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September 9, 1916

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SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXV. NUMBER 11] NEW YORK, SEPTEMBER 9, 1916 [10 CENTS A COPY $3.00 A YEAR

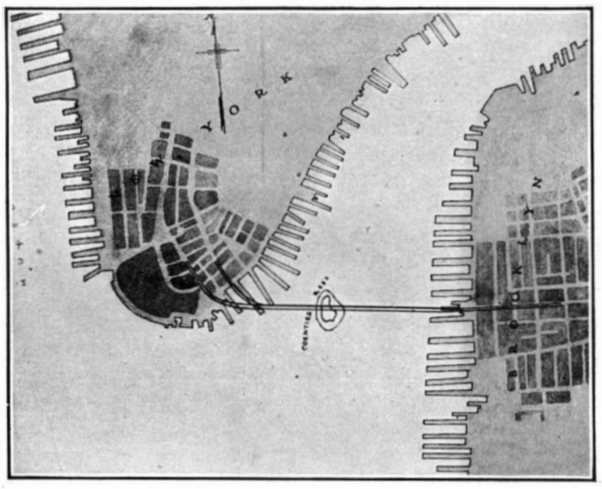
A Difficult Piece in Subaqueous Rock Excavation

By Robert G. Skerrett

SOMEONE said a while back that national preparedness should "begin at the bottom and work upward." This critic had in mind the East River, New York, and the part it would have to play in the defense of the Atlantic seaboard in time of war. He also was thinking of that vast movement of ocean-going shipping that the East River seems to invite superficially and yet hampers because of submerged obstacles. Plainly, he meant that the channel fairway should be made clear for heavy craft at least as far as the Navy Yard.

The biggest of our naval stations is situated on the Brooklyn side of the East River. There was a time when the site was admirably suited for the purpose. To-day, this is debatable, because the ships of the battle fleet have outgrown that haven or, to be exact, the one avenue of approach and departure. Unless the tide favor, the largest of our dreadnoughts cannot safely navigate the lower reach of the East River. Our fighting craft are deeper drafted than a decade back, and the existing channel is no longer a safe one at all times. This is because of a ledge of rock that reaches out from the Manhattan shore and rises in the form of a menacing hump within a trifle more than 23 feet below the surface at mean low tide. The biggest of our dreadnoughts and some of our naval colliers draw 30 feet and more when full laden, and because of subaqueous conditions these ships are not infrequently delayed in getting to and from the Navy Yard.

The principal stumbling block to free navigation at all hours is Coenties Reef. Originally, there was only 14.3 feet of water over the ledge at mean low tide, but the Government authorities cut away the rock and increased the depth 11 feet about 1875. Since then, ocean-going liners and the ships of the fighting fleet have grown apace. Time and time again Congress was urged to cut away more of the reef, but only recently have the funds been provided to strip the channel of this menace to shipping. Now, the work is under way, and probably before a year has gone the water over Coenties Reef at mean low tide will be not less than 40 feet. This provision will make it possible for naval craft of the deepest draft to come and go from the Navy Yard at any time and will make it easier and safer to maneuver the big merchantmen that now dock in the lower part of the East River.



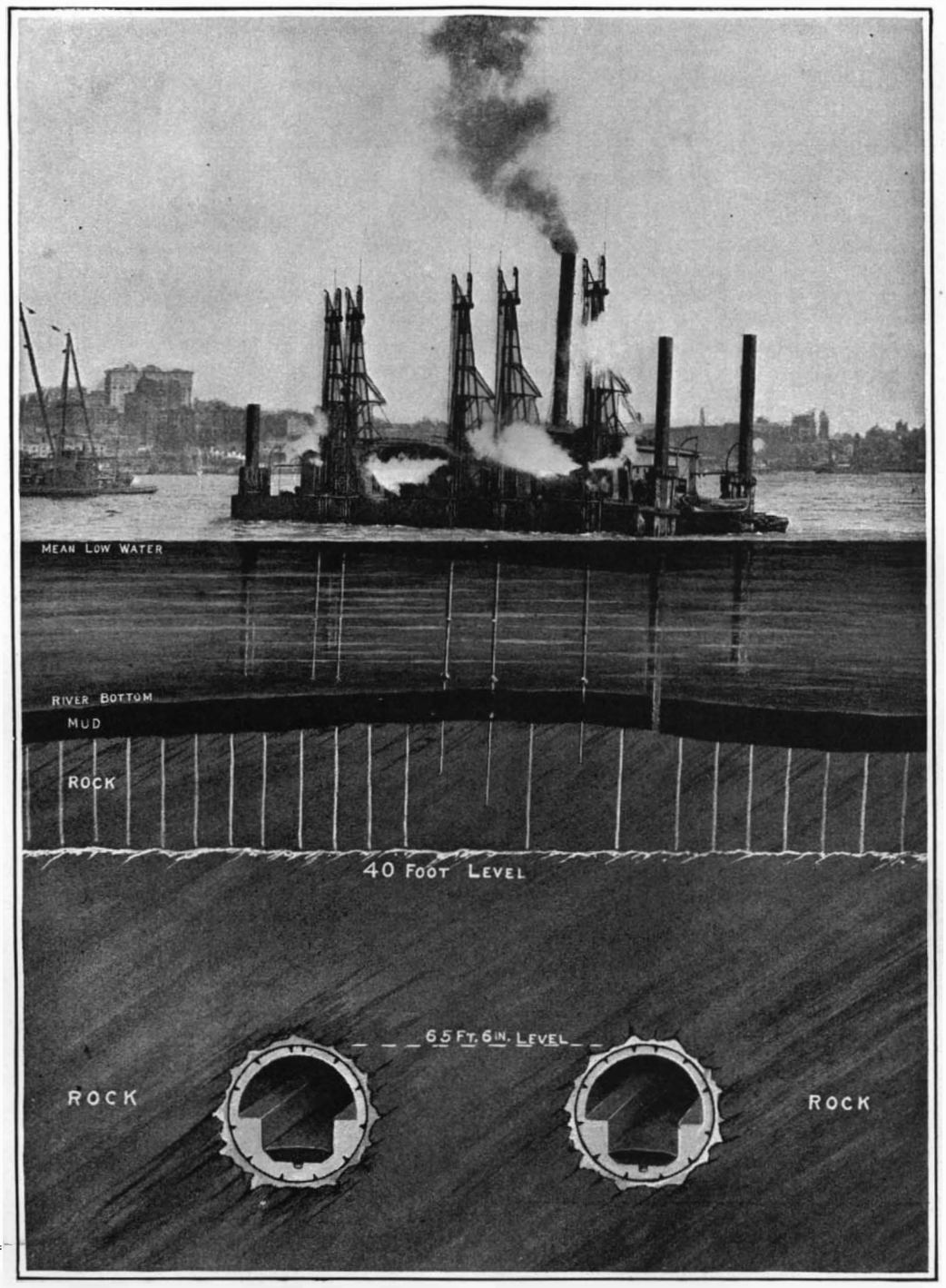
Coenties Reef and the Whitehall-Montague St. tunnels

The work to be done in order to lower the reef 15 feet will involve the removal of 28,555 cubic yards of ledge rock. The Government will pay for the excavation of the first 10 feet downward and the remaining 5-foot slice will be done at the expense of New York city. Big as the undertaking is and difficult as are the conditions, the total outlay will be only $196,900—such being the contract price; and this moderate charge is a matter of general interest, because it is the best evidence of what engineering skill has done towards facilitating the excavation of subaqueous rock. The public is probably not aware of it, but work of this sort is especially troublesome owing to uncertainties due to the very nature of the conditions involved; and in the present instance the contractor's task is made much harder because of the sweep of the currents and the fact that his drilling plant has to rest upon the slanting shoulder of the reef and to be held there firmly.

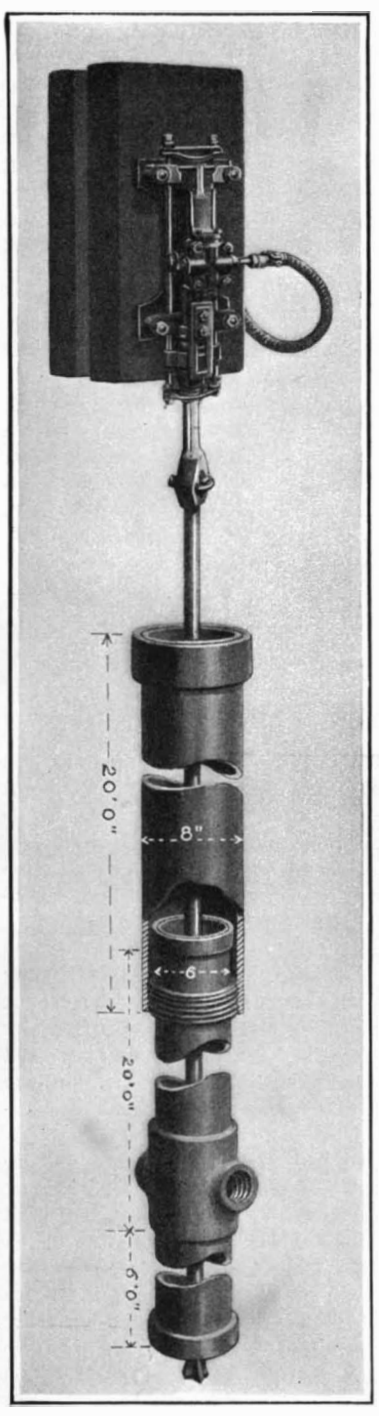
Again, the slicing off of Coenties Reef is not an ordinary case of the removal of under-water rock. The contractor cannot drill and blast as he commonly would if dealing with the average ledge. In this instance he has to temper his operations so as not to endanger tunnel builders, and their work, who are engaged in driving two 18-foot passageways right through the same rocky mass but, of course, some distance below. It is the general practice for excavators of subaqueous rock to drill down 10 feet below the level of designed clearance. The holes so bored have a diameter of about 7 inches. These holes are spaced 10 feet apart and then charged with dynamite at the rate of approximately 4 pounds per foot of depth of penetration. Of course, the quantity of dynamite is determined by the character of the rock to be blasted. When the charge is detonated the ledge is violently wracked, and the big wide-spaced holes suffice to break up the rock so that it can be dredged away to the desired level.

In the case of Coenties Reef, the top of the

(Concluded on page 247)



Sectional view showing the work of blasting away Coenties Reef over the new subway tunnels



A drill and its telescoping pipe guideway

SCIENTIFIC AMERICAN

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Announcement

OWING to the marked advance in the cost of labor and materials affecting every branch of the publishing business, the price of the SCIENTIFIC AMERICAN will be raised to $4.00 a year after October 1st, 1916.

In making this announcement we wish to explain that during the past year the price of print paper has increased from 100 to 150 per cent. There has been an advance in the cost of inks of all kinds, some of which have reached an almost prohibitive price. There has been a rise in the cost of printing and binding. Photoengraving has advanced nearly 100 per cent, and electrotyping metal now costs more than ever before.

The factors which have contributed to the present situation are only in part attributable to the war. Prices now prevailing are certain to continue with, at best, but a slight diminution, even after the struggle in Europe comes to an end.

While enduring these additional and unprecedented expenses, we have not permitted the SCIENTIFIC AMERICAN to suffer. In fact, we have improved it in form and size. In addition to the colored covers, which we are now publishing weekly, we beg to call attention to the fact that in 1915 the number of pages of the SCIENTIFIC AMERICAN amounted to 1210 as against 981 pages in 1909. This year we are publishing still larger editions, and it is probable that the total number of pages for 1916 will be close to 1300.

We have spared no expense to improve the editorial quality of the SCIENTIFIC AMERICAN. During the past year we have published many special articles on the war, and particularly on industrial conditions as now affected by the war and as they probably will exist when the European nations lay down their arms and return to their productive work.

Because the SCIENTIFIC AMERICAN is costing much more to produce than it ever did before, and because we are giving our subscribers a better product than ever before in the history of the journal, we are compelled to make the change in the price of subscription.

A Moratorium Concerning Patents, Trade Marks, etc.

CONGRESS has always been liberal in the treatment of citizens of foreign countries in the matter of procuring patents, and under our laws patents are granted to foreigners on the same terms as they are granted to our own citizens.

By a recent Act of Congress, entitled "An act to extend temporarily the time for filing applications and fees and taking action in the United States Patent Office in favor of nations granting reciprocal rights to United States citizens," the possibility of loss of patent and other rights in this country by inventors who may be participating in the world war has been recognized, and it is provided:

"That any applicant for letters patent, or for the registration of any trade mark, print, or label, being within the provisions of this act, if unable on account of the existing and continuing state of war to file any application, or pay any official fee, or take any required action within the period now limited by law, shall be granted an extension of nine months beyond the expiration of said period."

The benefit of the Act is extended to citizens or subjects of countries which extend substantially similar privileges to the citizens of the United States, but shall not extend to citizens or subjects of any country which may be at war with the United States.

The Act is also retroactive in that it is operative to remove defaults under the existing laws occurring since the first of August, 1914, and before the first day of January, 1918, and it provides that "all applications and Letters Patent and registrations in the filing or prosecution whereof default has occurred for which this Act grants relief, shall have the same force and effect as if said default had not occurred."

Under this Act, if a foreign inventor within its provision has failed to file his application for a United States patent within twelve months from the filing date of a foreign application upon which a patent has been granted, he can still obtain a patent in this country if he files within nine months after the expiration of the twelve months. In like manner, if he has failed to reply to an Office action within the twelve months now allowed by Statute, the present Act gives him a further extension of nine months within which to take such action, and also the period within which the final fee of twenty dollars shall be paid is extended for a period of nine months, so that a foreign inventor, within the provisions of this Act, may pay his final fee within fifteen months.

Also, the Act will automatically revive rights of foreign applicants coming within the provisions of the Act whose applications may have become abandoned or forfeited by the failure to take action and to pay fees within the statutory period.

This is a piece of constructive legislation, the author of which is to be congratulated; for the progress and advancement of civilization is due in large measure to inventors, and the result of any encouragement offered to them is directly opposite to the result of the terrible conflict in which those it is intended to benefit may be at present engaged.

Railways and National Defense

DESPITE the object lessons of the Pan-European struggle and the voluble discussions that they have provoked in our midst, it is probable that comparatively few Americans even yet realize the hopeless unreadiness of our country for a real war. This statement applies not only to the pacifists, the indifferent ones, and the advocates of "reasonable preparedness," but to many, if not most, of those who are clamoring for a great increase in our armed forces by land and sea.

We have occasionally adverted in these columns to what is being done and what ought to be done toward fitting the railways and other transportation facilities of the country to play their part in the defense of the nation whenever the necessity arises. The subject is one that needs to be dwelt upon. We now return to it especially for the sake of calling attention to an admirable address recently presented by Mr. W. L. Park, vice-president of the Illinois Central, before the International Association of Railway Special Agents and Police, on "Railways as a Part of a System of National Defense."

The old adage that a chain is no stronger than its weakest link expresses, among other things, the folly of one-sided preparations for war. "An army," says Mr. Park, "though great as patriotism or conscription can make it, and capable as years of training can produce, is utterly impotent without proper transportation facilities for its units and its supplies. The efficiency of a navy, though it were to outnumber the floating equipment of any other nation, is dependent upon a series of naval bases adequately maintained as to supplies."

These facts are self-evident, and it is in order to inquire how nearly our own transportation systems measure up to military requirements. The inquiry leads to startling revelations.

In Europe, where the railways, even when privately owned, are under the control of the state to a greater degree than is the case in this country, their utilization in the event of war had been the subject of expert study for years before the present conflict began; strategic considerations had governed the location of many lines; and ample provision had been made in the rolling stock and other equipment for the special needs of miltary movements. The feats achieved by the European railways during mobilization and subsequent operations are quite as remarkable as anything connected with the war. This is not true merely of the German railways. In England, the London and Southwestern Railway alone had run 15,000 special trains for the army from the beginning of hostilities up to February, 1915; while during the same six months several other English lines had run from 3,000 to 8,000. It is stated that trains were always ready for the troops, and arrived on or before schedule time.

Neither in trackage, equipment nor amenability to Military control are American railways prepared to render services analogous to those which the European lines have lately rendered to their respective governments. The shortcomings of our railways in the matter of special equipment are particularly striking. The new 16-inch gun now being developed by the Ordnance Department of the Army requires a special car for its transportation. According to Mr. Park only one such car exists in this factory, and it does not belong to the government nor to a railway, but to the Bethlehem Steel Company. The 14-inch gun requires a 200,000-lb. flat car, with an ordinary flat car serving as a trailer. Only two or three roads have any cars approaching this capacity. The gravity of the situation becomes more apparent when it is realized that guns of these large calibres must not only be transported from the factory to the field, but returned to the factory to be relined after firing, say, from 150 to 200 rounds. In a continuous engagement, such guns would need to be replaced about every two and a half or three hours. In other words, in an extreme case 8 or 10 guns a day might be needed at a single point to perform the service of one!

Not only are special cars needed for the transportation of great guns—and these should be the property of the government, since the need for them is too problematical to justify the railway companies in investing in them—but roadways and structures must be made strong enough to sustain such loads. As Mr. Park points out, "the whole outcome of a defensive movement might be reversed by the inability to transport some heavy guns across a bridge too weak to permit their passage."

Another problem is the transportation of ammunition from the points of production, 90 per cent of which are found within a circle having Peekskill, N. Y., as a center and a radius of about 160 miles. From this small area to the Pacific Coast the distance in an air line is about 2,500 miles, and to the Rio Grande about 1,600 miles, while actual transportation routes are much longer.

These are only a few of the facts that Mr. Park has adduced in his searching analysis of a situation that many "preparedness" enthusiasts appear to be completely unaware of.

The Bank Check to Invade Europe

THE use of bank checks was popularized in the United States during the days of wildcat currency. When no one could say that a bank-note would not become worthless overnight, when every cashier had to be a walking cyclopedia of good banks and broker banks, the check afforded the payee his only protection. The convenience of this means of payment, and the lack of an elastic currency that would expand and contract with the needs of business, caused the use of checks to become more and more general; until today they are an integral and distinctive feature of our national life, the monthly clearings throughout the country amounting to about $20,000,000,000.

If one reflects upon the consequences of an attempt to make the circulating medium do this work, one can hardly feel surprise at the announcement that French and German bankers are doing everything to establish the bank check in common use. Pamphlets are being circulated by the Bank of France describing with great fullness the American bank check, with all the details of procedure attendant upon its use, and pointing out its advantages. At present practically everyone in France habitually carries on his person a few hundred or a few thousand fracs in currency, making an aggregate of billions that are constantly withdrawn from profitable use, with a serious economic loss to the country from the gold reserve which must be kept idle to support this superfluous circulation. The Berlin Chamber of Commerce is taking the lead in a similar campaign.

Some idea of the popular inertia toward and actual opposition to the check may be got from the naïve suggestion of the Frankfurter Zeitung that as a first step in its introduction all civil and military officials be forced to use check-books. As a matter of fact, this attitude is easily accounted for. In this country the check has become so thorough a part of the business mechanism that its use and abuse are fully covered by the laws. The exact degree of responsibility of drawer, payee, bank of issue and bank of deposit are defined, the proper means of enforcing this responsibility are laid down, the line between civil and criminal procedure is sharply drawn, and the entire checking system has a degree of solidity which cannot be imagined by the average Continental. A European check affords the payee no protection against accidental loss or theft, for it reads "pay to John Doe or *bearer;*" the bank refuses to assume the responsibility of making payment to a proper holder only. Again, a Frenchman or German who accepts a stranger's check, or one drawn upon an out-of-town bank, has no assurance that the check is good, and no definite knowledge of how to proceed if it turns out to be bad. Further, the need for checks is not felt by the user, especially in Germany, because of the extraordinary facilities for postal remittance. No trip to a post office is necessary either to buy or to cash a money order; the carrier receives the sender's money, and delivers the cash to the receiver.

A beginning has been made at the overcoming of these difficulties. The English system of "crossing" a check—drawing two parallel lines across its face—has been introduced by law into France. This makes the check negotiable only at a bank, usually only by the payee himself, and makes the bank responsible for payment to the proper person. With a few more such steps toward legal standardization of checking procedure, it may be expected that this typically American business machinery will make a definite impression upon the strongholds of European conservatism.

Aeronautical Notes

An Aeroplane was Disabled by Pigeons recently while making a flight in England. It appears that the machine, an army aeroplane, ran into a large flock of pigeons. The propeller struck a number of the birds, with the result that it was badly shattered. The aviator was forced to volplane to earth.

