SOME FACTORS INFLUENCING THE LOAD OF THE SOLDIER.

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The subject of clothing and equipment, uninteresting as it may sound, is one which, in the hurly-burly of so many pressing problems, we might think could be left with safety in the hands of the Clothing and Ordnance Departments. This is an entirely wrong point of view.

The manner in which a soldier is clothed and equipped may, in fact actually does, govern the whole of his future conduct, and on that conduct the success or otherwise of operations may depend.

More work has, perhaps, been done on this subject than on any other in hygiene, yet in no other department has less regard been paid to scientific findings. It is over thirty years since it was decided that the optimum load for the infantry soldier is between forty and fifty pounds, and yet in the late war we found that the load of the soldier was always steadily creeping up; in many cases it was far beyond the optimum third, and in some cases it must have been periously near 75 per cent of his body weight.

Before criticizing this load and the causes which lead up to it, it is desirable to refer to Lothian’s article on this subject; he gives a complete story from the earliest times. This work of Lothian is not sufficiently known to the officers of the Corps. He cleared the way and laid the foundation, but the structure is far from being complete. One of the outstanding features in Lothian’s paper is the evidence he brings forward to show that the loads supposed to have been carried in other days by the soldiers were not in actual fact carried at all—that is in the case of the soldiers who were supposed to move, for the old encased soldier was not mobile.

The mobile soldier was surrounded by followers, including women, who did the carrying for their heroes.

In the South African War the official equipment was just over sixty pounds, but in actual practice this was greatly reduced by the soldier himself who threw away what he did not want.

The comment of an Italian, quoted by Lothian, is worth repeating. He says: “... having arranged a proper transport, independent of the railways ... they made the infantry march as they had never marched before, not paying much attention to whether the officers and men had their regulation baggage with them every day. By this means they were enabled to pursue and capture Cronje.”
It is the first few words of the extract that contains such a volume of good sense... "Having arranged a transport, independent of the railways"... What a text for a sermon! I shall return to this later.

The official equipment was revised in 1907 and reduced to 54\text{\textfrac{1}{2}} pounds; in 1908 the web equipment came in and the load rose to 59\text{\textfrac{1}{2}} pounds. With the outbreak of war the load received ever-increasing additions, until it became seventy to eighty pounds, varying with the season.

In considering this subject it is well to bear in mind the factors governing clothing and equipment. These are as follows:

1. The soldier's weight.
2. Climate.
4. Amount of work to be done, mobility.
5. Transport available.
7. Accessories for fighting.
8. Influence of gas.

It is under these various headings that the matter will now be considered.

(1) The Soldier.

It has been said that the idea of a soldier's optimum load being one-third of his body weight is no new one. We ought to have appreciated this fact long ago from our knowledge of animals. I doubt if a C.O. would ever permit the overloading of his pack animals, be they asses or elephants, yet that same officer loaded up his men far beyond their limit. It is a wonderful thing that though these men, unlike the beasts of burden, could complain, yet they rarely did.

It is obvious that clothing and equipment must be standardized. We cannot fit the load to the man, therefore we must fit the man to the load. This fact governs questions of weight and development of recruits, and it is universally recognized. Cathcart, Richardson and Campbell in their Report to the Army Hygiene Advisory Committee on the maximum load to be carried by the soldier, lay down definitely that the maximum load is 33\text{\textfrac{1}{3}} per cent of the body weight. This is no haphazard guess work. It is work, calculated by sound, well-proved and accepted methods. Taking a soldier of 135 pounds—a good, average weight for a young man—and allowing 14 pounds for his clothing and boots, we are left with a load of 31 pounds for actual equipment. At the moment, the weight of the load, excluding the weight of clothing is 41 pounds 6\text{\textfrac{1}{2}} ounces. If we add 14 pounds for the weight of clothing, excluding the greatcoat, we get 55 pounds 6\text{\textfrac{1}{2}} ounces. A man to carry this weight should scale 150 pounds. I submit that we do not get recruits of anything approaching that weight, nor are we likely to for several years. I put this period at a few years, as it is undoubtedly true that people who spent their youth or adolescent
periods of life during the war years, did lose something in their diet, especially fats and the like. Industrial classes suffered more in this respect than did the rural classes, and it is to be remembered that it is from the former classes that recruits come. In former days, the converse was the case. If the recruits are not forthcoming, and if we accept the above findings, as we are bound to do, it is absolutely necessary that the load must be reduced. This load includes, as fighting necessaries, the rifle and ammunition. Additional articles, which may amount to anything, will be referred to later.

