 61.—FIELD SPLINTS ON THIGH.

Fracture of the Leg.—Place the patient on his back, rip the trousers up above the knee; apply a first dressing to the wound, should such exist, make extension, and replace the broken fragments in their natural position. Now place the short splint on the inside, the long one on the outside, and buckle the straps,—the lower one in the figure of 8 round the foot and lower ends of the splints. (See Fig. 62.)

Where splints such as recommended above are not available, a musket, sword, piece of wood, &c. may be employed,

or the injured limb may be bandaged to the sound one. (See Fig. 63.)

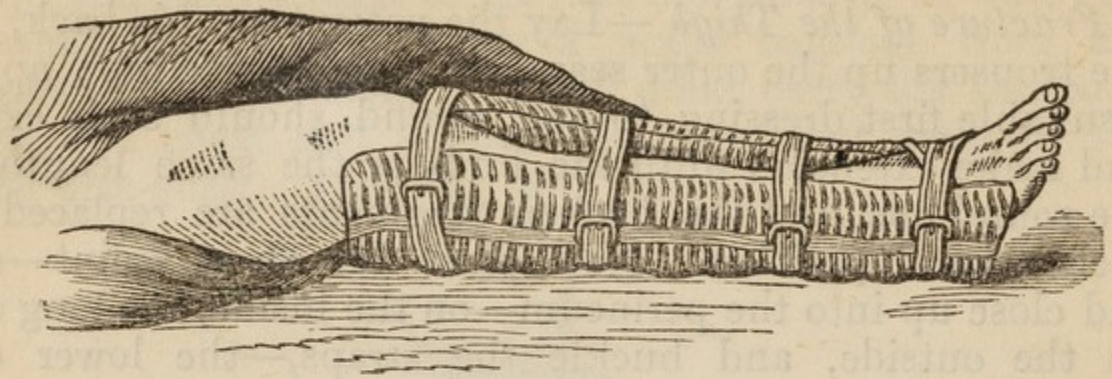

FIG. 62.—FIELD SPLINTS ON LEG.

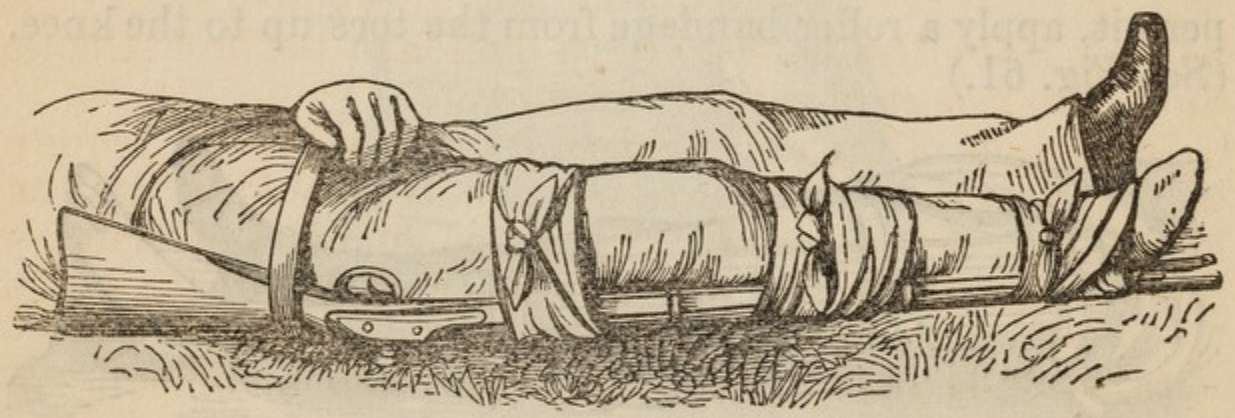

FIG. 63.—RIFLE SPLINT.

To lift and place in a Place of Safety or on a conveyance.—The best methods of lifting and placing wounded on stretchers, ambulance waggons, &c. having to be hereafter described, reference should be made to the chapters on those subjects.

Where bones are fractured, great care is necessary in lifting the patient, so as to prevent bending at the seat of injury. One hand should be placed under the limb, immediately above the fracture, and the other hand immediately below it, forming a bed of the palms of the hands for the limb to rest upon, and thus preventing the limb from being bent at the seat of fracture when lifting it.

One attendant should give his undivided attention to the fractured limb, while the body of the patient is lifted by other attendants.

Special care should always be taken to notice the part injured and the nature of the injury, as these determine in a great measure the position in which the patient should be placed during transport. In all cases the head should be kept low, and on no account pressed forward on the chest.

In wounds of the head care should be taken that he is not placed so that the injured part presses against the conveyance.

In wounds of the lower extremity the patient should be laid upon his back, inclining towards the injured side; such position being less liable to cause motion in the broken bone during transport in cases of fracture.

In wounds of the upper extremity, if the patient require to be placed in a lying down position, he should be laid on his back, or on the uninjured side; as in cases of fracture there is less liability in such a position of the broken bones being injured during transport.

In wounds of the chest there is often a difficulty of breathing. In such cases the patient should be placed with the chest well raised, his body at the same time being inclined towards the injured side.

In wounds of the abdomen, the patient should be laid upon the injured side, with his legs drawn up; or, if the wound be in the front of the abdomen, he should be placed upon his back, and his legs drawn up, so as to bring the thighs as close to the belly as possible; a pack or other article being placed under his hams to keep his knees bent.

CHAPTER X.

STRETCHERS AND THE PROPER CARRIAGE OF SICK AND WOUNDED BY THIS MODE OF CONVEYANCE.

Description of Stretchers.

The old regulation stretcher of the British army consists of two ash poles, two iron traverses, a canvas bottom, a pillow, four cord lashes, and two shoulder slings, and is thus constructed.

The two poles are each eight feet long and about five inches in circumference, except for a short space near their extremities, where they are slightly diminished to adapt them for being handled. Two plain iron rods, each 22 inches in length, one inch in circumference, and terminating in a ring at one end and a hook at the other, are attached by their rings to two staples fixed at a distance of seven inches from the ends of the two poles, but on opposite sides and ends of the stretcher.

At a corresponding distance from the end of each alternate pole is an opening in the pole itself of a size proper for receiving the hooked ends of the iron rod. These iron rods, when hooked across, form the traverses, and complete the framework of the stretcher.

The sacking is made of a piece of stout canvas, folded over down each side so as to form two plaits sufficiently large for the poles to be run through them. At one end is a small horsehair pillow, also covered with canvas, and

secured to the sacking by leather thongs passed from it through openings in the sacking and tied on its under surface

Two stout leather straps or slings, looped at their ends, are provided for each stretcher, but are not connected with it by any fixture. They are intended to be passed round the necks of the two bearers, to act as braces and assist in keeping up the weight of the stretcher when in use. One end of each strap is provided with eyelet holes and a buckle, so that it may be lengthened or shortened according to the respective heights of the bearers. The other end has a loop only for receiving the end of one of the poles of the stretcher.

When the stretcher is not required for use, each traverse should be unhooked and turned in along the poles, the canvas rolled round the poles, the slings stretched upon the rolled canvas, and the cord lashes bound tightly round the whole. (See Fig. 64.)

When required for use the cords should be undone, the canvas unfolded, the traverses hooked into their proper places, and secured by a pin to prevent their slipping out, and the canvas bound tightly to them by the cord lashes. (See Fig. 65.)

This stretcher is only used for field purposes when borne by men.

The new regulation stretcher consists of two ash poles, two iron traverses, a canvas bottom, four feet, and a pillow. (See Fig. 66.)

The poles are nearly 7 feet $9\frac{1}{2}$ inches in length, with a diameter in the middle of $1\frac{3}{4}$ inch, tapering towards the ends, square on the under surface and rounded on the upper.

The traverse is a flat bar of steel hinged in the centre and attached to the poles at both ends by a bolt, which

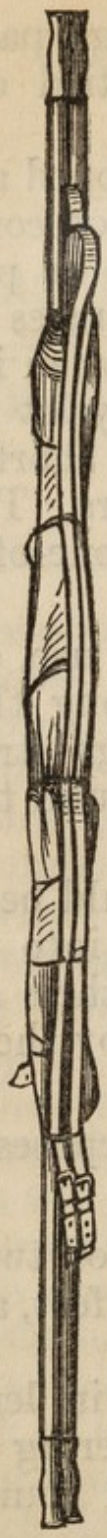

FIG. 64.—OLD REGULATION STRETCHER FOLDED UP.

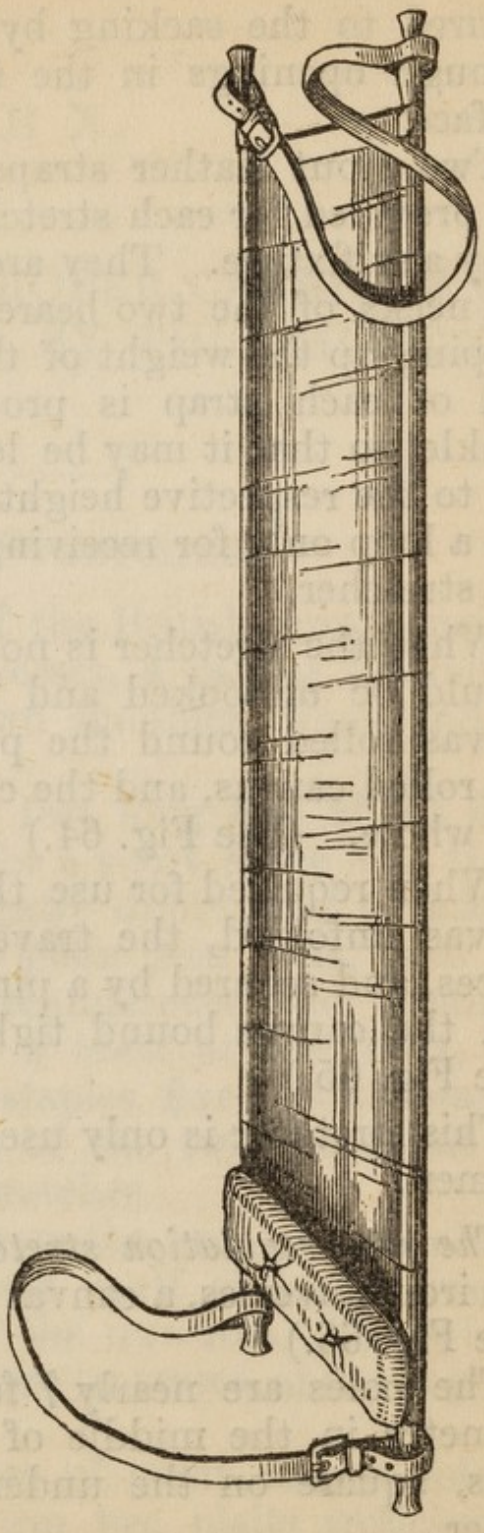

FIG. 65.—OLD REGULATION STRETCHER READY FOR USE.

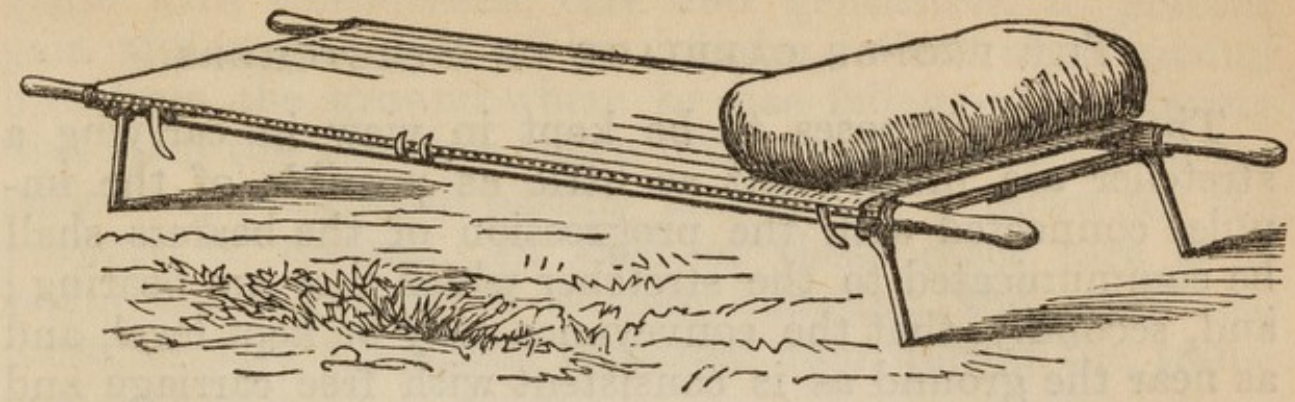

FIG. 66.—NEW-PATTERN STRETCHER.

answers as a pivot. The joint in the centre of the traverse is fixed by a sliding ring.

The canvas is 6 feet 6 inches in length and 1 foot 11 inches in breadth. It is nailed with copper tacks on the outside of each pole.

The feet are made of iron, hinged to the poles, 6 inches in height. They fold up close to the poles, being kept in position by leather straps.

The pillow is of hair, and is attached to the canvas by two cord lashes, passed through holes provided for the purpose, and tied on the under surface of the canvas. This pillow is only used when the stretcher is employed as a bed in the ambulance waggon, and in order that it may be available for this purpose, each new pattern ambulance waggon will be provided with two pillows as a part of its equipment. When the stretcher is used as a field stretcher it has no pillow, as it is considered a coat, a pack, or some other article of this kind will always be available.

The stretcher is folded up when not required for use by sliding to the side the ring on each traverse, and bending the traverses at the central hinges until the two poles are brought together side by side.

This new pattern stretcher is designed for use both as a field stretcher and for the new ambulance waggon.

The proper carriage of Stretchers.

The main purposes to be kept in view in carrying a stretcher are, firstly, that as little as possible of the impulse connected with the progression of the bearers shall be communicated to the stretcher which they are bearing; and, secondly, that the conveyance may be kept level, and as near the ground as is consistent with free carriage and the absence of risk of contact. If the conveyance be badly carried, it may be shaken in such a way by the movements of the bearers as they step along, that the patient may be rolled upon it from one side to the other alternately, or it may have such a motion communicated to it that the patient may be jerked *upwards* with every step, and this motion may be in addition to the lateral rolling before named; or the patient may be so placed that his head is lower than his feet, or his body may be unevenly supported, in either of which cases the ill results of the movements just described will be felt with more severity. The conveyance again may be raised so high that the patient upon it may be kept in constant apprehension of falling off; or, in case of one of the bearers accidentally stumbling and allowing the conveyance to fall, he may receive such additional injuries as to lead to serious consequences. All these objectionable movements and wrong positions, which would be irksome enough to men in sound health, entail serious suffering and risks to men who are worn by illness, or who are labouring under fractures of bones or other severe wounds. Fortunately this suffering may be in a great degree prevented by a systematic observance of the rules hereafter mentioned, whatever the circumstances of the locality, or whatever differences there may be as to height or strength among the bearers.

One of the first things to impress upon bearers is that every movement of a man who is just wounded must be

made with considerable care and gentleness, to prevent pain and aggravation of his injuries. Care when raising him from the ground where he has fallen, when placing him upon the stretcher, when lifting the stretcher with the patient upon it, when halting and laying it down for the purpose of resting. In each of these cases care is as essentially necessary to obviate suffering and additional mischief, as is a properly regulated step during the transport itself.

Very particular care is required when the patient has had a bone recently shattered by gunshot. The proper manner of accomplishing the delicate task of lifting and removing a man with such an injury, the various modes of protecting the broken limb during the transport, are subjects in which all bearers of wounded require to be specially instructed.

But it is not only in *recent* wounds that a disciplined system of proceeding is necessary for bearers; it is equally requisite, if not more so, for those which have passed the recent state. Great as the torture is of wounded men, when they are carried badly shortly after their wounds have been received, the torture is greatly aggravated under the same circumstances after inflammatory action has set in. Nature then increases her demands for rest and quiet in order that the processes of repair may go on, and by every means in her power makes the demand known. Interfere with her under these circumstances, and she resents the interference, not simply by the infliction of pain, but, if the interference be great, by pain that is past expression, and, if sufficiently prolonged, by pain that is past endurance, for the sufferer will succumb under its overpowering influence.

