Correspondence.

A Military Trolley Line.

To the Editor of the SCIENTIFIC AMERICAN:

Perhaps the greatest difficulty in the Santiago campaign was in the lack of transport, and I would like to ask if a military trolley line would have been feasible. A discussion might interest your readers in general. If a vessel had been sent with the squadron completely equipped for setting up and working a trolley, could not the reserve troops under guidance of experts have rapidly felled trees and made a road, with or without rails? A trolley would have added immensely to the efficiency of the commissariat. And it may be asked why contractors who furnish poor food and clothing are not as sharply looked after as are those contractors who furnish poor munitions. An army deserves to be as scientifically provisioned as were Nansen's expeditions. Certainly if a cake of kola chocolate and a lemon had been carried by the troops advancing on Santiago, the service would have been far more effective. Does not our scientific civilization involve the superseding of the army mule, hardtack and sowbelly? In short, has not the art of war as regards munitions advanced far beyond the land transport and commissariat departments? It appears to me that a discussion of these matters by the SCIENTIFIC AMERICAN at this time would be of great value and interest.

HIRAM M. STANLEY.

Lake Forest, Ill., July 19, 1898.

Vertical versus Inclined Armor.

To the Editor of the SCIENTIFIC AMERICAN:

In view of the recent advances in the manufacture of armor-piercing projectiles, I should like to ask about the relative values of the American and British systems of battleship protection for the "vitals."

It seems to me that the English device of curving the protective deck to meet the bottom of a thin belt will be found to be more efficient in the future than our own use of a single thick belt.

For example, take a United States ship with a 10-inch belt and an English battleship with equivalent armor of say a 6-inch belt reinforced by a 3-inch sloping deck; all the armor to be of Harvey reforged nickel steel. Then assume a capped shot with just sufficient energy to completely penetrate the 10-inch belt. In the United States ship we have now complete penetration; but in the British vessel, in penetrating the 6-inch belt the projectile loses its cap, and so has to attack the 3-inch inclined armor without the protection of a cap and with a point more or less weakened. Under these circumstances, I should think that the projectile would be broken up on the hard face of the 3-inch deck and fail of penetration.

I wish very much to get your opinion on this point, which seems to be of some importance.

GEORGE B. MOODY.

214 Broadway, Bangor, Me., July 24, 1898.

[There is much to be said in favor of both the systems above referred to. Their relative value will depend somewhat upon the type of projectile used by the enemy. If a solid armor-piercing shot is used, the thinner side armor and sloping deck will prove more effective, for the reasons suggested by our correspondent. In the other case, after passing through the vertical armor, the capless shot, if it were not shattered against the sloping deck, would probably be deflected and never reach the vitals. If armor-piercing shell were used, we think the vertical 10 inches would be preferable, for the reason that it would, in all likelihood, be burst before it got through, whereas it would stand a good chance of passing through the 6 inches of vertical armor and bursting in the bunkers and against the sloping deck. The great effort of designers is to give a ship such defensive armor that shells will burst outside the ship, and for this purpose the vertical armor is, we think, preferable.—ED.]

The Ancients' Hospitals.

