

THE WAR GAME—VI

SCIENTIFIC AMERICAN



GERMAN DESTRUCTION OF LANDMARKS ALONG THE BELGIAN COAST

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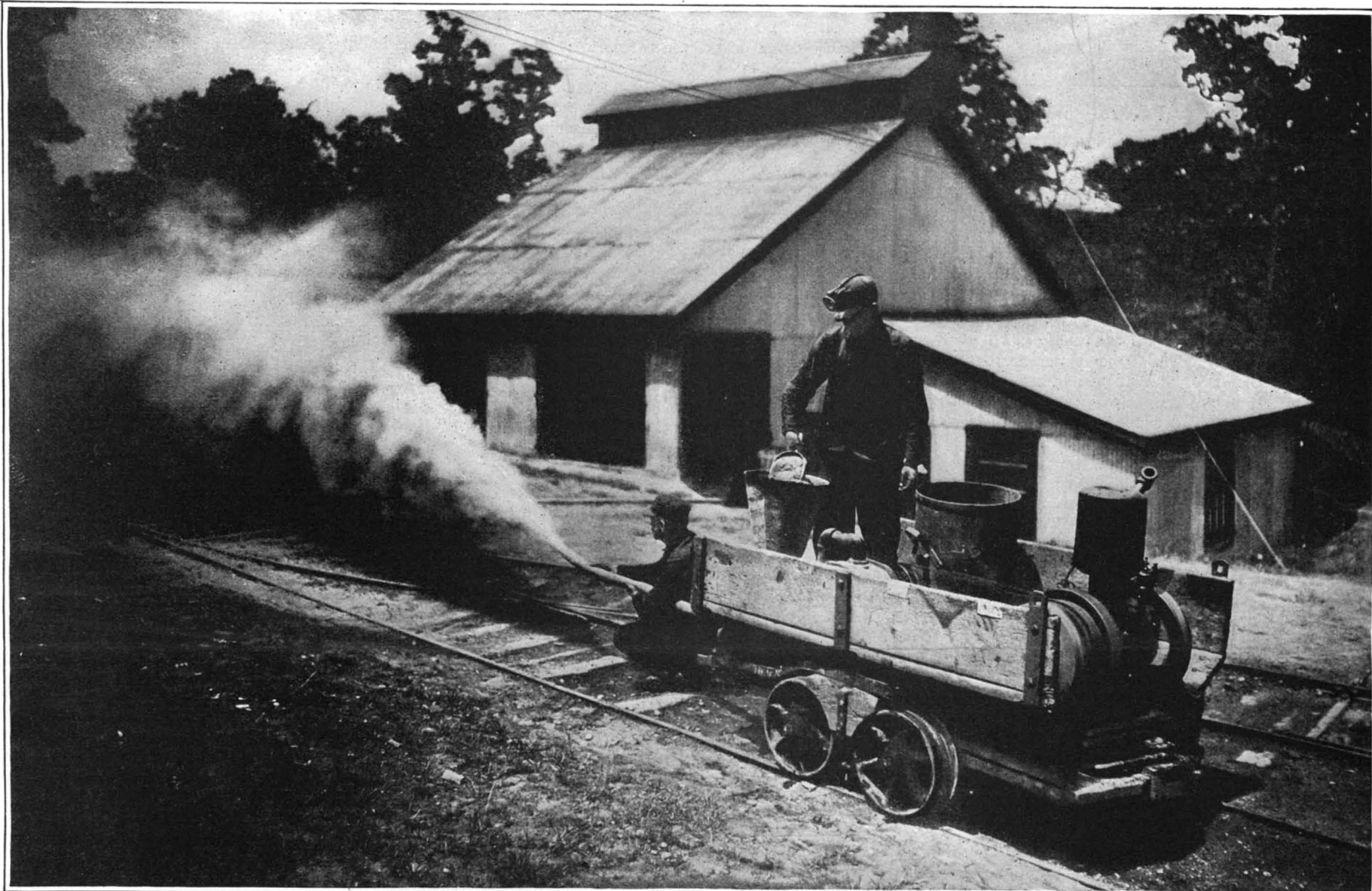
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Rock dust sprayer at work in the test mine of the Federal Bureau of Mines at Experiment, Pa. The essential parts of the sprayer are a gasoline engine, a blower, a hopper for the rock dust, and a mixing chamber

Preventing Coal Mine Explosions with a Spray of Rock Dust

THE Federal Bureau of Mines has made a large number of explosion trials at the test mine at Experiment, Pa., to determine the efficiency of rock dust in preventing the initiation of mine explosions and in checking them after they have been initiated. The proportion of shale dust to coal dust required in preventing or checking explosions has been determined for coal dust from many seams.

The rock-dust method appears to have such an advantage over water methods—in which water is applied infrequently—in that more constant protection is afforded, that arrangements were made with a coal company in the Pittsburgh district to rock-dust a part of one of its mines and keep accurate account of the costs. Bureau engineers inspected the rock-dusted zones from time to time and took samples to insure that the zones were in safe condition. This work was continued for a year, the entries being redusted from time to time as the occasion required.

The test just mentioned has been so satisfactory that the dusting has been extended to three other mines, and conferences have been held with officials of other companies for the purpose of explaining results, with the view to adopting the method. Considerable interest has also been shown in other parts of the country, particularly in Colorado, where rock dusting has been carried on in the Delagua mine of the Victor-American Fuel Company for more than four years. The probable wide adoption of this method of rendering coal dust inert, therefore, makes desirable the development of suitable machinery both for preparing the dust and for distributing it.

The first rock dust used in the Pittsburgh district

was pulverized limestone of such fineness that about 75 per cent would pass through a 100-mesh sieve. This material was very satisfactory, but a coarser material would be easier and cheaper to prepare; accordingly, explosion tests were made in the experimental mine to determine the relative efficiency of fine and coarse material. It was found that material prepared by grinding in a hammer crusher, equipped with a 1/16-inch slotted screen, was only a trifle less efficient than the pulverized dust. It is believed that suitable equipment to furnish such dust can be obtained at a low cost.

In rock-dusting a mine entry the best procedure is to apply the first coating by hand, because a thicker and better distributed coat is obtained. In time, coal dust settles on the rock dust, and redusting is desirable. This is best done by a rock-dusting machine, which blows into the air current a cloud of rock dust that settles in a mantle over the coal dust. The use of a machine decreases the cost and increases greatly the convenience of redusting. Such a machine, as used at the experimental mine and similar to one in use at Delagua, is shown in operation in the accompanying illustration.

The mine dusting apparatus is of simple construction. In its essentials it comprises a small positive blower, a mixing chamber or injector chamber, a rock-dust hopper, and a suitable outlet. The air from the blower passes through a two-inch pipe to the injector chamber, into which the rock dust is fed from a hopper, and the mixture of air and dust which is thus formed is blown through a hose into the atmosphere. The blower used in the experimental outfit of the Bureau of Mines has a volume of 288 cubic inches and is operated at about 1,000 revolutions per minute; the pressure in the outlet pipe when the machine is in use is

about two pounds per square inch. The injector chamber is carefully, although simply, constructed. Its two-inch air inlet is reduced to a nozzle of one-inch opening, and the nozzle is extended far enough into the chamber of the three-inch tee (which is used for the injector chamber) so that the nozzle opening is below the outer edge of the dust-hopper opening. The dust then falls or is drawn forward into the air stream and blown through the hose. A flexible hose is desirable for an outlet so that the air stream can be pointed in any direction; also, this permits its connection to pipes through stoppings to direct the dust stream into air courses or entries having no track, which ordinarily receive no treatment to render the coal dust present inert. The power to drive the rock-dusting machine is furnished by a small gasoline engine in the experimental mine apparatus.

Arsenic in the Hair

NEW light has been thrown on the legal side of arsenic poisoning. It has been found that arsenic compounds are absorbed by the hair of living persons though not absorbed after death. In the hair of man arsenic has been known to reach a concentration of one to five parts in a hundred thousand. The deposit takes place in the hair after it has been absorbed by the abdominal organs—liver and kidney in particular.

Therefore, in cases of acute, quick poisoning a chemical analysis of the hair would show no arsenic while it would be found in the liver and kidneys. On the other hand if slow arsenic poisoning was suspected, analysis would show arsenic in the hair, but not in the liver and kidneys, and it could safely be assumed that the poisoning was not recent. The legal value of such evidence is apparent.

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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.

Patriotism or Politics—Which?

THE most highly technical department of the Government is undoubtedly that of the Navy. The head of the Navy must, by law, be a civilian; and because the selection of our heads of departments is determined mainly by political considerations, the likelihood of the Secretary of the Navy's possessing any technical qualifications for his task is very remote.

To make good this deficiency, the Secretary is surrounded by highly trained technical advisers—officers of the Navy of long experience and proved ability. To them he looks for exact information as to the condition of the Navy. The General Board, the War College, the Chiefs of Bureaus, and, above all, the Aid-for-Operations are the sources which stand ready to impart the greatly-needed knowledge of facts and principles which shall guide the Secretary in his momentous decisions.

Nearest to him as technical adviser is the Aid-for-Operations. In the autumn of 1914 this office was filled by one of the most able and enthusiastic officers of our Navy, Rear-Admiral Fiske, the original inventor of that telescopic sight for guns which forms the basis of the wonderful accuracy of modern naval artillery. Having in view the threat of the European war, Admiral Fiske impressed upon the Secretary the fact that our Navy was totally unprepared to go to war with any first-class power. Backed up by the report of the General Board, he informed the Secretary that we had neither the number of ships, the personnel, the organization, the war plans, nor the experience in war maneuvers to qualify us to engage a first-class power with any confident expectation of success. The Secretary was informed that it would take five years to secure the needed ships, to enlist and train the needed men, to obtain and make efficient the necessary officers, to develop a General Staff, to carry out the necessary reforms in organization, and, by means of war maneuvers carried out under war conditions, to bring our fleet up to the high standard of wartime efficiency which marked the best of the world's navies.

And what use did Mr. Daniels make of these startling and most disconcerting facts? He was busy at the time with his annual report to President Wilson. The President depends for his information regarding the Navy upon his Secretary. Did the Secretary make known to the President, and through him to the country at large, the alarming condition of unpreparedness of our Navy? Did he inform the President that we were short ten or a dozen dreadnoughts—that the ships we had were undermanned—that we were short 30,000 men and 2,000 officers—that we had no General Staff—that our fleet, all too small in numbers, was inexperienced in war maneuvers on a sufficiently comprehensive scale—that we had no general and detailed war plans? Did he tell the President that he was informed by his Aid-for-Operations, his immediate technical adviser, that it would take five years to remedy these defects and bring our Navy up to a condition of full war efficiency?

He did nothing of the kind. A few days after he had learned of our total unpreparedness for war, and with the threatening glare of the European conflagration lighting up our Eastern horizon, the Secretary did not hesitate to write a flamboyant, highly optimistic report on the Navy, in which he most studiously concealed the facts revealed to him by his aid, ending his panegyric as follows: "Allow me, Mr. President, to congratulate you, as its Commander-in-Chief, upon the record it (the Navy) has made, upon its preparedness for duty, upon the reliance you can place upon it in any time of national need."

The italics are ours. It will be decidedly interesting to compare this statement with the report of the General Board and Admiral Fiske's letter, both of which Mr. Daniels has been directed by the Senate to produce.

An Estimate of German Losses

TO those who believe that the ultimate victory of the Allies will be due to the exhaustion of the Central Powers' supply of men, the estimate of German losses made by the well-known military critic, Hilaire Belloc, in *Land and Water*, will have profound significance. Belloc recently visited Paris for the purpose of obtaining data of an official character, gathered by the Intelligence Bureau of the French War Department, and it is largely upon the material thus secured that the following analysis is based.

The point of departure of Belloc's study is the official lists published by the German Government from the outbreak of the war to the 31st of January, 1916. The number of official lists thus published is 860, and the total number of German dead on these lists is 651,768. This total, it is claimed, is not complete; for over and above the number admitted as dead, the official lists give a certain number as missing. The missing can conceivably cover only three categories: First, prisoners in the hands of the Allies; second, deserters; third, dead left upon the battlefield after a German retirement. The number of prisoners is, of course, known to the Allies with precision; the number of deserters is negligibly small, the devotion and patriotism of the German people being answerable for that. After deducting the known number of prisoners and a small percentage for desertion, it is certain that the remainder represents a number of Germans who, though dead, appear under the category of "missing." The total figure thus reached is 160,000. Adding this to the official list of 651,768 gives a total of 810,000 dead, up to and including the last day of January, 1916.

Having established that figure by the government's own statistics, Belloc proceeds to apply certain tests of accuracy which certainly seem to indicate that the published lists do not represent the total losses, by death, of the German Army. The method used was to check the official lists by comparing them with lists published by private authorities in Germany—trade unions, professional corporations, and the like. These include parochial lists drawn up in the villages and published with legitimate pride as proof of patriotism; lists of the dead drawn up by unions of various kinds, religious and industrial; "roll-of-honor" lists given from time to time by large employers of labor; and, finally, the lists published by large clubs and associations formed for purposes of sport. All of these lists must be correct, because they are based upon the notifications given privately by the government to families when one of their members is killed.

Now a comparison of the private with the official lists reveals the very significant fact that for the first few months of the war the two lists practically agree. At the beginning of the winter of 1914, however, a grave disparity appears, and continues through 1915. The death rate established by the detailed private lists rises regularly and uninterruptedly, whereas the course of the death rate drawn from the general public and official lists as regularly declines. The conclusion, says Belloc, is inevitable: the private lists give the true death rate; the public lists, although at first carefully and fully maintained, give as the year proceeds figures less and less reliable.

Instructions were given, in compiling the private lists, to make sure that the data were gathered from widely separated points in Germany, and the greatest care was used to avoid any partial effect of trade, race or locality, the object being to obtain a combined result that would be thoroughly representative. By adding the shortage in the official lists, as shown by the more accurate private lists, it was found that the total of 811,000 dead, mentioned above, would have to be raised on December 31st, 1915, to over one million.

The most convincing proof that the German government, for military and political reasons, is endeavoring to conceal from the German people and from the world at large the extent of the German losses will be found in a study of the statistics of prisoners now in the hands of the Allies. A list was drawn up by the French authorities, giving the names, regiments, etc., of a great number of prisoners drawn from German units which had never left the front upon which they were originally engaged. This list was compared with the names appearing in the German lists of prisoners. The difference was over 69 per cent; that is to say, that very nearly 70 per cent of the names standing upon the French lists and representing prisoners actually in the French camps were found to be omitted from the German lists.

Adding to this total of one million the corresponding number of wounded (as shown by the ratio of wounded to dead established by the statistics of the present war), and making a liberal allowance of between 50 and 60 per cent of the wounded returned as once more efficient to the front, Belloc estimates that, at the very minimum, over three and one half million men had been permanently lost to the German fighting forces by January 1st, 1916, leaving only five and one

half million out of the original nine million maximum possible recruitment of German men effective for war.

Centennial of the Coast Survey

THOSE readers of the SCIENTIFIC AMERICAN who think that the broad and valuable scientific work carried on at Washington under the auspices of the National Government is a modern development, will be interested to learn that the United States Coast and Geodetic Survey celebrated on April 5th and 6th the centennial of its establishment. It is, of course, obvious that a maritime nation must have available a complete knowledge of its coasts and the character of the adjoining sea bottom, especially the location of reefs, shoals and other dangers to navigation, the rise and falls of the tides, the direction, strength of the currents, and amount of magnetic disturbance. Even in the early part of the nineteenth century, when the shore line of the United States was far less than to-day, the importance of an accurate knowledge of the coast was appreciated, and accordingly the Congress in 1807 authorized the establishment of a National Coast Survey. A plan was submitted by Ferdinand R. Hassler, a Swiss engineer, who had emigrated to the United States in 1805 and had been acting professor of mathematics at the United States Military Academy and professor at Union College. This plan was not put into effect until 1811, and actual field work was not actually begun until 1816.

The Bureau thus established had its varying vicissitudes, but the general plan of Hassler, approved by President Thomas Jefferson, was carried out, broadened and developed. It is under the direction of a superintendent, who supervises both the field and office forces into which the work is divided. The field officers comprise 64 assistants, 29 aids, 11 magnetic observers, 4 nautical experts, 14 tide observers, 59 mates, engineers, surgeons, deck officers, etc., 345 enlisted men, and an average of nearly 100 additional employees. The office force consists of various administrative officials, compilers, draftsmen, engravers, instrument makers, printers, etc., numbering 160, for not only does this department receive records and work them up, but it actually constructs and prints the charts from the original surveys.

Unfortunately, the importance of surveying newly acquired territory or State lines and fixing boundaries by permanent marks, after those positions have been determined astronomically, has not always been realized. Frequently there have resulted difficulties whose settlement involved direct financial outlay far greater than would have been required for the adequate support of the Coast Survey in the first instance. Thus in the case of the controversy between the United States and Great Britain over Alaska, had the boundaries of that territory been determined with precision and marked with monuments immediately after its acquisition from Russia, there would have been no opportunity for dispute regarding the actual limits following the discovery of gold.

The actual geographic work of the United States Coast Survey is based on a system of main and secondary triangulation, which covers the entire United States. On the Atlantic Seaboard the Survey has carried out a complete scheme of primary triangulation, while a second extensive system of triangulation extends across the continent along the 39th parallel of latitude and connects the surveys of the two coasts, furnishing a basis for the surveys of the thirteen States through which it passes. Other triangulation systems have been extended throughout the United States and expanded in various individual States. From the primary and secondary triangulations a tertiary triangulation has been developed along the entire Atlantic and Gulf coasts and Porto Rico, and the Pacific coast, except Alaska, where work still is in progress, as is also the case in the Philippines. The astronomic positions of various points on the systems of triangulation have been determined by the use of the zenith telescope for latitude and the telegraph for longitude. The familiar charts issued by the United States Government show hydrographic data, including all harbors, channels, buoys, etc., as well as the topography for a few miles inland, and in the case of rivers and other indentations to the head of tide water. Deep sea soundings are made and tidal records are compiled and published. Terrestrial magnetism is another field in which the operations of the Survey have been carried on, and the study of the force of gravity has been the subject of a number of important investigations. Lines of precise levels cover the United States in a network in which the Coast Survey has cooperated with other government agencies and several railways, and this work is being prosecuted from year to year with increased importance.

Few Bureaus of the Government can show a record of such continuous efficiency as the Coast and Geodetic Survey, and its future activities should receive from Congress the full and sympathetic cooperation they deserve.

Radio Communication

Seizure of Amateur Stations by Government.—More than 25 amateur wireless stations in and about the city of San Antonio, Texas, have been dismantled by Federal officers acting on instructions from the Department of Justice. The cause for the action is said to have been the interference of these amateur stations with the United States Army portable sets in Mexico.

Vessels Equipped with Radio Apparatus.—According to the *Lloyds Register* for 1914-15, there has been a steady growth in the number of vessels equipped with wireless apparatus and submarine signalling installations. There are now on the *Lloyds* registry of the world's merchant marine 2,939 vessels equipped with wireless apparatus, and 947 provided with submarine signalling systems.

Radio Communication Charts.—The superintendent of the Naval Radio Service announces that commencing with March, a complete communication chart is being issued to the public gratis upon request. This chart includes the various merchant vessels in North and South American trade, the time and date they may be reached by radio, the coastal stations through which traffic should be routed, and rates for radio landline service.

Improved Radio Signal Receiver.—It is reported in *El Imparcial*, one of the leading dailies of Madrid, that the Minister of Public Works, after examination and report by the Centro Técnico de Aeronáuticos, has approved a radio signal receiver of a type that does away with the usual ear-pieces. It is said that the radius of the new apparatus is in excess of 5,000 kilometers (the kilometer being the equivalent of about $\frac{5}{8}$ mile), and that it is contemplated to institute radiographic service between Spain and the United States.

Radio Telephone Experiments in the Navy.—It is learned that radio telephone experiments have been conducted during the winter maneuvers of the Atlantic fleet off Cuba. For the purpose wireless telephones have been installed on the "Wyoming," Admiral Fletcher's flagship, and on the "Texas." These instruments have been used in sending messages to other units of the fleet, which, while not equipped with radio telephone apparatus, have been able to receive the messages with their wireless telegraph receiving sets. It appears that the transmitters are based on the results of the American Telephone & Telegraph Company's successful radio telephone experiments, in conjunction with the Western Electric Company.

Standardization of Wireless Apparatus.—The progress made in wireless telegraphy during recent years has not been so much in the direction of new inventions and startling developments as it has been in the standardization of existing apparatus. It is not so long ago that every ship station, with but few exceptions, was unique, although designed, installed and maintained by the same wireless telegraph company which operated sets on numerous other ships. The result was that repairs were difficult, because of the lack of standard design, and, incidentally, the cost of the sets was greater in comparison to their actual value than if every part had been standardized and made in quantities. During the past one or two years the leading American wireless companies have been exerting every effort towards making their installations as simple as possible, of standard design and, moreover, with interchangeable parts. No longer is it necessary for a radio operator to acquaint himself with some particular set of apparatus to which he may be assigned, since all sets are alike; and if he has handled a ship station elsewhere he is prepared immediately to operate any other ship fitted with the same system.

Effect of Imperfect Dielectrics.—The loss of electrical energy in an antenna is caused by the resistance of the antenna, according to a recent announcement made by the Department of Commerce. The so-called radiation is a measure of the portion of the energy usefully dissipated in the emission of the electromagnetic waves. The remainder of the resistance causes a useless dissipation of energy that should be reduced to a minimum. It has been previously noted that, in the region of the longer wave-lengths, the resistance of an antenna increases with increasing wave-lengths and the explanation has been offered that this is caused by dielectric absorption or a loss of energy such as that which takes place in a poor condenser and that it is probably caused by the ground. However, the Bureau of Standards finds that the loss does not take place in the ground, but in poor dielectrics in the electric field of the antenna such as wooden masts, trees, insulation, etc. Running the leads into a building may increase the resistance unless the interior walls are covered with metal screen and connected to ground. It is important, therefore, to reduce to a minimum these sources of energy loss in designing an antenna.

Science

Observing Air Currents with a Telescope.—Prof. W. H. Pickering, in charge of the Harvard Observatory, at Mandeville, Jamaica, describes in the *Monthly Weather Review* the effects of passing hurricanes in that region upon the upper air currents, as observed by the following method: If we point a telescope on a bright star, remove the eyepiece, and place the eye near the focus, we perceive a bright disk crossed by dark fluctuating dots or lines. These are due to currents in our upper atmosphere. The same result is obtained if, instead of removing the eyepiece, we draw it out a few millimeters beyond the focus. In the latter case, if we determine the number of millimeters we can readily compute the altitude of the current whose motion we are observing. The dark lines travel longitudinally in the direction followed by the current. At Mandeville the "seeing" is never very bad, except when a hurricane is in the neighborhood. At such times the mode of observation above described gives timely notice of the approach of a hurricane, and also furnishes a means of studying the movements of the upper currents in connection with these disturbances.

The San Blas Indians, who occupy the north coast of the Republic of Panama from a point a few miles west of the Gulf of San Blas to Cape Tiburon, on the Columbian frontier, are well known to dwellers in the Canal Zone, which they frequently visit, but are by no means inclined to receive visits in return. They have resolutely maintained their independence, preserved their territory from foreign exploitation, and kept their blood and racial characteristics pure. Mr. J. G. Steese, writing of these people in the *Bulletin* of the American Geographical Society, says that they keep up the custom of requiring the traders who visit their coast to return to their ships at sundown. There has been friction of late between the Indians and the Panama government, and consequently the former are at present flying the Colombian flag. The President of Panama made a special trip of conciliation to the San Blas coast last spring, but most of the Indian chiefs refused to receive him. A result of this trip, however, was the establishment of a custom house on one of the islands of the Gulf, where all trading boats must clear, and this will give the government a stronger hold upon the tribesmen.

Practical "Probabilities" in Meteorology.—Although it is not yet possible to make trustworthy predictions of the weather for a coming season, climatic statistics furnish information bearing on this subject that is of practical importance to the agriculturist and others. A suggestive paper read by Mr. W. G. Reed, of the Office and Farm Management, U. S. Department of Agriculture, at the last meeting of the Association of American Geographers, brings out the value of knowing the "business risk" from unfavorable weather, as shown by a "probability curve," based on statistics of past years. The author exhibited a chart giving the dates after which, at various places, killing frost will occur one year in ten, on an average. Similar charts have been drawn for the first autumnal frost, and also for the probable duration of the frostless period four years in five. This idea of showing what will happen "in the long run," together with the percentage of probability, is of great practical value, and deserves to be more generally emphasized from the practical as distinguished from the academic point of view. It may be noted that the interesting series of "drought charts" published a few years ago by the Russian agriculturist meteorological service embody the same idea.

