WATER-BOTTLES AND MESS- TINS.

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Water-bottles and mess-tins are an essential part of a soldier's equipment.

In order to study the principal features of these important articles it will be convenient first to describe the various types which are, or have been, in use in the armies of the chief Powers.

WATER-BOTTLES.

Great Britain.—A water-bottle has been a regular constituent of the soldier's equipment for many years.

It appears that the troops that were sent to the West Indies in 1655 were not provided with this article. General Venables wrote home at that time: "Whoever comes to these parts must bring leather bottles, which are more needful than knapsacks in Ireland." These bottles were called "black-jacks."

One of the earliest types of water-carrier was the miniature wooden barrel which was in use for over a century (Plate I, fig. 3). The capacity of these barrels was about three English pints. They were supplied to the troops landing at Ostend in 1794, and were still found in use during the Peninsular War. Other early forms are stone bottles with short necks, and tin bottles.

The word "canteen" from early times was synonymous with "water-bottle." James in his "Military Dictionary," 1816, defines a canteen as "the tin vessel used by the soldiers on the march, &c., to carry water or other liquor in, each holding about 2 quarts.

During the Crimean War the water-bottle was made of wood and shaped like a child's drum (Plate I, fig. 2). There was no mouthpiece provided but simply a hole closed by a wooden plug or bung, secured by a catgut lace to the body of the bottle. It was painted a light blue colour.

1 Firth: "Cromwell's Army, 1622 to 1660." 1902.
2 Journal kept in the British Army from the landing of the troops under the command of the Earl of Moira at Ostend in June, 1794, to their return to England the following year. Printed for the author by Merritt and Wright, Liverpool, 1796.
In India, during the Mutiny, ordinary glass soda-water bottles covered with leather were in use (Plate I, fig. 1). The extremely small capacity of these bottles is worthy of note.

General Eyre’s Committee on Equipment (1864) recommended the adoption at home of a strong flat glass bottle instead of the Crimean type, which was then still in use. Trials made with some of the flat glass bottles used by the Prussians at that time proved them to be unsuitable.

At the end of 1873 the Italian pattern wooden bottle was introduced and remained the official pattern for the next twenty years. It is to-day the delight of many boy-scouts. In section it was an oval flattened on one side, narrow hoops of metal surrounded the ends and in the original type a metal band joined the two hoops on the oval face. The bottle was closed by means of a metal screw stopper which was pierced by a hole plugged with a wooden peg. The bottle was first carried clipped to the belt, but later the usual method of suspension from the left shoulder was adopted.

In the Afghan Campaign of 1880 tin bottles covered with canvas were used (Plate I, fig. 4). Enamelled iron water-bottles were first officially introduced in November, 1894. There have been four definite types of these bottles. The first two were circular and flat, the earlier retaining the old pierced screw stopper, which was replaced in the second by a cork and chain (Plate II, fig. 10). The two later types are rectangular and flat, but not so thin as the
circular type, while in addition the inner surface of each is shaped to the body.

The earlier of these had a cup-shaped mouth (Mark V), but as this was found liable to collect dirt it was removed in the later pattern (Mark VI), which is the bottle now in use (Plate II, fig. 11). Both patterns have as a stopper a cork attached by a cord to the neck. All the enamelled bottles described have a non-detachable felt covering weighing in the present type 2 oz. The felt used weighs 1 lb. 14 oz. per yard of 52 in. width. The specification directs that the present bottle should be made of the best charcoal iron plate or of best steel plate perfectly enamelled over the whole surface both inside and outside. Until the introduction of the web equipment (1908) these bottles were carried over the right hip suspended from the left shoulder, but the web carrier for the bottle is attached to the belt.

<table>
<thead>
<tr>
<th>Type</th>
<th>Date</th>
<th>Weight with straps</th>
<th>Capacity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooden barrel</td>
<td>Peninsular War</td>
<td>1 9\frac{1}{2}</td>
<td>1,685</td>
<td>59\frac{3}{4} in., diameter at extremities 44\frac{1}{4} in., Breadth 4 in., diameter 7 in.</td>
</tr>
<tr>
<td>Wooden drum</td>
<td>Crimea</td>
<td>1 7</td>
<td>1,670</td>
<td>58\frac{7}{8} in.</td>
</tr>
<tr>
<td>Leather-covered glass</td>
<td>Mutiny</td>
<td>1 8\frac{1}{2}</td>
<td>430</td>
<td>15\frac{1}{8} in.</td>
</tr>
<tr>
<td>Tin (India)</td>
<td>1880</td>
<td>1 3</td>
<td>1,240</td>
<td>43\frac{6}{8} in.</td>
</tr>
<tr>
<td>Wooden, Italian pattern with hook</td>
<td>1873</td>
<td>1 0\frac{1}{2}</td>
<td>770</td>
<td>27\frac{1}{8} in. and with a canvas strap.</td>
</tr>
<tr>
<td>Do. with strap</td>
<td></td>
<td>0 14\frac{3}{4}</td>
<td>720</td>
<td>25\frac{3}{8} in.</td>
</tr>
<tr>
<td>Enamelled iron</td>
<td>1894</td>
<td>1 2\frac{1}{4}</td>
<td>930</td>
<td>32\frac{7}{8} in.</td>
</tr>
<tr>
<td>&quot;</td>
<td>Mark V.</td>
<td>1 5\frac{1}{2}</td>
<td>1,100</td>
<td>38\frac{7}{8} in.</td>
</tr>
<tr>
<td>&quot;</td>
<td>Mark VI.</td>
<td>1 7\frac{3}{4}</td>
<td>1,170</td>
<td>41\frac{2}{8} in.</td>
</tr>
<tr>
<td>Aluminium</td>
<td>1912</td>
<td>0 15\frac{3}{4}</td>
<td>1,200</td>
<td>42\frac{4}{8} in. Present pattern. Present pattern, same as Mark VI.</td>
</tr>
</tbody>
</table>

Experimental aluminium bottles have been on trial for some two years. The earlier types were small (30 oz. capacity), one such bottle was flask-shaped and had a detachable felt cover. It was carried in a little canvas bag suspended from the belt in the same manner as the web cage of the present water-bottle. The latest type is a reproduction of the ordinary Mark VI pattern both in size and shape.
There is no official drinking cup, but the white enamelled mug usually carried by troops on manoeuvres is provided regimentally. Many native regiments in India have adopted some form of aluminium water-bottle (Plate II, fig. 9).