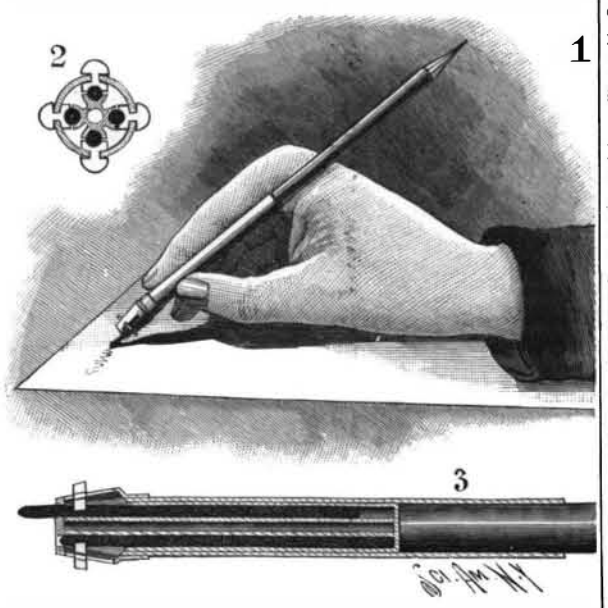
A very interesting and pleasing discovery is announced from Baden, near Zurich. The learned have been discussing for ages whether anything in the way of hospitals was known to the ancients—it is not to be said that they have been disputing, for there was not material enough hitherto to support a lively argument. One might read the whole volume of Greek and Roman literature, carefully, too, without noticing one passage that might be interpreted as an allusion to a hospital. The works of Hippocrates could not fail to speak of them surely, if any existed; but nothing is there beyond a reference to the notes of "cases" observed in the Temple of Æsculapius. So it is generally assumed that there were no hospitals in those days; the Aesclepia were "baths" with massage treatment. Scholars who hold to the other opinion can adduce only hints in its favor. But now we hear that one has actually been discovered at Baden, containing "fourteen rooms, supplied with many kinds of medical, pharmaceutical, and surgical apparatus, probes, tubes, pincers, cauterizing instruments, and even a collection of safety pins for bandaging wounds"—but these things are familiar. "There are also medicine spoons in bone and silver, measuring vessels, jars, and pots for ointment, some still containing traces of the ointment used." The latest date of the coins found appears to be in the reign of Hadrian. Probably it was a military hospital, for this was the station of the Seventh and Eighth Legions. But the find is certainly not less interesting on that account, for the army medical service of Rome and Greece is one of the deepest mysteries of archæology. Cæsar refers only once to his regimental surgeons—is there a single distinct allusion elsewhere? We hail with puzzled gratitude the casual remark of Xenophon that the Spartans sent their doctors to the rear when a fight impended—but we look vainly for more information from him or anybody else.

AN IMPROVED LEAD PENCIL.

A lead pencil has recently been patented by Gotthelf M. Seidel, of Easthampton, Mass., which is arranged to hold different movable leads, any of which can be readily projected and locked in place for immediate use.

Referring to our illustrations, it will be seen that the pencil is provided with a casing, one end of which is open and adapted to receive an ordinary pencil or eraser. The other end, however, has a number of longitudinal chambers or recesses containing leads of different colors or of different degrees of hardness. Each lead may be extended through a head on this end of the casing when in use, and may be locked in place by any suitable means. The locking device illustrated in Figs. 2 and 3 consists of a slide fitted to move on inclined guideways formed in the head. When the slide is moved outwardly, its inner end presses against and locks the lead in place.

When it is desired to use one of the leads, the corresponding slide is moved rearwardly to release the lead, and upon tilting the casing slightly, the lead is projected outwardly and may be locked in place by moving the slide forward.



SEIDEL'S LEAD PENCIL.

Photograph of the Holy Shroud by Electric Light.

In Turin, the other day, according to Il Osservatore Romano, a photograph by electric light was taken of the Holy Shroud, which gave an admirable reproduction of the body of Christ, says The Electrical World. The Holy Shroud was recently exposed to veneration, and King Humbert, who is its hereditary guardian, at first hesitated to give authority to have it photographed, lest the photographs should be speculated in. However, his Majesty at length gave the requisite permission to Signor Secundo Pia, a lawyer and member of the committee on sacred art, who had offered to photograph the Holy Shroud at his own expense. Signor Pia prepared his plates according to a special method, rendering them sensitive to the yellowish tint of the Holy Shroud by means of powerful electric reflectors. "Formerly," says Il Osservatore, "the appearance of the Holy Shroud gave an idea of the contour rather than the facial lineaments and body of Christ. On the other hand, the photographs, on being developed, showed a perfect representation of the face, hands, and limbs of Christ, the general effect being that of a photograph of Christ and not of his shroud."

Street Cars of Manila.

If Manila surrenders without being bombarded by Rear Admiral Dewey, the American troops may feel very much at home there when they ride through the streets of Manila in street cars which were built in this country, says The Railway Review. The total street car equipment of the "Tranvias de Filipinas" was built by the J. G. Brill Company, of Philadelphia.

Miscellaneous Notes and Receipts.

Testing Sumac.—Prof. W. Eitner says, in Der Gerber, that sumac is best tested for purity by using a microscope. The leaves of Rhus coriaria, from which the Sicilian sumac is prepared, are covered with very fine hair upon both sides, especially on the back, which covering is so glaring that the detection of a sophistication is easy.

