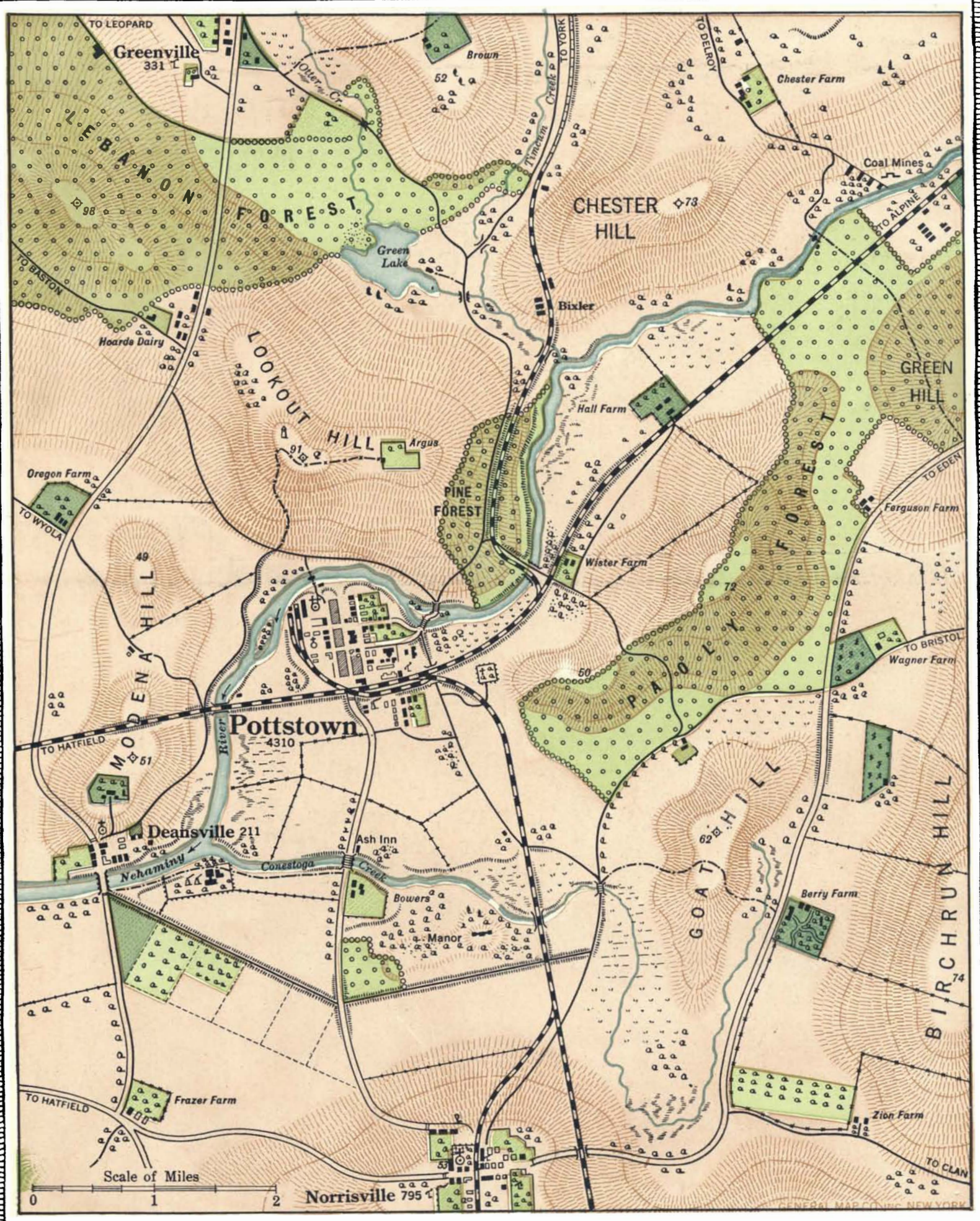
SCIENTIFIC AMERICAN



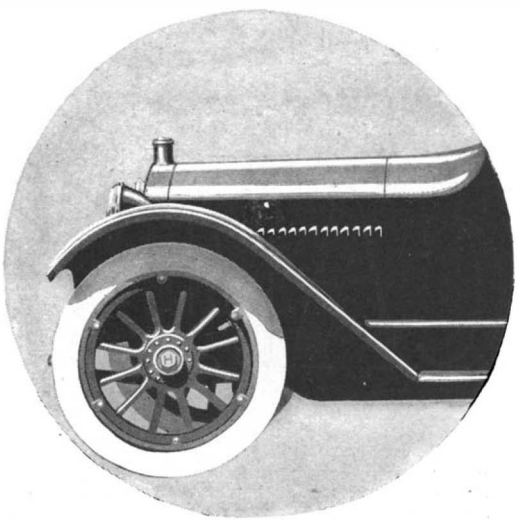
Map of the imaginary region in which the Scientific American War Game is being played.—(See Page 328.)