France.—On the Continent in early times skin bottles were carried, and we find Marshal Saxe advocating their use instead of the barrel. In the Peninsular War the French copied the Spanish goat-skin bottle.

Carré records that "In 1778 a petit bidon was distributed to each man; one grand bidon was allowed per tent; two serjeants per company carried a grand bidon of vinegar." Napoleon's army encamped at Boulogne in 1802 was supplied with the bidon. Its capacity was 1 pint, and it was to be carried on the knapsack. There seem to have been complaints that these bottles became rusty and that the contents were thus spoilt. It is also recorded that the soldiers threw them away when they began the march from Boulogne. Later in 1808 ½-pint glass bottles covered with straw were tried. The present bottle (Plate II, fig. 4) is made of block tin with a detachable cover of blue-grey cloth which laces up. The mouth is closed by a cork attached to a string which secures it to the neck. There is a second and smaller opening closed by a wooden plug which acts as an air inlet when the contents are being drunk. This bottle is carried by a narrow leather strap over the right shoulder and rests on the left hip, to which it is shaped. A small round tin drinking-cup is strung on this strap or carried in the haversack (étui-musette).

Trials have recently been made of flask-shaped aluminium bottles with corrugated sides. A cup fits over the bottom, which can be used to boil water. These bottles are no longer carried by a strap across the chest, but are suspended from the equipment.

There is a larger pattern of "bidon" issued to troops serving in Morocco, which holds 2 litres (70 oz.).

Germany (Feldflasche).—This article was only introduced into the Prussian Army in 1867. Until the last decade it was made of thick glass (Plate II, fig. 3) covered with black leather, having a metal cup which fitted over the bottom. The mouth was closed

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1 Saxe: "Reveries or memories upon the Art of War." 1757.
3 Jean Morvan: "Le soldat Impérial, 1800 to 1814," vol. i, 1904.
by a loose cork. It carried a swivel spring hook, by which it was attached to a ring on the haversack. It was flask-shaped and flat on both sides. The present pattern (Plate II, fig. 2) is also flask-shaped, but the inner side is slightly concave. The capacity is nearly double that of the old pattern. It is made of aluminium, and has a detachable felt cover fastening by push buttons. The mouth is closed by a metal screw cap attached to the neck by a chain. It is carried in the same way as the old pattern, and its movement is limited by a leather loop on the flap of the haversack through which the suspending strap passes. An oval-shaped aluminium drinking cup (trinkbecher), with a capacity of 250 c.c. (8½ oz.), is carried in the haversack (Plate IV, figs. 5 and 6), and has a pair of collapsible handles shaped to fit the sides.

**Austria.**—Formerly a glass bottle with a cover of tinned iron was in use; it was carried by a strap over the shoulder. This was followed by a pattern made of enamelled iron, covered with cloth and carried in the haversack. The present pattern (Plate II, fig. 1) of aluminium is also carried in the haversack in a pocket specially provided for it. This pattern is flask-shaped, and has no cover, the outer surface being ribbed for strength, while the inner surface is concave. It is closed by a cork attached to the neck by a leather thong.

**Russia.**—Formerly the Russian soldier carried a wooden bottle with zinc hoops. The pattern now in use (Plate II., fig. 6) is made of aluminium, and is flask-shaped. There is a detachable grey felt cover lacing up by means of a leather thong. The opening is closed by a loose cork. The method of carriage is from a very narrow (1 in.) canvas sling over the right shoulder, the bottle resting against the outside of the large haversack. Within the haversack there is a small aluminium cup.

**Italy.**—The bottle used in Tripoli to-day is identical with the “Italian pattern” adopted by Great Britain in 1873, and already described (Plate II, fig. 7). A small tin mug is carried.

**Norway.**—An aluminium flask-shaped bottle with a detachable grey felt cover which fastens up by push buttons is carried by a narrow black leather strap over the left shoulder. The cork has a metal top, carrying a loop, by means of which a leather thong secures it to the cover (Plate II, fig. 5).

**Sweden.**—The present 1906 pattern is made of green glass, the bottle is flask-shaped, with a flat bottom. One side is concave. There are three types of stopper, and commanding officers may choose the one they prefer.
Types of Stopper: (1) White porcelain stopper and rubber ring fixed by a wire catch; (2) glass stopper ground to fit the mouth, and also secured by a wire catch; (3) cork attached by leather thong to the neck.

Turkey.—The water-bottle is identical with the present German pattern, except that a cork replaces the screw stopper.

America.—The 1907 pattern of bottle was made of tinned iron, and shaped somewhat like a double convex lens, with the side towards the body somewhat flattened. It was protected by a layer of felt, over which was sewn a canvas duck cover. It was carried attached to one of the eyelet holes on the edge of the belt by a swivel spring hook (Plate VI, fig. 6). A large tin mug (Plate VI, fig. 2) was carried in the haversack, which was later replaced by a smaller one made of aluminium (Plate VI, fig. 4).