Something must be done to reduce the expenditure of energy by minor adjustments, but these sink into relative insignificance when compared with the major problem. I refer to Cathcart and Lothian's work on the subject—"History of the War—Hygiene," vol. ii, and my own contribution to this subject, Royal Army Medical Corps Journal, January, 1926.

(2) CLIMATE.

The climate of the country in which troops are operating has a great influence, but modern warfare, being what it is, adequate allowance evidently cannot be made for this. True, clothing may be modified or reduced, but the necessaries for war remain constant, or depending upon the country, may actually increase. The influence of climate, temperature and humidity, on the dissipation of heat is obvious and only adds to the difficulties which may have to be met.

(3) NATURE OF WARFARE.

This is of importance, only in so far as it has a bearing on the other factors, i.e., variations of climate, quality of roads, nature of transport, and weapons of war employed, etc.

(4) AMOUNT OF WORK TO BE DONE.

The work of the soldier up to the present time has been described in one word—"marching." Every other part of his work is subsidiary to this. "It is his daily bread. Fighting is a luxury" (Lothian). His whole training is arranged with this end in view—to be able to march with a load to the scene of action, and having arrived there, to destroy the enemy. From every side we hear the cry, "Forget the last war; concentrate on mobility." Mobility has been described as the soul of warfare. Everything is considered in terms of mobility, except the unfortunate soldier, who remains about as immobile as possible without being buried under his own load.

There are innumerable examples in history of the success of mobility, and in the late war there are many and glaring examples of failure, due to lack of mobility. Armies were saved because an enemy had come as far as he could. He was no longer mobile, due perhaps to the exhaustion of the troops or to the lack of transport, especially for food. Want of food and
physical exhaustion produce the same result. At any rate, it was the loss of mobility due to some cause which was the deciding factor. It is surprising to find that towards the end of the war troops were able to march only some \(5\frac{1}{2}\) to \(7\frac{1}{2}\) miles under their existing loads, even under the stimulus of victory and chasing a wearied enemy. Mobility at the very time when it was a crying necessity was a lost art.

(5) **Transport Available.**

The well-known methods by which in the past attempts have been made to reduce the load are: (1) reducing the number and weight of individual articles; (2) carrying whatever is possible on transport. Of the first method, the abolition of the entrenching tool is an example.

Transport was available on liberal lines in the late war, yet it was always needed for something, presumably more important than carrying soldiers' equipment.

Can we hope for better things in the future? It is doubtful. True it has been arranged that greatcoats will be carried in transport, but I think all of us can conjure up visions of situations where every particle of transport will be required for far more important things than greatcoats, such as ammunition, food, wounded men, stores of various sorts.

Too much stress should not be laid on mechanical transport as we knew it in the late war. We may confidently expect developments in aerial transport, but with a large force involved, it is doubtful whether this would be of much use in the forward area. The anti-aircraft policy of the enemy would see to that, unless our superiority in this direction were overwhelming.

(6) **Nature of Roads.**

We have to consider the nature and extent of roads, for on these will depend the amount of transport which can be used, and the possibility of some transport being available for what might be called the physiological needs of an army, i.e., assistance in load-carrying. Roads can take only a certain amount of transport—that amount, I suppose, only transport experts can assess.

Although in this country a scheme of large arterial roads is being worked out, we cannot allow this to dominate our policy in countries where few, if any, such roads exist. Nowadays, of course, we are approaching an era when transport may be independent of roads, i.e., by using the air, or by using transport in the form of tanks. The tank idea is capable of great development in many ways, and we, of the medical services, must watch this and keep pace with these developments, so that we may avail ourselves of any advantages offered.
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(7) ACCESSORIES FOR FIGHTING.