Bearers.—It is usual in the British Service to tell off only two men to every stretcher. For several reasons, however, it is most desirable that three men should accom-

pany every stretcher which is to be used for carrying wounded from the field of action. The third bearer is required in case of either of the other two bearers becoming wounded, to act as a relief to the bearers during the transport, and to assist in placing upon the stretcher men who have been rendered quite helpless by their wounds, especially those who have met serious fractures of bones from gunshot. For these latter cases the presence of a third bearer is of essential importance. A patient with a fractured thigh or leg should never be lifted up and put on a stretcher by two bearers only, unless under extreme urgency. The position of patients after they are on the stretcher, too, both on starting and during transport, frequently requires rectification, owing to the bellying of the canvas after they are lifted up, or to the effects of movement during the carriage, and this can only be done, without laying the stretcher down on the ground, when a third bearer is present.

The bearers told off for carrying a stretcher must be severally distinguished by some ready appellation, and one must take the direction of all the duties connected with the transportation of a patient. The bearer who marches foremost is usually designated the front or No. 1 bearer; the one who is behind, the rear or No. 2 bearer. If a third bearer is told off to assist in the transport, he is designated No. 3 bearer. The rear or No. 2 bearer must assume the direction, for his position enables him to see, not only the patient on the stretcher, but the front bearer also, while the front bearer cannot see either, but only the ground or other objects before him.* There are certain parts of the transport which should always be

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* If one of the bearers be a non-commissioned officer, he should take command of the party, and he may take the position of either No. 2 or No. 3.

conducted by short words of command. These are especially the lifting up and placing a wounded man on the stretcher, the start, and the laying down the stretcher. The object is not so much to ensure the alert and sharp movement which is required in military exercises, as it is to ensure, without loss of time, the necessary caution, steadiness, and well concerted action of the bearers.

Every bearer should be able to take the duty of No. 1, 2, or 3 bearer at any moment his services may be required in either capacity.

Placing the Stretcher.—Before attempting to remove a badly wounded man from the spot where he has fallen, the stretcher should be brought close up to him; the wounded man should not be carried by hand farther than can be avoided. In placing the stretcher for this purpose, *it should not be laid by the side of the patient*, but at his head, and should not be placed crosswise, but the length of the stretcher should be in the same direction as that in which the wounded man happens to be lying. If placed by his side, it interferes with the movements of the bearers, and is liable to cause them to stumble when they are depositing the patient upon it. If placed crosswise at the patient's feet or head it leads to the necessity of the bearers turning round, and again causes the risk of one or other of them falling over the side poles. These objections are avoided by the stretcher being placed longitudinally, the patient is readily carried head forward over the canvas on which he is to lie, and the bearers move with a clear view of the stretcher before and between them, until the patient's head is directly over the pillow on which it is to rest.

Placing a Patient on a Stretcher.—As soon as all essential preliminary attention to the general condition of the patient, or to the particular injury he has received, the necessary prevention of movement of a limb, if a bone be broken, by any available support at hand, the preparation

of stays or supports on the stretcher itself, if needed for the injured part, by arranging the man's clothing or accoutrements for the purpose, and all other such matters, which, it is presumed the sick bearers are familiar with, have been attended to, the next proceeding is to place the patient on the stretcher.

No. 2 bearer gives the word "Fall in."

At this command Nos. 1 and 2 take up a position on opposite sides of the patient, near his haunch bones, facing each other, and No. 3 near to and facing the injured part.

No. 2 now gives the word "Ready."

At this all stoop down, Nos. 1 and 2 gradually get each one hand under the back of the patient, near the shoulder blades, and lock them, their other hands being passed, and clasped, under the upper part of his thighs, as close to his breech as possible, while No. 3 supports and gives his undivided attention to the injured part. The word "Lift" follows.

At this word all the bearers, having secured a firm grasp, acting together, slowly rise from the stooping posture, and bringing their knees together stand up.

As soon as the erect position is gained, the word "March" is given.

The bearers march until the patient is exactly over his place on the stretcher, that is, with his head directly over the pillow on which it is to rest, and the order "Halt" is given, followed by "Ready," at which the bearers are to stop and get into a position in which they can lower the patient.

The word "Down" being then given, the patient is carefully lowered, each bearer at the same time dropping slowly into the stooping position, and deposited upon the stretcher.

Starting to carry a Stretcher.—The start in every instance will be best accomplished by dividing the action into four

parts, and assigning to each its distinct word of command. As soon as the patient is properly settled upon the stretcher which is lying upon the ground, No. 2 bearer gives the word "Fall in." At this command No. 1 and 2 bearers get into their proper positions at the head and foot of the stretcher, and No. 3 by the side of it. As soon as this is done, No. 2 bearer gives the word "Ready." The two bearers at once adjust the ends of the shoulder straps, and take hold of the handles of the stretcher-poles. This being done, No. 2 bearer gives the word "Lift," and immediately the two bearers raise the stretcher steadily together. No sooner is the stretcher raised, and all is seen to be right, than the word "March" is given by No. 2 bearer, and both bearers at once move off.

Halting with and laying down a Stretcher. — In like manner, when the stretcher is to be lowered and placed on the ground, it will be best done by corresponding divisions of the action and words of command. No. 2 bearer calls "Halt," at which both bearers stop, but without any abrupt or sudden jerk; the word "Ready" is then given, which is the signal for getting into position to stoop; the word "Down" follows, when the stretcher is lowered, and laid gently on the ground; and lastly, at the word "Fall out," the two bearers quit their hold of the handles and move away from the stretcher.

Marching with a Stretcher.—The front and rear bearers of the conveyance must start with opposite feet. They must not move "in step," but, on the contrary, must march out of step, or, as the ordinary expression is, must "break step." If the man in front step off left foot forward, the man in the rear must step off at the same moment right foot forward, and this broken step must be maintained throughout the whole distance of the transport.

The reason which dictates the rule named is readily apparent on examination. If two men carrying a stretcher

between them keep step at starting as a front and rear rank soldier do in commencing to march, that is, if both men advance their right feet together, there must at the same time be an inclination of the body of each man towards the same side in proportion to the distance to which his foot is advanced, and equally so of the stretcher which they are carrying. When next the left feet are advanced together, the inclination will be changed from the right to the left side, and the alternate change of inclination will be unavoidably communicated to the wounded man lying upon the canvas stretcher, and will be continued so long as the step is kept. The wounded man is placed in much the same circumstances as regards this kind of movement as a man who is riding on a camel, instead of being, as he should be, in the position of one on the back of a horse, when the animal is walking. But when the step is broken at starting, that is, when the front rank man advances his right foot, and at the same time the rear man advances his left foot, as the horse does his opposite feet the dipping motion down to either side is avoided, and the surface of the stretcher is maintained on a horizontal plane. With each step of the bearers there is a moderate upward and downward movement of the stretcher, chiefly owing to the pace and elasticity of the side poles, but with this exception the general level is preserved. There is no lateral movement, giving the patient a tendency to roll from side to side.

The rule equally applies if the stretcher be carried by four instead of by two men. The step must be broken by the front and rear rank men, so that the level of the stretcher may still be preserved.

In carrying a stretcher the pace should not be so long as it is in marching in the ranks, and the movement of the lower limbs should be conducted on different principles. When a combatant recruit is under instruction, he is

taught, in practising the balance step, which forms the foundation on which the art of marching is built up, that the knee should be kept stiff, and the whole limb straight, when it is either advanced in front or extended behind. The movements of his lower extremities are all to be from his hips. The toe of his foot is to be advanced, and foot brought to the ground at thirty inches distance, measured by the pace stick, from heel to heel. This is the slow step; in stepping out the pace is lengthened to thirty-three inches. In the ranks, not only is length of stride and consequent speed of movement gained by this proceeding, but it enables an uniform pace to be preserved with bodies of troops. At the same time the length of the marching stride and the movement from the hips unavoidably induce an upward and downward movement of the parts of the soldier's body above the hips. The trunk sinks as the foot is advanced; it is raised as the limb is again brought vertically under it. This alternate elevation and depression is sufficiently manifest to any one who observes a line of troops advancing towards him, or, more conspicuously still, if they are moving on the other side of the hedge with only the upper parts of their bodies exposed. The kind and length of the pace just described will not answer so far as stretchers are concerned, if they are to be carried to the best advantage. The gait of the hawker who habitually carries a basket of crockery, or of a man carrying a bucket of water, on his head, is the most suited to the circumstances of a patient carried on a stretcher; for with such a gait the trunks and arms of the bearers, and consequently that which they are carrying, are least lifted up or moved. The peculiarity of this gait is, that in it the hip-joints are used as little as possible, the advance is made with the knees kept bent, and the step is shorter. The knees are never wholly straightened, as in marching. The length of the pace is about twenty inches. This is the kind of gait

which is assumed by the native dhooley-bearers in India when they are carrying sick, and is the most effective for stretcher-bearers too, when trying to prevent undue movement of the stretcher.

The difference in the rise and fall of the upper part of the body between a pace of 30 inches and a pace of 20 inches, is greater than might be suspected. When two men holding a stretcher without a man upon it make together a pace of 30 inches, measured from heel to heel, the dip of the stretcher is $3\frac{1}{2}$ inches; with a man upon it, the arms being then stretched to the full by the weight, the dip is $4\frac{1}{4}$ inches. When the pace is 20 inches, the dip, without a man upon the stretcher, is only $1\frac{1}{2}$ inches; with a man, $2\frac{1}{4}$; or about one-half of the dip in the longer pace. Of course, in marching at either pace there is an alternate rise and fall to the same extent, and the effect of this on the elastic poles of a stretcher can readily be imagined. The extent of elevation and depression which has just been mentioned is irrespective of jerking or any other movement, having been carefully measured when the bearers were standing still at each position.

There is another difficulty in applying the ordinary marching step to men engaged in carrying stretchers. The position of the traverse causes it, with a pace of 30 inches, to press very severely, especially an iron traverse, upon the front and upper part of the advanced thigh of the rear or No. 2 bearer. The traverse also touches the back of the rear thigh of the front or No. 1 bearer; but, as the motion of this limb is away from the stretcher, it does not cause any marked inconvenience. The result is, that in trying to march with a space of 30 inches, the rear bearer is subjected to a sharp blow from the traverse on one or other of his thighs, at every step. A jolt is also, at each contact, communicated to the stretcher and patient upon it. With a pace of 20 inches, the traverse being placed, as it is in the

regulation stretcher of the British Service, at a distance of 7 inches from the ends of the handles, the thigh of the rear bearer is just cleared, and no impediment in this respect is given to the forward motion.

The bearers must march with a steady but easy step, particularly avoiding elevation of their bodies by springing from the fore part of the feet. The foot should be planted without any wavering on the ground at each step, and in moving forward it should only be raised sufficiently to clear the ordinary impediments on its surface. Some bearers, unless this rule is enforced, will make a slight spring in their movements, which spring is of course communicated to the more or less pliable conveyance they are carrying. They do so in the belief that the weight is sustained more easily in consequence of the elastic movement which is thus obtained, but they take no note of its ill effect on the person conveyed.

Whether even or uneven as regards measure of time, great care *must be taken* that the steps of the front and rear bearers are invariably *even and alike in distance.* If the steps do not well and accurately agree in length, there will constantly be a hasty " catching up " of one or other of the bearers; and the stretcher and patient will be jolted on every occasion when an effort is thus made to re-adjust the distance. If the bearers march with an exactly corresponding step as regards length, this source of disturbance will be avoided.

The same words of command are used in bearing a patient from the stretcher.

Rules and Cautions.

1. When distributing bearers, as far as circumstances permit, men nearly of the same height and strength should be selected for acting together. When a stretcher is supported by men of equal height and proportion, if the ground

be level, the stretcher will necessarily assume a horizontal position also, and men possessed of like degrees of strength will carry the weight and move together more evenly. If the ground be uneven, the bearers will have to mutually adapt the height of their respective ends of the conveyance to the irregularities, in order to preserve its level condition.

2. When braces or shoulder-straps 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.*

3. 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 act can readily be acquired by practising the carriage of the litter 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 litter in turn, so as to be made practically aware of the effects of even and uneven carriage.

4. If the ground over which the conveyance has to pass present a general ascent, and the bearers be of different heights, then the rear or No. 2 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.

5. If the ground present 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. 2 bearer, under the opposite circumstances, as mentioned in Rule 4.

6. 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.

7. If the bearers have to carry the stretcher up hill, the front bearer should support the end of the stretcher on which the patient's head is placed, excepting in the case mentioned under Rule 8.

8. If the bearers have to carry the stretcher down hill, the rear or No. 2 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 fracture of the thigh or leg. With regard to this exception, a reverse position of the patient is given 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. 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.

9. Never attempt 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 to avoid even 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.

10. In crossing a ditch, dyke, or hollow, the stretcher should be first laid on the ground near its edge. The first bearer then descends. The stretcher, with the patient upon it, is afterwards advanced, the first bearer in the ditch supporting the front of the stretcher while its other end rests on the edge of the ground above. While thus supported the second bearer descends. The two bearers now lift the stretcher to the opposite side, and the fore part being made to rest on the edge of the ground, while the rear part is supported by the second bearer in the ditch, the first bearer is left free to climb up. The stretcher is now pushed or lifted forward on the ground above, and rests there, while the second bearer climbs up. The two bearers then carry the stretcher on.

11. On no account should a stretcher be permitted to 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 already 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 it 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.*

Carriage of Stretchers on Wheeled Supports.

Stretchers, instead of being carried as just described, may be placed on *wheeled-supports* and wheeled along, thus saving labour.

The supports are of various kinds in different countries. That adopted in the British Service is what is known as "Shortell's Wheeled-Stretcher Support," slightly altered by the Transport Committee.

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* Taken from Professor Longmore's "Treatise on the Transport of sick and wounded."

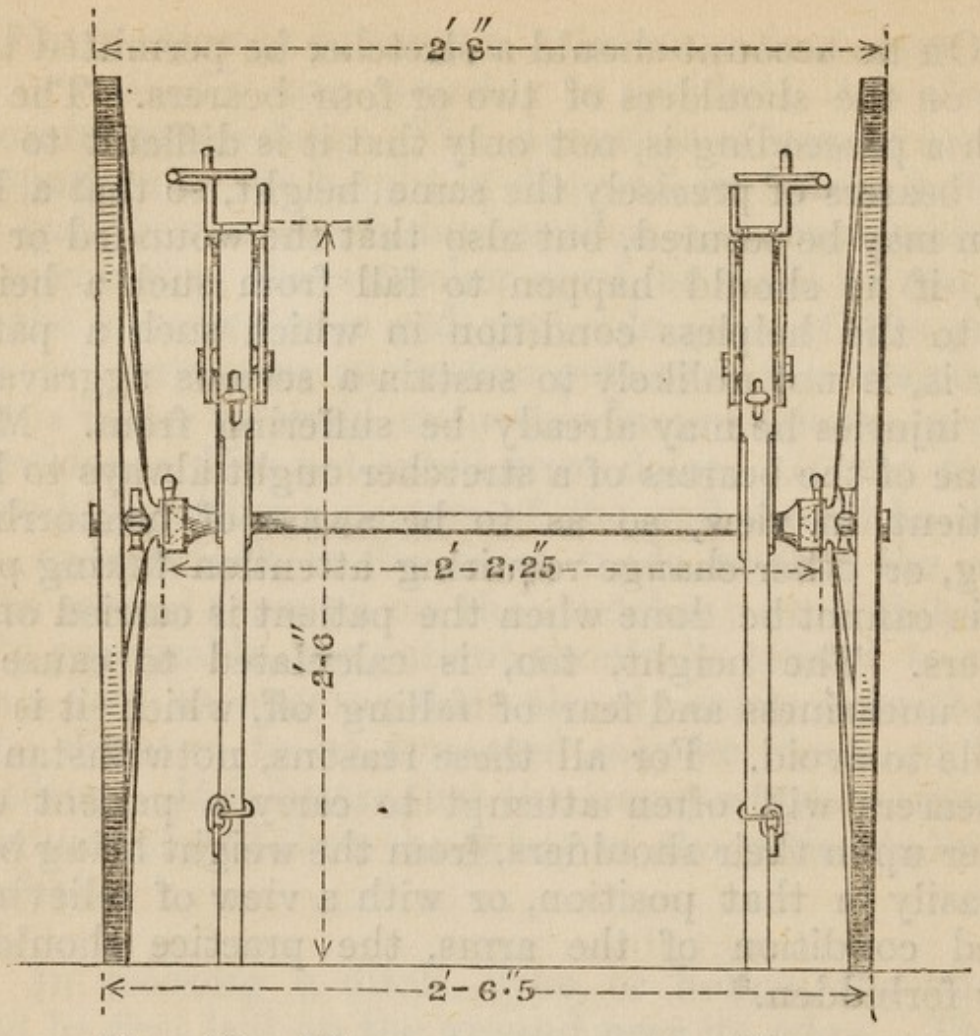


FIG. 67.—WHEELED-STRETCHER SUPPORT.