Lately an aluminium bottle has been adopted (Plate VI, fig. 7). It is flask-shaped, with a flat bottom, over which a cup fits. This cup (Plate VI, fig. 9) has a folding handle which, when opened and fixed in position, increases the stability of the cup. The nested water-bottle and cup are inserted in a canvas felt-lined receptacle (Plate VI, fig. 10), secured in position by two turn-screws. The whole is carried attached to the belt on the right side by means of the new “double-hook” attachment.

Japan.—This country uses a gourd-shaped aluminium bottle, with a flat bottom. There is no covering, and it is carried resting against the outside of the haversack in a net of leather straps, by a narrow strap over the left shoulder. The bottle is painted khaki colour (Plate II, fig. 8).

Mess-tins.

Great Britain.—Our mess-tins must be made of prime tin plate, the tin coating of which must thoroughly cover the whole surface. No pattern is to weigh more than 1 lb. 5 oz., and each is to be clearly and legibly marked with the name of the contractor and the year in which the supply is made.

The present pattern of infantry mess-tin (Plate V, fig. 5) has been in use for many years, unchanged except for the removal of a tray which in the older patterns fitted into the top of the tin.

In cross section it is almost semicircular (4½ by 6½ in.), one side being flat. The body is made of several pieces jointed together. Along the upper edge on the outside four brass loops are attached at intervals. A brass wire handle is secured to two ears riveted on the sides. The lid is detachable and has hinged
PLATE II.

WATER-BOTTLES:

1. Austrian.
2. German, New.
3. Old.
4. French.
5. Norwegian.
6. Russian.
7. Italian.
10. Great Britain, Old.

Weights and Capacity, see Table II.
to it an iron wire handle enabling it to be used as a frying-pan. For packing the handle folds into the lid.

Formerly the tin was issued with a cover. In the old valise equipment (1882) the cover was made of black waterproof material and the tin was carried on the top of the valise. In the valise equipment (1888) it was carried on the top of the greatcoat roll and below the valise. In the bandolier equipment, 1903, it was secured to the waist-belt at the back and the cover was made of khaki canvas. With the present web equipment, 1908, no cover is provided and it is carried in the pack.

The cavalry mess-tin consists of two round pieces (6 ½ in. diameter), the lid which is saucer-shaped and the bottom which is cup-shaped. The bottom has a tinned wire handle similar to that attached to the lid of the infantry pattern. It is made of stouter tinned plate, but being of smaller capacity the weight is the same. Each half is blocked out of a single piece of plate and thus all joints are avoided. Experimental aluminium mess-tins for infantry are at present on trial; they are similar in pattern to the old German tins with a loose handle.

Collective Utensils.—Formerly such utensils were in use in the British Army and were carried by the men in the Peninsular War as the following order of the Duke of Wellington's shows:—

G. O.
Fremantle,
March 1, 1813.

(1) The Commanding Officers of Regiments of Infantry are immediately to make requisitions on the Commissaries—for tin camp-kettles to be substituted for the iron camp-kettles.

(2) Numbers are to be, one for every six N.C.O's. and men.
Each kettle to have a bag—kettles to be carried on the march alternately by the men and not on mules as heretofore.¹

In the Crimea a large collective camp-kettle (Torrens pattern) appears to have been carried on the top of the knapsack by some men. The report of the Panmure Commission records that "on the march from the Old Fort to the Alma and during the battle most of the men threw away or lost their camp-kettles. Some divisions did not preserve even one in ten of the regulation number, viz., one to every five men." When the army arrived before Sebastopol each man had to cook in his own mess-tin. Camp-

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kettles were supplied in January, 1855. Every eighth man of the Camel Corps during the Egyptian War of 1884-85 carried one of these Torrens kettles.

France.—The French infantry are peculiar in that some of the men carry on the person besides an individual mess-tin larger cooking utensils (collective utensils). Until recently the individual mess-tin (gamelle individuelle) was in the shape of a truncated cone (diameters, top 6.2 in., bottom 5 in. and depth 3 to 5 in.) and held somewhat over a litre (35 oz.) (Plate III, figs. B 1, and B 2). The lid was permanently attached to the body by a chain. It was made of tinned iron and the body was blocked out of a single piece of metal, soldering being thus avoided. This utensil was carried on the top of the knapsack resting on the camp shoes and inclined backwards so as to inconvenience the soldier in the prone position as little as possible. It was retained in position by the "load strap" which passed through two small folding handles on its body. In 1888, the collective utensils were abolished and the individual mess-tin replaced by one of larger size known as the "nécessaire Bouthéon."

The adoption of these mess-tins resulted in a reduction of the weight carried, which, however, was very small, 186 grm. (6½ oz.). Further, the abolition of the collective utensils enabled this mess-tin to be carried on the flap of the knapsack, thus reducing the hitherto inconvenient height of the load. In 1891 the original arrangement was reintroduced. To-day the French are falling into line with other nations and have relegated collective cooking utensils to the transport. An aluminium mess-tin (now called marmite individuelle or marmite de campement) with a capacity of 3 litres (5½ pints) is now carried by each soldier on the flap of his knapsack.

Collective Cooking Utensils.—Camp-kettles or boilers (grande marmite) date from 1802, when Napoleon introduced them and allowed eight per company when in camp. In recent years every fourth soldier carried a grande marmite (Plate III, fig. 1). It was kidney shaped in section and the lid had a socket for a handle enabling it to be used as a frying-pan. The principal dimensions were: depth 11½ in., longitudinal diameter 9 in., capacity 6 litres (10 pints 10½ oz.). A wire handle was attached to the body, which

2 Morvan. loc. cit.
folded flat against the side. It weighed 3 lb. 2½ oz. and was made of tinned iron.

Large mess-tin or pan (grande gamelle) one to 8 men (Plate III, fig. 2). This was similar in shape to the small mess-tin but without a lid. Dimensions, depth 4½ in., diameters, top 12 in., bottom 8½ in., capacity 5 litres (8 pts., 15 oz.). It was lighter by one pound than the kettle and was made of the same material.

