M. Delorme, the French army surgeon, has reported this class of injury to have occurred when only strong tendinous soft parts had been traversed by the bullet, but in the experiments, and as actually experienced in South Africa, the implication of compact bone in the bullet track is necessary for their production in their really typical character. Injuries of this class were caused by the Snider and Martini-Henry bullets of as great severity as those resulting from small-bore bullets, but not so frequently, because the former did not retain a sufficiently high velocity over as long ranges as the latter. The older bullets produced them up to 100 or 150 yards' range, whereas the Lee-Enfield, Lebel, and Mauser bullets produced them up to about 400 yards. The cause of the great destructive effect seen on the exit side is the violent displacement of the fragments representing the comminution which occurs in the compact bone tissue, due to the great energy still inherent in the bullet at the ranges mentioned. The result is that the bone fragments, large and small, are driven forward through the soft parts and out at the exit side, producing the exit wound of the enormous size sometimes met with in specially severe cases, and when the exit side happens to be on the inner side of the limb large nerve and vascular trunks are very liable to be torn.

If injuries of this class are seen to result from solid small-arm bullets in experimental work, why should we immediately accuse the enemy of using explosive bullets when we meet with them in actual warfare, as we did in the Boer war, and as surgeons at the front are doing now? If small-arm shells were used in war, almost every bullet wound seen would be of the explosive type (the only exceptions being the few cases in which the bullets failed to explode), and they would not be confined to men hit at 400 yards and under, but would be experienced at all ranges, and whether bone had been implicated or not. Range and velocity and the structures traversed would, in fact, have nothing to do with the amount of damage done. But "explosive effect," experimentally and practically, is seen to result only under the conditions mentioned above; naturally, in these circumstances, we must admit the relation of cause and effect in this case. Surgeons who uphold the explosive bullet theory talk freely of the enemy's use of these projectiles. Why do they never produce one in proof of their contention? In every trench, or defended position, which has been evacuated by the fighting line, hundreds, perhaps thousands, of unused cartridges are to be picked up by any person who wishes; yet apparently nobody has ever found one with an explosive bullet in it. We accuse the Germans of using these missiles, and they accuse us of doing so. This kind of thing is just a phase common to the early days of all campaigns, and is equally untrue of all. The Germans carry on war in barbarous fashion, but they have not yet adopted this particular barbarity, probably because it would be of no advantage to them, for solid small-bore bullets do all they desire of them, and small-arm shells are not required.

I have seen references to the new sharp-pointed bullet first used in the German army as being more "humane" than those of other small-bore rifles. If humane in this connexion means less fatal, I believe that it will not prove, on actual experience, to deserve this character. Its centre of gravity, owing to its long and tapering shoulder and point, is situated unusually near its base. This gives it a marked tendency to turn over on meeting with even slight resistance, thus causing it to spin on its shorter axis during its passage through the part traversed by it, the result of which is certain to be increased damage to the contents of the head, chest and abdomen when these cavities have been traversed by it. Professor Fessler of Munich made experiments with this bullet when it was first introduced into the German army, and reported to the above effect.

The Buxton Council have resolved "that all officers, soldiers, and sailors of the Allied Forces invalided to Buxton be granted the Buxton mineral water treatment free of cost, such treatment to be prescribed by a medical practitioner." It is believed that the waters of Buxton combined with the dry bracing air will prove an excellent remedy for the cases of rheumatism contracted by our army and allies whilst in the trenches.

THE SOLDIERS' FEET AND FOOTGEAR.