The Harmful Effects of Cosmetics are discussed by M. I. Wilbert in *Public Health Reports*. Unfortunately the Federal and many of the state food and drug laws do not apply to preparations of this class unless curative claims are made for them. Hence unscrupulous manufacturers make use of deleterious and dangerous substances in their preparation. Wood alcohol is one of the many poisonous drugs that have been found in so-called "cosmetics" by the chemists in charge of state laboratories. Of the potent drugs of a possibly harmful nature used in "hair restoratives" the writer mentions lead acetate, silver nitrate, paraphenylene, diamine, and resorcin. Beauty washes and face enamels contain flake white or lead carbonate, diachylon or lead plaster, corrosive sublimate, calomel, bismuth subnitrate, etc. Flake white is generally recognized as the most common cause of industrial lead poisoning, and there is evidence that many forms of disease and nervous disorder may be due to the use of cosmetics containing lead. The salts of mercury and bismuth are also dangerous unless used with due care. Lastly, cosmetics, as ordinarily used, tend to clog the pores or irritate the skin and interfere with its normal action. Mr. Wilbert's arguments are, however, not directed so much against the use of cosmetics in general as against the frauds practiced by a considerable number of manufacturers.

Invention Notes

Patent Granted on Color Photography.—A patent was recently granted by the United States Patent Office to Frederick E. Ives, covering the process of color photography which was recently described in these columns. The patent covers moving picture films as well as prints in color.

An Economical Refrigerator.—Some of the most recently built houses are being equipped with a cooling cabinet which is designed to fulfill the functions of the refrigerator to a very great extent, if not entirely. It makes use of no ice, chemicals or machinery, but its interior is maintained at a temperature sufficiently low to keep viands in good condition for a moderately long period to answer all domestic purposes. The cabinet is kept cool by a circulation through it of the cold water used for the ordinary household purposes. This water circulates about each of the chambers of the cabinet and the temperature is maintained at an even rate which can always be relied upon. After its passage through the piping of this device it is discharged at the regular faucets.

Splints Which Are Adjustable.—An improved splint for setting the broken bones of the leg, arm or shoulder blade, which has been recently patented by F. A. Sprague of Concord, N. H., is entirely of metal and has the advantage of extreme simplicity; further, it is capable of adjustment while in place. Concave splint pads shaped to fit the contour of the limbs are arranged in pairs, with a stretching mechanism between them by which the pads are separated or drawn together as desired. Thus, after the cast is all on, if an X-ray examination should disclose the fact that the broken ends of the bone were not in perfect apposition, the ends may be brought into alignment by shortening or lengthening the adjustable connection between one or the other of the splints.

Steam to Clear the Soil.—A new piece of agricultural apparatus has been developed for the purpose of combating the destructive bugs and undesirable vegetable growths by an application of steam to the soil penetrating some distance below the surface. The machine carries a steam generating plant and moves over the surface on a large drum, the periphery of which is staggered with protruding steam outlets in the shape of blades or spines. As the apparatus is drawn over the ground the spines imbed themselves in the soil and while in this position the steam is released and penetrates the soil for some distance around the outlet, killing the worms, larvæ and bugs and the undesirable crop of weeds which seed themselves from one season to another.

Pedal Attachment for Washstands.—Hot or cold water flows from the same spigot and the handles on the washstand faucets have been rendered obsolete by a new arrangement, which provides a foot control for the flow of water. Sanitary cleanliness is the prime object of the new arrangement, but convenience is also an important consideration. In the state of Illinois it is compulsory to supply running water in factories and such places, and similar measures have been enacted or are under consideration in other states, the object being to prevent the contamination which is likely to occur when the wash basin is used in common. The pedal attachment is placed under the washstand a few inches inside of the front line and to one side, preferably the right side, and connections are made with two valves located under the washstand. The location of the pedal is convenient to the foot and the pressure exerted in the center of the pedal causes a mixture to issue from the spigot, while if the foot is shifted to the right or left the temperature is made hotter or colder as desired.

Revolving Table for the Book Bindery.—In book binding establishments where there is a variety of work to be performed there has not been introduced as yet a satisfactory device for gathering the signatures mechanically. At the present time this work is generally performed by girls, who walk about a large room, picking one part of the work after another from piles placed around the room. This work is so severe that the work of gathering the leaves is limited to the pedestrian abilities of the females. The capacity and comfort of these girls working in a Louisville, Ky., establishment have been increased by a revolving gathering table which has been designed by the manager of the company, Edward Gottschalk. The table is twelve feet in diameter and will accommodate comfortably ten gatherers, but several more could be crowded around it in an emergency. The table is driven by a two-horsepower motor. The gatherers are seated around it, and as the piles of sheets go by they remove those desired and assemble them. This table is large enough for all ordinary work. The Kentucky Statutes, consisting of 2,900 pages, was handled with ease. With a double-decked table it would be possible to handle a dictionary.

Two Recent Developments in Electric Illuminating Devices

TWO most interesting developments of electric lighting have been made recently, one of them in the direction of increasing the convenience of certain types of electric lamp and the other in improving the quality of the product.

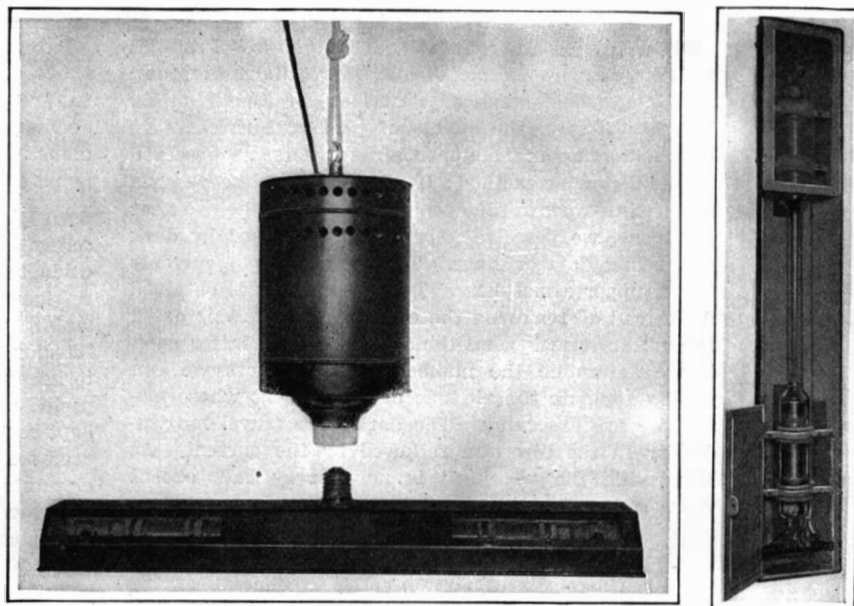
W. A. Darrah, an engineer of Mansfield, Ohio, is responsible for some changes in the design of the arc lamp through which the inconvenience of daily attention, such as cleaning and renewal of the carbons, is overcome. The lamp has been demonstrated at several meetings of electrical organizations, and the principle involved and the results achieved have been commended by those who have had the opportunity of studying it. The lamp has been hailed as the successor of the arc lamp; and it has also been pointed out that under certain conditions it may take the place of the incandescent lamp.

The lamp consists of a glass tube about the size of an incandescent bulb. At the lower end of the bulb a solid tungsten electrode about a quarter inch in diameter is supported by a small tungsten rod. A movable tungsten electrode attached to an iron core is placed within the upper neck of the tube and arranged to draw an arc from the lower electrode. A flexible conductor connects the upper electrode with a seal in the upper part of the lamp. The bulb is exhausted of air, and a given amount of titanium tetra-chloride gas mixed with bromine gas is admitted. The bulb is then sealed from the air after the manner of an incandescent lamp. A coil of wire adjacent to the iron core serves to lift the iron core, thereby separating the electrodes and drawing the arc. The lamp is thus entirely automatic and may be turned on and off by merely operating a switch.

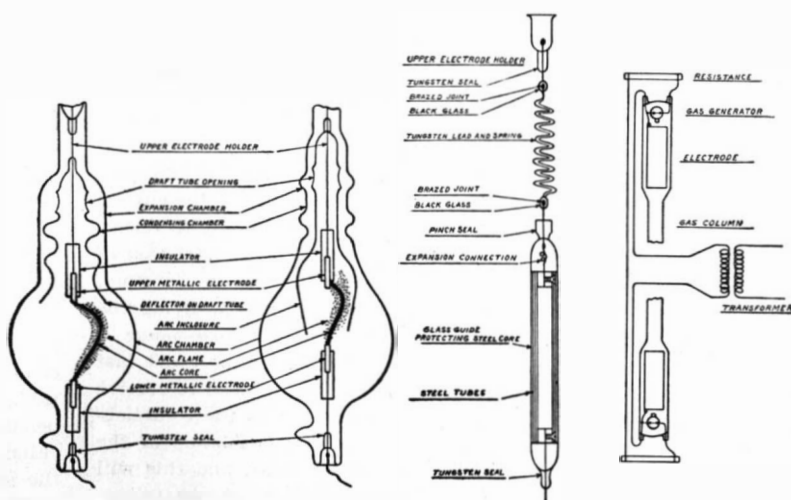
Since the electrodes are kept away from the oxygen of the air, they are not consumed as is the case of the ordinary arc lamp. The electrodes of the new lamp last for a long time. The vapors, which have been put into the lamp, make the arc intensely luminous and very stable; they are consumed at a very slow rate, and by reason of the construction, the lamp remains clean and requires little more attention than an incandescent lamp.

In operation the lamp gives an arc from 2 to 5 inches long depending upon the voltage of the operating circuit. The arc is about one eighth inch in diameter and has the appearance of an intensely bright, white, incandescent filament, being very steady, with almost no flicker. The efficiency is considerably better than that of the present incandescent lamps and somewhat better than the best modern arc lamps. The light has exactly the same spectrum as the light from the north sky on a clear afternoon. A spectroscopic analysis of the light shows that it is substantially daylight with the exception of a few dark lines across the spectrum, which are probably due to a slight absorption of the vapor in the lamp.

An important step in the production of artificial daylight is a new form of the Moore vacuum tube, recently shown before a meeting of the Electro-Chemical and Illuminating Engineering Societies. The new lamp is suitable for making absolutely correct color determinations and is applicable to a very wide field; but its particular usefulness is in enabling the dye shops of the great textile industries to run night shifts. Elaborate spectrophotometric investigations have shown that all articles when viewed solely by the light of the tube lamp have exactly the same values as when viewed by the light of a clear sky—all dyers and color experts agree that the standard light for color judging is that entering a window from a clear north sky at an angle of about 45 deg. at mid-afternoon with a clear sun shining in the south. The



Two views of the new form of electric arc lamp which contains its own carbon dioxide generating apparatus



Constructional details of the new enclosed tungsten arc lamp and the color-testing tube lamp that generates its own gas

tests referred to were made with dress goods, silks, meats, flowers, and samples from the National color card of America.

In one of the accompanying illustrations appears one of the new color matching lamps. The straight tube lamp is contained in an elongated sheet metal case which, however, is provided with a screw base similar to that used on the larger sizes of incandescent lamps. Instead of the lamp being fed carbon dioxide gas by means of an auto-magnetic feed valve, it is generated automatically within the tube itself. Near each electrode is placed a small bulb about an inch long containing calcium carbonate from which emanates carbon dioxide gas when the resistance wires, imbedded in it, become heated to exactly the proper degree by reason of their being connected in shunt to the gas column. The gas column appears as a solid bar of light of intense whiteness. The foot candles available near the tube is over 200, thereby making the apparatus practicable for the very closest color discriminations, so it is claimed.

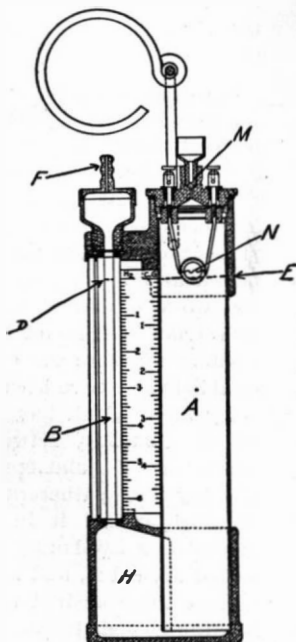


Fig. 2.—Sectional view of the portable gas detector for miners

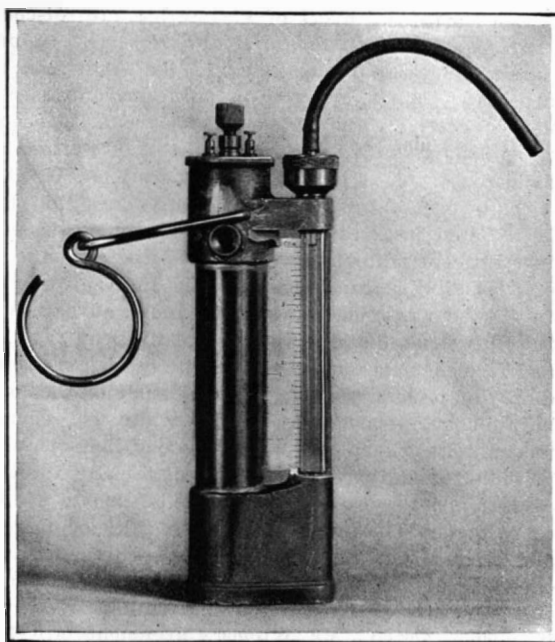


Fig. 1.—Portable gas detector for the use of miners. The sectional view of this type appears at the left

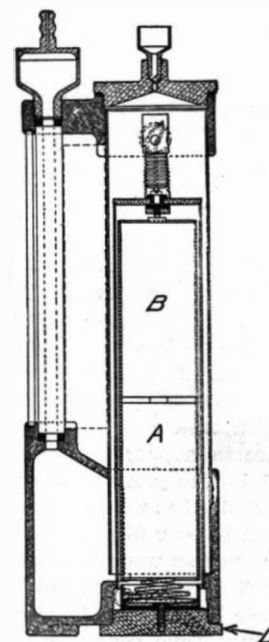


Fig. 3.—Sectional view of a gas detector containing dry cells

Portable Apparatus for the Detection of Combustible Gases in Air

By George A. Burrell

THERE recently has been devised by the personnel of the Bureau of Mines a portable gas detector which can be used for detecting methane—more commonly known as fire damp—in mine air, as well as for detecting natural gas in air, coal gas in air, gasoline vapor in air, water gas in air, acetylene in air, carbon monoxide in flue gas, and for the detection of other combustible gases in air.

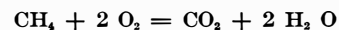
Ever since coal mining has been actively engaged in, technologists have ceaselessly endeavored to perfect methods for gas detection in mines. But despite these endeavors, the safety lamp remains to-day the universally used device for the quick testing of mine atmosphere to determine their methane content. With the safety lamp, percentages of methane as low as 1½ or 2 per cent in mine air can be detected by skilled observers, but it is highly desirable to detect proportions less than these, and also to eliminate as far as possible the personal element. Many other devices have been exploited, but the fact that they are not widely used is proof that they do not fulfill the needs.

In working on the problem of gas detection in mines, the author endeavored to develop something that would be superior to the safety lamp, as regards ruggedness, simplicity, weight and accuracy. It is believed that this has been accomplished, for the new apparatus is 10 to 20 times more accurate than the safety lamp, is lighter in weight, is more rugged and is fully as simple of operation.

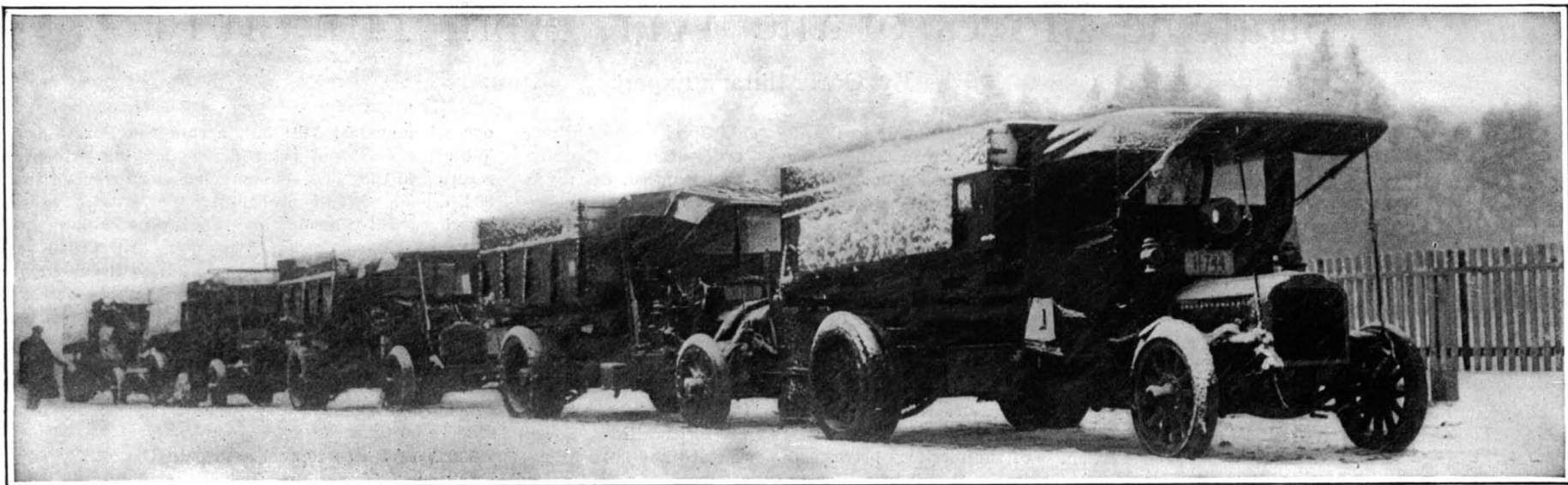
A photograph of the gas detector appears in Fig. 1. The parts are of aluminum and brass, except the stout glass at the right. A sectional view of the device appears in Fig. 2. The instrument may be considered to be a U tube, of which the limbs A and B are two branches. Communication is made between the limbs at a point near the bottom.

To start a series of determinations a brass cap is removed and water poured into A until it rests in the tube B at the point D, the zero point on the scale. The water will then seek the level E in the tube A.

To make a determination of combustible gas in air, say of methane in mine air, one blows into the tube F by means of a rubber tube (which is not shown in the drawing), thereby depressing the water in B to some point in H and filling the combustion space above E with water. One can tell when this combustion space is filled with water by hearing a slight click when water strikes the valve M. Next, the instrument is raised to the place where the sample is to be collected and the water allowed to seek the former levels at D and E. The water in falling to E sucks in a sample of the air to be tested. Next, the valve M is closed and the platinum wire N electrically heated. The methane in the combustion chamber burns to carbon dioxide and water, thus:



i. e., contraction in volume of the sample occurs corresponding to the amount of methane originally present in the sample. At the end of 1½ minutes the electric current is turned off and the instrument shaken to cool the gases in the combustion space and bring them to the same temperature as the gases were at the beginning of the test. The water in the combustion space will then rise to take the place of the burned-out space and fall a corresponding distance in the glass tube B, i. e., fall to a point on the graduated scale that will show the percentage of methane originally in the sample. A previous calibration, once and for all time, fixes the proper graduations on this scale. The latter carries four graduation columns: one for methane (Concluded on page 435)



The four load-carrying trucks led by the repair truck, parked in the open over night during the camp at New City

Civilian Motor Trucks as Army Supply Trains

A Test Run Under Adverse Conditions to Prove Practicability of Heavy-Capacity Units

By Joseph Brinker

PROOF of the practicability of heavy motor trucks for the transportation of army supplies in this country in time of war was the outstanding result of the trip of a fleet of fully laden 5- to 6-ton trucks recently held in regular army convoy fashion over the roads of southern New York and adjacent New Jersey. This in view of the fact that the United States Army recommends a 1½-ton truck as the most suitable for military work. The trip was the first of the kind ever held in this country wherein civilian truck owners volunteered their vehicles in a genuine endeavor to determine exactly what problems would have to be encountered by commandeered vehicles in case of war and the best manner in which to solve them.

The run was held by the Motor Truck Club of America, a national organization of motor truck owners and operators, with headquarters in New York City. All the trucks were volunteered by members of the club, who also provided the drivers and all the necessary equipment to make the convoy a self-sustaining unit. Army fashion, a commander of the fleet and his assistants were appointed from the club, together with passenger cars to enable them to accompany the train, and others for their orderlies to run back and forth along the line to give orders.

The route began at Stephens's coal yard in the Bronx, New York City, and ended at the horse farm of Squadron A, N. Y. National Guard, at New City, N. Y., a distance by road of 32 miles. The trip began at 3:30 P.M. on Saturday afternoon, April 8, the objective being New City, which was reached at 9:40 o'clock that night. Camp was made there for the night and the return trip made on the following Sunday. The time of the run on Saturday afternoon and Sunday was selected so as to cause as little financial loss as possible to the owners of the trucks, for the vehicles are employed in purely commercial pursuits during the

rest of the week, among them coal transportation.

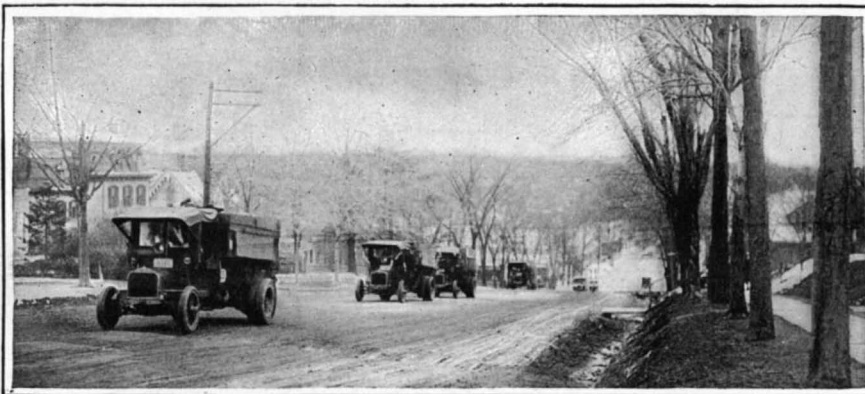
It snowed a veritable blizzard for almost the entire trip, which made the soft country roads regular quagmires in places and hid the ruts until the truck wheels had already fallen into them. The grades encountered

varied from 5 to 7 per cent, yet the ratio of the running time to the total time on the road was 86 per cent, indicating the great value of trained drivers and that the success of truck use is largely dependent upon their skill and past experience.

That the results of the trip might not go unnoticed by the army and militia authorities, Major General Leonard Wood, commander of the U. S. Army, Department of the East, and Major General O'Ryan, commander of the National Guard of New York, were invited to attend. Both sent representatives well versed in army transportation, the former Capt. Gordon Johnson, and the latter, Capt. T. H. Shanton. Both were much impressed with the great mobility of the large-capacity motor trucks.

The fleet was made up of six large motor trucks, five of 6½ tons' capacity and one of 5½ tons. In addition, there were passenger cars for the army officers, for the civilian commander of the train and his two lieutenants and for three orderlies, one of whom acted as a scout. The 6½-ton trucks were donated by the Olin J. Stephens Coal Co., and four of them were loaded to capacity with coal to take the place of ammunition or supplies that would have to be carried in time of war. The other 6½-ton truck acted as a repair vehicle, and was loaded with spare front and rear truck axles, a separate radiator, and every other small part which might need replacement in case of an accident. It was also loaded with planks, jacks, rope and tackle and all other tools which might be necessary to extricate one of the vehicles if it became mired. The sixth truck of the train, a 5½-tonner donated by George H. Pride, a Gotham transportation expert, acted as a commissary vehicle. It carried tents, kitchen equipment and cots loaned by Major W. R. Wright, Squadron A, for the entire personnel of the train, in addition to food.