Coffee-mills, one to 30 men (Plate III, fig. A2). This utensil is still carried on the person within the knapsack and is now made of aluminium. The original tinned iron type was in four parts, handle, mill, strainer (filtre klepper, Plate III, fig. A1), and a cover fitting over the bottom of the strainer. The strainer is shaped like the gamelle individuelle, within which it fits. From

PLATE III.

FRENCH UTENSILS.

1. Camp-kettle or boiler (grande marmite)
2. Large mess-tin (grande gamelle)
A1. Coffee-mill, strainer (filtre klepper)
A2. Side view of coffee-mill
B1, B2. Two views of the individual mess-tin (gamelle individuelle).

Napoleonic times until 1884 a 6-litre (10 pts., 11½ oz.), a grand bidon was carried; this clumsy and heavy utensil was then replaced by a canvas bucket.

Germany.—Aluminium has been employed for some time for the mess-tin (Kochgeschirr). Formerly a somewhat heavy (1 lb. 10 oz.) tinned iron pan holding 2½ litres (4½ pts.) was in use. This article was kidney-shaped in section and stood 7½ in. high and had a strong wire handle. On the adoption of aluminium the same shape and size were retained with a saving of 12 oz. in weight. A metal
piece was carried loose in the tin, which acted as a handle to the lid when used as a frying-pan, or as a hook by which the tin was suspended over the fire from its handle. The tin has now been reduced in capacity by 500 c.c. (17½ oz.) and is somewhat stouter in make (Plate IV, fig. 1). The edge along the bottom of the lid is so shaped that it will fit on to the body so that the lid when containing food can still act as a cover. A handle hinged to the lid (Plate IV, fig. 4) folds down flat against the side, in which position its extremity grips the bottom of the tin. The handle may be lengthened by the insertion of a stick into a D fixed at its end. Across the top of the body a combined fork and spoon is carried resting on two small projections (Plate IV, figs. 2 and 3). The interior of the body is marked off into ¼-litre divisions. Its wire handle folds down under the bottom. The outside is blackened all over. Each man carries one of these tins strapped to the flap of his knapsack by two straps, one of which, passing through a perforation in the handle, prevents the whole from slipping sideways.

Austria.—Mess-tin (Kochgeschirr), one to two men (Plate V, fig. 2). This is a heavy utensil in shape a cylinder with oval section made of strong tinned iron. It consists of three pieces, a lid with a hinged handle for use as a frying-pan, a body with a wire handle and a shallow dish with two collapsible handles fitting over the bottom of the body. Placed in a brown canvas bag it is carried on the flap of the knapsack, where it is secured by means of straps which engage flanges on the lid and the handles on the dish.
Water-bottles and Mess-tins

Water can (Wasserkanne), one to eight men (Plate V, fig. 1). The can is made of tinned iron shaped as the mess-tin but with a spout, and has the usual wire handle. Half the top is permanently covered in, the remaining half being closed by a hinged lid. The spout also has a small hinged cover. It is carried in a similar way to the mess-tin in a brown canvas bag.

The introduction of an individual tin is contemplated.

Russia.—Attached to the outside of an old Russian leather rucksack in the College Museum there is a very heavy iron mess-tin (2 lb. 13 ½ oz.). It has a lid and handle and is painted black. In shape it is a flattened cylinder standing 8½ in. high, with a capacity of 5 pts. 14 ½ oz.

PLATE V.

Various Mess-tins.

1. Austria. Water-can, one to eight men.
2. Austria. Mess-tin, one to two men.
4. Italy.
5. Great Britain Individual mess-tins.
6. Russia.

The present tin is in shape a truncated cone and is made of aluminium (Plate V, fig. 6). It replaced the old mess-tin of copper which weighed over a pound more, but is identical in other respects. Aluminium was officially adopted in 1897, but there were some units still using copper mess-tins in Manchuria in 1905. This tin is peculiar in having no lid and it is carried over the ends of the greatcoat roll.

Turkey.—A large, round, flat, copper cooking utensil, not unlike the grande gamelle of the French Army, is carried by every tenth man strapped to the outside of his knapsack.
Italy.—The mess-tin is of tinned iron and kidney-shaped in section. The bottom of the body is rounded. (Plate V, fig. 4).

Norway.—There is only one mess-tin to two men. This is a heavy utensil made of tinned iron. The hinged handle of the lid has upon it a D through which the strap securing it to the flap of the rucksack passes. The tin is carried upright. (Plate V, fig. 3).

Sweden.—Each man carries an aluminium mess-tin similar in pattern to the German tin. It is made of stouter metal, the lid being 1½ oz. heavier than the German lid. The hinged handle of the lid has two collapsible rings on it through which a stick may be inserted. The stick serves a double purpose, viz., it lengthens the handle and serves as a non-conductor of heat. Along the wire handle of the body slides a large wire hook which enables the utensil to be slung from a point at some distance above the fire. There is a D on the body of the tin over which a slot in the lid handle fits. Through this D and over the handle passes the strap securing the tin in an upright position to the knapsack flap.
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U.S.A.—The Americans can hardly be said to carry a mess-tin; it is rather a small oblong (Plate VI, figs. 5 and 8) frying-pan of aluminium with a cover which serves as a plate (Plate VI, fig. 3). The pan portion has a hinged handle (Plate VI, fig. 1) which turns down over the cover gripping the other side of the pan with its free end thus securing the cover in position. Until recently this was made of tinned iron. In the 1907 equipment the mess-tin was carried in the outer flap of the haversack which was then suspended from the belt. In the new equipment there is a special pocket for it on the outside flap of the haversack, which is now worn as a knapsack.

