the advantage of great speed on a level. It is true, that by diminishing the diameter of the driving wheels locomotives have been able to surmount comparatively heavy inclines; but in these cases it has necessarily required the sacrifice of a large proportion of speed throughout.

IV.—A SAVING OF EXPENSE IN THE CONSTRUCTION OF ROADWAYS AND CARRIAGES, ETC.—THE GENERAL WEAR AND TEAR.

With respect to economy, in addition to the above observations, it must be evident that the necessity of cutting, tunneling, embanking, and other engineering difficulties, being materially diminished, will obviate one of the hitherto most serious items of railway expense. The capability of traversing curves of any required radius will enable companies, in numerous instances, to avoid passing through parks, building land, and other property of great value, to be purchased only at enormous cost. A further source of economy arises from the flexibility of the new system, enabling the carriages to be constructed of a much lighter description than has hitherto been practicable; thus considerably reducing the dead or non-paying weight in each train, consequently a larger off-paying weight can be drawn by the same power of locomotive. The great annual saving thus arising from diminution in wear and tear of locomotives, carriages, rails, and other property, as above explained, is too manifest to require comment. In conclusion we may remark, it will be evident, that the mere production of any violent strain upon the plant must, in a general point of view, afford a liability to accident; but, by the proposed arrangement, the running off the line, to which in the present state of things there is so frequently a tendency, especially in curves of short radius, becomes next to impossible under any circumstances. The reduction of the center of gravity to so low a position precludes the liability to overturn; while the attachment of the train throughout its range to the guide rails, by means of the horizontal wheels, guarantees its security, unless the whole machinery were disrupted and displaced. The avoidance of that injurious and violent process of grinding and sliding on the rails, inseparable from the present defective state of things, involving as it does the unnatural expedients of coning the wheels, and giving undue and more dangerous play in their lateral range, must not be regarded as a trivial advantage; as by these means that oscillating and vibratory mo-

in campaign or battle, and like the poor, "they are always with us." Therefore it may be of interest to make a few suggestions with regard to them, which have occurred to the writer and possibly to others, and discuss wherein we believe improvements could be made in them as now issued, especially from the standpoint of common sense and utility.

First, ARMS, *The rifle and carbine.*—All officers wish their men to keep these in the best possible condition, both as regards the usefulness of these weapons and their appearance. The Ordnance Department insists upon, and has embodied it in the regulations, that nothing shall be done to improve the appearance of the stock. As received from the armory, the stocks of all rifles and carbines are of plain walnut, unfinished, soft and rough. Is there any good reason why the wood of the stock should not be filled and have a hard finish so that it will not be so easily indented, but will present a better appearance, and be more in conformity with the accouterments of a neat soldier?

As it is, about as soon as pieces are received from the armory, unless the captain is constantly on the alert to prevent it, men go to work in various ways by means of varnishes and shellacs to improve the appearance of the stocks and to make them more durable and impenetrable to water.

There is probably no small arms manufactory in the United States which turns out its rifles or shotguns in the same crude and unfinished condition as regards the stock as does the Springfield Armory.

In these arms, at present, the pull of the trigger is nine pounds or over. In the days of Frederick the Great, when Suabians and Walloons, ignorant and stupid peasants, were drafted in large numbers to serve as food for powder, there may have been some sense in having a nine-pound pull in order that the piece might not be discharged except by predetermined and strong effort. Our American soldiery, however, are senselessly handicapped by a nine-pound trigger pull.

No person wishing to purchase a rifle or shotgun for target or hunting purposes would ever think of getting one with such a pull. Three pounds is ample for all purposes of safety, especially in these days of brass cartridges and breech-loaders, and from the fact that a rifle is never loaded except to be immediately fired.