BY

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THE lexicographer might have said, "The question of feet comprises in itself a subject of no inconsiderable magnitude." The importance of soldiers having well formed and normal feet cannot be exaggerated, for an army lasts only as long as the feet of its infantryman. Feet to the soldier are what tyres are to the motor, wings to the bird. In fairy lore, classical literature, and mythology, the means of locomotion given to man and beast have engaged the attention of the greatest writers of the centuries. Children love to hear of the magic boots of the giant whose every stride covered a mile, while the tales of Cinderella and her slipper, and of the children who lived in a shoe have become immortal. The people of Abarimon, a district of Scythia, we are told, could only live in their native air, and their feet had toes behind their heels. Mythology tells us that Mercury, the son of Jupiter, had wings to his feet which enabled him to transport himself from place to place with lightning velocity. Amongst his many exploits he is said to have robbed Venus of her girdle, and Mars of his sword; nor must we forget Achilles, who was plunged by his mother in the Styx, and rendered invulnerable except in his heel. His life was one long day of deeds of valour until he met his death at the hands of Paris, who wounded him with an arrow in his vulnerable heel. Like Achilles, armies have proved themselves invulnerable except in their feet, and have suffered the humiliation of seeing victory snatched from their grasp on account of inability to march any further. When once the ambulatory power of a force breaks down, its moral and spirit suffer, and its attributes of pertinacity of purpose and celerity of movement are lost. This has been recognized by all the armies in the field to-day, and every endeavour is being made to cope with the question from a military and a medical standpoint. No one has shown more solicitude for the soldiers' feet than our King, who, when visiting the wounded, made anxious inquiries about their feet and footgear. The letters from soldiers at the front, published in the daily papers, constantly contain complaints about their feet, and may be well summed up in the sentence of Private E. Burton, of the Bedfordshire, who writes: "Sore feet are the great trouble, most of us being a bit lame." Brave as a man may be, it is a physical impossibility for him to march far with blistered and sore feet, and he becomes a drag on his comrades. In this respect one cannot help calling to mind how Captain Oates walked out of the tent into the Antarctic blizzard with his poor maimed feet tortured with frostbite, his one thought being to save his comrades who refused to proceed to "One-ton Camp" until he could accompany them.

No army in the world is better provided with good serviceable footgear than our own, and the Government, recognizing this to be of the utmost importance, are making strenuous efforts to keep this efficiency constant and lasting. The British "Tommy" has a special affection for his boots, for he knows that, in war time, they are his best friends, and a striking example of this is related by Sir Frederick Treves in his interesting book *The Tale of a Field Hospital*, in which he says: "Amongst other traits, one notices that the soldier clings with great pertinacity to his few possessions, and especially to his boots. There was one poor man at Spearman's who was in great distress because, just as he was being sent down to the base, he had lost his solitary boot. He said it contained a puttie, a tin of jam, two shillings in money, and a bullet that had been taken out of him."

The evolution of the human foot is of great interest. Man is the only animal whose thighs and trunk are in a straight line when standing, for even anthropoid apes have their lower limbs bent towards the belly at the hips, and flexed at the knees, when walking. To have gained our present erect posture has taken millions of years, for there is no bone, muscle, or organ in the body, which has not been changed. Although the ordinary monkey runs on all fours, the gibbon, or small anthropoid ape, runs along the

branches of a tree on its legs in an erect posture, only using its long arms to seize overhanging twigs to help it on its way, or to swing from bough to bough, or tree to tree, when pursued or in a hurry. In the gorilla the legs are comparatively stronger, and fashioned to bear the weight of the whole body, and in consequence have lost some of the features which make the monkey's foot chiefly a grasping organ. *Pithecanthropus*, the earliest human-like fossil discovered, had in all probability a foot like our own, for no human foot has ever been seen with the great toe separated like a thumb, as is the case in all anthropoids. To the scientific mind, however, there is little doubt that the great toe was once set like a thumb, and that the foot was used as a grasping organ. Wire walkers and the native artisans of the East use the great toe to steady and balance themselves and their work, causing the muscles of this organ to be well developed. The human foot was evolved, as far as one can say, in the Miocene period, and the upright posture of man appeared with the evolution of the gibbons. The chief changes which have taken place in the lower limb are:

- (a) The straightening of the limb into a line with the trunk when standing.
- (b) The stiffening of the mid-tarsal joint.
- (c) The lowering of the heel until it reached the ground when standing or walking.
- (d) The disappearance of the thumb and the substitution of the great toe.

