

for the narrow line of the clavicle, the relief from pressure against the chest should make this a very useful appliance. It has not, however, received an extended practical trial. After all, it is the way in which it is carried

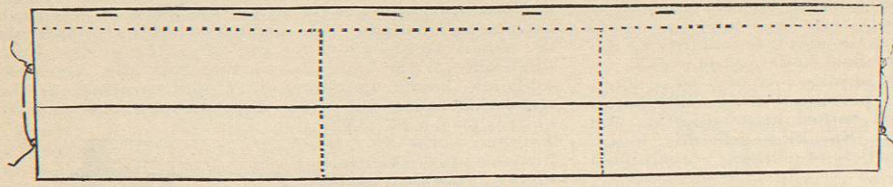


Fig. 3340.—Clothing Case, Open.

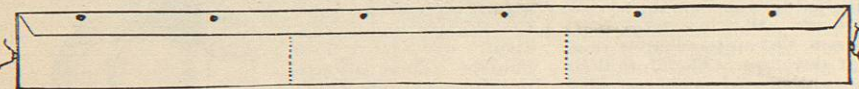


Fig. 3341.—Clothing Case, Packed and Folded.

rather than the actual weight of a soldier's necessary equipment that is trying the man. His respiration should not be impeded, the axillary vessels and nerves should be free from pressure, and the back should be exposed to the air as much as possible to facilitate evaporation. The nearer the load lies to the centre of gravity, the more easily it is managed. These various requirements have been most nearly attained by an equipment devised some years ago by Brigadier General Merriam, which in brief may be described thus:

The pack consists of two compartments and is designed for necessary underclothing, rations, and extra ammunition within, and for a blanket, a shelter-tent half, and, on occasion, an overcoat on the outside. It is carried in part by straps passing over the shoulders and hooking into the waist belt, but chiefly by two wooden supports that slip into sockets on a lower half-belt and rest against the hip

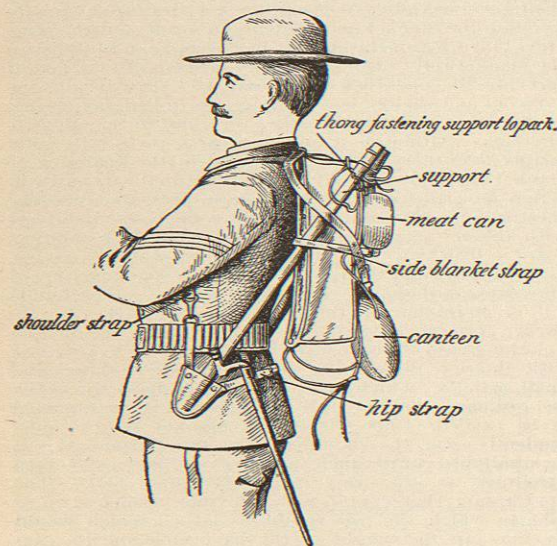


Fig. 3342.—Merriam Pack, showing Particulars.

bones. The supports by their inclination keep the burden away from the back, so that ventilation is maintained. To insure this the contents of the pack must be arranged so as not to bulge and press against the body.

The waist belt does not require to be tight, but, if desired, may be left unbuckled while marching. The weight is supported by the hips with some assistance from the collar bones, and there is practically no pressure upon the back and absolutely none upon the breast. This avoids all constriction of the chest and of the armpits, which is the great evil in the ordinary methods of carriage. The supports are interchangeable and when joined form a shelter-tent pole. It is intended to carry a shelter-tent half and a blanket rolled over the top and sides of the pack, the underclothing, toilet articles, and extra cartridges in the upper compartment, and the rations and

mess kit in the lower. The canteen rests against the lower back of the pack. An overcoat may be carried under the pack. It is, however, less important to define exactly what articles should be carried than to determine and comply with the principles by which the necessary burden should be borne. In this respect numerous actual trials in the field have demonstrated the efficiency of this method, and there can be no question as to the practical value of this device and its great superiority over the lately official blanket bag in poise and freedom from oppression. If it should be desired to carry an excess of rations and ammunition, as in the active operations incident to battle, the underclothing and similar articles may be removed for the time and the pack become in effect merely a haversack and an ammunition pouch. On the other hand a prolonged expedition can be conducted in heavy marching order with the minimum of discomfort. In the Cuban campaign it was carried to the firing line, and no system known to the writer equals it for armies in the field. For the necessities of the National Guard, the Merriam pack, already adopted by some States, is unsurpassed.