We all know how much practice it takes on the part of a recruit before he can keep his sight on the bull's-eye while pulling as hard as he can to fire the piece. This heavy pull handicaps even our best shots, our

the shoulder by means of the sling. As the sling is at present attached it cannot be carried at "swing rifle" with any comfort (see Plate 19, page 43, Drill Regulations). There should also be a hollow space in the butt of the rifle and carbine in which to carry cosmoline, a brush and thong, and a greased rag. Every soldier in the field should have these articles, and they cannot be conveniently carried in the knapsack or pocket.

As weight, especially in long marches, is quite an item in the many things that go to make up the efficiency of a soldier, everything that he has to carry on his person should be lightened in every way possible; and as some maintain that no weight can be dispensed with in the rifle, it seems at least that the bayonet and scabbard might be lightened. If the bayonet, which now weighs eleven ounces, were ten inches long and in the shape of a hunting knife, it would be useful for other purposes as well and would not weigh as much, and its scabbard could be of leather, weighing but a few ounces, instead of three-fourths of a pound as the present iron one does; nor would such a bayonet and scabbard be always in the soldier's way whenever he wishes to sit down, as is the case with the present one. A bayonet ten inches long is just as deadly as one eighteen inches long.

In the matter of accouterments it would seem that the heavy brass buckles now supplied for the field belt and the leather belt could be replaced by buckles made of aluminum, a very much lighter metal. The meat can, tin cup and canteen, which the soldier has to carry on his person and which now weigh about two and three-fourths pounds, if made of aluminum would weigh less than a pound. For practical purposes and to make every possible diminution of weight in all that a soldier has to carry on his person, why should not all ornaments and all buttons on overcoats and other garments be of aluminum?

Under the head of equipments of a company I desire to call attention to company boxes, or rather to the fact that we have no such thing as company boxes, suitable for use when the company moves or for storage purposes in the barracks, furnished by the quartermaster's department. Those who were in Chicago during the opening ceremonies of the World's Fair will remember what a sight it was to see a company of regulars unload its baggage.

Necessary as such boxes are, there is no way in which they can be obtained except for a company commander to get on the good side of the post quartermaster and get him to make some sort of a box, or to buy the timber and iron for them in some way and have them made in the company by a company carpenter. The result is that company boxes are alike in no two organizations and many companies have no boxes at all, and when commands move one sees the most heterogeneous lot of baggage, in general appearance not unlike such as one finds in the storeroom of a junkshop. Why cannot the quartermaster's department make and supply each company with a suitable and properly made set of boxes, including bread and mess chests, nicely painted and labeled? These might be sent out to posts, filled with clothing or quartermaster's stores, thereby saving special freight on them.

Some of the Canadian militia are supplied with laced canvas trunks, four for each company. These trunks or valises are made of heavy duck (painted) and about the size of an average company box, laced on top through eyelets with a heavy cord, and are used for carrying extra blankets or clothing.

I know all company commanders would be glad to have four or five such valises, to be used for similar purposes, or for packing tentage in when on the move, because they are very serviceable and weigh but little. As it is we generally tie our tentage in bundles with ropes, in which it becomes easily damaged and soiled, and is sure to get mixed up with the property of other companies where there are different commands moving together; and our extra blankets are packed in boxes which weigh almost as much as the blankets do.

Rations.—In the matter of rations some few suggestions, more especially useful in times of war or in field service, are offered: Each of the component parts of the ration which is used in active service should be put up in packages by the contractor, so as to be in multiples of 100 rations. For instance 100 rations of coffee is 10 lb., a bag of coffee should weigh 50 or 100 lb. net, which is coffee ration for 5 or 10 days for 100 men; 100 rations of sugar is 15 lb., 100 rations of sugar for 5 days is 75 lb., for 10 days 150 lb., and so on.

		net to the package,	100 rations.
Bacon,	75 lb.	" " "	50 "
Hard bread,	50 lb.	" " "	1000 "
Beans,	150 lb.	" " "	500 "
Beans,	75 lb. (alf sack)	" " "	1000 "
Coffee,	100 lb.	" " "	1000 "
Sugar,	150 lb.	" " "	1000 "
Sugar,	75 lb. (alf sack)	" " "	500 "
Vinegar,	10 gallons keg	" " "	1000 "
Vinegar,	20 galls., half bbl.	" " "	2000 "
Vinegar,	40 galls., bbl.	" " "	4000 "
Soap and salt,	40 lb.	" " "	1000 "
Soap and salt,	20 lb.	" " "	500 "

A sack of bacon would thus always be 100 rations; a box of bread, 50 rations; a sack of beans or sugar, 1,000 rations; a half sack of beans or sugar, 500 rations, and so forth.