DESCRIPTION OF WHEELED-STRETCHER SUPPORT.

The support consists of an axletree, a pair of wheels, a pair of elliptic steel springs, with crutches on their upper surfaces to receive the stretcher poles, and a pair of folding legs.

Packing for Stowage.—The feet are set free from the buttons, and turned back along the upper side of the springs, lying within the crutches, which receive the stretcher poles. The wheels and springs are then taken off the axle, one wheel is laid on the ground, one spring placed on the top of this, the axle laid in the spring, the other

spring on the axle, and the second wheel on the top, and lastly the whole placed in a waterproof canvas cover, and secured in position by lashings which are attached to the bottom of the cover.

The support is made to receive any kind of stretcher, as the distance between the crutches can be altered according to the breadth of the stretcher.

Preparing for use.—The wheels are put on the axletree, having first put on the springs at a distance apart suitable to the breadth of the stretcher, the legs are let down, and the stops placed on the wheels.

Placing a Stretcher on the Support.—The bearers, having placed the patient on the stretcher in accordance with the directions already given, lift it and march alongside the support until the centre of the stretcher is opposite the centre of the adjoining wheel. The word "Lift" is then given, at which the bearers lift the stretcher over the wheel and bring its poles over the springs; "Ready" follows, at which the centre of the poles, where the gaps are left in the canvas, are brought directly over the crutches; "Down" is then given, and the stretcher poles are lowered into their places.

The stretcher being thus placed on the support, each pole is fixed in its crutch by the small cross bar and button.

One of the bearers now lays hold of the stretcher handles at the end next which the feet of the support are placed, raises and secures each foot in succession in its place, and wheels the conveyance, pushing it in front of him.

The support with the stretcher on it is meant to be lifted over ditches and other places over which it cannot be wheeled, and the directions given in the "Carriage of Stretchers" are here applicable.

CHAPTER XI.

THE REMOVAL OF SICK AND WOUNDED BY IMPROVISED METHODS WHEN NO STRETCHERS OR REGULAR CONVEYANCES ARE AVAILABLE.

When no stretchers or other regular means of conveyance are available, patients may be transported for short distances by various improvised methods described by Professor Longmore.

Assistance when only one Attendant is available.—If the patient can stand up he should place his arm round the neck of the bearer with his hand on and in front of the apposite shoulder. At the same time the attendant should place his near arm obliquely across the back of the patient and grasp the opposite hip firmly with the hand, while with his other hand he should hold the hand of the patient placed on his shoulder. The bearer now walking by the side of the patient should throw his hip against him, and in this way he can give much support, and, if necessary, even lift him off the ground. (See Fig. 68.)

If a patient cannot stand, then the only way one attendant can remove him is by getting him on his back, and even this method is not practicable where the thigh is broken.

Carriage by two Bearers.

First method. Two-handed Conveyance for Patient sitting.—He may be carried in a sitting position by the two bearers joining two of their hands beneath his thighs, close

FIG. 68.—ONE BEARER ASSISTING A PATIENT.

up to the buttocks, while their arms which are not thus occupied are passed round his loins in the manner shown in the illustration. (See Fig. 69.)

In this instance the fingers of the left hand of one of the bearers are locked with the fingers of the right hand of the other bearer, and a seat so formed. The patient, if he be able, helps to support himself by clasping the bearers with one or both arms.

The same words of command may be used in lifting a patient by this method which are used in lifting a patient on a stretcher.

FIG. 69.—TWO BEARERS CARRYING A WOUNDED MAN BETWEEN THEM.

Second method. Two-handed Support for Patient semi-recumbent.—The advanced right and left hands of the two bearers are closely locked together, and the wrists brought into contact, not merely the fingers interlaced, so that a firm junction of both hands is established. At the same time the other hands of the two bearers are made to rest upon and in a certain degree to grasp each other's shoulders on the same side respectively. When a patient is carried according to this method, the weight of the patient falls chiefly upon the two arms behind, but to some extent also upon the chests of the two bearers, while that portion of

the weight which falls upon the arms in front does not bear upon the fingers and hands so much as in the former case, but is distributed over the forearms and shoulders. The patient is not carried in a sitting posture but lying back. It is therefore well adapted for removing a patient who is so weak as absolutely to require complete support at the back to prevent him from falling, or who is quite

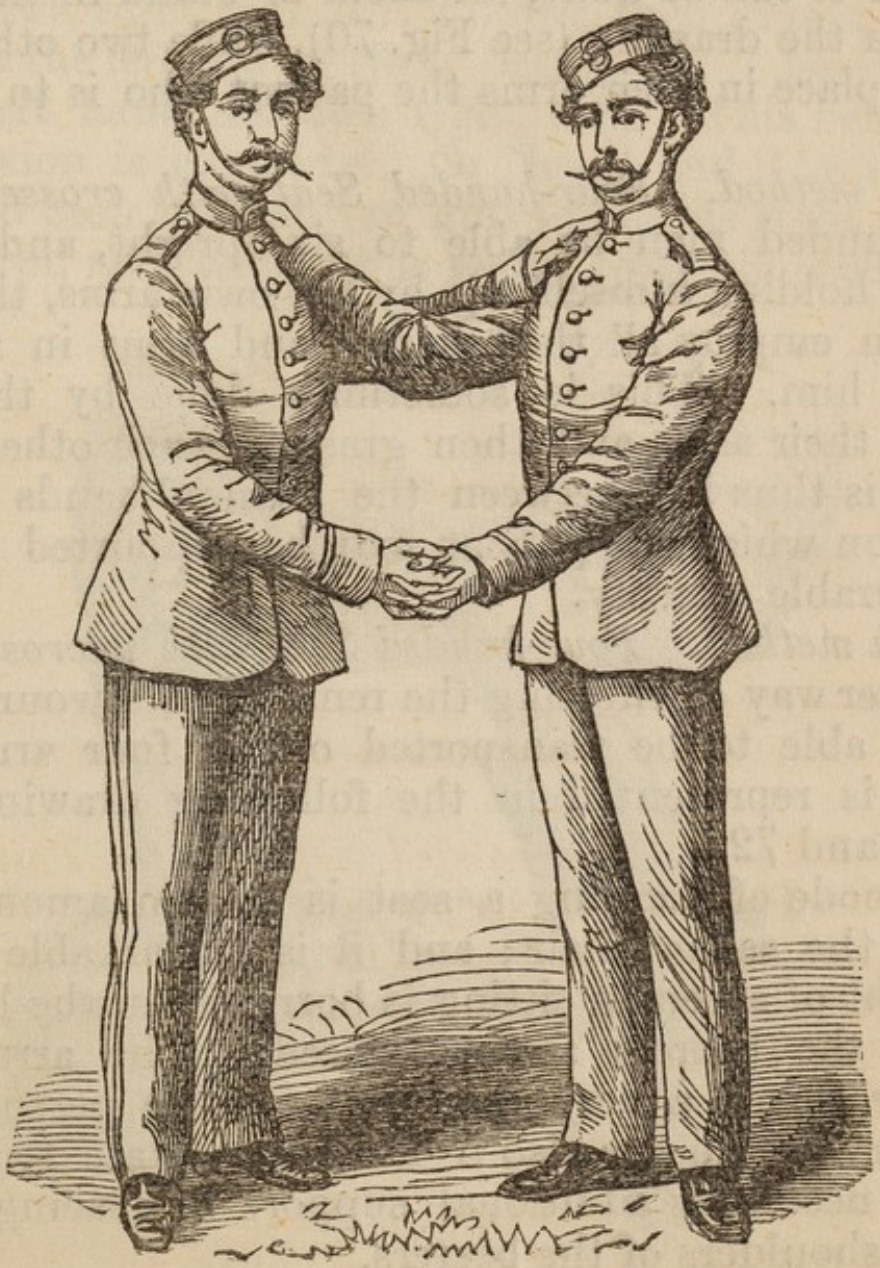


FIG. 70.—TWO-HANDED SUPPORT BY TWO BEARERS FOR CARRYING A PATIENT IN A SEMI-RECUMBENT POSITION.

helpless, or who is disabled in both upper extremities. It is not so easy for two bearers to assume the relative positions just described when they have to pick up a patient lying upon the ground as it is to take the former one, but they may easily pick the patient up by the first method, and change to this method.

If the bearers are untrained in this respect, it will be better, if it can be done, for them to stand in the position shown in the drawing (see Fig. 70), while two other bearers lift and place in their arms the patient who is to be carried away.

Third method. Four-handed Seat with crossed Arms.—If a wounded man be able to sit upright, and is able to assist in holding himself up by his own arms, the bearers may then employ all their hands and arms in forming a seat for him. This is sometimes done by the bearers crossing their arms and then grasping each other's hands. A space is thus left between the bearers' hands and forearms upon which the patient may be supported for a time with tolerable security.

Fourth method. Four-handed Seat with uncrossed Arms.—A better way of effecting the removal of a wounded man, if he is able to be transported on all four arms of the bearers, is represented in the following drawings. (See Figs. 71 and 72.)

This mode of forming a seat is known among schoolboys as the sedan chair; and it is remarkable how well the weight of a person sitting is borne when the hands and arms of the bearers are so placed. The arrangement, moreover, forms a very easy seat for the person carried, and a very secure one also if he is in a state to give himself the necessary additional support by placing his arms over the shoulders of the bearers.

As seen in the drawing, the backs of the bearer's hands are turned uppermost, while the palms rest on the adjoin-

ing arms. Each forearm, near its middle, is grasped by a hand, and each hand in its turn holds in its grasp the next arm, which is placed at right angles to it. They thus mutually support each other and are mutually supported.

Directions.—No. 1 bearer stands on the left side, No. 2 on the right. No. 1 bearer grasps with his right hand the left arm of No. 2 bearer, No. 2 bearer grasps with his left hand his own right arm, No. 2 bearer then grasps with his right hand the left arm of No. 1 bearer, No. 1 bearer grasps with his left hand his own right arm. This being done, the connexion is complete. Or Nos. 1 and 2 bearers may be directed each severally to grasp with his right hand his own left arm, and, when thus ready, to grasp each other's

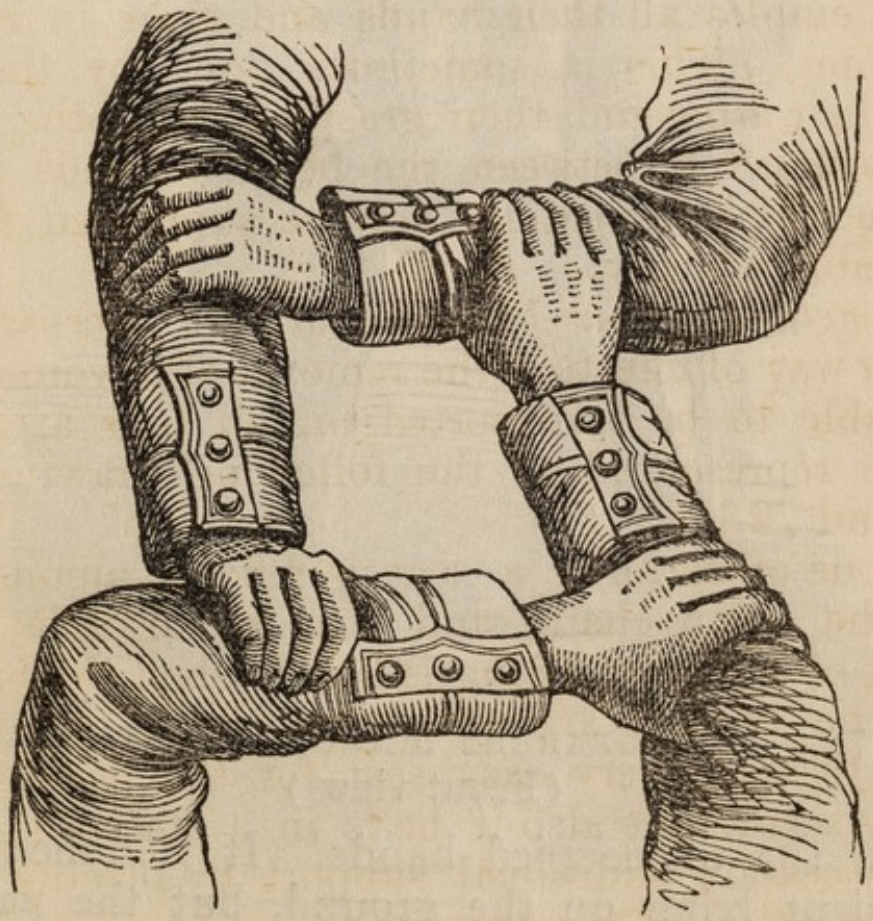


FIG. 71.—FOUR-HANDED SEAT FORMED BY TWO BEARERS, THE ARMS BEING UNCROSSED.

FIG. 72.—THE BEARERS MARCHING WITH PATIENT.
(Front view.)

arms with the unoccupied hands. It is difficult to pick up a patient lying on the ground, but the patient can easily be lifted up by the first method, and standing him against one of the bearers, change to this seat, or other bearers may lift him on to the seat when formed.

Fifth Method. Three-handed Seat and Back Support.—The three-handed seat is formed in the same way as the four-handed seat last described, so far as the position of the three hands and the mutual support given to them are concerned. A triangular instead of a quadrangular seat is formed for the patient. (See Fig. 73.)

FIG. 73.—THE BEARERS WITH THREE-HANDED SEAT AND BACK SUPPORT FORMED.

The hand which is left disengaged is then made to rest on the adjoining shoulder of the other bearer, so that the arm forms a back as it were to the chair.

Seat formed by Muskets.—Instead of either of the plans just described, a temporary substitute for a seat is occasionally formed by some article of convenient size and length which happens to be at hand being held horizontally between the two bearers, and thus converted into a means of support.

One or two muskets may be employed in this way. A great coat or blanket is rolled round the musket, or two muskets placed side by side, all secured by a couple of straps or handkerchiefs. The patient sits on this support, and places his two arms, if neither be wounded, over the shoulders of the bearers between whom he is carried. If any belts or other articles can be got, to answer the purpose of shoulder straps, the muskets can be carried with greater facility and less fatigue by the bearers, while their hands can be from time to time employed in giving additional support to the wounded man whom they are transporting.

Stretcher formed of Muskets and Blanket.—To form a stretcher with a blanket and two rifles, the ordinary field blanket should be spread on the ground, a rifle laid on each side of it lengthwise, and rolled in the blanket for one and a half or two turns. A folded coat or some other article is then laid on the blanket at one end for a pillow. The stretcher so formed is next placed at the head of the patient, and loaded like a regular stretcher. Four bearers will be required to carry it. Two should take up a position at each side, one at the head and the other at the foot. Each bearer stooping down should with one hand take hold of the roll of blanket round the rifle near its centre, and with the other hand of the roll of blanket immediately outside the end of the rifle (see Fig. 74). In this way a capital

stretcher is formed, and the rifles being each supported at four points are not likely to be strained or injured. The front and rear rank bearers should break step in marching, as in carrying an ordinary stretcher.

