The military shoe : First prize in the official military competition in 1874 / by S.A. Salquin ; assisted in the technical part by the brothers Giacomo and Stefano Tirone, of Turin ; wth a preface by Division Colonel Lecomte ; tr. by H.L.B., under direction of the quartermastergeneral, U.S.A.

33. № 244.

THE MILITARY SHOE,

BY

MAJ. S. A. SALQUIN,

MAJOR OF THE SEVENTH REGIMENT OF SWISS INFANTRY, SECRETARY OF THE MILITARY DEPARTMENT OF THE SWISS CONFEDERATION.

FIRST PRIZE IN THE OFFICIAL MILITARY COMPETITION IN 1874.

ASSISTED IN THE TECHNICAL PART BY

THE BROTHERS GIACOMO AND STEFANO TIRONE, OF TURIN.

WITH A PREFACE

BY

DIVISION COLONEL LECOMTE,

COMMANDANT OF DIVISION II OF THE SWISS ARMY.

WITH TWENTY ILLUSTRATIONS INSERTED IN THE TEXT.

TRANSLATED BY H. L. B.,

UNDER DIRECTION OF THE QUARTERMASTER-GENERAL, U. S. A.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1882.

TABLE OF CONTENTS.

	Page.
PREFACE	5
INTRODUCTION	7
CHAPTER I.—Object of the shoe in general; fashion	14
II.—Structure and physiology of the foot	16
III.—Construction of the fashionable shoe; its disadvantages	20
IV.—The common-sense military shoe	26
V.—Construction of the military shoe	32
VI.—Inconvenience and uselessness of gaiters	42
VII.—Linen, cleanliness, and hygiene of the feet	44
VIII.—Care and preservation of the shoe	51
CONCLUSIONS	53

PREFACE.

It has been ascertained that in all armies, in all contemporary countries, often a considerable number of men are for the time being rendered unfit for service by bruises on the feet, caused for the most part by various faults in the shoe.

Thus to search out the ameliorations of which this subject of foot-gear is susceptible, constitutes a problem not less important than useful. It has often been proposed, but until the publication of the first work of Captain Salquin, in 1876, entitled "The Common Sense Shoe," a satisfactory solution has never been found.

Now, after further study, this officer publishes a new work, to which he has requested me to contribute a preface.

I have read it with lively interest; I have weighed with care the references and demonstrations made use of by the author, and I am happy to be able to entirely sympathize with his efforts, and to express the opinion that the problem of the best military boot seems to me now stated and solved by him in a conclusive manner. He has only endeavored to throw off the double tyranny of custom and fashion.

After having clearly shown that the form actually given to the shoe does not correspond to that of the foot, nor even to its natural dimensions, and that it compresses it so as to turn it outside of its normal axis, the author of this work proposes the adoption of a model shoe in which the foot will be really at ease; can place itself naturally and move easily, without pressure or friction, and therefore without causing the least soreness.

The question of the shape and construction of the shoe, that is to say the *form*, being solved, it remains to decide upon the *kind* of boot which it is best to adopt, especially for the infantry, by taking into consideration the various other exigencies besides the principal one of avoiding wounds and contusions. In this respect, also, which appears secondary, a reform is legitimately claimed.

In Switzerland various experiments have been made to this end. Among others, after having used the loose shoe, then the shoe with gaiters of more or less length and size, they arrived at the boot worn over or under the pantaloons, with a pair of shoes for a change. But they have not failed to see that the boot is far from rendering the service which was expected of it. It often makes the step heavy and chafes the feet and legs.

A recent fact—the victims of which were the soldiers of an army which may pass for the first in the world—has proved that the boot has some great disadvantages; for certainly it is one, and a most disagreeable one, for a soldier to be obliged to leave his boot in the mud.

Will this inconvenience be avoided by making boots which are tight about the instep? Yes; but by creating others not less serious.

The best boot made cannot fulfill all the requirements; not only do the dimensions of the foot change by cold and heat, at rest and in walking, but the boot itself changes by dampness, by dryness, and by heat.

Suppose that a soldier enters upon a campaign with boots absolutely perfect, which will always be difficult, it does not result that they will remain so under all circumstances. It will not be long before the various above-mentioned agents will have a share in the affair, and the boot will become too tight or too large in the instep.

Having become too tight the boot can only be put on with great difficulty, and, once on the foot, will not fail to cause bruises which will render the foot-soldier for the time being unfit for service. Having become too large it will slip about, rub the heel, and fatigue the man in marching, without taking into consideration the possibility of its being left stuck in the mud, as at the grand review at Strasburg, September, 1879.

If we add to these faults of the boot, its great size, and its relatively high price, we see that it is necessary to replace it by something more reasonable and more convenient.

The system proposed by the author (buskins *à soufflet* for marching shoes, and the Neapolitan shoe for a change when off duty) appears to me to fulfill the desired end, which, nevertheless, can only be proved by experience and practical tests which the Government alone can order.

It is hoped that, in a question so vital to the infantry of all countries, since everywhere to-day is felt the need of increasing the readiness and power of marching, no state will refuse to make a trial by which its troops are expected to reap advantages, and, if this trial should be conclusive, as I firmly believe it will be, the military authorites cannot hesitate to introduce a change which is certainly better justified than many others.

Finally, this work contains some excellent advice upon the linen, cleanliness, and the hygiene of the foot, and upon the care and preservation of the boot, undeniably useful, not only to the military man, but to every one in civil life who wishes to walk easily and unflaggingly.

On the whole, this work treats the important subject of the military shoe in a more complete and thoughtful manner than has ever been done before, and I would recommend that it be carefully read by the authorities and by those of our military comrades who care for whatever can augment, even by progress more solid than elegant, the efficiency and well being of the army.

I wish great success for this work, and for the officer who has taken the initiative.

Lausanne, January, 1880.

FERD LECOMTE,

Division Colonel, Commandant of Division II of the Swiss Army.

INTRODUCTION.

The work which we have undertaken is specially designed for the Secretary of War of the United States of America.

It aims to show:

1st. That the actual form of the Army shoe is defective, that is to say, the form is not the same as that of the foot. *The result is that instead of giving it their form, the feet are obliged to conform to that of the shoe.*

The inability of troops to march has rarely had other cause, and it is because this fact has never been taken into consideration that the imperfections of the Army shoe have been sought for everywhere else than where they were, and where they now really are.

2d. That the system of the infantry shoe, especially as regards the contrivance by means of which the different kinds of shoes are fixed upon the foot and fastened to the leg, has not undergone the improvements of which it is susceptible.

3d. That all the new models, tested to the present time, have not yet solved the question as to what is really *the best marching shoe for the Army.* This being demonstrated, and the necessity of a reform in the existing shoe being established, we will indicate the means of accomplishing it by the introduction of a shoe of reasonable shape, that is, one which conforms to the shape of the foot, and which needs only a short trial to show its superiority over all which have preceded it to the present time. This work is accompanied by samples of shoes which fulfill the preceding conditions; we have, besides, for distribution to all the States which may request them, models of shapes in wood (lasts) similar to those used in the manufacture of our sample shoes.

We will explain, in describing them, the advantages of these new styles of shoes; we have worn them long enough ourself to be able to assert that nothing will better preserve the feet of soldiers in their normal condition, for they will suffer no distortion whatever, and in the future they will perform marches without suffering the inconveniences resulting from the use of the former shoe; and, lastly, this important advantage, that these styles do away with the employment of gaiters in those states where they are still in use.

The question of the Army shoe has been considered by all military authorities. They still continue to consider it, but they have reached

no practical nor definite solution of the matter, for, with the exception of some few improvements, the shape, style, and make-up of the military shoe remain as they ever have been worn in all countries.

With the exception of the shoe, there is no part of the clothing which has not undergone either numerous improvements or a complete change. Such will continue to be the case for a long time to come, if we refuse to understand that the shoe has never had a form similar to that of the foot, and that nothing has been done to give it a form more or less approaching it. But it is to be hoped that a question as vital for the Army as it is important for the material well-being of the troops—*the strong arm of the State*—will cause the prejudices that every new invention meets with in its path to disappear.

And, moreover, this does not appear as a new invention, but, on the contrary, it is a demonstration of a purely anatomical, pathological, and scientific principle; and what astonishes us is that no physician has made it known before this time, since it would have been sufficient for him to assert its existence, and to show that nothing is more simple than to apply it to solve, once for all, the important and disputed question of the Army shoe.

That state which desires to have a really capable army, and of which it can be said it is truly an army upon a *good footing*, ought to be interested above all to know how it can march. This duty is one of the most important that can be imposed upon a state; for it is well known to us all that the numerous experiences that have been repeated everywhere, of the inability of troops to march, have been deplorable in every respect.

These experiences are so much more to be deplored, since the inquiries, the investigations, and the tests of every kind to which they have given rise, have failed to discover the single and only cause of the great number of men who, having bruised feet, claim a place in the ambulances and the assistance of medical skill.

It is true other causes have also contributed to this result; but the principal fault, whence arise all the others, is that which we have indicated at the beginning of this work. *The shape of the shoe is not the same as that of the foot.*

No country has furnished an exception to this unfortunate rule, for the style of shoes generally adopted at the present time, is regulated by the desire for elegance and not for comfort.

The Swiss army is not only in the same situation, but it is still more exposed than any other to the inconveniences of the shoe worn by its troops, for it is the soldier who furnishes it and not the state. The result is that all possible shapes and qualities of shoes are represented in the Swiss army, and the injuries from them much more disastrous. This state of things has been verified at all times, and in a still more striking manner since the occupation of the Swiss frontiers in 1870–'71.

The universality of the complaints which have arisen under this state

of things, has had the effect of leading to an investigation of the causes; a meeting was held by the officers by whom was demanded a work destined to solve the three following questions:

"What are the faults of the present shoe of our troops?"

"What are the means of remedying them?"

"What ought and what could the state do to this end?"

The work which was required of the Swiss officers was evidently an unpleasant task for those who had not made this question the object of special study, of numerous observations, and of constant thought.

Surprising to remark, no military surgeon took part in this meeting.

Who is there, however, who has the mission, the duty, and especially the great facility to treat such a subject if not a physician, charged with watching over the health of the soldier, and expending on him constant watchfulness? And it is well known that the attention most frequently demanded is that required on account of wounded feet. However that may be, the first prize has been conferred upon the work that we have the honor of presenting upon this important question.

This result has been made public by the voice of the Swiss press; information has been asked by a great number of officers and by the representatives and military attachés of many of the principal states accredited to our country, and it is to fulfill the engagement that we have contracted with them, as well as to contribute our part in elucidating a question so important for all armies, and which has never yet been treated in so profound a manner, that we have prepared this work.

If it be asked why a Swiss officer takes the liberty of submitting the fruit of his studies and experiments to the secretary of war of other states, permit us at least to indicate the principal motives, hoping that every one will appreciate them at their just value.

1st. The question of the military shoe has never been solved in any country, because the tests of every kind to which it has given trial, have not been based upon simple anatomical principles, which would have definitely solved the difficulty.

2d. With the exception of Switzerland and the United States of America, all other states have permanent armies, and so are more directly interested that their troops are provided with a shoe which fulfills all the required conditions.

3d. The solution which we have given to this question is absolutely definite; that is to say, that the *common-sense shoe* is the only one which takes into consideration the anatomy of the foot.

4th. Finally, though we have not been engaged to publish a special work upon this subject, still we have not thought it right to be silent concerning an improvement which will evidently be adopted, sooner or later in the armies where the best style of shoe for issue to troops has not yet been discovered.

We close this introduction with a number of quotations, which show

the importance attached, at all times, by those whose names are known in history, to the question of the shoe.

The Dutch professor, Camper, anatomist and surgeon of the last century, was the first to publish an interesting book upon the best shape for shoes; among other things he says:

> One is astonished that in all ages intelligent people have been interested in caring for the feet of horses, asses, oxen and other animals used for work, or pleasure, even to the smallest details, and have neglected to care for the feet of their own species, leaving it to ignorant shoemakers accustomed to work only according to the ridiculous fashion and corrupt taste of their times.

This opinion, expressed in language more forcible than polite, however, as yet has lost none of its truth.

Until 1858 no one was occupied with this question. But during that year Meyer, professor of anatomy at Zurich, published a pamphlet entitled, "*Die richtige Gestalt der Schuhe*" (the proper form for the shoe). The author of this work, advocating the same anatomical principles as the Dutch professor, Camper, treated the question only from this single point of view, but it is natural enough that the manufacturers, intrusted to put in practice what had been wisely shown in theory, did not succeed in surmounting the difficulties; or rather did not take the trouble to find out how it would be possible to carry out the reforms which Professor Meyer demanded. Instead of acknowledging the truth of the new ideas which had been made plain, and especially instead of admitting that the shoe was susceptible of improvement, as well as any other part of the clothing, they rebelled for the most part against the new form proposed, and did not understand that in their position of masters of the trade, to them belonged the duty of seeking how it would be possible to obtain a result which should put an end to all special difficulties. However that may be, the work of Professor Meyer drew the public attention to this subject, and was the signal for a series of publications and pamphlets, of which we will cite the following:

Dr. Craig immediately translated the Meyer pamphlet into English. Dr. Humphrey published, in his turn, a pamphlet entitled *The human foot and the human hand.* James Dowie, a shoemaker of London, who had practiced his trade for sixty-four years, did not wish to be behind, and we owe to him a pamphlet called *The foot and its covering.* To tell the truth his work was only a translation of Camper's book. Finally, the journal "*All the Year Round*" published a very important article on this subject, called *Easy boots.*

In Germany Mr. Gunther published a work: *Ueber den Bau des menschlichen Fusses und dessen zweckmässigste Bekleidung* (of the formation of the human foot and the best covering for it).

In Denmark Colonel Lunddahl treated the question in a pamphlet with the following title: *The proper form to give to the shoe.* Dr. A. Nyström of Stockholm, in his turn, treated the same subject in a work entitled, *The foot and the hygienic form of shoes.* The preface of this

book is by Dr. Santesson, professor of surgery, who closes it in these words:

> The good old proverb says, *Every one to his own trade*; but this proverb ought not to hinder the shoemaker from giving to the shoe a shape as much as possible like that the Creator has given the foot. No human art will be able to invent one altogether more natural and more agreeable.

The authors of all these pamphlets and publications are unanimous in demanding a reform in the shoe, and in basing it solely upon anatomical principles. But whether their works were too scientific, or whether they were only circulated among a certain class of society, it is evident that the mass of the people received no advantage from them; no one gave himself resolutely to the work; so it made no progress, and we believe that we alone have (thanks to a familiar demonstration of the scientific part of the subject, and especially by the practical means of putting it into execution) succeeded in causing this last opinion to be shared as well by the people in general as by the masters of the trade in particular.

It is true, also, that the authors of all the works which we have cited are, without knowing it, themselves the cause of their excellent designs not being carried out by any one; for they have limited themselves to one single statement of the question, without taking into consideration the material difficulty in which one would necessarily be placed who should endeavor to find out anything in the midst of a multitude of details, excellent without doubt, but of which the fault was in not having undergone any co-ordination.

