Some months afterwards he was admitted into King's College Hospital with the fracture ununited. Sir William Fergusson rubbed the fragments together; subsequently he scarified them subcutaneously, and later inserted an ivory peg between them. No union followed, and Sir William amputated the limb. Secondary bleeding occurred after the flaps had partially healed, for which Mr. J. W. Hulke tied the superficial femoral artery. An aneurysm formed at the seat of ligature. The patient died a few months later. The specimen is not only instructive, but it is of historical interest.

Surgeons vainly imagined in the dawn of the twentieth century that they had seen the last of post-operative sepsis. Sir Charles Bell's water-colour sketches, recently exhibited in the museum, are vivid pictures of septic fungating gunshot wounds incurred at Waterloo. The present war has given surgeons an opportunity of testing their accuracy and witnessing similar horrors.

The large collection of pathological specimens illustrating war wounds, now lodged at the Royal College of Surgeons of England, should be utilized. If these preparations were systematically studied much that is useful could be co-ordinated, and this Section should be the medium for collecting some of the "choicest spoils" obtained by surgeons in London.

A REPORT ON TEMPORARY PEGS FOR AMPUTATION OF THE LOWER LIMB.

BY

W. A. CHAPPLE, M.D., M.P., MAJOR R.A.M.C.,

SURGICAL SPECIALIST, PAVILION GENERAL HOSPITAL, BRIGHTON;
MEDICAL ADVISOR TO THE PROVISIONAL LIMBS DEPARTMENT
OF THE JOINT WAR COMMITTEE, BRITISH RED CROSS
AND ORDER OF ST. JOHN.

It has been agreed by all authorities interested in the subject that during the interval elapsing between the healing of an amputation stump of the lower limb (or a near approach to healing) and the provision of a permanent artificial limb when the stump has shrunk to its permanent size, a man should wear some kind of temporary peg. The period of more or less rapid shrinking and re-shaping of the stump follows healing. Though the stump may appear to be following a normal course, however, the scar may become tender, or break down and ulcerate, or bulbous nerves may form, or spurs may develop; devitalized bone may, instead of recovering, necrose, or the atrophy and shrinking of the soft tissues may be so complete as to bring to the surface bony spurs or prominences that make the stump rebellious to a mechanical appliance.

A MODEL STUMP.

An ideal stump is one which most nearly conforms to nature's stump, the normal heel, and is capable of bearing without discomfort the whole weight of the body in normal locomotion. The characteristics of the normal heel are that it is dome-shaped, is covered with skin capable of hardening with use, is free from scar, and has a subcutaneous pad of fat honeycombed with connective tissue, which lies upon the periosteum covering the dome-shaped extremity of bone. Every surgeon aims at reproducing these conditions in the end of an amputation stump. He may fail, but the more nearly he approaches the more successful will be the result, and the more grateful his patient.

A MODEL BUCKET.

A well fitting boot on a normal foot suggests the characteristics of an ideal bucket. A boot should fit accurately the whole contour of the foot. It should be sufficiently tight to bear equally on every surface of contact, and should be sufficiently smooth on all its inner surfaces to permit of the slight amount of necessary friction in walking to take place between the sock and those smooth surfaces. If the inside of the boot is rough, the sock tends to cling to it, and the friction in movement is apt to take place between the sock and the skin. These characteristics are even more important when we have to deal with skin surfaces and bony prominences which are not meant by nature to submit to this pressure and friction. An ideal bucket will therefore have a smooth and almost

shiny inside surface, with a diaphragm so placed as to carry a maximum portion of the weight of the body on the end of the stump, and a rim so contrived and shaped as to carry the remaining portion of the body weight by coaptation to the appropriate bony surfaces, near the adjacent joint.

PEGS.

Various kinds of temporary pegs have been designed and made from time to time, with some attempt to conform to those conditions. A peg can be used even before the stump is quite healed. It rapidly shrinks and shapes the stump to its permanent size and form. It trains at the soonest possible moment the muscles that are to move the stump in locomotion. It tends to prevent stiffness from disuse of the adjacent joint. It picks out the weak spot in scar or bone or nerve that is destined to give way later to the pressure of the permanent limb; and it does this early and without waste of time, and with the scrapping of a limb that cost under 10s. instead of one that costs £15 or of a bucket that costs £4. It avoids the use of crutches, with their danger of crutch paralysis; the displacement of the centre of gravity of the body, and the unequal distribution of pressure on the joints of the sound limb. It frees the hands from the immobilization that crutches entail, and permits the man to get on with work or training. It provides a light domestic "slipper" after the man has his permanent limb, with which he can rest at home or in his garden, by throwing off his seven or eight pound limb and putting on one of one or two pounds. It supplies him with a spare for use if his permanent limb breaks down or requires to be repaired.