Japan.—The usual kidney-shaped aluminium mess-tin has been adopted, and this is painted or japanned khaki. A small dish fits into the top of the tin as in the older patterns of our own mess-tin. No means are provided to enable the lid to be used as a frying-pan. There is the usual folding wire handle. It is carried upright fixed to the flap of the knapsack by the load strap which passes through a D riveted to the outer convex side of the tin. Marks on the inside of the tin show the quantities of water required to cook one or two meals of rice. The tray carries the fish and condiments and the body will hold one day's ration (3 meals) of uncooked rice. Some units in Manchuria also carried on the person above the mess-tin an oval saucepan with a semi-circular handle at each side.

Conclusions.

Water-bottles.

The Method of Carriage.—A strap across the chest is in all cases objectionable; hence it is better to attach the bottle either to the belt or the haversack. In one case (Austria) it is carried inside the haversack—a practice not to be recommended, owing to the possibility of leakage. Care should be taken so to secure it in position as to avoid all possibility of its bumping against the body.

Accessibility.—It is probably better that men should not be able to drink from their water-bottles when actually marching; on the other hand, the bottles should be easy of access at a short halt. In a temperate climate, when men should only require to drink at the long halts, accessibility is not so important since equipment is always removed at these halts. In the rucksack equipment of some Gurkha regiments the bottle is carried attached to the outside of the rucksack, and, without the help of a comrade, is only accessible by complete removal of the kit. Although our
own bottle conforms with the first requirement, when properly buttoned into its case it is awkward to remove and replace in its carrier, especially if this latter be wet. The swivel attachment of the German pattern and the double-hook attachment of the new American bottle are superior in this respect—though, possibly, the bottles are so easy of access as to be detachable on the march. It is, perhaps, impossible to combine both of the above requirements in one method of attachment.

Capacity.—The most suitable capacity can be arrived at in the following manner. Even under the most unfavourable conditions, where the heat regulation is dependent entirely on evaporation, a man should not need to have recourse to his water-bottle till half an ordinary march of fourteen miles has been completed. During this time he will have lost a certain amount of water by evaporation, and from this point onwards he will continue to lose; and though a certain amount of loss is permissible without immediate replacement, still there must be some point below which the water content of the body cannot be allowed to fall without danger.

The amount of water lost by a man varies with the climatic conditions, and, further, the well-trained soldier loses water less rapidly than the untrained man. Therefore any estimation of water loss must necessarily vary widely according to circumstances.

It has been found practically that the average water loss during a seven-mile march amounts to 1,129 grm. The total amount of water present in the body of a 10-stone man is equivalent to about two-thirds of his body weight—93 lb., or rather over 9 gallons. Of this it is dangerous for him to lose as much as one-tenth, and any loss approaching one-twentieth must be replaced at a fairly early moment if efficiency is to be retained.

On a give-and-take road ninety calories are expended per mile, and each calorie represents a water loss of about 2 c.c. Hence the water loss per mile is 180 c.c., or 1 litre in six miles.

One litre (35 oz.) should therefore be amply sufficient for an ordinary march (fourteen miles), and a water-bottle should hold this amount. The British, American, and French bottles are of this capacity.

If the march is prolonged beyond the ordinary limit (fourteen miles) a special allowance of 1 litre must be given for every six
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miles covered. With a 1-litre bottle this means the water-carts need only be indented on once in two hours, a comparatively easy matter now they are first-line transport.

Material.—Wood is distinctly objectionable. Unless the interior is coated with lac the wood imparts a taste to the water. Wooden bottles cannot be sterilized by fire, always tend to leak, and are necessarily clumsy in shape. The only point in their favour is that they keep the contents cool. The weight of glass and its fragility prohibit its use, though its immunity from chemical action is a strong point in its favour. Of the metals, tinned iron tends to rust unless enamelled, but enamelling greatly adds to the expense and tends to chip. The block tin bottle of the French is free from such objections and until the introduction of aluminium the material of this bottle was probably the best for the purpose. Almost all the Powers now employ aluminium in the manufacture of their water-bottles and its use will be discussed later in this paper.

Shape.—The following points should be noted: A flat bottom is useful so as to enable the bottle to stand alone; the inner surface should be concave to fit the body; the bottle should be flat so as not to interfere with the swing of the arm; the mouth should be shaped so as to make drinking comfortable; an extra air-hole such as is found in the petit bidon of the French facilitates drinking; finally the shape should be convenient for cleaning out, hence rounded corners are best.

Stoppers.—The metal screw top attached by a chain to the neck of the German and American bottles is a good method of closing the mouth, but it is liable to jam if screwed on carelessly or if there are great variations in temperature. Corks deteriorate and are easily lost. In the British water-bottle the cork can readily be changed as the metal pin which perforates is detachable.

Major Faichnie\(^1\) has described a bottle with a press lid, detachable felt cover and a patent dust-proof stopper. He claims that this bottle can be kept thoroughly clean and that water can be boiled in it if required.

Covering.—A covering prevents the bottle clanking and glinting in the sun, and it may be moistened so as to cool the contents. The best material to use is felt. It is advisable that the cover should be detachable and a leather thong lace is superior to push buttons to secure the cover, since the latter get out of shape when

\(^{1}\) Journal of the Royal Army Medical Corps, vol. vii, 1907, p. 251.
trodden upon and will not fasten. If the cover is not detachable\(^1\) like our own, the bottle cannot be used to sterilize water by boiling. It is noticeable that the Japanese and Austrians have no cover.