We have endeavored to avoid this difficulty by dividing our work into two principal parts—the scientific and physiological in one part; the technical and practical in the other part. Each contains a series of developments and conclusions which it would not have been difficult to divert from their destination. In this manner each thing is in its place; no confusion is possible; one chapter is necessarily the logical consequence of that which precedes it, and without any great effort one will easily find what he needs.

In military life persons have been limited to aphorisims; to making assertions to show of what the military shoe ought to consist, &c.; but, as we shall see by the quotations following, they have gone no further.

Marshal Saxe said that the nation which gave the best shoe to its troops would have an immense advantage over its enemies, by keeping the men always in a condition for marching.

Again, Marshal Saxe says: "It is not the *arms* but the *legs* which win battles."

In an almost identical sense, and as strategically as physiologically, Napoleon said that he made war, not with the *arms*, but with the *legs*, of his soldiers.

Wellington expressed the opinion that two things were especially nec-

essary to the soldier: "A pair of *good* shoes on the feet, and a pair of *good* shoes in the knapsack."

Marshal Niel, in a speech delivered before the legislative body in Paris, in 1868, thus expressed himself: "*Shoes* have the same importance to the infantry that horses have to the cavalry."

Dr. Tourainne, surgeon-major of the first class of the French army, began, in 1856, to make observations upon the shoe. In a note published in 1872 he made the following pretty compliment upon the use of shoes and gaiters:

It has always resulted that from 25 to 30 per cent. of the effective force (of an army) are wounded in the first day's march, and 10 per cent. are obliged to demand the services of the surgeon of the regiment.

He indicates as the principal cause *the bad shape* of the shoes, their bad construction, &c.

About a year before this, Dr. Champouillon, chief surgeon of the first class, also of the French army, with the hand of a master treated the question of the shoes of the troops, and especially of the preparation, tanning, and quality of the leather. Like all his predecessors, he was actuated by the same anatomical principle so often invoked, of knowing that the shoes ought to be well made and "*to be exactly fitted to the shape of the foot; that is the true solution of the question,*" he adds.

Finally, Professor Morache, surgeon-major of the first class of the French Army, in his remarkable treatise on military hygiene, which appeared in 1874, summed up the conditions which the military shoe ought to fulfill, as follows:

To find for the infantry soldier a shoe at once resisting, supple, and relatively light, reaching high enough to do away with the use of gaiters, which always require much time to take off or put on, adapting itself readily to the shape of the foot, and being able, in a measure, to accommodate itself to the swelling of the member from the effects of marching.

These conditions, summed up and simplified by Professor Morache, are the same as those drawn up by Drs. Tourainne and Champouillon. It remains to us, however, to reproduce textually the conditions demanded by these two last *savants*.

Dr. Tourainne says:

A faultless shoe ought to completely protect the foot; to be fitted exactly to it without cramping it; without making it uncomfortable, to follow all its movements of stretching, of bending, of enlarging, and of shortening; to allow it to stretch itself out in every way, and finally to leave it the greatest liberty, both for its motions and for the circulation, to be easy to put on and take off. Such is a good shoe.

Dr. Champouillon is, if possible, more exacting. He expresses himself thus:

All tactics are in the legs; but it is not sufficient that the warrior be shod so as to execute freely all the commands given; it is necessary for his feet to be protected against certain surrounding modifying circumstances, such as cold, and especially damp cold. It is important, then, that the military shoe be at once strong, supple, and light, easy to put on and take off; equally fitted for all climates and all seasons;

manufactured in such a manner as to keep the foot dry and healthy, thwarting the play of none of the various articulations; preventing the entrance of sand or mud; and, finally, from an economical point of view, it is required that it should cost little and last long.

It does not seem as if so many equally necessary conditions could ever be realized; that is, however, the task we have imposed upon ourselves in spite of the surprises we have met with in ascertaining how difficult it is to shoe each soldier comfortably.

The models of buskins and shoes which we present to the different Governments should fulfill the conditions and realize the preceding advantages. To become convinced of this, it is only necessary to make a *comparative trial*, *during one month*, *in a single regiment*, fifty men wearing buskin No. 1, fifty men wearing buskin No. 2 (which, in heavy rains, snow, or high grass can, without any difficulty, be transformed into a pair of boots by means of a pair of leggins with which they are accompanied), and fifty men wearing the shoe. But as this trial aims at important practical, conclusive, and definite results, we ask:

1st. That we be permitted to furnish the samples for the trial.

2d. That the trials be directed during the whole time by a special physician.

It is in fact a physician who, above all others, should pronounce upon the anatomical principles which have served as a basis in the manufacture of the models which will be used in experimenting. This health officer shall choose for the test those men whose feet are the most injured and disfigured by the shoe. He shall make a statement in which he shall indicate exactly what was the state of their feet at the beginning of the trial; he shall also mention in it, from day to day, and on the return of the troops, the remarks which the soldier will not fail to make, and finally the result of those observations which the physician himself makes.

At the close of the trial the shoes will be taken back, and it shall be shown again in the same statement exactly in what state the men's feet are found, and also the condition in which the shoes themselves are found.

Let the tests be made under these conditions, and for the first time a result will be obtained which will render all further experiments useless; for it will only remain to adopt everywhere the style of shoe that we have the honor to present.

For the first time, also, this result will close the mouths of those who are always ready to assert that new experiments ordered signify nothing; that their result is foreseen in advance, &c.

Finally, we refer it, in all confidence, to the physician who shall direct the trial, and leave to him the task of drawing conclusions; and if, as we do not doubt, the fact is established that our models have rendered good service to the army, we shall leave it to the higher military authority to value the results, and to give us credit in a measure for the advantages that the army ought to derive from them.

THE MILITARY SHOE.

CHAPTER I.

THE OBJECT OF THE SHOE IN GENERAL—FASHION.

We wear a shoe for the same reason that we wear clothes, that is to say, to protect our lower extremities from the asperities of the ground and from wet and cold. To protect it from the asperities of the ground the sandal alone is sufficient.

The sandal is a strong sole of wood or leather, fastened upon the foot by means of leathern straps or cords, so as to completely cover the bottom of the foot.

When it becomes necessary to protect the feet from wet and cold, the foot and lower part of the leg are inclosed in various gear, cloth, stockings, socks, &c., and the whole generally covered again with flexible leather. This leather covering is called the upper leather. By joining the upper leather to the sole and forming one single whole, we have the advantage of fixing the shoe on the foot without the aid of the leathern straps or cords. This union of the upper leather with the sole has produced the shoe, the boot, &c. The shoe thus has been made to protect the feet against the asperities of the ground, against wet and cold.

This is the only duty which it has to perform, but it does not discharge this duty without giving place to numerous inconveniences, since it is tributary to fashion, which also interferes in all questions concerning our clothing.

Now, thanks to fashion, we contend that the feet of the entire human race are deformed by the absurd shape of the shoe which has always been worn, and especially that which is worn at the present time. This distortion commences in infancy, but it is not noticed, because one does not reflect that when the foot is first placed in a shoe, if the shape of the shoe is not the same as that of the foot, the foot being the more flexible, necessarily adapts itself to the shape of the shoe. This unhappily has always taken place ; for we shall have no trouble in showing that the actual shape of the shoe, whether for infancy or mature age, has no actual relation to the anatomical construction of the foot.

In civil life this inconvenience is scarcely noticeable, because one walks little, sits at his ease in making any journey whatever, and especially because one is not laden. In military life this does not happen; a soldier must march great distances and carry everything with him. To

arrive, and especially to arrive *in time;* to accomplish wonders in a campaign; not to be appalled by the distance between halting places; to endure fatigue cheerfully; to be always alert, active, and ready to respond to the orders of the chief, the feet must be in good condition.

This is the opposite of what has been stated to be a fact at all times, and more or less in all countries; so we know what the result is. A troop badly shod is, as a rule, crippled, and after a few days' march, counts, at the beginning of the campaign, 25 or 30 per cent. of the men with wounded feet; of whom 10 per cent. will claim place in the ambulances and the care of the surgeon of the regiment.

Dr. Tourainne, who is the author of this remark, has certainly had occasion more than once since 1856 to prove this. Now, if it be true of the French army, it evidently must be so, of course, for any other army.

To be well shod the foot must enjoy perfect freedom; *it must be able to spread itself out in every way in the shoe*, says Dr. Tourainne; in other words, the shoe must be made for the foot, and must have the same shape as the foot.

We will first examine into the form of the foot.

CHAPTER II.

THE STRUCTURE AND PHYSIOLOGY OF THE FOOT.

The foot is very skillfully composed of twenty-six bones, more or less movable, joined together by a score and a half of joints. They are strongly confined by the ligaments, and the movements are determined by the action of twenty muscles. Fourteen of these bones belong to the toes, the other twelve form the sole and the metatarsus of the foot.

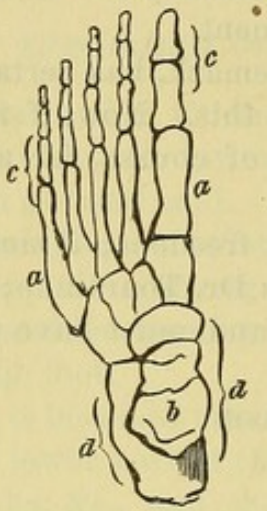

Fig. 1.

The bones of the metatarsus are the five long bones (*a*), to which are fastened the toes (*c*) or phalanges of the foot; the seven others are the bones of the sole of the foot or of the instep (*d*). One of the latter, the ankle-bone (*b*), supports the leg, which, by its two apophyses, incloses it on both sides.

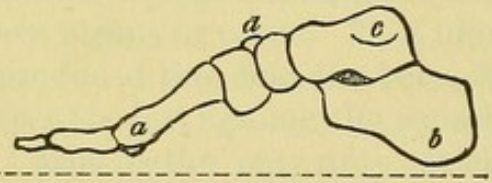

Fig. 2.

If we examine the middle part of the foot we see that it presents a cavity or bony vault, a kind of elastic arch, which has its two points of support upon the foremost extremity of the metatarsal bones, principally upon the great toe or first metatarsal bone (*a*), and upon the calcaneum (*b*), or heel-bone. The keystone is formed by the ankle-bone (*c*). The calcaneum, which is the largest of all these bones, forms the heel, which supports the greater part of the weight of the body.

The bony arch formed by the arrangement of these bones is more or less developed, which renders the foot more or less arched. This arch is not inflexible, but is held in place by strong ligaments passing through the concavity, and going from one bone to another. All the bones of the foot are thus joined together, and prevent the arch of the foot from giving way under the weight of the body. As long as we remain standing, or when walking, the cavity bends slightly under the weight of the body by means of the articulation *d* of Fig. 2; but it takes its natural curve again as soon as the foot is raised. This is the same motion which takes place in walking every time that, by muscular contraction, we raise the foot from the ground. In this movement the *point of sup-*

port is on a level with the foremost extremity of the metatarsal bones which rest upon the ground, the *point of resistance* made by the weight of the body, is on a level with the joint of the instep, while *the force* is fixed behind this joint, on the calcaneum, by the tendon Achilles, which the muscles of the calf of the leg bring into action.

The toes are placed in front of the metatarsal bones, to which they are fastened by ligaments. The small toes have two joints while the great toe has only one. The great toe is the most important of all, and is the strongest and largest; in walking it fulfills the following functions: When we raise the foot from the ground to bring it forward, we raise first the heel, when the weight of the body falls upon the great toe, in raising which, in its turn, from the ground we are thrown forward, still pressing the ground with the end of the great toe. To execute this movement the grea toe must be placed in the shoe in such a manner *that it can stretch itself out directly forward*, for in its normal condition it is found upon the prolongation of the longitudinal axis of the first metatarsus. In other words, as is seen by Figs. 3 and 4, *the continuation of the axis of the great toe is upon a line which passes through the center of the heel of all feet not deformed.*

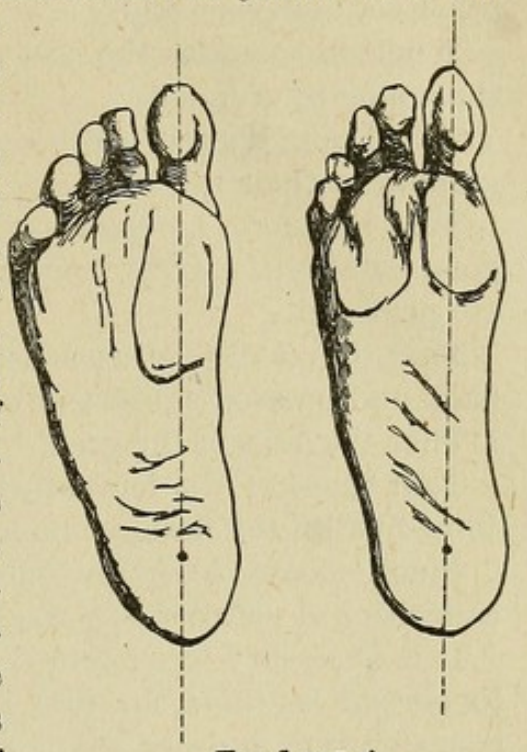

Fig. 3 and 4.

This demonstration is purely anatomical and scientific; we give it as we have seen it described in works upon the anatomy of the human body, to the study of which we have devoted ourselves, and it is besides clearly seen from Fig. 1 given above.

Alas! will it be believed? A superior commission, in which, it is true, no surgeon took part, found that this anatomical principle was disputable, and that a line passing through the axis of the *second* toe could also correspond to the center of the heel. This assertion, little flattering to science, might be understood, strictly speaking, if the commission of which we speak had not had under their eyes Fig. 1, and consequently the means of verifying the gravity of the error which they committed.

As to skeptics and scoffers in these matters, if they retain the least doubt in regard to this demonstration, we shall have no trouble in proving to them the perfect exactness of it, and will also furnish them the means of convincing themselves of it.

Let us regard the foot of a new-born infant; let us look upon the foot of a child who has never worn shoes; let us look at the foot of a young rustic who goes barefoot; let us examine the impress he makes in the

dust or in the soft ground, and we shall always see that the great toe, *straight with the inside of the foot, is separated from the others;* that the impress of the foot is similar in every respect to that of Figs. 3 and 4; that the little toes are perfectly straight, and that they are spread farther apart by the pressure of the body. It will be seen, also, that in placing two similar feet side by side the great toes will touch each other to their very ends.

When we examine the feet of a grown man, we shall see by placing them side by side—

That the two great toes do not touch each other, the separation beginning at their roots.

That they form an open triangle, explained by the deformation undergone both by the great toes themselves and the nails with which they are provided.

That the small toes are misshapen in their turn; that they are thrown back and pressed against or upon each other.

That the nails of the great toes have grown more or less into the flesh.

That those of the four other toes are turned back upon themselves, imbedded in the flesh, or no longer exist.

Finally, the five toes are, one or the other, affected with corns, bunions, callosities or soft corns, possessions as painful as unnecessary.