The two diagrams below show roughly the position of the lower limb in the pronograde dog-like monkey and in the anthropoid ape.

Fig. 1.—Diagram of the foot of a pronograde dog-like monkey grasping a branch of a tree. The heel is bent up and does not touch the branch; mid-tarsal joint is flexible.

In the former the limb is bent towards the belly, and flexed at the knee, while the mid-tarsal joint is very flexible, and the heel is a long way from the ground; while, in the latter, the limb is getting nearer the straight line, the mid-tarsal joint is becoming less flexible, and the heel is approaching the ground. The human foot, having to bear the whole weight of the body, is provided by nature with natural arches, which are recognized by engineers to be the strongest in existence. The hollow bony arches of the foot give it the necessary strength and elasticity, and, in addition, protect delicate structures (blood vessels and nerves), from pressure and injury.

In man, the arch of the foot was evolved by:

- (a) Development of a tonic and tetanic condition of the muscles of the toe and the flexors.
- (b) The stiffening of the mid-tarsal joint.
- (c) The approximation of the metatarsals 2, 3, 4, 5, to metatarsal 1, and not the opposite, as is usually supposed.

From within outwards, the longitudinal arch is dependent upon:

- (a) The way in which the bones are fitted together to form an arch.
- (b) The way in which the bones are held together by ligaments, especially the inferior calcaneo-scaploid ligament, supporting the head of the astragalus.

Fig. 2.—Diagram of the foot of an anthropoid ape. The heel is not bent so much, and nearly touches the branch; mid-tarsal joint is less flexible.

- (c) The tendons running round the inner ankle inverting the foot and flexing the toe, all tending to strengthen and maintain the arch, especially the *tibialis posticus*.
- (d) The small muscles of the foot.
- (e) The plantar fascia and the skin.

In walking or standing the maintenance of the arch depends on muscular action, and if, from strain or overwork, the muscles or tendons lose their power of bracing up the arches of the foot—and this task is left to the ligaments, which may themselves give way, either rapidly by rupturing or gradually by stretching—the result is what is known as flat-foot. It follows from this that the weight of the body should be distributed so as to cause least burden on the muscles of the arch, and should fall just in front of the transverse arch.

Fig. 3.—Diagram of section of a foot lengthways, showing bones of longitudinal arch.

Fig. 4.—Section of a foot crossways, showing bones of transverse arch.

The skin of the sole of the foot is composed of three layers, the most superficial of which varies in thickness and hardness according to the amount of friction and pressure it is subjected to. The middle or mucous layer is intimately connected with the other two layers, and, although it contains no blood vessels, it may allow fluid from those in the deeper layer to pass through it. This exuded fluid, not being able to pass the hard horny layer, separates the first and second layers, and forms a blister. The third layer, or true skin, is composed of dense elastic tissue containing blood vessels, nerve endings, sweat glands, etc., and this is the layer which is affected when men complain of sore feet.

Having briefly touched on the morphology, anatomy, and physiology of the human foot, we must next consider how it is protected from injury by artificial means. The custom of wearing something to cover and protect the foot is of great antiquity, and in the British Museum there are specimens of Egyptian shoes and sandals dating back some three thousand years. Sandals of plaited papyrus and other materials were used by the ancient Egyptians, Greeks, and Romans, and are worn to this day in the East. They persisted, in Europe, until the fourteenth and fifteenth centuries, when the *poulaines* became the fashion. On account of their length, which sometimes reached several feet, the *poulaines* were found inconvenient, and gave way about the end of the fifteenth century to the *souliers camus*. In turn the narrow and broad shoes came, and were followed by various forms of boots, the chief fault of which was that there was little or no difference in the two feet. Gradually the patten, which was used for outdoor wear, was superseded by the heel, and each foot was properly fitted with its own boot. The sandal, being correctly shaped to the normal foot, with a straight inner edge, caused little deformity, and the two straps, the latchet and the for-strap, which kept it in position, helped to maintain the proper adducted position of the great toe in walking and standing. Ancient writers, about the time of Christ, in spite of this, have left on record descriptions of deformities caused by ill-fitting sandals and shoes. When, in Europe, the sandal was discarded in favour of the shoe, the tendency amongst the fashionable set was to have it smart and pointed, though in the reign of Henry VIII it was considered more fashionable to have a shoe wide and broad.