Food is necessary to replace waste, to produce energy and animal heat, and to supply additional tissue for those who are growing. In general terms nitrogen and carbon represent the materials needed, and man requires fifteen times as much of the latter as of the former. Each of these must be arranged in particular form in order to be digested and assimilated, and the problem of all diets is to secure such food at a practicable cost. That is to say, a man must regulate the kinds of food according to his needs. Thus, if he were confined to a meat diet he would have to take up about four times as much nitrogen as is necessary in order to obtain sufficient carbon;

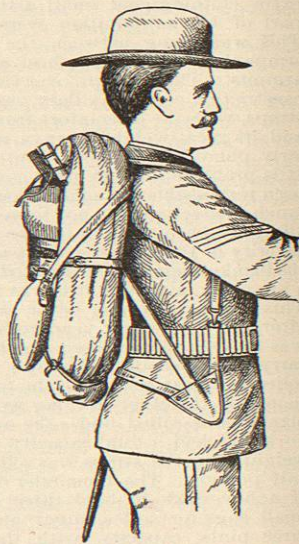


Fig. 3343.—Merriam Pack, with Blanket.

or a bread diet would overload him with carbon before he received sufficient nitrogen. For while foods are classed in a general way as the albuminates or nitrogenous, and the starches and sugars or carbohydrates, and the fats, or hydrocarbons, these merely indicate their preponderating chemical qualities, and both nitrogen and carbon are to be found in almost every article of diet. Nevertheless, to live upon bread alone would require daily four and one-half pounds; upon flesh alone, six and one-half pounds, or upon potatoes alone, fifteen pounds, and only at the risk of ultimate disease from the excess of unnecessary elements, even supposing the whole to be assimilated. Albumen, therefore, must be supplemented by fats, starches, sugars, organic acids and salts, and bread requires flesh, fats, etc. It is not the quantity ingested but the amount assimilated that measures the value to the individual of the food taken. And as the assimilative powers of individuals vary as to each other, and among themselves upon occasion, the food for a number of men should cover the average requirement. Neither, even were it possible, should the food be of purely nutritive qualities, for the presence of a certain amount of waste seems necessary for the complete digestive health of man.

A ration is the allowance for the subsistence of one person for one day, and is not, as civilians occasionally suppose, that for one meal. Besides meat, bread, vegetables, fruit, coffee, sugar, and seasoning, it includes a proportion of soap and candles. It varies in its composition with the station of the troops or the duty they perform, and is therefore known as the garrison, the field, the travel, or the emergency ration, according to these conditions.

The garrison ration, issued to troops in garrison or in permanent camps, is as follows:
Meat Components: Fresh beef, 20 ounces, or fresh mutton (at no greater cost) 20 ounces, or bacon 12 ounces, or canned meat (when fresh meat cannot be supplied) 16 ounces, or dried fish 14 ounces, or pickled fish 18 ounces, or canned fish 16 ounces. In Alaska the allowance of bacon is 16 ounces, or (when desired) salt pork 16 ounces, or salt beef 22 ounces may be substituted.
Bread Components: Flour 18 ounces, or soft bread 18 ounces, or (only when flour or soft bread cannot be used) hard bread 16 ounces, or cornmeal 20 ounces.

Vegetable Components: Beans 2 1/2 ounces, or peas 2 1/2 ounces, or rice 1 1/2 ounces, or hominy 1 1/2 ounces, and potatoes 16 ounces, or potatoes 12 1/2 ounces and onions 3 1/2 ounces, or potatoes 12 1/2 ounces and canned tomatoes 3 1/2 ounces, or potatoes 11 1/2 ounces and other fresh (not canned) vegetables when obtained near by or transported in a wholesome condition from a distance, 4 1/2 ounces, or desiccated vegetables (when fresh vegetables cannot be furnished) 2 1/2 ounces. In other words, the daily vegetable ration consists of a reasonable allowance of dried vegetable food and also one pound of fresh vegetables or its equivalent. In Alaska the allowance of fresh vegetables is 24 instead of 16 ounces, and that of desiccated vegetables is 3 1/2 instead of 2 1/2 ounces.

Fruit Components: Dried or evaporated prunes, apples, or peaches 1 1/2 ounces (when practicable, 30 per cent. of the issue to be prunes).

Coffee and Sugar Components: Coffee (green) 1 1/2, or roasted and ground 1 1/2 ounces, or tea (black or green) 3/5 ounce, and sugar 3 1/2 ounces.

Seasoning Components: Vinegar 3/5 gill, or vinegar 1/2 gill and cucumber pickles 1/5 gill, and salt 1 1/2 ounce, and pepper (black) 1/5 ounce.

Soap and Candle Components: Soap 1 1/2 ounce, candles (when necessary for illumination) 3/5 ounce. In Alaska the allowance of candles is 2 1/2 ounces.

The field ration, issued to troops in the field in active campaign, differs from the garrison ration chiefly in being less elastic. It is as follows:
Meat Components: Fresh beef or mutton (procured locally) 20 ounces, or canned meat (when fresh meat cannot be procured locally) 16 ounces, or bacon 12 ounces.

Bread Components: Flour 18 ounces, or soft bread 18

ounces, or hard bread 16 ounces, and baking powder (when ovens are not available) 1/2 ounce, or (when ovens are available) hops 3/5 ounce, or dried or compressed yeast 1/5 ounce.