It is necessary to explain the position and functions of *the great toe in its normal condition*, for that is the principal point we must take into consideration in order to understand the inconveniences which result when this organ has been deformed by the shoe.

As to the little toes, they are far from being useless. For, if one is standing, they rest upon the ground and sustain the outer side of the foot, especially by the posterior extremity of the fifth metatarsus, a bone corresponding to the little toe, which it supports, and to which is sometimes given the name of anterior heel. In walking, the small toes are thrown back, press strongly against the ground, and sustain the outer side of the foot. The first joint is strongly constructed whilst the second forms a concavity, which make the small toes appear as if pressed in the ground.

Such is the normal structure of the foot, and such are the functions which it has to perform.

To complete this purely anatomical description, let us add that the foot forms a whole at once supple and strong; supple in the forward part, and particularly strong and massive in the hinder part. Around the skeleton are found muscles, tendons, nerves, arteries and veins; all these organs are near the surface on the instep, where they are more frequently subject to painful pressure, since the skin in this region is fine and there is no fat. The soldier is much more subject to this compression than any one else; because, since the subcutaneous veins are much developed in those who labor standing, they are still more so with the soldier, as no one remains so long upon his feet as he. On

the under part of the foot the tendons, nerves, and veins are deeply imbedded in the integuments and protected by a thick bed of soft substances of fat and tissue, which form an elastic cushion, an efficient protection. Most of the veins are collected about the malleolus (ankle bone), so if there be a pressure there the circulation of the blood will be stopped or slackened, and a swelling of the foot will be the result.

Let us now examine the construction of the shoe in use; it will enable us to show that this shoe has not only always compressed the foot by preventing it from executing the movements which we have described, but that it has had no other result than that of disfiguring it, after having made each one undergo a variety of sufferings to bring about such a result.

CHAPTER III.

CONSTRUCTION OF THE FASHIONABLE SHOE—ITS DISADVANTAGES.

Shoes are usually made upon *two lasts*, one for the right foot and the other for the left. These lasts are *symmetrical*, and as long as they are in existence there is no use in thinking to obtain a *common-sense* shoe; that is, one that conforms to the shape of the foot; for it would be impossible to manufacture one with lasts which are not so formed.

Let us look at the shape of the sole cut after one of these symmetrical lasts (Fig. 5). We see that on a sole of this cut the continuation of the axis of the great toe is found upon the line *c–d*, coming out beyond the shoe instead of passing through the center of the heel. This sole being joined to the upper leather, Fig. 6 shows the position which the foot will have to take in the shoe. It cannot be otherwise; for the great toe is forced to throw itself into the middle of the shoe, because *there is no room for it elsewhere.* In this position it presses the smaller toes outward in an oblique direction, and obliges them to furnish it a place which the shoe does not contain. No more does the shoe contain the space which the other four toes demand; so that they are pushed in by the upper leather of the shoe and obliged to overlap each other. This Fig. 6 is besides instructive. Indeed, if we examine it closely, we will scarcely believe that it is not exaggerated, and that the foot can really lie in a shoe of which that represents the sole. However, such is the case, for it must be remembered that a similar shoe has been worn *from infancy.* Now, the feet of children being delicate and more flexible than the shoes they wear, necessarily adapt themselves to the form of the shoes whatever it may be. Since the shoe of infancy is as submissive to the caprices of fashion as that of mature age, it provokes a first deformity, which remains an acquired fact, and which can only be aggravated if, as is the case at the present time, one continues to wear a shoe so ridiculously pointed that the foot cannot move in it. The immediate consequence of this state of things is shown by the three following figures.

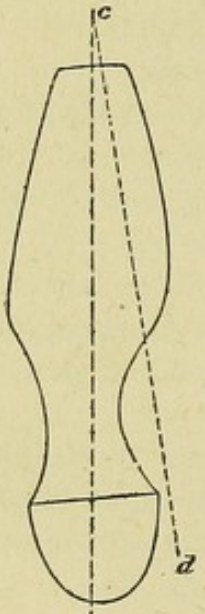

Fig. 5.

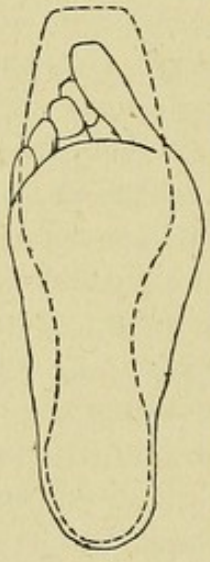
Fig. 6.

It is seen at once that the toes of the three feet are pressed and tapered to a point by the sides of the upper leather, and that it is where the foot is larger, at the root of the toes, that the pressure produces the greatest effect. The foot thus undergoes a very grave deformation, for the right angle triangle in which the toes are inclosed is transformed into an acute angle triangle, in which the toes are forced to find any place which they can, happy if they can remain side by side when the foot is in the shoe. But even this is not the case with the three feet which our figures represent. Indeed, the soles and toes of these feet are totally deformed by the pressure of the shoe; the second toe is always much pushed up, even so that it cannot be seen; in some cases it is entirely folded under.

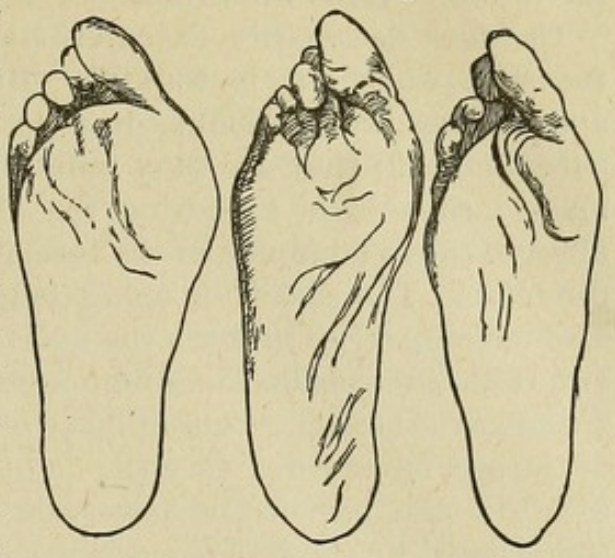

Fig. 7, 8 and 9.

As to the great toe, we see the place it occupies, and understand the pressure which it exercises on the others; we have seen a foot where the great toe had been so thrust aside by the shoe that it had crept under the smaller toes and there remained anchylosed.

Three principal causes have tended to the deformation of these feet:

The first *unique and chief cause* springs from the form of the shoe, an absurd shape for which we are indebted to fashion, and to which we will not return.

The second is due to the usual manner of taking the measure of the length of the foot, and the third, like the second, from the manner of taking the measure of the width of the foot. These measures are taken with the person sitting down.

Now, this is a great mistake, for the foot measured in this way has neither its actual length nor breadth. Indeed, when one is standing or walking, the *weight of the body* increases the foot in length and breadth about two centimeters, at least one tenth, whilst the manufacturer only calculates for from one-twentieth to one twenty-fourth, when he takes the trouble to make any calculation.

The shoe made from measures taken in this manner corresponds neither to the normal shape, the size, nor the actual dimensions of the sole of the foot; it is too short and too tight; the foot can not stretch itself out in length or width; it can execute no movement in the shoe, and, under these circumstances, what will become of the thirty articulations with which it is supplied, and with which nature has endowed it, that it may make use of them, that is to say, if the shoe permit them to have regular play.

The intolerable situation which we have described is a material, brutal fact.

Let us investigate, now, the consequences which result again, if we *march* under these conditions.

The foot necessarily executes a certain number of movements in the shoe when one is walking. But we have just seen that the foot and the toes are condemned to a permanent immobility in the present shoe, and that they are thus reduced to the state of an inert, compact mass, incapable of executing the least movement. Besides that, we observe the overlapping of the toes, pushed back and taking an oblique direction. The great toe being longer, the deformity begins with it. The toes converge towards the axis of the foot, and are disposed of in two rows, one row back and one towards the sole. This arrangement is not always the same; in a number of cases the upper row is composed of the second and fourth toes; in other cases of the great toe and the fifth toe; the toes of the lower row are always pushed together and compressed by those of the upper row.

It is to the constraint of the articular movements that we must attribute that peculiar affection called *la tarsalgie douloureuse desadolescents.* This malady is caused, says Professor Gosselin, by the multiplied inflammations of the joints, which are met with only among young subjects, and it happens only to those youths whose feet are tortured in their development by shoes which are too tight and too short.

Now, from the constriction of the flesh by the leather of the shoe, there result also local injuries and inflammations, more or less acute, of which we cite, among others, the following: We find upon the top of the first metatarsus at the base of the great toe, curving outwards, what is called a bunion; it is a thickening of the skin, with a little watery pocket developed in the cellular tissue underneath and lying upon the internal lateral ligament of the joint; often the bunion becomes inflamed, and pus accumulates in the watery bag, which little cavity it is then necessary to open.

We might also mention corns, blisters, and ulcers which are seated on the heel and upon the sole of the foot, folded and compressed by the shoe, and also often upon the top of the toes. When the shoe is too short, or the heel too high, the ends of the toes are thrust against the shoe, become bruised, and often large blood-blisters make their appearance under the nails, which after some weeks drop off.

Such is the balance-sheet of the miseries attributed by science to the faults of the shoe. The list is not, however, as complete as might seem at the first glance.

It is still necessary to furnish proof that, with the present method of taking the measure for the width of the shoe, it is not possible for the shoe to be of the same size as the foot.

If we examine the foot shod with the present shoe, we shall see that the upper leather juts out on both sides of the sole; that it is pushed out on the outside by the foot and on the inner side by the jutting out of the great toe.

The too prominent projection of the root of the great toe only, shows that it is pushed out by the tightness of the shoe. Now, the tighter the shoe the more the great toe will be thrust out of place, and will compress the small toes, the roots of which will force that of the great toe to project on the inside of the foot.

One final consideration will show still better the gravity of the ills that we have pointed out.

The confinement of the feet in shoes that are too short and too tight has a well-known injurious influence upon the health. It has an unhappy action upon the mind, in that it diminishes the intellectual impulse and drives away good humor. With shoes ill-made and too small, the soldier, in marching, experiences a feeling of heat, and a pressure more painful, since the foot when in use is increased in size by the distention of the veins. In winter, on the contrary, the feet will quickly become cold in consequence of the constraint and stoppage of the circulation.

To conclude, we will say, with Dr. Tourainne, too tight and too short shoes ought to be severely prohibited; they cause fearful suffering, and one ought to be merciless in regard to them.

Another consequence of the deformation of the foot by the shoe is shown by Fig. 10. As we have seen, it is impossible for the skeleton of the foot to remain in its normal condition, for the phalanges of the toes and the bones of the metatarsus have been subjected to the effects of the same deformation of the feet by the shoe.

Fig. 10.

It would be necessary to wear shoes of a directly opposite form to force the toes to straighten themselves. Even the use of a *common-sense* shoe would not succeed in making them resume entirely their normal position, if at the age of twenty the young soldier's feet were already much deformed.

We see, however, by Fig. 11, representing the sole of the foot of a young man of nineteen years, that as a rule the feet of young persons of that age are not yet much deformed. The toes of this foot have already undergone a slight deviation; the great toe towards the outside of the foot and the small ones towards the inside. The first cause of the deformation exists, and it would only become aggravated if the young soldier continued to wear a shoe of the same form as that to which he is indebted for the first deformation of his feet.

Fig. 11.

If, on the contrary, at the age of twenty years he wear a *common-sense* shoe he is certain to see his toes resume, little by little, their normal position.

Finally, the foot is still exposed to two other afflictions, which are again only the consequences of the faults of the present shoe. The first, which is most frequent, is the penetration into

the flesh of the nail of the great toe, or *the ingrowing nail.* It has become a real infirmity towards which we cannot draw too much attention. The great toe undergoes the strong pressure exercised by the shoe, but as it is provided with a very strong and very resistant nail the struggle is so much the longer and more obstinate. By continuing to wear a shoe of the same shape, the skin around the nail of the great toe is hardened under the pressure of the shoe and of the second toe, and is raised around the nail so that it is forced to penetrate the flesh. The nail will thus not only be out of place but imbedded in the skin, which will become inflamed by the friction which it undergoes in marching, and if the feet are not clean, or are subject to plentiful perspiration, the soldier will soon be in no condition to continue on his way.

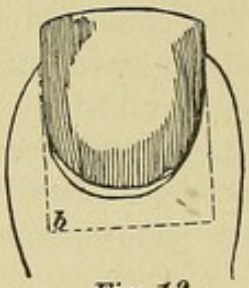

Fig.12.

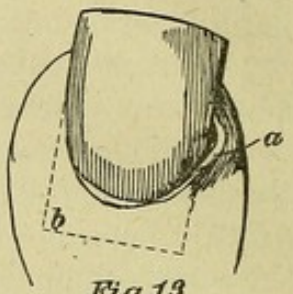

Fig.13

Fig. 12 represents the great-toe nail in its normal condition, and Fig. 13 the nail ingrowing and pushed out of place. The dotted line *b* shows where the nail is hidden under the skin, and letter *a* the inflamed edge of the skin.

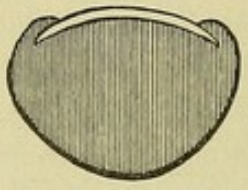

Fig.14.

Fig.15.

Figs. 14 and 15 represent a vertical section of the two toes.

We can calculate the miseries resulting from an ingrowing nail, and the sufferings undergone by soldiers afflicted with such an infirmity, when it is added to the inconveniences caused by the other faults of the shoe.

There is no remedy to heal an ingrowing nail; to get rid of it one must have recourse to a long course of medical treatment, and often even to an operation.

The second affliction to which the foot is still exposed, but which, happily, is much less frequent than the ingrowing nail, is the complication shown by Fig. 16.

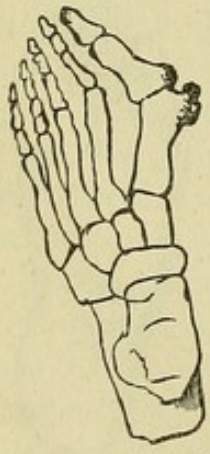

Fig.16.

When the pressure of the shoe is exercised for some time on the same parts, deep-seated troubles of nutrition are the result, which affect the bone. This is what is shown upon the joint of the great toe, where we see a bony tumor, or exostosis, which is formed upon the points irritated by a prolonged compression. These tumors are often more extensive than that shown in Fig. 16, and may exist on both feet.

Such injuries put a man, otherwise in good health, under the necessity of having recourse to the physician; the treatment is long and painful, and the soldier thus afflicted is only an invalid destined to encumber the ambulances and hospitals, still

happy if he comes out of it without being afflicted with an incurable infirmity.

We should be mistaken if we calculated that the faults and inconveniences of the present shoe are limited to those things which we have pointed out. They are, on the contrary, still very numerous, but they come under the details of the manufacture of the shoe; we will, therefore, refrain from enumerating them here, since they will be pointed out with those *which must be avoided* in the manufacture of the military shoe, as has been done in the models which accompany this work.