We must next review the steps taken by the Government to provide soldiers with suitable footgear. On joining the Regular Army each soldier is given two pairs of army boots and three pairs of socks, free

of cost. They are kept in stock sizes, and it is the duty of the officer to make quite sure that the correct sizes are issued, for if the soldiers are allowed to choose their own boots without official supervision, they are apt to let "vanity override wisdom," and choose too narrow or too small a boot. This is known in the army as "fitting the eye instead of the foot," and even after the proper sized boots have been issued, the soldier will often have them altered in shape at his own expense to make them look smarter. This should never be allowed, and, if discovered, should be severely dealt with. It may happen that no stock size will fit, in which case a man is permitted to have his boots specially made for him. The fact must not, however, be overlooked that such a man may prove a menace to his unit in a long campaign, for when his boots are worn out he will find it extremely difficult, or impossible, to get another pair to fit him. In every battalion there is a shoemaker's shop, where the boots are repaired at a fixed rate. The army socks are made of grey worsted and are of regulation sizes, and it is the duty of the soldier to see that they are kept clean and in proper repair. Periodically a kit inspection is held, when it is decided whether the boots and socks are in a satisfactory condition, and if the company officer is not satisfied that such is the case he either orders them to be repaired or new ones purchased. Every soldier has a clothing allowance, out of which new kit is purchased. If, at the end of a certain period, there is a surplus, the money is added to his regular pay, but if there is a deficit it is subtracted. By this means every soldier is encouraged to be careful and economical, and if he is careless and extravagant he has to pay for such weaknesses out of his own pocket.

When the British army is mobilized every soldier should possess two pairs of boots and two pairs of socks. If these are not in good condition the Government supply new boots in place of those not considered fit for active service. On reaching a foreign country, in order not to hamper the soldier when marching, his kit-bag containing his spare kit is left in charge of the company storeman at the Infantry Base Depot. Amongst the other articles in this spare kit are one pair of boots and one pair of worsted socks, which can be forwarded from the base when it is considered convenient or necessary. On active service the British soldier does not carry a spare pair of boots with him, but fifty pairs of shoes and thirty pairs of ankle boots or Highland shoes for each infantry battalion are carried in the regimental transport. There should always be supplies at the base for replacements. The Territorial in peace is not supplied with either boots or socks by the Government, so that the oddest assortment of both are often seen. The county associations, however, usually make a grant to men who are in possession of suitable boots for the annual camp, and on embodiment every Territorial is given 10s. by the Government if his kit is considered satisfactory by his company officer. It would make for more uniformity and efficiency if the Government could see its way to provide both boots and socks free of cost to every Territorial on embodiment. Every Reserve man has his mobilization equipment, including his boots and socks, kept ready for him at the mobilization stores.

THE ARMY BOOT.

Photographs of the army boot are given in three positions. Made of stout leather, it consists of the following parts:

The Sole is composed of two stout layers of leather

sewn together with or without a central filling. To add to its durability and to prevent slipping on wet ground, nails are inserted into it, and the sole is said to be "billed."

The Waist being the narrowest part of the sole is apt to

"give" too much, and for this reason a piece of stout leather is usually inserted between the two layers, from the heel to the tread.

The Heel consists of stout leather, and is "whole-tipped" in order to prevent it wearing out too quickly, and to act

as a protection from stones and other objects when marching. Generally speaking, the lower the heel the better, for if too high, it tends to throw the weight of the body on to the toes and strain the arch of the foot and the ligaments of the ankle, especially when marching downhill.

The Vamp, or front portion of the boot, is made of a softer leather, and is rounded over the toes. It covers the toes and instep and is continued up in front of the ankle into the *tongue*, which reaches well to the top of the boot.