Vegetable Components: Beans 2 1/2 ounces, or rice 1 1/2 ounces, and potatoes (procured locally) 16 ounces, or (procured locally) potatoes 12 1/2 ounces and onions 3 1/2 ounces, or desiccated potatoes 2 1/2 ounces, or desiccated potatoes 1 1/2 ounces and desiccated onions 1/2 ounce, or desiccated potatoes 1 1/2 ounces and canned tomatoes 3 1/2 ounces.

Fruit Component: Jam (in cans) 1 1/2 ounces.

Coffee and Sugar Components: Coffee (roasted and ground) 1 1/2 ounces, or tea (black or green) 3/5 ounce, and sugar 3 1/2 ounces.

Seasoning Components: Vinegar 3/5 gill, or vinegar 1/2 gill and cucumber pickles 1/5 gill, and salt 1 1/2 ounce and pepper (black) 1/5 ounce.

Soap and Candle Components: Soap 1 1/2 ounce, candles 3/5 ounce.

These supplies are not issued in the small and fractional quantities here noted, which are set down to show the daily allowance assumed to be necessary to subsist each man, but are supplied in bulk, generally in quantities of one hundred rations or multiples thereof.

The travel ration is issued to troops travelling otherwise than by marching, or when they are separated for short periods from cooking facilities. It consists per hundred rations of:
Soft bread 112 1/2 pounds, or hard bread 100 pounds, and canned corned beef or corned beef hash 75 pounds, and baked beans 25 pounds, and canned tomatoes 50 pounds, and roasted and ground coffee 8 pounds, and sugar 15 pounds, or, in lieu of the coffee and sugar in kind, 21 cents per day per ration is allowed for the purchase of liquid coffee.

Troops on transports have their food prepared from the articles of the garrison ration, varied by the substitution of articles of equal money value from the extensive list of subsistence stores other than the ration kept for sale. Ordinarily, fresh meat is issued seven days in ten, and salt meat three days in ten, the issue of fish being a substitute for that of salt meat. Whenever the issue of both the fresh meat and the vegetable components is impracticable, there may be issued in lieu of them canned fresh-beef-and-vegetable stew, at the rate of 28 1/2 ounces to the ration.

The emergency ration, prepared under the direction of the War Department, is supplied troops in active campaign for use only when the regular ration cannot be obtained. Each complete ration is contained in a metallic case which may be opened only by an officer's order or in extremity.

It consists of a chocolate component and a bread and meat component. The first contains equal parts of pure chocolate and pure sugar combined, molded into a cake of one and a third ounces. The second contains meat-flour and parched ground wheat. The meat-flour is prepared by grinding fresh lean beef, free from visible fat and sinew, desiccating it by heat, without cooking it in the slightest, until the moisture does not exceed five per cent, and reducing it to a powder carefully sifted through a fine-meshed sieve. The wheat portion is prepared by parching cooked kiln-dried wheat with the outer bran removed, and grinding it to a coarse powder. The compound consists of 16 parts of the meat flour, 32 parts of the ground wheat, and 1 of common salt, each by weight, thoroughly mixed in sufficiently small quantities to be homogeneous. These are compressed into a cake weighing four ounces. Three cakes of the chocolate and three of the bread and meat component are put up in a can with three-fourths of an ounce of fine salt and one gram of black pepper, and are designed to subsist a man for one day. The meat and bread component may be eaten dry; or be stirred into cold water and eaten; or one cake may be dissolved in three pints of water, boiled five minutes or longer, and seasoned to taste; or one cake may be boiled in one pint of water five minutes to make

thick porridge, to be eaten hot or cold. When cold this may be sliced and fried with any available fat.

The Subsistence Department issues to the soldier, entirely at the public expense, all the parts of the particular ration required for him, whether in garrison or in the field. In most foreign services the enlisted man when not actually campaigning must buy a large part of his food, and his pay is arranged with a system of stoppages for that purpose. But in the United States army this is not required, nor would it be practicable for individual men or company organizations to make such purchases in a great part of the garrisoned or marched-over regions at home or abroad. The formal constitution of the ration, except as expressly noted, is uniform for the service required regardless of locality or climate. Manifestly it is exactly suitable only within very narrow conditions, if indeed to any. But the alternative and substitutive portions give it wide range, which is further increased by the exchange or sale of surplus parts and the purchase of other food with the accruing fund. Besides the money value of the unconsumed rations, the savings of the post bakery, as explained later, and a share of the profits of the post exchange go into the hands of the company commanders as a company fund. By the administration of the ration, and of this fund which in part represents it, the captain demonstrates much of his ability to take care of his men. The hospital fund, for the purchase of extra diet for the sick, is created in the same way. An alternative provision for the subsistence of the sick occurs through an allowance of forty cents per man per day. When circumstances permit, vegetable gardens are cultivated by their own labor for the benefit of the troops. Besides adding to the table, the profits of any sale or exchange of vegetables accrue to the company fund.