Alloys Used in Zeppelin Construction.—According to the *Revue des Produits Chimiques*, a French publication, analysis of a Zeppelin airship recently brought down in France showed the following constituents: Aluminum, 90.27 per cent in angle brackets, 88.68 per cent in channel members, and 99.07 per cent in the bracings; zinc, 7.80 per cent in angle brackets, 9.10 per cent in channel sections, and 0.13 per cent in braces. The rest of the constituents, obviously of small amount. numbered copper, tin, manganese, iron, nickel and silicon. Magnesium, hitherto accounted a constituent in aluminum, appears to have been carefully excluded. Only a trace of nickel is reported.

The Value of Aeroplanes is again illustrated in the Somme drive of the English and French armies. Concurrently with the systematic bombardment of enemy entrenchments and establishments, the Allied airmen become more and more active, not only preventing the German airmen from crossing their lines but in most instances preventing them from even leaving the ground. The Teutons resorted to observation balloons, but these were soon shot down. A pilot who partook in these operations stated to a newspaper correspondent that "If we find guns and our artillery silences them, and our infantry takes advantage of the open road, the day's *communiqués* are good. But there are three chances to fail, of which ours comes the first."

A Camera for Airmen.—An American firm has developed a camera especially intended for the use of airmen. It is automatic in action, one pull of a flexible cable serving to wind up the previous exposure, set the shutter, make the exposure, and register the number of the photograph. The exposures are made on standard motion picture film, and from 1 to 750 pictures can be taken at one loading of the camera. The lens is exactly the same as that used by professional operators of motion picture cameras, having the great speed of f 2.5 or f 3.5. Altitude photographs can be taken from a height of 5,000 feet through a lens of 2-inch focus, and in addition the camera can be equipped with a lens of 4-inch focus to secure photographs at a height of 10 feet to 15,000 feet above the ground. The films exposed in the camera are subsequently used in a projection lantern, which throws them on a screen in any size up to 6 by 8 feet for any length of time without the least danger of fire.

Aircraft in the Verdun Struggle.— The following references to the part played by aircraft in the struggle for Verdun are made by *The Times* correspondent in Paris: "A series of photographs of the Fort Vaux, taken at different periods by French aviators, shows with what terrific force the German artillery bore upon its work. The successive pictures are more like microscopic slides of some terrific skin disease than photographs of strongly constructed fortifications. In the first photographs the great band of the fortress walls of earth and masonry is clear. In the last those massive walls have made no more impression on the plate than the zigzagging lines of trenches around the position. The whole area inside the fort, seen from a height of 4,000 feet, even before the last days of unremitting bombardment, resembles a relief map of Switzerland. On the hills and woods north and west of the position the guns fired, not in batteries, but almost wheel against wheel. Aerial observers, unable to mark the position of so many guns, had to content themselves with indicating the artillery regions."

An Australian Airship.—G. B. H. Austin, an Australian engineer, has invented an airship which will, he claims, be superior to the Zeppelin in action. It is an automatic balancing machine, and its planes act as girders and serve the purpose of a parachute when a descent is made. It is asserted that it will lift greater weights in proportion to its size than aircraft in present use, and will carry guns of longer range. A suspended car will serve to give the guns a steady platform. Trials have been made with a model of the machine equipped with a 12-horse-power engine. Carrying a weight of 380 pounds, the model flew to a height of 250 feet for various distances up to a mile without the aid of a pilot, the distance to be covered being regulated by a clockwork attachment connected with the engine. In every case the model landed safely "on all fours." It is claimed that the full sized machine will be able to carry a weight of 15 tons, including the engines, and will be equipped with two long range guns at each end of the platform. It is estimated that an engine of 1,000 horse-power will be needed to drive the machine. A company is being formed to build a full sized machine and offer it to the British Government to be tested.

Science

A Department of Tropical Forestry has recently been established by the School of Forestry of Yale University. This branch of forestry has heretofore received little recognition in American forest schools, though there are tempting openings for the trained forester in tropical countries. It is understood that the new department at Yale will organize field parties to conduct researches in South and Central America.

Ragweed and Hay Fever.—It is now believed that fully 85 per cent of the hay fever prevalent in the autumn is due to the pollen of the common ragweed, while goldenrod, which has been popularly credited with being the chief cause of the disease, is almost completely innocent. The pollen of ragweed is carried in great abundance by the wind. That of goldenrod is not easily detached from the flower, and, when transported abroad, is borne chiefly on the legs and bodies of bees and other insects.

A Method of Preventing the Staling of Bread was described by Mr. Arnold Wahl at the last meeting of the American Chemical Society. This consists in cooling the bread, after baking, in an atmosphere of carbon dioxide, freshly produced for the purpose by fermentation. Bread cooled in ordinary air becomes stale in a few hours, owing to oxidation of the protein by the air absorbed in its pores, while bread cooled in an atmosphere of carbon dioxide remains fresh for several weeks, because oxidation is prevented.

The Great Sea Serpent is reported, in *Nature*, to have been seen on June 14th by a Swedish officer, Major O. Smith, in a small arm of the Baltic not far from Stockholm. He and others claim to have seen, at a distance of 100 meters, a huge serpent's head, and behind it successive humps of a serpent-like body, with a length of about 80 feet. The usual skeptical comments have, however, followed this report. Another Swede writes that last year he observed a similar spectacle, which turned out to be due to sudden gusts of wind raising small, regular billows, which interfered with the reflection of the sun from the water and thus intensified the effect.

An Opportunity for Philanthropists is disclosed in a decidedly unique little pamphlet, recently published in a limited edition by a committee of the Amercan Physical Society. The pamphlet is introduced by two pictures, side by side, one of which is entitled "Science" and the other "Superstition." The former shows the late Prof. Rowland, with his marvelous dividing engine; the latter a patriarchal Hindu, loaded down with talismanic pebbles. The text of the publication is headed "Which?" and is a comparison of the results wrought by science and superstition, leading up to the fact that the *Physical Review*, the organ of the society and the chief medium for the publication of physical papers in this country, is being seriously hampered in its valuable work by lack of funds. An endowment yielding $5,000 a year or more would yield a rich return in terms of national and human welfare.

Removing Barium Chloride from Table Salt.—The U. S. Bureau of Chemistry finds that certain grades of salt used for domestic purposes contain considerable amounts of barium chloride, which is a poisonous substance and a menace to health. Mr. W. W. Skinner has recently reported a new method of treating brine to remove this ingredient. This method depends upon the addition of sodium sulphate and calcium oxide in proper proportions and the blowing of air though the treated brine to decompose the ferrous bicarbonate, naturally present, thus obtaining a rapid precipitation. A large salt manufacturer has installed the necessary equipment for treating 200,000 gallons of brine a day. The process has been a complete success. Instead of producing two or three grades of salt, as formerly, the entire output of the plant is now of the No. 1 grade, known to the trade as table or dairy salt, and only insignificant traces of barium remain. The cost of treatment is from 1¼ to 1½ cents a barrel.

Immuno-chemistry of Plants.—A great fund of knowledge has been gathered in recent years concerning the processes involved in the immunity of animals to specific diseases, but comparatively little is known about analogous processes in plants. Mr. R. W. Thatcher has reported some investigations of the latter subject, comprising a comparative biochemical study of healthy and diseased plants, and a biochemical and microchemical study of the reactions produced in the host plant by a growing parasite. He states that sufficient progress has been made to justify the recognition of two types of resistance, or immunity; viz., (1) an antagonism of the tissue substances of the infected plant to the action of the enzymes or other agents excreted by the growing hyphæ of the parasite, and (2) a hypersensitiveness of the host, whereby its tissues at the point of entrance of the parasite are killed and no longer supply nutrient material for the latter, thereby causing its death by starvation.

Industrial Efficiency

A Collapsible Tap is the means of saving much time and labor in the modern machine shop or factory. The time ordinarily lost or wasted in backing out with a solid tap can now be saved. The collapsible tap is so arranged that after it has cut the desired thread the cutting members can be collapsed together so as to enable their quick withdrawal from the hole.

Utilization of Fish Offal in Canada.—Mr. James White, vice-chairman of the Dominion Conservation Commission, is at present in British Columbia securing data in connection with the proposed utilization of fish offal. While at the present time a portion of this waste fish is used in the manufacture of fertilizer, but a small percentage is disposed of in this manner, most of it being thrown overboard. It is estimated that 25 per cent of halibut, and from 20 to 30 per cent of salmon, is included in the entrails, head, tail, etc.

The Dangerous Tin Can.—The expert malaria investigators of the United States Public Health Service have found that discarded tin cans containing rain water are breeding places for the mosquito which is the sole agent in spreading malaria. Tin cans should not be left about the yard of the home or factory, for they may lead to sickness and even death. But if cans cannot be disposed of and must be kept on the premises, each can should be punched with one or more holes in its bottom so that it will not hold water.

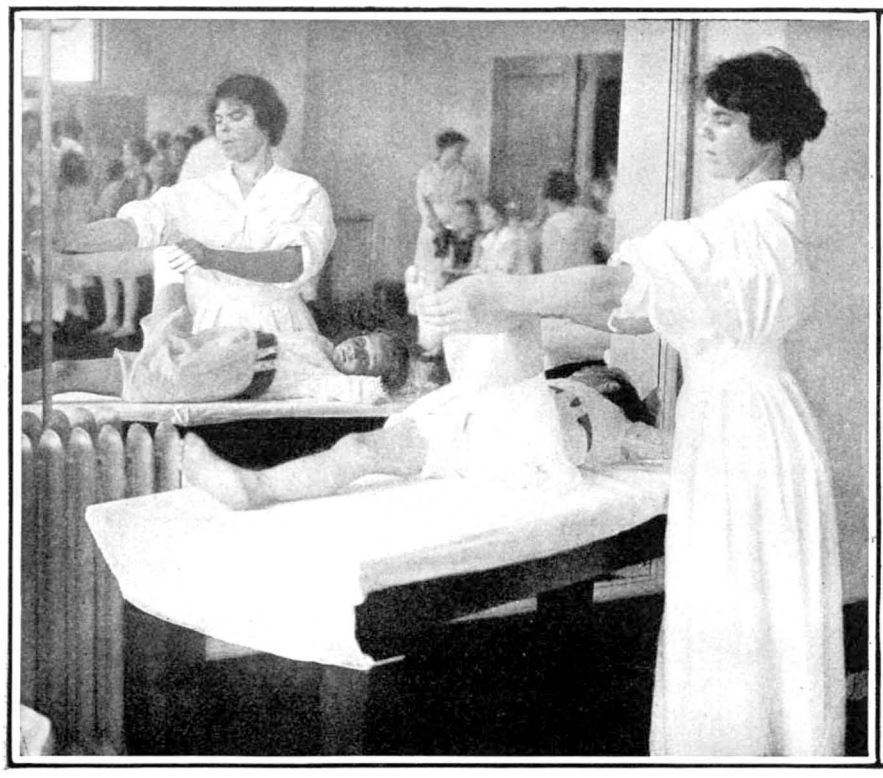
To Reduce the Amount of Damage sustained by goods shipped by freight, an American manufacturer has developed a steel container that is at once light, strong, and pilfer-proof. The container consists of five sides and the lid. The sides are made of three-ply steel, and so hinged that the container can be folded flat when not in use. It is provided with handles which normally rest in recesses so as not to interfere with the piling of the boxes. The steel container is immeasurably stronger than those of wood, while comparison with fiber boxes is quite impossible.

Money in Refuse Products.—"The Times" Engineering Supplement of England refers to the experience gained at Paisley. The report of the sanitary inspector for 1914 shows that a revenue of $2,080 has been obtained from the sale of "residual products." Some of these were as follows: Clinker, $1,088; mortar, $233; old tins and scrap metal, $535; waste paper, $73; other refuse, $107. During the last two years waste paper and broken glass have increased in value, and by the use of the vertical shaft type of furnace the working cost of the destructor has been reduced. The prospects for remunerative working appear to be greatly improved.

Using the Same Envelope Twelve Times.—A considerable economy has been effected by the Rock Island railroad lines in stationery, through the use of one envelope several times. The fronts of the inter-department envelopes used by the company are ruled off into twelve squares for names and addresses. Each time an envelope has served its purpose, the last name and address is crossed out and the envelope, after receiving a new name and address in the next empty square, is ready for another journey. During the past two years the cost of 3,253,000 envelopes has been saved, or an equivalent of $1,856.40. It is well to add that the envelopes of this kind are used only for inter-department business.

Collection of Old Paper in Germany.—With systematic German thoroughness old and used paper has been collected in Germany since the blockade of the Allies became effective enough to be felt. In Berlin alone there are 450 receiving offices where supplies of used paper are collected. The total number of receiving offices in the Kingdom of Prussia is about 2,000. School children are the best collectors and contribute vast amounts of old paper to the depositories. The paper is then sorted and sent to the mills. where it is reduced to pulp and used again. Iron rings are offered as rewards for large contributions. In this and other ways the public interest is stimulated.

An Auger for Drilling in Salt.—In the manufacture of salt it is necessary to keep the newly prepared product, after it comes from the evaporators, in a very wet condition, in bins holding several hundred barrels each of this commodity. This is known as "curing" the salt. The salt thoroughly cured, the packers begin their attack on the great piles of minute crystals with shovels, barrels, bags and scales. As the packers work into the great heaps of salt, perpendicular walls are formed. Formerly, many accidents were caused by these huge banks of salt falling and burying the workmen. To avoid this danger, there is now being employed a large, electrically driven auger, which bores holes deep into the pile just above the floor. The pile caves in slowly and the workmen, with no danger to themselves, may fill the barrels and sacks with loose, sparkling salt or load it into carts for the table salt refineries.



Passive exercises performed before a mirror so that the mind of the patient can concentrate on the action

Treatment of weakened muscles by application of galvanic, faradic and sinusoidal electric currents

The Baffling Epidemic of Infantile Paralysis

Treatment of Deformities Resulting from Poliomyelitis

By Henry W. Frauenthal, M.D., Physician and Surgeon in Chief in the Hospital for Deformities and Joint Diseases

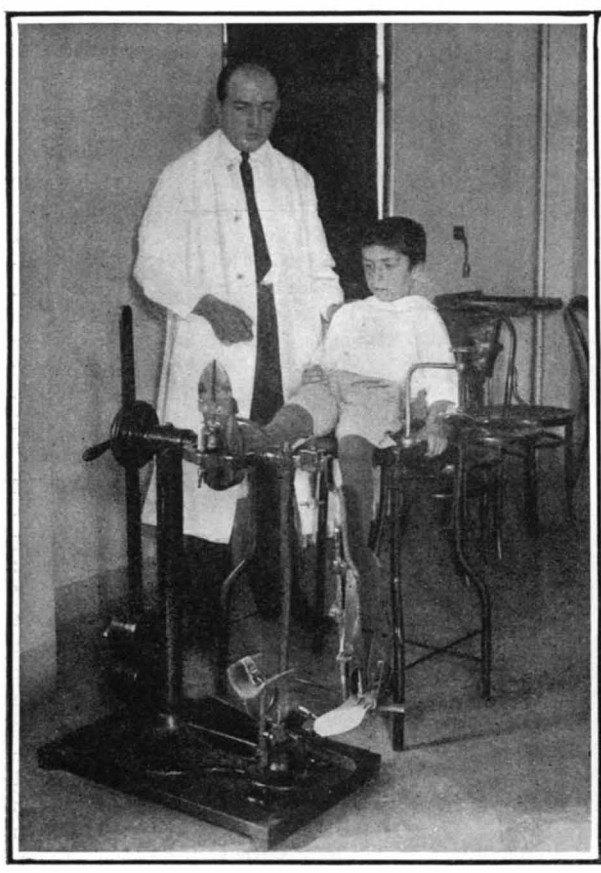
THE epidemic of infantile paralysis, or poliomyelitis now ravaging the State and City of New York and extending over a great part of the United States is the most serious in medical history. On September 1st the number of victims in New York State alone had reached 10,000, while the largest reported in any previous epidemic was 3,840. This was in Sweden in the year 1911. In the New York epidemic of 1907 twenty-five hundred victims were reported, but the actual number was probably much greater.

This cruel disease, which attacks the cerebro-spinal axis, causing death usually by paralysis of the respiratory muscles and crippling the great majority of those who recover, has only lately attracted the attention of medical science. It must, of course, have existed from the earliest times; but it was not described until 1841 when eleven cases occurred in Louisiana. During the last thirty years it has rapidly gained ground, claiming ever larger and larger number of helpless children and not a few adults as well, until now it is one of the most dreaded of all diseases. In the United States we have had fourteen carefully described epidemics, beginning with that of Vermont in 1894.

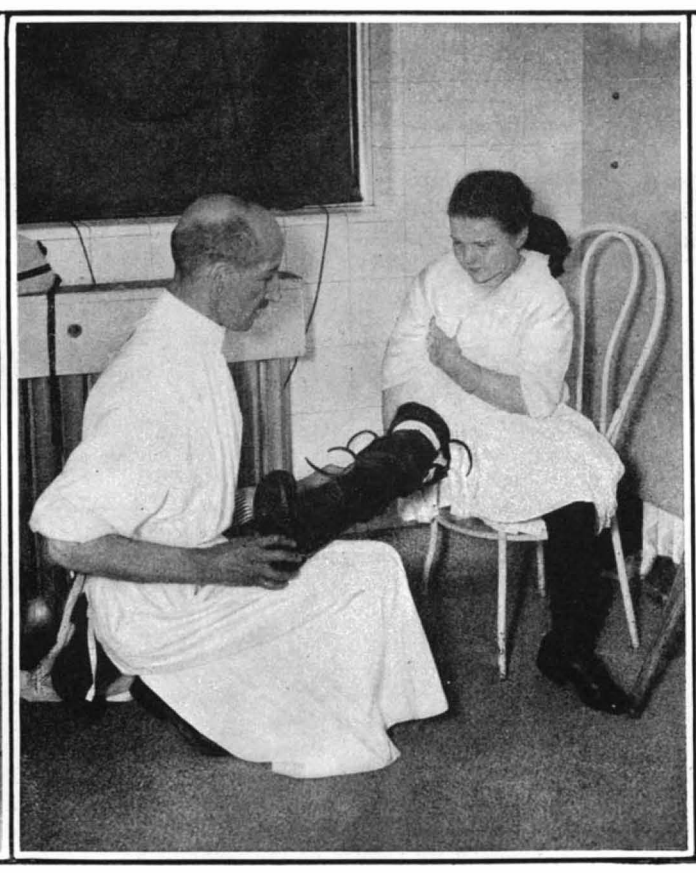
Since it emerged from that obscurity in which for ages its operations have been hidden poliomyelitis has been the subject of a vast amount of study; but as yet we know neither the manner of its transmission nor any reliable or generally available method of treating it in the acute stage. We do definitely know that it is caused by a minute infectious agent which cannot be identified by staining, and that this virus is transmitted through the secretions of the nose and mouth and the bowel discharges; but the manner in which it is conveyed from the sick to the well is so uncertain as to make the question of quarantine one of great difficulty. The weight of opinion favors the view that it is spread mainly by direct contact through such agencies as the hand, the bedbug and the fly, and probably to a great extent by carriers who are immune themselves, or have the disease in such a light form as to escape recognition; but considerable evidence has been adduced to show that the bites of insects as opposed to mere contact with them, are a factor, and there is reason to believe also that domestic animals are affected by the disease and aid in its dissemination, there being many records of paralysis among animals occurring coincidently with the appearance of the disease among humans. For this reason many thousands of dogs and cats have been destroyed during the present epidemic in New York city.

In the treatment of the disease three different methods have been used by the New York City Department of Health. At one hospital injections of adrenalin, as recommended by Dr. S. J. Meltzer of the Rockefeller Institute, are being employed; in another the patient is treated with his own spinal fluid injected subcutaneously and intramuscularly, and in a third spinal injections of serum from the blood of persons who have recovered from the disease are used.