March 25, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Hupmobile



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SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIV.]
NUMBER 13

NEW YORK, MARCH 25, 1916

[10 CENTS A COPY
$3.00 A YEAR

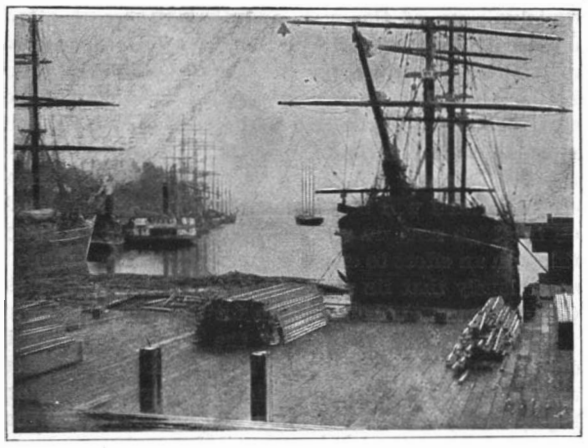
Our Vanishing Export Trade in the Products of American Forests

SINCE the days when the pioneer axeman went into the American forest to find resources whose natural advantages were not eclipsed in any land, the once great, and still important woodlands of the United States have been tapped repeatedly for use not only here but elsewhere in far corners of the world. The forests of America were very nearly everything in the beginning, and without them the settlers would have had far less with which to make their start, little in fact as they did have as such things are reckoned now. Not long following the discovery and adaptability of Colonial woods here, they began to make their way abroad in divers forms, slowly at first, but gathering headway as time went on.

By sled and crude plank road; in raft and drive; later by great lake tugs and barges; by logging spurs and standard gage, American lumber found its way down to the coast, and its merits spread. Abroad, some things especially contributed to this. Among the early English navies, already beginning to wrestle with others for the supremacy of the seas, our native oak had found, and kept, a quite important place; other kinds became well known there too, for as a sawmill man the American had antedated the Englishman by some generations, and the English forests no longer ranked as important producers of wood and timber. Elsewhere, in Europe, this new trade took hold. Following the Revolution in this country the returning Hessians took with them to Germany quantities of the white pine seeds produced by our trees here. These they planted with German skill, and the American white pine has been growing so long in the Fatherland that no doubt many of the people there mistake it for a native now.

As familiarity with American woods and trees progressed, the trade in them increased, and that in timber alone showed remarkable gain. Dividing into four periods the last half-century, the annual value of exported timber from 1865-1869 was only $1,451,607; that from 1870-1881, $3,794,097; 1882-1899, $6,131,414; and during the last, and fourth, period, the yearly value grew to $12,412,688. It practically doubled with each of the periods given, and this branch of the industry is only normal so far as the remainder is concerned. During the ten months preceding November, 1913, a thoroughly average period, there were sent to foreign countries from ports of the United States logs and round timbers, firewood and hewn timbers, lumber, cross-ties, box shooks and other manufactures of wood worth in the aggregate $100,076,690. This is a considerable total, and the figures are for only the value of these things from the forest; there is no mention of what they are worth to the shipping and railroad interests, to the lumber business here, of which it has been estimated that their export trade in normal times was fully 10 per cent of the whole, and to the labor and numerous allied interests dependent upon it abroad and here.

There they counted much upon their regular imports of American woods, and it was a well-found trade. Freight rates by boat were very reasonable, that from America to Europe being no more than for a few hundred miles by rail on land. The traveler, for instance, who visited the Netherlands, and Rotterdam at the outlet of the Rhine, could not fail to remark the piled-up stocks of wood and timber. Some was used there, but if the traveler journeyed up the Rhine to Germany he passed great steamer-loads of this same lumber en route to Frankfort or perhaps Mannheim, the German city that boasts the largest inland harbor in the world. There, on the waterfront, he saw again much of this same material, ready now for unloading and distributing to many parts of the Empire, then to be returned to us after some months as novelties, toys, perhaps tanning materials, extracts or whatever the cheap but skillful manufactories could produce there and sell here. It was a good trade, and the lumber from America was paid for as soon as it had been loaded upon the great freighters on this side. Germany was in no sense the only great user, either, but she was typical.



A lumber vessel in port

The lumber business at Port Blakely, Washington, is largely carried on through ocean shipments. The stacks of rough material are ready for loading, and sailing vessels still carry most of the coastwise cargoes.

Two years have made a change. The extensive German trade which had been piling up for many years abruptly ceased not long after the commencement of the war. Reports of the foreign commerce of the United States in wood make no mention of Germany for the ten months to the 1st day of November, 1915, and the trade with Belgium has also disappeared. True, in England, France and some of the other countries there still exists a slight demand. Black walnut, not only good for gun-stocks, is also being used for aeroplane propellers, while for white pine and spruce, ash and hickory, there have been found some special uses. Such woods are being exported in long, straight logs, but trade in them represents an unfortunately small part of what our exports formerly were, and the cheaper woods sold for such purposes as the construction of temporary army barracks at training and concentration camps has not enlarged the total greatly. The United Kingdom for example is receiving exports of wood worth about three quarters of what they normally should be. The United Kingdom, it may be added, makes a better showing than the rest.