Speaking generally, the bread and meat components are the vital parts of the ration and those most likely to be issued even under adverse conditions. Bread is not a complete diet, in that it is deficient in fat and moderately in nitrogen, on which account some form of oily food is instinctively eaten with it. But it is the only part of the ration in which there is no necessary waste, and it is one of the very few foods that never pall upon the appetite. Bread is dough distended through its particles with carbon dioxide and cooked, and dough is flour mixed with salt and water. Flour is the crushed wheat kernel with the two outer husks or bran removed, and it contains from nine to fourteen parts of nitrogen and between sixty and seventy parts of carbonaceous matter in the hundred. The bran contains about fifteen per cent. of nitrogen, three and a half of fat, and five and seven-tenths of salts, but although theoretically nutritious is too irritating, and therefore indigestible, to be assimilated. On this account the use of whole flour is of doubtful wisdom. In the market "high patent" flour is graded the highest, but moderately dressed or "straight" flour, which is the whole product of the wheat except the refuse, with a small proportion of low grades, is the best for issue. Whatever the standard the flour should be uniform in color, for specks show imperfect milling or a very low grade; but the best flour is no longer, as formerly, necessarily an absolutely impalpable and white powder. The roller process yields a slightly rough flour, and the hard winter wheat may give it a yellowish tinge. Good flour is slightly acid to test paper but not to the taste, and an acidity that may be recognized by the senses means a change. Acid flour makes sour bread, and any disagreeable taste or odor indicates bad flour. When boiling water is poured on a little flour, there should arise no odor but that of freshly ground wheat. The relative strength and elasticity of the gluten, which are determined comparatively by manipulating a small quantity of flour intimately mixed with half its weight of water, make a standard for comparison. This is known as the dough test, and its failure shows weak flour, from poor wheat or imperfect milling and defective gluten.

The carbon dioxide is introduced within the dough, (1)

by yeast or other ferment, (2) by a baking powder, or (3) by forcing the gas into the mass (aeration). The usual garrison method is to add eight to twelve pints of tepid water, four ounces of yeast, a little potato, and one or two ounces of salt to twenty pounds of flour, checking the fermentation at the proper point. When the dough is heated the albumen in the flour is coagulated, a part of the starch is transferred into dextrin and some sugar, and some additional carbon dioxide is formed. Yeast is the ordinary ferment, but a lump of leaven, which is common dough kept moderately warm for some time, may be thoroughly kneaded, while undergoing fermentation, into fresh flour and water. A good baking powder would be two ounces of tartaric acid and three ounces each of bicarbonate of soda and arrowroot—thoroughly mixed and kept perfectly dry (Yeo). Bread may be heavy when the yeast has fermented too rapidly or insufficiently, or when the heat has been too great or too little. Bitter yeast will make the bread bitter and excess of water may make it mouldy. If acid flour must be used, or if the flour has been grown on sandy soil where lime is deficient, it may rise well enough, but becomes heavy and sour upon cooling. In such a case mixing the flour with lime water made from quicklime will yield good bread. There are some soils the flour from which always requires strong lime-water. When the yeast is from stock that is too old, lime-water will sometimes act as a corrective. When bread is sour from an excess of acid it may be made edible by toasting it in thin slices, which volatilizes the acid. Stale loaves heated in an oven to 250°-300° F. after having been soaked in water are thus freshened; but they must be eaten within twenty-four hours. Thick slices of stale bread may be freshened by toasting.

At a permanent post the Subsistence Department establishes a bakery, and in that case it issues the flour in the form of soft bread only. As the gain in baking is about one-third, weight for weight, the bakery expenses are thus reimbursed; and should circumstances make it desirable the ration of bread, not of flour, may on account of such gain be increased up to twenty-two ounces, when ordered by the post commander on the recommendation of the council of administration. Bread loses weight after baking, and the weight of the bread ration is always taken cold. For large camps it is often practicable to establish great temporary bakeries, as was done successfully at Chickamauga, and perhaps elsewhere, in 1898. For marching columns bakery wagons and travelling ovens, such as were used with the Army of the Potomac, can accompany the troops wherever guns can pass. But in the field, where hard bread is not depended upon, baking for brigades or smaller commands will generally be done by the company cooks. Of the various methods of baking in the field, the simplest is to fill a small hole in the ground with a wood fire, and when this has thoroughly burned out to place in it on a stone a mixture of flour, salt, and water, covered with a tin plate and surrounded by hot ashes. The heat should be kept below 212° F., or the bread will be tough. Or two mess-pans may be taken and the rim of one be cut down an inch and a half leaving a rough border. Fill this pan two-thirds with dough and invert over it the perfect pan. Place both in a hole eighteen inches deep where a wood fire has burned several hours, and from which all the embers, except for two or three inches, have been removed. Cover the pans with hot ashes and earth and the bread will bake in five or six hours. The gases escape through the cut edges. A barrel oven is made by laying in a hollow a barrel with its head out, and covered throughout for six or eight inches with wet clay, and this for six inches with dry earth. At the top of the further end a three-inch opening is left for a flue. The staves are burned out, and after it has been heated for use the front and the flue are closed. The common Dutch oven is well adapted for baking for small messes in the field when fuel and transportation are abundant, and is a desirable part of company property. It is a heavy flat iron pot with short legs and a top which fits with a flange. It is heated by

coals placed upon as well as beneath it, and several may be used together in a trench with economy. The Buzzacott field oven, now supplied by the Government, is well adapted for baking and general cooking. It has greater range and less weight and cost than the same capacity of Dutch ovens, and may be carried wherever there is moderate transportation. It requires more care to protect from injury than the heavy Dutch oven. Loaves of bread for transportation should be laid on their sides or ends, not on their bottoms. An army wagon with side-boards will carry 1,800, and without side-boards 1,400, 18-ounce loaves of bread.