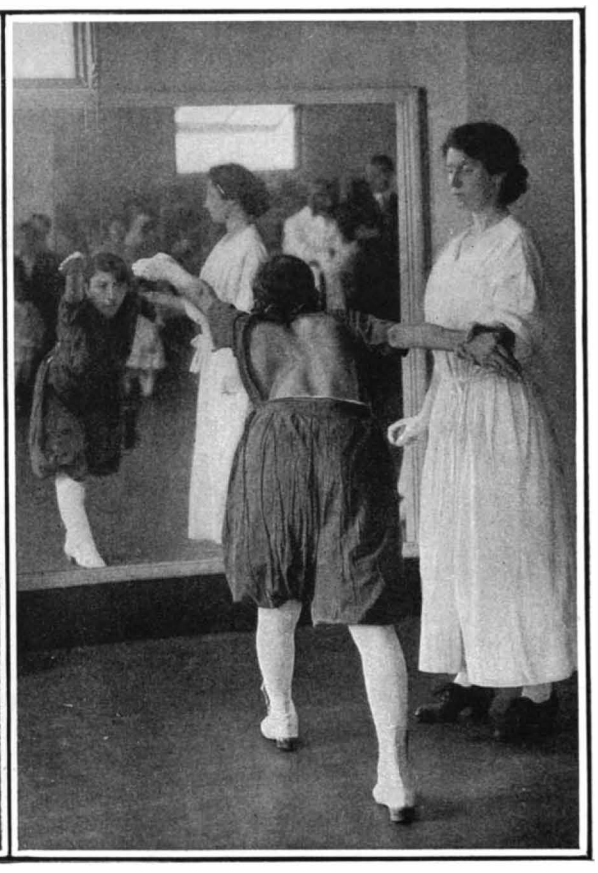
The system of auto-inoculation is based upon the theory that the spinal fluid contains the virus of the disease and will stimulate the production of antibodies which will aid in overcoming the infection; but



Active and passive movements with Zander apparatus to strengthen paralyzed muscles



Adjustment of splints to prevent deformity and aid locomotion. These should be put on very early



Development of muscles on the left side by mental concentration on the effort

since the withdrawal of the spinal fluid itself is frequently followed by improvement, possibly by the relief of pressure, it is difficult to form any opinion at present as to the efficacy of this procedure. Reliable conclusions can be reached only by comparing two series of patients, one treated by simple spinal puncture and the other by puncture followed by reinjection of the withdrawn fluid.

The treatment with immune serum has been used with great success on monkeys, and although the Board of Health announces officially that it is impossible to say as yet what virtue, if any, it actually possesses in the treatment of human patients it appears to be producing good results in some cases.

The first step in the history of this treatment was the demonstration by Flexner and Lewis, who were later confirmed by other investigators, that monkeys which had recovered from an attack of poliomyelitis could not be successfully reinoculated with the virus of the disease. The next was the detection, first in the blood of monkeys and then in that of human beings, of immunizing substances which possessed the power of neutralizing the virus of poliomyelitis in the test tube. The therapeutic use of the serum naturally followed, Flexner and Lewis demonstrating that when taken either from a human or a simian source it was capable of either preventing the disease or greatly moderating it in monkeys.

Netter of Paris was the first to apply the data obtained by experiments of monkeys to the treatment of poliomyelitis in man. He published the results of thirty-five cases which he considered highly favorable to the method, although in one case the serum had been taken from the blood of a person who had had the disease thirty years before.

Whatever success is attained with the serum, however, it can be of little use in an epidemic until some method of obtaining it from lower animals has been worked out, the human supply being necessarily limited and expensive. Careful records are, of course, being kept of the results of the various methods of treatment for comparison with each other, and with control groups, and it is hoped that a substantial addition to our knowledge will be the result.

Fortunately the treatment of the deformities resulting from infantile paralysis has made greater progress than our knowledge of the disease itself, and now that the epidemic is on the wane the problem of providing treatment for its crippled victims, who will probably number from five to eight thousand in New York State alone, looms large. They are mostly poor, for poliomyelitis is, generally speaking, a disease of the poor, and will have to be cared for at public expense.

To those cripples who get the proper treatment more than a ray of hope can be held out, for seeming miracles are wrought by electricity, massage, hydrotherapy and muscle education before mirrors. The earlier this treatment is begun the better, and since its efficacy is now well established the present epidemic ought to leave behind it no such aftermath of cripples as the preceding ones. In the case of earlier victims treatment was often neglected, for lack of knowledge, until it was either too late or very difficult to effect a cure, and all too often they were overtreated and exhausted.

At the Hospital for Deformities and Joint Diseases electricity, massage and hydrotherapy prepare the way for what is known as muscle education. Some authorities, among them Dr. Robert M. Lovett of Harvard, have been unable to satisfy themselves that electricity is of any value; but I have found it to be indispensable, since it will induce contraction of the muscles when none can be obtained by the will and therefore affords means of retaining and developing the muscle fiber until it comes under the guidance of the mind. Much harm, however, can be and has been done by the abuse of electricity. In my practice it is never applied for more than two or three minutes to any particular muscle or group of muscles, and never more than six to twelve minutes to the whole body, the current being the weakest that will induce contractions. This treatment usually follows the massage, since it has been found that after such manipulation the muscle responds more readily and vigorously to the influence of the electric current and to the will.

There is also a difference of opinion as to when treatment should begin. The New York City Board of Health advises the postponement of corrective treatment for at least five or six weeks after the onset of the disease. I do not hesitate to begin when the paralysis appears, even before the temperature is normal, great care being taken of course not to fatigue the weakened muscles. The results, in my opinion, fully justify the statement that both massage and electrical treatment may be advantageously given the moment the acute inflammatory symptoms subside, while passive movements may be begun as soon as pain has ceased to be a constant factor in the paralyzed extremities. These movements are most easily undertaken while the child's body is immersed in water of a temperature to slightly relax and soothe all hypersensitiveness. They may then be continued when out of the bath. With the increased ease of movement

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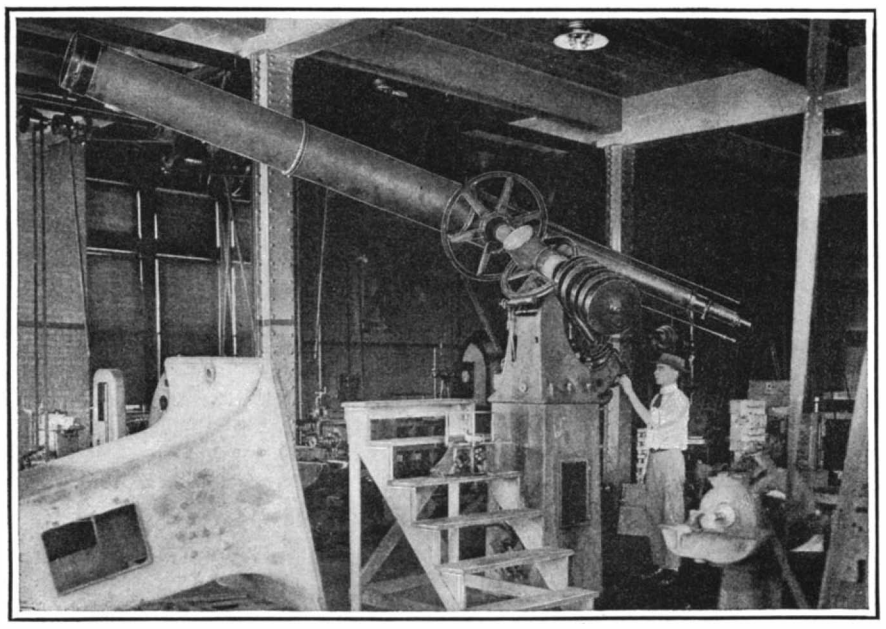

Student-built telescope of the University of Nebraska. Note the pedestal at the left. Because of its size the instrument cannot be mounted in the University shops

Large Telescope Built by Students

By K. P. Crawford

AFTER nearly seven years of intermittent work students at the University of Nebraska have practically completed the construction of one of the largest telescopes in the middle west, and the largest instrument in that state. The work was done by the students in the engineering department at Lincoln and probably represents one of the most difficult pieces of engineering work ever attempted by university classes. For instance, 320 wood patterns had to be worked out by the young men to be followed in making the castings in the university's foundry.

For several years the department of astronomy has been getting along with a very small telescope but has been prohibited from purchasing an adequate instrument because of the lack of funds. The head of the department of astronomy took the first steps toward a better telescope in 1907 and 1908 when he visited a number of observatories in the middle west to get ideas for the construction of an instrument. On his return he drew up preliminary plans, which in turn were worked out by the engineering department. Year by year the students spent their spare time building the telescope until to-day it stands practically complete and ready to be installed in a new observatory to be erected shortly.

The new telescope is eighteen feet long and will require an observatory dome twenty-six feet in diameter. It is equipped with a twelve-inch lens, donated by a friend of the university. To have purchased the instrument from a factory would have cost in the neighborhood of $6,000. As it is the university has secured it at an expenditure of only a very small part of that sum.

What the Telephone Means to the Fighting Men of Europe

WE have come to learn the importance of the telephone in modern warfare in a very general way, and it is only when some special incident in connection with the telephone systems of the European armies is reported to us by one of our correspondents that we realize to what extent this American invention is being employed.

In giving his personal impressions of a visit he had just made to the British front in France, Lord Northcliffe recently said of the British telephone system behind the lines:

"It is no mere collection of temporary wires strung from tree to tree. The poles and wires are in every way as good as those of the Post Office at home. Marching with the army and linking up a thousand essential points is a telephone system that cannot be bettered. To-day it would be quite possible for the Commander-in-Chief, if he so desire, to call up London from beyond Fricourt. Where necessary the English telephones are linked up with trunk lines of the French government, for which interpreters are placed in the exchanges. The speed of communication is remarkable. It varies, of course, with the amount of business, but I have seen a man call up Paris, London, and seaport

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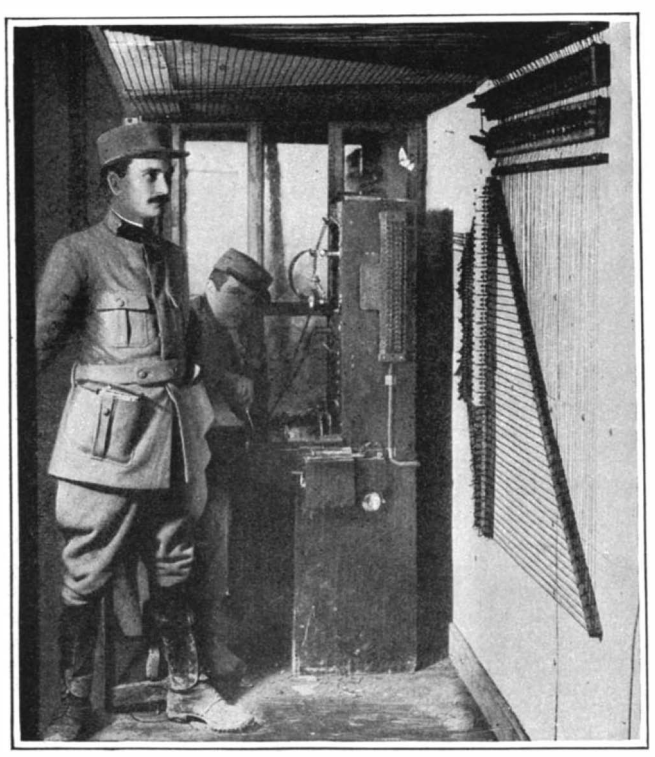


A French telephone station, showing the neat and systematic arrangement of the incoming wires

A telephone central station and telegraph office in back of the French lines. The telephone operator has to be as skilled as any girl operator in our busiest exchanges

Strategic Moves of the War, Sept. 1st, 1916

By Our Military Expert

WITH Roumania's declaration of war upon Austria-Hungary and the subsequent involvement with the master nation of the central alliance, a new and distinct phase of the war has come into being, one so rich with potentialities that it is not at all unlikely the beginning of the end may be unfolding.

For more than two years it has been evident where Roumanian sympathies lay, in a broadly popular sense, although the reigning House of the kingdom is allied to that of the German Empire by bonds of blood. Struggles, as fiercely contested in their way as those which marked the clash of bayonets on the field, have swayed the rise and fall of diplomatic tides, the Kaiser's striving to maintain the neutrality of Roumania with comforting assurances of continuity, the Entente to secure the active cooperation of King Ferdinand's armies by promises of territorial rewards which should go to build up a greater Roumania along ethnological lines, with well defined frontiers for military and commercial purposes.

At first Roumania's entry into the war was believed to be close at hand. With the great Russian armies sweeping through Galicia to hammer at the gates of Cracow itself, it seemed as though the moment were come. But the powerful back-thrust of Germany and Austria postponed the action with its threat to Roumanian sovereignty, and the impressive clearing of Serbia from end to end drove the lesson home with no uncertain hand.

Then the Entente seemed to arouse itself to the peril of disconcerted action. Conferences remedied the lack of united efforts, the troops which marched through Macedonia too late and too few in numbers to save Serbia were withdrawn to the Saloniki lines and augmented until a powerful army came into being and crouched in wait through many anxious months until a propitious moment for action should present itself.

In an article of this series, published some weeks ago, the writer attempted to explain this inaction of General Sarrail's forces by the ventured suggestion that the movement, when it came, would be within a short time coincident with Roumanian participation in the war, and that the Balkan offensive would be delayed until strokes could be delivered both north and south of Bulgaria. The latest developments indicate that the surmise was fairly correct. It must be confessed, however, that Roumania's decision was made and acted upon with more abruptness than anticipated.

It is far too soon to be able to catch a glimpse of the general trend of the campaign which now is beginning. The reports tell of minor engagements in Transylvania and lower Bukovina, in which latter district the Russians have joined hands with the newcomers. These clashes are but the fencing of advance guards, and it remains to be seen whether the main Roumanian force will thrust directly at Bulgaria from the north, in the effort to clip Bulgaria and Turkey from their alliances, in conjunction with the upward thrust of General Sarrail from Macedonia, or whether the next ensuing days will witness a westward leap at the exposed flank of Austria-Hungary.

With a population of approximately 8,000,000, Roumania should have no difficulty in raising an army of 800,000 men—ten per cent—although all may not immediately be called to the colors. It is safe to estimate that at least 650,000 Roumanians will take the field either on the line of battle or on the line of communications. In itself this force is formidable, but Germany and her allies might face this new contingent with equanimity, relying upon firm lines of defense as general retirement becomes necessitated, were it not for the accompanying opportunities offered for man-powerful Russia to concentrate large forces, march through Roumania and fall with thundering guns upon some vulnerable spot which is without the strong advanced line of trenchwork that marks the remainder of the battlefronts. The Entente may now maneuver, for the entry of Roumania offers a line 350 miles long across the Austria-Hungaria border, 350 miles on the Bulgarian frontier. Sixteen main Roumanian railways thrust themselves toward these fronts, providing ample railway facilities for attack and maintenance; in the matter of strategic railways Roumania is in far better case than any country of the Entente on the eastern line.

From a close inspection of the map one is tempted to venture the opinion that direct attack upon Hungary will be postponed until Bulgaria and her allied forces in the Balkans have been dealt with. The Transylvanian frontier is a forbidding one, for the Transylvania Alps form a great and deep barrier which should require the most concentrated effort to penetrate. Were such an undertaking commenced immediately, as long as there remained Bulgarian forces afield they would lie in a threatening rearward position and constitute a direct menace to Bucharest. To gain flank security, then, Bulgaria should be eliminated first. The Transylvanian Alps are as much a defense to Roumania as to Austria; they lend themselves admirably to such a purpose. It is therefore likely that while certain attempts will be made by Roumania to gain ground in the mountains to westward of her territory it will be mainly for the purpose of securing her own flank, while she, with Russia, turns upon Bulgaria in the effort to drive the nippers home. Once Bulgaria be eliminated and the Turkish line of communication with Germany, through Nish, be severed, Roumania and Russia and the upcoming forces of General Sarrail can

Roumania's situation in the great war

turn in security, turn the mountain positions which line the Roumanian-Hungarian frontier by attacking from Belgrade and a recovered Serbia, and strike straight for the heart of Austria through the comparatively open doorway thus regained.

It is evident that Germany and Austria can spare few men to the new requirements of Balkan conditions, for they dare not weaken either the western or the eastern lines to come to the aid of threatened Bulgaria. This condition leaves the odds against this latter country tremendous.

With ease Roumania can divert 300,000 of her forces against Bulgaria. Already, it is reported, Russia is marching through toward the Bulgarian boundary with a huge force—let us call it only 300,000. The sum of the two gives a strength of 600,000 to operate against Bulgaria from the north while the balance of Roumania's troops hold the mountain barrier on the flank and rear.

Sarrail is reported to have at his command nearly 700,000 troops; call it 600,000 for good measure, which will beat northward through Serbia and Bulgaria. North and south 1,200,000 effectives will be engaged in the "nipping" operation. What force will confront them?

By straining Bulgaria may muster 400,000 men. Germany and Austria may perhaps squeeze out a reluctant 200,000 more—600,000 combined. From her troubles in Turkey-in-Asia, the Ottoman Empire may release 200,000 men to aid—a vast number which is considered wildly extravagant as it is written; but adding them all together, here are 800,000 to face 1,200,000, a fifty per cent greater force. It can scarcely qualify for the task. This war, since the failure of the Marne, has been a war of arithmetic, and each passing week has seen the inexorable answer being graven to completion.

The job of eliminating Bulgaria—and Turkey by force of circumstances—may not immediately appear to prosper; 800,000—600,000—400,000 men, can put up a bitter fight and exact a huge price for eventual victory over them. But it is not unreasonable to believe that if the crushing menace to Bulgaria is too great, she will capitulate rather than suffer the fate of swept Serbia, with the possibility of becoming a vassal of her hated neighbors, will make the effort to save what shred of national unity the terms of her foes may permit her. Bulgaria had much the same problem to solve that was Roumania's; she was frankly and permissibly in the open market. Teutonic successes loomed large when she made her decision. As Bulgaria was actuated by purely selfish reasons to espouse the side of the Kaiser, there seems to be no reason why, if she wishes, she should not change front (as has been reported a possibility) and in the effort to save her individual state turn upon her present alliance. It is scarcely now a question of national honor or faith; there is no exaggeration in saying that Bulgaria's straits are desperate, and the law of self-preservation is the most instinctive one in the world.

Italy's declaration of war against Germany undoubtedly influenced Roumania in the taking of her recent step, and both of these events have made a profound impression upon Greece, where pro-ally sentiment has seemed preponderant over the court attitude. It is more than likely a few days hence it will develop that Greece has been forced for her own good to make a decision and will join the Entente after having dallied too long to win for herself the benefits which might have accrued from earlier participation in the war. This, by the way, would furnish at least 300,000 additional men for the cutting of the Bulgarian-Turkish link.

So it comes back to the opening statement of this article. A new phase of the war has begun, a distinct epoch. A month—six weeks at most—should be sufficient time to indicate clearly how matters are to develop. It is the most interesting situation existing in the theater of war to-day and should be watched closely; it is worth it.

Lighthouse Service Changes in Oregon

IMPROVEMENT of aids to navigation at or near the entrance to the Coquille River, Ore., is planned by the United States Lighthouse Service. The sundry civil act approved July 1st, 1916, appropriated $6,000 for this work.

Maritime interests have petitioned for the removal of the present station to a more advantageous locality, as it is now of no great benefit to commerce, and the fog signal would serve its purpose better if on the other side of the river at or near the end of the south jetty. Moreover, the station is on a point of land which is being encroached upon by the Coquille River.

The work contemplated to carry out the provisions of this appropriation consists of establishing an occulting electric light and a fog bell operated by an electric motor. This will require the erection of a tower, fog-signal building, and keeper's dwelling, electric wiring with poles, etc. These improvements will effect an economy in maintenance, as only one keeper will be required instead of the present number of two.

The March of Progress in the Paris Subway

WE are sure, after reading between the lines of a letter from our correspondent there, that Paris is no place for the busy American commuter, with his scurrying feet and his impatient soul. It appears that the Paris subway cars have three doors on either side, and that a compressed air system with control lever in the vestibule between cars has just been installed to facilitate the opening and closing of these doors. And we are gravely informed that this is a notable improvement, because it does away with the necessity for the guard to pass through the car at each stop, first opening and later closing each door by hand!

Verily, "the world do move." We expect that this innovation will be followed by nothing less revolutionary than the abolition of the horse-car in New York.

Correspondence

[*The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.*]

Another Point of View Upon the Industrialized Army

To the Editor of the SCIENTIFIC AMERICAN:

After reading the article "The Industrial Army," by Charles F. Talman, in your issue of July 22, I could not help a feeling of regret that it had not been placed immediately after the article on Industrial Preparedness; for this would have served so well to show the fallacy of the other. The work of the soldiers of any army—and especially of the United States Army—is so widely different from the work contemplated in this article for the proposed Industrial Reserve that it seems to me quite clear that, far from solving the problem, the plan suggested would merely add to the difficulty of its solution.