Waterproof Gelatine Paper.—The paper is coated on both sides with a solution consisting of 1 part gelatine, 4 parts water, and 1 part glycerine. Coagulate the gelatine and immerse the paper in a solution of 750 c. cm. of formol in 5 liters of water. The paper thus treated is, after drying, impervious even to steam.—Nueste Erfindungen u. E.

New Thermometer Fluid.—In determining low temperatures, thermometers filled with toluol alone or with a mixture of toluol and alcohol were employed heretofore. These latter thermometers could only be used as far as minus 100 degrees (below zero), because the said mixture solidified in a lower temperature. According to Kohlrausch petroleum-ether, whose freezing point lies as low as about 190 degrees (C.?), is very suitable as a filling for thermometers to determine low temperatures.—Pharmaceutische Centralhalle.

A simple method to restore the illuminating power of mantles was reported by Franck to the Polytechnic Society, at Berlin. As is well known, the mantles relax in illuminating power after they have been in use for some time. This luminosity may be restored to a certain degree, by blowing out the mantle from the inside during the burning, which can be accomplished with the aid of a small glass or paper tube. The president of the said society stated that he had personally tried this medium and had found it effective and, in consequence, recommendable. In order to facilitate the carrying out of the process, the German Incandescent Gaslight Company manufactures a tube, mounted in a rubber ball, which is very convenient for the said purpose.—Nueste Erfindungen und Erfahrungen.

A Superior Solvent for Nitrocellulose.—Artificial silk prepared in the well known manner from cellulose has not met with the favorable reception expected. This is principally due to its behavior in presence of water. In a moist condition it loses 90 per cent of its strength, and this characteristic, without taking into account the objections raised by customers by reason of this peculiarity, renders the manipulations of dyeing and finishing difficult. To correct this evil an English inventor has been issued letters patent for remedying the hygroscopicity of artificial silk—that is, its inclination to absorb water. The process consists in the addition of formaldehyde, acetaldehyde, paraldehyde, benzaldehyde, or any other substance belonging to this group, to the solvent of the nitrocellulose, or in treating the drawn thread with a solution of these substances. The quantity of the formaldehyde or the agents required for the treatment before the denitration of the finished spun threads may be as much as 15 per cent of the weight of the nitrocellulose. Since formaldehyde or the above mentioned agents, in combination with ethyl alcohol or methyl alcohol, ether, etc., is an extremely active solvent of nitrocellulose, it is advisable to add the formaldehyde, etc., when commencing to treat the nitrocellulose and to mix it.—Leipziger Faerber Zeitung.

Testing Commercial Albumen.—Gelatine, dextrine, and mucilage are generally used for adulterating the dry commercial albumen. Again, the albumen may also be worthless through partial coagulation. For testing a sample, 2 grammes are stirred into a small quantity of distilled water, by which a sophistication with flour may be recognized. The mass is next diluted with water to make 200 c. cm.; if the albumen contains no coagulated admixture, the solution remains clear. To 100 c. cm. of the solution are next added 35 c. cm. of a 1 per cent tannin solution and about 0·2 gramme of a pure commercial tartar. This mixture is agitated and filtered. One-half the filtrate is mixed with a 0·5 per cent gelatine solution (of which 25 c. cm. correspond to about 0·1 gramme of pure commercial tannin). If the sample is pure albumen, there must in no case be a precipitate. Should the gelatine cause a precipitation, then an excess of tannin is present; the albumen contains in this case either adulterants or else it is coagulated in part. If a precipitate is caused at the second addition of tannin to the albumen solution, the albumen is adulterated with gelatine or similar substances. From the quantity of tannin required for the second precipitation may be determined approximately the gelatine present, as the latter is capable of precipitating about four times as much as the same weight of dry albumen.

The presence of gelatine and of dextrine in albumen may also be ascertained by heating the solution of the product in a water bath. The albumen coagulates thereby and may be separated by filtering. If the sample is pure, the filtrate will give no precipitate with tannin. Dextrine and gum arabic can be found in the filtrate by the usual test methods.—Ann. Chim. Anal. Appliq., 1897, p. 241.