Hard bread (military biscuit) is unfermented dough thoroughly baked. Bulk for bulk it is more nutritious than soft bread, on account of the water having been driven off; but men do not thrive on it as a constant diet. When issued in very small rectangular crackers put up in one-pound stiff cartons very little is wasted, as occurs by crumbling when large squares are served from the original packing-boxes.

Cornmeal may be substituted for flour at the rate of twenty ounces per ration. It contains quite as much nitrogen and four times as much fat and is highly nutritious. It does not keep well and cannot be abruptly substituted for flour with persons unaccustomed to it. Neither does fine wheat flour agree at first with those accustomed to meal. Both these rules were illustrated by military prisoners during the civil war; the Southern sickened on a wheat diet, as did the Northern men when fed on cornmeal. Oatmeal develops ounce for ounce 130 foot-tons of potential energy against 87.5 for bread; it keeps fairly well, it is easily cooked and, although from its lack of adhesiveness large loaves cannot be made, it may be used in small flat cakes. It is a good military food and as a hot or cold gruel is extensively and profitably used by hard-working laborers. This would be an admirable issue for men on guard at night or on heavy fatigue.

The bread is probably the most important part of the ration to the new soldier. Men recruited in peace have frequently been underfed before enlistment; while those of a higher social class who become soldiers under the stimulus of war often require an excess of bread to compensate for their non-assimilation in the beginning of their career of the coarser parts of the ration. In both cases bread is so acceptable a food that it is always eaten in excess. All the care that may be spent on its preparation is well bestowed.

Besides restoring waste and adding tissue to the immature, the province of food is to supply energy and animal heat. These are yielded by the contained nitrogen and carbon respectively. Almost any form of food contains both these elements, but speaking generally the energy-giving part of the ration is the flesh, whose most acceptable form is fresh beef or bacon. The ration of fresh beef is estimated on the basis of the raw issue. The carcass wastes five per cent. in cutting up; a fair proportion of bone is twenty per cent.; and in cooking meat shrinks twenty-five per cent. in weight. The issue is sufficient when the quality of the beef is good, but it is insufficient when taken from range cattle, or from carcasses kept long in cold storage. The loss in cooking frozen meat is believed to be ten per cent. more than with fresh meat, and there is further believed to be a deterioration in the nutritive value of refrigerated beef. This latter point has not yet been scientifically demonstrated, but it is probably the case. Salted meats lose some of their valuable constituents by osmosis into the brine, and their texture becomes hardened. In general terms, salt beef has two-thirds the food value of fresh beef. Issue steers should weigh about one thousand pounds and be about four years old and be well nourished. The average net weight is about sixty per cent. of the live weight, and when the use of scales is impracticable this may be determined by one or the other of these formulas:

$(C^2 \times .08) \times L \times 42 = W$ (net), where C is the girth behind the shoulder blades, L the length from the front of the shoulder blades to the tail, 42 pounds represent

the weight of a cubic foot of flesh, and W is the net weight. In this case .08 is the equivalent of 0.7958, and the square of the circumference multiplied thereby yields the contents. Or $C^2 \times 5 L \div 1.5 = W$. Divide by 1.425 if fat, or by 1.575 if lean.