Considered *in toto*, the trade which two years since was quoted at $100,076,690, has been for the corresponding period of 1915 just $45,325,146—45.3 per cent of the former figure. For 1914, which was part peace and part war, this trade was 68.8 per cent of, we might say, the normal. And while the reason for most of this is plain, the same figures show unmistakably that we have not improved our trade with the countries of South America. It is impossible to say what the reading will be in 12 months more. With the resumption of "ordinary" times here and average conditions there, this export trade may regain its

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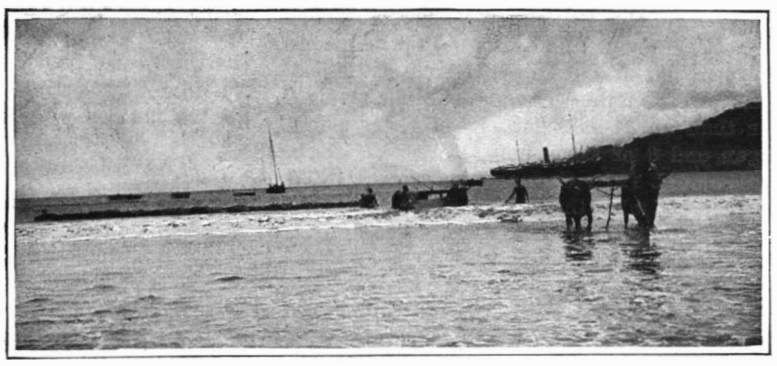
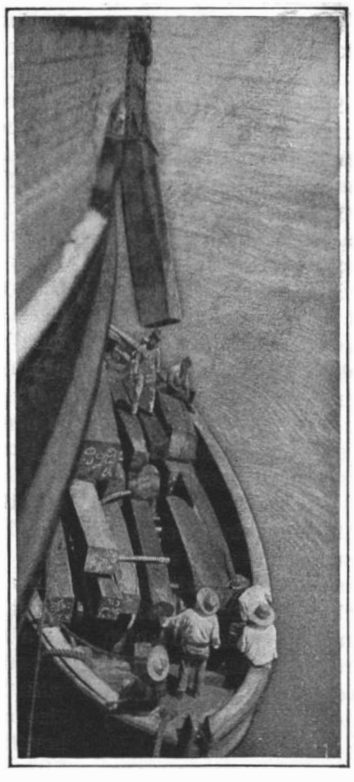


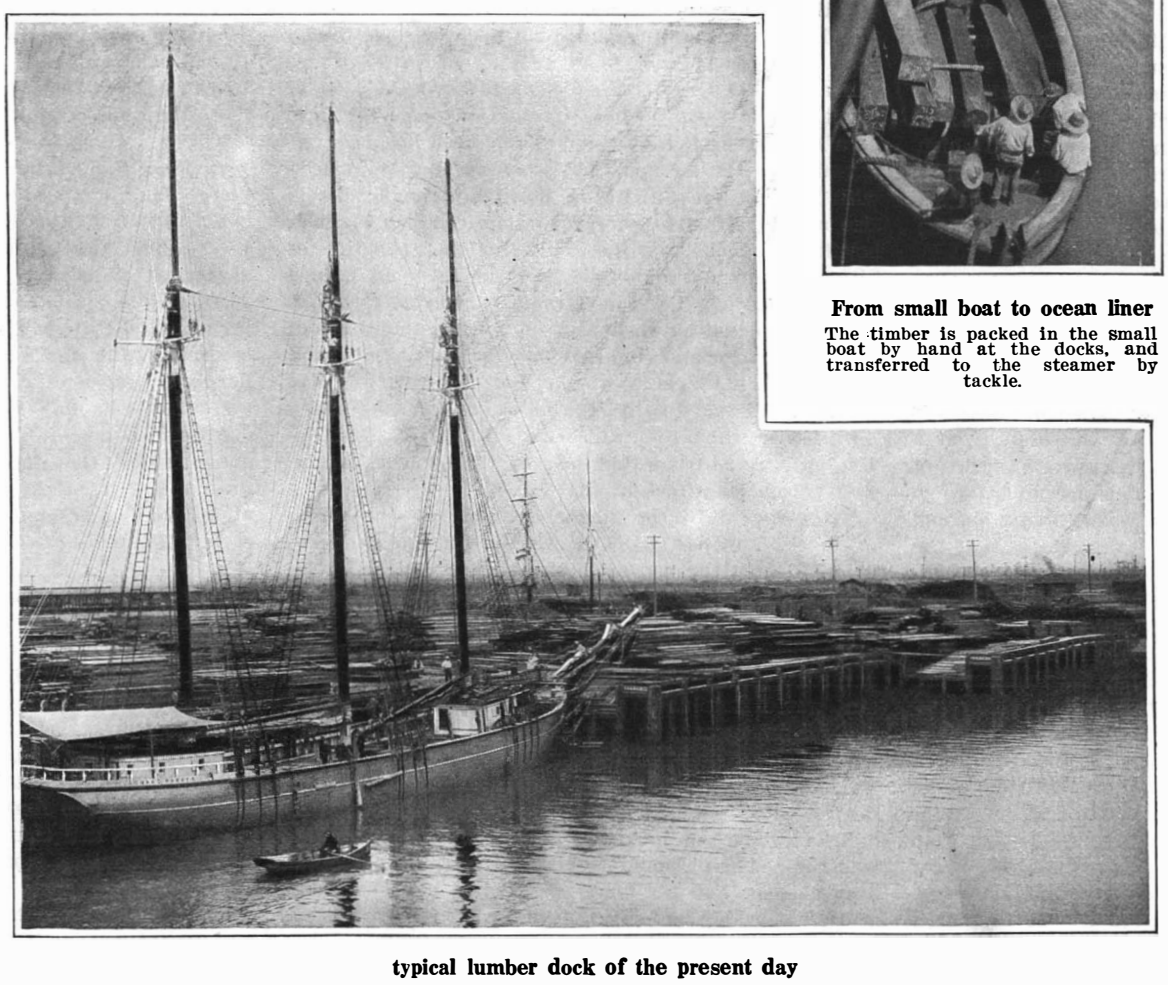
Crude methods of loading lumber in Central America

Rough-hewn sticks of timber are taken beyond the breakers by men and oxen, and from there conveyed by small boats to the freighter. Primitive methods still prevail, and so far no better means of "stowing cargoes" has been discovered.