The advantage of a uniform system in the weights of packages containing any of the component parts of the ration is obvious. This method of sacking and packing would be especially useful in time of war, when great quantities of these stores are to be shipped and handled.

It would do away with an immense amount of labor in weighing and reweighing every time stores change hands or are to be issued. By merely counting packages, the amounts on hand or being forwarded in cars or wagon trains could be almost always accurately stated. At such times and when it becomes suddenly necessary to forward rations by wagon train, perhaps to be loaded during the night; or when a brigade or regiment is required to draw ten days' rations on a dark night preparatory to a move early in the morning; there is great advantage in knowing the weights of all packages. No weighing would be necessary except what can be done on a small scale for the odd pounds, nor need even a pencil be used to add weights as they are loaded. By counting packages a commissary can tell accurately at any time how many rations are in any particular wagon or train.

Twenty sacks of coffee would weigh 2,000 lb. and be

KOLLMAN'S RAILWAY CARRIAGE TRAVERSING A CURVE OF SMALL RADIUS.

The wheels and axles are shown in the act of accommodating themselves to the curve.

tion, peculiarly distressing to most passengers, especially to females, as well as productive of injurious results to proprietors, is entirely removed, and the carriages will be found to keep the even tenor of their way without swerving or jolting, however rapid the transit on the direct line, or on such a curve as might call into action centrifugal force.

SUGGESTIONS FOR MILITARY IMPROVEMENTS.

By Capt. CORNELIUS GARDENER, 19th U. S. Infantry.

THOSE of us who serve with troops, especially during campaign or service in the field, have frequent opportunities to observe wherein improvements could be made in the arms, equipments, rations and clothing for the army, as now provided. In some cases the improvements that suggest themselves in these may be but slight and not of vital importance, but we also have opportunity from experience with them to notice their more serious defects and to wonder why these defects should be allowed to exist. Outside of the army at least, the American people generally are ever ready to improve upon anything that stands in need of improvement, and they pay but little deference to any spirit of conservatism, especially when it blocks the way of utilitarianism. Yet it is a fact that, owing to a condition of affairs that need not be explained here, those who have the best opportunities to judge of the needs of the army in matters that pertain to its welfare and efficiency, both in peace and war, have least to say in bringing about improvements upon any existing status. The art of war is never at a standstill, and the nation which is in the advance of others in all that appertains to making its armies effective in time of war, be it even in the smallest details, is most likely to win. We should therefore improve in army affairs wherever we see opportunity for improvement, and not allow any spirit of conservatism to stand in the way of throwing aside useless hindrances to efficiency, and of adopting, from time to time, the new ideas which suggest themselves in the way of improvement, especially where they are sensible and of manifest utility.

To officers of the line, the arms, equipments, rations and clothing of the soldier are matters of vital importance. Upon these largely do we depend for success

marksmen and sharpshooters; if not, why do good shots constantly endeavor to weaken the pull by filing the spring or by inserting pieces of leather, or why must there be a hammer at all to explode the cartridge? That a cartridge may be exploded as well by a less terrific blow, there is no doubt. Shotguns and army pistols have a much lighter hammer and weaker spring and yet do their work well.

There is much room for improvement upon the present rear sight of our rifles. The indistinctness of the graduations is a constant source of annoyance in skirmish firing. It is impossible to set the sight when advancing at a run.