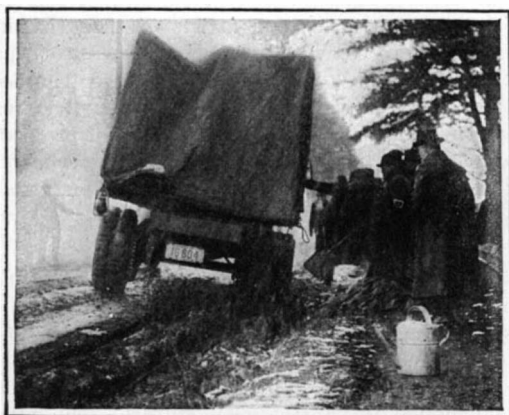
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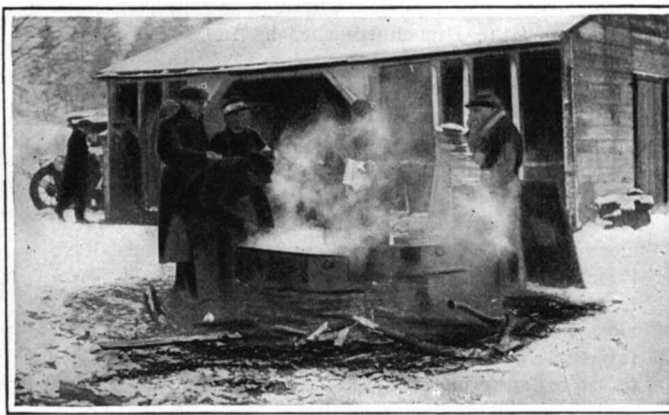
The fleet ascending the 7 per cent hill leading up from the valley of Englewood to the top of the Palisades, in New Jersey



The motor truck train coming down the hair-pin road leading from the top of the Palisades to the foot of the hill at the edge of the Hudson River



Motor truck mired as a result of its going to the side of the road to let other vehicles pass



The "Buzzacott" army field kitchen preparing the morning meal for the personnel of the motor truck train before returning to New York City



Difficulties encountered on a bad stretch of country road, in which the tow line was much used

Strategic Moves of the War, April 14th, 1916

By Our Military Expert

THE great German assault upon Verdun has lasted since Feb. 21, apparently with no end yet in sight. The massing of artillery, the rush of storming divisions and the employment of every means of warfare known to the modern day have each been in the superlative; there has been no action in all history which can be compared with the battle of Verdun. It is not a battle, it is not a siege; the two are combined in one, sanguinary in the extreme.

Foreign as well as local military writers, soldiers trained in the art of war, and strategians of high degree, freely confess that they are unable to definitely state what the object of the German Staff seems to be while whole army corps are being hurled, in the face of huge losses, against the serried guns of Verdun. The point is rather remote from Paris; it scarcely seems to be a drive upon the French capital. And while the Verdun salient without doubt establishes a certain menace against Metz in the event that the Entente begins a determined drive in the course of time, the German losses so far encountered seem utterly disproportionate to the possible gain of eliminating the menacing salient.

Merely for effect upon doubting neutrals and the shaking of enemy morale, maintenance of the attack for a few weeks would have had as much effect as this sustained effort; if the German Staff hoped to provoke a premature launching of an offensive by the Entente, it was demonstrated days and weeks ago that the hope was doomed to failure, for, with the exception of sporadic activities on the Russian front, no semblance of a counter-offensive has been witnessed.

It is very evident that for some reason, however, Germany seems willing to pay the price, to make enormous sacrifices at Verdun to gain the city and fortress. What the reason is, no one not in the confidence of the German Staff may know. For fifty-two days—up to the date of this writing—the general attack has continued, with brief intervals of inactivity, during which time positions gained were consolidated and preparations were made for resumption of the attack.

The sector held by the French about Verdun constitutes a salient, a weakness for defensive purposes, with the constant danger that one or both sides may be crushed in, bagging the principal defending force and striking a severe blow at morale. It appears to many as though the general safety of the French line would be better served were the position given up and the line straightened along the Argonne. The line would certainly be shorter, more easily manned, with defensive positions existing along its length at least as good as those about Verdun.

At first glance at the map, Germany appears to have gained considerable territory since the initiation of the offensive. The French line which extended from the Bois de Cheppy, west of Avocourt, to the vicinity of Malancourt, north of the Forges brook, to the Meuse at a point between Consenvoye and Brabant, has been pressed back, west of the Meuse.

East of the Meuse the line continued through the wooded slope eastward until about three miles north of the Poivre ridge; then it bore to the southeast between Ornes and Maucourt, through Fromez almost to Warq, thence southward until the town of Fresnes was included within its embrace.

To-day the line begins west of the Meuse at almost the same place as specified above; but the Bois de Avocourt has been practically cleared of French troops, who are pressed back upon the westerly slopes of the famous 304 metre hill. At Haucourt the line swings almost eastward, still enclosing the hill, sways southward a trifle to each side of the southern reach of the Forges brook, thence around Le Mort Homme, upon the northeastern slopes of which the Crown Prince is reported to have gained a tenuous foothold. The line then extends through Cumieres to the Meuse.

Three days ago the French evacuated the Bethincourt salient. The Forges brook practically bisected it; hills stood to either side, and the position was a low one, commanded by the neighboring eminences to a large extent. There was constant danger of a strong attack crushing it in, with disastrous results, and General Petain, the Sector Commander, withdrew in safety to higher ground between Le Mort Homme and Hill 304.

East of the Meuse the French hold but a slice of the Cote de Talou, that tongue of hillside which projects into the great bend of the Meuse north of Verdun.

The line extends to the Cote de Poivre, most of which is in German hands. South of Louvemont the line bends below Douamont and its dismantled, destroyed fort, to loop about Vaux, thence to Dambloup, where it follows the junction of high ground and low, behind which perch the barrier forts of the Verdun enceinte, covering the railway from west of Fresnes to its junction with the Verdun-Etain road near Eix.

Compare the two lines; that which existed when the battle commenced, on February 21, with the present one. It will then be seen that at only two points, Douamont and Vaux, have the Germans, after more than seven weeks, come in contact with the Verdun line of defense as indicated by the fort positions. Most of the territory between the two lines has been voluntarily given up to the Germans, in the face of their attacks; it merely constituted the advanced position.

But forts, in these days of warfare, are not the impregnable defenses they were two score years ago. The gigantic artillery of modern days is almost irresistible; the first days of the war taught the futility of armored cupolas. It is reported that all the Verdun forts east of the Meuse have been dismantled and stripped of their armament, which has been placed in position to the west of the city. From the present positions the Germans can batter the city of Verdun to a pulp if they so desire; but it can have little effect upon the lines now existing should they elect to do so. Instead of forts, the battle is being fought out by artillery, heavy and light, which strives to obliterate the French trenches ere the launching of the infantry

operation against Hill 304, across the Forges brook. With the employed principle of flanking, which has resulted in the Mort Homme lodgment, extended to the 304 assault, in all probability the district west of Avocourt will come in for a share of attack that 304 may be flanked, perhaps isolated. Hill 304 is supposed to be the key to the position to the northwest. Should it fall into German hands, if an attack is pressed home with the determination which has characterized the preceding ones, the great salient side to the northwest of Verdun may be caved in, the direct railroad to Paris threatened or taken, and, unless the salient is evacuated, the whole French force of defenders be taken.

Paris professes to feel secure in the ability of the French to hold Verdun. It is as possible that Verdun will hold out as that it will fall. In either case, so far as the present situation is concerned, France will rather appear the gainer; for, with the exception of the blow to national pride and the possibility of shaken morale, evacuation of the salient will shorten the French line, which can then be more easily defended, requiring direct frontal attacks to make any headway, with the elimination of flanking. And if Verdun holds out—it will have held out.

Well into the eighth week of the Verdun assault, there seems to be no diminution of the strength of attack, with due allowance for the preponderance of heavy German artillery, no let up in the grimness of defense. There is a possibility that with the coming of propitious weather a great allied counter movement may be begun; or the Entente may feel secure enough to let Germany butt against her defenses until later. Take your choice.

The Current Supplement

THE mysteries and wonders of our globe are never-ending subjects of interest to everyone, and the article on *The Earth*, considered from a geophysical standpoint, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2103, April 22d, will be generally appreciated. When so many are discussing systems for the conservation of our national resources it is pertinent to inquire what other nations have done; and in this connection the article on *The Industrial Development of Japan* is timely. A paper on *Insects that Perplex Naturalists* reviews many strange features that have defied explanation. It is profusely illustrated. *Cable Codes of the World* describes the various systems of signs used for the electrical transmission of thoughts.

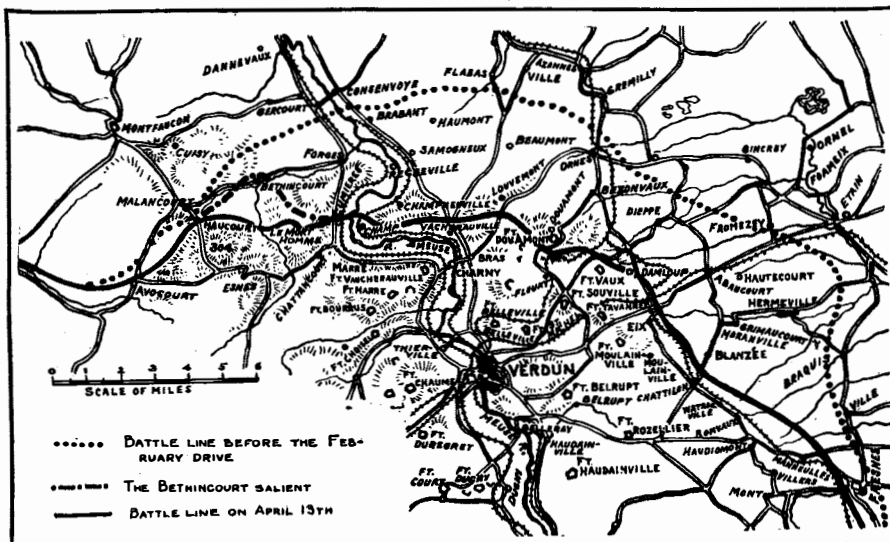
An article that will directly interest many is the article on *The Development of the Automobile Differential*. This is written by an authority on motor vehicle mechanisms, and is fully illustrated by explanatory diagrams. *Scientific Bomb Dropping* describes instruments that enable these destructive explosives to be accurately dropped from fast moving aeroplanes, and is accompanied by diagrams and illustrations. *A Notable Engineering Work* illustrates and describes one of the largest trestle railway viaducts on this continent. *Early History of the Anglo-Egyptian Sudan* treats of the subject from an ethnological point of view, and contains many points of great interest. There is the usual assortment of shorter articles of varied interest.

A Correction

THE oblong form of projectiles came into use with the advent of the rifled gun. Originally, the head of these projectiles was hemispherical. This was about the year 1865. Through a typographical error, the caption below Fig. 4, of our article on *The Extreme Ranges of Modern Guns* (SCIENTIFIC AMERICAN of April 8th, 1916), gives the date as 1900. The error has been called to our attention by the author of the article, who wishes to have it made clear that the form of projectile shown in Fig. 4 is as yet somewhat in the experimental stage; the form shown in Fig. 3 being the standard type.

Enamelled Wire

WIRE covered with an insulation of enamel has recently become very popular for certain electrical uses such as telephone wires in tropical countries. The Post Office Telephone Department insists that these wires shall stand an electrical pressure of 1,000 volts after immersion in caustic soda, sulfuric acid, nitric acid and hydrochloric acid for 48 hours each and in potash 35 minutes. With very thin wires it is difficult to coat the wire uniformly.



Map of Verdun showing the progress of the German offensive

attacks. And the defenders can merely cower amid the devastation until the storm ceases, when they dig themselves out to meet the assault of the infantry lines.

It seems the consensus of opinion among military men in this country that there are only two armies engaged in Europe to-day—the German and the French. England has 4,000,000 men under arms—but they do not constitute an army; merely a ponderous organization which has not yet found itself in its functioning. England will have an army in the course of time; but how soon no one can tell.

Germany began this Verdun attack with at least 400,000 men, about three times as many as the French had available in or near the sector. With the throwing in of additional reserves, the German forces have probably reached 600,000. To meet this it is doubtful whether France has more than 300,000 or 350,000 all told in the sector; for the remainder of the line through France cannot be stripped, although the English have taken over the French trenches as far south as the Somme.

Germany must have lost between 200,000 and 250,000 men in her attacks. This includes all incapacitated for immediate use. France has probably lost about half as many—possibly a trifle more—and the end is not yet in sight. It is not for any one to criticize the arrangements of those masters of their profession, the members of the German General Staff; they must have their reasons for the attack, obscure as they may seem to the outside observer. The fact remains that the most monumental assault of the war is being maintained desperately. And it would be of absorbing interest to know just what is behind it all.

It is far from being an impossibility that Verdun will fall. The attacks have been progressing westward steadily, mile by mile. If the Le Mort Homme position is gained, then the next step will be calculated

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.]

Retarding Tree Budding Electrolytically

To the Editor of the SCIENTIFIC AMERICAN:

Appreciating the frequently recurring loss to fruit growers throughout the East and West, due to short, warm spells in the early Spring prematurely budding fruit trees, it occurred to me that if the budding of the tree could be retarded at such times, it would result in the saving of millions of dollars to the fruit industry, and, knowing the effect of electrolysis upon salts and acids, it seemed that it should be possible electrolytically to change the food substances that, while the circulation of the sap would not thereby be impeded, it would permit only the circulation of impoverished food properties, wherefore the maturing of the buds would be temporarily postponed.

Unfortunately, I have never been so situated, nor have I had the means at my disposal, to carry on such experiments to an exhaustive conclusion, but, realizing their importance (if my conclusions were correct), I attempted the experiment, under less favorable conditions than would obtain in the colder climates—*i. e.*, in the Salt River Valley of Arizona, where extremes are seldom experienced. Notwithstanding this lack of climatic extremes, it seemed possible to conduct relative tests and demonstrate the value of the theory.

On January 8th, 1915, I chose two "Jordan" almond trees, of the same age (about four years) which had received the same cultivation and quantity of irrigation water during their life. In one of these trees a 1-64-inch hole was drilled in the trunk, 18 inches from the ground, a gold pin inserted therein and connection made therewith to the negative side of one dry battery giving a potential of 1.5 volts. The positive side was grounded to a rod driven into the ground about 2 feet from the tree trunk. Thus a circuit was established from the battery into the ground, into the root fibers, back to the negative side of the battery. The current flow was so slight as to be impossible of measurement with the instruments at hand. Therefore, on January 10th, four additional dry batteries, connected in series, were added, giving a potential difference of eight volts. This voltage was found, subsequently, to remain constant, showing a very slight, almost imperceptible, current flow; so small, in fact, as to be unreadable on the ammeter used. The current was permitted to flow continuously.

On January 17th (seven days after the addition of the four new cells) the buds on the untreated tree had developed one third larger, by measurement, than the buds on the tree upon which experiment was being made. It will be understood that when the experiment was begun the buds measured identically the same on both trees. Evidently the development of the buds upon the treated tree had been retarded very greatly by this feeble current flow.

In my opinion this current should have been withdrawn January 17th, since, after that date, there appears to have been a recovery from shock, for, upon February 10th, the treated tree put forth a vigorous development of the buds and those upon the extreme tips of the branches were in bloom February 12th, whereas the buds of the untreated tree were uniformly developed and did not bloom until several days later. The lower buds, or all except those occurring at the tips of the limbs upon the treated tree, were retarded and did not come into bloom for some time after those upon the untreated tree.

There are two conclusions to be drawn from this experiment: First, that the current strength was not sufficient to change the nitrates, carbonates, and phosphates so completely, but that some nourishment was supplied to the extreme buds. Second, that the current should have been discontinued upon January 17th, when the degree of retarding had been secured.

I am convinced, however, that if this experiment could be carried on upon a sufficient number of trees, so that the effect of the different current intensities and periods of application could be observed, the exact time and strength could be readily ascertained which would retard the budding at any period which might be desired. As to the chemical effect of such electrical treatment, I cannot say, but presume that the carbonates, nitrates and phosphates are changed into some other form of salts (probably peroxides) which do not contribute to plant nourishment, and, since it is a known fact that, for proper plant nourishment, the mechanical and chemical combinations must be exact, it is obvious that a slight change in the form of these salts will have its effect upon the development of the bud.

The simplicity of application and the cheapness with which an orchard could be so treated would commend the plan, even though the area to be so governed were

large. Further, the quantity of current required even for large areas is evidently so small as to be available from a few dry batteries.

In arranging a large orchard for such budding control, it would require only that a galvanized wire (such as telephone wire) be run along or in the tree rows, with short connections made to silver tacks or pins driven into the trunks of the trees below the branch lines sufficiently deep to penetrate the center axis of the tree. The beginning or terminating end of this parallel circuit would connect to the negative side of this source of electric supply, while the positive side of this supply would be grounded in some suitable manner, as by a pipe or rod driven into the ground.

Since the potential employed is low there will be no need for insulation of the wire where it passes through the trees. Therefore, the expense of installing and taking down, if it be found desirable to remove the wire, would be a minimum.

It is hoped that the suggestions here given may be followed out more conclusively than it is possible for the writer to do, and it is with this end in view that the above experiment is described.

The above experiments have been carried out unofficially, since they are not within the scope of the irrigation investigations carried on under the Office of Experiment Stations, U. S. Department of Agriculture.

I would like to add, further, that it should not be understood that the application of electric current for the above purpose has an analogy to the high potential, high frequency application of electric energy in stimulating plant growth by overhead inductive effect, as one is electro-chemical and the other electro-static and the effects are entirely dissimilar.

It should not be understood that the above preliminary experiments are conclusive or may be immediately utilized. It will require further experiment to determine the full value of this possible protection against premature budding. If further investigation proves the correctness of my conclusion, the application should prove of inestimable value to the fruit industry.

P. E. FULLER,

Irrigation Engineer, U. S. D. A.

Riot Gun for Trench Fighting

To the Editor of the SCIENTIFIC AMERICAN:

As an officer in the National Guard of my native state, I am naturally interested in what may be termed the military and preparedness features of your excellent periodical. Mr. Crossman's article on the bayonet and Mr. Hall's ideas in favor of the riot gun and the pistol against the bayonet are especially timely.

It has been a matter of constant wonder to me that the automatic or pump shot gun has not been used in defensive trench fighting as suggested by Mr. Hall. I have always thought that should I ever have a sector of trench to defend with a company of infantry, or even a larger unit, I should most certainly prefer a six-shooting pump gun with buckshot loads to the Springfield for "close-up" work, unless disadvantages which have not yet occurred to me should subsequently become obvious.

It is difficult to imagine an effective bayonet charge against infantry strongly intrenched and armed as I have described in addition to their usual shooting irons. The rifles could of course be laid aside with the bayonets fixed for emergency, but after the attacking force came past the hundred yard line and even to the very parapet of the trenches, I believe the modified riot gun would have a better "reach" and prove far more effective than the bayonet, a crude and unwieldy weapon at best.

I do not attempt to deal with the complication in ammunition supply, the dual equipment, the short effective range or the danger of changing weapons at the crucial stage of the action.

Probably these are the points which have weighed against the riot gun as a defensive military weapon. At any rate I should like very much for some authority to discuss the subject in your columns.

H. L. OPIE.

Staunton, Va.

Aiming a Rifle

To the Editor of the SCIENTIFIC AMERICAN:

Under the above heading I notice, in your paper of February 19th, that Mr. Edser agrees with Mr. Trotter that "one sees three front sights," "blurred hind sights," and other horrors.

Why do these gentlemen shoot under entirely impractical conditions and then instruct us how to avoid seeing everything blurred?

Of course, if a man shoots in a black "coal cellar" with a glimmer of light at the far end illuminating a small white card with a minute black dot on it, and tries to aim at this, he sees everything indistinctly.

Worse, he ruins his eyesight irreparably, and does not learn to shoot for all his trouble.

The way to shoot is, first put a big ivory front sight in place of the black one used for target shooting.

Most real objects one shoots at are more or less dark, and the black front sight is difficult to see on the object, the white shows up at once.

Next have your hind sight put on the rifle at the distance from your eye that you can read print best.

When shooting do not try to focus a black bull's-eye, a black front sight, and a black hind sight, and half a dozen other things, alternately while you hold on to your rifle like grim death.

Look at the object you want to hit, if it is moving, judge how much allowance in front you must make, bring up your rifle to your shoulder, swinging it with the movement of the object you want to hit, and press the trigger as the butt touches your shoulder.

The bullet will go where you want it to without your noticing sights at all.

If you want to be a good rifle shot at game, or as a soldier, join the nearest Clay Pigeon Shooting Club, and when you can break 90 per cent of the clays, you can rest perfectly confident that you can hit a man every shot you fire if being charged by an enemy if you have a rifle in your hands instead of a shot gun.

If you practice in a "coal hole" rifle gallery at a stationary black bull's-eye with a black front sight, and see "three front sights" and "blurred back sight," you are not learning to shoot but merely ruining your eyesight.

WALTER WINANS.

London, England.

The Canals of Mars

To the Editor of the SCIENTIFIC AMERICAN:

A sketch of Mars was made here on the night of March 11, at 8 h. 40 m. with our 11-inch refractor, and the result was almost identical with the figure shown in your issue of March 11. The chief difference was that our large telescope showed a number of faint canals that were purposely omitted from the figure, as confusing, and unnecessary for the purpose for which it was designed. It was noted, however, that the two canals shown were appreciably fainter than they had been earlier in the year. They were, therefore, more difficult than previously in our 3-inch telescope, with which the following observations were made. Seeing 8 is practically perfect for a telescope of this size.

March 11. Thoth can be clearly seen, but is not easy. Syrtis major conspicuous. Snow cap fairly easy. Magnification 180. Seeing 8 to 7.

March 14. The canals can be faintly seen, especially Nilosyrtis, and the end of the Syrtis. Think magnification 240 is better than 180. Seeing 8.

March 15. Can glimpse Thoth and Nilosyrtis with magnification 180. Cannot see them with 120. Seeing 8.

As indicating the interest taken in such observations and predictions by your readers, whether they are professional or amateur astronomers, or simply the interested public, I should be greatly obliged to any of them who may have looked at the planet on the dates specified in the article, if they would send me postal cards stating whether they succeeded or failed to see the canals. They should give also the diameter of the lens, and the magnification marked on the eye-piece of their telescopes. The fact that they may have failed to see the canals is of quite as much interest as if they had succeeded, and should be reported with the other data.

WILLIAM H. PICKERING.

Harvard Astronomical Station, Mandeville, Jamaica, B. W. I.

"The Guácharo"

To the Editor of the SCIENTIFIC AMERICAN:

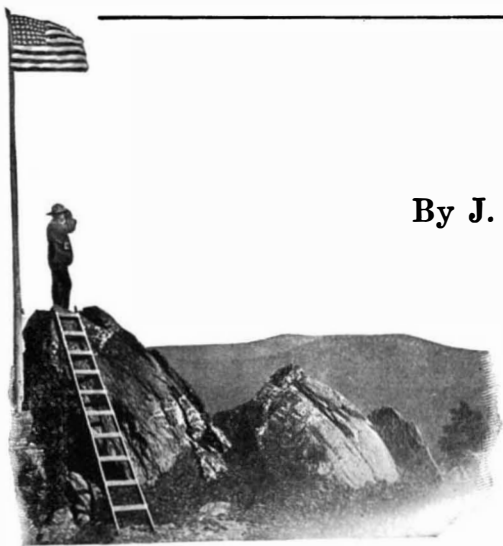
Far from me be the wish to detract anything from the value and importance of new discoveries, whether in the field of fluvial exploration or ornithological research, but I am constrained to remark concerning this *newly* discovered bird of the tropics, that in the interior of Colombia the "guácharo" has been well known for more than three centuries. It is a member of the family of *caprimulgus*, or "goat-sucker," of the group called *fisirostrus*, from a peculiarity of their beak.

In the central portion of the Department of Tolima, in Colombia, there is a very considerable cave called Cueva de Tulín, in itself an object of much interest, which is a permanent habitat of this nocturnal bird. It builds its nest very artistically, of gravel and sand, apparently cemented with its own saliva. Its food consists chiefly of beetles, moths and other night-flying insects.

The tenancy of this cave by the guácharo is shared only by innumerable bats of several species. In some parts of the cave the floor is deeply covered with the excreta of these birds which makes an admirable fertilizer, and is much employed by the nearby agriculturists for enriching their gardens, and especially in the preparation of "eras," or beds, for starting the seedlings of the tobacco plants.

Baron von Humboldt visited the Cave of Tulín early in the last century and speaks of it as a noteworthy natural curiosity, and also describes the habits and peculiarities of the guácharo.