Various Designs.

It is admitted that the ideal peg has not yet been found, and a number of manufacturing depôts have been busily engaged in making and improving pegs for the past two years. The following is a brief description of the most popular. They may be divided into two classes: (1) Therapeutic pegs, and (2) Auxiliary pegs. The therapeutic peg is one which shrinks and shapes the stump, but has no durability for permanent use. The auxiliary peg is one which is serviceable to the wearer after the limb has approximated its permanent shape and size. It has the characteristics of permanence and may be used to fill the interval between more or less complete shrinking and the time when a permanent limb can be supplied. If well made and well fitting and of durable material there is no reason why it should not act permanently as a spare, a rest, and a "slipper."

Plaster Pylon.

The most generally used peg of the therapeutic class is the plaster pylon. It is made of two wooden struts morticed into a turned wooden ferrule, to the bottom of which is fixed a rubber heel. These uprights are of unequal length for a thigh stump and of equal length for a leg stump. After the skin of the stump is smeared with vaseline, the upper ends of the struts are embraced in plaster-of-Paris bandages, which are wound round the stump. When a sufficient number of turns have been made to give the bucket stability, it is left for a few moments to harden, then slipped off and reinforced with more

Fig. 1.—Plaster pylons. P.P., Plaster-of-Paris bandages.

plaster bandages, the edges being turned over and shaped to conform to the bony prominences on which the body weight is carried. The inside is made perfectly smooth with plaster-of-Paris cream. It may be naturally or artificially dried, but it is usually hard within forty-eight hours from the time it is made and is ready for use. A hook is advisable in the outer strut for a thigh stump, and also a wooden spreader between the struts in order

that braces may be attached and used to support the weight of the peg. Some line the bucket with felt. This seems unnecessary, because it violates the principle already mentioned. The lining tends to hang to the stump sock and the friction in locomotion tends to take place between the sock and the skin. The lining also in many cases tends to ruck and get lumpy. The use of one or more socks is sufficient to give the upholstery necessary. The material costs about 5s.

Auxiliary Pegs.

The auxiliary pegs are of a more permanent character. Plaster-of-Paris soon crumbles, and the peg is valueless in from six weeks to three months from the time it is made, but being cheap and readily applied it can always be remade by chipping off the plaster from the struts and rebandaging with plaster-of-Paris bandages. Moreover, auxiliary pegs can be made to fulfil the function of a therapeutic peg. These pegs are so simple and cheap that if shrinkage does take place either the bucket of the auxiliary or the whole peg can be remade. The most popular of the auxiliary pegs are the following, described in their alphabetical order:

FIG. 2.—The Alder Hey peg. A, Wire ring and felt covering; B, wire struts; C, papier-mâché; D, wooden stem; E, thigh peg.

applied to the surface of the felt with a trowel to the thickness of one-eighth of an inch till a homogeneous surface is made over the whole cast. When the papier-mâché is dry it is removed from the cast. A diaphragm is made in this bucket by gluing to its lower edge a circular piece of wood about half an inch thick. Four iron stays welded below to a tube, 1 in. deep, of one and a half inch gas tubing are now applied vertically round the bucket in such a way as to embrace it firmly; they are fixed by strips of glued canvas vertically applied, and afterwards covered by gauze bandages firmly wrapped around the bucket and glued. The upper ends of these struts having been bitten off are bent over a ring of iron wire (No. 12 standard gauge) which encircles the upper edge of the bucket. The upper edge of the felt is then drawn over this wire ring and stitched down firmly, thus making a cushion upon which pressure can be made.

FIG. 3.—The Bath peg.

3. *Brighton*.—The Brighton peg consists of a cone of black fibre board. The fibre is riveted in such a way as to allow the upper end of the cone to embrace a bucket made of leather or of leather-board. For below the knee a plaster cast of the stump is first taken. Bony pro-