Beef should be killed twenty-four or thirty-six hours before issue in temperate and eight or ten hours in hot climates. The fat of good beef should be firm and sufficient and the flesh be firm and elastic, marbled from little veins running through it, and a little reddish fluid should exude. If the flesh is pale and moist it indicates that the animal was young, if dark that it was old. When the animal has not been properly bled the flesh is a deep purple in color. Blood should not be retained in the flesh, not because it is unwholesome but because it decomposes very rapidly. The interior should be no darker than the surface and there should be no softening of the tissues nor fluid within them. Commencing change is denoted by a disagreeable odor and by the color being paler at first and greenish later. Decomposing meat should not be eaten, although it may be tolerated by some digestive organs and be esteemed a delicacy by abnormal palates. Diseased animals ordinarily should be condemned as food, although such emergency issue may be made in the prolonged absence of other meat. It has repeatedly happened that cattle dead of the rinderpest and horses dead of glanders have been eaten with impunity. But it is essential that such meat be thoroughly cooked, and it is much safer that all the blood be drained away. Tuberculous meat and milk may affect the consumer; but it is probable that actinomycosis, a less communicable disease, is often mistaken for the former. Beef and pork infected by the measles (cysticercus) may communicate tapeworm, and trichinous pork trichina spiralis to man. The measles is observable by the eye as a small, rounded body; but it is incorrect to designate pork that is simply old and rusty as "measly," as is sometimes done. Very thorough cooking, so as to kill all the contained parasites, is necessary and the interior of boiled or roasted meat should show that this has been done. Notwithstanding that all diseased animals are not necessarily to be condemned for food under the stress of military emergency, it must be remembered that the stronger medicines used in their treatment have been known to poison persons eating such flesh. Animals with malignant pustule are always dangerous and their carcasses should not be buried, but burned. Sausages and meat pies sometimes become toxic by the development of a substance not yet isolated; and hash prepared over night in warm weather and stale mixed dishes are liable to induce intestinal disorders with marked choleraic symptoms. Fresh meat may be preserved for some time by heating the outside very strongly, thus coagulating the outer albumen and sealing the contained juices against infection from without. The external application of charcoal, sugar, or gunpowder well rubbed into the surface is also preservative. Partly prepared fresh meat may be preserved on a large scale by canning, but the use of antiseptic chemicals is apt to be hurtful. Corned beef, cooked and canned, has double the nutritive value of the same quantity of uncooked beef, and is a valuable substitutive part of the ration, at the rate of twelve ounces, where fresh beef cannot be issued. It contains sixty per cent. solids, of which forty are albuminoids, fifteen fat, and five salts. Corned beef contains six per cent. nitrogen. Bacon is the exception to the rule that cured meats are less digestible than when fresh. Its fat is more acceptable than that of pork, and it is a form of food that is easily transported and is well suited to the demands of severe exercise. From its nature it wastes much under heat. It is distasteful to those not in rude physical vigor and to most in hot climates. There are several alimentary substances not ordinarily used that necessity may lead troops to eat. Of these horseflesh, which contains more nitrogen and less carbon and hydrogen than beef, is the most commonly available. To an army in the field horses are more useful as auxiliaries than as food; but in a siege, or when not required

for their ordinary purposes, they afford a wholesome and efficient diet. A field hospital after an engagement, if at all short of meat, should certainly utilize horses killed in action.

To Cook Meat.—For boiling, the piece should be as large as possible and be plunged in boiling water to remain five or ten minutes. This coagulates the albumen in the outer layers and retains the juices. The temperature of the water should then be reduced to 160° F., as at 170° and above the meat would become hard and indigestible. The meat should remain in the water fifteen minutes for every pound of its own weight. Baking, which is not roasting, although ordinarily so called, is treating meat exactly similarly to roasting and for the same reasons, except that a dry heat is used. To roast properly the meat should be cut into pieces one or two inches square and be held for a few minutes before a hot fire, as in the field. Frying as ordinarily attempted evolves fatty acids, generally injurious, which penetrate the particles of food and envelop them in grease which the gastric juices do not dissolve and which irritates the stomach. Food cooked in fat should be drained in a sieve for a few minutes. Stewing when properly conducted is admirable. Small pieces of meat should be kept for about two hours in a little water at not far from 134° F. This partly extracts the juices, keeps the albumen semi-fluid and enriches the accompanying liquid, which must be served with the meat. Stewing is the exact opposite of boiling, in both theory and practice. Soup is made by putting uncooked meat into cold water, one pound to a quart, and heating gradually. Rapid boiling volatilizes the aroma and probably part of the nutritious matter; cracked bones increase the strength of the soup, and cooked meat may be added three-quarters of an hour after putting on the fire; potatoes thirty minutes before it is done; other vegetables an hour and a half. The essentials are scrupulously clean pot, slow cooking, and constant skimming. Stock for soup is made by putting lean meat into cold water, three pounds to a gallon, and cooking slowly for several hours. The fat is skimmed off and a jelly remains after cooking. When re-dissolved by heat and reboiled, with water and seasoning added, soup is quickly made. Such stock can easily be made in camp and carried on the march.

One marked element in the greater efficiency of the regular over the volunteer soldier is his ability to prepare his food and to assimilate it, to avoid waste without and within the body. The civilian who has depended upon trained cooks and domestic conveniences, in the field wastes the raw material in trying to dress it and cannot digest and appropriate much of what he eats. "An army moves upon its belly," and to teach each recruit and militiaman the practical use of the army ration would render him more valuable as a fighting man than would any amount of rhythmical movement in a manual that is never executed under fire, or perfection in establishing an alignment that can never be preserved in battle. Hence at the militia camps of instruction caterers should not be permitted, and the men should be taught and exercised in the principles and practice of the simpler cooking. In permanent garrisons of organized troops messes of more than one company should be forbidden, as having a direct tendency to render men helpless in emergency. The garrison mess is an agency that lessens the responsibility of the company officers, diminishes the interest of the men in a most important part of their company organization, and fosters ignorance of the very features by which their success in the field is maintained. It would be an economy of energy and of material for each militia company to employ a good cook as instructor in the use of the army ration during the summer encampments; but details of men should be required to do the work and they should be made to understand that duty in the cook-house, however distasteful, is quite as honorable and is of more value than some of the showy exercises that would otherwise occupy their time. When its importance is explained, the public spirit that inspires the better militia regiments, a patriotic senti-

ment which cannot be too highly commended and which is the essence of their usefulness as public bodies, would soon enable the citizen soldiers to bear this burden in common with other trials that are necessary to make them efficient in the field. Then they may in campaign justify the sacrifices already made, and not fall ignominiously into the ranks of the non-effectives because they have neglected this inconspicuous but essential preliminary.