W. S. CRANE.



Wood Wastes—II

Results and Remedies

By J. Gordon Dorrance, F. E., State Board of Forestry, Maryland

Photographs by U. S. Forest Service

[This is the second instalment of a paper on wood waste by Mr. Dorrance. The first instalment appeared in the SCIENTIFIC AMERICAN, of April 8th, and dealt with the woods, the mill and the factory.—EDITOR.]

AS the occurrence of waste has its inception in the woods, is resumed in the mill, and practically concluded in the factory, so must measures for its reduction or elimination follow the same general course. Now the remedying of present defects in the mill and in the factory is, to a very great extent, a matter of mechanics. Much is written and said nowadays of *efficiency*, and it is becoming common knowledge that the man in business, and especially big business as we know it, who is satisfied to merely talk about efficiency had much better leave business while he may, for if he does not possess himself and all that is his of methods of efficient management, the lack of it is sure in time to possess itself of him.

The old-time circular saws, in the days of their general use, were renowned for their great speed of cut, but they are now chiefly recognized for the thoroughness with which they waste the material which comes their way. Yet mills with such equipment do still exist, are in operation, and may occasionally be found in the mountainous parts of the South, either as stationary mills, or as the more common portable mills which use saws of no other kind, moving about the country from place to place and cutting it clean as they go. Their waste is often more than half. Very recently there was a circular-saw mill in operation quite close to New York city, but their use now is not growing, and is relatively limited, so that it is seldom expedient or possible to replace them with some more modern make—since they are usually to be found running where the exhaustion of the local cut is already in sight.

Modern Methods of Milling

Elsewhere, in the great forests of the West, in the still larger pineries of the Gulf States to the South, the band mill, fast and efficient as the circular never was, has taken its place. The band saw is a very practical remedy for waste. The old mills usually wasted as much as they manufactured, frequently more. There are some mills, still running, which have one foot of board to show for three of log. But the band saw is one of narrow kerf, and as it flashes through one log after another there is the minimum of loss. It is run, as it must be, by a sawyer who is master of his trade, and the rough boards are cut from the log with the greatest precision and care. Their further manufacture frequently leaves something to be desired, for even lengths and widths are still the rule in many plants, and the difference is often much. Odd sizes have found their way into some Associations' grading rules, but to a very slight extent into the hands of the trade. However, there is generally a more careful use of the edgers and resaws, with a smaller number of the old gangsaws employed about the mill. Changes of rulers have helped to utilize more of the defective stuff, although there is still room for a better utilization of the shorter lengths of lumber.

In an occasional plant is found a new kind of resaw—one exclusively for slabs—which turns "barky" material of all sizes into lumber of merchantable dimensions. They are capable of saving, and sawing, several thousand feet of lumber in a day, and there should be more of them in use. Sawdust is still blown out to great piles from most mills, and there are comparatively few where it is sold. That it may be otherwise disposed of than blown away or burned has been proved

to the satisfaction of one firm at least, which receives about \$30 a car for whatever they choose to market in this way. As the cars are placed on a convenient siding, and the end of a blower inserted at the top of the door, the process of loading entails little labor, and this disposal is nearly all profit. The sawdust is taken by several ice companies in a nearby city, and some also is used by packing houses and stables. There are other general uses which pay as well, and in some sections alcohol is being made of it. In one or two places such material is even pressed into bricks to be used as a cheap and readily handled fuel, after the fashion of the briquettes of Europe, also a product of successful waste disposal.

As to the slab wood, the cuttings and trimmings, there are additional fields. The distillation of certain soft-

New Ways of Factory Waste Disposal

At the factory such improvements and innovations in methods and operation should be continued. Better designing by the draughting room is an aid to complete utilization, while such modern equipment as the machines which perfectly dovetail and glue waste pieces as narrow as one inch to a single strong, usable block of wood, are an instance of closer utilization proved successful. The right sequence of operation is important in wood-working, and manufacturing in the right order is nearly as essential as manufacturing in the right way. If the residue from turning out the firm's principal products may not advantageously be converted into some by-product in the plant itself, there are other uses outside which are still feasible.

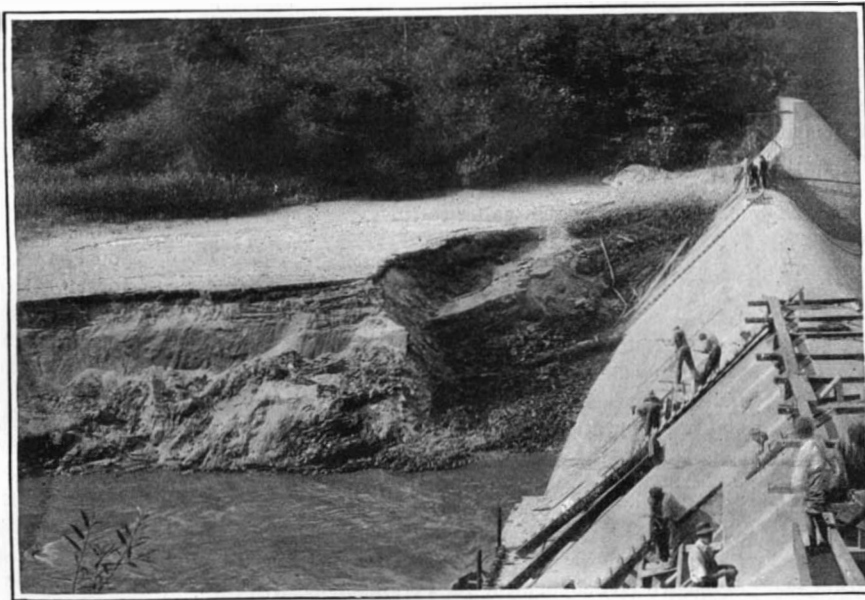
The United States Forest Service some time since began the experiment—for it was altogether new and untried then—of a Wood Waste Exchange. They first ascertained the kinds, amounts, and sizes of woods which a large number of wood-working firms were selling as cheap firewood, or using themselves as such, and then prepared a list of "Opportunities to Buy and Sell Wood Waste." At present the names of over two hundred factories and mills appear upon their monthly statement, and it is proving of actual service. There is no charge for the Government's coöperation in this, and much has already been accomplished in a practical way. For instance, they cite the case of a large firm in New York city which manufactured novelties, using for the purpose small, half-finished pieces of dogwood. Through the Forest Service's list they were enabled to secure the rejected and principally disused material of a manufacturer in another line, paying for it substantially more than it had brought as kindling, at the same time much less than the buyers had always paid for large-sized lumber which was only cut up to small pieces. Similarly, a maker of wooden-backed brushes began to purchase material of the right kind, size, and price from the waste pile of a school desk factory. These cases are representative of the work that the Forest Service is doing toward the practical discouragement of useless waste. It is a step in the right direction.

Several States are carrying out similar plans, and in some of them, for instance Maryland, it promises to be equally successfully in a more restricted way. Valuable as is this outside aid, it cannot accomplish everything, and the manufacturers themselves may find in the factories making novelties, tool handles, gunstocks, brushes, picture frames, umbrella sticks, and parquetry work, perhaps in their own city, a market for their wares. Modern, intelligently operated machines; efficient direction; and the coöperation of employees are the real essentials to the better use of mill and factory waste.

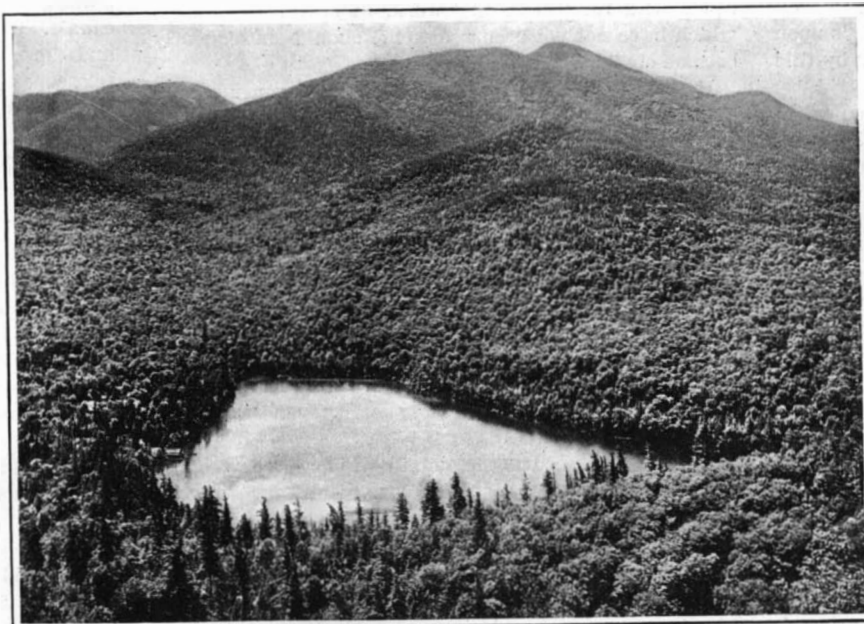
Forest Uses as They Should Be Here and as They Are Elsewhere

Since but 66 per cent of the tree finds its way to the mill, becoming there 44 per cent in boards, 35 per cent in the final factory product, the importance of a right beginning is clear, a beginning that must be made in the forest itself.

Many suggestions for the marketing of mill waste are applicable also to the woods operation. Cutting to a reasonable diameter limit; careful work that uses to the full the cut trees, and protects sufficiently those that are uncut; the leaving of a few seed trees per acre to regenerate the stand with other trees of value; burning or scattering brush and refuse to reduce the subsequent fire hazard; close use of still sound construction mate-



Ten years' accumulation of silt behind a dam, the wash of a deforested watershed, which caused a temporary shut-down of a power plant



The forested watershed

As a protector and regulator of water supply the forest fulfills an important office.

woods for turpentine is possible; chestnut furnishes material for tannic acid; hardwood distillation and other special processes produce charcoal, grain and wood alcohol, gray, brown and iron acetates—nearly all articles for which there now exists a greatly inflated demand. Trade in them should be captured while it may be easily secured. Even in hardwood ashes there are possibilities for further utilization through the great need of potash. The softwoods in general—spruce, hemlock, balsam, pine—as well as such of the harder woods as poplar, cottonwood, and soft maple, are available for pulp making, and have been so used quite profitably in certain cases.

rial, and of the logs which have fallen from logging cars or sunken in river drives; all must be consistently carried out to reach the end desired. It is not an easy matter to arrange, and the decision must rest largely with the ultimate users—the public.



Reforestation in Europe is one of the oldest investments for communities and individuals to make

In the cities of Germany, on a Sunday, you will see the poorer citizens picking up small twigs and fragments of wood in the parks and under the trees, later carrying them away home in baskets or little carts. Twigs used there, logs discarded here, and still we have so much, apparently, that we do not take time to appreciate or really feel the need of it. Perhaps we may be generally lacking in good management and efficiency, and really do not know how to do better. Probably it is a little of both. Plenty means low prices, and low prices a low regard. Lumbermen have been heard to say, when listening to complaints about their prices, "My dear sir, the prices are not half high enough." Perhaps, viewed in a broader way, apart from the varying standpoints of producer or consumer, he is right. Certain it is that abroad corresponding values maintain so much higher a level, that wood waste there is an extravagance which economy will not permit, nor public sentiment allow.

It is largely a matter of tradition and education. The people there are educated to a logging which takes the whole tree to a foot or more below the level of the ground, leaving at the end of the operation clear logs, no stumps, stacked cordwood, and bundles of faggots. They are familiar with close use in the factory and home, and preservative methods which lengthen the life in use of such of the material as may be used outside. Those methods have gone on a long time, and so have ours, and both are hard to change.

Original Forests and the Forest Investment

Prevalent methods here have materially changed the area and composition of the original forests. The present area is not much over half that of the first woodland, and the make-up of what remains has been noticeably altered and reduced. Forests in the North and East have been wiped out in many cases, or given way to scattered woodlots; in the South are eroded mountain slopes and the deforested watersheds of great streams. You hear reforestation spoken of, and to date about one and one quarter million acres have been replanted to forest trees. About one hundred municipal forests have been established, and may in time become as generally accepted and desired as in the cities of France, Switzerland and Germany. Some of the "communal" forests in Heidelberg are making as good net returns as \$10 to \$15 per acre per annum, and it is possible on such investments here to realize fully half as much, exclusive of the interest at 6 per cent on labor, trees, land and taxes.

Our system of taxation, on improvements, has worked such injury in the past that in Connecticut, Michigan, New York, Pennsylvania and Vermont equitable laws have finally been enacted which base their tax on forest plantings upon the actual value of the final yield, or income. Such protection, with the forest planting stock which 14 States in over 30 nurseries are distributing

at cost to landowners, are strong incentives to this constructive step. It may be added that the Federal Income Tax recognizes forest interests so far as to exempt from the final tax all costs of planting, protecting and growing the crop of timber. The forest investment, however, by the very nature of its long life and relatively high cost must, to be most effective, be one made by National, State, or Local Governments. Some of these have made a beginning, which public backing will substantially increase. It is claimed by the Conservation Commission that lands fit only for reforestation, and as such imperatively in need of it, cover an area larger than the States of Pennsylvania, Ohio and West Virginia.

Forest Fires: Cause and Prevention

Of equal importance with the reclamation of sterile lands which forest wastes have made possible, is the capable protection of the areas still in forest.

of 1,317,000 acres of mountain forest in the East, purchases which, together with those farthest West, make a nucleus of timbered lands where forest wastes, at least, will not be tolerated, and are already being proved unnecessary. The Post Office Department is also assisting through its rural carriers in making prompt reports of forest fires. It is estimated that more than one half of the occurring forest fires are due purely to inexcusable carelessness, and joint action upon the part of the public should reinforce the efforts made officially. It is incumbent upon the public to exercise a certain amount of discretion in the care of the forests as in the uses of wood.

New Ways of Using Wood Waste

Encouraging signs, however, are now and then appearing. A New England paper manufacturer has developed a by-product from his pulp wood waste which is said to be an acceptable substitute for lard; other manufacturers are making gun stocks from small pieces of walnut left from the production of veneers, securing a product in excellent demand; and in varied lines first attempts at a timely and better utilization are being made. One of the largest railroad systems in the United States has tried the experiment of reclaiming instead of burning its worn-out rolling stock. Old freight cars have recently been taken apart to see what of value was really in them, and it is said now that the experiment will be continued as long as their supply of old cars lasts. The official in charge of the work summed it up by saying that "burning an old car means the actual destruction of \$20 worth of timber, for the returns from the salvage have demonstrated that

it is as valuable as that to a railroad. Machinery for resawing lumber makes it possible to work over old piling, bridge timbers and car material.

Among the great lumber countries of the world there are but three which may increase exports without a decrease in forest capital—Russia, Finland and Sweden. Since the deficit grows in Western Europe, which for generations has not been self-supporting where timber is concerned, it does not constitute a reliable source of supply should our own be exhausted. It is probable that requirements for agricultural lands will soon reduce still further our total wooded area, leaving perhaps 400,000,000 acres for forest culture. Under present methods it is not enough, nor would be were it twice that size. With less waste, better management, and more intelligent use throughout, 400,000,000 acres might prove ample.

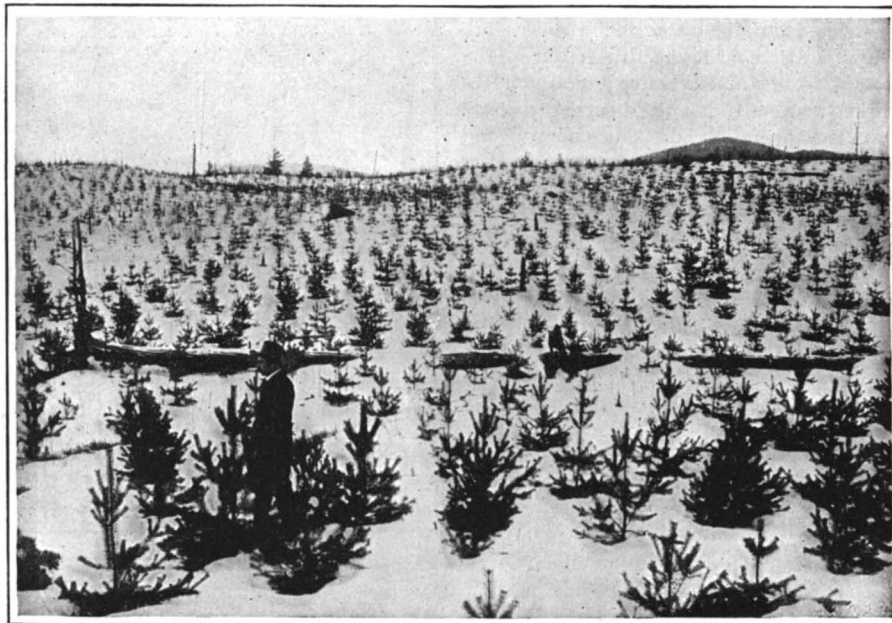
The story of lumbering and wood-using in the past has been brief and to the point—prodigal use and over-production, low prices for high grades and loss of the rest. Illy-devised and poorly applied taxation has discouraged alike the holding of old timber and the growing of new. Great waste has resulted, of timber, of wood, of land—of resources not readily restorable. Remedies have been pointed out; a few have followed them. But this is no subject for individual undertaking or single-handed effort. The public must act in unison with the States and Govern-



A "burn"—a heavy stand of red spruce and balsam reduced to blackened timbers which will be valueless unless removed immediately

Such protection is now extended over only about one third of the total timbered area held privately, though the Forest Service, on its holdings, and a few States as well, are doing as much as limited appropriations will allow. In one important Middle Atlantic State not a cent has ever been expressly appropriated for the protection of woodland which constitutes more than one third its total area. The status and conduct of a State's affairs should not be so radically different from the incorporated town or city which must at all times safeguard property within its borders.

Through Section 2 of the Weeks Law of 1911 the U. S. Department of Agriculture and the Forestry Divisions of certain States are lately coöperating financially to prevent loss by forest fires on the watersheds of navigable streams. The same law has made possible the purchase to date



Reclamation through forest planting—a stand of Scotch pine four years from planting

ment which represent them. Efficiency is the keynote of progress in the development of the American forest and its products.



War Game—VI

The Decisive Attack

By Guido von Horvath



THE objective, the point selected for the decisive attack, should be struck unexpectedly, and with the greatest possible force. The tactical decision is brought about in several ways. The envelopment of the enemy's flank is the one most commonly employed, and is the one which ordinarily gives the greatest promise of success.

The meaning of envelopment is clear and simple. The enemy is held to his line, or in his position, by a part of the offensive force while other parts attack one or both of his flanks. The result of such an attack, when successfully carried out, is a superior, converging fire, more or less enfilading the enemy's position. Naturally, the moral effect of a successful enveloping attack is very great. If properly prepared, and if the flank against which the main assault is directed is taken by surprise, the attack will result in the defeat of the enveloped enemy.

It is well to remember in studying the tactics of the attack, that in combat an action always should bring a counter-action. Except in the case of a surprise, there is always some action which will defeat the plans of the enemy. The form which the counter-action, the counter attack, will take, as well as its probable success, will depend in large measure upon the personality of the commander.

It would seem almost absurd to assume the possibility of a complete surprise. The service of security, with its thorough reconnaissance, should make a surprise extremely unusual. At least, it would seem so on our map. History tells a different story, and there are good reasons for all of these instances of surprise attacks. In our case, the attack of the Red cavalry, as related in the previous Game, will be clear after considering the shelter of the Lebanon Forest, which made the surprise possible.

It may be assumed as true that, while the vigilance of the enemy diminishes the chance of surprise, it does not eliminate it altogether. For this reason in the War Game, as well as in actual warfare, the commander must strive to surprise the enemy. The envelopment of one of the flanks, or in very rare cases the envelopment of both flanks, is one of the surest means of forcing a decision. But it must be carried out, in order to be successful, in coöperation with the fire action of the frontal group; and this fire action must be worked gradually to such a serious menace that the attention of the enemy commander is diverted from the dangers threatening his flanks.

Another form which the decisive attack may take is the penetration, the piercing, of the enemy's line. This can be accomplished by careful and thorough fire preparation, and the timely and well selected massing of reserves at the point where it is planned that the enemy line should be penetrated, then separated and rolled up.

Note: The Turning Movement, another form of decisive action, we shall not consider here, as it involves too great forces to be handled successfully in our War Games.

Aside from the principles involved in carrying out the foregoing methods of forcing a decision, we must remember a few of the controlling principles which are necessarily a part of these methods, and without which we cannot hope for a favorable decision.

First, it must be understood that in the War Game, as well as on the field of action, the rôles of the fighting forces are not distinct and clearly defined, nor can they be so defined. Second, that decisive success in

combat can be gained only by a vigorous offensive. From this, it follows that, with the exception of infrequent and peculiar situations, every commander who offers battle with the expectation of gaining the victory, must, sooner or later, assume the offensive. Often the situation is such that the offensive may turn or be turned into the defensive, just as we have shown in War Game V, where the Blues were forced to take the defensive.

Of course, in the War Game the skill of the com-

mander of determination is the source of defeat. Hesitation and inactivity are far more harmful than action based upon faulty plans. The latter may develop into success—inactivity never will. The fruit of hesitation is inevitably an advantage to the enemy; he will surely utilize the time gained to force his own will upon the hesitating commander. *All of these considerations lead up to the one cardinal principle: Action. Make your decision; issue the orders which will carry out your decision, and go ahead.*

Once these principles are understood, we can consider the next important factor in gaining the decision. This is the well directed, accurate and overwhelming fire action of the combined arms, to be crowned, at its climax, with the assault of the Infantry.

In order to give a picture of these fundamental principles, we shall now go back to the problem of the Reds and the Blues, just in the situation where we left them at the end of War Game V.

The Attack: Enveloping One Flank of the Enemy

Night has come to the battlefield of our problem. With the darkness, the fire of the forces facing one another has slowly diminished. Both commanders have realized that the day's struggles have sapped the strength of the firing lines, and have weakened the spirit of the reserves. The darkness of a moonless night must be used to give some rest, an opportunity to feed the men, to refill emptied cartridge belts and to care for the wounded.

In such close proximity to the enemy, the firing line must remain where it was at dusk. If the position is to be held, the darkness must be utilized to throw up entrenchments; if trenches have already been constructed, they must be consolidated and strengthened.

The rest under arms on the battlefield will not be of a peaceful character. At the slightest provocation, bullets will whistle back and forth. If there are searchlights on the field, they will sweep across from time to time, to vanish again in the darkness. The vigilance is tense and high-pitched, but it is an organized vigilance nevertheless. Those men not on duty will, even under this tremendous nervous strain, fall asleep from sheer exhaustion.

Under such trying circumstances, the night will pass with slowly dragging hours.

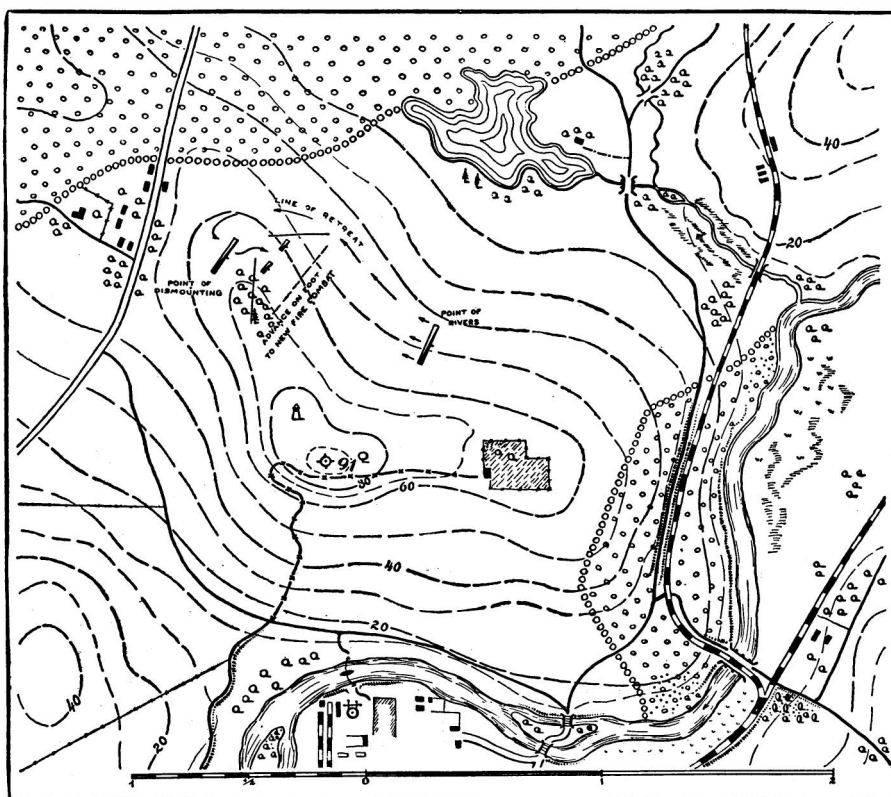
Somewhere on Lookout Hill, behind the lines, possibly in Argus farmhouse if not destroyed by the enemy's artillery fire, perhaps on the edge of Pine Forest, by the dim light of his camp lantern, Colonel K., the Blue commander, is making his plans for the morrow's action.