In the first place, I consider it most improbable that there could be found, in the directions indicated, legitimate employment for the force of men that would be necessary for the protection of the country on an adequate basis. Then, too, the expense would be frightful; for only by paying the men of the force a wage equal to what they could get for similar work in their civilian capacities could the ranks of such an army be kept filled. Again, Mr. Talman assumes offhand that manual labor would be the proper thing for soldiers, whereas, as I shall point out, there are really several other occupations much more suitable for them.

It is true that the employment of troops for such work would be feasible in some few directions. But the experience of the War Department in taking weather observations through the Signal Corps from 1870 to 1890 was that the work provided a very good Weather Bureau but a very poor Signal Corps. When the war with Spain called them into active service in 1898, there were still a number of Signal officers who had had less than one year of field work with troops. The same thing applies to a less extent to the Engineer Corps; while this body had not been scattered out on detached duty in small squads, having been stationed in but two posts, still many of their officers had been absent from duty with troops for as much as ten years.

Further, if Mr. Talman will study up the things which a man must know in order to be even a fairly good artilleryman, he will perceive that that arm, at least, of the national service would have to be left out of his system. The same applies to a less extent to the cavalry, and to a far greater extent to the aviation service.

It seems to me that much more practical would be a modification of the system that has been in use in several European nations for a few years past; *i.e.*, make the army the training school for all the police forces of the country. It would probably be found wholly practicable to train all our firemen in the same way, and perhaps even the members of the street cleaning departments. But, unfortunately, it is not even doubtful whether this could be put into practice or not; it certainly could not. It would, however, be quite feasible to organize all the railroad men, both train service and track service, into a reserve army; but only if all the roads were taken over by the Federal Government.

In fact, however, all of this is but a means to get around the thing that is really needed—universal training for national defense. Men who spend a fair lifetime studying all they can find from any source about the art of war may be pardoned for being a bit skeptical about such plans to turn the American soldier into a day laborer. It is on a par with the suggestion, seriously discussed, of using some of our battleships and cruisers as freight and passenger liners.

NAVY.

One Solution of the Fuel Problem

To the Editor of the SCIENTIFIC AMERICAN:

"Owing to the increasing demand for gasoline, etc., engineers and inventors should bestir themselves and discover some method whereby kerosene, crude oil, etc., may be used as automobile fuels, etc."

This is the kind of thing we see in almost every issue of automobile and scientific periodicals, and the few who know about steam automobiles, past, present and prospective, cannot refrain from indulging in more than a smile.

Although not manufactured in large numbers, we still have the steam car in our midst, in spite of prejudice and superstition, and even though editors and writers seem to consider it as extinct as the dodo. With a successful example of the kerosene-burning automobile on the market, inventors continue to grope blindly for some method of satisfactorily using kerosene. But to continue the hunt is absurd in the extreme.

Technical writers seldom, if ever, refer to the possibility of "burning" fuel, being apparently obsessed with the idea that nothing is worth a moment's thought nowadays except the internal combustion motor. The question may prove to be a "burning" one. It is barely possible that they think the "longest way round is the shortest way home." To a cow grass on the other side of the fence is always the most succulent and tempting. With necks through the fence inventors are after the most miles per *gallon* when what is most important to the automobilist is simplicity and the most miles per *dollar*. That means kerosene or crude oil and the steamers. The steamer is the simplest and most economical car to-day and simplicity and economy will win out. Steam power needs only development and improvement—not discovery.

Thinking men are becoming alive to the possibilities of steam power, and in a city where automobiles are built by thousands, careful experiments on a steam power plant are being conducted, and those now manufacturing gasoline automobiles are looking on with great interest as the results are described as "eye-opening."

There are many who believe this to be an undeveloped field, full of promise and possibilities. It is certainly a very fascinating subject to those who have handled a sturdy and reliable steamer. "Ask the man who owns one." You will find him a devotee, and his satisfaction increases every time he audits his expense account and checks over his fuel and tire bills. But when he reads that some one has still to discover a successful method of using kerosene as an automobile fuel, the only relief for his overwrought feelings is a ride in the car with the "yet to be invented" kerosene burning power plant. More light on this "burning" question is what is needed.

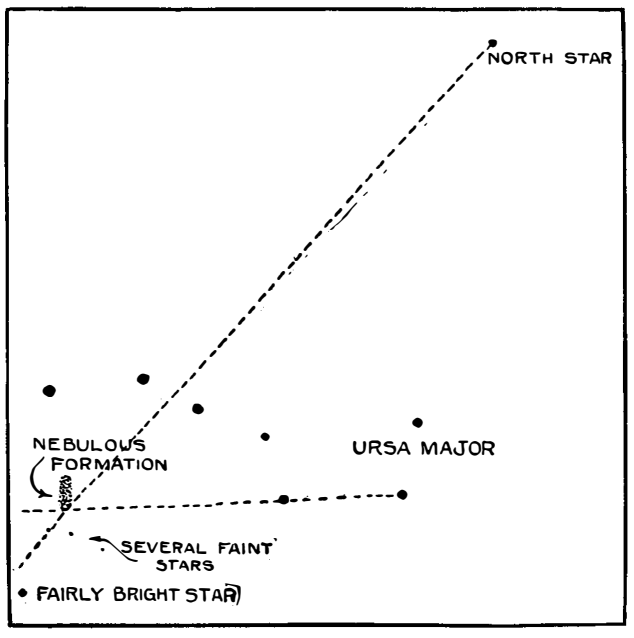
CHAS. EDW. PRIOR, JR.

Hartford, Conn.

An Unusual Aurora

To the Editor of the SCIENTIFIC AMERICAN:

I am writing you with regard to an unusual and puzzling phenomenon which I witnessed last night (July 19) between 10:30 and 11 P.M.



Sketch showing where the curious formation appeared

While sitting with my cousin on the hill some hundred feet above the city, I saw, at a point indicated upon the enclosed rough diagram, what appeared to be a small comet. Through a rather powerful field glass I saw that it had no definite nucleus and seemed to be a streak of nebulous luminous matter, well defined, in length perhaps two degrees and in width half a degree. I called my cousin's attention to it, and she saw it plainly. As we looked, its light seemed to pulsate; and gradually dimming, it finally disappeared.

In a few minutes there appeared a very faint nebulous formation, but at least *ten degrees* to the *left*, so faint that I am afraid to vouch for its existence. But within five minutes the original formation reappeared at the same place, gradually reached a decided visibility and then faded again from view. A bank of clouds finally covered the sky. The formation, having the shape of a dirigible, my cousin suggested that that might be it, but the fact that one could see the faint stars behind precludes that theory. That portion of the sky was entirely clear, and besides, I do not think it could have been a small cloud as it had a typically nebulous appearance. I am completely at a loss to know what this could have been, and while I realize that my description is not very clear, I would like very much to have an opinion from you.

As indicated on my sketch, the object in question was at the intersection of a line through the two stars forming the base of the Great Dipper with one drawn from the North Star and passing between the second and third stars of the handle.

WALTER H. EAGER.

Huntington, W. Va.

The Editor referred this inquiry to Professor Russell, writer of his monthly astronomical page, and received the following reply. It is to be noted that an Aurora in July so far south is a most unusual event.

The phenomenon described was evidently in the earth's atmosphere, since it appeared and faded in so short a time. From the account given it seems probable that it was a detached cloud of Auroral light, similar in nature to the ordinary Aurora Borealis. The transparency of the luminous matter, its pulsations, disappearance and reappearance, all fit in with this explanation.

HENRY MORRIS RUSSELL.

The Vegetable Dyes of India

SINCE the outbreak of the war in Europe investigations have been carried on in India jointly by the Departments of Industries in Mysore and Madras with a view to determining to what extent the present shortage of synthetic dyes could be made good by reverting to the natural dyestuffs of vegetable origin that were formerly employed. The work has been carried out mainly in the laboratories of the Applied Chemistry Department of the Indian Institute of Science, and with Prof. Sudborough have been associated Dr. H. E. Watson and Dr. F. Marsden, the tinctorial expert of the Government of Madras.

Dr. Marsden's report has recently been submitted to his Government and is reproduced in the *Indian Trade Journal* for March 3rd. The materials dealt with in the investigation included chay root, nuna, ventilago bark, *Rubia cordifolia*, red sanders wood, sappen wood, cutch, divi-divi and other tannin materials, annatto, kapila, lac, and *Wrightia tinctoria* leaves. The paragraph of the report relating to annatto is of special interest:

"The dye obtained from jabara seeds was tested upon bleached mercerized cotton, upon which it gives a pleasing rich orange shade. The method of dyeing is simple, consisting in working the yarn in a warm alkaline bath made by extracting the dye from the dried seeds with water and then adding a little carbonate of soda or potash. The dyeing is finished by giving a weak bath of acid and rinsing.

"It is generally assumed that the shades given by annatto are not fast, but I find that the fastness properties are equal to those of many of the bright aniline dyes which have been so largely used here, and there is no reason why, if the shade is liked, the material should not find a more extended use upon silk and cotton materials, in which brightness of color is a consideration."

Paper from Cotton Stalks

THE announcement made by the Royal Material Testing Office at Grosslichterfelde, Germany, that paper can be manufactured from cotton stalks is very interesting and timely and will doubtless attract the attention of the American industrialists. Like all the species of the mallow family, the most important fiber-producing group of plants in the world, the stalks of the cotton plant contain a long fiber suitable for making paper. It has long been known that the bark of these stalks contains a fine jute-like fiber and various attempts have been made in this country to bring it into use. It has been demonstrated beyond a doubt that a good fiber can be prepared from the bast not only for paper but also for thread, twine and coarse cloth.

According to the Dictionary of Economic Products of India, Vol. IV, cotton stalks yield good fibers which may be separated by retting. A number of investigators in India called attention to this subject more than 20 years ago and recommended the use of the cotton fibers in a commercial way. In the Sandwich Islands the bast of *Gossypium tomentosa*, a species closely allied to the true cotton plant, is employed by the natives for making a rude twine. Among the articles in the fiber exhibits sent to the Paris Exposition of 1889 was a fine example of the fiber obtained from the bast of cotton plants grown by Gov. J. B. Gordon of Georgia. The American Consolidated Fiber Company prepared the material from the green stalks 60 days after planting.

The fact that both the bark and the ligneous portion of the cotton stalks can now be utilized successfully for making paper is of special importance at this time not only because the price of paper and its demand are constantly increasing, but because the materials now used for paper making are becoming scarce, expensive and in some cases inaccessible. The supply of cotton stalks is almost unlimited and the cost will naturally be very little above the cost of gathering and transportation.

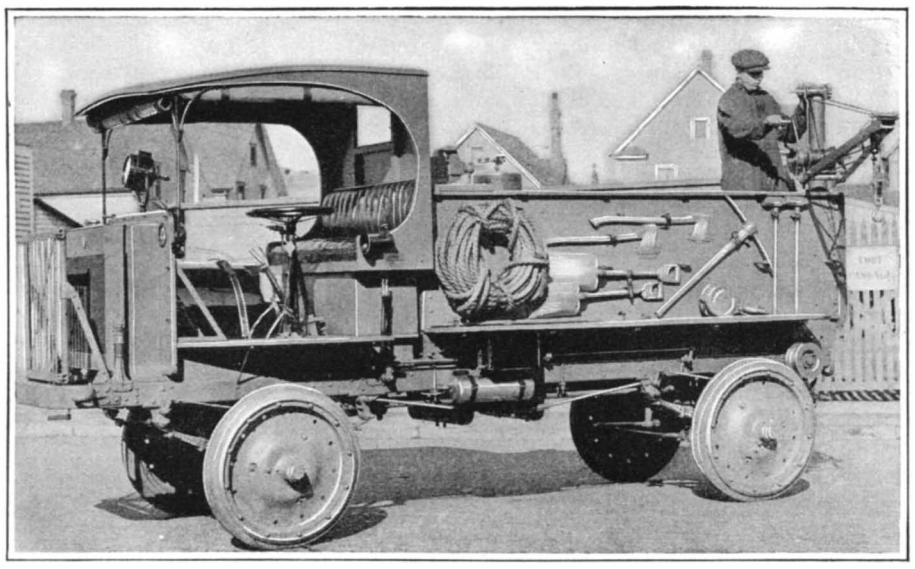


Fig. 1. Wrecking truck for use with train of vehicles of any make and mounted on a four wheel driven brake and steer chassis

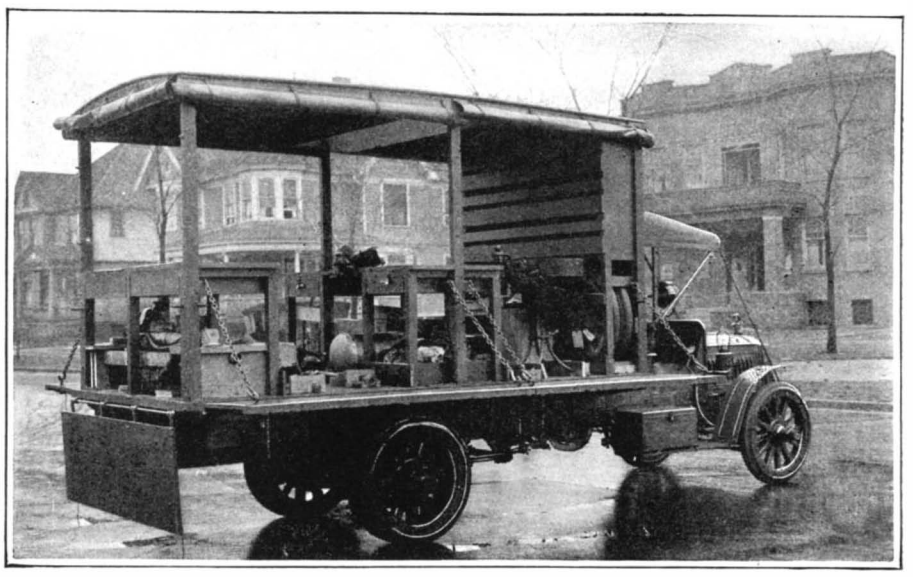


Fig. 2. Repair truck carrying outfit of spare parts, intended for service with a train composed of trucks of the same make

Auto Repair Trucks for Field Service

Importance of Portable Machine Shops in Modern Warfare

By Victor W. Page, M. S. A. E.

IF the experience and recommendation of the commanding officers of our punitive expedition in Mexico can influence our government to any extent, the motor truck is assured of a permanent place in the transport service of our army as well as in defensive and offensive operations.

The European war has demonstrated that reliable truck transport service can be obtained only by painstaking maintenance and prompt repair and salvage of wrecked or damaged trucks. Various types of traveling workshops have been devised and equipped to handle almost any kind of repair work expeditiously. Some are installed for use at bases where they become part or units of a large repair establishment, while others have such an equipment that they are suitable for service in the field with truck trains.

Naturally, the development of the repair truck has been rapid and some improvements are possible, especially in the items of equipment provided. However, those repair shops that are already in service are very practical and are supplied with a stock of tools and machines that surpasses the mechanical equipment of many automobile repair shops of serious pretentions. The mobile or traveling repair shops will be fully as useful in repairing other forms of war machines as in restoring the mechanism of motor trucks. The armorers can use the complete equipment to advantage in repairing ordnance, the engineers will be enabled to keep their road building machinery, tractors, etc., in better repair as well as having equipment available for all kinds of erecting and wrecking work. Our aeronautical branch will need even more mechanical attention in proportion to its size than the motor transport service. In fact, there is hardly a phase of modern military activity that will not require the services of skilled mechanics as much as well trained and brave fighting men.

Army repair trucks may belong to one of four classes. The less numerous is composed of those types adapted to moving machine equipment to form repair shops at bases. In this class no one unit is equipped completely enough to be suitable for field service. For example, one truck may carry only the power plant. Another, lathes and similar machine equipment. A third form may have light machinery installed; still another type may serve only as a storehouse for supplies. It is evident that the equipment of a train of this type can include machines of all types and carry raw material for fabrication into machine parts. It is to the base repair shop that all seriously damaged trucks would be brought, where extensive overhauling and rebuilding would be done. This establishment, of course, would be situated a considerable distance in the rear of fighting forces and would only advance in order to maintain the proper relative distance between the machine equipment and the forces it served.

The next type to consider is the traveling general repair shop which carries a very complete outfit of tools, but which does not carry spare parts for any particular make of truck. Only such parts as are common to all trucks would be stocked in a shop of this character. It would, however, be adapted for repair service to all makes, by virtue of its usually com plete tool equipment.

The third class is the special service repair truck intended primarily to serve only a distinct make of truck and to be convenient to the field base of truck trains. The army authorities recognize the advantage of grouping trucks of the same size, make and power together, rather than having the trains composed of a miscellaneous collection of different vehicles. A truck of this nature does not carry any machine equipment to speak of, but is furnished with a large stock of spare parts for ready replacement.

The fourth, and what is destined to be the most numerous class, is a wrecking truck suitable for general duty with all truck trains, for the engineer corps and artillery. A truck of this kind is equipped with only such tools as are needed for emergency repairs, and is intended more for keeping the trucks in movement than for repair work. It is evident that a truck of this character can serve a train of any make of trucks, as it need carry only such repair parts as would be apt to be required to keep itself in commission. These wrecking trucks are a general utility type that can be used in many military operations.

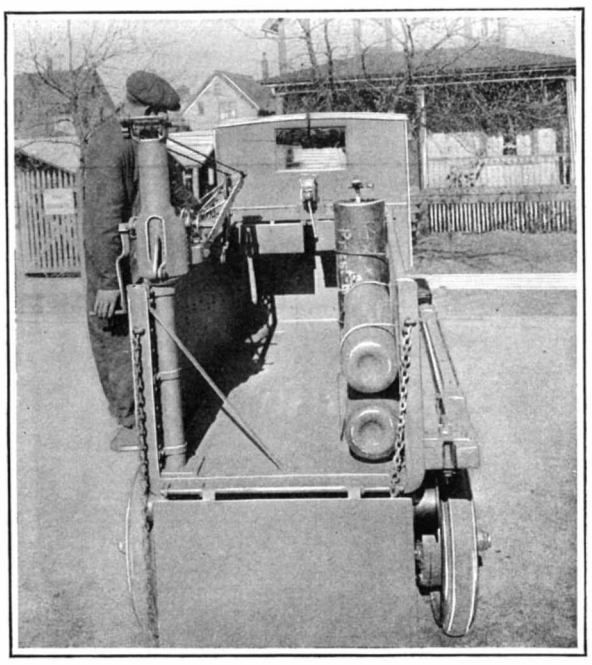


Fig. 3. Interior of steel body of the wrecking truck shown in Fig. 1

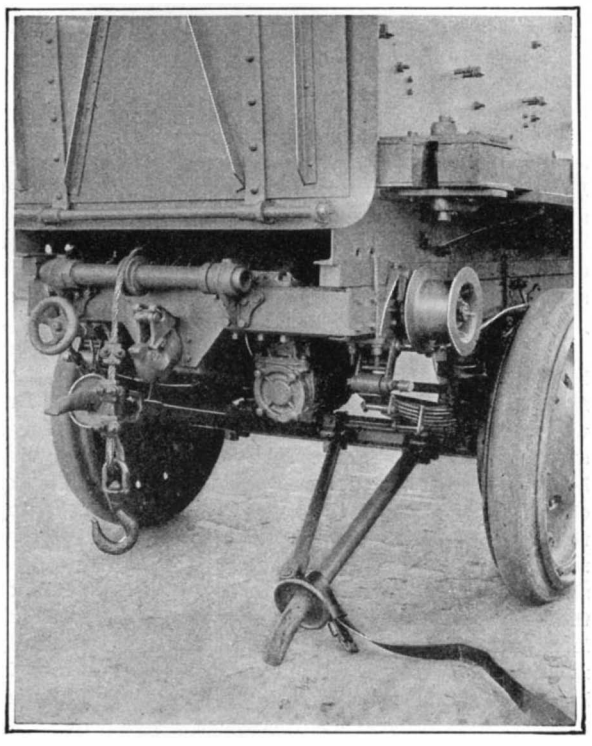


Fig. 4. Rear view of truck shown in Fig. 1. Note the winch towing-hook winding drums and substantial sprags

It is not the purpose of this discussion to consider the types that are adapted for use at base repair shops but only those which can be of service to the army in the field and which are sufficiently complete in equipment to make each unit independent of others of the same type. A typical mobile repair shop of this nature mounted on a four wheel drive chassis is shown at Fig. 5. The body is of the Russian type, having a detachable prairie schooner top. This top had been removed when the photograph was taken to show the various items of equipment clearly. The power for operating the machine tools and for lighting is furnished by a direct current generator connected direct to an auxiliary nine horse power four-cylinder gasoline engine which is independent of the large power plant furnishing the propulsive force for the truck.