1. *Alder Hey*.—The Alder Hey peg consists of a papier-mâché bucket and a wooden stem. The plastic mixture consists of used tramway tickets boiled for six hours. The pulp is then wrung dry in a coarse cloth and mixed with glue and common whitening added gradually till a pultaceous mass is obtained. The mass can be kept moist and workable for three days if wrapped in a damp cloth. A plaster cast of the stump is first taken, and to this a layer of felt is applied and firmly stitched. The felt is then painted over with glue, and before the glue sets the plastic mass is applied to the surface of the felt with a trowel to the thickness of one-eighth of an inch till a homogeneous surface is made over the whole cast. When the papier-mâché is dry it is removed from the cast. A diaphragm is made in this bucket by gluing to its lower edge a circular piece of wood about half an inch thick. Four iron stays welded below to a tube, 1 in. deep, of one and a half inch gas tubing are now applied vertically round the bucket in such a way as to embrace it firmly; they are fixed by strips of glued canvas vertically applied, and afterwards covered by gauze bandages firmly wrapped around the bucket and glued. The upper ends of these struts having been bitten off are bent over a ring of iron wire (No. 12 standard gauge) which encircles the upper edge of the bucket. The upper edge of the felt is then drawn over this wire ring and stitched down firmly, thus making a cushion upon which pressure can be made.

2. *Bath*.—This peg is made of four thin laths embracing at their lower ends a wooden ferrule shod with a rubber heel, and at their upper ends a bucket made of plaster-of-Paris and glue bandages, surrounding a felt lining which has been cut and stitched to fit the stump, on which the moulding is done. The material costs 5s. for above the knee or 15s. for below knee.

minences, such as the shin or the tuberosity of the tibia or the head of the fibula, are exaggerated on the plaster cast by tacking on little pieces of trimmed leather in order that the subsequent leather bucket may have concavities

FIG. 4.—The Brighton peg. A, Fibre corset; B, edge of bucket; C, rivet fixing bucket; D, leather-board bucket.

similarly exaggerated, and thereby prevent too forcible a contact between the bony prominences and the bucket in walking. An appropriate size of leather or of leather-board is soaked in water till it is quite limp. It is then stitched over or overlapped over the plaster-of-Paris cast, and hammered into all concavities, bound temporarily with firm bandages and then allowed to dry hard. If leather is used, the edges may be stitched down the back of the cast corresponding to the back of the leg; or if leather-board, the edges may overlap and be riveted when dry and then shaved smooth. This bucket may be reinforced with glue bandages or plaster-of-Paris bandages, or, when subsequently fixed into the upper end of a fibre cone and riveted there, the interstices may be filled up with papier-mâché. The fibre cone is then made to the correct length and its lower edge screwed round a wooden ferrule. Two hinges corresponding to the knee-joint and with their upper arms riveted to a corset to embrace the thigh, are as a rule necessary to keep the cone firmly applied to the stump when walking. If the stump shrinks this bucket can be removed, reshaped on a new cast, and then reinserted in the cone. The material costs 5s. 6d. with leather bucket. (Leather buckets alone cost about 2s. each, leather-board 3½d.)

FIG. 5.—The Brighton peg. P.C., Plaster cast; L.B., leather bucket.

4. *Chelsea*.—At Mulberry Walk, Chelsea, a fibre cone is made, the overlapping edges being firmly riveted. The bucket and upper edges are upholstered and a vertical split is made from the upper edge to about three inches or four inches. The vertical edges thus made are strengthened and laced. Several eyelet-holes are also made in the trunk of the cone at a level corresponding to about one inch from the end of the stump. Laces are threaded through these holes and are under the control of the patient; he may loosen or tighten them according to the amount of pressure he can bear on the end of his stump. A pad of rubber sponge or other material

FIG. 6.—The Chelsea peg. P.C., Plaster cast; L.B., leather bucket.

is laid upon the diaphragm made by these laces, which can be altered or replaced to meet the comfort of the patient. There is great merit in this device, the patient himself training the end of his stump to bear its full share of the weight under his own sensation and control. Hinges for the knee are sometimes applied. The vertical split weakens the bucket, but it is said to give comfort. The material costs 9s. 6d.

FIG. 7.—The Eaton Gate peg.

extent sacrificed in this attempt. The material costs about 12s. 6d.

6. *Erskine House*.—This peg consists of a bucket made up of vertical laths, to the lower end of which a wooden diaphragm perforated for a wooden stem is attached; to the upper end an elliptical wooden ring is fixed. Inside these laths is a compressible bucket attached to the lower edge of the ring and embraced by a strap and buckle. These elliptical rings are made in a special manufactory and are supplied in eight sizes. The adjustable bucket inside the laths is made of a single piece of three-ply wood one-eighth of an inch thick, and its overlapping edges are free and yield to the pressure of the strap and the buckle, so that as the limb shrinks it can be altered by a

FIG. 9.—The Kensington peg.

are riveted in their whole length, making a perfect cone in length and a perfect circle in cross section. This gives stability and endurance. A new peg is made if shrinking takes place. The cost of materials is 8s. 6d.