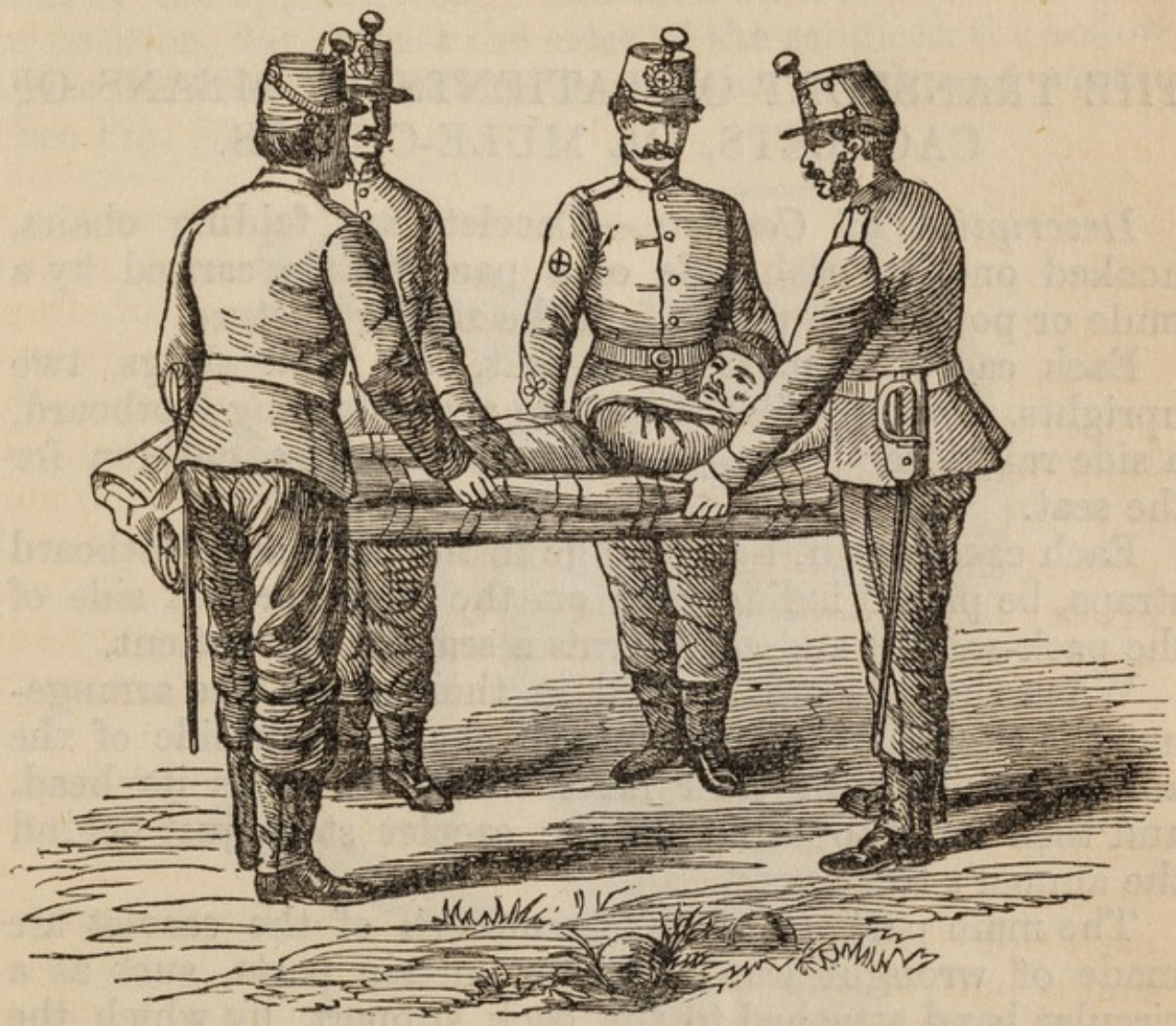


FIG. 74.—BLANKET AND MUSKET STRETCHER.

CHAPTER XII.

THE TRANSPORT OF PATIENTS BY MEANS OF CACOLETS, OR MULE-CHAIRS.

Description of Cacolets.—Cacolets are folding chairs, hooked one on each side of a pack-saddle carried by a mule or pony, with patients in the sitting posture.

Each cacolet consists of a seat, two hook slings, two uprights, a wooden footboard, two straps to sling footboard, a side rail, a back strap, a waist strap, and a cushion for the seat.

Each cacolet can, by a change in the back and footboard straps, be placed indifferently on the right or left side of the pack-saddle, and each forms a seat for one patient.

When the pair are secured in their places, the arrangement is such that two patients sit one on each side of the animal's sides, with their faces turned towards its head, and their feet supported on the cacolet steps just behind the animal's fore legs.

The main portions of the framework of the cacolet are made of wrought iron; but for certain parts, such as a circular band attached to the back support, by which the patient is secured from falling forwards, and some of the minor details, straps of leather are employed. The seat is covered with a leather cushion.

The foot support consists of a little plank of wood suspended by two straps which hang vertically down from the front of the seat. The upright and horizontal bars of the framework are connected by hinged joints.

The whole conveyance when not in use can be folded up

closely together, and turned up against the boards of the saddle, the footboard carried back and passed through the back strap, and the waist strap, which is attached to the back strap, carried over the pack-saddle and buckled to that of the opposite side; and thus both cacolets are held in position, flat against the sides of the saddle in the hollow space between the extremities of the crutch and cantle. (See Fig. 75.)

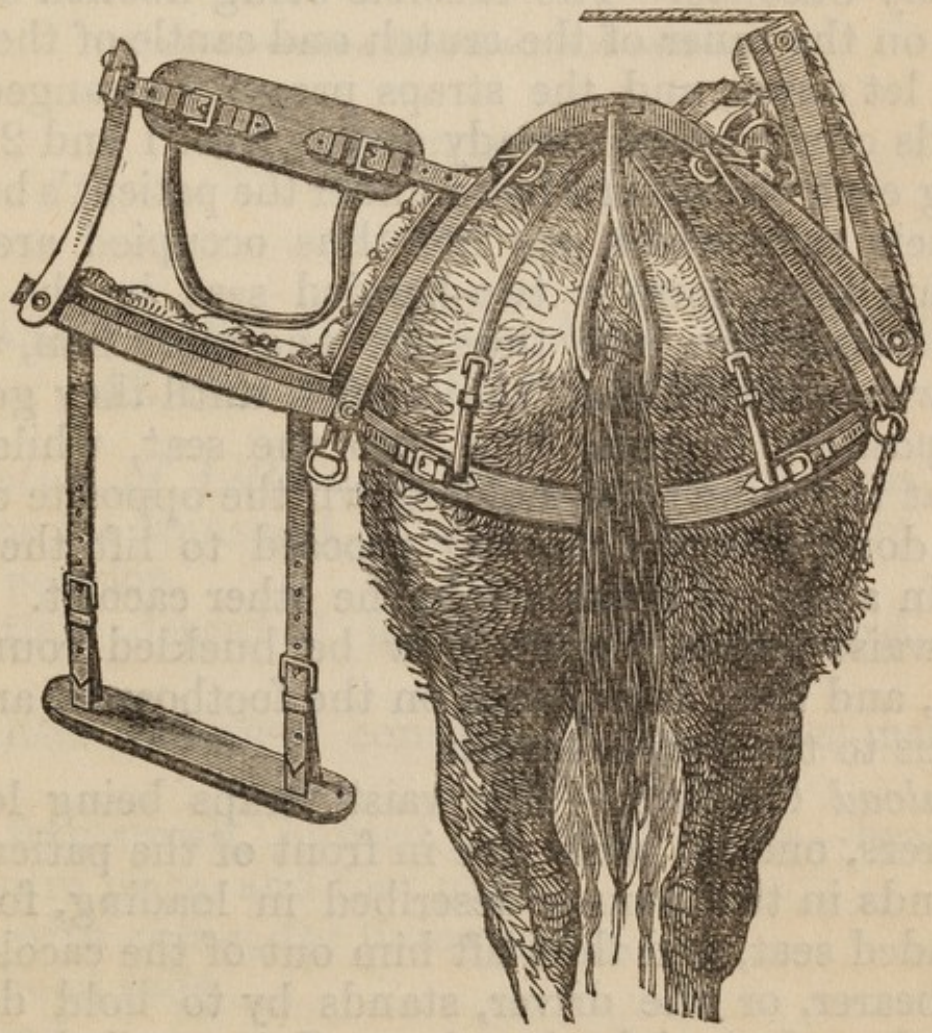


FIG. 75.—END VIEW OF MULE CHAIR OR CACOLET, OPEN FOR USE, AND PACKED FOR TRAVELLING.

Management of Cacolets.—As patients are carried in cacolets in the sitting posture only, such only as are able to bear this mode of carriage are transported in this way.

Patients with fractures, or other severe injuries, of the lower extremities, are not suitable for this mode of transport, nor are very weak patients, who may become faint when placed in the erect position.

Two bearers, with the aid of the driver, are sufficient to load and unload cacolets, but if a third bearer be available, so much the better, as the driver can then give his undivided attention to keeping the animal steady.

Loading Cacolets.—The cacolets being hooked on to the buttons on the inner of the crutch and cantle of the saddle, the seat let down, and the straps properly arranged, using the words of command already given, Nos. 1 and 2 bearers, grasping each the other's hand under the patient's buttocks, while their arms which are not thus occupied are passed round his loins, form a two-handed seat in the manner described elsewhere, and thus lift and carry him, with his back towards the front of the cacolet, until they get into a proper position to raise him into the seat, while No. 3 bearer, at the same time, holds down the opposite cacolet.

This done, the two bearers proceed to lift the second patient in a similar manner into the other cacolet.

The waist straps should now be buckled round both patients, and their feet placed on the footboards, arranging the straps to the proper length.

To unload Cacolets.—The waist straps being loosened, two bearers, one at each side in front of the patient, place their hands in the manner described in loading, forming a two-handed seat, and thus lift him out of the cacolet, while a third bearer, or the driver, stands by to hold down the cacolet when the weight is taken off it until the first two bearers are disengaged to lift the second patient out as they did the first.

In case of a difference in the weights of two patients carried in cacolets, it may be remedied in the manner described when speaking of litters.

The same remark will apply to the selection of the strongest mules to carry the heaviest patients, the average weight of a pair of cacolets loaded being—

Pack-saddle complete	- -	63 lbs.
Pair of cacolets	„ - -	56 „
Two patients	„ - -	308 „
Total	- -	427 „

CHAPTER XIII.

THE TRANSPORT OF SICK AND WOUNDED BY MEANS OF MULE-LITTERS.

Description of Litters.—Litters are carried on mules, and are for the transport of sick and wounded in the recumbent position.

The litters described below are of the latest French pattern.

Each litter complete consists of the under-mentioned parts:—

1 iron framework, jointed, in three parts—head piece, centre piece, and foot piece.
4 pins, with straps, for fixing joints.
2 iron hood rods.
1 foot rail.
2 cross bars.
2 uprights.
2 sling hooks.
2 straps for belly straps and back suspension strap.
1 hood strap.

2 side straps.
2 bellyband straps, long and short. } Common to both
1 back suspension strap. } litters.
1 canvas bottom, with eyelets and rope lacing.
1 pillow.
1 cover, with straps and buttons.

Weight, 82 lbs.

Litters are suspended by pairs from the pack-saddle of a mule; but, unlike cacolets, they cannot be used indiscriminately for either side. They are therefore distinguished as right and left.

Owing to the greater strength and height of the mule at the shoulders, the patient is carried head foremost, with his feet towards the hinder part of the animal.

The framework of the litter is made of iron, and jointed into three principal parts—head, centre, and foot pieces—for the purpose of folding up when not in use. These joints are fixed by pins.

In order to secure a patient from slipping downwards beyond the end of the litter, in the most recent French patterns a small foot rail is added to it.

To prevent rolling off on the outside a double side rail is placed along the middle compartment of the litter.

The head part of the litter is always raised a little, and, in addition, the pillow obviates any tendency on the part of a feeble patient to slip in that direction.

When required for use the litter is laid on the ground and the wounded man placed upon it. As soon as he is settled in his place the litter is raised by three men to a level with the saddle, hooked on, and securely fixed in its place.

A long strap is made to pass from the upper bar of the outer side rail of one litter, over the patient upon it, and over the pack-saddle, to the corresponding rail of the other litter. This strap holds up the two litters, which would

otherwise, by their breadth and the weight upon them, have a tendency to dip downwards at their outer margins.

Another strap passes from the lower part of the outer side rail, under the litter, the belly of the animal, and under the other litter, to be buckled to the lower part of its side rail, and a third passes from the inner side rail of one litter to the inner side rail of the other litter, also under the belly of the animal.

The combined influence of these three straps is to prevent the two litters swaying up and down during the movements of the animal, and thus to lessen the disturbance which would be caused to the patient's lying upon them. (See Fig. 76.)

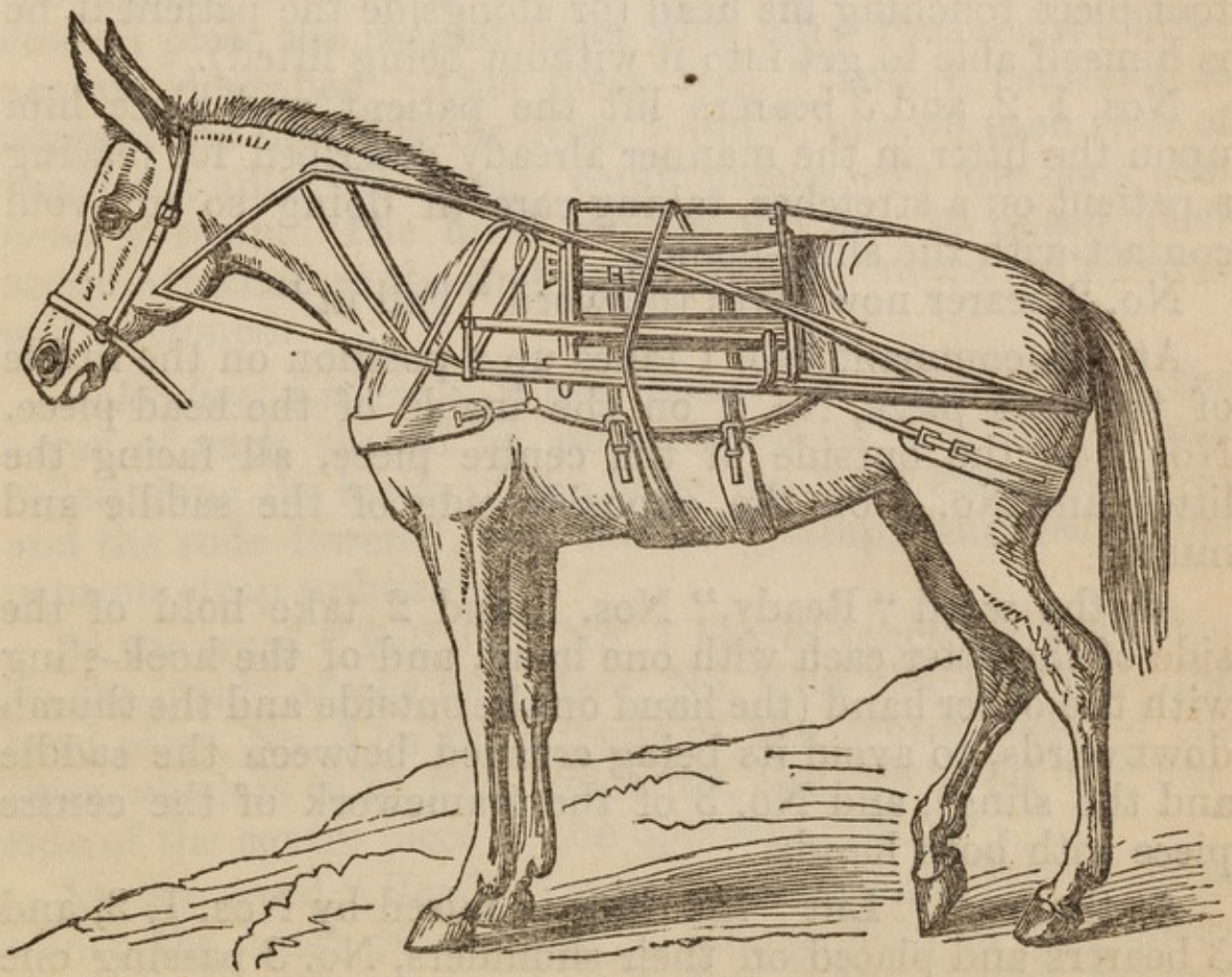


FIG. 76. MULE LITTER ATTACHED TO ITS PACK SADDLE.