*Cleansing and Sterilization.*—The following regulations deal with these points: King’s Regulations, 1912, para. 1720 states that water is not to be kept in water-bottles when the bottle is not in use. Field Service Regulations (1909), Part I, para. 46 (4) draws attention to the necessity of cleaning water-bottles out and scouring them with boiling water, or chemicals provided for the purpose may be used. In the “Field Service Pocket Book” (1911), Chap. 2, Sec. 12, (5), it is recommended that bottles should be cleaned out with a mixture of 16 gr. of potassium permanganate to 1 gallon of water, or roughly 1 teaspoonful to 3 gallons. The washing with this mixture should be continued until the fluid comes out pink.

In the field it is probable that no chemicals will be available and also that boiling water in sufficient quantities to cleanse thoroughly and to sterilize bottles will be difficult to obtain. In this case, as recommended in “R.A.M.C. Training” (1911), the bottles should be filled with hot tea as near boiling point as possible and then placed aside if possible for one hour. Scouring with sand or gravel should be avoided as instead of cleansing further contamination may result. A bottle in which water can be boiled such as the American or Japanese type is excellent.

**Mess-tins.**

In order that the food when distributed may be used to the best advantage it is necessary that it should be well cooked and eaten hot. This will render it more palatable and assimilable and hence will enhance its energy value.

On active service the soldier should be able to cook his food quickly, wherever he happens to be, and at any time of the day. If it were necessary for him to wait for the arrival of the transport on many occasions he would be deprived of a hot meal. It is therefore advisable for each man to carry on his person some utensil for cooking. Travelling kitchens, although being generally adopted, can never enable the soldier to dispense entirely with the individual mess-tin, as such kitchens are liable to the same accidents as all transport. Further the mess-tin provides a suitable means of

\(^1\) See *Journal of the Royal Army Medical Corps*, vol. ix, 1907, p. 294, for a method suggested by Captain Tate of making the cover detachable.
<table>
<thead>
<tr>
<th>Country</th>
<th>Water-bottles</th>
<th>Mess-tins</th>
<th>Drinking Cups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Material</td>
<td>Weight of bottle only</td>
<td>Weight complete with cover and straps</td>
</tr>
<tr>
<td>Great Britain</td>
<td>(1) Enamelled iron</td>
<td>445 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td></td>
<td>(2) Aluminium (experimental)</td>
<td>210 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td></td>
<td>(3) Aluminium (experimental)</td>
<td>180 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>France</td>
<td>Block tin</td>
<td>326 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Germany</td>
<td>Aluminium</td>
<td>176 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Austria</td>
<td>Aluminium</td>
<td>193 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Norway</td>
<td>Aluminium</td>
<td>147 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Italy</td>
<td>Aluminium</td>
<td>275 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Russia</td>
<td>Aluminium</td>
<td>156 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>U.S.A</td>
<td>Aluminium</td>
<td>304 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Japan</td>
<td>Aluminium</td>
<td>161 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Sweden</td>
<td>Aluminium</td>
<td>300 gm.</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Aluminium</td>
<td>326 gm.</td>
<td>1 oz.</td>
</tr>
</tbody>
</table>

Remarks:
1. Present pattern Mark VI.
2. New marmite individuelle, wt. with handle.
3. Flask-shaped pattern.
4. Weight of mess-tin with loose handle.
5. One mess-tin to two men.
6. Weight of water-bottle includes cup.
7. Wooden and tin cups were also used in Manchuria.
N. Dunbar Walker 437

carrying the unexpended portion of his meat ration and also some utensil is necessary for each man in which to receive his portion from the travelling kitchen or from any collective utensil used to prepare his food. It is in addition the only substitute for a plate available in the field. Every country provides an individual mess-tin except Norway and Austria, in which countries every other man carries a tin for two. The latter country is now considering the adoption of the individual mess-tin.

Many of the remarks made concerning water-bottles obviously apply equally well to mess-tins. They should not catch the eye, and to avoid this most aluminium utensils are blackened, except the American, which is carried in a specially provided pocket, and the Russian and Norwegian, which have no special covering, but would probably become blackened after a few days' use in the field. The tinned iron mess-tin of the Austrians has its special brown canvas bag. Almost all mess-tins are now made of aluminium, and the points bearing upon its employment are discussed under the heading of Use of Aluminium.

Shape.—The most universal continental type is deep and kidney-shaped in section, having the lid fitted with a hinged handle. Our own mess-tin is not so deep and hence is of smaller capacity (2 pints). The size of the present 4 and 5-pint experimental aluminium utensils is preferable, though probably so large a capacity as 5 pints is unnecessary and utensils of this size have been found in practice to be rather bulky for the pack. There is also difficulty in eating from them on account of their depth. There are disadvantages in having too low a handle when manipulating the tins over a fire. It is to be noticed that the body handle of our tin is particularly low, due to the fact that the tin is so shallow and the handle must fit the bottom closely for packing. All the hinged lid handles must also necessarily be short and are very liable to become too hot to hold. The lid and body handles of the Swedish mess-tin have two convenient additions already noted to overcome these difficulties, namely, a hook on the body handle and rings on the lid handle through which a stick can be passed so as to lengthen the handle. When water is boiled in a deep tin ebullition occurs first on the surface and care must therefore be exercised that the whole contents are brought to the boiling point, especially if complete sterilization of the contents is important.

Method of Carriage.—Our mess-tin is carried at present in the pack and thus forms part of the "marching equipment," which may be left behind on going into action or when any rapid move
is in progress. When we consider the conditions which obtain in modern warfare there must be occasions when its absence will be felt and, if possible, it seems better that the soldier should not be separated from this article. In actual practice all regimental authorities are agreed that the men must not be separated from their packs unless it is absolutely unavoidable, e.g., where the men are worn out.

The only exceptions to this rule are the regimental scouts and the men of the machine-gun detachment. There is no provision for the carriage of the packs of the former, but those of the latter are carried in the limbered wagon.