From small boat to ocean liner

The timber is packed in the small boat by hand at the docks, and transferred to the steamer by tackle.



typical lumber dock of the present day

Savannah is not popularly considered a great lumbering center, yet great quantities of timber are usually shipped from there. The schooners are docked in individual berths, and the lumber assembled here comes by rail from a very large territory inland.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, March 25, 1916

Charles Allen Munn, President, Frederick C. Beach, Secretary.
Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Matter at the Post Office Department, Canada
Trade Mark Registered in the United States Patent Office

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.

Industrial Preparedness for War

THE most practical and comprehensive work looking to preparedness against war is that being done by the Committee on Industrial Preparedness of the Naval Consulting Board. With the object of effecting a complete mobilization of such of the country's resources and manufacturing facilities as may lend themselves to the production of war material, the Committee is enlisting the services of the great engineering societies of the country, including the civil, mechanical, electrical and mining engineers' societies and the chemical society. As the result of this effort, some 30,000 highly educated and thoroughly expert men scattered throughout the length and breadth of the United States have undertaken the voluntary work of gathering and forwarding to the sub-committee complete statistical data regarding the industrial facilities and resources of the country. The assistance of the financial and business men of the country, moreover, has been assured through the hearty coöperation of that powerful institution, the United States Chamber of Commerce.

The plan of operation is to send to every one of these 30,000 engineers a tabulated form, broadly similar to those used in census taking, on which will be recorded the nature of the product or products turned out by the various manufacturing concerns; the number of employees; the size of the plants, and the character of their equipment; the facilities for transportation, both of the raw materials and the finished product; and a score of other facts bearing upon the question of the suitability of the various concerns investigated to turn out munitions or other military supplies.

Although the details of the working plan which will be based upon the statistics thus gathered have not been finally determined, the broad idea will be to place with each of the concerns included in the mobilization a yearly order for a small amount of those army and navy supplies, for the furnishing of which in war-time, on a large scale, the plant is suitable. These small orders will be filled under the standard specifications of the government.

The manufacturers selected will thus gain experience in turning out supplies that are subjected to the regular government tests; they will become familiar with government procedure, and they will ultimately be in a position to start upon the large emergency orders which would be received upon the outbreak of war. The work will be done on a cost plus a reasonable profit basis; and thus the war-for-profit cry of the pacifist will be smothered!

Modern war is machine-made. More than ever before and far more, even, than the experts had imagined, science and machinery have proved to be the dominating elements on the battlefields of to-day. The possession by a country, such as ours, of scores of thousands of machine shops and millions of skilled mechanics is no guarantee that it can go to war successfully at a week's notice. On the contrary, the sad experience of many of the American firms which accepted foreign orders for munitions at apparently very favorable and lucrative prices, has proved to our engineers that the manufacture of war material is an exceedingly specialized branch of the engineering arts, calling for the provision of special tools and appliances before the manufacture of a shell or a rifle can be even commenced. In proof of this, consider, for instance, the fact that the millions of rifles ordered from this country must be made in all their parts to the thousandths of an inch and pass the searching test of specially fine gages—the mere bolt mechanism of the rifle alone having to pass the test of over 160 gage measurements. It was found, when the huge foreign war orders were being placed in this country, that there were only three firms engaged in the manufacture of such gages as were necessary; and it was estimated that, if dependence had been placed on these firms alone, it would have taken years of time and millions of money merely to provide the gages necessary before manufacture could be undertaken.

The story of the delay in the delivery of war orders to the Allies from this country affords eloquent testimony to our state of unpreparedness. So much time has been lost in the preliminary work of getting ready to manufacture, that we are authoritatively informed that not a single shell out of the millions that have been contracted for has yet been fired from a French gun.

The German Fleet in the North Sea

THAT the German main fleet has lately passed out from the shelter of Helgoland and has been maneuvering in full strength in the easterly half of the North Sea seems to be pretty well established by the cable dispatches from Great Britain and the neutral countries. A considerable portion of the British press is disposed to interpret these movements as an indication that the German Admiralty, after nineteen months of preparation is about to put the supremacy of the British Navy to the test in a great general engagement.

There is every reason to believe that 1916 will be the decisive year of the war, and that the great attack on Verdun will prove to be the forerunner of a series of violent offensives by the Central Powers, which realize that they have now reached the maximum of their fighting strength and, if they are to win the war, must do so in the coming months, or never. Some of the British naval critics believe that the great German effort on land will be matched by a stupendous battle on the high seas, in which Germany will stake everything on an effort to crush the British fleet or cripple it so seriously that its stranglehold on the throat of the Central Powers will be broken for the rest of the war.