Permit us, before closing this chapter, to reply to an observation which will not fail to be made after having read what precedes.

It will be said: But the shoe actually in use in the different armies is not the fashionable shoe; it is different and larger. That is true, but we will remark that the fashionable shoe is worn to the age when the young soldier is enlisted; in short, that he comes with his feet already *deformed*.

We have in view a double object in publishing this exclusively military work: To introduce into every army a walking shoe fulfilling all the required conditions, and proving at the same time the necessity of wearing a similar shoe from infancy. It is the only means of preventing the deformation of the feet, and, in our opinion, it would be better to prevent a difficulty being created than to be obliged to cure it afterwards.

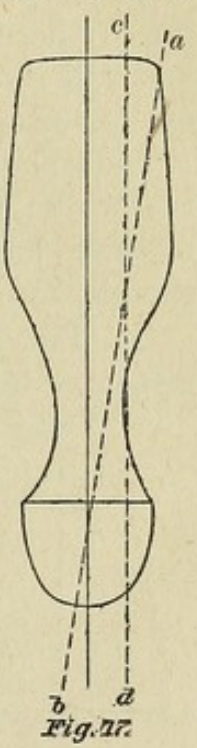

Fig. 17.

Finally, the proof that the shoe with the toe of an exaggerated width does not fulfill the desired conditions is shown by the opposite figure.

It is not sufficient to enlarge the end of the shoe for the great toe to preserve its normal position in the shoe, for it will be found upon the line *c d* of Fig. 17, instead of the line *a b*, which is the prolongation of its axis passing through the center of the heel. This line, it is true, passes through the center of the heel of Fig. 17, but we see that at its extremity *a* the space necessary for the great toe does not exist.

CHAPTER IV.

THE COMMON-SENSE MILITARY SHOE.

After what we have said at the beginning of this work upon the normal structure of the foot, and farther on, of the disadvantages of the present form of the shoe, it will not be difficult to point out on what principles the military shoe ought to be constructed in the future, to fulfill the various conditions that we have a right to require in a walking shoe.

The chief condition of all is, that the great toe preserve its normal position in the shoe.

Nothing being more easy to reach, the immediate advantages which will result from it are, in few words, the following:

The shoe, constructed upon new and different principles, shall correspond exactly to the form and size of the foot; it will facilitate walking by permitting the foot to move about and stretch itself out in it, and will thus insure the regular play of all the joints of the foot without exposing them to any pressure or friction.

The shoe which shall fulfill these conditions can be constructed in two ways; we think we ought to point out both, but at the same time observe that the second is the only one applicable in armies where the shoe is furnished by the Government:

1st. For a shoe to feel right and not hurt, it must be made from exact measures taken of the feet of each customer. The great fault of taking measures with the person seated must be avoided. On the contrary, he must stand upright, with the legs straight, so that under the weight of the body the arch of the foot sinks down and the sole of the foot is obliged to take its true dimensions. But as all feet without exception are more or less deformed, care must be taken to separate the toes, and to bring the great toe back towards the inside of the foot; since the more this organ deviates towards the outside of the foot, the less exact will be the length of the foot, if the measure be taken to the end of the great toe when out of place. This done, we will measure the length of the foot from the back part of the heel to the extremity of the straightened great toe upon a right line, *a b*.

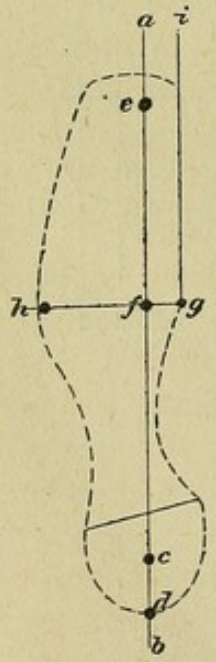

Fig. 18.

We will take, then, the half of the breadth of the heel and by carrying back this measure upon the middle line *a b* thus obtain at *c* the central point of the heel.

A second measure of the length of the foot will then be taken from the end of the *straightened* great toe to the point where the foot begins

to be concave, that is to say, at the extreme limit of the projection of the great toe; this length, *e f*, represents about two fifths of the whole length of the foot; going back to the corresponding point of the line *a b*, we have at *f* the point where the foot is the largest. At this point we draw a line which cuts the middle line *a b* at right angles and obtain in *g h*, the greatest breadth of the foot. We will then obtain the inside edge of the great toe by drawing the line *g i* parallel to the middle line *a b*, commencing at the point *g*, which indicates the inside edge of the greatest breadth of the foot. We will then have *d e* representing the *actual length*, and *g h* representing the *actual breadth* of the foot. If these measures are taken exactly as we have indicated, nothing will be easier than to represent the form of the sole of the shoe which must result from them, as seen by the dotted lines drawn around these points in Fig. 18. In other words this shape will be exactly like that of Fig. 19.

The great toe is found on the line *c d*. This form fulfills all *required conditions*, as there is the necessary space in the shoe for this toe, and the prolongation of its axis passes exactly through the center of the heel.

The line *a b* is, on the contrary, that around which the ordinary sole is traced, and we see the place it occupies on the new sole that we propose.

We can still better consider the difference which exists between the two soles by examining Fig. 20.

The dotted line shows how the common-sense sole differs from the symmetrical sole, and consequently how easy it is to remedy the faults of the latter.

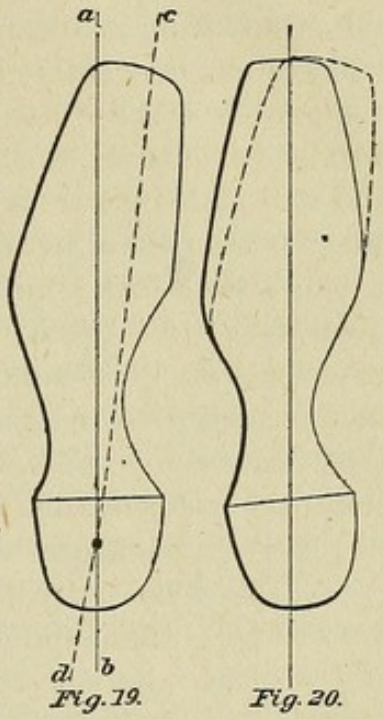

Fig. 19. Fig. 20.

2d. The Army shoe could also be manufactured from measures taken of the feet of each soldier; but we see that this system would be impracticable in armies where the shoe is furnished by the Government.

As a rule the different parts which constitute the military shoe are cut in a uniform manner from certain measures, which must do for all feet.

Nothing hinders the Army shoe from still being manufactured in this manner, provided the shapes and patterns of which they make use in cutting the different parts of the shoe, and the lasts upon which it is made, undergo the changes necessitated by the new form which it is desired to give them.

It is especially very important that the lasts upon which the shoes are made, be absolutely like those used in the manufacture of our models, for these lasts differ noticeably from those now in use, in that they present a comformity as exact as possible with the outward form of the human foot. In short, it will be sufficient to compare them with the lasts now in use everywhere to observe the following differences:

The present lasts are entirely symmetrical. By placing them side by side, we see that they begin to separate from the point of the projection of the great toe; at their extremity, the thickness of the wood is entirely insufficient; in short, that *shoes* made upon these lasts *contain* no necessary space *in height* for the great toe.

The culminating point at the extremity of these lasts is in the middle, from which the wood diminishes in thickness on both sides to the rise of the instep. The two posterior sides of the last are cut nearly vertical, so that the shoe does not open out enough for the entrance of the foot and the heel, which are therefore constantly compressed. Finally, the bottom surface of the present last makes no account of the sinuosities which are felt in passing the hand lightly over the sole of the foot. These are all faults which have a direct action upon the construction of the shoe, and which have been completely avoided in the formation of the *new lasts* which have been used in making our model shoes. These lasts have one special advantage which it remains for us to set forth. They have an outline similar to the outline of the inside of the foot, and they are of the same thickness as the foot. The culminating point of the extremity of these lasts is at the inner edge, corresponding to the place occupied by the end of the great toe; from there the wood diminishes in thickness to the point occupied by the little toe. The appearance is far from being ungraceful; it is not perceived when the shoe is on, and it is absolutely necessary that it should be thus. It is indeed by this arrangement of the last that the great toe is able to remain in its normal position. Better still, the great toe, which is *already deformed*, will be obliged, little by little, to take again its normal position; for the shape of the shoe will prevent it from continuing to take its place *in the middle* of the shoe. Then there will be no more compression of the small toes by the great toe, and regular play will be secured to all the joints of the foot.

Besides this advantage realized by these new lasts, they present another not less important. They have a bottom surface reproducing the same sinuosities which are felt on the soles of the feet. By passing the hand lightly over them we see that the projection of the great toe is more or less prominent; now the lasts must possess this same prominence, that the corresponding space may be found in the shoe when finished. This space serves for a lodging for the projection of the great toe, which will be no longer compressed in this cavity which has been arranged for it; it will give sufficient space between the sole and the upper leather, and the foot will not widen out and push the upper leather over on both sides of the shoe, as is seen in the shoe where the inner side of the sole is absolutely flat, and where this space cannot then exist.

The models of buskins and shoes which we present, fulfill all the conditions that we have just enumerated, and they are, besides, distinguished from all other systems known at the present day in that the

new contrivance, by means of which they are fixed upon the feet and fastened to the leg, is the only one which allows for the increase and diminution of the size of the foot in marching.

The buskin No. 1 is properly called the walking shoe. It is *à soufflet* but of a new construction, for it requires neither strap, buckle, nor lace. This shoe is very strong; it is also as light as possible; it reaches high enough to do away with the use of gaiters; it allows the foot freedom in all its movements; it is put on and taken off with the greatest facility; finally it costs little and will last so much the longer, as it has no struggle to keep up with the foot, being perfectly fitted to it in shape and size. The *soufflet* with which this buskin is provided is a simple garniture of more flexible leather, fixed on the outside around a customary opening in the two vertical seams which join the upper leather at the quarter-piece. This opening, which is from ten to twelve centimeters (3 or 4 inches) long, entirely protects the ankle-bones from pressure or friction, and the garniture which closes it follows every movement of extension, flexion, enlargement, and shortening. The little fastening with which this *soufflet* is provided fulfills a double purpose. It gives a certain elegance to the shoe; it causes the quarter-piece to fit closely behind the ankle-bones after the passage of the foot, and prevents the *soufflet* from becoming misshapen by following the forward and backward movements which take place in walking, and which have the effect of forcing the leg of the shoe, and the *soufflet* itself, forward and back at each step. If it is closed, the *soufflet* does not get out of shape, and it holds the pantaloons better around the lower part of the leg; but it may be opened if, during great heat, the soldier feels the need of having more freedom either for the movement of the foot or for the circulation of air in the buskin. Moreover, whether it be shut or open, no inconvenience can result, for the buskin is so well made that it fits exactly to the foot and lower part of the leg, and the soldier will never have worn so practical and agreeable a shoe. The two straps of the buskin are placed on the outside, and as the opening must be larger to allow the entrance of the foot than is necessary for the lower part of the leg, nothing is easier than to put the bottoms of the pantaloons inside, whether they be cut straight like those of the Austro-Hungarian soldier or whether it is necessary to tie the bottoms of them in order to get them in the leg of the buskin.

Buskin No. 2 presents the same advantages as buskin No. 1, the manner of fastening alone being different. The *soufflet* with which this is furnished is placed upon the front instead of being upon the side, like buskin No. 1. It possesses an instantaneous fastening, which is accomplished by means of brass eyelets and leather string. This model is accompanied by a pair of leggins which are placed over the leg of the buskin, and are fastened around the leg by means of the same cord as the buskin. In this way the buskin may without any inconvenience be transformed into a pair of boots. This transformation can always

be made if it be necessary to protect the troop against cold, snow, or wet, and can be effected with great rapidity.

The *shoe* like No. III is the second shoe, or the shoe for the soldier when resting. It is a simple Neapolitan shoe, furnished with a fastening by *instantaneous lacing*. Three brass eyelet-rings on each strap and a round leather cord eighty centimeters in length (31 inches), crossed in lacing, with the two ends coming out at the top, and the question is solved.

We have met with many trials since we have undertaken to find out the best possible shoe for the army; but we do not regret the trouble we have taken, for we have found at last, in the shoe that we offer, the most practical, convenient, and comfortable shoe that one can wear. This shoe is constructed on the same principles as the buskin, the fastening alone being different, but not less practical, for it adapts itself even more readily, if possible, to the expansion and increase of size of the foot from the effects of walking. The instep is never pressed in this shoe, for the leather lacer, crossed in the eyelets, readily adapts itself to the tension of the foot and yields to the pressure which the shoe would otherwise exercise upon the instep in walking. The leather cord need never be taken out of the eyelet-holes, and there is no danger of its being cut by them, as they are rounded in the inside; it is sufficient to tie the two ends to prevent them from escaping in opening out the shoe, and it holds the shoe to the foot by being fastened on the inside of the leg. These eyelets are fixed in the shoe by the use of two instruments—one to make the holes and the other to adjust the eyelet-rings therein. These nippers and the eyelets are furnished by the house of J. Huet, 118 Turenne street, Paris, a house which has patents in all countries, and to which an award of merit was granted for the excellence of its products at the general shoe exposition, which took place in Switzerland in 1876. This house is now occupied in the manufacture of a new eyelet which can be put in without the aid of nippers. If it succeeds in this, of which we have no doubt, it is certain the eyelet will be more easily put in position, and it will also lessen somewhat the price of the shoe. We only ask that this eyelet be made a little larger than that with which our model shoes are furnished, for then it would be possible to use a larger and stronger leather string, which would last longer.

Finally, the principal advantages of these new styles of shoes are sufficiently characterized by the following considerations:

1st. The new shape that has been given them, secures for the foot complete liberty in all its movements; there being no longer any compression to fear, the increase in the size of the foot will be produced less rapidly, perspiration will be less abundant, it will not so soften the skin of the feet, which will thus be less sensitive, and finally the perspiration will have an outlet to escape by means of the *soufflet*, which, in the two buskins, acts as a ventilator, and in the shoe itself, which is

low enough, and of which the style of fastening must necessarily allow a free circulation of air through the shoe, since the string yields to the tension of the foot.

2d. The buskins Nos. 1 and 2 offer some advantages which are not to be disregarded; they completely cover the foot and lower part of the leg; they are entirely closed, and no mud, dust, sand, nor water can penetrate the shoe. The construction is most simple; there is no roughness inside the shoe; all the seams are on the outside, and thus are more easily managed.

3d. A final consideration is that the shoe is as well adapted to walking as either of the buskins; for, with the exception of its manner of fastening by means of a string, its construction is in all respects similar to that of the buskin.

During the heat of summer the soldier would evidently be better in the shoe than the buskin; he would be more comfortable, would suffer less from heat, and would hold out between far-apart halting places without the risk of losing his high spirits or good temper. If either of the two pairs of shoes is being repaired, the other will be entirely sufficient for the requirements of the service. The only precaution to be taken with this style of shoe is to provide each soldier with an extra string. This string is 80 centimeters (31 inches) in length. We have purposely given it these dimensions, for, supposing it should break in the middle, it would still be long enough to fasten over the instep.