The Americans provide a special pocket for the mess-tin in the "fighting" portion of their new equipment. It will be remembered that Stonewall Jackson's men retained their frying-pans even after all equipment save rifle and ammunition had been cast away, a favourite method of carriage being by inserting the handle into the rifle-barrel.¹ The Russians,² during their campaign in Turkey of 1877-78, were often separated from their knapsacks for long periods, but never parted with their little copper cooking pots which were normally carried fixed to their knapsacks. During their campaign in Manchuria³ they frequently left greatcoats, tent sections and kit-bags on the ground when advancing to the attack, and on those occasions the mess-tins must have been left on the greatcoat roll. When the Japanese discarded their knapsacks during the same war, before an engagement, the mess-tin was never left behind. It was invariably secured to some part of the remaining equipment, such as the cloth holdall which replaced the knapsack, usually by means of string.

*Collective Utensils.*—The collective utensils of the French Army are the best examples of an equipment of this type, though Norway and Austria carry a mess-tin for two, and one man in ten of the Turkish infantry carries a large utensil. The advantages claimed for such an arrangement are that food is better prepared, less fuel is required, the common pot engenders comradeship and the group of men belonging to each pot is under better supervision. On the other hand, the common pot has the disadvantages that the utensil is very heavy and cumbersome and difficult to

³ Official Reports, Russo-Japanese War.
⁴ Lavisse, "Sac au Dos," 1902.
attach to the knapsack and that if its carrier is killed, wounded or taken prisoner his mess suffers the loss of the pot.

Further, it is doubtful whether fuel is saved; in the smaller tins cooking is done quicker, and if several men cook round one fire, one of them boiling water, one cooking meat and another vegetables, the idea of comradeship is still fostered.

Drinking Cups.—The infantry soldier of many continental armies (see Table II) carries one of these articles, which are, however, not officially issued to our army. They are a convenience which appears indispensable since they are always carried, being provided regimentally. If a man drinks directly from the bottle no estimate can be arrived at of the amount he has drunk, but by the use of cups control of the amount of water drunk during a march could be secured. Probably it would be better to issue them officially and replace the enamelled iron mug now used.

The Use of Aluminium.

Historical.—The French seem to have been the first seriously to experiment with aluminium for the manufacture of these articles of equipment, a Commission being appointed in 1892 to inquire into its suitability [1]. A considerable number of such articles, 15,000 sets, were manufactured and used in the Madagascar expedition of 1894, and reported upon favourably by the Commission [2].

In 1893 an inquiry into the subject was made in Germany; a report was made to the Reichstag pointing out that the adoption of aluminium would effect a great saving in weight.

Although the French began experiments in 1892, it was not until very recently that the adoption of aluminium throughout armies has become general. By 1905 Switzerland, Belgium, Germany, and Russia had officially sanctioned its use.

In the British Army during the 1910 manœuvres experiments were made with aluminium mess-tins very similar to the first German pattern. At present experiments are being repeated on a larger scale with the articles already described. Mess-tins and water-bottles of aluminium have long been in use among the native regiments of India.

At the present time, Switzerland, Italy, and Great Britain do not use aluminium for water-bottles, and Austria, Italy, Norway, and Great Britain do not employ it for mess-tins.

Although there were many difficulties, chemical and other, when this metal was first introduced, they were soon almost wholly
overcome and the great stumbling-block to its exclusive use in the 
manufacture of these utensils was the expense.

To-day the price of aluminium has fallen considerably and in 
fact a water-bottle of this metal of the same size as the present 
enamelled iron bottle would actually cost less.

The mess-tin is made of tin plate, a far cheaper material than 
the enamelled plate of the water-bottle, and to replace the tin plate 
by aluminium would incur considerable expense. The aluminium 
mess-tin now on trial would cost about five times as much as the 
present tin, but has double the capacity.

*Physical Properties.*—Lightness: The hammered metal has a 
specific gravity of 2·67, and as compared with pure iron (specific 
gravity 7·84) it is one-third the weight. The advantage of its 
light weight is well illustrated by the following table, from which 
it will be seen that for the amount of water carried our bottle is 
the heaviest.

<table>
<thead>
<tr>
<th></th>
<th>Great Britain</th>
<th>France</th>
<th>Japan</th>
<th>Austria</th>
<th>Germany</th>
<th>Russia</th>
<th>U.S.A.</th>
<th>Norway</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight (grm.)</td>
<td>36·3</td>
<td>31·6</td>
<td>26·6</td>
<td>26·0</td>
<td>21·8</td>
<td>21·5</td>
<td>19·4</td>
<td>19·0</td>
</tr>
<tr>
<td>100 c.c.</td>
<td>31·1 block tin</td>
<td>aluminium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If our water-bottle were made of the lightest aluminium, namely, 
that used by the Norwegians, our 1,170 c.c. (two pints) could be 
carried by 222 grm. (just 8 oz.), which represents a saving of 
203 grm. (7·2 oz.).

In the same way if our present mess-tin were made of the same 
aluminium as the experimental tins referred to instead of 
41·3 grm. weight of tinned plate being required for every 100 c.c. 
capacity, 14·4 grm. of aluminium could provide for the same 
capacity, and the total weight of such a mess-tin would be only 
187·2 grm. (6·6 oz.) instead of 538 grm. (1 lb. 3 oz.), which would 
mean a saving of 341 grm. (12·4 oz.). Thus, retaining the present 
pattern of water-bottle and mess-tin, by the adoption of aluminium 
in their manufacture, a total saving of 1 lb. 3·6 oz. (water-bottle, 
7·2 oz., and mess tin 12·4 oz.) could be obtained. If a large type

1 Note.—Since writing this paper, I have obtained a specimen of the proposed 
aluminium bottle (Mark VI pattern). The metal of this weighs 211 grm. 
(7·4 oz.), which represents a saving in weight of 235 grm., or just over half a 
pound.
of mess-tin were adopted similar to the experimental ones, then the saving would only be 10.8 oz. These calculations have been made from the actual utensils, stripped of covers and straps, details of which are given in Table II.