It is highly important for the student who is following these Games to try to visualize the action, just as though he were actually on the field. This is the reason why, instead of the usual formal statements which tell the situation, and orders of a purely mechanical character, the writer is trying to lead the reader into the heart of the real action.

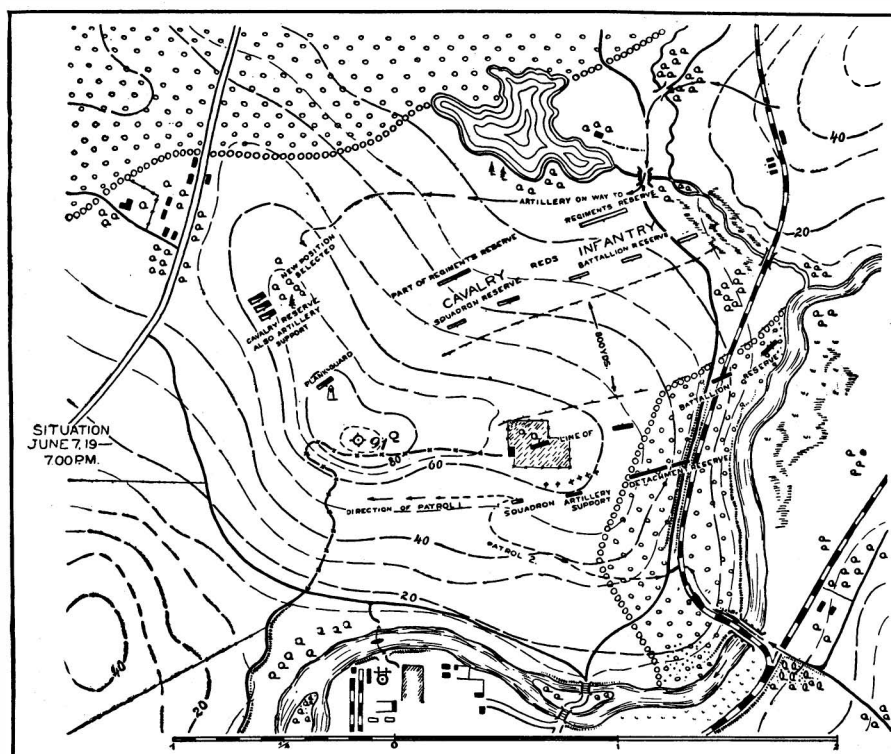
In the headquarters of the Blues, Colonel K. and his adjutant are studying the General Staff map of the country. The Colonel holds several written reports and orders in his hand while the adjutant is carefully measuring distances on the map. Then he glances over these documents again.

They read as follows:

(Concluded on page 435)



Answer to Question 2 in War Game 5



The situation on June 7th, 19—, at 7 P. M. Answer to Question 3 in War Game 5

mander and of his subordinates is the only decisive factor. The War Game is a battle of brains. On the field of action, on the other hand, organization, training and, above all, a firm determination in all ranks to conquer at all costs, are factors which must be added to the skill of the commander.

Both in the War Game and in actual warfare, half-hearted measures can never bring victory, and the lack

Armored Car Battery for the United States

UTILIZING the experience gained in the European war, there has just been formed in New York City an armored car battery, which is to be a special organization under the direction of the New York National Guard.

The new organization has been rendered possible by the presentation of 40 armored cars to the state by several men prominent in finance and industry, who have taken a leading part in the preparedness campaign. The contributors are E. H. Gary, H. C. Frick, R. M. Thompson, D. Olcott, G. N. Wallace and H. G. Montgomery.

The first unit of the organization to be completed is a heavy armored car, which is shown in the accompanying illustration. The battery comprises battle cars fitted with rapid-fire guns, anti-aircraft cars, repair cars, tank cars, motorcycles and auxiliary equipment. The entire organization is modeled closely on existing batteries in the European war, combined with the experience gained in the National Guard maneuvers of last fall in the Plattsburg camp.

Although so far only 10 cars have been placed in actual service, it is the intention to add the others as soon as sufficient men can be enlisted for their operation. Seventy-five motorcycles are now ready for use in connection with the cars, the whole force being under the command of Capt. Harry G. Montgomery, who has been the most active worker in connection with the organization of this battery.

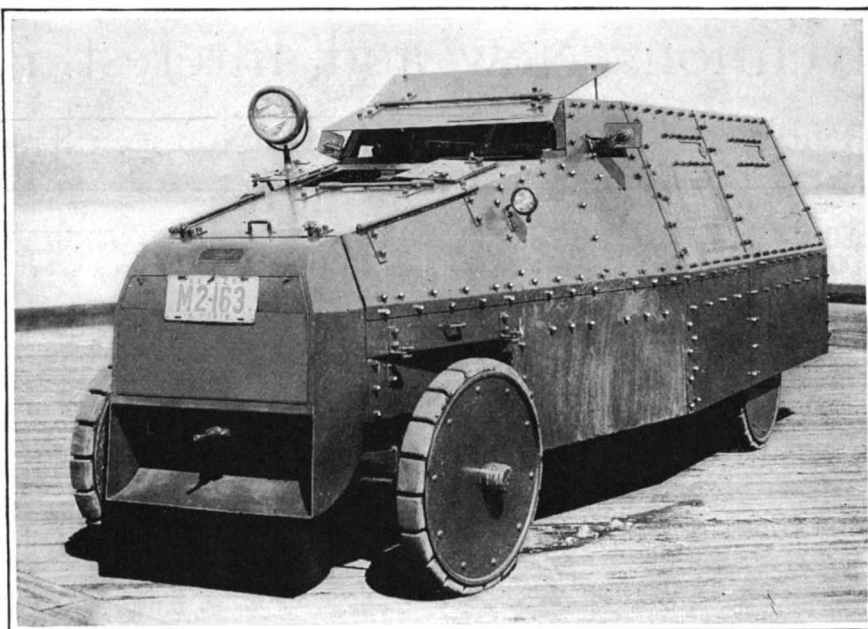
Simulating the Conditions of an Actual Fire in Testing a Record Safe

AS a striking demonstration of fireproof furniture, a light, movable, steel safe-cabinet has been constructed that will preserve papers, currency, and valuables of all kinds under conditions equal to those of the most devastating fires. Recently this cabinet was subjected to a very rigorous test, whose very severity makes it of more than passing interest.

Into the steel cabinet were put filing devices partially filled with records, papers, books and memoranda, and a considerable amount of currency. In the first of the accompanying views is shown the appearance of the cabinet interior before the test. The doors were then closed and locked, and the steel cabinet placed in a specially built brick retort furnace, the dimensions of which allowed more than a foot of space on all sides and above the steel cabinet.

Through the door of the retort there were introduced twenty 3-inch natural-gas burners, arranged so as to distribute the heat evenly throughout. Six thermocouples—four inside the cabinet and two outside—were installed to record the temperature. Readings were to be taken from a pyrometer-galvanometer graduated in Fahrenheit degrees. The door of the retort was closed and the gas ignited with an electric spark. Through observation holes arranged in the walls of the furnace the steel cabinet was seen to be surrounded by a solid wall of fire averaging nine inches in width. Temperature readings were then taken every minute for the first 20 minutes; after that, every five minutes for 25 minutes. At the end of this time, 45 minutes in all, pyrometer readings showed the temperature inside the retort to be 1,820 degrees. The four thermo-couples inside the cabinet indicated a temperature of only 220 degrees.

The gas was then turned off and the cabinet removed, red hot, and placed at once on an elevator. It was hoisted to the top of a 30-foot tower, from which it was thrown down,



The armored motor truck which forms the initial unit of the recently formed armored car battery of the United States

whirling the safe cabinet with sufficient force to give it at least one complete turn during the fall. The center view in the accompanying illustrations shows the safe dropping from the tower. As soon as it struck the ground a ton of bricks was hurled on top of it. The bricks completely covered the cabinet, and for test purposes equaled the falling of walls containing many tons of bricks. The weight of the bricks in a test of this kind is considered negligible, the first impact being the damaging agent.

The cabinet was then placed in the retort again and the heat turned on as before. For a period of 60 minutes, during which time the pyrometer indicated a heat of 1,880 outside the cabinet and an average of 244 degrees inside, the ordeal of fire was continued. At the end of that time the cabinet was removed and allowed to cool for a period of three hours. It is well to add here that during the final hour in the furnace the highest temperature recorded inside the steel cabinet was 262 degrees, which is about 50 degrees lower than the danger point for combustible materials such as paper. The cabinet was subjected to a furnace heat for a total of 116 minutes.

In the third and last view appears the interior of the cabinet when opened, after it had been allowed to cool. The contents were found to be disarranged, to be sure, but unscathed. The records found in the filing devices were not even discolored and the paper money was not scorched. Nothing that was placed inside the cabinet for the test was destroyed or damaged.

Electricity as a Silent Waiter in Restaurants

NO longer will the shouting of orders to the kitchen hands be characteristic of small restaurants in the future, at least not if a recently-invented system of ordering is installed.

The new hotel and restaurant indicator is primarily

intended for restaurants of the quick-lunch type and in hotels and clubs. The apparatus comprises a cabinet in which are contained as many electrically-operated number dial devices as are required by the menu of the institution where it is used, acting as the indicator in the kitchen; and one or more sending stations in the dining room in the form of wall, counter or post plates mounting a plurality of push buttons, each of which is labeled with the dish it represents.

The cabinet containing the indicator units is placed in the kitchen of the establishment where it is installed. It can be made in any size for accommodating 16 to 100 units. When the waiters push the buttons of any of the sending stations, the corresponding indicators of the cabinet are operated, signifying the food desired. The numbers in the kitchen cabinet advance one at a time as the buttons in the restaurant are depressed, so that any number of orders for the same dish can be signalled from the dining room without danger of confusion or error. The chef checks off each article sent out from the kitchen by pushing a

button at each unit desired, causing the numbers to diminish one step at each push of the button. During the time any unit is "alive" or off zero, a small incandescent lamp remains lighted, and when no orders are registered, the lamp is out. Thus at a glance the kitchen hands are aware of the issuance of an order, and the number of orders to be filled for any particular dish is constantly indicated. The push buttons at the sending stations and the indicators of the cabinet in the kitchen are provided with removable labels of white celluloid, so that the signalling system can be altered to meet changes in the menu.

The current required to operate the hotel and restaurant indicator obviously varies with the size of the apparatus, but it is said to be equivalent to that required by an 8 to a 32 candle power lamp. The cost of the installation also varies with the size and the number of push button stations wanted, also the kind of electric current available. The wiring is run in steel conduit to make it water- and moisture-proof.

Future Gasoline Supply from Shale

IT is estimated by the United States Geological Survey that in Colorado alone there is sufficient shale, in beds 3 feet or more thick, to yield 20,000,000,000 barrels of crude oil from which at least 2,000,000,000 barrels of gasoline may be extracted by ordinary refining processes.

Little attention has been paid to this shale because the quantity of petroleum produced from wells in the United States has been sufficient to satisfy all demands, but for more than 50 years the oil shale industry of Scotland has been a very important one. In a recent year more than 8,000 men were employed in the industry in that country, yet the average yield of oil per ton of shale was much less than that which appears possible from the shale of Colorado and Utah.

The area that has been studied by the Geological Survey comprises northwestern Colorado, northeastern Utah, and southwestern Wyoming. The shale found there contains materials which, when heated, may be converted into crude oil, gas, and ammonia. Sooner or later this great source of supply will be utilized to supplement the decreasing production from the regular oil fields of this country.

When refined by ordinary methods the shale oil yields an average of about 10 per cent gasoline, 35 per cent kerosene, and a large amount of paraffin.



Interior of the steel cabinet prior to the test, showing its contents.

Dropping the cabinet to the ground, 30 feet below.

Interior of the cabinet after the fire-resisting test.

Phases of the test to which a portable, fireproof, steel-cabinet safe was recently subjected

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Auxiliary System of Control for Automobiles

A NEW YORK inventor has recently brought out a device whereby in cases of emergency the occupants in the tonneau of an automobile can bring the car to a stop by depressing push buttons which shut off the engine and apply the brakes. It is especially in instances when the chauffeur fails in his duties or is suddenly incapacitated that the invention is most valuable.

Briefly, the device serves to apply the brakes and control the power of the car on which it is installed, by means of a spring held under compression, which is electrically released. The device weighs but 15 pounds and can be mounted in any car without interfering with the existing equipment. One novel feature of the control system is that while the occupants of the tonneau can apply the brakes and bring the car to a halt in time of emergency, provision is made to prevent them from interfering with the control of the vehicle at all times when the chauffeur is properly driving the car. Furthermore, in an emergency the chauffeur can apply the brakes by means of the device by depressing a push button conveniently located on the steering wheel.

Veneer Trimming Made Simple by Use of Electric Motor

ON veneer woodwork there are usually edges to be removed after the gluing process is completed. It has been customary to do this work with a draw-shave or rasp in the past, but since the careless use of either of these tools renders the work liable to damage, great skill is a necessary essential in its successful undertaking.

A small electric motor, which drives a diminutive circular saw at high speed, has solved the problem of trimming veneer both quickly and safely, even by unexperienced hands. Its saw can be adjusted to trim the veneer flush with the surface of the board to which it is applied or to any height desired by the simple turning of a screw. To operate the tool, the workman simply pushes it along the edge of the work in the same manner as a flat iron is run over the surface of an ironing board. The saw extending just enough on one side to cut through the delicate wood, removes the edge rapidly without splitting it and without becoming clogged with dried glue. All the edges of the saw are protected except the one which is actually working, so that there is very little danger of injuring the hands through accidental contact with it.

Current for the veneer trimmer can be supplied from any lamp socket, and a connecting cord of sufficient length enables the tool to be used with considerable latitude.

Simplifying the Teaching of Mathematics

THERE has been invented by Miss Albertina Bechmann, assistant principal of the Jackson School of Cincinnati, Ohio, a simple device which enables students to learn multiplication and division and subtraction and addition tables in the minimum of time. She has been granted a patent on her invention.

Briefly, the invention consists of a board on which are printed rows of figures from 0 to 144. The rows are separated by grooves. The method of using the device is simple: for instance, if it is desired to learn what 6 times 4 is, all that is necessary is to locate the figure 6 at the top of the

board, and then figure 4 at the side; then a ruler is placed in the groove nearest 6, as shown in the accompanying illustration, and another ruler in the groove nearest 4. In the corner made by the two rulers the

answer, 4, appears immediately at the outside end of the second ruler.

The device lends itself equally well to simple problems in addition. If one desires to learn what 6 plus 18 is, it is necessary to first hunt up the 6 column and underneath the 18 will be found the answer, 24. If it is desired to subtract 6 from 24, the reverse operation of the foregoing-described method is resorted to.

Smoke Oven for Curing Meat at Home

IN the present times of economic difficulty in many countries of Europe, many housewives are confronted with the problem of accumulating such stores of preserved meat as possible, for that article of food is scarce indeed and there is no telling what the future may bring. A new household device has just been invented, however, which admirably serves to this end. It is a special oven for curing meat at home.

The new apparatus consists of a lacquered cylinder which is provided with an interior dividing wall, separating both halves of the cylinder. One portion is designed to hold the meat to be smoked, while the other is for the passage of the smoke. Underneath is a smaller cylinder which serves to admit the smoke. This is so constructed that the smoke must first pass through the transmission compartment and enter the smoking compartment from above, in order to return finally to the fireplace. That an even distribution of the smoke may be achieved, there is a perforated plate above the smoking compartment in the large cylinder. This also serves to prevent the entrance of particles of soot and dirt. Two rings are provided on which to support the meat.

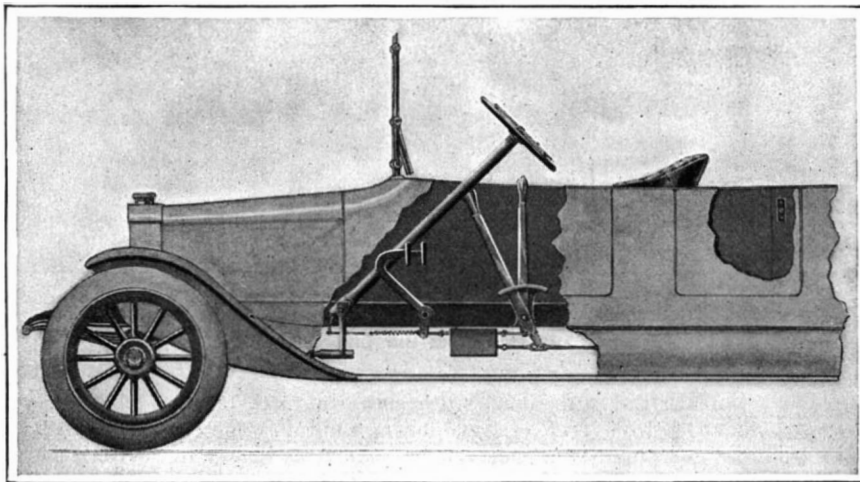
The home meat-curing oven may be installed in the cavity of any fireplace, without much preliminary preparation. The smoke may be furnished by dry sawdust, tanbark, or by any suitable material which burns with considerable smoke.

Contemplated Mangrove-Bark Trade in Brazil

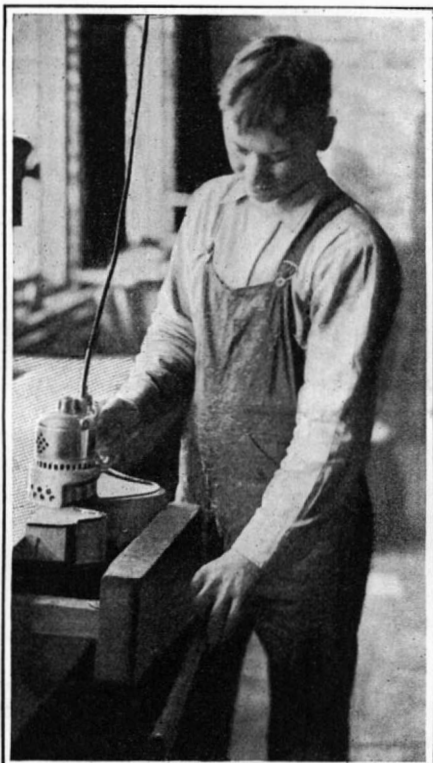
THE percentage of tanniferous extract usually obtainable from the Brazilian mangrove seems to be about 36 per cent from the wood, and 24 per cent or less from the leaves. No apparent use appears to be made of this important natural source in that country. The chief difficulty is reported to be a legal one; many of the municipalities of Brazil have the fear that if promiscuous cutting of mangrove swamps were permitted the sea would make inroads upon the denuded coastal regions and, besides, that dangers of fever would be present after the deforestation.

Another very great, but perhaps not insuperable, difficulty lies in the fact that by law a broad strip of the Brazilian shore, throughout the coast, is reserved to the government as a "maritime zone" for the purpose of national defense, and that this would include practically the entire habitat of the Brazilian mangrove. It would probably be possible, however, to obtain concession from the Brazilian government to work certain defined coastal sections.

It is reported that several parties have already signified their readiness to furnish mangrove bark, both leaf and wood. The latter is valuable for use as construction material, especially piles and railroad ties, and has, as such, already attracted attention in France.



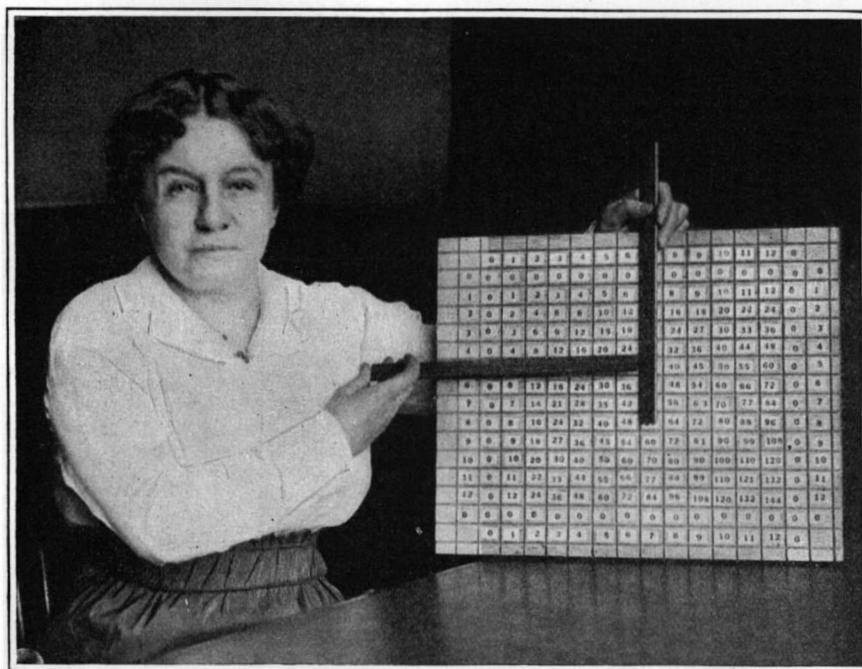
New invention which enables the passengers on the rear seat to bring the car to a stop by depressing a push button



Boy trimming veneer with the skill of a trained workman, by means of an electric trimmer



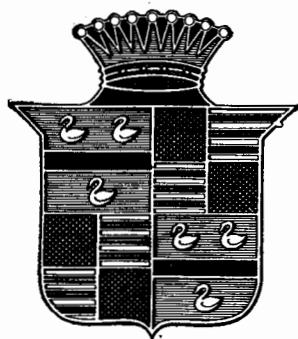
Newly invented oven for the curing of meat in the household, which is being largely employed in Germany



A simple mathematical device that greatly simplifies the teaching of elementary arithmetic, and its inventor

answer is found, in this instance 24.

If it is desired to divide 24 by 6, one ruler is placed between 6 and 24 and another ruler is placed in the groove that runs at right angles with 24, and the



SALESMANSHIP IS A FINE ART.

It throbs with earnestness, energy and enthusiasm.

It is infectious, hypnotic, well-nigh irresistible.

It is apt, therefore, to interfere with calm, deliberate judgment.

It has its dangers, as well as its allurements.

A motor car should be selected in our saner moments.

It should be bought with an eye to the far future, rather than the rosy present.

We should dwell upon unwelcome possibilities, as well as immediate pleasant prospects.

We should look at the shining, beautiful thing before us, in the light of twenty, or fifty, or a hundred thousand miles of service.

We should listen to the voice of reputation rather than the engaging eloquence of the salesman.

We should retire within ourselves, and inquire:—

What do I know about this car; and especially, what do I know of the company that builds it?

And then:

Is there another car of which I know more—built by a company of higher and wider repute?

You should be able to recall such a car instantly—a car of which all men think well, and none speak ill.

The moment your mind has gripped that thought—that there *is* a car which stands out above all others—then salesmanship has no power to impress you.

You find yourself listening to yourself—and deaf to all else.

You see a car which has come down the years with a clean escutcheon—hand in hand with honor.

You say to yourself: In choosing this car I cannot make a mistake.



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

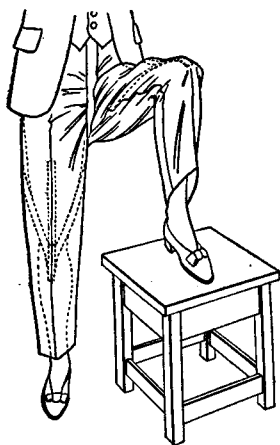
DETACHABLE HEEL.—A. BECKELMAN, 1473 Hoe Ave., Bronx, New York, N. Y. This invention relates to heels for shoes, and particularly to what is known as a detachable heel, and has for an object the provision of an arrangement of securing means whereby the heel may be quickly and easily applied and removed, and, when applied, will be held rigidly in place.