CHAPTER V.

CONSTRUCTION OF THE MILITARY SHOE.

The shapes, the patterns, and the lasts having undergone the changes that we have indicated above, the different parts of the shoe having been cut, it remains to put them together. They ought to be cut in lengths of from twenty-five to thirty-one centimeters (9 to 12 inches), interior dimensions, of four different widths. Thus we shall have twenty-eight different measures, which will be sufficient to calculate for the conformation of all the feet we shall be called upon to shoe. These figures can be increased according to the conformation and dimensions of the feet in the different countries. The length measures (25 to 31 centimeters) are not according to regulations in all armies, but we have thought it best to hold them because they must appear in a regular manufacture, and besides, since the shoemakers wet the leather to work it, we must allow the shoe to dry before issuing it to the troops. Then in drying it will shrink very much if it be not the object of skillful care during its storage in the depots.

We will come again to the subject of the care and preservation of the shoe in Chapter VIII of this work.

The construction of the shoe, that is, the putting together of the different pieces and joining the sole to the upper leather, is accomplished by three different means—the work is sewed, screwed, and pegged. The sewing is either done by hand or by machine, and the pegging is done with wooden pegs or nails. Until the strength and durability of the machine-sewing, as well as the possibility of repairing it, are well established, we give the preference without hesitation to the hand-sewing.

The work sewed by hand is always more flexible and adapts itself more readily to the movements of the foot in the shoe. The sewing should be done with a strong thread, well waxed, to escape the solutive action of water and dampness. Shoes made in this way will always be preferred on account of their durability, the facility with which they can be repaired, and for their suppleness and strength. But care must be taken that the size of the thread corresponds exactly with the hole made by the awl. The thread must be very strong and well waxed, and only a small awl must be used. It is true, considerable effort will be required to pull the thread through; it will be fatiguing and perhaps discouraging; but every other method is adverse to the strength of the shoe.

The screwed work has only one advantage over the hand-sewing; it is more quickly done and costs less. But if a shoe strongly screwed lasts as long as one strongly sewed by hand, which we hesitate to assert, it

presents on the other hand disadvantages numerous enough to make it impossible for us to recommend it.

The screwed shoes were invented in America in 1808; they have been tried in most countries, especially in France, in 1815, 1849, and 1868. The results obtained were not favorable to them, for it was proved that they did not wear as long as others and did not admit of repairs; besides, the screws projected into the inside of the shoe, and were always pushing up; for, pressed on one side by the ground and the other by the foot, they penetrated the flesh, which offered the least resistance; finally, during the march they enlarged the holes in which they were fixed, and ended by falling out and leaving an opening for the entrance of dampness.

The shoe *pegged* either with wood or nails, absolutely presents only faults. We must make the same objections as to the screwed shoe, with this aggravating circumstance, that there are more pegs than screws. The pegs fall out more easily than screws; the shoe cannot be repaired; and, finally, a most serious consequence, if the shoe be not the object of continual and very skillful care in the depots, it will dry up, and the pegs will no longer hold in their places, and the soles fastened in this manner will have only the appearance of solidity, and we can perfectly understand the misfortune that might befall a soldier who had pegged shoes issued to him from one of the depots—that of having the sole come entirely off by hastily thrusting his foot into it!

Pegged and screwed shoes have another fault. In a shoe firmly sewed by hand the upper leather is sewed to the sole by means of the welt. In the screwed or pegged shoe the sole is joined directly to the upper leather by the screws and pegs themselves. The shoe is often furnished with an inner sole, which usually is simply glued into the shoe. This sole is often very thin or of bad quality. Then, if it be simply glued to the shoe, it becomes detached under the influence of heat and perspiration; if it be not detached it forms wrinkles which wound the foot. Whether we remove it or not—whether it be glued, pegged, or screwed—the result will be the same; the ends of the pegs or screws will project into the inside of the shoe, and instead of a smooth surface the foot will rest upon a collection of asperities. And how could it be otherwise? Every one knows that the screws and wooden pegs or nails are sharp at the end, that these points easily penetrate the flesh, and that they will be forced into it by the pressure of the ground on one side, and the foot on the other.

The wooden pegs, which are used in setting up the shoe sewed by hand, have also their disadvantages, but it would be dangerous to order them replaced by nails, for if it should be forgotten to remove them when the shoe is finished it could not be worn. Of two evils we must choose the least—to tolerate wooden pegs for setting up the shoe, but to require that they be reduced to the smallest number possible, and that they be carefully shaved down, for otherwise they will protrude

and cause blisters or abrasions, painful and difficult to heal during the march.

It would be well, without doubt, as a means of avoiding the inconveniences of which we have just spoken, to have a shoe well made, and place in it an inner sole of leather, not too thin but very smooth. This sole would fulfill another end, which we will explain in the chapter "Conclusions" of the present work.

In the manufacture of the shoe another fault is committed, of which the consequences are deplorable to the soldier.

The different parts of the shoe are usually cut without taking into consideration the grain or fiber of the leather. Now, it must not be forgotten that a skin varies in the direction of the grain, and that it is far from being of no consequence whether it be cut lengthwise or crosswise. The skins of animals are composed of curved surfaces more or less straightened by the effects of a defective or insufficient tanning; now they return to the natural and primitive form as soon as they come under the influence of dampness, and the following are the immediate consequences which result therefrom: Some upper leathers stretch, others shrink, and the quarter pieces curl up, all of which produce numerous excoriations upon the sides of the foot, on the heel, and below the ankle bones. It is necessary, then, to look to the quality and good construction of the shoe, and to be less concerned about the *number* of upper leathers, soles, and heels that can be secured from the skin of one animal. But if the shoe manufactured under these conditions cost more, it will also last longer.

SEAMS.—It is imperative that all the seams of a shoe be made on the outside, otherwise the foot, rubbing against an inside seam, is necessarily wounded, *no matter what kind of a shoe it may be.* This observation is of rudimental simplicity.

AILETTE.—This is the name which is given to a piece of leather placed in the inside of the shoe to strengthen the part which receives the most wear, and which is particularly weak or of bad quality. For example, if the upper leather has been cut from the extreme flank of the skin, or from too thin a skin, it will certainly not withstand the pressure to which it must be subjected. This is why it is generally provided with a piece which is let in between the two soles and sewed to the inside of the upper leather on the outer side, if it does not entirely line it. This seam is perfectly felt with the hand. If, as in our models, shoes had always been furnished with soles of the same size as the sole of the foot, it would not have been necessary to line the upper leather to strengthen it against the continual pressure made upon it by the foot. However that may be, and in spite of this resistance, we see the upper leather project over the sole when the shoe is worn, and if the heel is worn down on the outer side the upper-leather will project to such an extent that it will end by being trod upon in continuing to wear the shoe. Under such circumstances the seam of the *ailette* rubs on the

outside of the foot until injuries result. All inconveniences of this kind would be avoided by cutting the upper leathers of the military shoe from skins weighing from 4 to 5 kilograms (8 to 11 pounds). Moreover, the proof that the disadvantages of the *ailette* and inside seams generally are well understood, is that they are prohibited in the manufacture of the military shoe of most countries.

CUT OF THE UPPER LEATHER.—We will also draw attention to a fault which, thanks to the conspicuousness of the outrage, has never appeared in the manufacture of the military shoe, but which, on the contrary, did exist, and probably does at the present day, in the construction of the civil shoe. It happens frequently that the upper leather is cut by the shoemaker just above the edge of the sole on both sides. It is an *accident* which is caused in the following manner: In removing the inequalities at the edge of the welt and the sole, with a paring-knife, or a cutting tool called a *fer à bavures*, the workman not being careful, cuts at the same time, but without knowing it, the leather of the uppers adjoining the edge of the sole. If the cut be not made with these tools there is danger of its being made with the *fer d'emboitage*, another implement which shoemakers use *hot* to smooth and polish the edge of the sole. But as the heated edge of this implement glides along during the operation, the greatest precaution must be taken not to cut or burn the upper leather, especially when it is joined to the extreme edge of the sole, where the necessary space for passing the instrument does not exist.

There are still many shoes of which the upper leather is cut or burned in the same manner. Thus it is evident that the pressure exercised by the foot on both sides of the upper leather need not be very great to make the leather burst out at the incision or burned place, and so necessitate the mending of the shoe.

LENGTH OF THE SOLE.—Whenever a country is required to make any important provisions hastily, we must expect to find the hand of fraud in the supplies. We do not speak of the shoe provided with *pasteboard soles*, a scandalous fraud which has been attempted several different times in the French army, but of the shoe of which the outer sole extends only to the heel, instead of being a single piece the whole length of the shoe without piecing under the heel. If the outer sole comes only to the heel, we can understand the benefits that a shoemaker receives in saving his leather; but look, on the other side, at the inconveniences that result to the soldier, and the man who wears them. The sole that extends only to the heel is made thin at the end, and is simply placed between two pieces of leather joined under the heel. Then, if the heel be too high or too narrow, the shoe will *run down* between the heel and the sole, and that is the place where the greatest effort of the leg bears upon the foot. But a greater fault than the running down of the shoe is that to which must be attributed the existence of *flat feet*.

A shoe provided with too narrow or too high a heel will not support

the arch of the foot; if that be not supported, and one continues to wear a shoe of which the heel tends to displace the point of support of the leg, there is but one result: The arch of the foot will give way under the weight of the body, will sink down more and more towards the ground, until finally it will become completely flat.

The origin or cause of flat feet has been long sought for, and has not yet been settled upon. If this one that we have just pointed out is not the only cause to which we can attribute this infirmity, it must necessarily contribute towards it. The means of avoiding it are very simple. We must require the sole to be of a single piece, of the whole length of the shoe, and the heel long enough, that is to say, one quarter the whole length of the shoe.

THICKNESS OF THE SOLE.—This question is one of the most important of which we have to treat. Thus, after having studied it thoroughly, we shall not be surprised if the conclusions to which we have arrived meet with incredulity. These conclusions are justified by an experience of many years, so that we have the right to hold strictly to them.

The sole plays an important part in the shoe of the army. It ought to be easy, impervious to dampness, and to have a certain thickness to guarantee the strength and durability of the shoe; but it ought to be forbidden to split the leather, so that it would be impossible to provide the shoe with a sole of which one of the surfaces is spongy and permeable to dampness.

The quality of the shoe depends upon the quality of the leather, and the quality of the leather upon the kind of skins and upon the processes employed in tanning them. The skins designed for shoes come from animals slaughtered for the butcher's shop, from those killed by accident or disease, and from animals sacrificed at the time of the epizootic. This difference of origin is not without importance, for, according to their origin, the skins differ more or less in their texture, and endure more or less successfully the operation of tanning.

We have not searched deeply enough into the question of tanning to enter into many details in regard to it. We will confine ourselves to saying that well-prepared leather of good quality may be known; when it presents a glossy cut; when its texture is close and compact; when its color is like that of the inside of a nutmeg; and when in letting a drop of water fall upon the side, the drop retains a globular form. Inflexible leather, sonorous and brittle, is bad; it comes from imperfectly tanned skins.

Russian leather is the most impervious. It owes this quality to the empyreumatic oil of birch bark. It is made red by steeping it in a decoction of sandal wood. Russia leather never gets mouldy, and no insects trouble it on account of its odor. Finally, if we leave a side of Russia leather soaking in water for some hours, and one of any other country, we shall find in weighing them again, that the Russia leather has absorbed only one-third as much water as the other leather, which sufficiently shows the inferior preparation of the latter.

We have said that the soles ought to have a *certain thickness;* if they be too thick they impede the walk by their stiffness, and *neutralize* the play of the joints of the foot; and if the leather be too dry and too compact, it soon cuts the thread of the seam. The thread of the seam can also be destroyed by greasing the shoe with animal fat (lard). This question is treated farther on in Chapter VIII.

As to the *thickness of the sole*, most countries fix the *weight* of the sides or bands of leather from which the soles must be cut. But that in only a half measure; for a heavy leather can be less thick than a light one. It depends in fact upon the food and previous condition of the animals, and especially upon the length of the process of tanning and the preparation of the leather. If, for example, the animals receive not very substantial food, the skin will always be thin, while it will be much thicker if they are fattened on bran, meal, potatoes, &c. The best meal is that made from Turkish corn; but it ought to be eaten *dry* by the cattle. Thus we see that it is not sufficient to prescribe the *weight* of the sides of leather from which the soles must be cut, but it is much more important to require a certain thickness for them. This thickness can only be obtained by a good condition of tanning. Formerly the process of tanning lasted two or three years. Thus we had an excellent quality of goods; for the tannin combined with the gelatine of the skin, increased the weight and thickness of the leather about one-third. At the present time the competition is such that they tan quickly rather than well, and even have recourse to an artificial tanning which only takes a few days; so that it is difficult to obtain an impervious shoe.

Leather tanned by processes of this kind, is that which is used with rare exception for the shoe of customers in civil life. But in order to make the soles appear more solid and thicker than they really are, the shoemakers put between them all the waste leather possible. Then, as every one knows by experience, when the outer sole becomes worn, all this debris falls out. This inner layer of thin fragments of leather does not appear on the outside of the shoe; for the edge of the soles undergoes a preparation which, when the shoe is finished, prevents any one from being sure of the true thickness of the leather. The only means of discovering the fraud is by ripping or taking to pieces the shoe.

The sole of the military shoe ought to be cut with the grain of the leather, and to have a thickness of at least three millimeters after they have been beaten by hand by the workmen.

It makes no difference whether the skins of oxen or cows are used. We will remark, however, that the skins of cows as thick as those of oxen are stronger, because the grain and texture are finer and more compact. However that may be, whatever they use should be well tanned, and have at least three millimeters of thickness, not after the soles have been beaten by *machinery*, as is done in some countries, but after they have been beaten *by hand* by the workman.

Under these conditions only are the soles thick enough to make it unnecessary to use any other filling than that which is required to fill the space existing between the sole and the upper leather caused by the joining of the latter with the welt of the shoe. This filling up is generally done by means of an old sole rendered impervious by use; it extends to the heel, and is fastened between the two soles with some kind of paste, and it is strengthened under the arch with one or two pieces of leather, better old than new. All other filling is useless, and, as we have already said, is of no use but to deceive as to the true thickness of the sole.

NAILS AND PEGS.—We acknowledge at the beginning that nails have undoubtedly the effect of lessening the wear and tear of the sole, and of protecting the seam which comes in contact with the ground. But we also affirm that if the sole be really of good quality, it is useless to furnish it with an armor of nails or pegs, which have the effect of transforming it into a veritable sponge, and causing it to lose its flexibility, one of the most important and necessary of its qualities.

The military shoe has been filled with nails only because the soles were not of good quality.

This is contrary to what ought to take place in future, and we shall see that shoes moderately nailed will last as long, and even longer, than those provided with an armor of nails. In any case they will not have the inconveniences of the latter, of which we are about to furnish the proof.