The proposed addition to the soldier's load of an "iron ration" weighing over 2 lb. makes it imperative that the total weight carried should be reduced, and the use of the metal in question is one of the methods of obtaining this result.

Conductivity. — In respect of this property, aluminium is superior even to silver, one of the best conductors known, and facilitates rapid cooking.

Other Physical Properties.—It is malleable, and articles can be blocked out. The metal may also be cast. Both these methods of working avoid the presence of joints in the completed article. The pure annealed metal bends very readily, but alloys, particularly with copper, are more resistant, and the French in their first experimental mess-tins used an alloy containing 20 to 25 per cent of copper. But, since the metal is tough, indentations in articles can be easily removed. There is no difficulty in riveting, but a satisfactory solder for aluminium is yet to be discovered. It is easily cleaned, and will take a high polish [3].

Chemical Properties.—Manufactured by the electrolytic method, it should contain over 99 per cent of pure metal, but when made by the sodium reduction process, it may only contain 97 to 98 per cent of pure metal. The chief impurities are iron, copper, and silicon. Pure aluminium does not oxidize in air at ordinary temperatures, but the presence in sufficient quantities of silicon (0.5 to 1.0 per cent) is detrimental, as this element finds its way to the surface, where it is oxidized, forming a layer of silica. Sulphuretted hydrogen has no effect on the pure metal. It dissolves readily in hydrochloric acid and the alkalies. If more than 1 per cent of iron is present, tea and meat stews prepared in such a tin are liable to act on the metal. At boiling temperature it is attacked by organic salts, but only very gradually. Organic acids attack it slightly, producing hydrogen bubbles, which adhere to the surface, limiting any further effect. The action of common salt is important. Alone its action is comparatively slow, but in the presence of acids the action is hastened. Thus some slight deterioration may be expected to occur in cooking utensils made of this metal [4].

The Germans have had some trouble with their mess-tins on account of the acid used in the process of blackening the outsides.
Water-bottles and Mess-tins

The blackening process is carried out as follows:—

(1) The surface for treatment is prepared with sulphuric acid, 80 per cent.

(2) It is then treated with a mixture of:—

<table>
<thead>
<tr>
<th>Substance</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure spirit</td>
<td>1 litre</td>
</tr>
<tr>
<td>Chloride of antimony</td>
<td>100 grm.</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>300 &quot;</td>
</tr>
<tr>
<td>Manganese oxide</td>
<td>50 &quot;</td>
</tr>
</tbody>
</table>

(3) Finally stained black by a stain consisting of:—

Spirit.
Aniline colour.
Shellac.

Certain mess-tins which had been stored for two years showed light white concretions and rough spots on the outer surface. They had been stored, standing one on the top of the other with a piece of paper between the surfaces in contact. It was at the contact surfaces that these changes were most noticeable, but they occurred elsewhere, more especially at the points at which the ears carrying the handle were riveted to the tin. It has been shown that these spots are the result of storing the tins in a damp place and of the presence of sodium chloride in the dust which settles on the tins. The salt attacks the aluminium, forming the hydroxide which is dissolved by the acid employed in the blackening process, while the presence of moisture in the store-room greatly increases the extent of this reaction.[5]

Le Chatelier [6] has made some similar observations on utensils used in the French Army, the exteriors of which are treated with gum-lac. This observer states this change is most likely to occur if the aluminium contains calcium.

It is clear from the statements made above that for storage all articles made of this metal should be kept dry and as free from dust as possible. The requirements can be attained by the use of vaseline and if possible the utensils should be thoroughly washed out with rain or, better, distilled water before storage. The French, as already stated, were the first to try such articles and the reports after the autumn manoeuvres, 1894, state that the large collective utensils completely satisfied all requirements during the manoeuvres, but the small equipment soon became unserviceable.

The reports from Madagascar, however, were very favourable, and a special notice is directed to the fact that sea-water had no action.

The experimental utensils of the British Army have been
examined at the Royal Army Medical College, and the mess-tin has
the following composition:—

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper, carbon, and silicon</td>
<td>0·960 per cent</td>
</tr>
<tr>
<td>Iron</td>
<td>0·464</td>
</tr>
<tr>
<td>Aluminium</td>
<td>98·567</td>
</tr>
</tbody>
</table>

100·000

These tins (5 pint) are painted black, which slightly limits their
usefulness for cooking over a fire [7]. The outside of the latest
4-pint experimental aluminium mess-tin is untreated.

Mess-tins in constant use will suffer no serious detriment
provided they are cleaned, and provided meat stews are not
retained in them for any considerable time.

The foregoing remarks have reference to mess-tins only.

As regards water-bottles the presence of fluids in continuous
contact with the metal leads to chemical action in some cases.
Aluminium forms compounds with alcoholic radicals, but the effect
of alcoholic beverages on such bottles need not be considered "as
it is wrong in principle to select a water-bottle on such grounds" [8].
Water containing silicic acid, like the Berlin supply, was found
to act on bottles after standing in them for some time. Acid
drinks should not be placed in aluminium water-bottles, but if the
aluminium be pure and contains no serious trace of iron they may
be filled with tea.

Except in special circumstances the chemical action of drinking
water is negligible.

To sum up the advantages of the use of this metal:—

(1) Lightness, on account of its low specific gravity, thus
helping to reduce the load of the soldier.
(2) Joints which may open can be avoided.
(3) Its good conductivity leads to rapid cooking and a con-
sequent reduction in the fuel necessary.
(4) It does not oxidize easily.
(5) Its salts and oxides are innocuous.
(6) It is easily cleaned.

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1905.


vol. iii, part 5, 1912.