For known distance practice where time is not a consideration, they are all right enough; but does any one suppose that men under the excitement of battle, or out of wind from advancing by rushes or double time, can or will set these indistinct sights as ordered? The graduations are so hard to see on the range that, in order to make them more distinct, our best shots often fill them with chalk or whitening for skirmish firing. For actual service we should go back to the leaf sights as the Germans have done, or else have spring notches, plain and distinctly visible, so that all the captain's command need be, "first," "second," or "third notch" or leaf. As they are at present it takes a good light and perfect eyesight to set a sight as ordered, except by guess.

The battle sight should have few and very plain graduations about which there can be no mistake. An extra leaf with finer graduations for long-distance firing, with wind gauge, etc., could, if it is needed, be placed beneath the battle sight. Let us hope that the new rifle, the trajectory of which is to be very flat, will do away with raising and lowering sights within battle range.

The rifle should also have a *third band* about six inches below the present upper band, with swivel attached, so that it could be conveniently carried over

20,000 rations, about a load for a wagon. Fifteen sacks or 30 half sacks of sugar would be 15,000 rations and would weigh 2,250 lb. At present, hard bread is the only part of the ration so issued. This is issued in 50 lb. boxes, or rations for 50 men for one day.

This rule of uniformity in weight should also be followed in sacking grain for animals. Sacks of corn should weigh 120 lb. or 10 days' rations for a horse; sacks of oats 60 lb., or 5 days' rations.

All proposals for army contracts for rations and forage should specify the number of pounds required to the package. The additional cost would be very small.

As shrinkage in weight is due almost altogether to the evaporation of water, no account need be taken of this in issuing the rations in unbroken packages of the kind indicated, just as at present no account of it is taken in issuing hard bread and soap. But if this be an insuperable objection, then add to each sack say 2 per cent., to make up for any shrinkage that might occur in weight between dates of purchase and issue.

In regard to the different kinds of food that go to make up the soldier's ration, there is probably but little improvement necessary. In these days of canned vegetables it would seem, however, as if tomatoes and green corn in cans should be a part of the ration. In the field there is not enough antiscorbutic in the ration as now prescribed. Potatoes and onions, being bulky and heavy and subject to being frozen, should be issued desiccated for field service. My experience with desiccated potatoes and onions, from having used them an entire winter in Colorado, is that they can hardly be told from fresh vegetables when well soaked and properly prepared. A half hour's soaking in warm water, or overnight in cold water, is all that is necessary.

There should also be issued to troops in the field or on the march, and especially when fresh beef cannot be obtained, beef extract as now manufactured in its semi-solid state. For a noonday lunch or on a long fatiguing march, a tin cup full of beef tea, either hot or cold, would be infinitely better than the everlasting coffee, especially such as a soldier gets. Extract of beef is easy to carry and easy to use and is very palatable with a hard tack soaked in it. Extract of the coffee bean, containing all the elements except the woody fiber, can now be obtained in a liquid state and also in solid shape in cakes or tablets like chocolate, each cake being enough for one or more cups of coffee. By substituting these for the green coffee in the field ration, especially in times of war, a great saving of weight would be effected. There would be no coffee burnt by the cook and the coffee mill could be left at home. Such articles of food may cost a little more than those which men now get on a campaign, but war is an expensive game at the best, and much sickness and camp dysentery could be prevented by providing more nourishing foods.

When armies are raised composed of men entirely unused to camp life and coarse foods, more men are killed in the first six months after they take the field by bacon than by bullets. It is expensive business to recruit men simply to lie in hospital awhile, and then be pensioned for the rest of their lives, in order to save money on the food supply.

Clothing.—In the matter of army clothing there has of late years been considerable improvement in some respects, but many believe there is room for more. In the matter of color of the uniform, except for the recent associations connected therewith, no one will deny that gray is better than dark blue. It cannot be seen as far and does not show dust or dirt as easily. Cadets have always worn gray, even when the Southern troops did, if that be an objection. If gray is the best color, it should be adopted for our army. We might with equal propriety never eat corn bread because the Johnnies lived principally upon that article of food during the war. Certainly blue is *not* the best color. We all know how plainly visible a marker is on the target range at any distance. One could not have a better target than a soldier dressed in a dark blue blouse. He is much more distinct than the black paper silhouettes at which we fire.