The electrical equipment includes a five horse power motor and suitable rheostat to drive the lathe. The drill press is driven with a one horse power motor. It seems to the writer that the one five horse power motor would have more than sufficient power to drive both the lathe and the drill and then have enough surplus to handle a bench grinder or small hand milling machine. An electric bench grinder, which of course includes another electric motor and an electric breast drill complete the electrical power equipment.

A bench cabinet carries machinist's and pipe vises and is bolted to the rear of the body. A place is provided for everything. Miscellaneous equipment such as fire pots, blow torches, hand grinders, chain falls, etc., are bolted or clamped to the body or to special braces in accessible places. Acetylene and oxygen tanks are hung on brackets under the body. The ends of the tanks can be seen projecting from the rear of the chassis in the photograph. The welding and cutting outfit used in connection with these is installed in a cabinet which slides into a drawer built under the truck body. The blacksmith and carpenter tools are housed in other drawers also built under the body. A three hundred foot coil of rope is fastened on the chassis at the rear.

The machine tools include a sixteen-inch drill press and a thirteen-inch swing by five foot screw cutting lathe, equipped with a compound rest, suitable face plate, chucks and steady and back rests.

The writer believes that a gap bed lathe would be more serviceable because it combines the advantages of the regular form with the capacity for handling considerably larger work in an emergency. A small hand miller or a milling attachment for either lathe or drill press should also be included because there are many repair jobs that could not be satisfactorily accomplished with the lathe or drill press alone.

The special-service truck of the type shown at Fig. 2 does not carry any machine tool equipment to speak of, though it has a complete bench equipment and a blacksmith's outfit, including a forge and anvil. A truck of this kind is equipped with special tools designed for the ready handling of the parts, but these tools can-

not be used on any other make of truck. It carries an outfit of emergency tools, such as crowbars, shovels, sledges, axes and picks and has chain falls, towing cables and lifting jacks. The spare parts equipment is unusually complete, some large units being included. But these parts will fit only one type of truck, so that the scope of the special-service truck is not large.

A side view of the deservingly popular wrecking truck type is shown at Fig. 1. This is mounted on a four wheel driven, brake and steer chassis and has great pulling power. Several of these are now in service and others are being turned out as fast as possible in anticipation of the rainy season in Mexico. A feature of this truck is a power operated winch carrying 300 feet of steel wire cable and two capstan heads, one at each side of the frame. The winch and capstan head is shown in Fig. 4. The body of this truck is made of steel and is of large capacity as shown at Fig. 3. It is ten feet long, forty inches wide and thirty-two inches deep. It has a wide running board on each side which is strong enough to carry considerable outside load. Beside the wire cable, the truck carries 100 feet of 1¼ inch Manila rope and an oxy-acetylene welding and cutting outfit. A hand operated derrick which as clearly shown in Figs. 3 and 1 is provided for lifting heavy objects in and out of the truck. The auxiliary equipment which is neatly carried at the side of the body includes axes, crowbars, shovels, pick axe, sledge hammers, gin pole, tow chain, chain falls, wheel and flange pullers, clamps and fire extinguishers.

When this machine is used to pull a mired transport truck out of the mud, over a bank or through a stream it is stationed a convenient distance away and the emergency brake lever is set to lock all five brakes. A couple of substantial sprags at the rear end (shown in Fig. 4) are let down and pushed into the ground to prevent the truck from hauling itself along on the cable while the winch is being operated and to insure that all of the effort will be exerted on the truck that needs it. The winch is started and the powerful four cylinder motor and multiplied effort is sufficient to move almost any truck. Although the four-wheel-drive principle as worked out in this chassis, provides a positive non-slipping drive to each wheel which means that it can proceed when even only one wheel can secure traction there is always a possibility that the mud or sand will be so deep that all of the wheels may rotate without securing traction. In such a case, the wrecking truck can extricate itself without assistance. The one hundred foot Manila rope carried by the truck is secured at one end to a convenient tree or to a "dead man" buried in the ground. The other end is wrapped a few times around one of the capstan heads and the capstan is given the necessary grip on the rope by three or four men who hold the rope taut and haul off the slack as the head rotates. In this way the truck pulls itself along the road until the wheels secure traction. Sometimes two ropes are needed, one on each capstan head. In tests, this wrecking truck was able to pull itself through a marsh and was also able to haul a five ton trailer through the same place after it had reached a point where the sprags would hold in the ground. It is evident that a wrecking truck of this nature has a wide application in the military service as it would prove just as useful in hauling heavy artillery as pulling motor trucks or trailers.

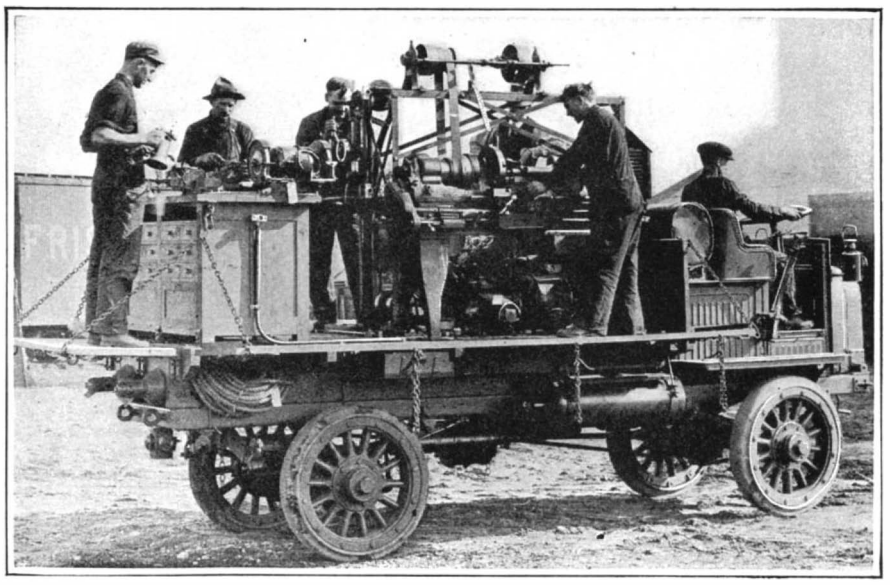


Fig. 5. Complete mobile repair shop for field service, mounted on a four-wheel-drive chassis

Armored Car Planned and Built in Four Weeks

By George F. Paul

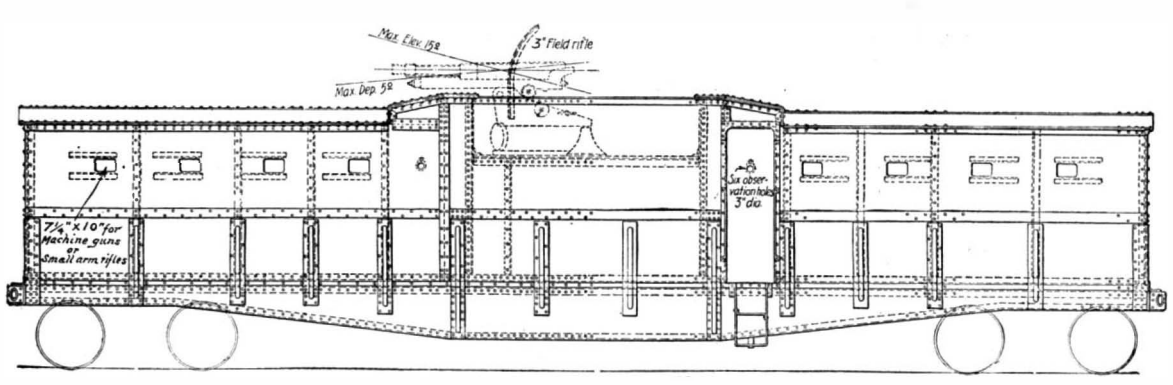
THAT American car works can speed things up when there is necessity has just been shown by the planning and building of an armored car for the U. S. Army Engineering Corps in 27 days. It is just such a car as would do excellent service along the Mexican border in protecting railroads and depots and in affording shelter for skirmishing parties when hard pressed. It is the first of several cars of this type that are to be constructed.

This movable blockhouse has several distinguishing features, one of them being the three compartments into which it is divided. The middle compartment furnishes an ammunition storage room below, while above is the gun pit, with the special recoil mounting for the 3-inch field piece. This field rifle is capable of a depression of 5 degrees and an elevation of 15 degrees, making it convenient to operate under varying conditions.

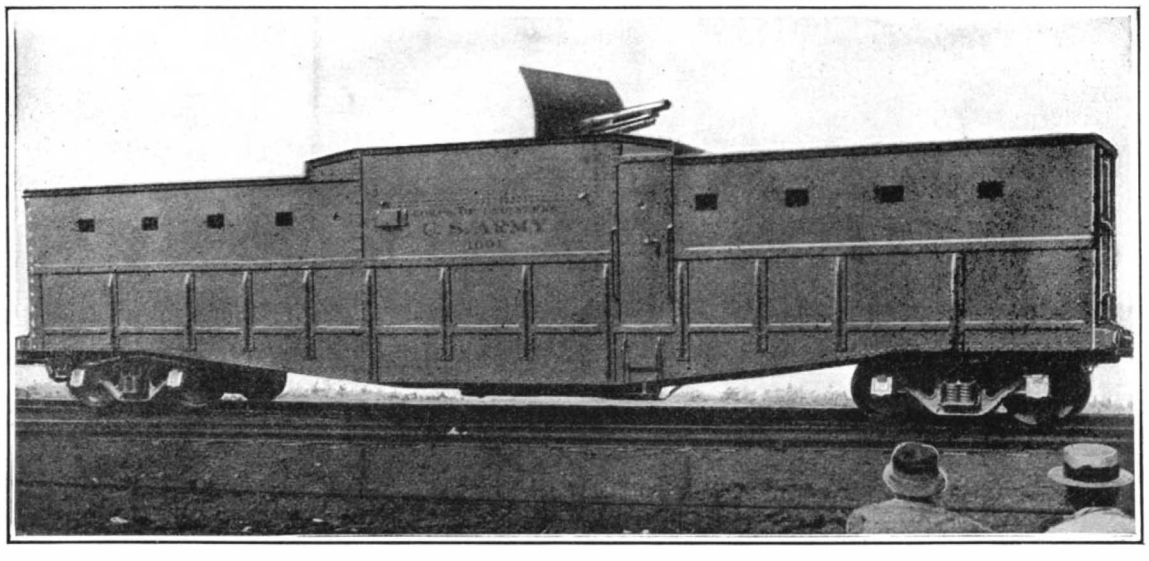
Plenty of portholes, twenty in all, provide opportunities for rifle or machine gun fire. The entire car has an armor plating planned to render harmless any shots that may strike it from portable arms. Under each porthole is a swivel mounting for a machine gun. If it is desired to shut off any of the portholes, this can be done by means of movable slides of armor plate. There are four well placed doors, which are also made of heavy steel plate. There is a door at each end of the car, and also one on each side, so that it would be an easy matter to enter or leave the car, no matter from which direction the fire might be coming. The gun well is nearly ten feet across, and is connected with the compartments at the ends of the car by means of short ladders.

The car has a total length of nearly 47 feet, with a weight of 86,200 pounds. The end compartments are 7 feet high with a width of 9 feet, 1½ inches. It is thus evident that the car is roomy enough to be used as a transport for a company of infantry. When employed on regular patrol duty, a complement of twelve men would be sufficient to operate the machine guns and the rapid fire field piece. A large storage tank for water is one of the features of the car equipment.

This car and other cars of this type are to be taken to the Sandy Hook proving grounds, where they will be properly equipped for the highly important duties that they are planned to perform.



Side elevation of the new U. S. Army armored car showing mounting of the 3-inch field piece



Armored car for the United States Army, built in twenty-seven days

The Current Supplement

THESE are days when constantly greater demands are being made on the strength and the character of metals employed in great engineering works, in bridges, ships, locomotives, motor vehicles, monster artillery and a host of other directions; and in a timely article on *Present-Day Knowledge of Metals and the Engineer*, in the current issue of the Scientific American Supplement, No. 2123, for September 9, attention is called to the necessity of greater familiarity by engineers with the real nature and properties of metals, as developed by the investigations of recent years, instead of an entire reliance on text book formulae and heterogeneous collections of test sheets. *German Military Aeroplanes* tells us something about the type of fighting machines of which we so frequently read, and points out their similarity to previously designed French machines. It is accompanied by illustrations and diagrams. *A Novel Cooler for Internal Combustion Engines* illustrates and describes an English device that is useful where water is scarce. *The Status of Water-Power Development* discusses the comparative advantages of water and steam as a source of power. The article on *The Extension of the Spectrum Beyond the Schumann Region* is concluded. *Underground Habitations on the Firing Line* tells of the elaborate subterranean abodes that the soldiers of both sides in France have excavated, far below the surface, to make living at the fighting front endurable. It is accompanied by a number of photographs. *The Plains of Northern India* tells of their geological relationship to the Himalaya Mountains. *Internal Combustion Engine Cycles*, while considering whether motors designed to operate on the Otto cycle have reached their ultimate state of development, suggests and describes an ingenious and interesting constant pressure cycle, which is illustrated by several drawings. *Fuel Economy* treats of the proper utilization of coal. There is also much other matter worth reading.

"Bees"

THIS term, according to a circular of the Department of Agriculture, is applied to a kind of wild yeast or ferment, supposed to have originated among the mountaineers of Tennessee and Kentucky. A mixture of corn meal and molasses exposed to the air becomes impregnated with wild yeast and other bacteria, and the ferment thus produced has been used under the name above mentioned in certain primitive communities for making a sort of vinegar or certain alcoholic beverages, by adding it to a mixture of water with either brown sugar or molasses, which is then allowed to work or ferment. The attention of the department has been directed to the fact that ferments of this character are now being offered for sale more or less widely under the names "vinegar bees," "beer bees," "Australian bees," etc., and it is claimed by their promoters that, when added to solutions of sugar or molasses, they will produce excellent vinegar, beer or wine. The department pronounces these claims fallacious, and suggests that harmful as well as desirable bacteria are likely to be caught from the air in the "bees"-making process.

Growing Our Own Dates

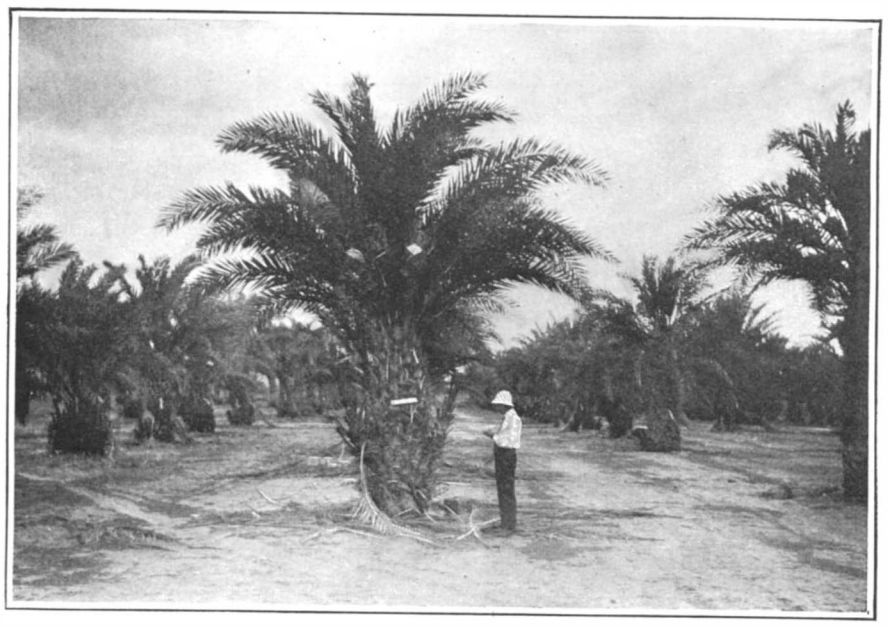
By Monroe Woolley

FOR a long time we have been importing our supply of dates from the warm countries of southern Europe and Africa, but if the efforts of western experimenters are as fruitful of results as the trees grown have been full of fruit it may be expected that the United States will before long grow all its own dates.

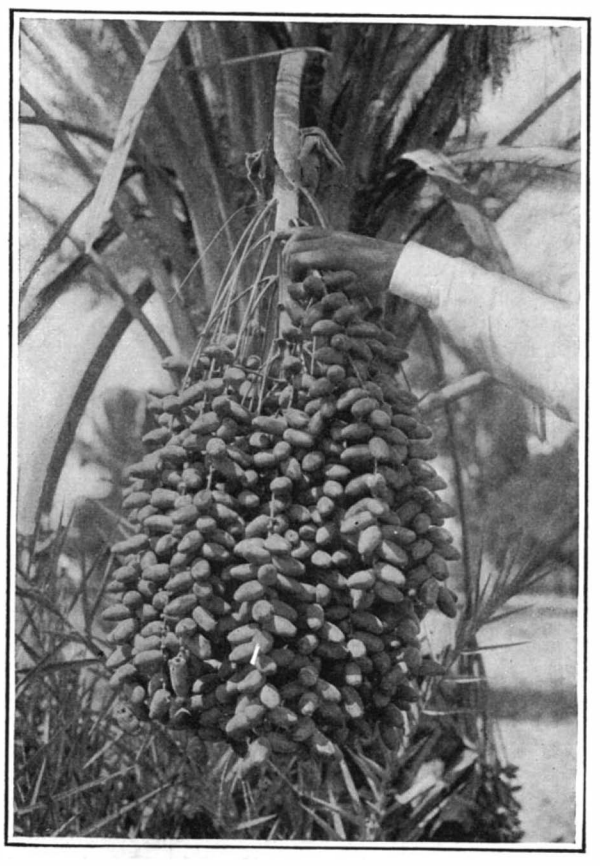
It took us a long time to find out that the arid plains and valleys of the southwest were really fit for something. All the deserts needed was water; with plenty of moisture these areas could be made to grow almost anything from horseshoe nails to alligator pears, and incidentally fruit the like of which we have never before known.

The experiment station of the University of Arizona grew 22,000 pounds of marketable dates last season. The station has more than two hundred thriving trees. The price received was 17 cents per pound, or $3,740 for the crop. From this it will be noted that date growing is no mean occupation, provided one has suitable land. Once upon a time a good date soil could be had for a song, but when water flows over the desert sands wastes jump somewhat in value. The faculty at the Arizona university have conclusively demonstrated that dates can be made a profitable crop in the Salt River valley, and elsewhere where soil conditions and climate are similar.

No tree is more graceful and beautiful than a date palm, and the plants make stately ornaments for lawns and parks. At the same time they grow an appetizing article of food. In northern Africa, the native habitat of the date palm, the fruit is a common article of daily diet.



An Arizona date-palm orchard



Dates from Arizona experimental farm

Growing Shagbark Hickory for Profit

IT seems strange that so few farmers think of utilizing odd corners of their farms by planting nut trees. The term nut here means edible nut, such as the walnut, chestnut, pecan nut or shagbark. These trees grow in many parts of the United States and are well known to practically all farmers. Many farms have waste places which cannot be cultivated and owners would do well to consider the high claim these trees have to an area which would otherwise fail to yield anything toward paying an annual rental. There are areas now under cultivation which would be more profitably employed in growing trees than in ordinary field crops. This is true, particularly, with steep hillsides which erode badly during heavy rains.

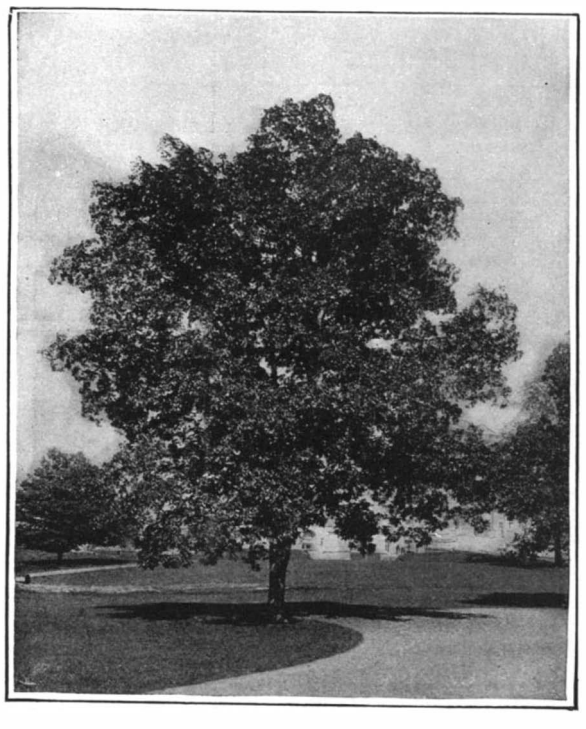
The planting of our native nut trees is done very rarely in this country. Their rather slow rate of growth may account for this, but those who will plant them, not only improve the conditions and value their farms, but they insure an annual crop of nuts for which there is a very good market.