Judged by the strength of the respective fleets in dreadnoughts, such an attack, if it be made, must seem to all impartial critics to be in the nature of a forlorn hope; for if all the battleships and battle-cruisers that were authorized by the two nations when the war began have been completed, Great Britain now has 48 dreadnoughts against Germany's 24. And it must be remembered that this preponderance of 100 per cent in mere numbers does not represent the full advantage enjoyed by the British; for none of the 48 battleships carries a gun of less than 12-inch calibre and 32 of them mount guns of 13.5-inch or 15-inch calibre; whereas, 11 of the German ships mount nothing heavier than an 11-inch gun, 13 of them mount a 12-inch gun and 3 of them, only, mount a 15-inch, or, if recent reports from Germany be correct, a 17-inch gun. In speed also the British have a marked advantage, their battleships running from 21 to 25 knots (this latter in the case of the five Queen Elizabeths) as against speeds of 19½ to 23 knots of the German battleships. Furthermore, the British can oppose 10 battle-cruisers of from 25 to 30 knots speed against 7 battle-cruisers of from 25 to 29 knots speed.

On paper, then, the superiority of the British fleet is overwhelming, and it is this fact which has led to a growing conviction, at least among the lay public, that the German navy "has something up its sleeve," and that when the rival forces are engaged, it will be found that German ingenuity will uncover some totally new, unexpected, and overwhelming enginery of sea warfare, which will be sufficient to turn the tide of battle to her favor. These speculations take the form of a belief: first, that the German fleet has been rearmed (as the German press has frequently stated) with 17-inch guns, and with howitzers comparable in size and destructive energy to the 16½-inch German howitzer, which stole the credit for the reduction of Liege, Namur and Mauberge from the Austrian 12-inch Skodas; second, that the German submarine fleet has been augmented by an unsuspectedly large addition of new submarines of unusual power and speed; and thirdly, that the skill of the German chemists has furnished the navy with huge smoke- and gas-producing shells, with which they will break up the British battle-line as effectually as they cleared the trenches in the first poison-gas attack of the war.

With regard to the rumor that the German fleet, or indeed any portion of it whatsoever, has been rearmed during the war with the 17-inch gun, let it be understood that such rearming is, in the very nature of things, impossible. So great would be the size and weight of a 17-inch gun that the existing turrets, barbettes, gun carriages, ammunition hoists, magazines, etc., would have to be taken out of the ship and entirely new structures, far more massive, occupying much greater space, and of considerably greater weight would have to be built into the ship. Probably the hull itself would have to be strengthened to withstand the additional stresses imposed; and by the time the job was completed it would be found that it would have been cheaper and far more effective to have built an entirely new ship. If any 17-inch naval guns have been mounted it has been in the three latest ships of the "Frederick III" class, which, when the war opened were not so far advanced but that the necessary hull and gun position changes might have been made. As for the mounting of big howitzers aboard the German ships, nobody knows better than the Germans themselves that the inaccuracies of howitzer fire, due to changing atmospheric conditions and the long period of flight of the projectiles, which worry the artillerists on shore, would be absolutely prohibitive, if the howitzers were fired from the ever-moving platform of a ship at sea.

As to the ability of the Germans greatly to modify naval tactics by the introduction of smoke- and gas-bombs we have our doubts. True it is that photographs taken from an English cruiser have been published showing, or purporting to show, in the distance and lying low on the water, a dense bank of dark smoke clouds produced in this way; but we doubt if, during a line-of-battle engagement, sufficient streams of shells could be poured at an enemy moving at 18 to 20 knots seriously to interfere with his vision. The destroyer smoke-attack, first developed in our navy and used by the Germans in the North Sea fight, is far more effective than any practicable number of smoke-bombs could be, and if the Germans make use of the smoke screen they will do it by that means.

If the German Admiralty has anything "up its sleeve" it probably will have to do with its mining and submarine offensive. The very serious nature of the secret mine planting from submarines which Germany is now practicing, seems not to have been generally appreciated, and this form of attack, impossible of immediate detection as it is, might be used to deadly effect in the strategy and tactics of the great North Sea fight—should it ever take place. We are still of the opinion moreover that before the German fleet comes out to battle, its Admiralty will call home and assemble in the North Sea the whole of the German submarine fleet; and probably on the great day of trial the Germans will plant floating mines where the water is too deep for anchorage, and fields of anchored mines in shoal water such as obtains on the Dogger Bank, and that she will assign groups of submarines to assemble at certain definite stations in the North Sea. The main fleet, if it fails to attract the British to the mined waters off the German coast, will probably steam boldly to the English coast, draw the British fleet out, and then itself make a running fight of it to the eastward, endeavoring to draw the British fleet over the mine fields or into one or other of the waiting submarine flotillas.

The Rise of the Bureau of Standards

THE activities of the United States Bureau of Standards have now ramified so far, in a geographical sense, that the name of the institution is probably familiar to every reader of this journal; yet so rapid has been its rise that the majority of the population certainly does not realize the immense and ever expanding scope of its work. The name of the bureau is not illuminating in this respect until one learns that the "standards" with which it is concerned include standards of measurement, standard values of constants, standards of quality, standards of mechanical performance, and standards of practice. Hence it is very far indeed from being merely a "bureau of weights and measures." In fact, it combines functions that are, in most countries, entrusted to more than one official establishment.