Alinit.

Under this name a manufacturer of coloring matter in Elberfeld (Germany) has put on the market a product in the form of yellow powder which, according to the inventor, will make the production of cereals possible independent of the richness of the soil in nitrogen; in other words, it is supposed to play the same part in feeding these plants that nitrogen does in feeding leguminous plants.

A farmer of the name of Caron, to whom we owe the discovery of this product, says that "alinit" is the cultivation of a germ of the soil which causes the nitrogen in the air to enter into chemical combinations especially adapted to the nourishment of cereals. In experiments conducted in the laboratory and also on the farm, the plants treated with alinite produced from 10 to 30 per cent more than those not treated. Therefore, alinite would do away with the use of azotic manures, nitrates, sulphate of ammonia, etc., in the cultivation of cereals.

These experiments are certainly promising and worth being verified. This is what Dr. Hartleb, who communicated the results of his work to the congress of naturalists recently held in Brunswick, has just done.

The cultivation of "alinit" is supposed to consist of the bacteria of putrefaction, and should resolve nitrogenous materials into nitrogen gas instead of causing them to enter into chemical combinations useful to plants.

We must note that Hartleb was content with mixing "alinit" with earth without sowing any grain therein; objections have been made, and they have weight, that the alinite germs cannot attack the nitrogen of the air except on condition that they live in common, in symbiose as scientists say, with the growing grains.

In the last issue of the Revue Agronomique du Temps, M. Grandean reports on the observations recently made on "alinit" by M. Stoklasa, a professor of Prague. In common with those of Hartleb, they establish the fact that the "alinit" germs, to which Caron gives the name Bacillus ellenbachi, is not a new species, but that it is the Bacillus megatherium discovered by Bary on putrefied cabbage leaves, and which also exists abundantly in the earth and in water. Cultivated in a soil containing a nitrate, it decomposed 20 per cent of this salt in the space of two months and a half. It would, therefore, seem that B. megatherium would be more harmful than useful, because it destroys the nitrogen which nourishes the plants. Besides this, it has two other extremely remarkable qualities. Stoklasa pretends that "alinit" really attacks the nitrogen of the air, but only in the presence of a growing plant. During a trial growth of barley which lasted sixty days, one kilogramme of prepared earth attacked seventy milligrammes of nitrogen.

In order to get an idea of the importance of this amount, I call attention to the fact that a hectare of earth 20 centimeters deep weighs about 4,000,000 kilogrammes. Admitting an absorption equal to that claimed by Stoklasa, in the space of two months a hectare would have absorbed 280 kilogrammes of nitrogen, which is more than enough for three excellent crops of grain.

This is not all. M. Stoklasa also claims that Bacillus megatherium increases the assimilative power of nitrogenous substances of an organic nature. Turf containing 0·83 per cent of nitrogen (after having been impregnated with alinite) contained, at the end of seventy-two days, 42 per cent of its nitrogen soluble in water.

The result of this experiment is that "alinit" would increase the fertility of soils rich in black mould.

It would not be wise at present to take sides in such a complicated and little known question as that of alinite; it offers such wonderful prospects to agriculture that it will not fail to cause numerous researches by scientists in all parts of the world. Practical persons will do well to await the results of the scientists' experiments before making an extensive use of a product whose efficacy is not yet firmly established.

The above article was published recently in Le Phosphate. In order to learn what opinion was held by our own authorities on this subject, the editor wrote to the Department of Agriculture and received the accompanying exhaustive and courteous reply:

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., July 8, 1898.

To the Editor of the SCIENTIFIC AMERICAN:

DEAR SIR: I take pleasure in sending you the following statements in regard to "alinit," which have been prepared in the Division of Chemistry of this department in response to your request of June 29.

Since the announcement in 1885 of the experiments of Berthelot which indicated that the free nitrogen of the atmosphere is brought into chemical combination with other elements by the action of micro-organisms contained in the soil, and the experimental demonstration in 1885 by Hellriegel and Wilfarth of the part played by micro-organisms in the assimilation of free nitrogen by leguminous plants, numerous investigators have been strenuously endeavoring to discover the conditions under which these organisms may be made to supply field and garden crops with nitrogenous food with certainty and with profit to agriculturists. Methods have been patented for inoculating soils and seeds with the organisms which live in symbiosis with leguminous plants in the nodules on their roots, and thus enable them to utilize the uncombined nitrogen of the air for the construction of the nitrogenous substances which are especially abundant in the plants of that family. Pure cultures of these organisms are manufactured and offered for sale by Farbwerke vormals Meister, Lucius & Brüning, Höchst a. M., Germany, under the trade name of "nitragin."