A shoe filled with nails is always heavy and stiff, and costs more. The surface of the nails is never on the same level; furthermore, if there are too many, the heads of the nails are easily knocked off on paved streets or graveled walks, and the nails fall out, one after another, leaving place for the entrance of dirt and wet, so that they must be replaced. If the head of the nail has fallen off, the point remains in the leather, and it must be taken out, or make a hole beside it for another nail. If this is not done, and on a campaign it never is, the point will rust and corrode the leather; the shoe being sewed, water will reach the thread, which will become rotted, and allow dampness to reach the feet, and the shoe itself will soon need repairs, and will become useless long before the expiration of the time we might reasonably expect it to last.

Even in winter a soldier ought never to have cold feet, and consequently no dampness must be permitted to penetrate the shoe. The sole, then, must not only be strong, but impervious. This is absolutely necessary, for there have been cases when soldiers have been found frozen when relieved from guard duty.

Good leather, well tanned, is of itself impervious if it be not plowed with nails. Soles can be made still more impervious by the following process: When the two soles, inner and outer, have been cut in the same proportions, we fasten to the first the welt, the upper leather, and the quarter-pieces, after which we spread over it a layer of shoemaker's

wax melted in a *bain-marie;* the outer sole is, in its turn, spread with a coating of the same wax, and while these two layers are warm the soles are stuck together as exactly as possible. They are thus rendered impervious; but this operation requires the following precautions: The layer of wax must be thin and very uniform; the wax must be neither too hard nor too soft; if too hard it breaks up in cold weather; if too soft it takes the impress of the foot, and if the inner sole be too thin it forms hummocks, which cause bruises, blisters, excoriations, &c.

This question of the imperviousness of the shoe will be treated more in detail in Chapter VIII.

Heels.—The usefulness of heels should not be forgotten by any one, for they offer many advantages, especially in wet weather. Although *fashion* cannot vary to any great extent the shapes for inclosing the foot, it has, on the contrary, introduced a variety of heels. But we must say, to its shame, that all these shapes are more or less ridiculous.

The very high heel was invented by the ancients. They did not know the use of handbills for plays, so they distinguished their actors who represented the gods and heroes, by making them wear shoes with very high heels and very thick soles. These shoes were called buskins. The women, especially those of small stature, were not long in following this fashon, which, in a short time, became general everywhere.

In the XVIIth century high heels reappeared, and the fashion has continued to the present day. The height remains the same, but the cut is more elegant.

The military shoe, happily, has not been so much under the influence of fashion as to be exaggerated in this respect; but it is not yet provided with a truly practical heel, such as it is important to give it.

The French military shoe is the only one, to our knowledge, of which the shape of the heel is good; but that is badly sewed and comes off easily, especially when the men are obliged to hold back the gun-carriages down a steep declivity.

Too high heels have numerous disadvantages, some of which are important enough to be pointed out.

In walking, the foot always has a tendency to push forward in the shoe, and the more the heel is raised the more the foot will push forward.

Too high heels are at the same time too narrow; they thus lack a firm base; further, they displace the point of support of the leg, which, instead of resting upon a horizontal surface, slips forward upon an inclined plane. The weight of the body is thrown in a disproportionate manner upon the toes, and if the heels are worn down on the side, the displacement of the axis of the limb causes the distention of the lateral ligaments of the tibia tarsal joint; certain muscles contract in a permanent and exaggerated manner, and walking becomes fatiguing and painful. The toes are ill-treated in their turn; they hit against the end of the shoe, and are pushed back, and although the shoe may

not be too short, they suffer the same inconveniences as though it were. This may especially be stated concerning a shoe provided with an inside sole curved at the end. It is to *fashion* that we are indebted for this invention, of which the only use is to deform the *toes* and abuse the *nails* with which they are provided. They have in fact no place to move in the end of the shoe; and as, on the contrary, they find there an absolutely insuperable barrier, nothing more is needed to explain the tortures that result for those who make long marches in such shoes.

To be truly *in the fashion* at the present day, every shoe must be as pointed as possible, and provided with an inner sole curved at the end.

We have already said, in speaking of too short soles, that if they are joined with heels that are too high and too narrow, the shoe will not prevent the foot from resting upon the ground, and thus will cause a flatness of the foot. This is inevitable, especially if the heel be not long enough and does not extend far enough under the foot so as to support the arch of the foot. We repeat that the greatest effort of the leg is borne upon the arch of the foot, and if that is not supported by a large enough heel, the shoe will run down at the heel and the foot will become flattened. If the leather be flexible and moist, it will require little time to accomplish that, while it will take longer if the leather be dry and hard.

On the march, men are fatigued more quickly with shoes having too high and narrow heels, because the foot has no solid base; and so, according to the nature of the ground over which they march, it is necessary to protect themselves from injury on the road, and there results a tension of mind as fatiguing as the march itself.

A good marching shoe, then, ought to have a large heel, long enough and a little raised, which protects the foot against the inequalities of the ground and forms a solid base. A soldier will only be truly solid upon his feet with a shoe which has a large and sufficiently thick sole and a heel equally large and low, cut vertically, with a height not exceeding from fifteen to twenty millimeters at the most. The heel must be kept in place by two seams; a vertical one which passes through it, and an oblique one which joins together the heel, the stiffener, and the quarter-pieces.

Iron on the heel.—It is unfortunate that opinions are divided upon the usefulness of the iron on the heel, for nothing is more practical than this little iron to prevent the heel from wearing out on the sides, for maintaining the foot in a perpendicular position, and for avoiding sprains and displacement of the axis of the member, under the strain which the leg places upon the foot.

The iron on the heel prevents the shoe from becoming misshapen; the shoe never getting out of shape will wear out less rapidly; the heel remains straight until the iron is worn out, and thus lasts a long time itself. The expense of frequent repairs is considerably diminished, and

the result is a true economy, as well for the soldier as for the Government.

In spite of these unquestionable advantages, we have not thought it best to provide our models with iron on the heel, because it is claimed that it causes the soldier to slip on stones and on icy roads. This accusation is not without foundation, but only when the shoe is provided with an iron on the heel absolutely smooth and polished, as is still the case with the military shoe of some countries. On the other hand, it would never apply to the iron that we have invented; for it is to avoid all such inconvenience and danger that the surface of this iron has been grooved in such a manner that, until it is entirely worn out, the soldier will never be in danger of slipping upon any ground whatever.

We have samples of this iron for distribution in all the countries to which we have the honor of presenting our models of shoes; and we add that nothing is more easy than to place the iron upon the heel of these models, for the heel has two rows of pegs in the space between which can be fastened the five screws designed to fix the iron firmly in position. These screws should have the heads copper-plated.

We see only advantage from the military shoe being provided with iron on the heel. The iron costs little; it increases very slightly the weight of the shoe; the soldier can take it off and put it on easily, since he only requires a screw-driver to do it.

The shoe of most of the permanent armies is provided with iron on the heel, but they have not taken pains to give it a rough surface like that of the iron which we have invented.

Finally, the iron on the heel has another end to accomplish. There is no reason why it should not be used upon the shoes of all troops *during summer*.

But, if the army makes a campaign *in winter*, or if the country to which it belongs possesses alpine troops, in order that these troops may be able to move with the greatest freedom and facility in any season or upon any ground, we have perfected the invention of the iron on the heel by the introduction of cramp-iron screws, to take the place of the screws that fasten it to the heel.

These cramp-iron screws are fastened to the heel by means of a special key, and are placed in such a manner that, even upon the steepest and most frozen roads, as well as upon snow and ice, the soldier is in no danger of slipping forward, backward, or sideways.

Besides the iron for the heel, we have a sample of these cramp-iron screws, and the key necessary to place them and to remove them, for presentation to all the countries which shall do us the honor to ask for them.

CHAPTER VI.

INCONVENIENCE AND USELESSNESS OF GAITERS.

Gaiters, of whatever kind they may be, offer absolutely only disadvantages, and serve to increase those of the shoe itself in armies where they are required to complete the shoe.

The *leather* gaiter, which is used in some armies, does not adapt itself well to the shoe; it is too large or too small; rarely fits well, unless by a happy chance. The leather for gaiters is, besides, badly tanned, and becomes very hard if it remains a long time in store; moreover the foot must serve as a last to shape the gaiter that covers it. It is always at the price of pain, and often of excoriation, that the foot endures this shaping, which lasts several days before being definitely completed.

To adjust the gaiter firmly to the leg, and to hold the shoe, the soldier is obliged to fasten his gaiters by means of footstraps (which considerably diminishes their length) and by lacings, which, placed vertically, cause their chief pressure upon the instep. Under this pressure the lacing gives way and comes out, and the gaiter no longer binds the instep, but presses the lower part of the leg, and has the effect of impeding the circulation and causing the swelling of the foot. The result is the same if the gaiter press the instep.

Besides, leather gaiters require too much time to lace, and that operation can be performed only in the daytime, or in the light. The result is that, on a campaign, the men do not dare to take off their shoes at night, for fear of not being able to put them on in case of an alarm. Is it thus that the feet are rested? And if they take them off to escape the compression which they inflict, the men are *hors de combat;* inasmuch as in case of alarm they have no time to put on their gaiters again, and the shoes will not stay on the feet without them.

If the gaiters are not strapped tightly they fall upon the heels; dust, mud, gravel, sand, and water get in between the gaiter and the upper leather and quarter-pieces; they penetrate the shoe, make it very heavy, and cause wounds which necessitate the discontinuance of the march.

Gaiters become absolutely useless if the footstraps give way. As they are only sewed with ordinary thread, it is easy to understand that by the alternatives of rain and drought, mud and dust, the thread quickly becomes rotten, the footstraps come off, and the men drag their shoes with difficulty for many hours. The same thing happens during an action if the sewing has not been renewed in time before coming to pieces.

Finally, when the leather gaiter gets wet it becomes thoroughly soft-

ened; as soon as he comes in again the soldier hastens to dry it before the fire; the leather contracts, hardens, loses its flexibility, and the next day there will be a new torture to endure to fit it again to the foot.

Canvas-gaiters, dry and well fitted on setting out, bind the foot in an intolerable manner, prevent the circulation of air in the shoe, and close all outlet for the perspiration, until walking becomes a veritable torture for the foot-soldier.

If, on the other hand, the gaiters are dampened by dew or rain, they keep the feet damp, they shrink, and cannot be loosened except by undoing all the buttons, and if one takes them off they cannot be put on again; finally, they tear and wear out rapidly, and although not high-priced, the care of them is very burdensome; for they need to be often washed and cared for to have them always neat and presentable. As to their footstraps, they come off as easily as those of the leather gaiter.

We conclude, then, that gaiters only present diasdvantages, and that, thanks to our model shoes, we can do away with an expense useless in all respects.

In winter, the only gaiters which can render any service by keeping the feet and legs warm, are of cloth, or woolen felt, reaching to the knees, but under the condition of wearing them only in sharp, dry cold weather.

It would be better, without doubt, to be able to do away with them to avoid expense, and to reduce to its minimum the weight of the soldier's burden; but if, on the other hand, the *impedimenta* of the army ought not to be increased, there are certain countries where this measure would be justified by the severity of the climate.

The health of the men is besides a very important consideration, and it is especially in winter that it ought to be the object of the greatest care and of a solicitude well understood by those who are charged with watching over the material well being of their soldiers.

CHAPTER VII.

LINEN, CLEANLINESS, AND HYGIENE OF THE FEET.

This subject is not one of slight importance to the soldier who wishes to preserve his feet in good condition; only he ought not to be given over to his own resources. On the contrary, the Government must come to his aid in some manner, not only in respect to the linen which he needs for his feet, but also as to the means of keeping the feet, in all seasons, in a perfect state of cleanliness.

LINEN FOR THE FEET.—We must first of all declare that we do not understand why this part of the soldier's clothing has not been the object of greater solicitude in all countries. They appear to have attached no great importance to it; or, what is more probable, they have given way before the expense and difficulties of keeping it in repair.

In Switzerland, regulations prescribe that each soldier shall be constantly furnished with two pairs of stockings or socks. That is so plain that the soldier is never without these two additions to his clothing. One does not understand how soldiers can have their feet bare in their shoes. It is not the same in other armies, which explains the great number of maladies contracted in service, especially in winter. Whether they be furnished by the Government or by the soldier himself, every man ought to be provided with two pairs of cotton socks for summer and two pairs of woolen ones for winter. During summer the socks could, if needful, be replaced by cloth (?) (wrapped about the feet.)

Each soldier in the German army is provided with two pairs of woolen (felt) socks for winter. Thus during the siege of Paris, and especially during the month of December, 1870, the cases of freezing the lower extremities were very few in number in the German army, while they were in greater proportion in the French army. We saw numerous cases everywhere in the French army of the east, after its entrance into the Swiss territory in February, 1871.

Dr. A. Doyon, chief of the second Lyonnais ambulance, and who was in Switzerland during the continuance of their detention, had occasion to observe a case of frozen feet which made a great impression on him. He was attending a man whose great toe of the left foot showed on the inner surface a frozen spot about the size of a franc-piece. The scab had just begun to come off, when, without any appreciable cause, he began to exhibit tetanic symptoms, which neither a large dose of chloroform, nor hypodermic injections of morphine, nor dressing the wound with morphine, could avert, and *death soon followed.*

The frost-bitten soldiers who generally presented themselves to the ambulance, bore *upon the inner surface of the two great toes,* perfectly

symmetrical scabs, which were nothing less than the effects of cold and the continual pressure exercised by the shoe upon this part of the foot.

It has been stated, besides, that the soldier has no greater enemy than cold; for when he is not in motion, let him allow himself to be overcome by fatigue or sleep, let him combat them by imbibing brandy, and let him fall asleep in the open air, and he is absolutely lost.

Consequently during great cold the sentinels and outposts ought to make it a duty to be constantly in motion, however freezing the wind may be, in order to avoid freezing the lower extremities, and the necessity of suffering amputation of the leg; cases of which Dr. Doyon saw during the campaign of 1870–71.

To protect the troops as much as possible from the cold to which they are exposed during winter, it would be well to give each corps a certain number of greatcoats or cloaks, well furred and provided with hoods, so that during great cold the men could have them constantly at their disposal. It might be necessary to issue to them a few pairs of boots of the following description, which would render them unquestionable service:

During his expedition to the north pole to discover the northeast passage, Professor Nordenskjöld was obliged to pass the winter in the Bay of Kolutschwinsk, from the 27th of September, 1879, until the 1st of April, 1880. Now, during these six months none of the men had frozen feet, although the temperature sometimes descended to 46° below zero.

The foot-gear worn by these men, consisted of a pair of boots made of very strong canvas and furnished with a leather sole upon the inside; this sole was covered with a layer of reeds (*Carex Visicaria*); the feet were first encased in woolen stockings, and afterwards wrapped in a piece of *woitok*, a kind of fleecy stuff. All who wore this foot-gear assert that there is nothing better in every respect. In prolonged marches over a country covered with damp snow, these boots were found to be much preferable to leather ones. The latter absorb dampness, become very heavy, and cannot be completely dried during the night. The canvas boots, and the layer of reeds inside them, on the other hand, dry very rapidly. They have another advantage, that when they are wet they are not as heavy as leather ones. These boots are, besides, very hygienic; for the air circulates easily through them, thanks to the vegetable lining with which they are furnished.