Management of Litters.—With each mule for the carriage of litters should be a driver, whose duty it is to attend to the animal, harness it, and drive it.

Four orderlies or bearers are required to load and unload litters. They are named respectively Nos. 1, 2, 3, and 4 bearers.

Loading Litters.—When about to load litters the joints should first be fixed by means of the pins attached for that purpose, the cover of each unbuttoned on the outside and neatly rolled along the inside of the litter, the hood rods lowered, the strap being laid along the rolled cover. The litter is then brought to the spot where the patient to be transported is lying and placed on the ground, with the foot piece touching his head (or alongside the patient if he is himself able to get into it without being lifted).

Nos. 1, 2, and 3 bearers lift the patient and place him upon the litter in the manner already described for placing a patient on a stretcher, taking care in doing so to avoid contact with the sling-hooks.

No. 2 bearer now gives the word "Fall in."

At this command No. 1 takes up a position on the inside of the foot piece, No. 2 on the inside of the head piece, No. 3 on the outside of the centre piece, all facing the litter, and No. 4 on the opposide side of the saddle and mule.

At the word "Ready," Nos. 1 and 2 take hold of the side of the litter each with one hand, and of the hook-sling with the other hand (the hand on the outside and the thumb downwards, to avoid its being crushed between the saddle and the sling), and No. 3 of the framework of the centre piece with both hands.

At the word "Lift" the litter is raised by Nos. 1, 2, and 3 bearers and placed on their shoulders, No. 3 passing one hand underneath the litter and taking hold of the inside of

the framework, while Nos. 1 and 2 each retains his hold of the hook-slings.

At the word "March," the litter is carried alongside the mule, with the head towards the animal's head, until the centre is opposite the centre of the saddle.

At the word "Ready," Nos. 1 and 2 guide the hook slings into a position to slip on to the saddle hooks, while No. 4 takes hold of the saddle on the opposite side to prevent its turning.

At the word "Down," by a simultaneous action of the three bearers, the sling-hooks are lowered into the saddle hooks.

"Fall out" is then given. No. 3 remains, bearing up the loaded litter, but Nos. 1 and 2, joined by No. 4, proceed to place the patient upon and affix the second litter as just described. This done, Nos. 3 and 4 continue to support the litters, while Nos. 1 and 2, one on each side of the mule, affix the straps, commencing with the back suspension strap. The hood rods should now be raised, their straps attached at the foot rails, and the covers pulled over and buttoned.

Unloading Litters.—When about to unload litters the cover of each should be unbuttoned on the outside and rolled along the inside of the litter, the hood straps loosened and the rods lowered, and the belly straps and back suspension strap unbuckled.

At the word "Fall in," No. 1 bearer takes up a position on the inside of the foot piece, No. 2 on the inside of the head piece, No. 3 on the outside of the centre piece, of the litter which is to be first unloaded, and No. 4 on the outside of the centre piece of the opposite litter.

At the word "Ready," each bearer places his shoulder under the litter, Nos. 1 and 2 taking hold of the hook-slings each with one hand, and Nos. 3 and 4 each passing

one hand under the centre piece of his own litter and taking hold of the inner side of its framework.

At the word "Lift," all raise the litters until sufficiently high for Nos. 1 and 2 to slip the hooks of their litter off the saddle hooks.

At the word "March," the litter is carried to its destination. "Halt," and "Ready," follow, with the action to suit; and the word "Down" then being given it is steadily lowered from the shoulders and placed on the ground.

Nos. 1 and 2, aided by No. 4, then proceed to unload the other litter in a similar manner.

If there be six bearers present, three should go to each litter, and place both on the pack-saddle at the same moment.

When the litters are not required to carry sick or wounded, the pins being removed, they should be folded up close to the sides of the saddle.

Patients of as nearly equal weights as possible should be carried on a pair of litters, and where a choice exists the strongest mules should be selected to carry the heaviest patients, as it should be borne in mind that the following is the average weight carried by each mule :—

Pack-saddle, complete	-	63 lbs.
Litters „	-	82 „
Two patients, about -	-	308 „
Total -	-	453 „

When a difference exists in the weight of the two patients to be transported, the heavier patient should lie towards the inner side of the litter, while the lighter lies towards the outer edge of his litter; but should the disproportion in their weights be so great that this arrangement will not preserve the balance, a pack, rifle, or some other weight must be employed on the lighter side.

When patients with fractured limbs are being transported, every available means, such as straw, hay, or articles of clothing, should be used as padding to keep the limb in an easy position and to prevent movement.

CHAPTER XIV.

THE TRANSPORT OF PATIENTS BY THE AMBULANCE WAGGONS IN USE IN THE BRITISH ARMY.

The old pattern ambulance waggon is a four-wheeled spring vehicle, drawn by two horses and fitted with two seats, one in front and one behind, each for three, ~~patients~~. It also contains a basket for packs, straps for carrying arms, a water barrel, water bucket, two stretchers, which are for the purpose of forming beds in the waggon for the transport of sick and wounded who require to be carried lying down. They are called "Ambulance Waggon Stretchers." (See Fig. 77.)

The ambulance waggon stretcher is double, the upper stretcher, upon which the patient lies, being supported upon another stretcher below, with intervening india-rubber springs. The upper stretcher is padded, covered with canvas, and sloping, being raised about four inches from the under stretcher at the head, and closely connected with it by hinges at the foot.

This inclination is given by the india-rubber springs, two sets of which, of different heights, are placed between the two stretchers. The bed of the upper stretcher is strengthened by a strong network of webbing, and the

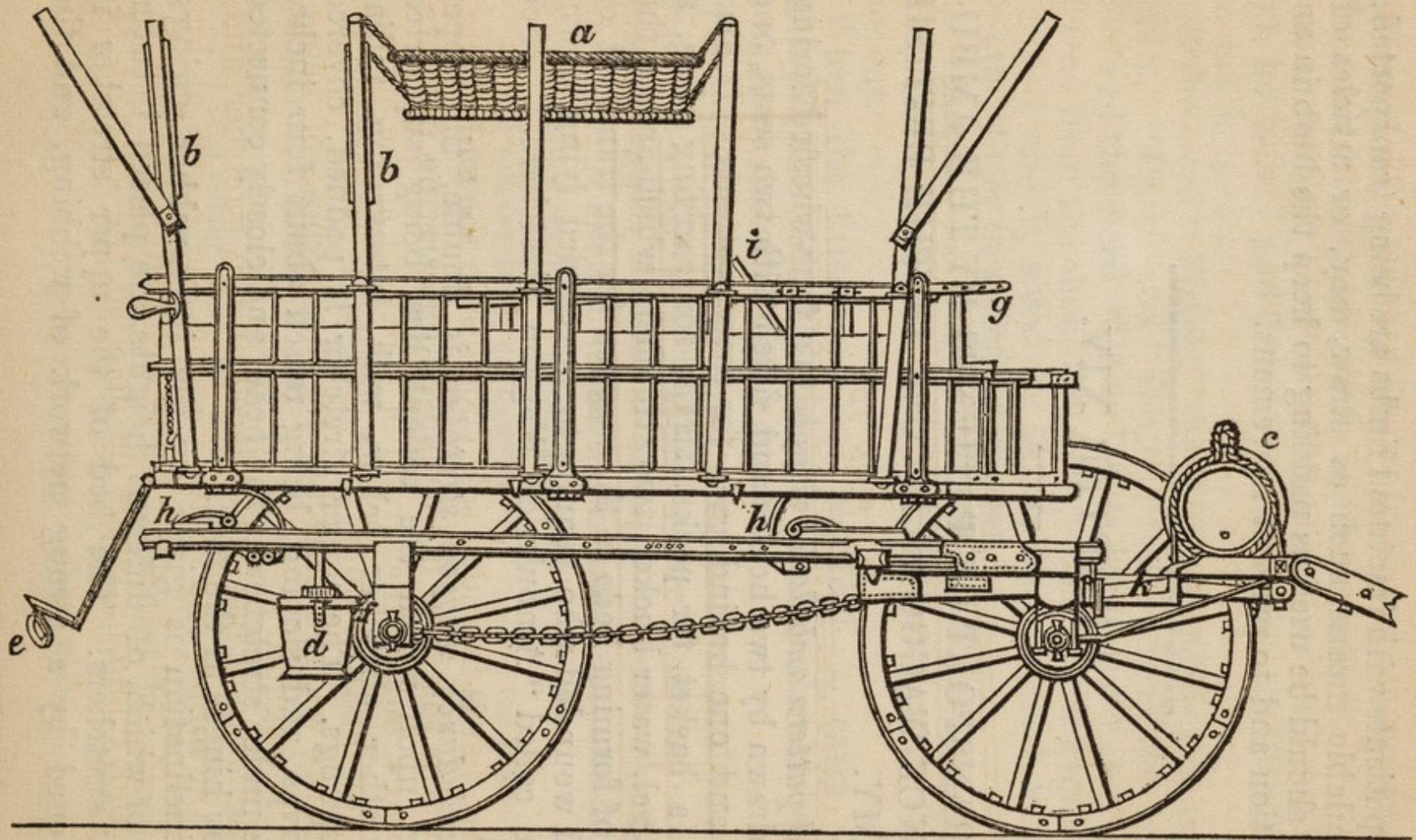


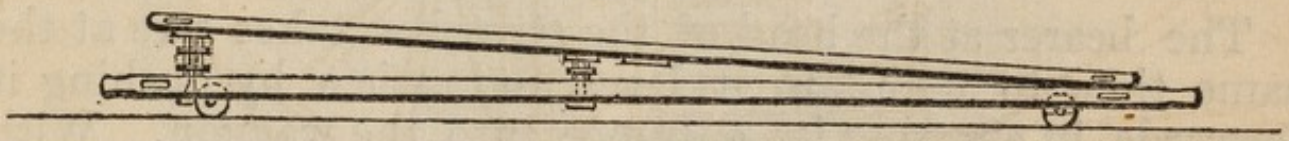
FIG. 77.

a Basket for knapsacks.
b Straps for firearms.
c Water barrel.
d Water bucket.
e Apron.
f Grease-tin.
g Ladder.
h Springs.
i Seat.
k Swingle tree.

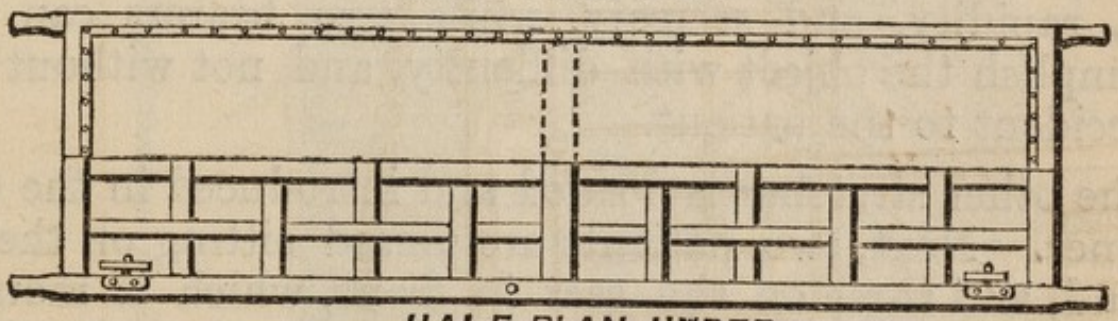
under stretcher is furnished with handles. Two small rollers, one before and one behind, are attached to each of the side poles of this stretcher to facilitate its insertion into and removal from the waggon, on the floor of which it is designed to be carried when in use.

The length of the upper stretcher is a little over six feet, the lower is of the same length with the addition of the handles, the width between the poles is 18 inches. (See Figs. 78 and 79.)

FIG. 78.



HALF PLAN TOP.



HALF PLAN UNDER.

FIG. 79.

This stretcher is intended solely for use in the ambulance waggon, and is therefore not employed for carrying patients long distances, but on the arrival of a patient at the ambulance waggon on an ordinary stretcher, he is transferred to the ambulance waggon stretcher for the purpose of being placed in the waggon.

When the patient has been placed on this stretcher, and carried to the hinder end of the waggon, the bearer at his feet should be ready to move round the end of the pole in his left hand, retaining, while he does so, the support of

this pole only. Before he makes this move, however, No. 3 bearer must grasp the right-hand pole ; the hold of it should on no account be given up by the first bearer until he has quite ascertained that it is fully supported by No. 3 bearer. When this is known to be accomplished, the first bearer turns round, supporting the left pole at the side as he does so, and then, acting in concert with No. 3 bearer, raises the ends of the poles, which are now free, into the compartment of the waggon destined to receive them.

The bearer at the head of the stretcher takes care at the same time to maintain it level, and assists by pushing it forwards, in effecting its entrance into the waggon. With this system the admission of the stretcher is effected with ease, rapidity, and security, while two bearers can only accomplish the object with difficulty, and not without risk of accident to the patient.

The other stretcher is loaded and introduced in the same manner. Next, two patients are placed sitting on the seat behind, and three on the seat in front, which is mounted by a ladder, carried for the purpose, attached to the side of the waggon.

In unloading, the sitting patients are first to be removed, and afterwards the stretchers with the lying down patients. The same care should be exercised in removing the stretchers from the waggon as when inserting them.

The new pattern ambulance waggon is in general form almost the same as the old pattern, especially as regards the number and arrangement of the sick and wounded to be carried, that is to say, three sitting on the front seat, two lying down on stretchers in the body of the waggon, and two with an attendant sitting on the seat behind. (See Fig. 80.)

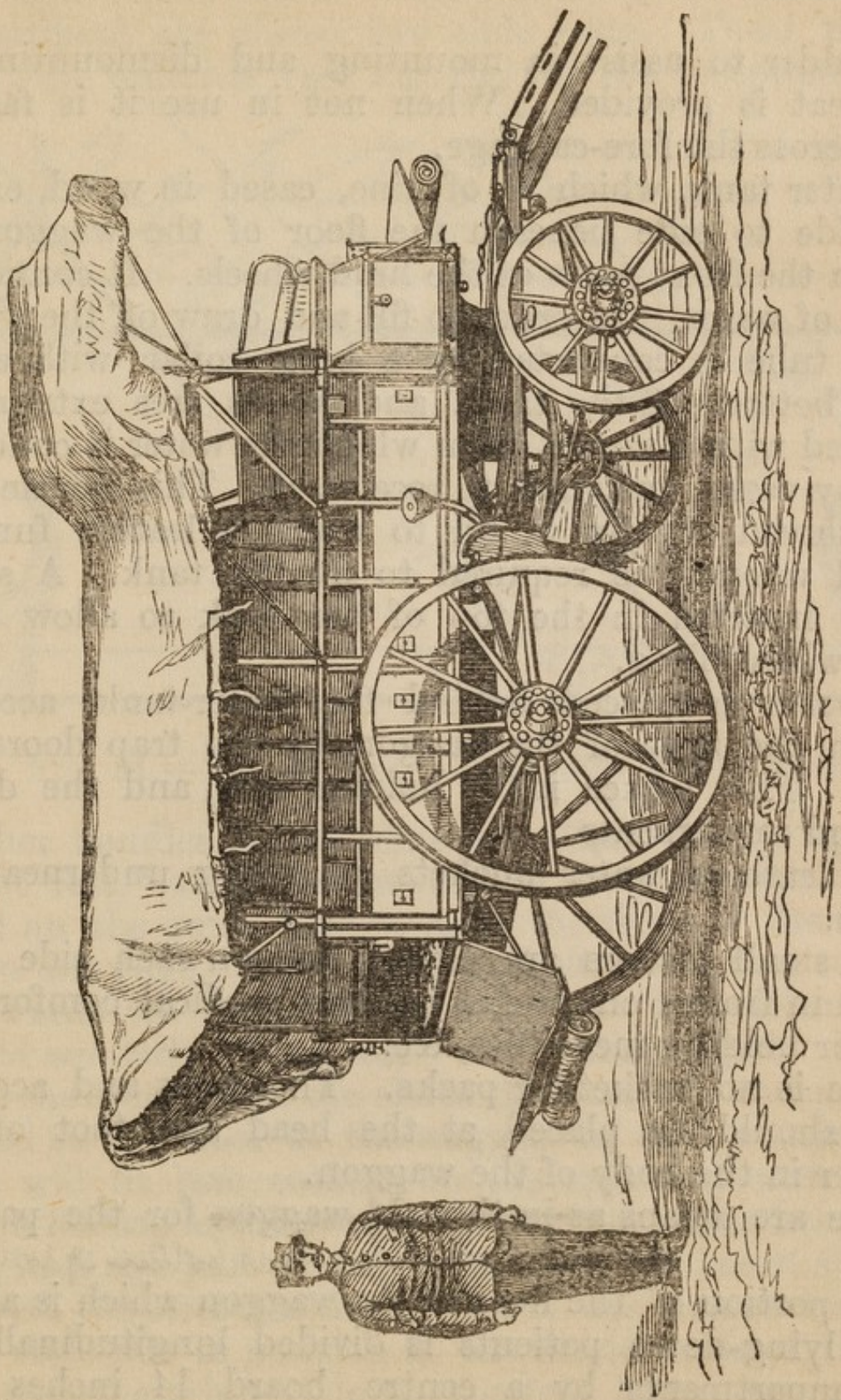


Fig. 80.