Newly organized regiments require careful oversight and instruction in the care and preparation of their food from the very first. A recruit has enough physical ills to contend against to make it of the first importance that his bodily strength should not be impaired by an imperfect or hurtful diet. The law requires that "the line officers of the army shall superintend the cooking done for the enlisted men" (Rev. Stat., 1234), and "the officers of the medical department of the army shall unite with the officers of the line in superintending the cooking done by the enlisted men" (Rev. Stat., 1174). It is not expected nor is it practicable that these officers shall minutely instruct in cookery, but they should have a knowledge of the general principles of that art and, especially with new troops, should promptly interpose when there is a suspicion of deficient quantity or deteriorated quality. A sudden increase of the sick report in the direction of gastric and intestinal complaints, especially if limited to distinct subdivisions of the command, requires the medical officer carefully to examine the kitchen and the table. Beans imperfectly cooked, potatoes not thoroughly "done," a cheap grade of molasses bought through mistaken economy outside of the Subsistence Department, are among the common causes of such trouble. Any food undergoing fermentative change is likely to do harm. All these conditions are directly within the domain of preventive medicine, that is, of hygiene.

Besides the bread and meat already discussed, which are the essentials of every ration, vegetables are liberally supplied to United States troops. Beans when properly cooked are admirable food; when improperly cooked they are said to be more disabling than the enemy's fire. They contain more than twice as much nitrogen as bread and supplement it admirably. But they require to be soaked at least twelve hours and to be boiled slowly until tender, which requires two or three hours more. They should not be boiled in hard water, for the lime salts render the legumin insoluble. No amount of boiling will soften old beans. They should be soaked twenty-four hours and then be crushed and stewed. But if lime water must be used for cooking beans, a certain amount of the lime may be precipitated by preliminary boiling, after which the supernatant water carefully poured off may be used. The difficulty in cooking beans increases directly with the altitude of the place.

Fresh vegetables, now a liberal part of the ration, are always desirable as food, to stimulate the appetite, and probably to assist the digestion and assimilation of other food. They are especially valuable as antiscorbutics, but partly on account of their perishable nature and partly from their bulk they are difficult to issue in campaign or under adverse conditions; that is, just when most needed there is the greatest risk of failure of supply. Potatoes on account of their starch are an excellent addition to bread and, properly cooked, are always appreciated. The tomato, on account of its malic acid (0.3 per cent. free and as much combined with bases), is a better antiscorbutic than the potato. No savings from fresh vegetables are purchased by the Subsistence Department. The shrinkage in cooking vegetables is about ten per cent., exclusive of waste. Desiccated vegetables do not appear to have the practical value that theory would indicate, but they are not to be rejected when the fresh are unattainable. To secure tomatoes canned without the present excess of water would be most acceptable, and is an aim worthy of the utmost effort. In receiving canned tomatoes it should be remembered that the two- and three-pound cans of commerce fall short of their nominal

weight, so that the aggregate deficit where large quantities are involved is considerable.

Cheese.—Cheese is no longer a part of the ration, but it is well adapted to the mess-table as an occasional purchase. When well masticated it is not indigestible, as popularly supposed, and it is a nutritious and concentrated food of which a half-pound contains as much nitrogen as a pound of meat, and a third of a pound contains as much fat. But cheese decomposes readily so that it is not easily kept, especially in hot climates; and an obscure fermentative change sometimes develops an active gastro-intestinal poison (tyrotoxin) in cheese which appears sound. This yields no peculiarity of appearance, odor, or taste; but it may be detected by a strip of blue litmus paper pressed against it suddenly turning red. The poison is volatile in boiling water; therefore poisonous cheese may be safely eaten after being cooked.

Canned Foods.—These sometimes ferment, and they should be rejected when bulging of the end of the can shows the pressure of gas. The inspection of large contracts should be very rigid, because the temptation to supply inferior goods is very great. The cans should be resistant, and should have both the name of the factory and of the dealer on the label. A fictitious factory name or no dealer's name is a sign of doubtful goods. A rosin flux to seal the cans is better than one of zinc chloride, which now is more common. When carelessly used the rosin may harmlessly affect the taste; but the zinc labors under the charge, not yet proven, of injuring the health. It is possible that hermetically sealed food, when kept for a long time, especially under either extreme of temperature, may deteriorate. The actual weight and the nominal weight of cans as sold frequently are not the same. The War Department officially estimates the contents of certain trade packages as follows: So-called one-pound cans of baked beans, 10½ ounces; three-pound cans, 34½ ounces; two-and-one-half-pound cans of tomatoes, 2 pounds; three-pound cans at 2½ pounds; gallon cans, 6½ pounds.