Of these I am not competent to write. They include ammunition, rifle, bayonet, grenades, rocket apparatus, gas respirator, and a host of other articles which may conceivably be added to aid the fighting powers of the individual or to resist the inventions of the enemy. The point is that the staff should appreciate the fact that any additions can only be permitted when an equivalent weight has been discarded, or arrangements made for its carriage otherwise than on the soldier, that is to say, if the Staff wish the force to remain a mobile one, capable of striking at a moment's notice. I am still thinking of the mobility-soul-of-war theory.

(8) INFLUENCE OF GAS WARFARE.

It is difficult to discuss this subject, except in the most superficial manner, but, nevertheless, it is a factor which may quite well dominate any future situation and which may demand a considerable readjustment of our present ideas. The need for protective clothing, for example, may well call for some modification of our policy.

I have gone into these factors in order to show the difficulties which lie in the path of those who would seek to reduce the load. It is like the much-desired reduction in national expenditure where every reduction is opposed by the people it hits. Every reduction in load is going to hit someone or the theories or policy of some one, i.e., the soldier or G branch especially, with, of course, the physiologist always in the background, clamou ring for these reductions and resisting to his utmost any attempted increase.

Let us first consider the soldier's clothing. Can any reduction be made? Lurking in the background for the moment, but ready to spring with an irresistible force is public opinion, to which we may be forced to give in. This increases the difficulties, and it becomes our duty to educate public opinion.

As a first question, it may be asked: Is it necessary that the soldier should wear very thick underclothing? It may be the habit in industrial classes.

Why should not the soldier be taught to produce his own heat, instead of depending on many layers of thick undergarments? Thinner articles might not be so economical, but here is a case where it is clear that economical considerations should bow before physiological necessities. Ordinary people do not wear these thick undergarments. The "modern" woman has left the "thick-clad" age far behind, and is evidently healthier and stronger, as judged by physical achievements.

To come to details, I would suggest that the present under-drawers which weigh one pound should be replaced by drawers of a thinner material and of a pattern which does not reach below the knee. It is quite unnecessary to wrap the knees and legs with thick layers of material.
The important parts—the abdomen and the lumbar region—will still be adequately protected. Apart from this, loss of heat will be facilitated by the freer ventilation of the area round the knees, which will then have only the covering of the trousers, which will be quite sufficient. Many men now do not wear the regulation underclothing, preferring to buy thinner garments for themselves.

The question of the retention or not of the greatcoat is a vexed one, and the authorities have evidently compromised by retaining it, but legislating for its carriage in transport. I have already said something about the availability of transport under all circumstances. Supposing the transport on which the coats are being carried ceases, for some reason, to be available at a time when it is separated from the main body of men, a difficulty at once arises. Imagine too the difficulty which might arise in sorting out 800 coats at a given time. In an emergency we must meet situations as they arise. Some other protection must be given to the men in the form of a waterproof cape, if the principle of separating a man from his immediate belongings is accepted, which it has been.

I suggest that if such a cape as was used at the end of the War—a combined ground-sheet and cape—were used, the greatcoat might be dispensed with altogether. As a night wrap, its benefits might almost equal those of the greatcoat. The existing ground-sheet could then go. The weight of such a coat is less than half that of a greatcoat.

There is a need for some sort of a portable shelter in our Army, and if the force is to be a highly mobile one, that need will become more pressing, especially if such a force is not to be encumbered with heavy tentage. It is just possible that a shelter for two men might be made from two such cape ground-sheets, using small light poles as a support. Public opinion may conceivably be shocked at a proposal to abolish greatcoats, but this would appear to be a case where the subjective feelings of the soldier should ultimately influence public opinion.

That the soldier will only throw away such articles as encumber him at a time when his efficiency is the all-important feature, may be accepted. If, however, he has a light cape which he can dispose of in his pack or haversack, this tendency might be counteracted.

Smaller things may be considered for a moment. The cap-comforter is a doubtful comfort. It is objectionable, and is not used in wet weather by the men. If it is used at all, it must be a reflection on the lack of suitability of the cap, which, therefore, should be altered to make it suitable. The housewife might very well be reduced to one per company. Soldiers do not mend their socks as much as formerly, with the advent of cleansing and laundry units; and one repairing outfit at company quartermaster stores would be adequate for the work of sewing on buttons—which must be the chief function of this article.