We will only remark that the layer of reeds to which the escort of Professor Nordenskjöld had recourse, could advantageously be replaced by a layer of very even and well-dried straw, for straw has all the necessary qualities; not only does it prevent dampness from penetrating, but *being a bad conductor of heat*, it absolutely shuts up every passage for evaporation from the warmth of the feet. It is well understood, besides, that the boots of which we speak ought to be large enough to be worn over the ordinary shoe of the soldier.

The question of the cost of purchasing socks and keeping them in repair can not be any serious obstacle to their use in the army; for in 1867 an English manufactuer offered to provide each soldier of the French army with two pairs of very thick cotton socks, of which the price of purchase, of repairing, and returning again, would not be more than 20 centimes (4 cents) a man per month. Fixing six months as the limit of the durability of two pairs of socks, we shall arrive at an annual expense of 2. 40 francs (48 cents) per man—a little more than the cost of two days in the hospital, said Dr. Champoillon!

Let us hope, then, that they will not shrink from the slight sacrifice which will result from the introduction of socks into the army, which will be, besides, largely counterbalanced by an important diminution in the cases of illness, which, as a rule, have no other cause than the cold to which the men are exposed during winter.

As to the shape of these socks, it is unnecessary to say that it ought to be similar to that of our model shoes, that is to say, the point ought not to be in the middle of the end, but on the inner side, corresponding to the place occupied by the end of the great toe. The principle is the same as that which governs the construction of our model shoes, and we have sufficiently demonstrated it, so that it appears superfluous to return to it again in this particular case.

Whatever clothing for the feet the soldier may be provided with in the future, it is indispensable that it be kept in the greatest state of cleanliness, especially in summer. Therefore the soldier ought to wash it every night, certainly in hot weather. By washing it every night it will be very quickly clean as well as quickly dry. If this washing does not take place regularly, the perspiration with which the stocking will be impregnated and the filth which necessarily results from it, will dry up and become stiff during the night. Without considering the intolerable odor which proceeds from cloth, or stockings, impregnated with fetid perspiration, and which will simply poison the atmosphere of the place in which he will pass the night, the soldier who has not washed his stockings the previous night, will put them on in the same state the next morning or the morning after; but covered with a layer of filth, which will become stiff during the night, they retain the fetid odor of the perspiration, and the soldier subjected in such clothing to another day of marching, of fatigue, and of perspiration, is certain to end by having sore feet.

Cleanliness of the feet.—It ought not to be necessary to rec ommend to a soldier what he should do in this respect; but it is to him that the following counsels are addressed; for we regret to say he has not generally that constant care of his feet of which they ought to be the object.

It is a positive necessity for the soldier to keep his feet clean. It is necessary for his own particular interest and for the interest of all. The feet ought to be still less neglected since they are shut up in a shoe

where perspiration is produced with the greatest facility. Now, if the march or the maneuvers have been long and trying, especially if they have been carried on in time of great heat, the feet become irritated by being compressed in the shoe and exposed to the friction of any inside seams, or simply to the rubbing of the stockings upon the skin. This irritation can only be allayed by regularly bathing the feet. If this care be omitted, if it be not performed regularly, and the march be resumed, the irritation of the skin soon develops into sores or blisters which require the aid of the physician.

All barracks should be provided with toilet rooms, bath rooms, or even simple basins for foot-baths, since it is necessary that every soldier bathe his feet night and morning; we go even farther, and wish that he were obliged to bathe the whole body from his head to his feet. Living together in the way soldiers do, requires the strictest and most constant cleanliness. The soldier, by the nature of his occupations, is liable to soil himself very much; it happens upon the field of action and in marches upon dusty ways, and it is therefore urgent that he perform frequent and bountiful ablutions. Not only will health and vigor of body be found in this manner of caring for himself, but he will avoid the disagreeable odor which betrays itself in the sleeping room on account of want of cleanliness, he will be protected against the spread of skin diseases, and will acquire habits which he will retain in civil life.

We would also avoid compliments like those which Victor Dupuy published in 1872 in the *Etudes d'hygiène militaire*, in which we have found among others the following:

When under a bright sun we look upon a passing regiment, clean, shining, brilliant, do we ever ask ourselves if the underside corresponds to this beautiful carriage? If the magic wand of a fairy should display all these brilliant soldiers in the costume of our first father, how many illusions would disappear! Yes, it is sad to say that nothing is more filthy than a soldier. It is required that he have clean gloves, well blacked shoes, well brushed clothes, but why is it never asked if his feet and hands are washed?

It is necessary to be present at the entrance of a sick soldier to the hospital to have any idea of the degree of his bodily filth. Thus, physicians find nothing more necessary than to prescribe a bath for all new comers, at least, unless the gravity of the malady positively prevents it.

While hoping and expecting that the just wish expressed above may be realized, we insist that the soldier shall be compelled to bathe his feet morning and night. It is sufficient to wipe them off with a damp cloth, not forgetting to pass it between the toes to remove all the small eruptions that are so easily produced there, and to wipe them dry immediately. These attentions are of the most simple nature, but they must be practiced strictly and regularly, for that is the only condition under which they will have any efficacy. They will be especially appreciated upon a campaign when full baths and foot-baths are banished to the background, if the troops be not entirely deprived of them. In ordinary times general baths ought to be frequently taken. The best

time of day to take a bath is without doubt the *morning*, and not the evening, as has been the general custom. We will try to furnish immediate proof of it, especially concerning *foot-baths*.

After a fatiguing march, a day of action, &c., during summer, the first thing a soldier will do, if it is not ordered for all, will be to seek, as soon as possible, a river, a brook, a pond, or any pool whatever, to plunge in his feet. But they are often inflamed and sore in consequence of fatigue and perspiration, and in this state he will immerse them in water more or less cold or frozen. He will find, without doubt, a momentary relief, but the warm blood that circulates abundantly in the lower extremities will be suddenly driven back to the higher organs of the body, and the soldier will be exposed to all the dangers that arise from violently arresting the perspiration in any part of the body whatever. Perspiration of the feet is more or less abundant with every man. It ought to be considered, by those who are affected with it, as an excremental elimination produced by nature. It can be moderated by regularly bathing the feet, but it would be imprudent and very dangerous to suppress it, for we have seen formidable maladies, and death even, follow the suppression of it.

From all points of view, then, it is preferable for troops to bathe in the morning, whether they take a full bath or only a foot-bath. In the morning the blood is quiet, the circulation is normal, therefore there is less danger. As to the water for bathing, it ought to be perfectly clean, and, if possible, it is better to choose still water, or that of a river or brook that runs the least rapidly. The faster it runs, the more the temperature of the water will be affected, especially if it have its source in the mountains in the vicinity of glaciers.

One ought, in every case, to abstain from using the basins of fountains for bathing the feet, for the water should remain clean for watering horses, and for the requirements of the population in the midst of which they are found. Foot baths would become superfluous if the soldier were required to wash his feet every night and morning.

Hygiene of the feet.—We believe we ought to point out here a certain number of hygienic rules of which the soldier has never had the least notion, and which will be of the greatest service to him, for he will certainly have more than one occasion to make use of them. In a general manner the feet require the following attentions:

1st. Foot-baths.

2d. Brushing and rubbing with pumice stone those parts of the skin hardened by the friction or the compression of the shoe.

3d. Cutting and cleaning the nails.

4th. Cutting and paring off callosities and corns.

1st. We have spoken so fully upon the necessity of foot-baths that there is no need of returning to the subject.

2d. Brushing and rubbing with pumice stone is an operation that has for its object the prevention of the development of callosities, and

even corns, about the heel and the plant of the foot near the toes, where the skin becomes hardened under the pressure of the shoe. As a rule these attentions are not observed by the soldier, and we speak of them for the information of those who shall need to have recourse to them.

3d. Cutting and cleaning the nails are as necessary for the feet as for the hands. The nails ought not to be cut too short, and it is not best to allow them to grow too long. The following important rule should be observed and conformed to: *The nail of the great toe ought to be cut squarely across.* It is the only way of avoiding the ingrowing nail, when the soldier is not yet affected with this infirmity. When the nail begins to penetrate the flesh, one thinks to remedy it, or seeks to prevent it, by cutting or rounding the edges of the nail; but, like the hair, the nails grow more rapidly the oftener they are cut; thus the evil increases; the cut edges being sharp and uneven cut the flesh and penetrate it deeply. One is then afflicted with an ingrowing nail, and must have recourse to the services of the surgeon. There is, in every case, a way of putting the ingrowing nail back to its normal condition.

The soldier should keep quiet. He should file the upper side of the nail, on the affected side, until it be thin enough to be taken hold of by a small pair of nippers, and turned back in the opposite way from its natural curve. This done, place under the nail a small plate of lead, a few millimeters thick, which must be carefully bent around under the toe. In this way the flesh does not come in contact with the edge of the nail, the pain ceases, and it is only necessary to allow the wound time to heal. Every alternate day the nail should be filed to keep it thin and soft, until the skin, having regained its normal condition, can resist the friction of the nail; after that the lead plate is taken away.

We add, finally, that when a soldier wears the shoe that we have proposed, he runs no risk of being troubled with nails growing into the flesh. We affirm, on the contrary, that even in a case where there is more or less trouble with ingrowing nails, it will be sufficient to wear our style of shoes for a time to see the nails sooner or later come back to their normal condition, without having recourse to any particular attention, and without any medical treatment whatever.

4th. Cutting or scraping callosities and corns, is an operation familiar to every one, for among a hundred persons there are at least ninety who are, or have been, afflicted with this infirmity. Its seat is upon the surface of the skin, upon the toe joints and between the toes themselves.

If the soldier afflicted with corns sees fit to have them taken out by a *skillful* corn doctor, the cure is certain; he will be entirely free from them. If he is not convinced of the skillfulness of the doctor, he had better take it upon himself to cut or pare his corns. But he must never cut or pare them until they bleed, then the operation can be performed again every time he feels the need of it. The corns may disappear at length by this treatment and by the use of a shoe that presses no part of the foot, but they must not be of too long standing nor must

the shoe be the same as that to which the soldier is indebted for his corns, since they are produced and developed not only by the pressure exercised upon the feet by shoes that are too tight and hard, but also by the friction of those that are too broad and too large.

We close this chapter by giving some counsel to soldiers who have cold feet. In winter, especially upon sentry duty performed during rain or snow, it is natural enough for the soldier to return to the post with his feet more or less frosted. If they are not damp, or wet, it will be sufficient to take rapid exercise to re-establish the circulation, and bring back warmth to the feet. Gymnastic exercises, where the legs are chiefly brought in play (as leaping, running), will accomplish the same result. Recourse can also be had to friction (as rough as possible) with a brush, a flannel, or any cloth. A roller of wood may also render the same service, rolling it under the feet until warmth is developed.

The most efficacious means is to immerse the feet in cold water, but that is not always at the disposition of the soldier. It is sufficient to plunge the feet into a bucket of cold water, draw them out immediately, wipe them, and rub them with a brush. By repeating this operation two or three times in succession, a sufficient reaction is produced in every case to bring back proper warmth to the feet. If, on the other hand, the feet are wet or very damp, he should immediately change his stockings and shoes and exercise in one of the ways that we have just enumerated. To preserve his health intact the soldier must avoid cold feet at any price. The connections are so close between the head, the stomach, and the feet, that, if the latter be not kept constantly warm, varied and grave disturbances are the inevitable consequences.

Finally, let it not be forgotten that cleanliness, strict, unremitting cleanliness of the feet and the foot gear, will often prevent, and always lessen, the tendency to cold feet.

CHAPTER VIII.

CARE AND PRESERVATION OF THE SHOE.

The military shoe must fulfill a multitude of conditions, as we have sufficiently demonstrated. But that it may render the service which we have a right to expect from it, it must be the object of the most skillful care. The first difficulty will present itself immediately after the manufacture of the shoe.

In countries where the military shoe is furnished by the Government, it is manufactured in advance, and preserved in a certain number of depots. These depots, or rooms, should be dry and airy. But if the shoe is pegged or screwed it dries up, and both pegs and screws become troublesome. If, on the other hand, the depots are damp and cold, the leather is not preserved, while the pegs and screws remain firmly fixed in their places. There is, then, no alternative—*pegged and screwed shoes must always be rejected.*

Leather designed for the manufacture of shoes must possess several essential qualities; it must preserve at any price its suppleness and elasticity, and be as impervious as possible.

As to the soles, if the leather be well tanned and have sufficient thickness, nothing more is necessary for the leather to preserve its impermeability. The upper leather should be cut from hides of from 4 to 5 kilograms (9 to 11 pounds), but to make sure that they are without fault, they must not be blackened nor covered with any glazing whatever, so that it will be sufficient to hold them between the eye and the light to discover any perforations there may be in the skins.

The leather ought not to be blackened, because in that condition it will be a good conductor of heat, and in winter the feet will quickly become cold in the shoe; in summer, on the contrary, the leather absorbs the sun's rays, transmits them to the feet, the skin is softened by perspiration, and becomes excoriated after a few hours' march. Second, the leather should not be blackened, because then it cannot successfully undergo the operation of greasing, which renders it flexible, elastic, and impervious. It is an error to believe that blacking preserves the leather flexible and elastic; on the contrary, it makes it as stiff as pasteboard, and it is not long before it becomes completely dried up from the effects of the corrosive acids which penetrate the leather. There are few blackings into the composition of which some acid does not enter; one is convinced of that from their odor. Under these conditions leather loses its flexibility, becomes hard and brittle, is dried up, forms folds which blister the feet, and naturally also loses its impermeability.

It is right to require the soldier to be neat, but in order to be always so he is obliged to blacken his shoes five or six times a day. It is too

much work for the result obtained, for, when it rains or snows, in muddy or dusty, the ephemeral shine of the blacking is soon done away with.

We hold to a very black shoe and a very white gaiter, but we sacrifice thus the practical side to appearance. To preserve all the qualities of the leather there is only one way, that is to grease it. This operation is as necessary for the upper leather as for the soles; if the shoe is to be rendered impervious by greasing, it is the *sole* which ought to be made so in the first place, unless it be sufficiently thick and flexible to dispense with very frequent greasing. To this end it is necessary to choose a firm, compact leather, but, as it dries up quickly—and it must be well dried to be more resistant and less permeable—care should be taken to grease the shoe thoroughly before issuing it to the soldier, and to furnish him, besides, the means of repeating the operation from time to time. In this manner not only will the leather retain its flexibility and elasticity in all temperatures, in the warmest and coldest climates, but it will become entirely impervious. The grease which should be used for this purpose is horse grease. It is the best of all; its cost is not great; it can always be procured; it keeps any length of time, requires no particular care, and may be used with great advantage in the care and preservation of harness. One can also make use of a grease known by the name of *dégras*. The *dégras*, a half solid, half liquid substance of which tanners make use to grease hides, is obtained by steeping sheep-skins in fish oil combined with a small quantity of potash. It is also called leather manufacturer's soap.