The overcoat of the enlisted men is made of excellent material, but it is not made so as to get the most warmth or protection out of the material in it. There is too much cloth around the body, if we include the cape, and not enough to protect the legs and thighs. It should be longer and have more material in the skirt. The cape should be very small, and only protect the shoulders, or better yet, there should be no cape at all, but instead a hood such as officers wear, for rain or cold weather. As now issued with a long cape, the knapsack cannot be worn unless the cape is detached, and then what shall be done with the cape but leave it at home? The overcoat should be longer and more like an ulster, just as ours is; and in order that the front skirt be not in a man's way when marching, or climb up on his knees in going against the wind, there should be a couple of buttons and button holes to button them back with, leaving the legs free. There should be two breast pockets in the overcoat outside and one side pocket at least, so that on the march a soldier may have a chance to warm his hands there and also have a place to carry a few things, such as his pipe and tobacco, or an extra box of cartridges. If outside pockets are unmilitary, as some say, why do officers have them in their overcoats? At all events it is not good sense to sacrifice recognized utility to an old foggy notion. There is too much of that in the army, and besides, an overcoat is not a full dress affair.

We need no full dress coat for a soldier. The padded dress coats they now wear are very warm, and yet they are principally worn in summer. They are uncomfortable in every way, and expensive, and as far as looks go do not come up to a well-made blouse, nor does a company look as neat in dress coats as in blouses. There is no better garment to show off a good figure such as most of our men have than a blouse. To take the place of the full dress for soldiers I would suggest the present blouse, just as it is, except with a standing collar, a few white facings for the privates and gold lace chevrons for the non-commissioned officers; then when it has been worn awhile for best, these might be removed and the blouse worn for every day, without trimmings. The

American people do not take kindly to much fuss and feathers any way, and the less of these we are made to wear the more respect they will have for us.

Gorgeous uniforms may be tolerated in Europe from the peculiar conditions which exist there, but to Americans, a man bedecked in gold lace and plumes is not an object of admiration, and any person so arrayed is apt to be jeered at by the small boys on the street, and the small boys often echo the sentiments of their parents. I believe that in this country where people hate ostentatious display in its officials we should strive for utility and simplicity in army uniforms, and the sooner the better.

The presence of a regiment dressed as was the Twenty-second infantry when it was in camp on the lake front in Chicago during the riots, having been brought in from a campaign on the plains and dressed apparently for business only, had a better effect upon a mob than if the men had been dressed in finery with gold lace. In these things we copy too much after European armies. We should set the example for simplicity, utility and common sense in clothing our soldiers, and we would save much unnecessary expense and be less subject to ridicule by non-military people. "We have heard it said by those of old" that fine uniforms are beneficial in some way toward making good soldiers, and that the soldier will be more military if he wears one, but this, too, we believe to be old foggyism.

Under the present *regime* the private soldier has plenty of head gear. A well equipped soldier has a dress helmet (Prussian), forage cap (French), a cork helmet (British), a musk rat cap (Esquimaux), a slouch hat (cowboy), a brown cap which covers his entire face and neck except his eyes (Kuklux), and at the discretion of the post or company commander a straw hat, to wear in summer when off duty.

Who prescribed all these different sorts of head gear for the army? and by what authority do some *made blouses* have outside pockets and others not, some six buttons and some five?

The fact is that whatever is sent out to a post nowadays, by some quartermaster, is uniform for the soldier, and it is only by examining the annual price list issued by the quartermaster's department that we can tell what his military wardrobe should consist of. In order that an officer may be dressed as his men are, he should have all these things also, we presume, yet as there are no positive orders requiring company officers to wear what their men do—leggings, hats, fur caps, fur gauntlets or overshoes—we sometimes see commands turn out with officers wearing combinations of any of these articles or entirely without them. The supply departments apparently know what we want, and so they send it to us, and consequently we are apt to appear at any time in strange and odd looking garments, being experimented upon like models in a military shop; and are accumulating thereby an ever-increasing military wardrobe, wearing with patience anything sent to us, until the next change.