The last annual report of the Bureau of Standards, reviewing its operations during the fiscal year 1915, is more than impressive—it is bewildering. A mere enumeration of the various lines of inquiry and service upon which the institution has embarked would fill several columns of this journal. From gauging the speed of photographic shutters to developing apparatus for measuring the heat of the stars; from testing twine to studying the effects of sea water on concrete; there is hardly a branch of industry in which the bureau has not taken a hand.

All this is magnificent; but it is also puzzling, when one considers that the total annual appropriation for the bureau is less than $650,000. Apart from the director, at $6,000 a year, and two chief assistants at $4,800 each, the experts of the institution do not receive such salaries as would discourage private establishments from bidding for their services. Lastly, even if, by some miracle, the bureau were able to attract and retain the very best technical talent of the country, the mere numerical strength of the staff would seem to impose a limit to its versatility.

Is the Bureau of Standards attempting too much? We hasten to say that if such is the case—and we do not insist that it is—there is only one remedy for the situation that the American people ought to consider for a minute, and that is an increase in the bureau's appropriation that would enable it to live up to its ambitious programme.

For the Bureau of Standards has become absolutely indispensable to American manufacturers and dealers in public utilities.

Automobile Notes

Fire Dangers.—Most everyone who has had any dealings with machinery knows about the liability of oily rags and waste that have been used for cleaning purposes to ignite from spontaneous combustion; but few are aware that sawdust, when soaked with oil drippings, will act in the same way. Sawdust is sometimes seen scattered over garage floors, but this practice should be prohibited. Sand is the safest for absorbing drippings.

Some Causes of Accidents.—It has been frequently noted that accidents seldom happen when the driver is riding alone, and the inference is drawn that when he has passengers he "visits" with them, thus having his attention diverted from his duties in guiding and controlling the machine. There is still another situation that has not been mentioned, and that is the petty minded man who wants to "show off," or worse still, who thinks it funny to frighten his passengers by taking risks that he would not think of doing when alone. Such cases are but too common, and it is a pity that there is not a psychologic recorder that will expose such people and lead to a revocation of their licenses.

Are Cars Too Complicated?—Almost every new model that is brought out has some new attachment or fitting intended to promote the convenience of operating, but the question arises whether our cars are not becoming too complicated for the average user. Even where a professional driver is employed it can hardly be expected that he can be an expert in the many different directions necessary to proper adjustment and repair of the car of to-day. The bicycle is about as simple a piece of mechanism as can be conceived, but in their day a favorite claim of some makers was that they were "fool proof." It was not a particularly tactful expression, but if such construction was necessary then, how much more desirable now.

Alloy Pistons.—Much attention is being given to aluminum alloy pistons, and although they have been under investigation for some years, the user generally supposes that their value lies in their light weight. This is not the case, for, as a rule, little is gained in this direction. These alloys are so soft that it is necessary to fit larger wrist pins in order to secure them properly from coming loose, and to put in considerable metal to hold these pins, so that the resulting piston is little lighter than a good steel piston. There is, however, an advantage in using these alloys, for they are approximately three times better conductors of heat than cast iron or steel, and this is an advantage worth having, as the heads keep cooler than cast iron, and less carbon is produced. Also, owing to the metal being softer, there is less liability of such a piston seizing, and little injury results if it does. They also wear well in a cast iron cylinder.

Dimming Lights.—California has made a law requiring headlights to be permanently dimmed on state or public highways, and prescribes that the center rays must not strike the ground further than seventy-five feet in front of the automobile. A correspondent of that state tells how he has arranged his lights, as follows: The lower part of the headlight is covered with "lamp frosting" up to the level of the center of the electric globe, and this cuts out the rays that shine upward, and only permits the free passage of the downwardly directed rays from the upper half of the reflector. The lamp must be properly focussed, and the lamp itself is tilted slightly downward if necessary. This arrangement gives the full power of the light on the road, but does not dazzle approaching drivers. This method of dimming is directly contrary to the usual practice, in which the upper half of the lamp glass is frosted, but it obviates excessive tilting of the lamp, and the results are stated to be superior.

Automobile Accident Records.—According to the best statistics, the number of automobiles in the United States increased from 200,000 in 1909 to 1,750,000 at the end of 1914. The number of deaths attributable to automobiles rose in the same period from 632 to 2,623, or an increase of 775 per cent. However, statistics indicate that the proportion of fatal accidents to the number of automobiles is decreasing, indicating that the drivers of automobiles are becoming more skilful and more careful. Of these fatalities a noticeable proportion occur at railway crossings, and for these the victims can only blame themselves, for the necessities of the majority of automobilists are not so pressing but that they can spare enough time at a railroad crossing to insure their own safety. The majority of other accidents occur in cities, and there is no question but too many city drivers attempt to maintain too high speeds. Undoubtedly the walking public is extremely careless—even stupid; but this does not free the automobilist from the obligation to drive his heavy car with caution, especially when it is considered that a speed that would insure freedom from accidents only amounts to the loss of a very few minutes in a day.