The fittings, however, are different and so are the following, viz. :—

A ladder to assist in mounting and dismounting the front seat is provided. When not in use it is fastened down across the fore-carriage.

A water tank, which is of zinc, cased in wood, extends from side to side beneath the floor of the waggon, and between the front parts of the hind wheels. It contains 10 gallons of water. In order to fill and draw off the water, a leather tube is connected by a brass collar with a cock in the bottom of the tank, and at its free extremity is furnished with a nozzle, from which the water is conducted into any vessel prepared to receive it. This nozzle has a screw thread cut on it, on to which a leather funnel is screwed when it is required to fill the tank. A smaller cock is inserted in the top of the tank to allow an air escape when filling.

A locker is placed behind the water-tank, accessible through the floor of the waggon, by two trap doors padlocked. This locker is for holding oats, and the driver's tools and implements.

Two leathern water buckets are slung underneath the waggon.

Two small lockers are placed one on each side of the waggon in front; one is for holding medical comforts, the other for holding medicines, &c.

There is no basket for packs. The packs and accoutrements should be placed at the head and foot of each stretcher in the body of the waggon.

There are straps ~~as in the old waggon~~ for the patients' rifles. * under stretchers at bottom of waggon.

That portion of the floor of the waggon which is allotted to the lying-down patients is divided longitudinally into two compartments by a centre board 14 inches high. Guide bars are placed in each compartment along the side

board and centre board. Upon these guide bars in each compartment are placed two slide rests. These rests are fitted with crutches (see Fig. 81) for the reception of the

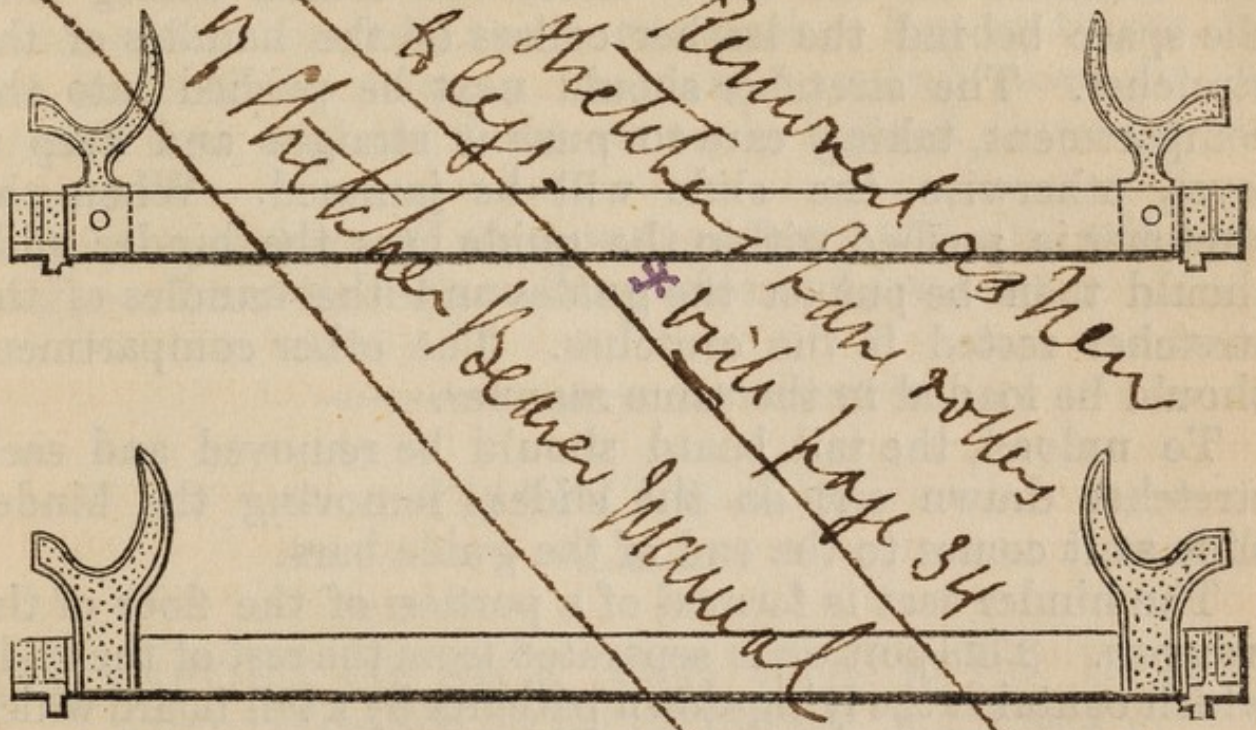


FIG. 81.—SLIDES AND RESTS FOR STRETCHER.

stretcher handles. One slide is marked on its upper side "front rest," which means this is the slide which is to be placed on the guide bars towards the front of the waggon, and on one edge, "hind edge," which means this edge is to be towards the front of the waggon. The other slide is marked similarly "hind rest" and "hind edge." In addition to the crutches on the slides there are two spare crutches chained to the floor of the waggon in each compartment. These will fit into sockets on the side and centre board, and are for use in the event of any of the slides being lost.

To load this part of the waggon the tail board should be removed, the stretcher drawn out of one compartment, the front slide put in position at the hinder ends of the guide bars, and the other slide on the foot board ready for use when required. The patient should then be placed on the

stretcher in the manner before described by three bearers. The stretcher should then be carried foot end on to the hinder part of the waggon, and the two handles placed in the crutches on the front slide, the crutch fitting into the space behind the leather collars on the handles of the stretcher. The stretcher should next be pushed into the compartment, taking care to push it straight and keep it level, otherwise the slide will be jammed. When the stretcher is pushed within the guide bars the hinder slide should then be put on the guides and the handles of the stretcher rested in the crutches. The other compartment should be loaded in the same manner.

To unload, the tail board should be removed and each stretcher drawn out on the slides, removing the hinder slide as it comes to the end of the guide bars.

The hinder seat is formed of a portion of the floor of the waggon. This portion is separated from the rest of the body which contains the lying-down patients by a tail board which acts as a back support for this seat. The seat is provided with a cushion and a foot board, on the under surface of which is a leathern apron folded up, which can be drawn up over the legs and lower part of the bodies of the patients sitting on the seat.

To load this seat the bearers should carry each patient by the *two-handed seat sitting up* back foremost and sit him on the seat. It should be unloaded in a similar manner.

The front seat is accessible by a ladder. Only such patients as can walk up a ladder with assistance should be placed on this seat. To load it the ladder should be placed in position at the side, one bearer should get up on the fore part of the waggon ready to assist the patient as he mounts the waggon, while the others should assist the patients to the foot of and up the ladder by the improvised method of *one bearer assisting a patient* previously de-

scribed. The seat should be unloaded in the same manner as it has been loaded.

In arranging the patients for an ambulance waggon, either new or old pattern, the attendant should select the two worst cases, especially those with broken legs or thighs, for the body of the waggon, the next two bad cases for the hinder seat, and the least seriously injured three for the front seat.

Any stretcher of whatever pattern will fit into this waggon, provided it is not too wide and too long.

CHAPTER XV.

TRANSPORT OF SICK AND WOUNDED IN THE RECUMBENT POSITION BY RAILWAY.

The carriages on British railways which may be made use of for this purpose are,—invalid carriages, specially constructed, second class passenger carriages, and goods waggons.

Invalid Carriages.

A carriage of this kind is now being constructed at the Metropolitan Works, Birmingham, intended to convey such invalids as require the recumbent position from Portsmouth to Netley Hospital. It is designed to carry eight patients, lying on ambulance-waggon stretchers placed in bunks. The bunks are arranged in two tiers, one above the other, along the sides of the carriage, thus leaving a passage in the centre. The doors of entrance are on the sides at one end. There is also a door of communication in each end of the carriage. It contains a watercloset, lavatory, water-tank,

and other conveniences, also medicines and medical comforts.

Directions for Loading.—Three bearers at least will be needed for this purpose. The bearers place the patient on an ambulance-waggon stretcher according to the directions already given, and carry it through the side door of the carriage, and along the central passage until it is brought side-on to the bunk in which it is intended to be placed. The sideboard being previously let down, and the slides drawn out, the stretcher is placed on the slides and pushed sideways into the bunk. The sideboard should then be raised and secured in its place by the bolts provided for the purpose.

Patients are placed in the other bunks in a similar manner.

Directions for Unloading.—The sideboards of the bunks being let down, one bearer places himself opposite the head of the bunk, the other at the foot. Then both seizing the stretcher draw it out of the bunk sideways, at the same time moving round to the end and taking hold of the handles. The stretcher being freed from the bunk and slides is carried down the passage, turning to the right or left as the case may be, and out of the carriage on to the platform. The stretcher may then be introduced into an ambulance waggon for further transport without removing the patient.

In cold weather each stretcher should be provided with a blanket and a rug. A pillow in addition to that on the stretcher would add much to the comfort of the patient.

Second-class Railway Carriage.

The large second-class railway carriages are those suited for transport purposes. Each compartment has a length from side to side of about 7 ft. 6 in., and a breadth from

the back of one seat to the back of the other of about 4 ft. 10 in., with a door of about 1 ft. 10 in. in width.

Two cross supports are placed upon the opposite seats, and two ambulance waggon stretchers with patients placed upon these, leaving a space between on which one or two attendants can sit.

The cross supports are of wood, four feet eight inches long, six inches broad, and an inch and a half thick; a centre block and two side blocks are nailed on one side, leaving two gaps, into each of which the side pole of one stretcher fits. (See Fig. 82.)

FIG. 82.—CROSS SUPPORT.

Directions for Loading.—Three bearers are required for this purpose. The two cross supports are placed on the seats of the compartment, each about a foot from the door. The door is held open to its full extent. Should the guard strap not be sufficiently long to allow the door to open to its full extent, it will have to be undone at one end, either by drawing the nails or peg with which it is fastened. The bearers place the patient on an ambulance waggon stretcher in the usual way, and carry the stretcher end on to the doorway. No. 3 bearer gets inside the compartment and takes hold of one handle of the stretcher, while No. 1 moves round the other handle to the side, and in this way the handles are inserted through the doorway. No. 3 now takes hold of the other handle from No. 1, which leaves No. 1 free to assist No. 2. The stretcher is thus carried along to the opposite side of the compartment, when No. 3 lifts his end over towards its place, and resting it on the cross supports, gets to the side of the stretcher. The stretcher is next lifted completely within the compartment

and placed in its proper position, close up to the side or partition of the compartment, resting over the seat. The second stretcher is inserted in the same manner. (See Fig. 83.)

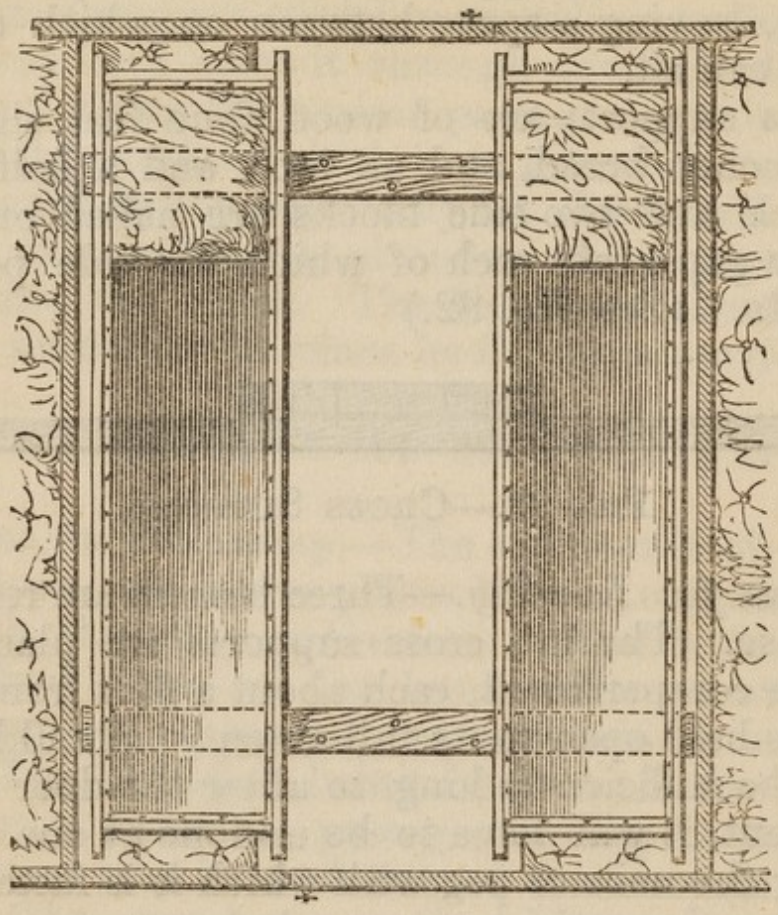


FIG. 83.—COMPARTMENT OF RAILWAY CARRIAGE SHOWING ARRANGEMENT OF STRETCHERS.

An attendant sits upon one of the cross supports between the two stretchers to take charge of the patients on the journey.

Directions for Unloading.—The carriage being alongside the platform, the door is held open to its full extent. Nos. 1 and 2 bearers go inside the compartment, and take up a position one opposite each end of the stretcher. Both, reaching over, lay hold of the handles and lift the stretcher out of its place towards the centre of the compartment,

resting it on the cross supports. No. 1 descends to the platform, and with the aid of No. 3 withdraws the end of the stretcher through the doorway, No. 2 in the compartment carrying the other end. When the latter has reached the door No. 3 comes to his assistance, and each taking hold of one handle, pass it through the doorway.

The stretcher may now, without removing the patient, be placed in an ambulance waggon or on a wheeled support for further transport.

Goods Waggons and Cattle Trucks.

To render goods waggons and cattle trucks available for the transport of sick and wounded, a simple method has been devised in Germany. Four springs and two poles are required for each set of stretchers. The springs are of steel and semi-elliptic in shape. A foot is placed at one end of the spring furnished with three or four projecting spikes, and at the other end is a roller. On the top of the spring is a crutch, into which one end of the pole fits. The poles are as long as the breadth of the waggon.

Directions for Loading.—Two springs are placed, one at each side of the waggon, and fixed by driving the spikes projecting from the feet into the floor. This done, a pole laid crosswise as to the waggon, is fixed at either end into the crutches on the springs. Two other springs and another pole are similarly placed at a distance of about six feet. Stretchers of any kind with patients upon them are then carried in the ordinary way, and laid on the poles in the direction of the length of the waggon.

A waggon is broad enough to admit three stretchers thus placed, but it is seldom sufficiently long to allow of two rows; so that three patients only can be carried in each waggon. The stretchers should be so placed that they will not come in contact with the sides of the waggon.

CHAPTER XVI.

FIELD HOSPITAL ENCAMPMENT.

Hospital Marquee.

The hospital marquee, complete, consists of the following parts, viz. :—

1 inside linen roof 1 outside ditto 8 walls (4 inside and 4 outside) 82 bracing lines (40 inside and 42 outside), with wood runner and button to each 2 wood vases, painted red 2 weather lines (90 feet long each) with large runners	Packed in a canvas valise, laced up the centre, and marked on the outside "Hospital Marquee."
180 small tent pins 4 large ditto (for weather lines) 2 mallets	Contained in 1 pin bag, marked on the outside with contents and marquee to which it belongs.
1 set of poles, consisting of 8 pieces, viz., 1 ridge in two pieces, and 3 standard or upright in two pieces	Lashed together in 1 bundle by two box cords.
1 waterproof bottom, made of painted canvas, in four pieces, each piece measuring 15 by 8 feet	Rolled in a bundle round a thin pole, and tied by three box cords.