The Quarter, or back part of the boot, covers the ankle-joint and the heel, and is pliant over the former and stiff over the latter.

It is composed of two halves seamed together with the edges of the seams turned outwards. It is stitched to the vamp in front and the "counter" behind, and is pierced with eyelet-holes for lacing. The laces are made of strong leather.

Fitting the Boot.

It may seem a matter of small importance to insist that the boots fit the feet properly, but it must not be forgotten that ill-fitting boots are the cause of bunions, corns, hallux valgus, metatarsalgia, ingrowing toenails, hammer toes, bromidrosis, and hyperidrosis.

The fitting of ready-made boots is no easy matter, and many things have to be considered before the right pair is finally selected. Not only the length and breadth of the foot, but also the height of the instep, must be taken account of, and for this reason *magnitude* as well as *size* must be allowed for. The size and magnitude are stamped on the inside of the boot for future reference, the former being placed below the latter—for example, $\frac{3}{4}$.

On standing or walking the whole weight of the body is thrown on the feet, and two changes take place in them—namely: (a) The whole foot spreads out and increases in length and breadth. (b) The great toe is drawn to the middle line of the body, although its alignment is seldom that of the first metatarsal bone, as it should be. For these reasons it is necessary to make the soldier stand and walk in the boots to see if they are comfortable and roomy.

enough in front. It is important to remember that the foot swells when heated and fatigued, and that a boot which fits perfectly over a thin sock, may be very uncomfortable over a thick one.

An ideal boot should protect the foot from cold, wet, and external injury, and support it when necessary without hindering any of its normal movements or causing any undue pressure upon any part of it. It should fit tightly round the heel and as far forward as the middle of the metatarsus, but should be roomy in front of this to allow for the spread of the foot, the adduction of the great toe, and the free use of the metatarso-phalangeal joints. The sole of the boot should have a good projecting welt, be straight on the inner edge, and be pliant so as to ease the toes and the tread when marching. If the front part of the sole is not pliant it bends up and forms a curve called the "spring" of the boot, and gets fixed in this position. Although some soldiers say that such a boot facilitates marching by enabling them to use their feet simply as rockers with minimum muscular effort, sooner or later troubles will arise, such as corns in the sole of the feet, with pain and inflammation around the metatarso-phalangeal joints. The vamp of the boot should be pliable, especially near the roots of the toes, so as to allow free movement to the "natural hinge" of the foot, and should be boxed up and rounded over the toes to prevent pressure or friction. The quarters should not interfere with the bending of the ankle, nor should they quite meet in front, otherwise it will be impossible to lace them so as to apply firm pressure. If the quarters are too high the soldier will be tempted to leave one or two of the upper holes of the lacing undone to give more movement to the ankle.

I would insist upon the following details being carried out in fitting a soldier with boots:

1. Fit the boot *after* a march, when the foot is fatigued and swollen.
2. Fit the boot over the thickest sock.
3. Have both boots properly laced, to see that the quarters are not too high and that the ankle-joint is free.
4. Fit each boot separately.
5. Make the soldier stand and walk in his boots before deciding which pair to give him.
6. If no ready-made pair fit, insist upon a special pair being made.
7. Give full instructions about the preparation and subsequent care of the boots.
8. Give a boot that is too large rather than one that is too small, for leather, when wet, shrinks.

On handing a recruit a new pair of boots he should be told to soften them *before* wearing them, and this is best done by well soaking them, inside and outside, with crude castor oil. It is important to keep the uppers supple by the constant use of oil or dubbing, and especially is this necessary when the boot is thoroughly wet. If this is not done regularly the leather becomes hard and brittle, and one of the commonest mistakes a soldier makes is to place his wet boots near a fire. It is on record that during the first winter in the Crimean war our soldiers suffered from their boots getting soaked through, and many were in the trenches without either boots or socks, as the leather of the boots shrank so much from the constant wetting that when once they were taken off it was impossible to get them on again.