It is not claimed for any of these pegs that it is ideal. Workers realize that the perfect peg has not yet been

5. *Eaton Gate*.—This peg is made of fibre and is cone-shaped. Its overlapping edges are not riveted, but bound together by a series of broad straps and buckles, while the upper edges are upholstered and then covered with a movable chamois leather covering, which can be changed. In this peg an attempt is made to serve the double purpose of the therapeutic and the auxiliary pegs; it can be used before shrinking has taken place, and gradually tightened as the shrinking progresses. Stability and permanence are to some

FIG. 8.—The Erskine House peg. A. Wooden ring; B. strap round compressible bucket; C, C. laths; D. diaphragm; E. wooden stem.

7. The *Kensington* peg is a fibre cone like that already described. The rim along the inner side is slightly everted, when moist, with a hot tool, and then padded. The bucket, which is simply the top of the cone, is upholstered in such a way as to accurately fit the stump. A movable and washable sock covers the rim and lines the bucket. In the case of a short thigh stump a pelvic band with a hip hinge is attached. This gives better control of the peg by the stump. There is no vertical split in the bucket, and the overlapping edges

found, and all are attempting new designs. It is hoped that all the dépôts will use their best endeavour for the provision of an auxiliary limb which will so fulfil the every need of a limbless man that the provision of a permanent limb may be postponed for a longer period than has hitherto been the rule, in order to avert the great cost of refittings following premature manufacture, and the consequent disappointment of the man.

SOME REFLECTIONS ON CARDIAC CONDITIONS IN SOLDIERS.

BY

R. O. MOON, M.D., F.R.C.P.,

PHYSICIAN TO THE HOSPITAL FOR DISEASES OF THE HEART.

THE belief of Hippocrates that the heart was not affected by disease, which idea persisted well into the seventeenth century, stands in strange contrast with our present-day experiences of the numerous ramifications of cardiac specialism. The war would seem to have made affections of the heart bulk more largely in the eyes of the profession than ever before.

In any large military hospital at the base on any front there is always in the medical wards a fair proportion of so-called cardiac cases; then again, in the examination of recruits, the invaliding of soldiers out of the army or their recategorization, the view taken of the cardiac condition is frequently of primary importance. In a military hospital the number of cases with definite organic disease of the heart is, as might be expected, comparatively small, for such would hardly have passed through the various meshes which encompass the prospective recruit prior to his admission into the army. The large majority of these cardiac cases have gone sick with a variety of symptoms, such as shortness of breath on the march, faint feelings or a general sensation of exhaustion, pointing certainly *prima facie* to some derangement of the circulatory system and often classified under the rather unsatisfactory title of "Disorderly Action of the Heart." As in other departments of medicine, or indeed of life in general, war would seem to have revealed aspects of heart affections which had been but imperfectly apprehended before.

On the one hand war has shown the strength, on the other hand the weakness, of the heart. Many of us must have encountered cases with an organic valvular lesion which had yet been able to carry on satisfactorily for a considerable length of time, and had finally gone sick with something having no obvious connexion with the heart condition. No one can fail to be astonished at the amount of hard work which can be performed by a man with a serious cardiac lesion who has either escaped the vigilance of the recruit examiner or fallen in with an unduly indulgent one. Thus, I well remember a case of mitral stenosis in a man aged 42, whose lesion was clearly due to an attack of rheumatic fever contracted some twenty years previously, but who had been driving a motor in the A.S.C., first in France and then in Salonica, since 1914, and had not suffered from any cardiac symptoms till a month prior to his admission into hospital with malaria in July, 1917. Similarly, I came across a young Canadian with obvious aortic regurgitation, dating from an attack of chorea at the age of 17, who had served in France for eight months in the infantry and about the same period in the field artillery without having had any cardiac symptoms to trouble him, and who had come into hospital for a gunshot wound of the thigh. French writers are of opinion that mitral stenosis is the form of valvular lesion which shows least resistance to active service conditions, whereas aortic disease, when of rheumatic origin, may be viewed more favourably; but it need hardly be said that all valvular lesions, whether mitral or aortic, when of degenerative, arterio-sclerotic origin, are quite unfitted for active service in any form.

But, of course, the war has also disclosed the hitherto unknown weakness of some hearts, just as it has surprised us with the unexpected strength of others. Many of those hearts which give way on active service are, doubtless, intrinsically unsound, though their owners have been able to do their ordinary work in civilian life with little inconvenience, because it has involved no special stress or strain. Hearts are affected less by the actual