The advertisement of this firm, on the last page of the recent issues of the Deutsche landwirtschaftliche Presse, states that the treatment of one morgen (0·63 acre) of land with "nitragin" costs 2·75 marks (69 cents). This method of soil inoculation has been tried with varying success in Continental Europe, in Great Britain, in the United States, and perhaps in other parts of the world.

However, the only way to obtain a supply of nitrogenous food from the air for the use of wheat, rye, corn, oats, barley, and other crops not belonging to the leguminous family by means of the root-nodule bacteria, is to first grow a leguminous crop and plow it under as a "green manure," or to feed it to farm animals and apply to the land the manure produced. The evident need of the agriculturist is an organism which will bring the nitrogen of the air into the form of a chemical compound suitable for the nutrition of non-leguminous agricultural plants. The nitrogen of the air is free; nitrogen in forms suitable for food for cereal crops costs the farmer 6 to 13 cents per pound. A German agriculturist of the name of Caron, Rittergutsbesitzer at Ellenbach, in the province of Hesse, claims to have found this organism in the bacterium which he calls Bacillus ellenbachensis α. Pure cultures of this organism are manufactured and offered for sale to agriculturists under the name of "alinit" by the Farbenfabriken vormals Friedrich Bayer & Company, Elberfeld, Germany. The cost of the material for the treatment of one morgen (0·63 acre) of land is from 2·775 to 3 marks (69 to 75 cents), according to the quantity purchased. Caron began experimenting earlier than 1894, and since that time has used his method of soil inoculation extensively at Ellenbach for the growth of various non-leguminous plants. He claims an increase in the harvests of as high as 35 per cent in some cases.

"Alinit" and the process for its manufacture are protected by English patent No. 5,574, March 2, 1897, and undoubtedly by patents in other countries also. The commercial material is described as a brownish yellow amorphous powder sealed in a tube of yellow glass, packed in a cardboard box and accompanied by directions for its use and a pamphlet setting forth the results of Caron's experiments. The powder contained in the tube is prepared from dry cultures of the organisms, of which a very large proportion of the individual cells have passed into the resting spore stage, and are thus enabled to retain their vitality when stored for a long time. For the practical use of the material, it is mixed with water and the infusion obtained is applied to the seeds before they are sown. Five hundred to one thousand individuals of the organism are said to be made to adhere to each seed.

Stoklasa, of Prague, has subjected "alinit" to a careful study, and claims that the organism contained in it is identical with Bacillus megatherium (De Bary), an organism that is very abundant in soils and natural waters. He found that in a soil inoculated with the organism and seeded with barley, there was a fixation (bringing into chemical combination) of nitrogen amounting to 0·07 gramme of free nitrogen per kilogramme of soil in sixty-two days. He also observed that the organism was especially active in rendering soluble the nitrogen contained in peat and in soils rich in humus. Stoklasa has published papers on this subject in the scientific journals as follows:

Centralblatt für Bakteriologie, Zweite Abtheilung, 1898, iv., 39–41, 78–86, 119–130, 284–289.

Deutsche landwirtschaftliche Presse, 1898, xxv., 243.

Chemiker Zeitung, 1898, xxii., 181–182.

His results have been discussed in Annales Agronomiques, 1898, xxiv., 171–180 and 253–254.

Stutzer and Hartleb, of Bonn, have also studied "alinit," and have reported their results in the Centralblatt für Bakteriologie, Zweite Abtheilung, 1898, iv., 31–39, 73–77. They also report the organism of "alinit," Bacillus ellenbachensis alpha (Caron), to be identical with B. megatherium (De Bary). They were unable to detect any fixation of nitrogen when the organisms were grown in various culture media.