While the pecan rightly claims first place among the native nut-bearing trees, it may be of interest to consider the usefulness of the shagbark hickory as a fruit-bearing, as well as an invaluable timber-producing, tree. Many sections in this country have long been associated with the collection and marketing of shagbark hickory nuts from wild or forest-grown trees. Although this forms an important industry in the aggregate in parts of Pennsylvania, Maryland and West Virginia, there is a general impression prevailing that the tree will not flourish when planted in groves and in other soils and climates. This is an unfortunate mistake, for it has prevented many hundreds of acres of land in the eastern States from being profitably employed by judicious planting of shagbark hickory.

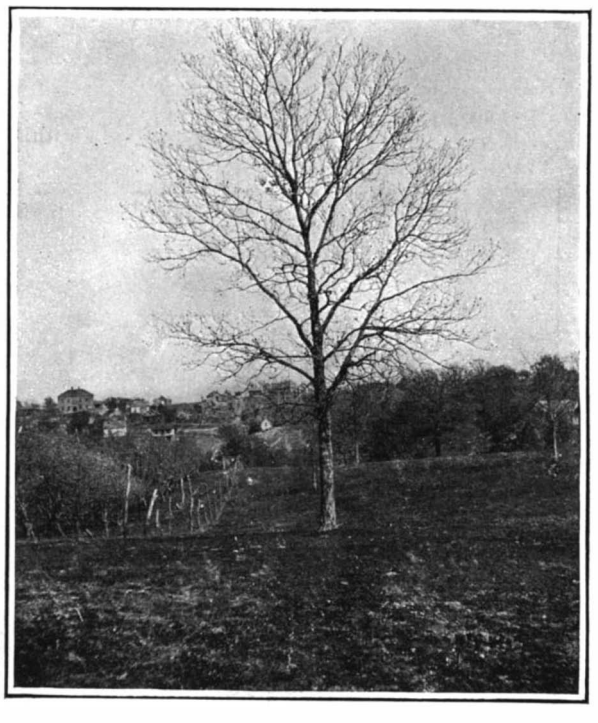
It is to be regretted that at least a small portion of the waste lands on many good farms in the East are not utilized in this way, because such plantations would serve as object lessons to owners of similar lands. Nor is the time required for the trees to grow sufficiently large to bear a crop of nuts so long as is generally imagined. Thrifty young trees five years old begin to bear fruit. While such trees may be regarded as exceptional, it is safe to say that all trees at the ages from 15 to 20 years produce profitable crops every year. For a single two-acre plantation in Lebanon County, Pennsylvania, the owner is authority for stating that his trees, which are 46 years old, give a return of more than 32 per cent on the money invested. For the person of small capital, in a position to buy a few acres of land, no investment of his money and labor could be more profitable than that of shagbark growing. Unlike the run of the market garden crops, the first is almost the only expense, the annual digging of the ground around the trees for the first few years and the gathering of the nuts involving the greatest yearly outlay.

As a marketable commodity shagbarks are of excellent value; they command a good and steady sale from year to year. The nuts are not perishable, and if the market price should be low at the time of gathering them, they can be easily stored and held until there is a favorable rise in the market. It rarely happens that the nuts sell for less than $1.50 per bushel at the place of harvesting, and they frequently sell for as high as $3.00 per bushel. The annual yield of trees in full bearing is occasionally as high as 40 bushels. Supposing each tree to yield only 5 bushels of nuts at $1.50 per bushel, the return per tree would be $7.50. With only 40 trees to the acre, the annual returns would amount to $290, which is about eight times more than the returns that wheat will bring on the best land.

One of the chief deterrents in forest planting is the high price of the planting stock, but with the shagbark this should not be necessary. Raising the plants from the nuts planted directly in the place the tree is to grow has been practiced with good success. This is the method of getting up a plantation of shagbark that can be fully recommended. The method usually pursued is as follows: Plough and harrow the ground, if possible. This should be done during the winter or early spring, and during the following autumn plant the nuts, placing them in line from 4 to 6 feet and 4 feet between the rows. Weeding and cleaning will be required for the first few years, after which time the size and strength of the young trees will kill out the weeds. Blanks in the lines may be filled in the second year. In planting it should always be borne in mind that the largest and best developed nuts be selected; this rule, of course, applies not only to nuts, but to the seeds of practically every economic plant. Pruning and thinning at an early stage of the plant's growth is to be recommended, as these do away with the necessity of having them to perform at an advanced date and when the trees have attained to more bulky proportions.



The shagbark hickory used on a country estate for its ornamental value



A shagbark hickory about thirty years old, in full bearing

Control of Drugs and Medicines

SOME rather startling facts concerning the variation in the strength and purity of the drugs and medicines dispensed in this country are presented in a recent paper by Martin I. Wilbert, of the U. S. Public Health Service. That medicines, when given for their physiologic effect, are often disappointing in acting feebly or not at all, or on the other hand, that supposedly small doses sometimes produce unexpectedly violent or otherwise untoward results ceases to be surprising when we read the statistics of state and other laboratories where drugs are examined in connection with food and drug laws. A table is given by Mr. Wilbert showing the number of samples of widely used drugs and preparations reported on by such laboratories in 1914, with the results of the tests. The rejected samples of many substances amounted to 50 or 60 per cent of the total number submitted! Of ammonia water 76 samples were examined and 46, or 62 per cent, were rejected; of diluted hydrochloric acid 63 per cent of the samples were rejected; and so on. The worst record of all was made by tincture of belladonna. It is almost unbelievable that of 172 samples of this important drug, examined at 6 laboratories, 133, or 77 per cent, were found to be below standard requirements. The need of more effective control is evident, and the greatest desideratum appears to be the systematic inspection of retail drug stores, where, apart from deliberate adulteration and substitution, drugs suffer deterioration from several causes. The importance of such investigation and supervision is incalculable. It touches the health of the nation.

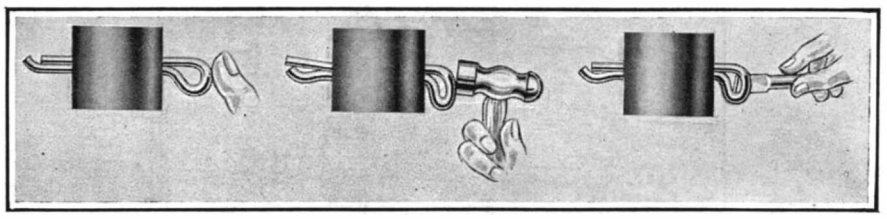
Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Cotter Pin that is Readily Inserted and Removed from a Hole

THOSE who have used the conventional type of cotter pins will appreciate the handiness of a recently invented pin of ingenious design.

The present cotter pin is readily inserted into a hole because its ends, as may be seen in the first of the accompanying illustrations, are together, giving it a pointed end. When the pin is once in place, it is only necessary to give it a light blow on the head in order to drive the straight wire past the bent end of the other, thus locking it firmly in position. The procedure is shown in the second illustration. To remove the pin, the tip of a screwdriver is inserted in the eye and slightly twisted in order to draw back the straight branch. As will be noticed in the third illustration, the cotter pin is now of essentially the same shape as at the start, so that it can be used again without difficulty. It is claimed by the manufacturers that the new cotter pins can be used over and over again with the same convenience as if new pins were used each time, which can hardly be said of the usual cotter pins.



Recently-invented cotter pin, showing how it is inserted, locked in place, and removed from a hole

How Steel Bars are Rolled for Use in the Manufacture of Shrapnel Shells

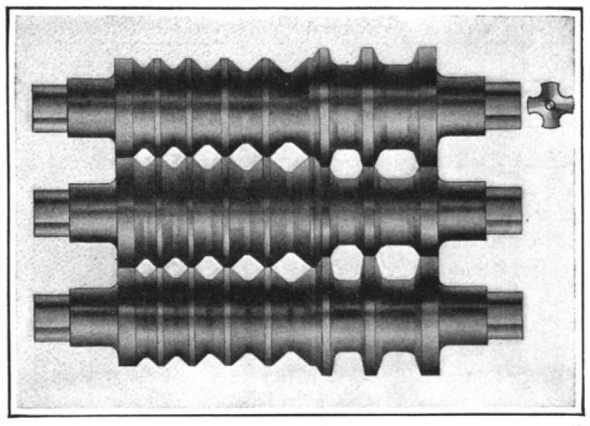
By W. S. Standiford

THE extensive manufacture of shrapnel shells in the United States during the past twelve months lends interest to the rolling of the steel bars from which the projectiles are made. These bars are round in form and are produced by rolling, the latter process making a dense and fine grained metal, well suited to the exacting processes of manufacture which it undergoes before the shells are ready for use in the guns. As the steel bars are the basis from which the shrapnel is manufactured, the design of the rolls, their proper adjustment and their handling should be subjects of much interest.

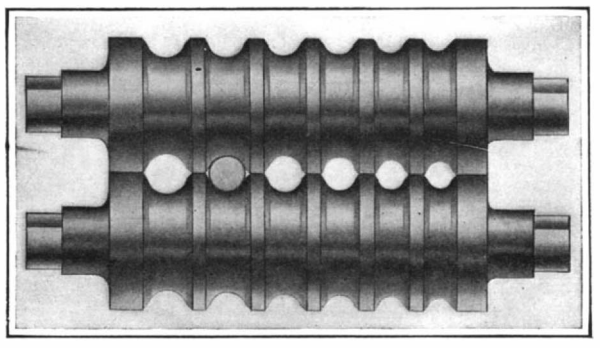
At first thought one might tender the suggestion that the shells could be manufactured faster and better from castings containing the chamber for powder and bullets, thus leaving very little metal to take off in the machining processes as contrasted to the existing practice of punching a hole in a solid steel blank and then finishing the interior and exterior. But castings cannot be used in this case, for cast metal usually contains blowholes, making it dangerous material for shells. Were cast shells used, there would be danger of their bursting in the guns. Another reason is that the weight and balance of a shell made from a solid bar has a steadier flight through the air than one made from a casting, since in the latter the heavier ingredients of the steel settle to the bottom during the cooling, making certain parts of the walls of the projectile heavier than others, which obviously disturbs its balance during flight.

Steel bars as a munition material have the carbon and other ingredients equally distributed, for the rolling process mixes them equally, making the metal fibrous in character. The size of the round bar rolled is 3½ inches in diameter. This is the size used to make the 18-pound projectile used in British field guns, and it will be noted that sufficient metal is allowed to permit of the machining operations.

The roughing rolls used in making steel shrapnel bars are three-high, which design rapidly reduces the steel as compared with the two-high design. Quick reduction of the hot steels at the start is most important, for the metal must be worked while it is at a high heat. This makes it fibrous, which is a desirable quality, since this condition makes for strength in iron and steel. In the first illustration are represented the roughing rolls, and it will be noted that each roll contains a box and edging pass, while the others are put in on an angle. Box and edging passes, by their shape, allow heavy drafts to be used. The first and second passes work the metal on top and bottom, there being very little work done on the sides. As will be observed in the illustration, the sides are slanting toward the top of the groove. This is done so that the bloom will leave the pass easily. If the sides were straight, the bloom would stick in the pass and such metal as would be forced between the collars would be broken. In actual practice the sides of the box and edging passes are opened out 6 deg., the width at the bottom being just wide enough so that it will fit the bloom. The box, edging and angle passes all contain fillets at the bottom, so that the corners of the bloom will be worked as much as possible in order to make all parts of the bar of uniform strength.



Rolls used in the rough rolling of steel shrapnel bars



Finishing rolls used in rolling the square bars turned out by the rough rolling process

The work done on the bloom by the above-mentioned passes has so compressed the metal that when the angle grooves are reached there is but slight flashing of the molten steel coming from the bar as contrasted to the flashing when the bloom first enters the rolls. In the accompanying illustrations of the roughing and finishing rolls the full number of grooves in both sets has not been shown, in order to gain clearness and keep the drawings within reasonable limits.

The angle grooves next engage our attention. These have an angle of 95 deg., and by their position in the rolls work the bar mostly on the top and bottom corners—the corners at the sides have no work done on them. The bar goes through the angle passes alternately, until it is reduced to four inches in diameter. Then it is ready for rolling in the hand rounds or finishing rolls, which appear in the second illustration.

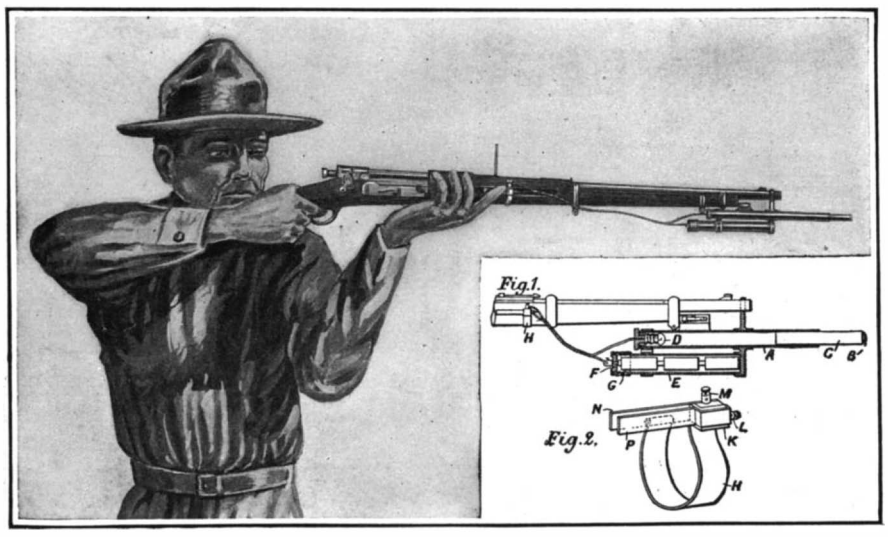
The hand rounds or finishing rolls are provided with grooves which are put in by means of round steel plugs. They are ground after hardening, as the latter throw them out of true circular form. By studying the drawing it will be seen that the sides of the passes are slightly widened, the reason for this being that it prevents a long ridge or fin from forming on each side of the bar at the joint of the rolls.

The four-inch square bar from the roughing rolls is sent once through the 3¾-inch pass. It is then turned to a right angle to its previous position and pushed into the 3½-inch finishing pass. As the bar from the 3¾-inch groove passes through the 3½-inch one the metal spreads out in the extended sides, and is about 7/16 inch wider at the sides as a result. For this reason it is then turned over at a right angle so that the wide part will touch top and bottom, and rolled again. This is followed by again turning it at a right angle to its previous position and giving it its final rolling. The last rolling rounds out any slight inequalities on the surface that may exist. The shaded outline of the finished bar indicates that the total width of the cut away clearance part of the pass is slight.

In the manufacture of round iron and steel bars by the use of rolls it is quite impossible to produce by rolling a bar that measures the same on all sides, the variation from a true circular shape being as a rule about .007 inch. However, some manufacturers, by placing an extra set of rolls in front of, and at an angle to, the regular ones succeed in turning out bars having a variation of only .003 of an inch over size, which is perhaps the best that can be done at present.

It is a fact that the consumers demand increasing accuracy each year. To meet the ever-increasing exactness of their demands requires the utmost care and skilful handling of the rolls by the operator—obviously not a task for one who has not had the most thorough experience. The best that the ordinary roller can do is to make iron or steel bars 1/64 inch out of true circular form. This is due to their incorrect setting and handling in the rolls, such as inserting the metal at too high a heat in the finishers; not having the grooves in line; and not turning the metal over at an exact right angle at each rolling in the finishing pass. Too low a temperature in the finishing pass also influences the shape of the bar and makes it uneven in size. Thus, when the bar has places on it that are relatively cold as compared to other parts, in going through the rolls the cold spots cause the rolls to spring more than the hot spots, with the result that the bar is larger at some places than in others. If there are numerous cold spots on a bloom, due to careless heating in the furnace, the finished bar will be wavy in appearance. For this reason it is essential that the furnace and rolling men work in perfect unison in the production of perfect rounds.

In buying steel for shrapnel shells the requirements of the purchaser are most exacting, with the result that the manufacture of shrapnel bars is costly. As an example, bars for high explosive shells call for a discard of 40 per cent of the ingot; bars for shrapnel, 30 per cent, and ordinary steel bars about 15 per cent. The bars for high explosives and shrapnel shells are subjected to a rigid inspection. The demand for a large ingot waste by the purchaser is due to the latter's desire to secure a metal free from airholes and segregation, which would interfere with the proper working of the shells in the guns.



Details of an electric lamp adapted to marksmanship practice, and how it is used on a regulation military rifle

Using an Electric Lamp in Place of Ammunition in Marksmanship Training

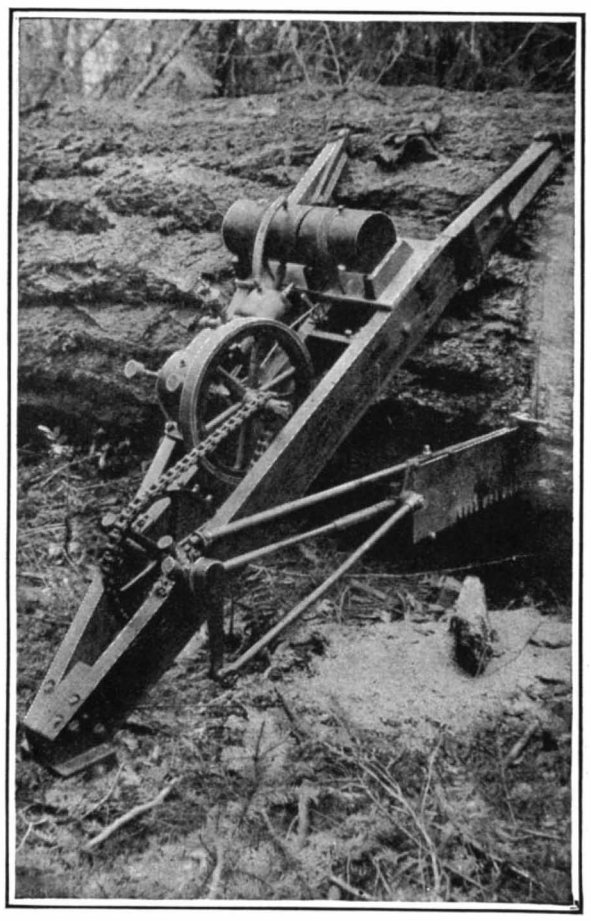
WITH the object of providing a device that would replace the use of ammunition in marksmanship training with

regulation military rifles, E. Edser of London, England, has developed an ingenious form of spotting lamp which is readily clamped onto the firearm.

Briefly, the rifle-practice device may be said to comprise an electric lamp with means of focussing the beam of light upon a supplementary target, and a circuit closer which clamps on the gunstock so that it may be operated by a slight pressure of the left hand. The beam of light is thrown on a spot other than that aimed at, so that it does not lie in line with the sights. The reason for this is so as not to interfere with the aim of the rifleman, and to compel him to rely absolutely on the rifle sights alone for securing his aim. The beam of light indicates the success of the "shot" to the instructor or observer.

As will be noted in Fig. 1 of the insert drawing of the rifle-practice device, a metal tube *A* is attached to the end of the rifle in a manner essentially similar to that used with the bayonet. The electric bulb *D* is placed at the rear end of the tube, while the forward end is fitted with the sliding tube *C* and the lens *B*. The lens, by means of its sliding-tube mount, may be adjusted so as to focus the image of the glowing filament of the lamp on the supplementary target. The focal length of the lens may be about 12 inches; in this case the distance between the lens and the lamp should be capable of adjustment between 12 and about 18 inches. The tube *E*, which is attached to the lamp member, contains three cells of dry battery for furnishing current to the lamp. It will be noted that the cells may be renewed by unscrewing the end piece *G*, which is provided with an insulating disk, *F*, through which passes one of the leads from the battery. The other side of the battery is connected directly to the case of the container, the electric wiring system making use of the entire metal structure of the device as one side of the circuit.