Directions for Pitching the Hospital Marquee.

Laying out the Ground.—Undo and empty the peg bag, (keeping the four large pegs for the weather lines by themselves), fit the handles in the mallets, and fix the two pieces of the ridge pole together. This done, proceed to lay out the ground for pitching the marquee as follows :—

Lay the ridge pole on the ground selected, and drive in a peg at its centre and each of its two end holes. These pegs will mark the positions of the standard or upright poles, and will be seven feet apart. With each end peg as centre, in a semicircle with a radius of six yards, lay thirteen pegs with their points inwards where they are to be driven. This will be easiest done as follows,—step six yards from one of the end pegs, and in a straight line with the three standard pegs lay the centre peg of the semicircle; next step six yards to each side of the end peg, and on a line at right angles to the three standard pegs lay a peg for each end of the semicircle; then lay at each side between the centre peg of the semicircle and the two end pegs, equal distances apart, five pegs, and the semicircle of thirteen pegs is complete. The other end will be done in the same way.

For the sides of the marquee on a straight line parallel to the three standard pegs and five yards distant, lay six pegs, the first and last of which will be eighteen inches distant from the lines formed by each end standard peg and the two end pegs of each semicircle. Now the pegs for the outer roof are all laid and should be driven before proceeding further.

For the inner roof, lay a peg between each two pegs of the outer roof, but on a line one foot further in. The space, however, between the third and fourth pegs on each straight line is to be left blank for the doorway. These driven, the pegs are complete for the marquee, except the four weather-line pegs. These are each driven at a corner where two lines would meet if drawn from each end and centre peg of the semicircle. (See Fig. 84.)

Arrangement of Marquee before raising.—The ground being laid out, carry the marquee within the line of pegs, unlace the valise, and arrange and spread out the marquee, the roofs one inside the other, in such a manner that the

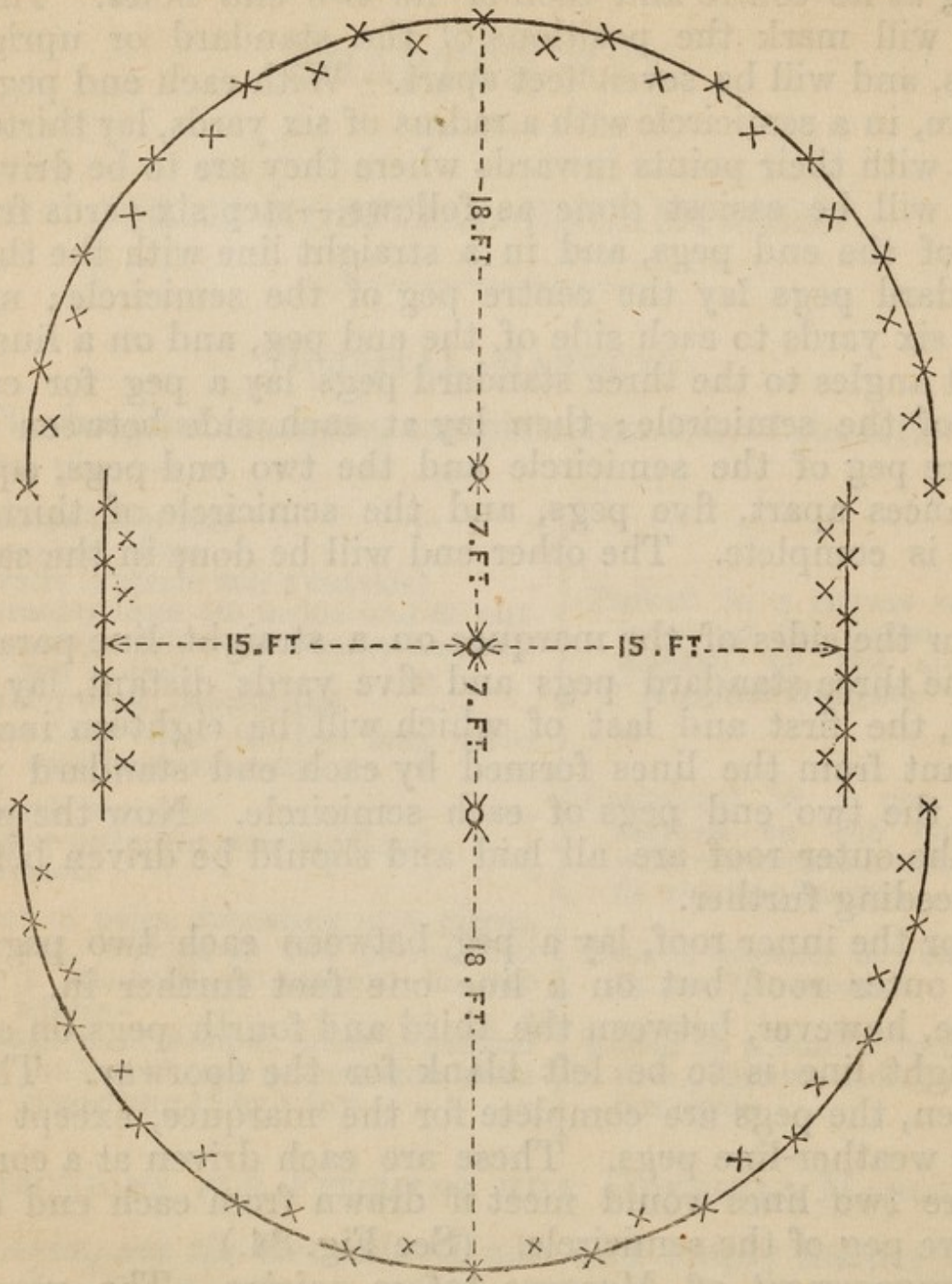


FIG. 84.—GROUND PLAN OF THE PEGS OF THE MARQUEE.

base and ridge will be parallel with the line of the standard pegs, and the former touching them. Roll up the upper side of the outer roof as far as the ridge, so as to expose the web slings of the inner roof, and roll up the upper side of the inner roof in a similar manner.

Fix the two pieces of each standard pole together by their numbers. This done, pass them through the openings in the inner roof, and their pins through the holes in the ridge pole, through the eyelet in the two end web slings, and also through the eyelet-holes in the ridge of the outer roof. Now fit the vases on the pins of the end standards, and pass the opening lines of the ventilators through the holes of the vases and down through the holes in the ridge of the inner roof by the side of the standards. Next pass the lines for opening and shutting the windows through the corresponding eyelets in the inner roof. Unroll the inner and outer roofs to their proper position, bring the ends of the standard poles so as to prop against the three standard pegs, and square the ridge pole on the three standards thus placed.

Raising the Marquee.—To raise the marquee ten men and one non-commissioned officer will be required. These will be styled four weather-line men, six standard men, and one director. One weather-line man will take up a position at each large peg, holding in his right hand the runner, and in his left the line, with a loop ready at any moment to slip on the peg. Two standard men will take up a position at each pole, one at the foot, the other at the top, facing each other. When the director sees all are ready he will give the word to raise, when all working together should steadily erect the standards, taking care not to raise one before the other. The director should now go to the side and dress the standard poles, tightening and slackening the weather-lines as required until the poles are

perpendicular. He should next go to the end and dress the poles in a similar manner in that direction.

Putting on the Bracing Lines.—The weather-line men should not leave their posts until the bracing lines are on. Four of the standard men should put on the bracing lines, while two of them should take mallets to drive any loose pegs there may be. To put on the bracing lines two men should go to each side of the marquee, commencing with the outer roof, one should take the line at one side of the window, and the other the line at the other side, which should be put respectively on the third and fourth peg of the outer straight line, thus working towards the ends until meeting the men from the other side. In tightening the bracing lines the marquee should be pulled towards the pegs so as to slacken the line, otherwise the pegs will be pulled out of the ground. The lines of the inner roof should be put on in a similar manner, beginning at each side of the window and working round to the ends. When two lines are together, they should for the present go on the same peg, but afterwards be shifted.

Putting on the Curtains.—The curtains are in eight pieces, four for the inner wall and four for the outer wall. The outer curtain should be put on so that the ground flap will be inside and that it can be pegged on the outside. The inner curtain should be put on with the flap out so that it can be pegged on the inside. Commence with the outer curtain at each side of the doorway and work round towards the ends. Take care to have enough to overlap and close the doorway. When the curtains are on they should be pegged down both inside and outside.

Trenching the Marquee.—A trench nine inches broad and four to six inches deep should be dug round the curtain, especially on the upper side, if the ground be sloping. The trench should be cut well under the curtain, so as not

to leave a ledge, otherwise the water will drip on the ledge and run under. (See Fig. 85.)

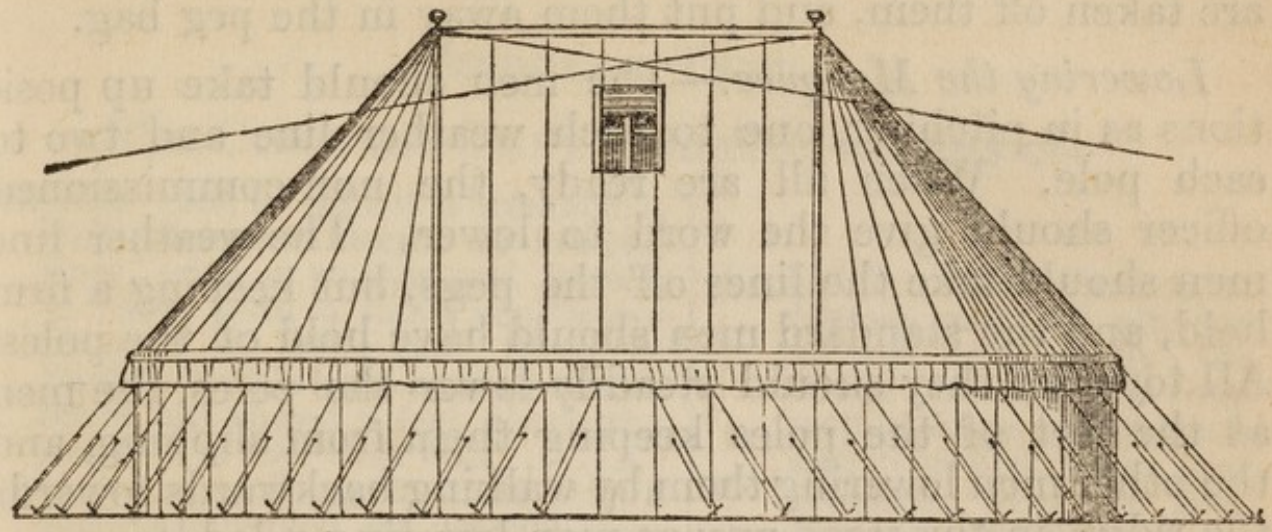


FIG. 85.—HOSPITAL MARQUEE.

Points to be attended to.—When rain comes on, the ropes, as they become wet, get tight, and if not attended to, will pull the pegs out of the ground or break the poles. They will also get tight with a heavy dew. Thus it will be necessary to slack them when rain is expected, and also at night if there is a heavy dew. Again, if the ropes have been wet, they will slacken as they dry, and will require to be braced up, otherwise the marquee flaps and will draw the pegs. The doorway of the marquee should be on the shelter side. The curtains should be taken off the pegs and raised daily for ventilation. They can be fastened to the bracing lines by the buttons of the peg loops.

DIRECTIONS FOR STRIKING THE HOSPITAL MARQUEE.

Curtains and Bracing Lines.—Unfasten the curtains at the bottom, and unhook them from the roof, beginning with the inner one. Fold each piece into eight parts. The four weather line men should now stand by the weather lines, while four men should unfasten and do up into a

skein the bracing lines, beginning with the inner roof at each side of the doorways and working round to the ends. The two mallet men should take up the pegs as the lines are taken off them, and put them away in the peg bag.

Lowering the Marquee.—The men should take up positions as in pitching, one to each weather line and two to each pole. When all are ready, the non-commissioned officer should give the word to lower. The weather line men should take the lines off the pegs, but keeping a firm hold, and the standard men should have hold of the poles. All together they should steadily lower the poles, the men at the feet of the poles keeping them from slipping, and the other men lowering them by walking backwards towards the ridge, in the same way as men lowering a ladder.

Directions for repacking the Hospital Marquee.

Removing the Poles.—Roll up the four weather lines and take the vases off the pins, leaving them there attached by the ventilating cords. Spread out the roofs and roll up the upper flap so as to expose the ridge pole. Next pull away the standard poles and remove the ridge pole from the slings.

Folding the Marquee.—This done, unroll the upper fold of the roof. Bring over each end to the centre, across the middle of the window, and fold the square thus made from the ridge to the base into three equal parts. Place the eight pieces of curtain on the roofs, lengthwise, overlapping in the centre, and the flaps towards the thick end. Roll up the whole thus placed evenly, commencing with the thick end, taking care not to have the roll too wide or too narrow for the valise.

Putting Marquee in Valise.—Spread out the valise, and shoving one of the side flaps under the marquee, roll it into

the valise. Having arranged the flaps lace them commencing with the ends.

Circular Tent.

The Circular Tent, complete, consists of—

1 circular roof, to which is attached a wall 13 inches deep; 22 bracing lines, with a runner and button to each, with 5 small ventilators at apex of roof; and three of Doyle's ventilators, equal distances apart, but placed 3 feet above the junction of roof with wall	Packed in a valise, the roof at *bottom* and the pin bag at *top*, horizontally; the whole forming one compact package, marked outside "Circular Linen Tent complete, with Pin Bag, Pins and Mallets."
1 pin bag, containing 42 small pins, 2 mallets (marked on outside with contents and tent to which it belongs	
1 pole, in two pieces	Lashed together by 2 cords.

Directions for Pitching the Circular Tent.

The spot for the pole to rest being marked by a peg, a party consisting of one pole-man and four peg-men proceed as follows to pitch the tent. Three paces at each side of the pole-peg, and in a straight line drive two pegs. At right angles to this line, and each three paces from the pole peg, drive two other pegs. These are the four pegs for the red runners (see Fig. 86). Spread out the tent within these pegs, with the door uppermost. Introduce the pole, taking care that it is well into the cap. Raise the tent and button the door, the pole-man remaining inside to keep the pole perpendicular. Each peg-man take hold of a red runner, and, the tent being slewed round until the door faces in the right direction, put it on one of the four pegs. Drive four pegs in a semicircle in the spaces between each two of the four red runner pegs. Peg down the curtain and dig a trench with a proper drain to carry off the water (see Fig. 87).

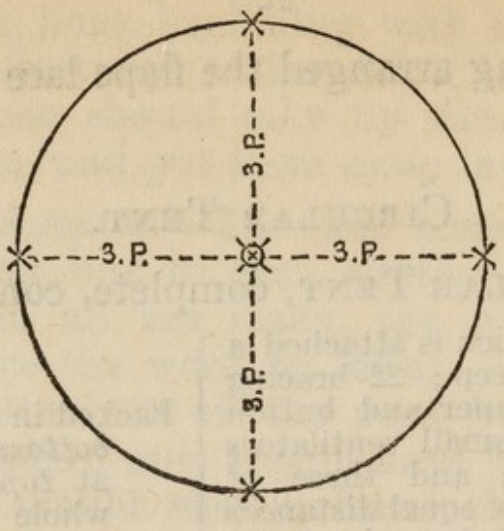


FIG. 86.—GROUND PLAN OF FOUR RED RUNNERS AND CENTRE PEGS OF TENT.

FIG. 87.—THE CIRCULAR TENT.

Points to be attended to.—Slack the bracing lines for rain or heavy dew. Tighten them as they dry. Cut the

trench well under the curtain, so as not to leave a ledge for the water to drip upon. If the tent stands too high the pole is too long, sink it a few inches in the ground. Take care that the pegs are driven so that the bracing lines will form a straight line with the tent seams.

Laying out the Encampment.