Astronomy

Observations on Mars at the Lowell Observatory during the present opposition show that the canal development strikingly corroborates the theory of seasonal dependence on the melting of the polar cap. The northern canals are now very dark, indicating increased activity with advancing spring, while the southern canals are faint in their autumnal decline. The season in the northern hemisphere of Mars is now late April.

Recent Observations of Saturn at the Lowell Observatory show a remarkable change in the color and brightness of the planet's ball, which is now of a pinkish brown tint and strikingly darker than the rings. Comparisons of the stellar magnitude of the planet with Capella, Procyon and Mars also show that its brightness is less than that predicted in the ephemeris.

Progress of the 100-Inch Telescope.—Director Hale, of the Mt. Wilson Observatory, reports in a recent note that at the close of the 1915 construction season the steel dome for the 100-inch reflector—the world's largest telescope—was completely inclosed and in working order. The shipment of the tube, constructed at the Fore River Ship Yards, has been delayed by the suspension of traffic via the Panama Canal. The parabolizing of the 100-inch mirror is now 85 per cent complete. It is not now thought that the great telescope can be ready for use before the summer of 1917.

Dark Celestial Objects and their Luminous Background.—Prof. E. E. Barnard has recently called attention to the discovery of many dark objects on the photographs taken with the Bruce telescope of the Yerkes Observatory, often in regions of the sky where there is no ordinary nebulosity and where the stars are too few to form a luminous background for their relief. The appearance of these objects in black relief on the plates can perhaps be explained on the assumption that space itself possesses a feeble luminosity sufficient to affect the sensitive photographic plate with very long exposures. Similar dark objects are also seen in relief against a nebulous or stellar background.

Synchronous Solar and Planetary Phenomena.—Periodicities in various meteorological and magnetic phenomena on the earth have been more or less conclusively linked up with the sunspot period and other periods of solar activity; hence it is natural to look for analogous correspondences between the phenomena of the sun and of other planets than our own. In this connection *Nature* cites some recent researches by T. Köhl, who finds that Jupiter's northern cloud belts appear to be especially weak at times of sunspot maxima, and to become broader and more conspicuous during sunspot minima. Observations of the "secondary light" on the dark side of Venus suggest coincidence in time with auroral displays on earth, and the latter, of course, coincide with periods of solar activity.

Meteor Campaign.—In the SCIENTIFIC AMERICAN, of July 10th, 1915, announcement was made of a meteor campaign in which amateur astronomers were invited to take part. The object was to make an exhaustive study of meteor trails in order to connect them, if possible, with the orbits of lost comets. Prof. S. A. Mitchell, of the Leander McCormick Observatory, reports that the campaign has been very successful. The total number of observations sent in, up to the beginning of January, amount to no less than 4,644. This makes the largest piece of systematic work ever done on meteors in this country. From the observations sent in there are sufficient data for the formation of about 120 parabolic orbits, which, of course, give the paths of the meteors. The work is still proceeding and an invitation is extended to all who are interested in the subject, to write to the Leander McCormick Observatory, University, Va., for instructions.

Fluctuations in Solar Radiation.—The researches of Dr. C. G. Abbot and his colleagues show that short-period fluctuations of solar radiation were relatively large in 1913 and small in 1914. In the former year the values of the solar "constant" ranged over nearly 10 per cent, between the extreme limits of 1.81 and 1.99 calories, though the range was seldom more than 3 per cent in any ten-day interval. In 1914 the extreme range was only 4 per cent, between the limits 1.91 and 1.99 calories. Associated with these short-period fluctuations are found variations in the contrast of brightness between the center and edges of the solar disk. Strange to say, while greater contrast is associated with greater solar radiation and with numerous sunspots in the general march of the sun's activity, lesser contrast is associated with greater solar radiation in the march of the quick, irregular fluctuations of the sun's emission. "This paradox," says Dr. Abbot, "points to two causes of solar variation; the long-period changes may probably be caused by changes of the sun's effective temperature attending the march of solar activity; the quick fluctuations may be ascribed to changes in the transparency of the outer envelopes."

Electricity

Electric Lamps Burn for Thirteen Years.—While refurnishing the City Opera House at Waterville, Me., several carbon-filament incandescent lamps were found still giving service. These lamps, continues the *Electrical World*, have been in use almost every evening for 13 years.

Sea Water and Electricity as Disinfectant.—By the electrolysis of salt water there is being produced aboard the British hospital ship, "Aquitania," a powerful disinfectant in the form of a solution containing sodium hypochlorite, or available chlorine. The process is not new, but its present application is somewhat of a novelty.

Nitrogen-Filled Lamps Replace Arcs.—One by one the leading cities of the United States and Canada are gradually replacing the ordinary arc lamps with the new gas- or nitrogen-filled lamps. Not only do the latter type lamps eliminate the necessity of trimming the carbons, but they effect a saving which in some instances is reported to be about 35 per cent.

Electricity Reduces Mine Costs.—The Montana State mine inspector, in his annual report to the Governor, W. B. Oser, states in part: "By installing electric power in nearly every mining camp of importance in Montana, it has been made possible for operators to resume work on properties which otherwise would have been idle. This has done more to reduce the cost of mining than any other thing."