When we come to the subject of shoes for the army we feel discouraged. My own personal experience goes back only as far as 1873, but at least ever since then, the quartermaster's department has faithfully tried to manufacture or contract for a good shoe. We have had many different kinds of shoes and boots since then, but none which were at all satisfactory, and yet, strange to say, during all these years, one could step into any store in a large city, and purchase just such a shoe as a soldier would like to wear when he marches. The quartermaster's department seems to have an idea that an army shoe must be some odd shaped affair, different from anything that any one else wears, who walks or hunts, and in that respect alone have they so far succeeded in the matter of shoe production. There are many styles of excellent marching shoes manufactured in this country, shoes with soft uppers, broad toes and sole, and a low, flat heel, laced far up to prevent dust getting to the foot, just such a kind as any pedestrian would purchase, but they cannot be bought for \$1.78. A good sewed shoe of the kind mentioned cannot be made for less than \$3, and as soon as the quartermaster's department becomes cognizant of this fact, it may succeed in providing the army with a suitable shoe.

The cowboy slouch hat, of which I have made mention heretofore, is another instance of poor economy in buying inferior goods. This hat would be the most comfortable and useful of the present head gear for field service if it were of good shape and quality, but ours is made of cheap wool instead of felt, and it becomes so shapeless after the first rainstorm that it gives thereafter even the most exemplary soldier the appearance of having been on an extended spree.

We in the line are so entirely in the hands of our friends of the supply department in all these matters of arms, equipments, rations and clothing, that any changes or improvements brought about in any matter suggested must come through them; but as we have the opportunities, from our experience with troops, of observing defects that might escape the attention of these departments, it is to be hoped that we will not be deemed presumptuous in pointing them out.—*Jour. Mil. Serv. Inst.*

THE KIESELGUHR FIRE BRICK.

A SOMEWHAT novel brick has recently been introduced under this name as a substitute for ordinary fire bricks. The chief advantage about these bricks is their lightness, which renders them specially suited for blast furnace pipes, covering retorts, etc. They can be used for all the purposes to which an ordinary fire brick is put, as the material of which they are made, *pure Kieselguhr*, possesses chemical properties which render it as infusible as quartz. These bricks have been utilized for special purposes in chemical works, where lightness and great heat-resisting and non-conducting properties are desirable, with great success. They also give satisfactory results for retort settings at gas works.

The success of these bricks as fire bricks is now undoubtedly established, and as an indication of their lightness as compared with other fire bricks, it may be mentioned that the brick itself has a specific gravity of 0.6. A cubic yard weighs about 12 cwt., which is about a fourth of the weight of a cubic yard of Dinas bricks. Some idea of the composition of the brick can be

gathered from the following analysis of the Kieselguhr from which they are made:

Silica	83.8 per cent.
Magnesia	0.7 "
Lime	0.8 "
Alumina	1.0 "
Ferric oxide	2.1 "
Organic matter	4.5 "
Moisture and loss	7.1 "
100.0	

This is an average analysis, and represents the average composition of Kieselguhr.

MANUFACTURE OF SODA ALUM.

UNLIKE the solution of potash or ammonia alum, a boiling solution of soda alum of a density of about 60° Twaddell's hydrometer, or 1.3 specific gravity, gives on cooling scarcely any or no crystals; and one which is much above this density, instead of yielding on cooling a crop of well defined crystals, from which the impure "mother liquor" may readily be drained out, resolves itself into an opaque, viscid or cheesy magma.