Concentrated Food.—There has been a constant effort to arrange a condensed ration that will supply much energy in a small bulk, and new emergency rations are frequently devised. It remains true, as set forth by Parkes, that for constant work a man must consume at least from 260 to 350 grains of nitrogen and from 8 to 12 ounces of carbon in the twenty-four hours, which are not yet available in a less bulk than 22 or 23 water-free ounces. Life and vigor can be sustained for a few days on less, although with some loss of weight, and thus concentrated food may be used for a few days. Eleven ounces a day is the minimum amount and one week is the maximum period of safety. They develop a certain amount of force, but they supply tissue waste in a very limited degree, so it is quite necessary for troops that operate under their spur to rest and replenish when the dash is over. They are not organic magazines for the supply of material, and they must be supplemented by sleep and the carbohydrates. Those directing their use must be made to understand that concentrated foods, like high explosives, have strict limits to their fields of usefulness. The German pea sausage, which is probably over-rated as a constant diet, consists of pea flour, fat pork, and a little salt. It is issued cooked and makes soup readily. The original United States emergency ration practically consisted of a full day's allowance of hard bread, bacon, and coffee with four ounces of peameal for soup-making and a little tobacco. It has been experimentally shown that five days' such rations will maintain men actively occupied for at least ten days with trifling loss of weight. The food elements are rather more than required for a mere subsistence diet, and the reserve energy of nature must be drawn upon to supply the draft made by unusual exertion. A new emergency ration has been prepared, as explained on a previous page, and is about to be issued. Repeated trials with moderate bodies of troops have approved it, but it has not yet been tested on a large scale. It is probable that the most valuable of all truly concentrated

preparations is Liebig's *extractum carnis*, now made in many places. It is not strictly a food, but is rather a nitrogenous stimulant, whose office is to urge the heart and remove the sense of fatigue. It would be an important special issue to pickets and to all troops after prolonged exposure. It is often the case that the conditions of rapid marching, of severe fighting, of bad weather, in short the rougher aspects of military life, are those which, at the same time that they develop the necessity for food, limit its supply to what the troops have upon their persons. When most needed, the supply trains are apt to be the farthest away. If the beef extract, or something analogous, could be issued in suitable packages to the men individually along with the extra ammunition before an impending engagement, those who could be induced to preserve it until after the battle would have at hand a most valuable restorative. Such a method would secure for the wounded a wide distribution of food at precisely the most important time. The medicinal use of kola certainly greatly lessens the sense of fatigue and extends the limit of muscular exertion. It is commended for use by medical officers with a marching column to assist those liable to break down from over-exertion, but it should not be put in the hands of the troops for indiscriminate employment.

A great deal of recent discussion has taken place upon the character of the ration adapted to the tropical countries, having specially in view our southern borders and our insular possessions. Much of this is due to confusion between the food allowed and the food consumed. As herein explained, the allowance of food is liberal and widely alternative, and when the substitutions which the local conditions permit are made it is believed that not only no sickness will be found directly due to the diet, but that, as far as food is a factor, the health of the troops will be maintained by it. The only recent change or addition of importance has been an increased allowance of sugar, for an excess of which there was a spontaneous general call. It is probable that the excessive use of starches to the exclusion of flesh among the Asiatic races is primarily due to financial considerations and secondly to inherited peculiarities. Certainly it would be very unwise suddenly to impose upon white troops from temperate regions a diet identical with that of the natives of the tropics, merely because they have been transferred thither for military duty with no prospect of permanent residence. A surfeit of meat is likely to produce more harm in the tropics than at the north, but there is no probability of surfeit in military life.

Antiscorbutics.—Bodies of men, afloat or ashore, are prone to be attacked with scurvy when deprived of fresh vegetables for a length of time and especially when fed upon salt meat.

Mental and moral depression engendered by military reverses and by monotonous lives under conditions of isolation have a predisposing tendency, and it is certain that scurvy itself exerts a disheartening influence on the men's spirits. Constant entertainment and physical amusements should not be overlooked as hygienic precautions against this disease. The diagnosis of scurvy will be found in the appropriate article, but it may not be out of place to warn the inexperienced officer that it frequently simulates muscular rheumatism at the beginning, and is liable to be mistaken for the simple effects of exposure to cold and wet. Night-blindness coming on in a man whose vision has heretofore been good points toward scurvy. Scurvy is presumed to be due to the want "of the salts of citric, tartaric, acetic, and malic acids, and of the acids themselves." Their use prevents it, and the eaters of fresh meat generally escape. It is uncertain, however, how far those who are supposed to be exclusively eaters of fresh meat, as the hunters and scouts of the plains, owe their immunity to the vegetable matter that they probably devour as occasion offers without looking upon it as formal food. Pemican, a combination of the best beef pulverized, fat, sugar, raisins and currants, is a particularly nutritious antiscorbutic for cold climates, and is in great vogue with Arctic trav-