Following on the introduction of a new emergency ration, a saving of a further one pound will be effected. But with a reduced available ration it is
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all the more necessary that adequate precautions should be taken to ensure food supplies. Increased mobility of the force will augment those transport difficulties, and if food transport suffers, then mobility must also suffer.

Further economies in the weight of the load which can be effected by lessening the weight of clothing and equipment mentioned, seem impossible, but the diminution of the load by the changes already indicated seem considerable.

The field ration is adequate for all purposes; the unconsumed portion will be carried as at present.

The only modification of equipment which can be suggested is in the pack, and in the sealed pattern—incorporated in the Mill's equipment—the idea seems to have been anticipated.

The question of the pattern of the pack and method of carriage is intimately bound up with the greatcoat question. The Mill's equipment consists of a pack in two separate parts—one presumably for the coat, though I have seen pictures of this equipment showing the greatcoat rolled and hung round the pack; the other part for the remaining articles which have to be carried in the pack. The greatcoat portion may be disregarded. How the greatcoats are to be carried in transport has not been indicated; but I presume a container is unnecessary.

With the proposed introduction of a new emergency ration, replacing the old bulky iron ration, the question of the pack will require revision. A feature of the Mill's equipment is the ease with which the packs may be detached, leaving the man with his ammunition, etc., ready for action. It is impossible to separate him from his emergency ration, which must, therefore, be carried in the haversack—which is intended. We are left, therefore, with the following articles for the half-pack:

<table>
<thead>
<tr>
<th>Cap-comforter</th>
<th>Holdall</th>
<th>Housewife</th>
<th>Mess-tin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-sheet</td>
<td>Socks</td>
<td>Soap</td>
<td>Towel</td>
</tr>
<tr>
<td>Oil-tin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total weight = 6 lb. 15½ oz.

If the cap-comforter, housewife and ground-sheet are discarded, the weight will be 2 pounds 13½ ounces, but it will be necessary to add the weight of a cape-ground sheet. This may be taken as equivalent to the present ground-sheet—total weight 6 pounds 9½ ounces.

The distribution of such a load as has been outlined will then be as shown in table on next page.

This is roughly a saving of four pounds on the existing weight, as laid down in official tables.

For purposes of balance, the lateral and front portions of the load may be considered as one. This gives a weight of 14 pounds 9 ounces against 12 pounds 7½ ounces on the back. The rifle, braces, etc., have been disregarded in the calculation.

This difference, if anything, is desirable, as such personal articles as
the soldier might desire would probably find a place in the pack, and so make the balance more perfect. At the same time the principle of higher carriage of the soldier’s load has been attained.

The only article which has not been legislated for is the blanket. The occasion when this would be required to be carried by the man would be in a special emergency, in which case it would be carried on the back in lieu of the pack.

Clothing (9 ½ oz. have been taken off the total weight laid down in Field Service Manual, 1924, on account of reduction suggested),

<table>
<thead>
<tr>
<th>Item</th>
<th>lb.</th>
<th>oz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Lateral Balance—Bayonet scabbard</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Haversack</td>
<td>1</td>
<td>9  ½</td>
</tr>
<tr>
<td>Unconsumed ration</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Emergency ration</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Water bottle</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Water</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Front—Ammunition and carrier</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Back-Pack (weight of half)</td>
<td>0</td>
<td>13  ½</td>
</tr>
<tr>
<td>Contents of pack</td>
<td>6</td>
<td>9  ½</td>
</tr>
<tr>
<td>Box respirator</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Steel helmet</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Rifle</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Waist-belt, braces, etc.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total weight</strong></td>
<td>51</td>
<td>4  ½</td>
</tr>
</tbody>
</table>

I have attempted to focus attention on the load of the soldier, as it compels consideration, for many are the ills which may be attributed to overloading. Every effort should be directed to obviate this in the future, and to render an army really mobile.

REFERENCES.


CATHCART and LOTHIAN. Quoted in "History of the War Hygiene," vol. ii, pp. 126-127.