The circuit closer, illustrated in Fig. 2, is held in position on the stock of the rifle by means of a U-shaped spring, *H*. A block of vulcanized fiber or rubber, *K*, is fastened to one end of the U-shaped spring. Two metal tongues, *N* and *P*, are attached to this block, so that they are insulated from each other. The tongue *N* is connected to the binding post *M*, while the tongue *P* is connected to the binding post *L*. An insulated wire connects the binding post *L* to the insulated lamp terminal, and another insulated wire connects the binding post *M* to the insulated terminal of the battery. The entire device may be applied to any rifle in a few moments' time.



A portable drag-saw that is operated by a gasoline engine

A Gasoline-Operated Drag-Saw for the Cutting of Timber

THERE has been successfully developed by Elbert Vaughan, an inventor of Portland, Ore., a gasoline drag-saw to take the place of the cross-saw in timber that runs from 16 inches to 7 feet, and to replace the old-style, cumbersome skid machines.

The present drag-saw is equipped with a two-cycle, 3½ or 4 horsepower gasoline engine, and weighs 225 pounds complete. It will cut wood or buck timber under any conditions to be found in the lumber and wood camps in any kind of weather, according to its designer. As will be noted in the accompanying illustration showing the portable saw in actual use, the open end of the V-shaped frame of the drag-saw is placed on the log to be cut. while the closed end is rested upon the ground or a stump or anything coming in the way of placing the machine to make a true cut. The machine is held to the log by two steel dogs bolted to each projection of the open end of the frame and driven into the log. No other means of fastening are required. When one task has been completed, the machine can be carried to the next point of use by two men.

Among the work done by the new drag-saw may be mentioned the cutting of 35 cords of 4-foot wood in 10 hours under favorable conditions, while under adverse conditions some of the machines have cut about 15 cords. The average cut, under fair conditions, is said to be about 20 cords. A single-hook drag-saw is used with all the machines of this type.

The "Fountain Pen" Receiver—A Portable Wireless Receiving Set

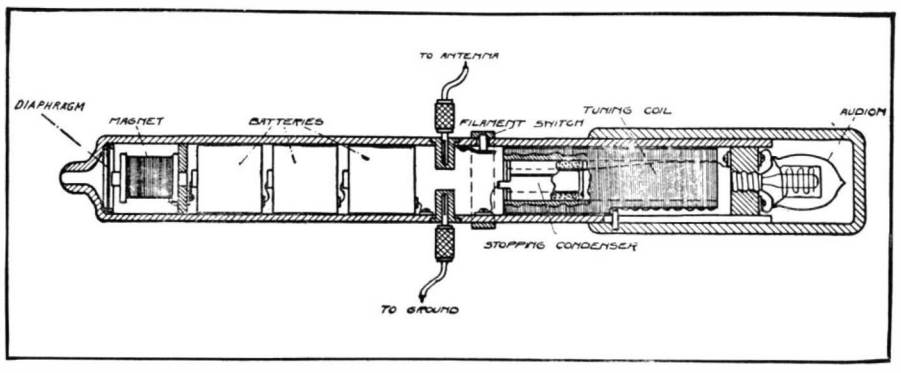
SO numerous have pocket wireless sets been in the past that they have long since ceased to be a novelty. Yet the so-called "fountain pen" receiver recently developed by Dr. Lee DeForest directs attention to itself on the part of electrical and wireless men, because of the unusual degree of newness presented in its design.

The "fountain pen" receiver is a complete wireless receiving set no larger than some of the extra-sized fountain pens in use by men with heavy hands. With it wireless signals from stations up to 8 or 10 miles can be intercepted without difficulty, in conjunction with even a small aerial. This means that a man with one of these receiving sets, stationed in Manhattan, would have no difficulty in reading all the wireless messages which might be sent out from the United States Navy Yard in Brooklyn.

The new instrument, a sectional view of which appears in one of the accompanying illustrations, depends entirely upon the audion bulb for its efficiency. It is this sensitive form of detector that makes the "fountain pen" receiver feasible. It is possible, by using a very "soft" audion, to get fair sensitiveness with only four volts for the B battery, whereas in the ordinary receiving set employing the audion the B battery usually has a potential of many times that. Although by making the case longer, it is possible to use a higher voltage B battery, the inventor states that this is not necessary.

It will be noted that the tuning of the new set is accomplished by means of a tuning coil wound with No. 40 wire. Taps taken from the coil are led to a number of points over which slides a contact mounted on the movable cap at the end of the receiver. By moving the cap one way or the other the wavelength of the receiving set is altered to meet the wavelength of incoming signals. The tuning coil can be operated satisfactorily for short wavelengths, and the audion is connected directly to it, giving an untuned secondary. The battery is placed in the middle of the receiver, while at the very end is placed the telephone consisting of the magnet, bobbins, diaphragm, and a special ear piece. The antenna and ground connections are made by means of bayonet contacts fitting into contact holes.

To use the instrument the operator should have a metal plate on the heel of one shoe, to which is attached the ground wire leading to the set. The wire can be passed through his trousers so as to be inconspicuous. The wire to the antenna may be run down through the coat sleeve into a hollow cane and through to the ferrule. Standing against any iron fixture running into the ground, the operator should place the metal plate on the heel of his shoe against the iron, meanwhile holding his cane over his shoulder. The ear piece is then placed in one ear, while the cap at the free end is moved back and forth to tune the set to the desired signals.



Sectional view of the "fountain pen" receiver for wireless signals

Method of using the "fountain pen" receiver

French Decree Regarding the Use of Military Inventions by the Government

THE decree regarding patents which has been issued not long since by the French Government is of considerable importance to inventors as well as to all persons who are interested in this subject. Here are all the essential features of this decree which bears the date of April 15th and is published in full in the *Journal Official*: According to the decree, the War or the Navy Department will have the right henceforth to make use of all patented inventions which concern war matters either directly or indirectly. An indemnity for such use will be granted to the inventor, and the invention can be employed either in establishments or works belonging directly to the government or this use can be delegated to private establishments who are doing work for the State. The War, Navy, Public Instruction and Beaux-Arts Departments are from now on authorized to take note of all applications for patents which are deposited at the Patent Office, and the inventors' exclusive right will become suspended either altogether or for a time. Such matters will be decided by a special commission. Should the application for patent not yet be granted, the publication of the invention will be suppressed and it will be considered as turned over to the government against the payment of a sum which will be determined by a special arbitration committee. Should such decision be taken, all further divulgation will be suppressed as being in disaccord with the national defence. The inventor will be notified as to such decision within a period of three months after the patent is applied for, and as regards applications which are in the patent office now, notification will be made three months after the above date of the decree. All delivery or publication of patents, or other descriptions of inventions can be suspended for a certain time, and no further official copies of patents will be handed out, except for sufficient reasons. On the other hand, a no less important clause of the decree forbids all citizens or domiciled foreigners from making applications for patents in a foreign country either directly or through a representative, as regards the above class of inventions for which patent is applied for in France, and even concerning any inventions which relate to the marine or navigation, aviation, aeronautics, armament, artillery, military engineering, telegraphy and tele-

(*Concluded on page* 248)

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A Difficult Piece in Subaqueous Rock Excavation

(*Concluded from page* 235)

two tunnels will lie but 25 feet below the ultimate 40-foot plane, and it is not therefore safe for the overhead excavators to drive their drills more than four feet below that level. Neither is it judicious for them to drill large holes. As a result, the borings have a diameter of only 4 inches and are spaced every 5 feet. The dynamite charge is just about half that commonly employed. Because of these precautions the rock is broken up in smaller fragments and shattered effectually, without transmitting harmful shock to the underlying mass, through which the tunnel workers are breaking their way also with high explosive.

Owing to the delay in providing the money for the cutting down of the reef, the city tunnel builders—driving on toward Brooklyn—reached the ledge first and were well into the obstruction before the people operating from the river's surface were ready to go ahead. Coenties Reef does not cover a great area, and it was feared at first that blasting at two points would cause trouble and possibly rupture the tunnel borings unless fitted with their steel lining. This threatened to delay either one or other of the undertakings, but the experienced excavators have skilfully met this phase of the problem, and, by following after the lengthening tunnel and suiting their procedure to the novel conditions, they have been able to break away the initial layer of the ledge without hurtfully jarring either the people or the structure down in the body of the rock.

The submarine drill boat is equipped with 5 drill towers, which can be shifted from point to point along the rail. The tools are driven down to the rock inside of a telescoping pipe guideway. This guideway serves to direct the blasting charge when the drill is removed from the boring and also facilitates washing out the shaft preliminary to shoving the dynamite and its electrically-fired detonator into place. The current in the East River at times is in the neighborhood of five knots, and because of this the semi-flexible charging tube is forced aside and the lead to the hole lost. Of course, that means doing the work over again. To reduce these losses to a minimum, the tubes have been stiffened by additional straps and other means, and as the work goes on the contractors will adapt their apparatus to the trying circumstances. However, it is clear that the drill boat must be placed with a nicety over the site and held there during operations.

For this purpose, the drill craft is kept in place by four spuds or mooring posts. These are heavy affairs of timber or structural steel and are provided at their lower ends with steel points or iron shoes, which are designed either to penetrate the surface of the ledge or to secure a footing there. The spuds are disposed at the corners of the rectangular barge or boat, which carries also the steam power plant and other working mechanisms. With the spuds in position, the boat is raised bodily a few inches by means of four spud hoists or engines—one at each spud. In this manner a portion of the vessel's weight is made to bear down upon the mooring posts, and thus the plant stands, as it were upon four sturdy legs that straddle the underlying reef. It is necessary to shift this load with the changing conditions of the tide, otherwise the barge might be floated and moved, and injury done to the drills. Again, with the falling tide the boat must be lowered so that her entire weight will not be placed upon the spuds. This might strain the vessel.

The Baffling Epidemic of Infantile Paralysis

(*Concluded from page* 239)

which comes from suspension in water the child may be encouraged to make active movements himself, and to this end games are devised with the aid of those delightful expanding and floating toys made by the Japanese.

At this very early stage, too, much can be done to prevent deformity. The feet may be kept at right angles by means of a sand bag or pillow, thus preventing the common deformity of dropped foot. The limbs may be kept straight by means of light removable splints of aluminum. Lateral curvature of the spine caused by the inability of the muscles weakened by the disease to withstand the pull of the stronger ones may be minimized by avoiding attitudes that increase it.

The patient must not be confined too long. It has been too much the custom to allow such children to sit and lie around until they have acquired flexion deformities of the hips, knees and ankles. It is best to get the little victims into an upright position as soon as possible, not only because it antagonizes the evils of a permanent sitting position, but because the effort to balance on the feet instinctively excites to effort a large number of muscles not otherwise to be reached. For this purpose expensive braces will often be necessary, and there ought to be no delay in providing them for those whose parents cannot afford to purchase them. Braces of course are not treatment, but they are very important in aiding locomotion and preventing some deformity. They will not prevent it entirely, or to any very great extent, since they cannot be put on tight enough for the purpose without doing a great amount of damage to the paralyzed limb. Braces are never treatment. Treatment consists of electricity, massage, hydrotherapy and muscle education, and many badly deformed children owe their condition to the fact that their parents depended on braces and neglected to provide treatment.

Muscle education is the one great agency in restoring the weakened members, all other being auxiliary to it. It consists in an attempt to drive an impulse from the brain to the affected muscles by a new route. The bundles of motor centers are connected with each other and with the muscles in a most intricate way, and in the partial destruction of such centers, which is more common than their total destruction, it is only reasonable to expect that a new route may be opened. This is accomplished by means of active and passive exercises which are *performed before mirrors*—compound if necessary—while the clothing is so arranged as to reveal the working of all the muscles involved. Thus the patient is enabled to watch the working of the affected muscles and concentrate the mind upon them.

This procedure is based upon the fact established by Anderson of Yale and others that when the mind is concentrated on any particular part of the body changes take place in the brain and nervous system which react upon that part. In Anderson's experiments, for instance, the subject was placed upon a support so delicately balanced that any change in the distribution of the blood caused it to tip, and it was found that the concentration of the mind upon one extremity would cause the balance to tip in that direction because of the flow of blood to the part concerned.

When the patient is unable to contract the muscle himself the limb is put through the required motion by an attendant or by the aid of the Zander apparatus, and after a time the muscles almost invariably come under the control of the will. I have been able to show at medical meetings numerous patients who had been practically cured after having been unable to walk for periods extending from nine months to fourteen years.

Unfortunately, however, very few of the children who need this treatment have been able to get it. The facilities are available only in the larger cities, and there is a great lack even there of properly trained attendants. The exercises can be and often are taken under the direction of a mother or untrained nurse, but in that case their efficiency is usually reduced about two thirds, as they do not know the anatomy.

As regards operations for the correction of deformities, the best authorities now favor their postponement until after the age of ten and the exercise of considerable caution in undertaking them at any time. Sometimes the results are very brilliant, but in other cases they are far from satisfactory. Though an operation may appear to be successful at first, the patient is often worse after two years than if no operation had been performed. If the same effort were made to educate muscles before operation as is made afterward, in many cases the operation would be unnecessary.

With the progress that has been made in the correction of these pitiful deformities one of the darkest aspects of the problem of infantile paralysis has been solved. There is now practically no dispute about the efficacy of the treatment outlined above. It is accepted in the main by the best authorities and has been endorsed by the New York State and City Boards of Health.

The future of the child crippled in the present epidemic is thus very different from that which confronted earlier victims; but it still remains to see that the knowledge we have gained is intelligently applied and that no one who might have been cured is allowed to drag a crippled limb through life.

What the Telephone Means to the Fighting Men of Europe

(*Concluded from page* 239)

bases in France, all within an hour."

At all times the armies exert every effort to protect their telephone lines from being severed, but even then it is quite impossible to maintain a network of wires, no matter if they be buried far underground, in the face of an intense bombardment. This, then, accounts for the confusion with which a defense of a series of trenches is conducted in the face of a heavy drum fire which has resulted in destroying all telephonic communication between the men in the advanced positions and the reserves and artillery to the rear.

From London comes the nonchalant remark of an officer who evidently has been a prisoner in Germany. His statement, which again shows the drastic measures which the authorities employ to prevent their telephone lines from being tampered with, follows:

"I narrowly escaped being shot just after dawn that morning because the Germans fixed the wire of a field telephone across the window out of which I was looking. The men told us that if the wire was touched the street would be shot to pieces."

At the front, as well as in the hectic offices of city editors on this side of the water, the telephone is the ready implement of the newspaper reporter. An American newspaper correspondent recently obtained an interview with the Crown Prince of Germany over the telephone. In his hotel in Berlin the newspaper man was summoned to the telephone one morning, shortly after he had telegraphed a question on the duration of the war to the Crown Prince. He was informed that His Imperial Highness the Crown Prince was calling from German general headquarters in France. Under the marvelous system of military telephones by which the Kaiser keeps in touch with every section of the frontiers, it was undoubtedly possible to put the call through without making an appointment for it the day before, as mere citizens had to do before the war.

An aide asked the newspaper man if he preferred to speak in English and answering in the affirmative the reporter was at once connected with the Crown Prince himself, who had telephoned to answer the question put to him as to whether or not the war would be ended in 1916. "It is difficult to say whether our victory will be proclaimed in 1916," declared the heir to the German throne over the telephone wires, "but of the ultimate outcome I have no doubt." He continued his conversation with brief discussion of the American policy of war supply exports.

French Decree Regarding the Use of Military Inventions by the Government

(*Concluded from page* 246)

phony, powders or other explosives, asphyxiating or inflammable material, and in general all inventions which can be used in the war, and the decree forbids inventors from making known such inventions or using them in foreign countries. However, an exception is made to the foregoing, and a French or foreign inventor can be authorized by special decision of the Department of Commerce or on the advice of a special commission to proceed as he desires and to apply for such an invention in a neutral or allied country and also to apply it in practice if need be. Such decision will be made in the space of three months after the inventor files his demand at the Patent Office to this effect. Any infraction of the above rules will incur severe penalties.

Clearing of Fog by Electrical Precipitation

THE fact was long ago scientifically established that all dust and fog particles in the open atmosphere are electrified and subject to dispersion or precipitation, but how to clear fog from a street, along a railway, or from the neighborhood of a ship at sea, and to do it in a manner commercially feasible has been a matter of serious study for many years.

The question having recently aroused fresh attention, particularly in the neighborhood of San Francisco, through researches planned by the University of California, it was decided by the Smithsonian Institution at Washington, during the past year, to make an appropriation to further this investigation, which is under the general direction of Dr. F. G. Cottrell, who has done so much toward the practical precipitation of dust, smoke, and chemical fumes at large industrial plants.

The American Institute of Electrical Engineers has also appointed a committee to co-operate in this work, and reports on the results of the study are awaited with much interest.

NEW BOOKS, ETC.

PRACTICAL SHEET METAL DUCT CONSTRUCTION. A Treatise in the Construction and Erection of Heating and Ventilating Ducts. By William Neubecker. New York: The Sheet Metal Publication Company, 1916. 8vo.; 194 pp.; illustrated. Price, $2.

The development of sheet metal construction has led to the establishment of shops contracting exclusively for such equipment as is treated of in this handbook, which is the first work to devote itself entirely to heating and ventilating duct construction. Here all the necessary operations are described and most of them are illustrated; it is a compilation of practical methods, so arranged as to make any desired information instantly available. It is assumed that the student already knows how to read plans, and how to calculate the capacities of ducts and the heating surfaces of pipes and coils. With this knowledge to draw upon, the treatise will be found very instructive and helpful. The numerous drawings plainly show detailed construction and include hanging ceiling ducts, register boxes, ducts for direct-indirect heating, mixing dampers, and ventilators.

STRAIGHT AMERICA. A Call to National Service. By Frances A. Kellor. New York: The Macmillan Company, 1916. 16 mo.; 193 pp. Price, 50 cents.

"Straight America" is a vigorous arraignment of our national character in the light of our laws and their administration. Our neglected duty toward the immigrant is held responsible for much of our hyphenated patriotism, and the author thinks little of the preparedness that does not realize the basic importance of this problem. The inconsistencies of state laws are brought out in high relief, together with certain brutalities in their administration. Miss Kellor, however, still believes in America's ability to control her own destiny, and her little volume is an attempt to awaken an intelligent patriotism based upon early ideals, an attitude that shall avoid the narrowness of the present nativism.

THE TREATMENT OF INFANTILE PARALYSIS. By Robert W. Lovett, M.D. Philadelphia: P. Blakiston's Son & Co., 1916. 8vo.; 163 pp.; 113 illustrations.

This treatise brings together in one handy volume information that would otherwise have

to be sought in the scattered literature of the periodical. The introductory chapter discusses pathology, symptoms and types, mortality, diagnosis, and prognosis. Thenceforward, however, the work confines itself strictly to treatment, dividing the manifestations of the disease into three periods, the acute, the convalescent, and the chronic. In the first phase, efforts should for the most part be confined toward limiting the destructive processes; this is accomplished through serum and drugs, by rest, and by measures for the prevention of deformity. In the second phase, the period of spontaneous improvement, various treatments are indicated—ambulatory and mechanical, massage, heat, electricity, and muscle training. The third stage is that of stationary paralysis, and here the work takes up operative methods, both for the relief of fixed deformities and the improvement of function. Both deformities and methods of correction are the subject of numerous illustrations, and the author admits that he has made the text almost elementary in his desire to be understood. The profession should welcome so timely a treatise by an acknowledged authority who, while emphasizing the deductions of his own wide experience, quotes generously from the work of others.

NOTES AND QUERIES

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14152) C. R. M. asks: What is the average distance (in miles) of the ninth moon of the planet Jupiter, from the planet? A. The mean distance of the ninth moon of Jupiter from the planet is 18,900,000 miles, and its time of revolution, sidereal time, is three years.

(14153) L. M. H. asks: Some time ago a newspaper carried a story attributed to Mr. Wyley, in which he stated that a farmer in Dakota heated and lighted his house for winter by a windmill attached to a generator which was fed by a storage battery. Obviously, the heat and light were from electricity. The engineering department of the 'Frisco Railroad maintain that this cannot be done and I can obtain no information from Washington about it. As a subscriber to your paper I appeal to you for the information. A. There is no impossibility in heating and lighting a house with electricity generated by a windmill. You, however, state the matter incorrectly. The generator is not "fed by a storage battery." Every engineer, of course, knows that that is impossible. The action is in this way: the wind drives the windmill, the windmill drives the generator, the generator produces the electricity which charges the storage battery, and the storage battery lights the lamps and heats the house. In a place where the winds are usually strong and constant so that they may be relied upon to drive the mill, there is little difficulty in securing the electricity for the uses of the family. It may be used for doing many other things than lighting and heating. You will find articles describing the methods of utilizing the wind on a farm to produce electricity in the SCI. AM., Vol. 107, Nos. 13 and 26, which we will send for ten cents each.