ICE CREEPER.—P. J. PINTO, 233 E. 151st St., Bronx, New York, N. Y. This invention has reference to an improved ice creeper or non-slipping device for use upon the foot, and has for an object the provision of an improved structure, which may be quickly and easily applied and removed.

HAT CONFORMATOR.—A. C. LARSON and C. J. OLOFSON. Address the former, 606-608 Seventh Ave., Rockford, Ill. In this instance the invention is an improvement in hat conformators, and has particular reference to a device which may be automatically fitted to the head, and the hat subsequently mounted thereon and shaped to conform to the head of the person to be fitted.

FOLDING UMBRELLA.—S. C. BURNHAM, 233 W. Everett St., Dixon, Ill. The more specific object of the invention is the provision of a novel arrangement of bows and braces whereby the umbrella can be folded into a very small space, the rod of the umbrella being made in telescoping or detachable sections, so that when the umbrella is not in use the total length will be reduced to a minimum.

TROUSERS KNEE LIFTING DEVICE.—S. ABRAMSON, 251 Bleecker St., New York, N. Y. This invention relates to a lifting device for each leg of a pair of trousers for the purpose



TROUSERS KNEE LIFTING DEVICE.

of automatically lifting the lower portions of the legs when the knees are bent, as in sitting down, ascending steps, stooping, and the like, whereby the objectionable bagging of the trousers legs at the knees is positively prevented and movement of the legs is unimpeded.

BRACELET.—B. R. JOLLY, 128 Fayetteville St., Raleigh, N. C. This invention relates particularly to a bracelet formed from links in such a manner that the links will give or spread. An object is to provide a bracelet formed of links, having overlapping parts and a spring for resiliently holding the parts in a predetermined position while allowing a stretching or sliding movement of the parts.

HAT DISPLAY RACK.—M. A. WILLIAMS, Thurber, Tex. This invention relates to hat display racks forming a part of the accoutrements of a haberdashery for the supporting or display of hats in such a manner as to permit a full line of hats to be displayed, as well as to economize space and render more convenient the keeping of the hats in stock.

HAT.—B. WERTHEIMER. Address F. F. EISEMANN, 41 Park Row, New York, N. Y. This invention provides improvements in ladies' hats whereby a proper fitting of the hat is insured, and the hair of the wearer is utilized to hold the hat in place on the wearer's head. To accomplish this use is made of a head band or bandeau extending within the crown and having one side bent outwardly toward the adjacent portion of the crown and at an angle thereto.

Electrical Devices

INSULATOR.—W. G. GEE. Address W. A. Snoop, 2202 Oak St., Trenton, Mo. The invention relates to insulators to be formed of glass, or other non-conducting material, and having means for securing the same on a pin or other support, and for engaging conductor wires. It relates more particularly to an insulator in which pairs of retaining lugs are provided on the insulator for engaging the wires.

SUPPORT FOR ELECTRIC WIRES.—R. B. DURAN, Calle Gracia Carrillo, Torreon, Coah, Mexico. This invention provides a support for electric wires, which makes the use of an auxiliary supporting cable unnecessary, while at the same time, doing away with all danger of broken or fallen electric wires. The invention also prevents the wearing of the wire sections at their supports.

TERMINAL CONNECTOR FOR STORAGE BATTERIES.—P. M. MARKO, 1191 Bedford

Ave., Brooklyn, New York, N. Y. In this case the invention has reference to storage batteries for starting, lighting, and other purposes, and has to deal more particularly with the terminal connectors, whereby the cables or wires are connected with the terminal posts of the battery.

LIGHTNING PROTECTING SYSTEM FOR OIL TANKS.—C. H. GUNTHORPE, Beaumont, Tex. An object here is to provide a system by means of which there will be no likelihood nor danger of a spark occurring within an oil tank, even should it be struck by lightning. A further object is to provide a system wherein the various plates which go to make up an oil tank are brought into good electrical condition, one with the other and properly grounded.

Of Interest to Farmers

HEN'S NEST DEVICE.—H. W. KEMBLE, Setauket, N. Y. This improvement relates to means for breaking up sitting hens, and the main object thereof is to provide means within a nest which will prevent a hen from generating the heat required for sitting, and thus causes her to give up her desire to sit.

INSECT DESTROYER.—C. L. KING and S. A. MCKIE, R. F. D. No. 2, Brownwood, Tex. This improvement provides an apparatus comprising a reservoir from which is fed an insecticide to a nozzle device, air pressure being used to generate a forceful jet at the nozzle for effectively distributing the insecticide over the area to be covered whereby various forms of insects may be destroyed.

Of General Interest

PEN.—R. J. ESTES, Coalgate, Okla. The invention relates to a pen including a nib and a holder therefor, the holder being adapted to receive a pen staff. The form and arrangement of the elements result in strength and simplicity; convenience in changing the nib; insures a firm holding of the nib, and provides for an ample supply of ink and a free feed of the ink.

MASSAGE APPARATUS.—H. L. CRANE, 182 St. Nicholas Ave., New York, N. Y. This device is intended for self-treatment and is in the form of a hollow body having a concave surface used for massaging the tissues by the body being rubbed over the surface of the part or parts to be treated, the body being hollow so as to contain a heating or cooling medium so as to have any desired effect on the tissues.

REINFORCED CONCRETE GROIN.—G. O. CASE, 1170 Broadway, New York, N. Y. This improvement relates to reinforced concrete groins or the like adapted for erection along the shores of lakes, rivers, or seas, and has particular reference to means adapting such groins to be erected in sections applied one to another without requirement for special machinery or driving of piles or the like.

ENVELOPE LOCK.—G. F. SMITH, 12 Chatham Square, New York, N. Y. This invention pertains to sheet metal fasteners adapted especially for sealing or locking envelopes or other containers, so that they cannot be opened without detection. An object of the invention is to construct a paper or similar container adapted for use especially with the improved sheet metal device.

PEN ATTACHMENT.—E. VARLEY, P. O. Box 137, Pietermaritzburg, Natal, S. Africa. Mr. Varley's invention relates to pen attachments,



PEN ATTACHMENT.

his more particular purpose being to provide a pen, such for instance as is usually employed for writing or drawing, with suitable means, whereby the ink carried by the pen point is prevented from reaching the surface of a ruler, a straight edge or the like employed for guiding the pen.

UTILIZATION OF KELP AND SIMILAR AQUATIC PLANTS.—T. BOBERG, Fairlawn, Clarence Road, Clapham Park, London, S. W., and N. TESTRUP, 3 Dean Farrar Street, London, S. W., England. This invention relates to the utilization of kelp and similar aquatic plants for the recovery of sodium and potassium salts or iodine or both therefrom, and is particularly applicable to the treatment of giant kelps, in which the alkali salts are present in amount to represent a value greater even than that of the iodine.

PROCESS OF MAKING NUTS.—A. H. JONES, 66 Mead St., Newark, N. J. The improvement provides a process whereby a longitudinal toothed bar is wound into a helix with the teeth on the bar forming an interior, continuous thread. The so-formed helical member can then be served into sections of predetermined length, thereby forming helical nuts which are resilient and self-locking.

EXPANSION AND FASTENING DEVICE.—G. C. RAEGER, Waterloo, N. Y. The invention provides a device, which is arranged for use in concrete walls, posts, and other structures, to permit of conveniently locking the device in position in a hole in a structure, and at the same time fastening a pipe, rod, wire, or other article in place on the structure.

OIL-WELL PUMP.—C. A. BUTLER, 120 North Alabama Ave., Okmulgee, Okla. This invention relates to oil-well pumps, wherein the gas in the well is utilized for driving the oil from the well. It provides a simple, inexpensive, valveless pump, which is automatic in its action, and which will require little or no attention, as there are no parts apt to get out of order.

MANUFACTURE OF PRESSED YEAST.—J. EFFRONT, 73 Avenue de Solbosch, Brussels, Belgium, and A. BOIDIN, Seclin, Nord, France. This invention, wholly or partially, dispenses with the use of malt and increases the yield of yeast and alcohol. This is attained by submitting the grain or other amylaceous material to a special fermentation by the aid of micro-organisms in the course of which the nitrogenous substances of the cereals, etc., are rapidly rendered soluble and peptonized without losses of fermentable materials due to malting.

PROCESS FOR MAKING BREAD.—S. F. McDONALD, care of Memphis Bread Co., Memphis, Tenn. In this process, the addition of salt to the dough is made after it has been fermented for from four to seven hours, which is the time ordinarily required for proper fermentation. The salt is added through the dusters of the dough-shaping machines by either dusting the salt on to the dough or the parts of the machines which shape, receive, or carry the dough. The process not only obtains a better salt flavor of the bread, but economizes on the dusting material used at present, for salt is cheaper than flour.

BIRD PERCH.—C. W. MUELLER, 1099 Summit Ave., Jersey City, N. J. Among the principal objects the present invention has in view are: To provide a removable perch for birds; to facilitate by the removal of perches of the character named, the cleaning of bird houses; and to reduce the cost of manufacture and simplify the construction.

SMOKE CONSUMER.—O. W. KING, Fort Worden, Wash. The present invention relates generally to improvements in smoke consumers adaptable in connection with smelters, furnaces, and like apparatus, and arranged to effectively withdraw the smoke and poisonous gases therefrom, with a desired quantity of air for final disposition at another point.

SCHOOL DESK AND SEAT.—F. W. ELSE, Oskaloosa, Iowa. This improvement provides a school desk and seat provided with two side frames spaced apart, and with means to adjust a seat and a book pocket on the frames, so that the seat is pivoted and the book pocket is secured to the frames at any desired height, and also so that the seat or book pocket will extend at the front and the rear of the frames as desired.

Hardware and Tools

TOOL FOR REMOVING BOILER SCALE.—D. H. SMITH, Bankhead, Alberta, Canada. In the present patent the invention has reference more particularly to a pneumatic hammer for removing boiler scale, and it is so constructed that it can be used where it is impossible to work effectively and conveniently with chisel bars or a hand hammer.

WINDOW BEAD FASTENER.—M. M. BENSTER, Gettysburg, S. D. This invention pertains to improvements in windows and more particularly to window beads and fasteners, and has for its object to provide means for permitting the ready removal of window sashes and for holding them in place in operable position.

IMPACT TOOL.—C. EKBERG, 3316 Hoyt Ave., Everett, Wash. This invention relates to improvements in impact tools wherein a reciprocating piston is operated by fluid pressure, such as compressed air, and in which the piston serves the purpose of a hammer to strike successive and numerous blows against the tool shank for cutting, calking, or riveting in metal or stone work, and various other purposes.

HAMMER.—J. T. HALL, 317 N. 11th St., Waco, Tex. This invention provides a hammer having a starting claw arranged adjacent to the central portion of the hammer near the point at which the hammer head is connected with the handle and adapted to be utilized in starting nails and the like which are difficult of extraction, in such manner that the strain on the handle and hammer head will be minimized.

WOOD SCREW.—W. R. SWEET, Wakefield, R. I. The purpose here is to provide a wood screw which is simple in construction, easily screwed into wood or other material, and arranged to lock the screw against accidental unscrewing, and to prevent water or moisture from leaking past the head of the screw into the material.

Heating and Lighting

GAS PRESSURE REGULATOR.—B. M. GATTERMEIR, California, Mo. This improvement has reference to means for automatically controlling the supply of gas in the degree of use, and the main object thereof is to provide such means which are an improvement over devices of this class now known to the inventor both structurally and in use.

GAS LIGHTING SYSTEM.—D. D. CORNING, Cedar Falls, Iowa. This invention improves and simplifies the construction of a combined gas valve and circuit switch so as to be reliable and efficient in use, and so designed that the turning on and off of the gas and opening and closing of the ignition circuit can be easily accomplished.

Household Utilities

FOLDING CRIB.—E. ANDERSON, 750 51st St., Brooklyn, New York, N. Y. The improvement provides a structure which may be folded to occupy the minimum space when stored; arranges the members so that when folded the parts will be mutually held from movement; provides locking devices for the folding members, said devices being arranged to lock in

out-of-service position; and provides easy access to the crib.

BOILER FUELING RECORDER.—T. FULSHAW, 73 W. 38th St., Bayonne, N. J. This invention relates to stoves and furnaces, and has particular reference to indicating and recording means whereby a permanent record is made of the times when the furnace doors are opened, and a record is made of the length of time the doors are left open.

GAS STOVE.—F. B. JACKSON and A. B. VESPER. Address the latter, 201 W. 29th St., Indianapolis, Ind. This invention utilizes the gas supply pipe to constitute the guard for the gas cocks. The supply pipe is positioned horizontally in front of the gas cocks and nearly at the level thereof, at a distance to permit the cocks to turn in an arc from the closed to the open position in an outward direction, so that when the cock is open the handle will be disposed at right angles to the gas supply pipe, and its outer end adjacent to the gas pipe, and protected thereby, although projecting somewhat above the gas pipe to be conveniently grasped.

PIE PAN.—MARGARET L. NOXON, 205 W. 102nd St., New York, N. Y. This pie pan can be manufactured at little cost, and has an inner head spaced from the top of the pan and positioned to secure the sides of the under-crust to permit of the upper crust being pressed there against, while the edges of the upper and lower crusts may be pressed against the fluted edge of the pan above the head.

DRAWER ATTACHMENT FOR BED-STEADS.—H. M. DANIEL, Gulfport, Miss. This invention relates more particularly to means whereby drawers may be suspended in slidable relation beneath a bedstead frame or similar structure, for the purpose of economizing in room space, and provides means forming guides for the slidable reception of drawers beneath a bedstead frame and the like, together with a cover plate for effectively covering and holding the drawers in closed position beneath the frame from which they are suspended.

STAIR TREAD.—H. ENGEMANN, No. 2 Tuck Apartments, Salt Lake City, Utah. This inventor provides a stair tread of such nature as to economize the use of carpet or other material employed, by eliminating the use of the carpet on the risers of the stairway, and provides for the exposure at will of previously protected fresh sections or areas of the carpet to replace the portions which have become worn and disfigured, so that in time all of the material will be used before such material is discarded.

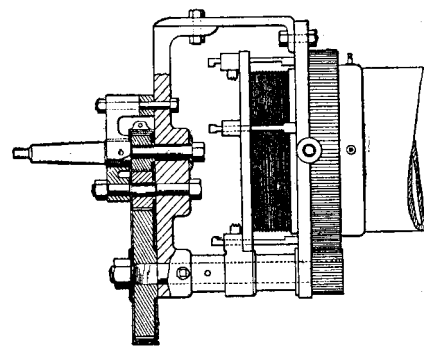
FLUSH TANK SIPHON.—P. BALZE, 200 Christie St., Leonia, N. J. This invention relates to plumbing, and has particular reference to flush tanks for closet bowls of the nature set forth in Mr. Balze's previous patent, No. 1,090,189. It so arranges the siphon breaking tube as to cause the air to be admitted into the siphon in such manner as to render the action of the flush tank practically noiseless when designed either as a low-down or a high tank.

OPERATING DEVICE FOR EXPANDING PLUGS.—H. KAYFETZ, 189 Herzl St., Brooklyn, New York, N. Y. This device is more especially designed for expanding a plug in the pipe leading to a sewer to permit of making a house test of the plumbing, and arranged to permit the plumber to conveniently place the operating device in position together with the plug, and to actuate the operating device with a view to expand the plug by means controlled exteriorly of the pipe.

Machines and Mechanical Devices

DOBBY OR JACQUARD OF WEAVING LOOMS.—GEORGES E. LEVY, Paris, France. The present invention consists in mounting the shedding bars on supports, directly connected by metallic connecting bars with the rocking levers; each shedding bar slides transversely, from left to right, and inversely on its support which serves as a guide, while the support always remains in alignment with the traction of the connecting bars.

PIPE THREADING MACHINE.—W. E. NESTOR, 821 5th Ave., Hunting, W. Va. This invention is an improvement in pipe threading machines, and has for its object the provision



PIPE THREADING MACHINE.

of a portable machine of the character specified, especially adapted for cutting threads on large pipes at the place of their utilization, and wherein the machine may be operated manually, being placed directly on the pipe.

ANIMAL TRAP.—C. RITTELMANN, 1-3 Brenner St., Newark, N. J. The object in this case is to provide a new and improved animal trap, which is very simple and durable in construction, cheap to manufacture, easily set up and

(Concluded on page 434)

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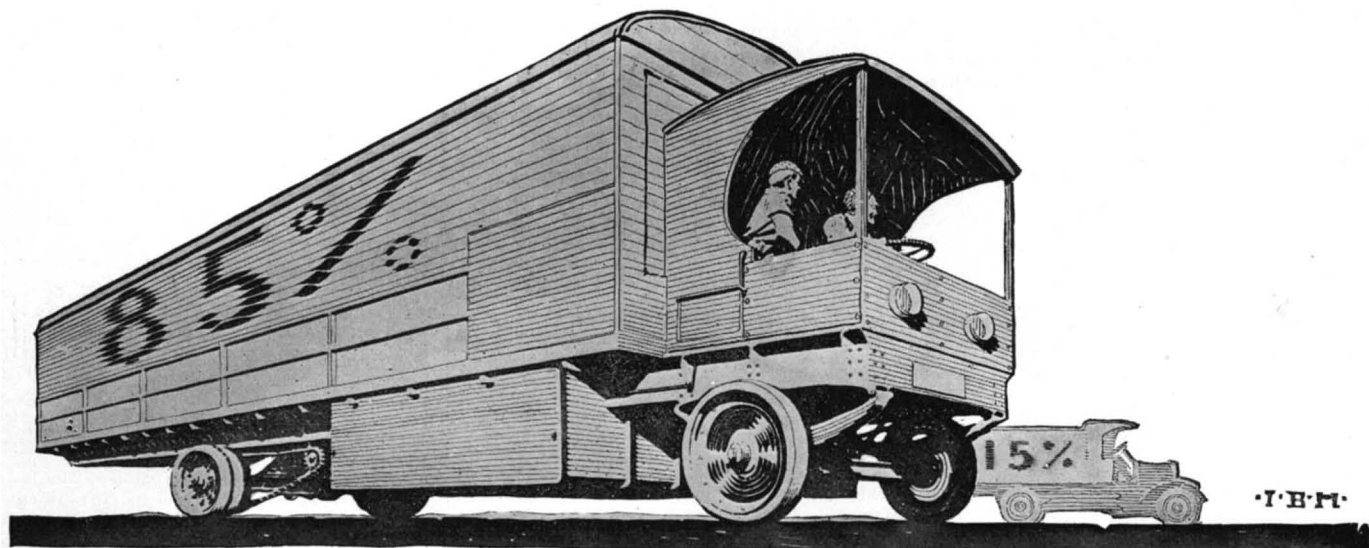
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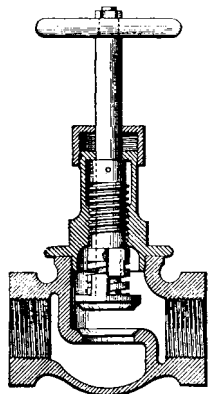
Dealers in open territory are invited to correspond



(Concluded from page 432)

arranged to take up very little room to permit of conveniently placing the trap in position at almost any place.

GLOBE VALVE.—W. H. JOHNSON. Address F. Guth, 28 W. 71st St., Chicago, Ill. The improvement has for its object to provide a



GLOBE VALVE.

valve so arranged that whenever the valve is opened or closed, it will be turned or ground on its seat, to provide for an intermittent re-grinding on the contact surfaces of the valve and seat, and wherein the grinding pressure is for a portion of the time during the opening and closing of the valve under full pressure.

GATE OPERATING MECHANISM.—E. PHELPS, 30 Longwood Ave., Brookline, Mass. The invention relates to gates and more particularly to gate operating mechanisms whereby a gate can be opened from a point at either side thereof without the driver or rider being required to get off the vehicle or horse for the purpose of manually opening the gate in the ordinary manner.

VALVE MECHANISM FOR TRAPS.—G. W. MOHR, 182 Central Ave., Jersey City, N. J. This inventor provides a valve mechanism for traps, which is exceedingly sensitive and arranged to insure a positive opening and closing of the outlet to periodically drain off the accumulated liquid from the trap without danger of the working parts becoming inoperative by sticking or other causes.

VENDING MACHINE COIL CONTROL.—N. O. TRAVERSE, General Delivery, Minneapolis, Minn. In the present patent the invention has reference to vending machines, and relates more particularly to the check- or coin-control of vending machines. An object of the invention is the provision of a simple, automatic, and inexpensive coin control.

LATCH KEEPER FOR EXCAVATOR DIPPERS.—E. F. COLBATH, Rockland Lake, N. Y. The invention relates to excavators or dredges, and has particular reference to the construction of dippers employed in excavating or dredging operations. An object of the invention is to improve the construction of an excavator or dredger dipper with reference especially to the latch keeper thereof for the door.

CONCRETE WALL MACHINE.—M. DEEKS, Rochelle Park, N. J. This invention relates to apparatus for building plastic or concrete walls, and has particular reference to devices of this nature adapted for continuous operation for forming a wall in courses one above another in a rapid and reliable manner. It simplifies the construction and operation of machines of this nature adapted for forming a hollow wall or a wall having inner and outer portions with an air space between them.

NUT TAPPING MACHINE.—T. M. DANIELS and J. C. HOLSCHMACHER. Address the former, 208 South La Salle St., Chicago, Ill. The main object of the invention is to render any of the top spindles inoperative in the event of the nut blank thereunder being defective, either by being under size or by not having been provided with the hole to be tapped. It provides means, in such event, for removing the defective blank from the machine automatically.

TRANSPORTABLE APPARATUS FOR ACTUATING TOOLS OR MACHINES.—M. BOUCHET, 22 Rue Alphonse de Neuville, Paris, France. This invention relates to an apparatus capable of constituting various machines such as saws of any kind, boring and grinding machines, etc., or of serving for actuating various machines, such as pumps, agricultural implements, etc. It is arranged to be used for multiple purposes and to operate in any position, so as to avoid moving the work or the machine to be actuated.

AUTOMATIC VALVE OPERATING MECHANISM.—I. M. BALDWIN. Address F. F. Aldridge, care of American Thermostat Co., 103 Mechanic St., Newark, N. J. This invention provides means for operating valves which may be connected with a thermostat to be actuated thereby. The thermostat has means for closing circuits connected for driving a motor for rotating a wheel or disk which has cams for engaging a thrust rod connected with a valve stem for operating the valve. Means provide for continuing the running for a period even if the thermostat should move to open the circuit disposed at the thermostat.

PRESSURE REGULATOR.—J. P. METZGER. Address J. S. Leslie, care of the Leslie Co., Lyndhurst, N. J. The invention relates to pressure regulators in which a main or regulating valve is controlled by a piston governed

by controlling means controlled by low pressure from the outlet side of the regulator to admit high pressure from the inlet side of the regulator. Mr. Metzger has invented another pressure regulator, which relates to pressure regulators in which the main or regulating valve is controlled by a piston governed by controlling means controlled by low pressure from the outlet side of the regulator to admit high pressure from the inlet side of the regulator.

SCALE OR WEIGHING DEVICE.—J. P. CLIFFORD, 70 Grove St., Passaic, N. J. This invention provides scales for weighing large amounts and indicating the amount of over weight upon each weighing operation, so that the exact amount will be recorded. It provides a scale to weigh a predetermined amount, but adapted to indicate the correct weight of a lesser amount, and also the correct weight of a greater amount.

RESUSCITATOR.—T. E. ACKLEN, care of Acklen Bros., 237-239 E. McLemore Ave., Memphis, Tenn. This device is for use with persons suffering from suspended respiration, and wherein mechanism is provided adapted to be secured in place on the upper portion of the abdomen and adjacent portion of the stomach, for moving the wall of the abdomen outward and inward, in a manner simulating respiration, in order to restore the function of breathing.

DRIVING BELT.—E. HOWL, The Quarries, near Dudley, and F. PERRY, Shrubbery, Bloomfield Road, Tipton, England. The object of the invention is to provide a practical extensible belt capable of producing useful variation of speed ratio, and the invention comprises an extensible or elastic belt having certain properties, and having arranged therewith inextensible or inelastic parts adapted to make driving contact with the pulleys on the shafts.

AUTOMATIC CAMERA SHUTTER LOCK.—P. HOLT and R. G. HOLT, 122 Francis St., Providence, R. I. This invention provides a stop structure which will positively prevent a second operation of the shutter until the stop has been released. It provides a mechanism connected with the film shifting structure, and with the shutter whereby the film shifting mechanism may release the locking mechanism arranged adjacent the shutter, in order that one exposure may be produced for each film.