When a good piece of ground can be selected, the best plan is to arrange the marquees in the form of a triangle. The figure (88) shows the plan proposed. In the plan nine marquees are arranged, but three, five, seven, or a larger number than nine, may be equally well placed in the same order. There is good exposure to air, and convenience in administration.

A non-commissioned officer and two orderlies of each hospital should be detailed for the purpose of marking out the site to be occupied by the camp of the hospital to which they belong. These men should be provided with four hospital camp colours, and should know the number of paces required for the front and depth of the camp.

On their arrival on the ground, the staff officer having pointed out the site, the non-commissioned officer should at once proceed to mark off the camp as follows. He will place one colour man at one end of a line for the front row of tents, and the other colour man he will make take the number of paces required for its front in the given directions, halt, and turn about. The covering being corrected the camp colours should be fixed firmly in the ground. The line of the colours should be 10 paces further in than the front of the camp, to allow room for the tents.

The line of the marquee at the rear of the camp should next be marked off in a similar manner, having a space outside it also of 10 paces.

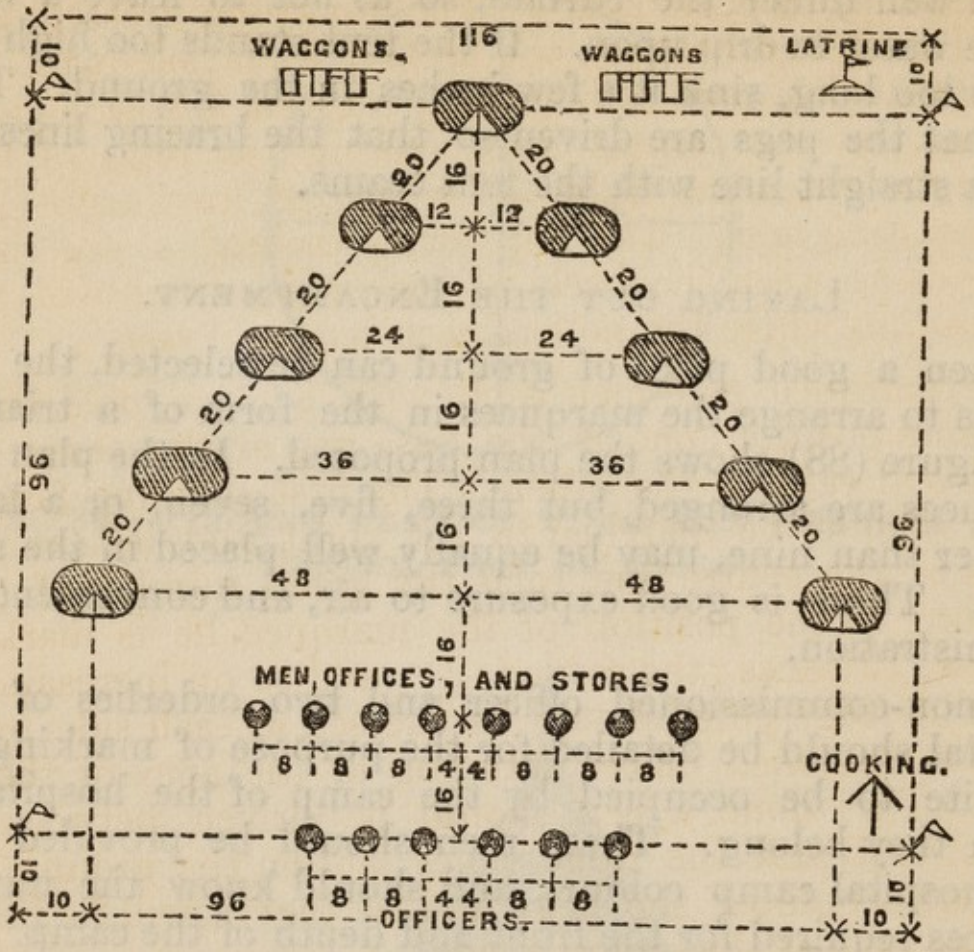


FIG. 88.—FIELD HOSPITAL ENCAMPMENT OF 9 MARQUEES AND 14 TENTS.

Measurements are in paces to centre poles of marquees.
Total depth, 116 paces. Total length of front, 116 paces.

On arriving on the ground the waggons should be parked in two lots, with the tail-boards towards the camp, on the line of the rear camp colours.

The marquees and tents should now be got out and a pole-man for each marquee and tent got in readiness.

The pole-men (those for the marquees taking each a ridge pole, the others the tent poles,) should be extended on the line running from the centre of the front to the rear

of the camp, 16 paces apart. The line being dressed, a peg should be driven between the heels of each pole-man.

The tent pole-men taking up a position on each side of the pegs, on the central line, making the rows of tents, should be extended right and left so to leave eight paces between each tent. The line being dressed a peg should be driven between the heels of each man, which will mark the position where the pole of each tent will rest.

The marquee pole-men each with a ridge pole should take up a position, one at the base peg of the centre line, and two at each of the others. The first standing fast, the others should be marched to the right and left at right angles to the centre line, each the given number of paces according to the position of the marquee he is marking; the first, 12 paces; the second, 24; and so on increasing by 12. The ridge poles should be dressed at each side by the non-commissioned officer standing at the apex of the triangle. This done a peg should be driven between the heels of each and the ridge poles laid on the ground with the centre hole at the peg, and so that it will be in line with the pole at the opposite side.

It will be seen that this plan is applicable to any odd number of marquees from one upwards. Where there is an even number to be pitched it would be better to leave out the one at the apex.

The *cooking place* or *kitchen* should be made to leeward of the camp. The following directions and plan are taken from the Horse Guards' Regulations.

If the encampment is only for a night or two a temporary cooking place will suffice. A trench or two according to the numbers in hospital should be dug 10 feet long, 10 inches wide, and 12 inches deep, and with a splay mouth pointing towards the wind.

If, however, the encampment is for a longer time it is advisable to make a regular kitchen. Three trenches, of the same dimensions as before, should be made converging to a point. The turf should be cut from the top of the trenches and used to build a chimney from 3 to 4 feet high, other sods being obtained from a little distance for this purpose. (See Fig. 89.)

This kitchen should be constructed as follows :—

The site having been selected, a picket must be driven to mark the centre of the chimney, and circles respectively of one foot and three feet radii marked on the ground for the base of the chimney. The trenches are next traced, the centre one towards the quarter from which the wind is blowing. The centre trench is traced 10 feet long and 10 inches broad, with a mouth as shown on plan ; the other two trenches are traced in a similar manner, one on either side, making an angle of about 40° with the central one.

One man excavates each trench, commencing from the bottom of the chimney, making it in the thickness of the chimney only 6 inches wide and 12 inches deep. When beyond the base of the chimney, each man works to a width of 10 inches, gradually increasing the depth to 14 inches at the mouth, and forms the ramp. Another man cuts out the bottom of the chimney to connect the three trenches, and then commences building it, laying stones or sticks over the trenches at their ends, to carry the base of the chimney, and gradually building it up with sods cut by a fifth man. The men in the trenches having completed them, are employed respectively in providing and mixing clay, carrying water, and getting stones and sticks to lay across the trench. Great care must be taken in the construction of the chimney, all holes and interstices being plastered up with clay. The inside of the trenches may be rendered with clay if it be plentiful, in which case the

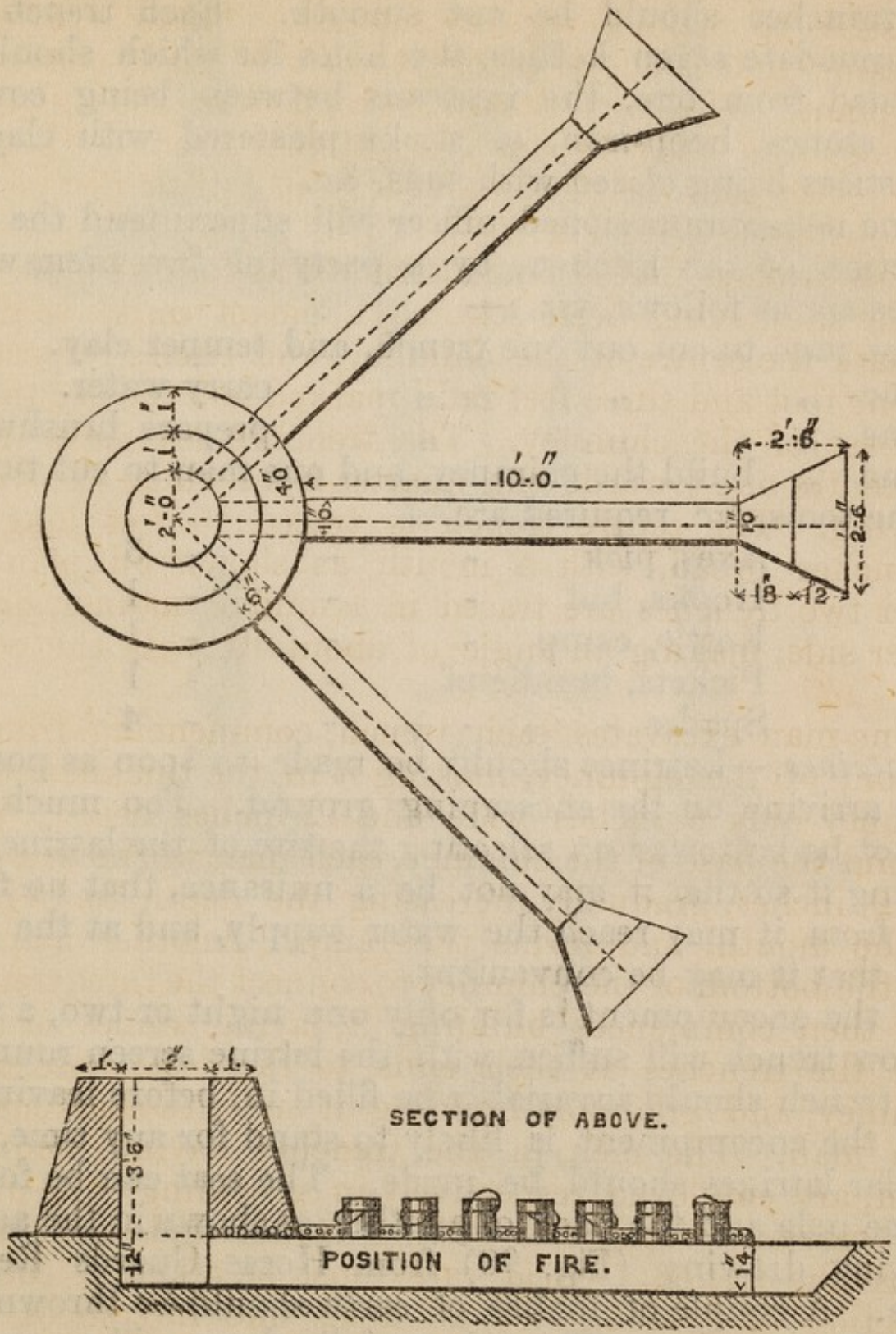


FIG. 89.—BROAD ARROW KITCHEN.

dimensions should be slightly increased ; if clay be scarce, the trenches should be cut smooth. Each trench will accommodate seven kettles, the holes for which should be moulded from one, the intervals between being covered with stones, hoop-iron, or sticks plastered with clay, all interstices being closed with sods, &c.

One non-commissioned officer will superintend the construction of the kitchen, by a party of five men, whose duties are as follows, viz. :—

One man to cut out one trench, and temper clay.
One „ „ „ carry water.
One „ „ „ prepare brushwood.
One „ build the chimney, and one man to cut turf.

The tools, &c. required are,—

Axes, pick - - -	3
Hooks, bill - - -	1
Kettle, camp - - -	1
Pickets, bundle of - -	1
Spades - - - -	4

Latrines.—Latrines should be made as soon as possible after arriving on the encamping ground. Too much care cannot be bestowed on selecting the site of the latrine, and placing it so that it may not be a nuisance, that no filtration from it may reach the water supply, and at the same time that it may be convenient.

If the encampment is for only one night or two, a small narrow trench will suffice, with the latrine screen round it. The trench should invariably be filled in, before leaving.

If the encampment is likely to stand for any time, then regular latrines should be made. The seat can be formed of one pole and the back of another, as shown in the accompanying drawing (Fig. 90) from Horse Guards Regulations. A couple of inches of earth should be thrown over the soil every day. This, if carefully done, will prevent all smell.

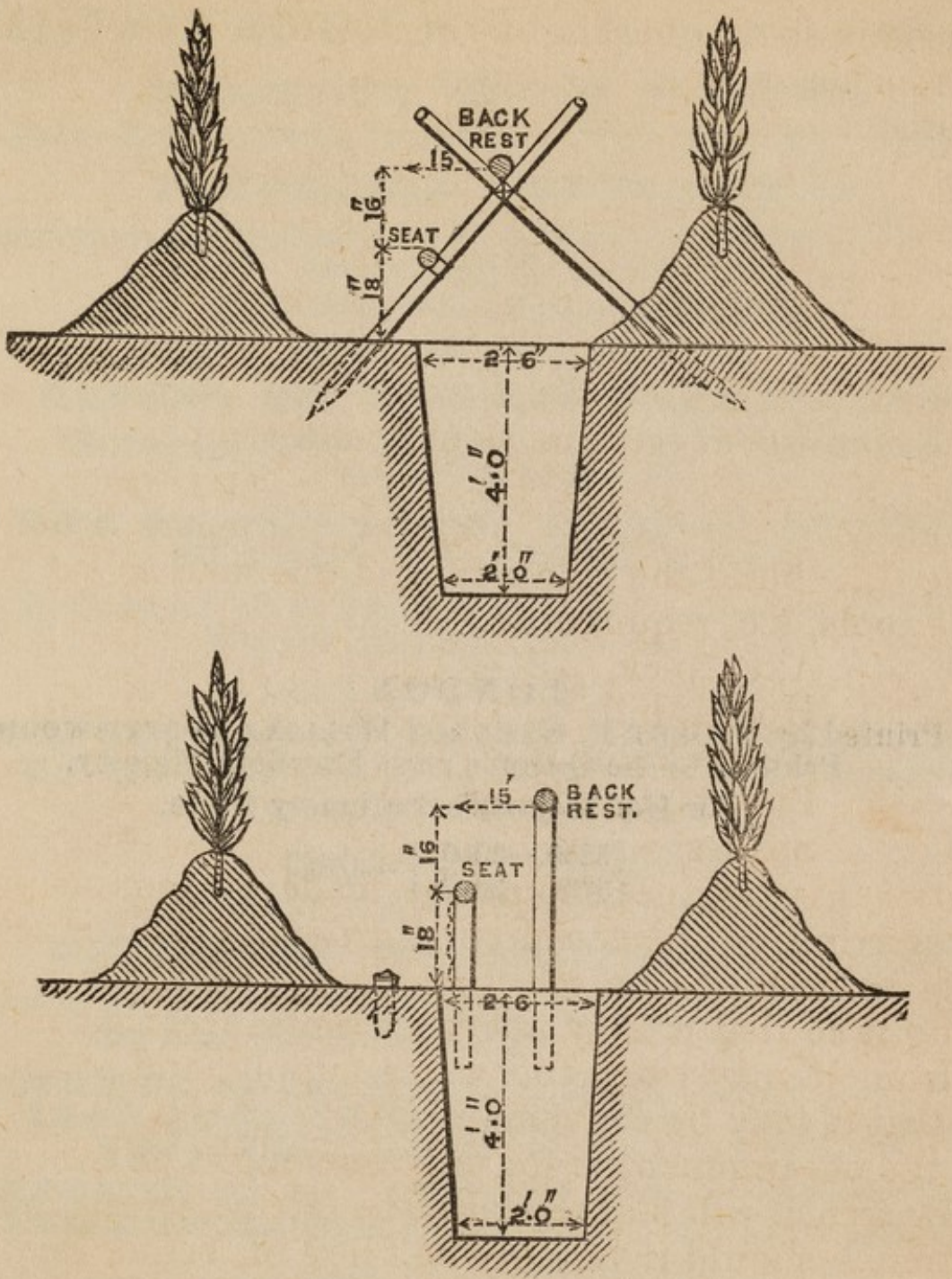


FIG. 90.—LATRINES.

Note.—These trenches should not be more than 15 feet long.

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