Lauck, of Jersitz-Pozen (Centralblatt für Bakteriologie, Zweite Abtheilung, 1898, iv., 290–295; Deutsche landwirtschaftliche Presse, 1898, xxv., 243), finds the bacterium of "alinit" to be Bacillus subtilis, an organism closely related to B. megatherium and of very common occurrence in the soil and on agricultural plants; in fact, it is commonly known as the "hay bacillus."

Miczynski (Deutsche landwirtschaftliche Presse, 1898, xxv., 393), working in the laboratory of the Agricultural Institute of Göttingen, found "alinit" to contain two organisms: B. mesentericus vulgatus, the "potato bacillus," and B. subtilis.

Frank (Annales Agronomiques, 1898, xxiv., 253) found the organism of "alinit" to be B. tereginus.

Dr. Paul Wagner, Director of the Agricultural Experiment Station at Darmstadt, a most skillful, careful, and experienced investigator, has tried "alinit" in pot and field experiments with various crops and obtained negative results.

The value of "alinit" is, therefore, at present an open question which future experiments must settle. Theoretical considerations point to two conclusions: First, it seems logical to expect that if we plant with the seed large numbers (500 to 1,000 for each seed) of an organism capable of rendering available the humus nitrogen already contained in the soil and endowed with the power of absorbing more nitrogen from the air, our young plants should begin their growth with a vigor and rapidity that would insure an abundant harvest. On the other hand, it is a well known fact that almost every bacterium multiplies at an astonishingly rapid rate whenever it is placed in a pabulum suited for its growth. The wide distribution of the organisms under discussion argues therefore that we should study how to insure their abundance in the soil by making it a medium favorable for their growth rather than by adding relatively small numbers of them in the form of artificial cultures to soil which is deficient in them because of its unsuitability for their growth.

While "alinit" and the methods proposed for its use may be devoid of value, the study of the question which it has called forth undoubtedly hastens the writing of one chapter of the history of the development of our knowledge of the microscopic organisms of the soil.

Respectfully,
JAMES WILSON, Secretary.

Opening of the Waterloo and City Electric Railway.

The formal opening of the Waterloo and City Electric Railway, London, took place July 11 in the presence of a distinguished company, which traveled over the road by two trains. A representative of the SCIENTIFIC AMERICAN was among the invited guests. The new electric underground line, which we hope to illustrate in another issue, connects Waterloo Station on the Southwark side of the Thames with the "City," the terminus being at the Mansion House opposite the Bank of England—a distance of a mile and a half. Access to it is obtained from Waterloo Station, whence the tunnels, two in number, pass under York Road at a depth of only eighteen feet from the surface, and then descending toward the river they cross Waterloo Road, a few inches below the main sewer of the London County Council. Proceeding along the line of Stamford Street to Hatfield Street, they then pass under the river in a northeasterly direction, emerging under the Victoria Embankment in front of the Royal Hotel, at Blackfriars, whence they pass under Queen Victoria Street till a commodious terminal station is reached opposite the Mansion House. The stations at each end are spacious and attractive, the tunnels are lighted from beginning to end with the electric light, the carriages are commodious and well arranged, the ventilation is good, and the trains passed from end to end with an ease and rapidity that left no ground for misgivings as to the thorough and practical way in which the work had been done.

Our Progress in the Manufacture of Iron.

The official report on the production of iron made by the American Iron and Steel Association shows conclusively our pre-eminence in this branch of industry. In the first half of 1898 our output was the largest known, either in the United States or any other country for the same period, and more than half a million tons greater than in any other half year of our existence.

The following figures give the production of the last half year and of the other periods which have in any degree approached it. They show a progress such as no other country has attained.

	Production.
1898, first half	5,909,703
1897, second half	5,249,204
1897, first half	4,403,476
1896, second half	3,646,891
1896, first half	4,976,236
1895, second half	5,358,750
1892, second half	4,387,317
1892, first half	4,769,683
1891, second half	4,911,763

Production has increased so as to reach 984,950 tons a month, and the apparent consumption has increased even more, reaching 991,391 tons. The highest production and the highest consumption have both been attained with low prices, both for pig iron and for finished products.

THE largest barracks in the world are at Warsaw, Russian Poland. About 38,000 men can be accommodated there. The barracks at Aldershot, England, hold 20,000 men.—Le Chasseur Français.