(14154) W. J. W. asks: Please let me know how far down a piece of cast iron would sink in the ocean if the ocean was 2,000 English miles deep. Would not the weight of a cubic foot of water at 2,000 miles depth be increased to such an extent that it would weigh more than a cubic foot of cast iron, assuming that the iron could stand the pressure without being compressed. A. We regret to say that we cannot tell how dense water would be if there were an ocean 2,000 miles in depth. There is no ocean anywhere which approaches this depth. The sounding wire has reached the bottom at all points where it has been tried. There are no bottomless places in ocean known to man. The deepest known is the Planet Deep of 32.086 feet, off the coast of Mindanao, which was found by the German ship "Planet" on July 14, 1912. This is 6 miles, 406 feet. But if there were enormous deeps in the ocean we could not determine the density of the water in them. Water is not compressed uniformly as the pressure is increased, and the rate of compression diminishes as the pressure is increased. This would indicate that at some points water may cease to be compressed at all by an increase of pressure. For the facts in the case see Query 13077, in the SCI. AM., Vol. 113, No. 11, which we will send for ten cents. The question, What would be the weight of a cubic foot of water at the depth of 2,000 miles is, therefore, an academic question merely. You can calculate an answer by assuming that water and iron are compressed uniformly by an increase of pressure and that therefore the weight of each is increased uniformly with the depth. This is not true, but it is the only way in which a solution can be made. Sea water weighs 64.25 lbs. on the average, at the surface, and fresh water weighs 62.4 lbs. under one atmosphere of 14.7 lbs. This gives 34 feet as the water column, giving one atmosphere of pressure in fresh water and about 33 feet per atmosphere of salt water. The compressibility of water may be taken by engineers as .00004663 per atmosphere, and that of iron is about one-tenth as much. A depth of 2,000 miles would give about 32,000 atmospheres of pressure in salt water of the density of the sea at the surface. You will see from these suggestions that your question is more easily asked than answered.

(14155) G. W. L. asks: I am advised that ten years or so ago some experiments were made by an Italian showing that under special conditions as low as eleven (11) volts have proved deadly. I should appreciate your giving me a reference to that end if possible. A. In reference to your inquiry we would say that the human body has a resistance varying from 10,000 down to 300 ohms, mainly dependent upon the dryness of the skin. The average resistance is taken to be 2,500 ohms. We would say also that a current of 2 amperes traversing a vital part is almost certainly fatal, while as little as two-hundredths of an ampere will produce terrible muscular contractions. These figures we quote from the recent edition of Thompson's Elementary Lessons in Electricity, which we will send for $1.65. The voltage of a current does not do the harm to a person. It simply determines the number of amperes which will bow through a circuit. The law is volts divided by ohms give the amperes. You will see, then, that 11 volts divided by 300 ohms give a little more than three-hundredths of an ampere of current. The effect would be very disagreeable, and in certain peculiar conditions might be fatal if this quantity of current were prolonged. We do not recall the experiments which were performed by an Italian, about which you inquire. The figures we give you are the most recent we have. Whether a person will be killed by a certain current of electricity is a very uncertain matter. It depends upon the physical condition of the person at the time to a large degree.

(14156) W. G. writes: In your issue of the 5th instant, under "Notes and Queries," A. L. (14127) asks for information concerning the "production of heat without *blaze*." In your answer you state that "We are not able to locate the article upon the production of heat without *fire*," etc. The italics are mine.

If you will turn to your SUPPLEMENT files you will find in the issue of August 17, 1912 (of which I have a copy) a most interesting and well illustrated article from the pen of Prof. W. A. Bone, F.R.S., on this very subject, and it may be that it is what your correspondent desires. I was myself considerably interested in the matter at the time and have been on several occasions since. One of the professors at Columbia College gave the results of his many experiments along that line about two years ago in a booklet, and some efforts were made by a firm in New York to introduce a series of ranges operating on this principle.

We thank our correspondent for the information given in his letter. Those desiring to find the article in question will find it in Sup. 1911, under the title "Surface Combustion." This number can be had from the H. W. Wilson Co., White Plains, N. Y.

(14157) J. W. H. asks: (1) Is the current from the secondary of an induction coil, which is operated on a direct current, using a vibrator as an interrupter, direct or alternating? (2) Why does moist blue litmus paper turn red when held against the positive wire of an electric circuit? (3) Why does a magnet with its poles held to an arc extinguish it? Will it extinguish a spark from a transformer? (4) Can one wireless station operate so as to destroy any message between two other stations? If so, how? A. (1) If the spark points of an induction coil are close together so that a very short spark only is produced, you will see a spark pass both when the primary circuit is made and when it is broken. The secondary or induced current is then alternating, as it is also when the secondary terminals are touching each other and no spark is seen at any time. But when the secondary terminals are wide apart no spark is produced on closing the circuit and no current passes. The spark is produced only upon breaking the circuit, and the secondary current is always in the same direction. It is a direct, pulsating current, not continuous. (2) Blue litmus paper turns red where the positive electrode is in contact with it, because the acid radical is negative and goes to the positive electrode. (3) A magnet blows out an arc because its lines of force push the lines of force of the electric current away from the electrodes and open the circuit. Lines of force tend to move so that they will be parallel to each other and lie in the same direction. It is this action which causes the motion of the arc. An arc is simply an electric current, a procession of electrons across an open space between two electrodes. This procession has the lines of force about it and behaves in every way like a conductor, a wire, for example, through which an electric current is flowing. The wire in a motor armature turns under the stress of the lines of force in the field. The arc turns under the stress of the lines of force of the magnet. The two actions are entirely similar. (4) A wireless station can confuse the signals from another station if it can find the wave length and frequency of the station which is sending, by sending meaningless signals of the same sort into space. In a way this is similar to a rowdy making a din to prevent a speaker being heard.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

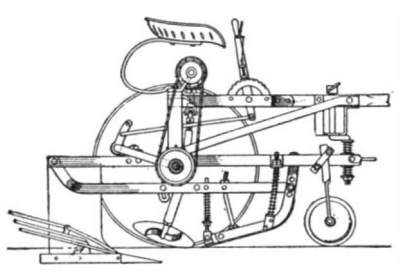
Pertaining to Apparel

COMBINATION GARMENT. — F. E. SZEMERE, 750 Cauldwell Ave., Bronx, N. Y., N. Y. This improvement provides a garment, such as a combination shirt and union suit, rompers, pajamas, chemisettes and bloomers and the like, and arranged to permit the user to readily convert the garment from a loose body garment to one with leg portions, and vice versa, and while the garment is in position on the user's body.

SUSPENSORY.—A. J. SCHWARZER, 104 Lexington Ave., New York, N. Y. This invention provides a device which is very easily and quickly placed into or taken from operative position, which enables the removal of the container into inoperative position without necessitating the removal of the belt portions, which is composed of two distinct members rendering the manufacture thereof very easy, and which is very efficient in use.

Of Interest to Farmers

BEET HARVESTER.—J. A. KITE, Las Animas, Colo. The inventor provides a device wherein a main wheel supported frame is pro-



BEET HARVESTER.

vided and an auxiliary frame mounted to yield upwardly with respect to the main frame, the auxiliary frame carrying means for removing the dirt from the beets, means for crowning the beets, means for guiding the crowning mechanism to insure the crowning of the beets at the proper point, and means for digging the beets.

Pertaining to Aviation

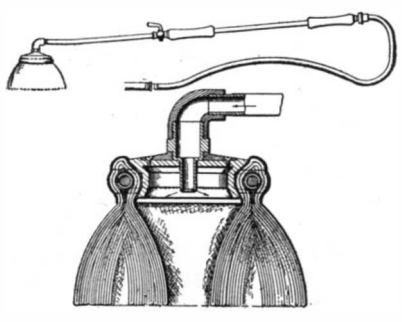
AIRSHIP.—C. H. H. SCOTT, Lynchburg, Va. An object here is to provide an airship having a main sustaining plane formed of two sections disposed in angular relation to each other in substantially V-shaped relation, with means for forcing air against the planes, the thrust of the air serving to raise the device and to sustain it.

Electrical Devices

SYSTEM FOR TELEGRAPHIC AND TELEPHONIC COMMUNICATIONS.—J. H. CLAUS, Hulmeville, Pa. This invention provides means to carry on communication at higher speed with high capacity cables, through the use of high frequency alternating electric currents; provides means for holding telephonic communications over a cable or land wire by varying the volume of such high frequency alternating electric currents with a transmitter in accordance with the pitch variation and amplitude of the sound waves; and provides means whereby telegraphic signal and spoken telephonic communications can be carried on by several operators in both directions at one and the same time and all independently of each other.

Of General Interest

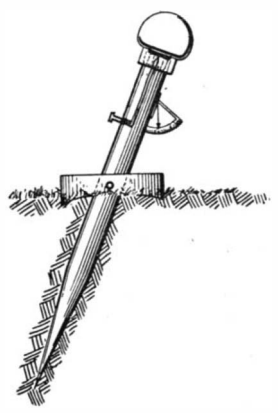
FOUNTAIN BRUSH.—C. FREDERICK, Salisbury, N. C. This brush is for use in cleaning vehicle bodies, such as automobiles, carriages glass windows, walls and railroad passenger



FOUNTAIN BRUSH.

cars. The mop is composed of strands and can also be converted into a wall duster or floor polish mop. The invention provides a fountain brush or mop having a back which is perforated to permit the entrance of a stream of water, which is provided with means for detachably holding the strands of the brush. It provides a device in which the strands are held by spring means to the back in such manner that while the holding means will prevent accidental displacement of the strands or their detachment from the head, the strands may be detached when it is desirable to change them for a new set. It also provides a device in which the mop may be detached and a brush substituted.

TRENCH GUN AND PROJECTILE.—C. F. WICKER, Department of State, Washington, D. C. The gun is a staff of steel weighing 16 pounds, one end of which is designed to be thrust into the ground. The explosive, in the



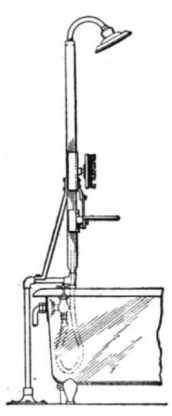
TRENCH GUN AND PROJECTILE.

form of a thin disk, rests on one end of the staff between it and the projectile, which fits over the end of the staff and is retained thereon by a tough, ductile flange and guiding fingers. The combination affords a light trench gun of cheap construction, portable by the individual soldier and capable of hurling comparatively large projectiles over short distances for trench destruction.

Household Utilities

DISPENSING CAN.—H. ROSENTHAL and I. ROSENTHAL, care of Sanitary Soap & Towel Supply Co., 224 Center St., New York, N. Y. An object here is to provide a dispensing can with discharge openings and means for normally covering the same, said means being constructed so as to act as a stirring device associated with an automatic actuated structure for resiliently maintaining the covering member over the discharge opening.

MASSAGING APPARATUS.—J. JACOBY, 527 San Julian St., Los Angeles, Cal. This invention provides an apparatus particularly adaptable for use in connection with a shower bath, by means of which the back and shoulders of the bather may be conveniently



MASSAGING APPARATUS

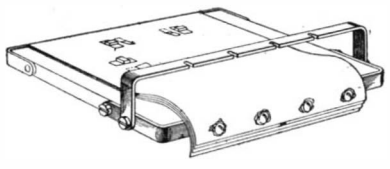
and thoroughly massaged and scrubbed without the necessity of the bather straining and twisting his arms, a disadvantage accruing to the use of the ordinary hand brush usually employed, whereby elderly and rheumatic persons may find convenience in bathing.

COUNTERBALANCE FOR WINDOW SASHES.—G. J. L. LANGFORD, Ingersoll, Ontario, Canada. The invention provides means for holding the main sheave yieldingly in position and also for securing the main sheave in position for adjustment, such adjustment being required to take up the slack of the sash cord which takes place after heavy sash have been hung for some time, due to the stretching of the cords.

Machines and Mechanical Devices

ORE CLASSIFIER.—W. H. WIEGAND, Trojan, S. D. The improvement relates to ore classifiers of the rotary type. An object thereof is to provide a simple, inexpensive and efficient classifier whereby the process of classification can be controlled by varying the discharge opening and also the liquid level.

REMOVABLE TYMPAN HOLDER FOR PRINTING PRESSES. — H. C. SONNENBERG, 1725 South Wabash Ave., Chicago, Ill. This invention provides holders for tympan sheets and make-ready therefor, which may be de-



REMOVABLE TYMPAN HOLDER FOR PRINTING PRESSES.

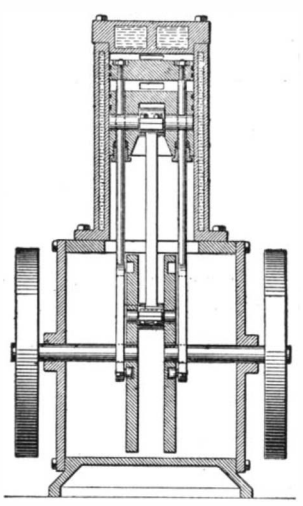
tached and removed from the printing press platen without loss of the make-ready; provides means for preserving the make-readys used in platen printing presses, thereby facilitating the running of successive orders; and simplifies the construction and reduces the cost of said holders.

CO-OPERATING COUNTER GATES.—J. T. BERTHELOTE, Havre, Mont. The invention relates particularly to counters provided with a side gate and a top gate so that the two gates require to be opened, the one vertically and the other horizontally. It provides means comprising coöperative interengaging elements on the top gate and side gate whereby the raising and lowering of the top gate will open and close the side gate.

SUBMARINE PROPULSION.—D. F. MURPHY, 3920 Ave. H, Galveston, Tex. This invention pertains to submarine vessels having any usual or common form of means at the stern thereof or elsewhere for propelling the vessel forwardly or rearwardly, and it provides mechanism, located preferably at the bow and stem, whereby the vessel may be readily elevated, lowered, or otherwise maneuvered, either in conjunction with or independently of said usual or well-known propelling means.

Prime Movers and Their Accessories

INTERNAL COMBUSTION ENGINE.—E. J. WAGNER, 102 North Alconiz St., Pensacola, Fla. This invention has reference to an internal combustion engine and has for its ob-



INTERNAL COMBUSTION ENGINE.

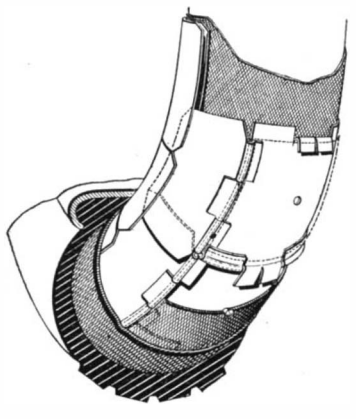
ject the provision of means for scavenging the cylinder in an internal combustion engine at the termination of the power stroke and simultaneously opening the inlet port and recharging the cylinder with a combustible mixture. With the improvement much more horse power is obtained relatively to the weight of the engine than is possible with the usual type four-cycle engine, it being possible to operate any engine without mechanically operated valves.

Pertaining to Vehicles

COLLAPSIBLE, FOLDABLE CRAWLER FOR AUTOMOBILES.—G. E. HILD, 230 Lake Ave., Lyndhurst, N. J. This invention provides a device adapted to be collapsed and folded into small compass and carried normally in the vehicle, under one of the seats, such device enabling the driver or other person to lie therein upon his back, and while in such position, transport himself, by manipulating his hands and feet, beneath the automobile for inspection and repairs or other purposes.

PNEUMATIC TIRE BUILDING APPARATUS.—P. DE MATTIA and B. DE MATTIA. Address De Mattia Bros., Garfield, N. J. This invention provides means for rapidly centering and holding in operative relation a metal core for holding automobile tires preparatory to molding the same; provides means for mechanically centering the core; provides means for mechanically accommodating cores of a variety of diameters; prevents the expansion or breaking of the core at the centering groove; and steadies the core in action.

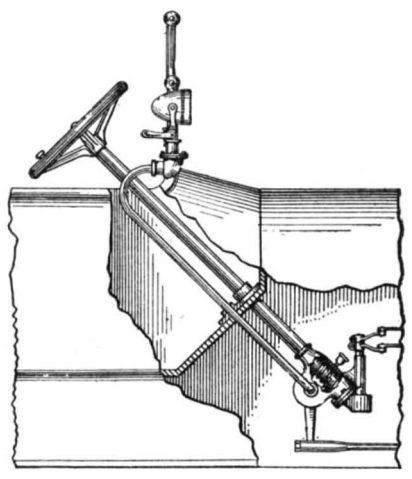
INTERNAL ARMOR FOR PNEUMATIC TIRES.—A. NIELSEN, Brigham, Utah. The armor includes a plurality of hingedly connected thin metal plates which effectively



INTERNAL ARMOR FOR PNEUMATIC TIRES.

cover the major portion of the inner tube so as to prevent nails, glass or other objects from puncturing the inner tube if they should cut through the shoe of the tire, the plates being so disposed and connected together that ample flexibility is provided, and, furthermore, the plates are covered with canvas or equivalent fabric so as to prevent wear on the shoe or air tube.

ADJUSTABLE SPOT LIGHT.—G. H. JOHNSON, JR., Spuyten Duyvil, New York, N. Y. This adjustable spot light is arranged to automatically turn with the steering wheels to illuminate the roadway ahead on making turns and to permit the driver to turn the spot light independently of the automatic control to illuminate signs and the like alongside the



ADJUSTABLE SPOT LIGHT.

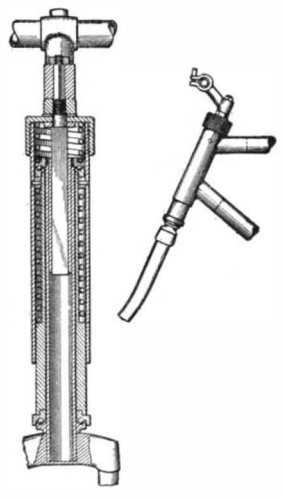
roadway, or license numbers and the like on passing vehicles.

MOTOR-GOGGLES.—H. T. LOUCH, 65 Hatton Garden, London, E. C., England. This invention relates to improvements in motor-goggles or the like. The object of the invention is to devise an improved form of motor-goggles or the like in which complete protection for the eyes will be secured, while the ventilation within the goggles will be considerably improved.

TRACTOR.—C. F. SMITH, Box 345, Scottsbluff, Neb. This invention is an improvement in tractors, and has for its object to provide a tractor, consisting of similar independent units, each having its own power plant, and wherein mechanism is provided for connecting the units to permit them to operate together.

MOTOR VEHICLE.—J. BOHAN, R. F. D. 1, Box 79, New Hartford, Iowa. The purpose here is to provide a connection between the wheels and the axle that will permit the wheels to move angularly with respect to the axle within limits, yet will constrain the wheels to move with the axle, thus dispensing with the necessity for differentials.

CUSHION HEAD FOR MOTORCYCLES AND BICYCLES.—P. GENOVESE, 614 Fordham Road, New York, N. Y. The invention has reference particularly to cushion head for bicycles, motorcycles and similar devices, and has for



CUSHION HEAD FOR MOTORCYCLES AND BICYCLES.

an object the provision of an improved construction and arrangement whereby the jolts and jars of the front wheel of a bicycle or motorcycle are taken up by one or more springs.

PNEUMATIC TIRE BUILDING CORE.—P. DE MATTIA and B. DE MATTIA. Address De Mattia Bros., Garfield, N. J. This improvement provides simple and efficient means for locking up in operative relation sections of a tire core; provides means for registering the sections of the core when assembling the same; and provides means for rapidly and conveniently unlocking the core.

VEHICLE WHEEL.—C. F. ERICKSON, 374 Greenwich Ave., Greenwich, Conn. This improvement refers more particularly to the resilient, non-pneumatic class of wheels. It provides a simple, strong and inexpensive wheel which is characterized by a resilient rim connected to the hub by spokes having links.

LOCKING DEVICE.—P. A. ROSENTHAL, 36 Vesey St., New York, N. Y. The improvement provides a device more especially designed for use on bicycles, motorcycles and similar vehicles and machines, and arranged to enable the owner to quickly and conveniently lock the steering device against turning, thus preventing an unscrupulous person from mounting and riding away with the vehicle.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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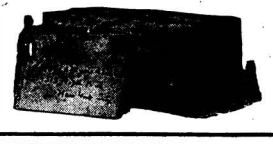

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