It has been proposed to overcome these difficulties by running the hot, strong solution of soda alum, under prescribed conditions, into a cold saturated solution of soda alum, and by that means to obtain good crystals free from the cheesy magma above mentioned. It has been found, however, in actual working, that the quantity of cold saturated solution of soda alum required for this purpose is relatively so large—viz., about three times the quantity of the hot solution—as to make it difficult by ordinary means to so regulate the temperature of the whole as to obtain the crop of crystals, and thus the process is rendered unremunerative.

A magma which requires no treatment with cold solution, but which on being stirred or turned over will resolve itself into soda alum crystals and mother liquor, is produced as follows: A hot, highly concentrated solution of soda alum is prepared in the usual way from ordinary sulphate of alumina and sulphate of soda, or from aluminoferric and sulphate of soda, and this is mixed with a smaller proportion, generally one-half the quantity, of cold saturated solution of soda alum to yield on cooling a magma not too stiff to be freely stirred or turned over.

It is practically more economical to use aluminoferric than a purer sulphate of alumina—a solution of aluminoferric of strength not exceeding 60° Twaddell, or 1.3 specific gravity; and in this is dissolved the requisite quantity of ordinary commercial salt cake containing the usual percentage of sulphate of soda, the proportions used being about five parts, by weight, of aluminoferric cake to one part, by weight, of salt cake.

The operation is conducted in the lead-lined steam dissolving box used by alum manufacturers. While steam is being blown into this box a stream of the aluminoferric solution is run through the box and at the same time the salt cake is shoveled till the whole of it has been dissolved by the aluminoferric solution. The solution thus obtained is run into a tightly covered lead-lined tank, in which it is allowed to stand until the suspended impurities have been settled out. This takes about twenty hours. The clear liquid is then run off into a lead-lined evaporator fitted with a coil of lead pipes containing high pressure steam, and by means of this coil the solution is boiled down until it attains a strength of about 90° Twaddell, or 1.45 specific gravity. This boiling liquid is then run into a cold saturated solution of soda alum in the proportion of about two parts, by volume, of the hot solution into about one part, by volume, of the cold liquid, taking care to thoroughly mix the two liquids by means of a suitable stirrer. The mixed liquid is then run into a lead-lined cooler of such a depth as will allow the magma that is to be produced to be easily turned over by means of a wooden shovel. Then, by means of a wooden rake, mixed liquids are agitated and cooled until the magma has formed, and the magma is then turned over at intervals by means of a wooden shovel, until it has been brought down to ordinary atmospheric temperature and till it has been transformed into good crystals of soda alum. The agitation of the mixed liquids necessarily tends to cool them more quickly, and thus to hasten the formation of the magma; but if the mixed liquids are allowed to cool without agitation, the magma produced may then be turned over, as above described, until it is transformed into good crystals. By these means the magma is converted within a comparatively short time into good soda alum crystals, from which the impure mother liquor may be readily drained out by any well-known means or may be separated by a centrifugal machine. This obtains a crop of soda alum crystals equal to or greater than the weight of the aluminoferric cake employed to produce it. From the resultant mother liquor such proportion as will, together with the small portion of iron removed by the alum itself, withdraw all or practically all the iron that was introduced by the hot concentrated solution is removed, and the remainder of the mother liquor, which is the "cold saturated solution" already referred to, is reserved for mixing with a new increment of hot concentrated solution, as already described. The proportion of mother liquor withdrawn is utilized either (a) for conversion into potash alum or ammonia alum by well known means, the alumina being readily crystallized out of the solution as potash alum or ammonia alum on the addition of the proper potash or ammonia salts, or (b) is used either in the liquid form or in the form of a cake for the purification of sewage or other impure waters or for any purpose for which impure aluminous compounds may be employed.—*Chem. Tr. Jour.*

THE Bordeaux mixture has been used with success in experiments by the Department of Agriculture to rid fruit trees of lichens which adhere to the bark of the trunk and limbs. The mixture was applied with a whitewash brush and the lichens at once turned yellow, and within three weeks were all dead. Later experiments showed that equally effective results could be had with the ordinary spraying machine.