BAIT OR DRAWING TOOL HOLDING DEVICE.—S. B. HENSHAW, care of Charleston Window Glass Co., Charleston, W. Va. This improvement provides a support for the bait or drawing tool which will enable the strain of its weight being taken from the cylinder laid out for capping, and which will withdraw the bait a sufficient distance from the cylinder after the latter is cut off from the bait, to prevent checking or tipping of the adjacent cylinder end.

VIBRATOR.—P. J. JOECKEN, 2651 E. 79th St., Cleveland, Ohio. The invention provides a device operating by fluid under pressure, and wherein a cylinder is provided, and a piston in the cylinder, and wherein valve mechanism is provided in connection with the cylinder for operating the piston to positively force the same in opposite directions.

Musical Instruments

KEYED ZITHER.—L. JOST. Address OSCAR SCHMIDT, 87 Ferry St., North Bergen, N. J. The object of the invention is to provide a new and improved keyed zither, which is very simple and durable in construction, easily manipulated and arranged to enable the player to conveniently actuate the spring hammers for sounding the melody strings.

Prime Movers and Their Accessories

WATER CIRCULATION SYSTEM FOR EXPLOSION ENGINES.—W. K. LEGGETT, care of Eugene Phillips, 213 Francis St., Jackson, Mich. This invention provides an attachment, designed to be interposed between the exhaust of the engine and the water line of the radiator for utilizing the impulses of the exhaust to supply cold air to the radiator or engine for cooling the same, and aiding the circulation of the water.

CARBURETER.—G. A. BOYCE, Edgemont, Nev. The carbureter is provided with an adjustable fuel nozzle and an adjustable air intake at the nozzle, with means for regulating the nozzle and the air intake simultaneously, so that the velocity of the air at the air intake is substantially the same at all times, to vaporize the fuel perfectly whether the carbureter is wide open or partially closed.

ROTARY ENGINE.—E. F. O'HAVEY, Box 331, Carlisle, Ind. This invention produces a rotary engine having comparatively few parts, and so arranged that the movement of the rotary piston causes the latter to directly engage, and operate step by step, a single revolvable member which performs many of the functions usually performed by more complicated mechanism for applying power to the piston.

Pertaining to Recreation

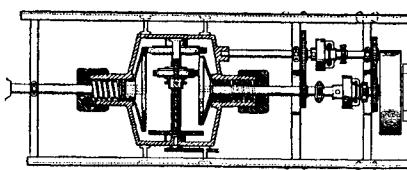
SLEEPING EYES FOR DOLLS.—O. E. DENIVELLE, care of the Denivelle Co., Inc., 42 Wooster St., New York, N. Y. This invention provides sleeping eyes for dolls, arranged to permit each eye to move into open or closed position independently one of the other to insure free movement of the eyeballs. It provides a construction to allow of manufacturing the doll's head very economically.

Pertaining to Vehicles

AUTOMATIC STARTER FOR AUTOMOBILES.—O. E. WOOLDRIDGE, 117 South 6th St., Greenville, Ill. This invention provides means for mechanically cranking an automo-

bile engine; provides means for manually controlling the same; provides means for automatically governing the stored power of said cranking means; and simplifies the mechanism and condenses the space occupied thereby.

DIRECT DRIVE FRICTION TRANSMISSION.—C. S. ALLEN, 337 Mills Bldg., San Francisco, Cal. This invention provides a device having a few parts, and these of a simple



DIRECT DRIVE FRICTION TRANSMISSION.

nature, therefore eliminating troubles due to a multiplicity of complex elements. It provides a transmission mechanism, whose use will insure the longer life of all the parts of the car, such as engines, chassis, and tires, due to the fact that jerks and jars such as that caused by changing gears, are entirely eliminated.

VEHICLE TIRE.—J. MONSON, 201 E. 30th St., New York, N. Y. An object in this invention is to provide a non-pneumatic tire which offers a gradually increasing resistance to stress exerted upon it. A further object is to provide a tire and wheel construction comprising means for fastening the tire to the felly of the wheel.

WAGON JACK.—R. AMES, 528 Rookery Block, Spokane, Wash. The prime object of this improvement is to provide a wagon jack having means to engage a vehicle wheel in a manner to lift the wheel and axle, and to give a sliding movement to the wheel relatively to the axle to remove the wheel or restore the same to its position on the axle.

LIFTING JACK.—W. W. BELL, Beaver Creek, Minn. The object of the present invention is to provide a lifting jack having elements thereof so disposed that the strains in operating the jack will be distributed. A further object is to increase the efficiency of jacks and to promote convenience in the operation of the jack and in the adjustment of the parts.

VEHICLE WHEEL.—J. C. SMITH, 2112 5th Ave., Birmingham, Ala. The invention refers more particularly to wheels designed to be used on automobiles and heavy trucks, the object being to provide a wheel which shall have positive traction and be cushioned to utilize the benefits of pneumatic tires without the danger of puncture, or to use spring pressure, or combined pneumatic and spring pressure.

SIGNALING DEVICE.—A. R. COLGIN, 916 Napier Ave., Richmond Hills, N. Y. This invention provides a device more especially designed for use on automobiles and other vehicles, and arranged to enable the driver to readily signal ahead to oncoming vehicles and to persons intending to cross a highway in front of the vehicle, and to signal rearwardly to following vehicles the intention of turning out to the right or to the left during the day or the night.

BRAKE FOR PLATFORM TRUCKS.—J. L. SMITH, care of S. & S. Mfg. Co., Savannah, Mo. This invention relates to platform trucks, such as used at railway stations, and provides means for preventing a truck from being run off the railway platform, as by suction or jarring caused by a rapidly moving train or by winds, and likely to cause serious accidents if the truck rolls or falls upon the rails in advance of an approaching train.

SPRING TIRE.—H. M. LAMBERT, care of Lambert Multiplus Co., Portland, Ore. This invention is an improvement in spring tires, and has for its object to provide a tire of the character specified, which while having a large amount of resiliency will not be injured by puncture, and wherein means is provided for permitting the resiliency of the tire to be varied.

AUTOMOBILE BODY AND WATER BAG PROTECTOR.—F. B. SULLIVAN. Address T. A. Lotz, P. O. Box 417, Carson City, Nev. This device is for use with automobiles and other motor vehicles, and comprises a bag of flexible material, such as canvas or the like, having means for connecting the same with the body of the vehicle to support the bag in inclined position between the fore and rear doors, in such manner that the bag will not mar or injure the body, and will be yieldingly supported to prevent injury to its contents.

DIFFERENTIAL LOCK AND TRANSMISSION CONTROLLER.—F. H. TREGO, care of Knox Motors Co., Springfield, Mass. This invention improves and simplifies the construction and operation of the apparatus so as to be efficient in use, and having locking means whereby only one gear can be thrown in at a time, and when the gears of the transmission are in meshing relation the differential gearing cannot be thrown in.

TIMER AND DISTRIBUTOR.—D. E. MOUTON, Pierre, S. D. The object here is to provide a simple, compact, efficient and inexpensive device, the parts of which are so related that the same can be easily inspected or cleaned when necessary and the relation of which parts is such that they require little attention, and the same are self-adjusted.

COMBINATION RIGID AND FLEXIBLE FRAME FOR MOTOR CYCLES.—C. D. COMPTON, 404 Bleecker St., New York, N. Y. The invention relates to means for resiliently sup-

porting the rear fork of a motor cycle, or other form of velocipede, to yield relatively to the rigid frame. Its object is to provide a means for the indicated purpose, improved in various particulars, to the end that efficiency may be promoted in effecting the assemblage and adjustment of the parts.

SAFETY DEVICE FOR AUTOMOBILES.—E. U. MACK, 327 E. Palmetto St., Florence, S. C. This invention relates to the starting of internal combustion engines, in automobiles, particularly of the Ford type, and provides means preventing the starting of an engine unless the commutator is in the correct position for starting the engine, as, if the commutator should be "advanced" when the crank is joined to the crank-shaft and revolved to rotate the said shaft, back-fire results and a broken arm may result.

VEHICLE SKEIN.—W. W. WOOD, JR., Huntington, L. I., N. Y. This invention relates to improvements in vehicle skeins, and has for its object to provide a construction which is automatically self-lubricating. It provides a skein for a vehicle axle which will act in the usual manner of skeins of this character while forming a fountain lubricating structure.

AUTOMATIC LUBRICATING HUB.—M. L. SENDERLING, 333 Fairmount Ave., Jersey City, N. J. The inventor provides a device for re-distributing the lubricant to the supply thereof with which the wheel is furnished; provides means for retaining the lubricant with which the axle is provided within the hub of a wheel; and provides a means for holding in place the dust-guard provided on wheels of this character.

WHEELED SCRAPER.—H. C. ROWELL, R. F. D., No. 3, Modesto, Cal. This invention relates to grading and excavating devices, and more particularly to a wheeled scraper. An object is the provision of a novel dumping means for the scraper, whereby it is rendered unnecessary to tilt the entire structure in order to unload the contents thereof.

Designs

DESIGN FOR A SOCKET COVER FOR LIGHTING FIXTURES.—S. SHAPIRO, 15 Laight St., New York, N. Y. The socket cover in this case when viewed in its front, side, and rear positions shows an article of highly attractive simplicity and graceful lines. Mr. Shapiro has also made a design for an oval back for brackets for lighting fixtures. In the side and bottom plan views the article represents ornamental features of effective neatness and beautiful lines.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—S. GEISMAN, 27 Spruce St., New York, N. Y. This ornamental design for an article of manufacture shows a wonderfully original assemblage of grotesque animal monsters, Oriental human figures, idols, and numerous accessories. In another design for an article of manufacture Mr. Geisman shows a plan view, the field of which presents a remarkable variety of outlines, amid which appear both lightly and deeply mottled effects numerous pointed with small and heavy dots. The same inventor has made an ornamental design for an article of manufacture which represents an original massing of butterflies and flowers. In still another design for an article of manufacture, Mr. Geisman represents the article in alternate band effects, plain and then hatched.

DESIGN FOR A LADY'S HAND-BAG.—ELSA DIENEMAN, 8675 20th Ave., Brooklyn, New York, N. Y. The article of manufacture in this case is shown on the attractive formation of a hand-bag simulating a dressed doll having a wide or flaring skirt constituting the bag proper, while the bust portion constitutes the closure. Ribbon hangers serve as the handle.

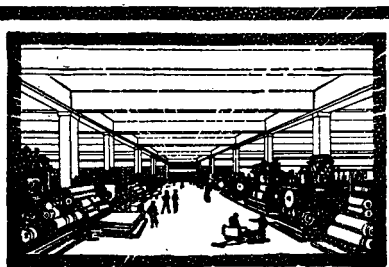
DESIGN FOR A FOUNTAIN.—T. LLOYD, 40 Northfield St., Boston, Mass. This design comprises an upright tank having flat faces, the height of the tank being greater than the width, and the width being greater than the depth from front to rear, but tapering toward the base. The base has a circular flaring front flange, and an arc-shaped arch spanning the rear portion of the base and secured to the front portion of the tank.

DESIGN FOR A TOY STORE.—M. UNGAR and E. S. BECKER, 1012 Fox St., Bronx, New York, N. Y. The front view of this construction of a toy store shows an original design, the top of the store having an ornamental sign inscribed with the words, Dr. Pill & Co., Druggists. A branch in every home. The second view illustrates a transverse section of the store.

DESIGN FOR AN ENGAGEMENT RING.—H. ROEDE, Address B. ROEDE & Co., 45 John St., New York, N. Y. Between the body of the ring and the stone carrying crown appear two interlinked hearts pierced by an arrow. The open frame work on both sides of the ring is flanked by connecting bars extending tangentially from the ring body to the crown. The second design shows an edge view of the ring.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—E. BOOTE, 35 W. 23rd St., New York, N. Y. This ornamental design shows the article in circular form and richly ornamented with running flowered vine border with a center comprising a flower plant on a stem of which is perched a beautiful bird.

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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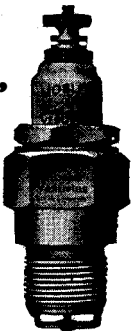
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Portable Apparatus for the Detection of Combustible Gases in Air

(Concluded from page 422)

and natural gas, one for hydrogen, one for gasoline vapor, and one for coal gas.

The electrical energy for heating the platinum wire is derived from a miner's electric cap lamp storage battery, thereby providing the electric cap lamp with a gas detector; this is something it does not possess at present yet it has been an objection to the use of electric lamps in gaseous mines.

In Fig. 3 is shown another gas detector similar in operation except that it contains two small dry cells, A and B, for supplying the electrical energy. These cells cost but a small sum and will operate the detector for a minimum of twenty determinations. When they are exhausted, their renewal is a simple matter.

The patent rights on the gas detectors just described belong to the Bureau of Mines. Plans are under way to exploit the instruments in such a way that the public interest will best be served.

War Game—VI.

(Concluded from page 428)

Greenville, 7 June 19—, 7:00 P.M.

To Colonel K.,

Argus Farmhouse.

One regiment of Red cavalry passed this village at 3:30 P.M. As far as could be ascertained, it is independent cavalry of the main forces coming from the North. No other enemy has been seen.

I shall continue reconnaissance toward Leopard.

L.,

Lieutenant, Ninth Cavalry.

It is evident that this is the report of a patrol which was sent out by Colonel K. during the day to gain more information of the enemy. This patrol is part of the squadron which has been active since early morning.

Message from Brigade Commander:

Morrisville, 7 June 19—, 5:00 P.M.

To Colonel K.,

Argus Farm.

According to reports from our aerial scouts, an enemy brigade coming from the North has camped near Delroy.

This brigade marches at 9:00 P.M. today, via Deansville and Oregon Farm, to envelope right flank of enemy in your front.

In order to establish our position securely north of the Nehaminy, you will hold your position along the crest of Lookout Hill.

I shall ride with the advance guard.

G.,

Brigadier General.

Report from Patrol:

Coal Mines Ferry, 7 June 19—, 7:30 P.M.

To Colonel K.,

Argus Farm.

Enemy patrols have succeeded in repairing ferry boat. A Red platoon has occupied Ferry House and prepared it for defense. Messengers were sent north on Delroy road.

I remain in observation.

S/1,

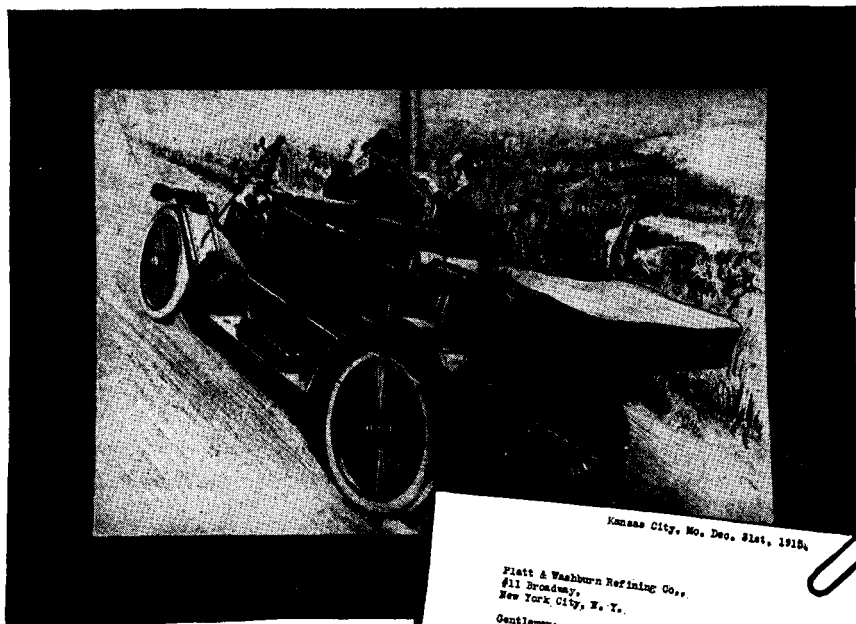
Sergeant, Ninth Cavalry.

It is evident that the proposed concerted action of the detachment under Colonel K., now on Lookout Hill, and of the First Infantry Brigade under General G., will effect a great change in the situation. The Blues, upon the arrival of the Brigade, will possess a force far superior to that of the enemy.

We must now consider what the Red Commander, Lieutenant Colonel LC., will do.

At dusk, all the advantages were on the side of the Reds. The reader had a clear picture of the position and situation of the Blues, and it will be interesting to consider here just what plans Lieutenant-Colonel LC. would make, were he in possession of all the information which we have.

We must assume that the Red patrols have been and still are doing their duty. It will be remembered that a Red patrol, in War Game IV, reported that a strong Blue force had been observed moving towards Norrisville. Delroy, mentioned in



The hill climb test shown above was made by Mr. J. H. Chandler, President of the White Star Oil Co. of Kansas City. Before his connection with the above company, Mr. Chandler was in the automobile business, so that he knows every angle of automobile lubrication. The hill climb test in which he found that Veedol carried him over the top of the hill at 20 miles an hour on high gear, is an indication of what Veedol will do for your car.

Kansas City, Mo. Dec. 21st, 1915.
Platt & Washburn Refining Co.,
311 Broadway,
New York City, N. Y.
Gentlemen:
I wanted to put Veedol to some severe practical test. I was in the automobile business for eight years and know about how a motor runs under proper lubrication.
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Ordinary oil breaks down after a few hours' use and forms black solid matter. Part of the oil loses all lubricating value.

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How to Make the Road Test

Remove the drain plug from the lowest part of your motor crank case and allow all old oil to run out. Replace the plug, fill the sump up to correct oil level with kerosene, and run the motor under its own power for about thirty seconds to cleanse the interior. Then draw out all kerosene. Replace the drain plug and refill with Veedol.

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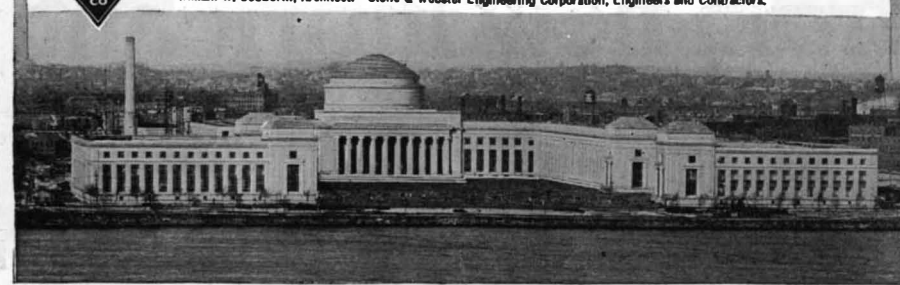
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the message from Brigade headquarters, is about 25 miles from Lookout Hill.

The plans of Lieutenant Colonel LC will be explained later.

The Dispositions of Colonel K of the Blue Detachment

We will return to Colonel K. at the time when he has considered the important reports and messages which he has received. These will constitute the basis for his order, which he will dictate to the commanders of the four infantry battalions and the battery. These officers have been directed to report to him for orders.

"The enemy force in our front consists of one regiment of infantry, one regiment of cavalry and one battery. A Red brigade has been observed about 25 miles north.

"Our First Infantry Brigade is advancing via the Deansville-Greenville road to envelope the enemy's right flank. They should arrive about 1:00 A.M.

"We will hold our present position.

"The battery will withdraw behind Argus Farm.

"Reserve will move from its present position to the eastern edge of the forest. One company from the artillery support will reinforce the left flank guard and act as its reserve.

"Engineers will assist in construction of entrenchments.

"All reserve ammunition will be issued to the firing line.

"Field kitchens will at once issue food to the firing line.

"Wounded will be transferred to Pottstown. Dressing station will be established at eastern edge of Pine Forest.

"I shall remain here."

The officers repeat their orders and depart. During the night an occasional shot is fired, while on the road farther south the blue brigade is advancing to the attack.

Questions

Question 1. With the information given in this and in previous War Games, locate on the map the positions of the Reds and the Blues.

Question 2. About how much of the Blue reserves have been used up in the day's combat?

Question 3. What advantage does the Blue artillery gain by moving back of the crest of Lookout Hill?

Question 4. How will the Blue artillery direct its fire?

Question 5. What features of the terrain must Lieutenant-Colonel LC, commander of the Reds, consider, when he receives information that overwhelming enemy forces are threatening his right flank?

Question 7. In order to avoid defeat and the destruction of his force, what will be the decision of Lieutenant-Colonel LC? What will be his orders?

Answers to Questions in War Game V.

1. In answering this question, we will assume that Lieutenant-Colonel LC made his decision 15 minutes after the partial repulse of the Red cavalry, which ended in their withdrawal and dismounting for fire action. The order which he gave was as follows:

"The enemy, with a force of four battalions of infantry and a battery, is advancing from Lookout Hill against our position on Timcum Creek.

"We will attack the enemy on Lookout Hill, enveloping his right flank.

"The infantry will cross Timcum Creek and attack the enemy's right flank.

"The cavalry will establish communication with the detachment 1,000 yards west of Argus Farm, and will attack enemy's position on Lookout Hill, advancing in the direction of Argus Farm.

"The battery will cover the crossing of the detachment and then concentrate its fire on the enemy's right flank.

"I shall remain near the bridge."

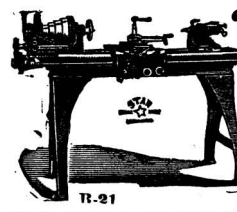
2. See map.

3. See map.

4. Without doubt, the left flank of the Blues. The reason for this is that this flank is really the only vulnerable spot of


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the Blue position. In addition, a successful attack against the Blue left flank would secure the commanding top of the Hill for the Reds.

5. The immediate result of the gaining of the highest point by the Reds would be the threatening of the Blues' left flank, which would necessitate their farther withdrawal.

We know that the mission of the Blue forces is to hold the bridges over the Nehaminy river above Pottstown. If the Reds succeed in taking the high point in question, they would from this position command the two bridges and their artillery could either destroy them or make the crossing very difficult for the Blues.

6. In answering this question, the terrain is the decisive factor. The difficulty of making an advance across the bridge is great enough, but that is very little as compared with the crossing of the bridge in a retreat. Such a retreat would undoubtedly involve a complete disaster. On the other hand, the good defensive line of Lebanon Forest, with the lake guarding the flank, would make such a retreat easy.

7. This question has been fully answered in the plan for the attack enveloping the right flank of the Reds.

* * * * *

Developments of Importance

At 4:00 A.M., on the 8th of June, the Blue forces open up a heavy fire against the Red line. The fire superiority of the forces making the enveloping attack, compels the Red right to withdraw.

The following articles will discuss the retreat of the Reds, and the assistance of the engineer troops in making a double envelopment of the Red forces.

Civilian Motor Trucks as Army Supply Trains

(Concluded from page 423)

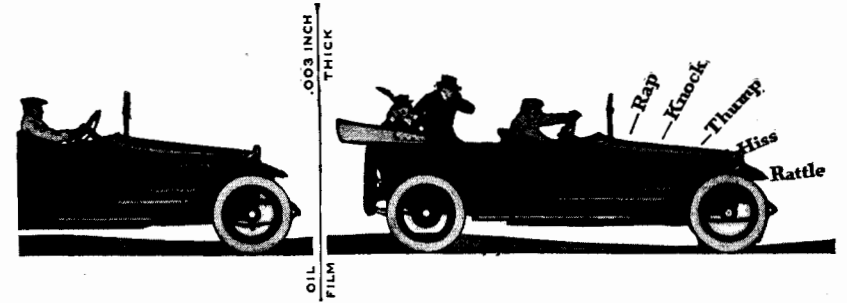
The convoy formation of the train was made up of a scout car, then one of the lieutenant's cars, then the commissary truck, followed by the four burden-bearing trucks. The commander's car was next in order, followed by that of his orderly. Then came the repair truck, followed by another lieutenant's car, with two orderlies in cars at the extreme rear. The lieutenants and their orderlies in the performance of their duties naturally deviated from these positions from time to time.

The personnel of officers was as follows: Commander, Arthur J. Slade, formerly a member of Squadron A; Lieutenants Roderick Stephens and George H. Pride. R. D. Dumont, 23rd Regiment, N. G. N. Y., was in charge of the commissary.

The results of the trip showed that fully loaded trucks of from 5- to 6-ton capacity could negotiate with ease even the worst of the roads if they had any foundations at all. Even grades of from 5 to 7 per cent on dirt roads were traversed with but little delay, as is evidenced by the fact that the average running speed of the train over the entire trip was 6.2 miles per hour.