In the Balkan war the result of the men being in wet trenches for twelve to twenty-four hours on end was seen in various forms. Many suffered from cholera and dysentery, but it is also stated that gangrene of the foot was not an uncommon occurrence, beginning in a painless way with mere discoloured blistering over one or two toes, to death *en masse* of the leg as high as the knee (Max Page). Depage considers that many of these cases were caused by the pressure of damp boots and putties shrinking as they dried. It is probable that a vasomotor disturbance very similar to this occurred in the Crimean war, and was classified in the statistics as frost-bite.

It is true that, *Cucullus non facit monachum*, but the boot *may* make the soldier, and no trouble can be considered too great which not only provides him with a sound and perfectly-fitting boot but also with the knowledge of how to keep it supple and in an efficient state for the hardship of war.

THE ARMY SOCKS.

The question of the soldiers' socks, although not so important as his boots, is one which requires most careful attention. Some years ago the Germans did away with socks, and kept the soldiers' feet well greased. It was reported to have been successful, not only from the point of view of economy, but it was maintained that the men marched more easily, and that the feet showed fewer blisters than when socks were worn. That this plan had its disadvantages is proved by the fact that the Germans are provided with socks at the present time. The socks should be properly shrunk before being worn, and should be a little on the large size. If too small, they will cramp the foot and compress the toes, and be liable to wear into holes very quickly. If too large, they are liable to cause blisters and sore feet from wrinkling. Unshrunk socks should be at least two or three sizes larger than the foot, otherwise, after several washings, the heels will be pulled down under the soles, and cause trouble. The army socks are made of grey absorbent worsted, and must be kept clean, or they become hard and non-absorbent, and cause sore and offensive feet. Each soldier should be taught to darn his socks evenly, so as to leave no ridges or imperfections, and on no account should he be permitted to wear socks with undarned holes. As thousands of socks are being made by patriotic ladies all over the country at the present time, the following particulars may be useful:

The socks are made with heels and toes of the usual kind, and should be woven or hand-knitted with No. 13 needles, and 4-ply superfine or wheeling in grey, Lovat's mixture, or natural colour. The lengths of foot asked for are 10 in., 10½ in., 11 in., and 11½ in.; the largest number required are those measuring 10½ in. and 11 in. in length. For sizes 1 and 2, 64 stitches should be cast on in the first instance, and for sizes 2 and 3, 68 stitches.

A substitute has been tried for socks in the shape of foot-cloths, which can be more easily washed and dried, as they are simply wrapped round the feet. It is a matter of small consequence if they shrink, but, even with these advantages, good, well-fitting woollen socks have proved to be more efficacious.

(To be continued.)

INSECTS AND WAR:

VI.—FLIES (PART II).

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Who fills our butchers' shops with large blue flies?
Rejected Addresses.

BUT there are other flies, first amongst which may be mentioned *Fannia canicularis* and *F. scalaris*. These belong to the family known as Anthomyiidae, and are distinguished from the house-fly by being smaller in size and by many other small details in the imago stage hardly to be appreciated except by trained dipterologists. For a short time at the beginning of the summer during May and June *F. canicularis* is more abundant than *M. domestica*, and, as watched on the window panes of our living rooms, are apt to be thought by the uninformed to be young specimens of the latter. But, as has been said in a previous article, flies when they are once flies do not grow; all the growing they do is done in the larval stage. But as the days lengthen the common house-fly becomes vastly more common than *F. canicularis*, the "lesser house-fly," and the latter now tend to aggregate in those rooms of our houses not devoted to cooking, and may frequently be noticed flying in a jerky and disconcerting manner around the chandeliers or bedposts in unfrequented living- or bed-rooms. The relative proportion of these two genera now varies in different localities. Roughly speaking, out of 100 flies collected in a house there is something between 90 and 99 per cent. of *M. domestica*, but the numbers not only vary with locality but with temperature.

On the other hand, there is a curious disproportion between the number of the sexes found "at home" in the lesser house-fly. For every 100 *F. canicularis* taken indoors 70 to 75 are males, the numbers being evened by an equal preponderance of females who have remained out of doors. The larva of *Fannia* is a flattened-looking