The sole-leather furnished by tanners is already impregnated with *dégras*, without the greasy matter, which is expelled under the action of the hydraulic press; besides, as shoemakers soak the leather, or make it up when it is fresh, because it works better in this state, it becomes necessary to dry the shoes before issuing them to the troops. The soldier ought then to grease them again to make the leather supple; for one cannot march long without being blistered in a shoe of which the leather forms wrinkles, as much rougher as it is drier, if it has not been greased.

It is very important to remark that the upper leather of shoes ought to be moistened before applying the *dégras;* for the water makes this grease penetrate the pores of the leather. Consequently the shoe should be thoroughly cleaned, then moistened on the outside. When the leather is sufficiently damp (it is not necessary to be very much so) it may be greased with a cloth stopper, rubbing the shoe in every part, and afterwards leaving it to dry in *the air*. The leather ought never to be dried near the fire; for, the damper it is, the more it will contract; it will become hard, and lose its flexibility and imperviousness. It is useless to add that, besides, it runs the risk of being burned.

In case the preparation, *dégras*, cannot be procured from tanners, the shoe can be greased with a mixture composed of fish-oil and tallow. Melt a certain quantity of tallow, and when it is boiling pour in an equal quantity of fish oil. The fish oil must be very pure and fresh, otherwise it

will soon have a bad odor. If it cannot be procured good and in sufficient quantity, it can be replaced by pure olive oil; but that makes it cost more. Finally, as to the tallow used, none is better than mutton tallow.

Lard (hog's fat) is the worst agent that one can use for greasing shoes; for, if the leather is moist it penetrates deeply, opens the pores of the leather too much, deposits therein stearine which takes away all porosity; and, finally, if one is not careful about the seam in the operation of greasing, this grease penetrates to the thread, the wax of which it dissolves, water or dampness penetrates the shoe and the seam itself, and the thread soon comes to pieces.

There are in existence many other preparations for greasing shoes, but we refrain from mentioning them, not only that there may be no temptation to use them, but because, in our opinion, nothing equals horse grease, or the mixture of *dégras* and mutton tallow. Any other preparation will not be of a nature to keep the leather flexible and at the same time impervious, although these two qualities can exist at the same time.

The only difference in using horse grease or *dégras* is that the shoe need not be moistened, but simply cleaned, to be greased with the former of these articles.

CONCLUSIONS.

Having finished the task that we have imposed upon ourselves of effecting a reform in the military shoe of all armies, we wish still to draw attention to some considerations of the highest importance, and which it is absolutely necessary to consider if we wish the troops really to move with the greatest rapidity, and to render everywhere *all* the service that we have a right to expect of them.

As may be understood by the foregoing work, we propose to substitute in all armies THE COMMON-SENSE SHOE FOR THE FASHIONABLE SHOE.

We believe we have pointed out, as fully as can be done, the difference which exists between these two styles of shoes, but the work will not be complete if we do not add that the common-sense shoe, as we have described it, ought to be worn everywhere by children. In short, *all* feet, without exception, are more or less deformed by the shoe worn at the present day, so that it is necessary to take that into consideration in the manufacture of the common-sense shoe. It is the maker who must judge in each particular case how nearly he can make the shoe approach the common-sense shape. It is only little by little that he will be able to introduce this kind of shoe, and only after the deformed toes have resumed more or less their normal condition. The use of this shoe will accomplish that; for the feet of young people of twenty years are not so gravely misshappen that they cannot resume their normal position after having worn the common-sense shoe for a certain length of time.

We have taken this circumstance into consideration in the manufac-

ture of the models that we have the honor of presenting, so that they can be worn by the troops in all confidence, for never will they be found in better condition than in this style of shoe.

When the advantages are once appreciated, every one will realize the necessity of having this shoe worn by children, and from that time we shall see feet and toes grow and develop, without undergoing any deformation.

The joints remaining in their normal positions would receive no pressure whatever from the shoe, and as a natural consequence children would wear no other shoe in the future.

The immediate advantages which would necessarily result for all armies are so evident that it seems in a measure superfluous to urge them. Let us say that in every country where they shall adopt the common-sense military shoe, the army will receive only young men with their feet in a perfect condition; it will no longer allow a straggler in the rear; the vigor and mobility of the men will be increased tenfold; they will be in a state to render services that it is materially impossible to require of them to-day with their feet deformed and mutilated by the shoes they have worn at the present time.

As to the military common-sense shoe that we present, all who have worn it are convinced of one fact, important above everything, and that is that when it is *new* it is worn as easily the *first* time as if it had been worn several months. The foot enters this shoe without difficulty, and is immediately in its place and at its ease because its actual form and true dimensions have been fully taken into consideration.

Finally, as to the price of this new shoe, it is unnecessary to say that nothing justifies an increase of that, as it is only required to give the shoe a new shape, nothing more. In the work which has just been read, it will no doubt be remarked that we have not spoken of the boot, or the half boot, or bootee. We have designedly avoided this question, because opinions are very much divided in this respect.

We have had the honor of being included in the committee appointed by the Swiss military department to furnish an opinion upon the shoe to be introduced into the army.

We have had the honor of presenting a report of the minority against the introduction of the boot proposed by the majority of the commission. It would be useless to reproduce here the reasons brought to the support of the report in which we had proposed the models which accompany this work. It is sufficient to say that if we have not declared in favor of the boot for the Swiss army, it is, first, on account of the inconveniences we meet with generally in a boot manufactured in advance of its use; and on the other hand, on account of the circumstances under which the Swiss army will be called to make use of it. It is not as a rule put upon the foot in winter; therefore the boot is worn in a season when its use offers only disadvantages. We call as witnesses all officers doing duty for some years in summer, that they may tell us if their troops have not always shown a strong aversion to the boot,

even in the service of instruction; if the number of sore feet has diminished since the boot is inflicted upon the infantry, and if, in their reports, commandants of schools and of courses of instruction as wel as those of assemblages of troops, have not, in the majority of cases, pronounced against the use of the boot for infantry.

We call also as witnesses, the military authorities of the cantons, and higher Swiss officers, called upon to decide upon the two reports of the shoe commission that had been submitted to them by the Swiss military department. By a majority bordering upon unanimity, they pronounced against the boot for foot troops.

The situation is not the same in a permanent army, and, besides, it is necessary to take into consideration the nature of the climate of the country where the boot has been worn till now, and where it could be introduced in the future.

In spite of the models of *shoes* which we present, we are not opposed to the *boot* in countries in which its use is justified by the necessities of the climate. It is evident, in fact, that in a warm country the boot and its modifications, renders no service, and only causes inconvenience, while in a temperate or cold country the buskin and the shoe would perhaps be insufficient. It is a question of habit and education. What shoe is worn in different countries to the age of twenty? If it be the boot or the half boot, it is evident that either habit or the nature of the climate has made it a necessity to the greatest number. There is reason then, in taking this into consideration in military life, and not to deprive oneself of the advantages which must necessarily result from habits contracted by men in civil life. It is natural that each country should have its habits, and that as in many countries they would march very badly in the Indian moccasin, so the Spaniard, so active in his sword drills, would not go far, booted like a Russian or a German.

Consequently, taking into consideration the acquired habits and the exigencies of military life, we would choose for the army the shoe most common in the country.

Among the numerous requirements of military life, there is one of special importance. We speak of the *mobility* of the soldier. We are not the first to declare this truth; General Trochu, in his book published in 1867, speaking of the necessity of returning to the principles that ought to regulate the existence of armies in peace, said:

> Why defer the realization of it in a time when *quickness, above everything, will be the invincible law of war, and will become the preponderant aptness of armies*?

Two principal causes favor or hinder this quickness and mobility—*the burden of the soldier* and the style *of shoes* he has on his feet.

The weight of the knapsack varies considerably in different countries; it is of this that the men complain most, and in an attack it frequently happens that they seek to free themselves of it; at least for the moment. Now, if in the ardor of the strife the company is carried forward a great distance, or is obliged to beat a hasty retreat, the knapsacks are inevitably lost; and, without the articles which they contain, the man is

not only deprived of all resources, but he will be entirely *hors de combat* if, as in the Swiss army for example, his reserve ammunition is inclosed in the cover of the haversack. This is truly a disaster that nothing can avert, and upon the consequences of which we certainly have no reason to dwell.

Napoleon I, in speaking of the knapsack, said, "Let the knapsack be reduced to the least possible size, but let the soldier have it always with him."

To prevent men from freeing themselves of it, it becomes urgent to diminish its weight, and to no longer carry it upon the shoulders, as is the custom now in most armies; for, with the present style of suspending it, the result must be to repress muscular efforts, movements of respiration, and the play of the circulation.

The English army possesses to-day the best system of suspending the knapsack. It is worn on a level with the loins by means of braces crossing behind, passing over the shoulders and fastened to the sword-belt; some small leather straps, starting from the knapsack, under the arms, are buckled in front to the braces and prevent the knapsack from slipping about. The chest is thus left entirely free, and the knapsack has not the adherence of one fastened to the shoulders; the man is not so harassed; he breathes freely, and his equilibrium is perfectly maintained by means of two cartridge-boxes and a bag for cartridges fastened to his belt. Finally, which is an important advantage, by simply unbuckling his belt, the man takes off all his equipment, without having to undo a strap, and puts it on with the same facility. Let this knapsack be introduced everywhere, and the burden of the soldier would be much diminished.

Finally, this manner of carrying the knapsack is similar to that made use of by numerous workmen who travel over the continent; but the system of suspending the English one is evidently the most practical of all.

As to the burden of the infantry soldier in general, it is everywhere too great, and ought in no case to exceed 25.076 kilograms. (55 pounds), even including all that can be added as portable accessories. And even in this case the whole burden ought to be distributed as follows:

	Kilograms.	Pounds.
Clothing	6.482	14
Equipments and accessories	3.942	8½
Arms	6.350	14
Linen and shoes	4.352	9½
Ammunition (100 cartridges)	3.150	7
Rations (one day)	0.800	2
Total weight	25.076	55

This weight is exceeded in nearly all armies. The French foot soldier carries 32.918 kilograms (72½ pounds), including four days' rations; the Prussian soldier, 28.240 kilograms (62¼ pounds), including eighty cartridges and three days' rations; the Italian soldier, 30 kilograms

(66 pounds); the Russian soldier 31.268 kilograms (69 pounds); the American soldier, 24.051 kilograms (53 pounds), with eight days' rations, 20 kilograms (44 pounds) only, with forty cartridges and without rations; the English soldier, 22.254 kilograms (49 pounds). The Swiss soldier, carries the weight above indicated, 25.076 kilograms (55 pounds).

Under these conditions the march will be felt so much the more if the man have not on his feet shoes perfect in every respect; for if we call to mind that the soldier carries from 18 to 20 kilograms (40 to 44 pounds) more than a man in common life; that he carries the greater part of it on his shoulders; that he increases the weight still more by personal accessories, such as his money, letters, pocket-book, pipe and tobacco, &c.; and that his knapsack getting wet weighs at least 500 grams (23 ounces) more, we shall easily be convinced that if it be necessary to diminish the weight of the whole burden of the soldier, it is still more so to secure for him a shoe fulfilling all the conditions desired to mitigate as much as possible this intolerable situation.

If the models of shoes that we present are not perfection itself—perfection, moreover, not being the fruit of human genius—they realize in every case considerable advantage over all styles known at the present time. Now, in a country where they wish to substitute the boot or the half boot, nothing is more easy than to furnish the boot with the same style of fastening as our buskin No. 1, and the half boot with the same fastening as our shoe. The style of fastening of this buskin and this shoe, applied to the boot and the half boot, is the means of getting around an inconvenience that nothing else can prevent. That is, to fit boots or half boots on young men of twenty years, when they have not yet attained their full growth and physical development. The result is easy to understand. At this age the feet continue to grow; then after a few months of service these boots necessarily become too small, too short, and too narrow, and the men can wear them no longer.

There is now a simple way of preventing this grave inconvenience, namely, by adopting the models of shoes that we have the honor of presenting; or of introducing into the boot an *inner* sole, of which we are about to speak.

The boot, besides, is far from being indispensable; it would be much better to dispense with it, because it requires much more leather than the buskin or the shoe, and we ought certainly to try to be economical in furnishing an article of clothing that wears out as rapidly as the shoe. Besides the boot, manufactured in advance, will always possess disadvantages that our models of buskins and shoes do not present. In summer it will be too warm; if it be not well fitted to the foot, if it be too small or too large, it will compress the foot immoderately, will wound it, or it will not stay on.

In countries where the boot is in use, they seek to meet the evil by issuing to the men generally boots much larger than their feet. They do not feel badly in summer because they give space for the increase of the size of the foot, but they make the walking heavy, and in winter,

or in soft ground, the feet slip around in the shoe and are wounded, or the boots remain stuck in the mud. The German army had such an experience during its maneuvers in the autumn of 1879.

We have already said, in Chapter V, that the use of an *inner* sole would be the means of preventing the points of the nails from penetrating the flesh. This inner sole could be made to overcome two faults of which we have just spoken, in the case boots become too small after a few months use on account of the growth of the feet; and in the case of boots too large *in the beginning*, which they have *purposely* issued to the men to allow for the increase in the size of the foot during great heat.

In the first case it is sufficient to take out the inner sole, when the soldier finds it necessary to have more room in the shoe; or to put it in large boots in proportion to the growth of the foot.

In the second, the inner sole should only be worn during winter, since it would be superfluous in a season of great heat, when, on account of their increase in size, the feet have no more room in the shoe than is necessary to them.

From both these points of view there is reason for having an inner sole to every shoe.

But, as we have already said, this sole ought to be of very smooth leather, and thick enough not to wrinkle from the effects of perspiration.

All other soles, and especially those of cork, offer only disadvantages and even dangers; for, when they are dampened by perspiration or by water, they maintain a constant moisture in the shoe.

Such are the numerous precautions to be taken with boots. It is reasonable, then, to weigh carefully the advantages and disadvantages of this covering for the foot before introducing it, or securing it for the infantry in particular. It would have to be kept in a depot during the summer, and only issued to the troops for winter.

For mounted troops the soft high top boots, with or without the system of fastening of our buskin No. 1, and our shoe, as a second shoe or resting shoe, appear to us to constitute sufficient covering for the foot.

Finally, as to engineering troops who are often required to work in the water or in soft ground, they must also have a high boot, but with thicker legs and without the *soufflet*, and they must have great care to render them impervious by greasing, as we have shown in the preceding chapter.

Whatever may be the style adopted for mounted troops and engineers, it is essential that it be given the form that we have sufficiently described, which will be very easy, since the models, patterns, and lasts necessary for that are already in existence, and the same conditions must be observed in the manufacture of this boot as we have required for the shoe of the foot soldier.