At one spot, just out of New City, on the return trip the road was so soft that it was decided to send the trucks through it in pairs, the first towing the second, the idea being that if one of them lost traction the other might have enough to pull both through. The first pair got through without trouble, and the third was sent over the soft spot alone. It got mired, but the repair truck pulled it out in less than five minutes by its tow rope. By rushing the soft spot and straddling the rut, the other three trucks got through without aid. This brought out the fact that heavy trucks do not sink deeper into the soft roads than lighter ones, for the reason that the tire widths of each are in proportion to their loads, due to the limited capacity of the rubber in the tires. In fact, the larger width tires have sort of a rolling effect on the road, tending to flatten out the ruts if the road has any kind of foundation.

The maintained average speed of 6.2 miles per hour over the bad roads and the steep grades was a revelation to the army



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And this thin film is *not* the cool oil you pour into your crank-case. In use the oil heats quickly. Then the test comes.

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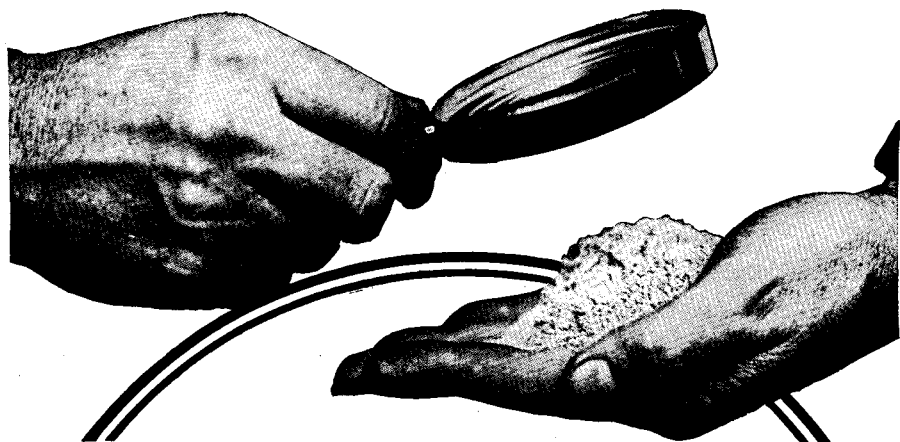
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CARS	Summer	Winter	Summer	Winter	Summer
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Apperson.....	A	A	A	A	A
Auburn.....	A	A	A	A	A
Autocar.....	A	A	A	A	A
Avery.....	A	A	A	A	A
Buick.....	A	A	A	A	A
Cadillac.....	A	A	A	A	A
Cartercar.....	A	A	A	A	A
Case.....	A	A	A	A	A
Chandler.....	A	A	A	A	A
Chrysler.....	A	A	A	A	A
Chevrolet.....	A	A	A	A	A
Cole.....	A	A	A	A	A
Cummins.....	A	A	A	A	A
Delaney-Belleville.....	A	A	A	A	A
Detroit.....	A	A	A	A	A
Dodge.....	A	A	A	A	A
Empire.....	A	A	A	A	A
Federal.....	A	A	A	A	A
Ford.....	A	A	A	A	A
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Oakland.....	A	A	A	A	A
Oldsmobile.....	A	A	A	A	A
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Packard.....	A	A	A	A	A
Pontiac.....	A	A	A	A	A
Peerless.....	A	A	A	A	A
Pierce Arrow.....	A	A	A	A	A
Pullman.....	A	A	A	A	A
Reo.....	A	A	A	A	A
Richmond.....	A	A	A	A	A
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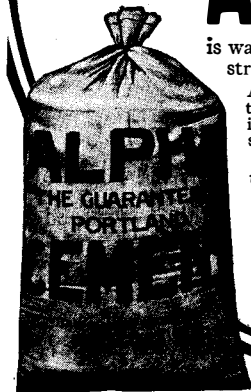
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NATIONAL DEFENSE AND INTERNATIONAL PEACE

observers, so much so to one of them that he volunteered to aid in laying out a military problem for a future truck run in which small and large trucks will be made to carry their respective loads over the same route, with a view to comparing their efficiency directly.

While it was admitted that in cross-country running, trucks of light capacity probably are more efficient than heavier ones, because of the elimination of the rolling effect of the wide tires, due to the lack of road foundation, it was pointed out that only about 10 or 15 per cent of the transportation of the 175,000 pounds of supplies which are required daily by an army division is cross-country work, the remainder being expressed in the haul from the rear base to the one nearest the actual fighting line. It is in this particular work in which the heavy-capacity motor truck stands pre-eminent, for this class of transportation is not vastly different from commercial haulage, in that the problem remains simply the transportation of a certain amount of goods over a certain route in the minimum of time. Where there are heavy loads to be hauled, commercial users of trucks have found that the larger the unit of goods hauled per vehicle, the less cost per ton.

Another very important advantage of large over small trucks for army transport work is that the number of the former to carry a certain given tonnage takes up less road space than the latter. This advantage cannot be overlooked, for it provides so much more road space for the passage of troops.

Aside from the question of capacity, the trip brought out forcibly the need for some form of day and night signaling devices to enable officers at one point of the train to communicate with those at others. In several cases the roads were so narrow that even the officers' passenger car could not pass one of the trucks en route without becoming mired. If the trucks left the center of the road, they, too, became mired. Motorcycles are out of the question except on good roads. Whether the solution of this problem will be the development of a semaphore arrangement on each truck for day work, or searchlight flashes or tail light signaling at night remains to be seen.

NEW BOOKS, ETC.

STARTING, LIGHTING AND IGNITION SYSTEMS. Elementary Principles, Practical Application, Wiring Diagrams and Repair Hints. By Victor Pagé, M.E. New York: The Norman W. Henley Publishing Co., 1916. 8vo.; 509 pp.; illustrated by 295 specially made engravings. Price, \$1.50.

A notable addition to the literature of automobile electricity is this compact volume by a well-known writer and expert. The last two or three years have witnessed many changes and improvements in starting, lighting, and ignition accessories and motorist and repairman must continually familiarize themselves with the new variations in practice. This handbook provides the maximum of information in the minimum of space, and every detail is made distinct and explicit. A discussion of elementary electricity clears the way for the specialized information of succeeding chapters; the work then takes up, in turn, battery and coil ignition methods, magneto ignition systems, elementary electric starter principles, typical starting and lighting systems, and starting system faults and their systematic location. As electricity is coming into popular use in the operation of many other accessory devices, a final chapter is given over to these applications, among them being electric alarms, horns, direction indicators, gear shifts, and brakes. Throughout, the reader is impressed by the convenient arrangement of material, the many excellent illustrations which often make clear at a glance what would otherwise require long descriptions in the text, and the up-to-the-minute character of the information offered. It would be hard to conceive of a work better adapted to the needs of those in any way interested in that modern equipment of the automobile which so largely contributes to its safe, economical, and pleasurable operation and control.

CUBAN CANE SUGAR. By Robert Wiles. Indianapolis: The Bobbs-Merrill Company, 1916. 16mo.; 85 pp.; illustrated. Price, 75 cents net.

"Cuban Cane Sugar" is a most attractive little treatise on an industry whose importance is not sufficiently appreciated. The world's sugar crop is much larger than her cotton crop, and is surpassed only by the grain crops. Cuba, by virtue of the superior quality and depth of her soil, seems entitled to the by-

name of "the world's sugar bowl." Mr. Wiles tells in an unusually entertaining manner the story of sugar, with particular reference to the Cuban industry, until the reader is familiarized with the history of the product from soil to sack. His book also contains much suggestion for increasing the output by improving the quality—and hence the sugar content—of the cane. While the work addresses itself to the general reader, it must appeal strongly to the investor. Its array of reliable statistics and its suggestions toward agricultural and refining efficiency should make it particularly valuable to the man who is financially interested in sugar production.

A STUDENT'S BOOK ON SOILS AND MANURES. By E. J. Russell, D.Sc. Cambridge, England: The University Press. New York: G. P. Putnam's Sons, 1915. 8vo.; 206 pp.; illustrated. Price, 90 cents.

Successful crop production is so largely dependent upon the quality of the soil that the farmer is coming to recognize more and more the importance of a better understanding of soils and fertilizers. Dr. Russell's work offers a course that assumes no knowledge of chemistry, preferring to leave chemical explanation to the judgment of the teacher. The first division of the work deals with the composition and the organic matter of the soil, and with the needs of the plant, together with a brief consideration of the effects of climate on fertility; the second division takes up cultivation and the control of fertility; and the final section of the text is devoted to fertilizers. There are many illuminating illustrations and an appendix cites numerous methods of soil analysis.

THE FINGER PRINT INSTRUCTOR. By Frederick Kuhne, Bureau of Criminal Identification, Police Department, City of New York. New York: Munn & Co., Inc., 1916. 8vo.; 155 pp.; illustrated. Price, \$2 net.

Seldom do we find a work that places before the student the whole science of an attractive, uncrowded, and promising occupation, but this is precisely what Mr. Kuhne, of the Bureau of Criminal Identification, has done in "The Finger Print Instructor." The public knows little of this subject, save what it gets from its fiction, and the matter has hitherto been surrounded by an aura of mystery. Yet as a means of identification the finger print has repeatedly shown its superiority over both handwriting and physical measurements. Handwriting experts so often flatly contradict each other that the judiciary and the public have lost faith in their testimony; no such fiasco is likely to arise where a comparison of finger prints is in question; here identification is quickly made, or the evidence thrown out, on positive and definite findings. Even the Bertillon system of physical measurements presents great disadvantages when compared with the finger print method. It calls for a costly and ponderous equipment, and for a high degree of proficiency; its decisions may be arrived at only after long research; worse still, the human body being an organism subject to growth and change, the deductions of any measurement system are frequently inconclusive and open to argument. None of these drawbacks are found in the finger print method. The equipment is simple, inexpensive, and portable. Definite conclusions are usually reached in less than five minutes. Its principles are applicable to any age from babyhood, through maturity, to death; and only decomposition can destroy the irrefutable testimony which the ridge-lines of the fingers disclose. As Mr. Kuhne points out, the finger print system has so far been restricted—with the exceptions of the impressions of illiterates as taken by some savings banks, and the identification of dead upon the battlefield—to criminal procedure; but signs are not wanting that its sphere of usefulness is to be greatly extended. Certainly the "scientific efficiency" movement cannot long ignore the admirable adaptability of this means of identification to the requirements of banks, corporations, life insurance companies, the Immigration Bureau, and the Bureau of Elections. In short, the finger print system bids fair to find its highest usefulness in industrial and financial life. Again, were every citizen required to file impressions, it would mean immediate notification of his family or friends in the event of accident or death. All sound reasoning must favor the general adoption of this system, and it is safe to prophecy that its universal use would modify our criminal statistics by vastly increasing the difficulties of successful forgery and impersonation. The author of the work in hand has every qualification for imparting to others an efficient knowledge of this fascinating occupation. He has reduced intricacies to their simplest forms, and difficulties melt away before his penetrating dissections and clean-cut explanations. The work is profusely illustrated with a large variety of actual finger impressions, and nothing of principle or practice is withheld from the reader. Once the easy instructions are mastered, the student will find himself fully qualified to take and file prints, and to identify any individual from the filed records. A pocket in the cover of the book contains a number of facsimiles of the cards used for filing impressions, showing their actual appearance and the mode of designating the different varieties of impressions with which the operator comes in contact. Mr. Kuhne's work is based upon the Sir E. R. Henry system, and the comprehensive information and exposition it offers make it an invaluable desk-book for the expert, as well as a text for the student.

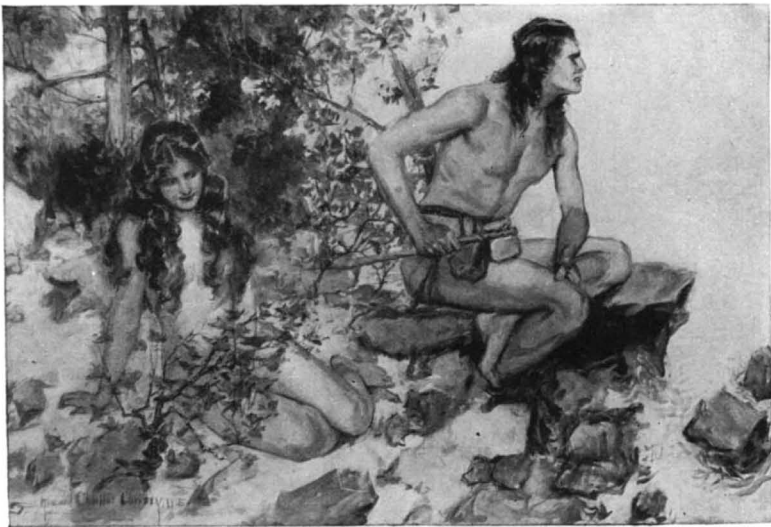
"Mr. Britling Sees It Through"

is the title of H. G. Wells' new novel which graphically pictures the awakening of the slow-moving British mind to the actuality of war. The blundering inefficiency of English institutions and the essential soundness of English character are summed up by England's leading novelist in this vivid, intimate, humorous and moving story of a quiet countryside. The first chapter of Mr. Wells' latest serial will be published in the April 29th

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416 West 13th Street, New York City

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Morgan Robertson's genius leaped beyond the conventional love story. In this idyll of young love he pictures man and woman in an amazing situation—in conditions as primitive as when Adam found Eve.

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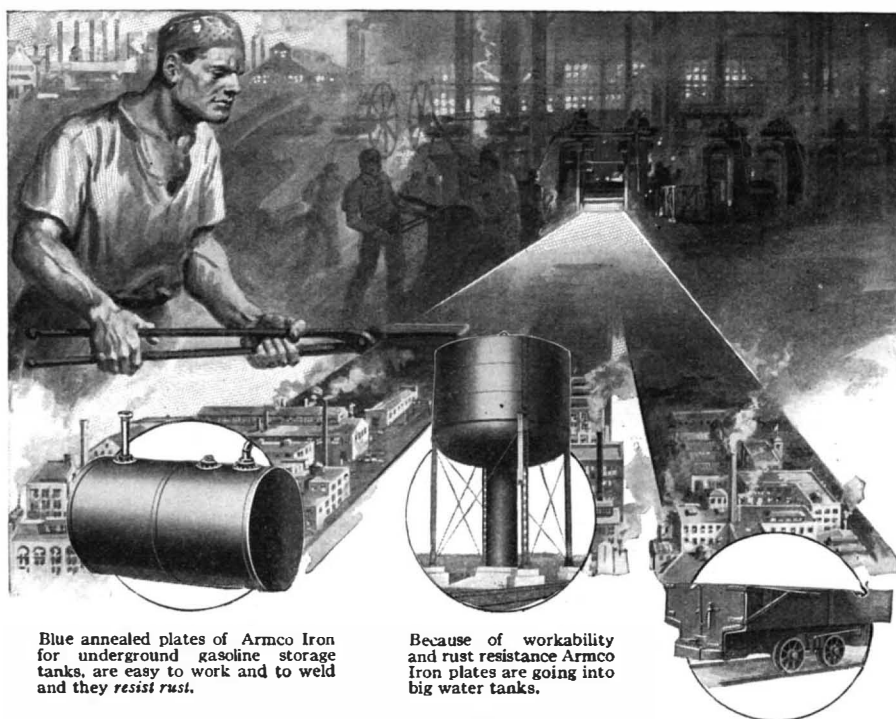
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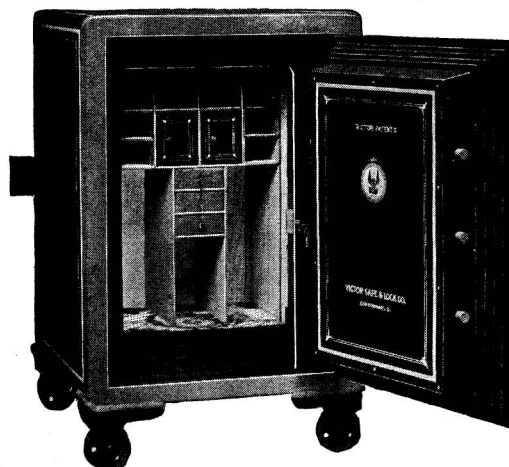
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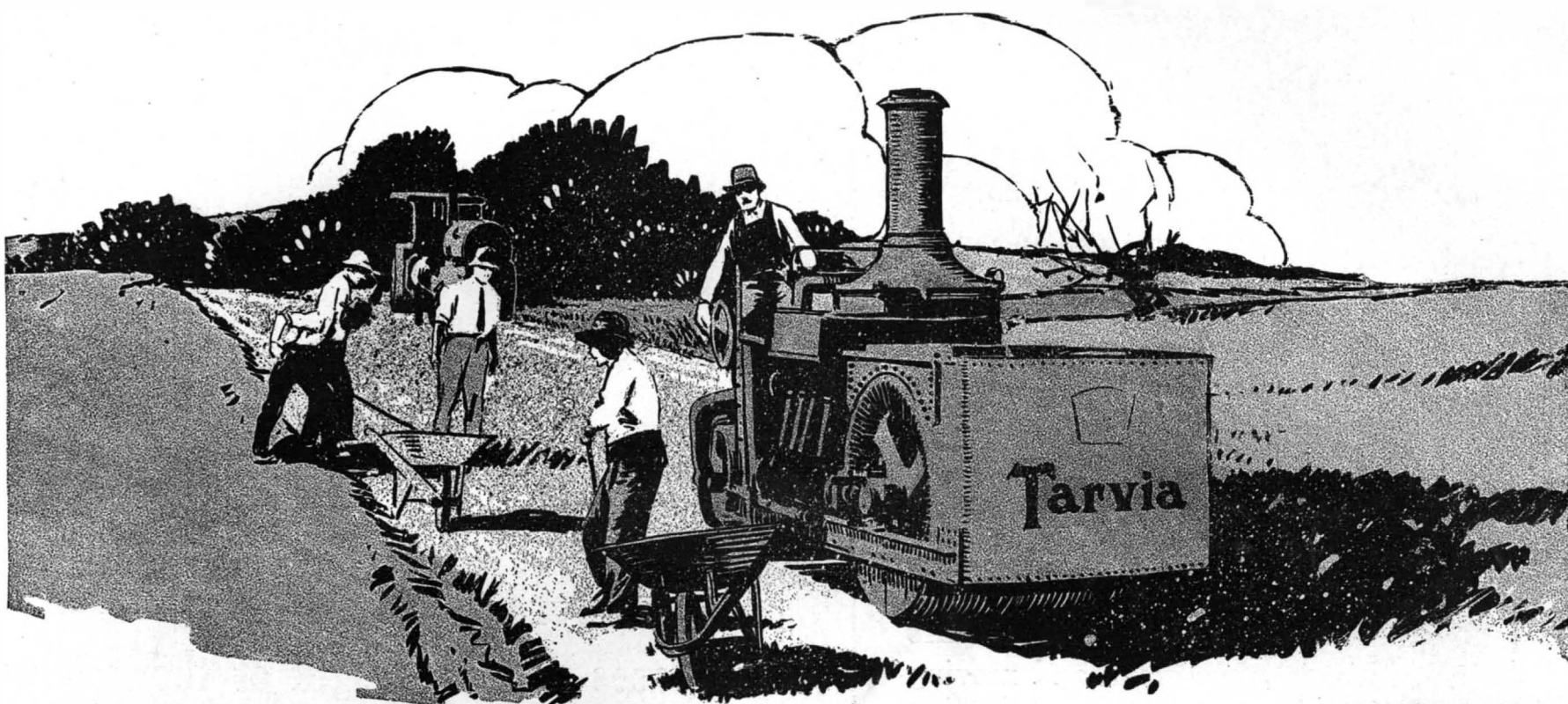
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GOOD ROAD BUILDING

How Tarvia Makes Durable, Dustless, Mudless Roads

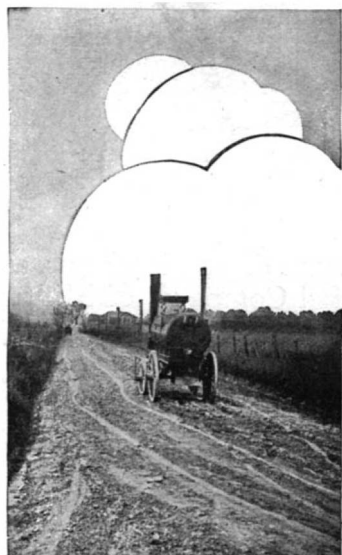
What You Already Know About Tarvia Roads—

YOU know, from the "ads" you have been seeing so long, that Tarvia Roads are *durable, smooth, resilient, dustless, mudless*, and at the start cost little more than ordinary macadam, and in the long run cost less.

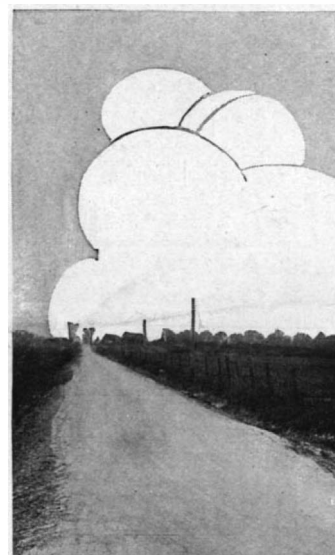
You know, from probable experience in motoring or driving over Tarvia Roads, (for they are now in nearly every section of our country), that all these statements of *quality* are facts.

You know, (if a citizen in a Tarvia neighborhood), how Tarvia Roads have brought a new comfort to living, and have reduced distances by their splendid smoothness. You know, (if a taxpayer in sections where Tarvia has been used), that the claims of superior economy are also facts.

But, perhaps, you may not know, (not having sent for a Tarvia Booklet), how Tarvia Roads are made, and how the above results surely follow the process. Here are a few facts that we think will interest you.



Phillips Werner Road, Rochester, Indiana
Before Treatment with Tarvia.



Phillips Werner Road, Rochester, Indiana
Shows transformation of road surface after the use of "Tarvia-X."

What Tarvia is

Tarvia is a coal tar preparation, shipped in barrels or in tank cars. It is made in three grades, to be used according to road conditions: viz.

"Tarvia-X," "Tarvia-A," "Tarvia-B."

The chief use of Tarvia is for constructing and treating macadam roads,—to make them durable, smooth, resilient, dustless, mudless, water-proof.

It is also used on concrete roads, on brick pavements, and even on good gravel roads,—to smooth out irregularities, to arrest disintegration, and for repairs.

"Tarvia-X"

is always to be used when you are building a *new* macadam road, both as a binder and surface coating. The old way in building macadam was to use *water* as a binder.

But a water-bound macadam wears out quickly under the prying strain of the automobile driving-wheels and the horses' hoofs. You know how that strain loosens the surface, grinds it into clouds of dust, makes heavy mud, and leaves the road full of holes.

Results and Cost of "Tarvia-X"

With "Tarvia-X" in place of water, you have a road smooth enough to dance on—resilient enough for rubber tires to grip on without skidding, or for horses to trot on without slipping, without dust in dry weather—without slime in wet weather. You have a road that *lasts*.

The first cost of making a tarvia-macadam costs but little more than the old-fashioned macadam, but the saving in maintenance more than pays this difference. So Tarvia costs you nothing!

"Tarvia-A"

is, practically a thin "Tarvia-X," used for re-coating the surface of a macadam road already built. It is applied hot and adds greatly to the life of the road. It keeps the road dustless, smooth, and inviting to traffic, but its use is confined to certain kinds of traffic to be economical.

"Tarvia-B"

is a much more widely used preservative. It is applied *cold*. It is thin enough to sink quickly into the road, yet strong enough to bind the surface particles together into a dustless, durable surface. "Tarvia-B" offers the lowest cost

of road maintenance yet invented. It can be used effectively, for repairing and preserving macadam roads under varying conditions of traffic and situation. It may even be used effectively on certain classes of gravel, shell and adobe roads.

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An important point about Tarvia construction is the fact that traffic begins immediately after the road is finished—there is no delay. The traffic itself gives the finishing touch to the perfect whole.

Special Service Department

In order to bring the facts before taxpayers as well as road authorities, The Barrett Company has organized a Special Service Department, which keeps up to the minute on all road problems.

If you will write to nearest office regarding road conditions or problems in your vicinity, the matter will have the prompt attention of experienced engineers. This service is free for the asking.

If you want *better roads* and *lower taxes*, this Department can greatly assist you.

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