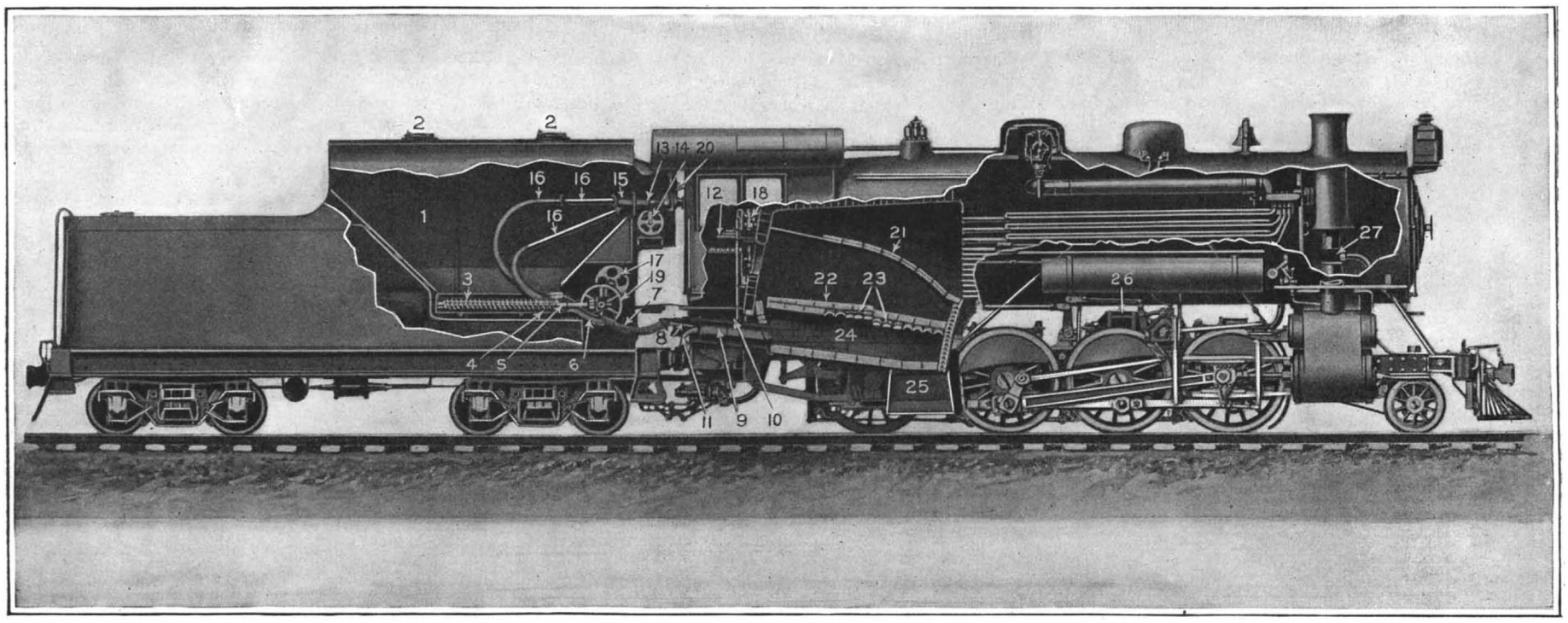
Longest Telephone Circuit in the World.—On February 14th the Bell Telephone Company successfully opened the Montreal-Vancouver telephone line. The line is 4,227 miles long as compared to the 3,400 miles of the New York-San Francisco line. The Montreal-Vancouver line does not run direct through Canada but instead for the greater part passes through the United States, touching the following connecting points: Buffalo, Chicago, Omaha, Salt Lake City, and Portland, Ore.

Cleaning Metals Electrically.—Although the electrolytic process of cleaning metals is comparatively new, it has recently been introduced by many large manufacturing concerns because of its efficacy and cheapness. The baths used are usually composed of alkaline substances such as sodium carbonate or potassium carbonate with small portions of potassium cyanide. It is said that with a current of from four to eight volts there is developed in such solutions sufficient hydrogen to remove organic substances from the metals, leaving them chemically clean.

Magnetic Hand for Crippled Germans.—There has been devised in Germany a magnetic hand which will enable those who have been crippled in the war to work at their ante bellum occupations. Briefly, the magnetic hand consists of an electromagnet held by two universal joints to a sleeve which fits over, and is strapped to, the wearer's stump. Current can be turned on and off at will so as to energize the electromagnet when desired. Since the hand can only be used in connection with objects which are attracted by magnetic influence, tools such as wooden planes have been fitted with small plates of iron so as to respond to the magnetic pull.

Temperatures of Gas-Filled Tungsten Lamp.—S. E. Doane, chief engineer for the National Lamp Works at Nela Park, Cleveland, Ohio, speaking before the Western Association of Electrical Inspectors recently said that the measurement of the temperature of gas-filled lamps is attended by many difficulties, on account of the fact that the light rays are intercepted by the thermometer used and upon their interception are transformed into heat. Careful tests have revealed that the temperature attained by the lamps is in the neighborhood of 150 deg. F., and that the base of the lamps becomes hotter than is the case with the former tungsten lamps. However, it is reported that the sockets and connecting wires are not seriously affected by the increased temperature.

Study of Rail Joints and Bonds.—The Bureau of Standards has recently published an interesting paper entitled "Modern practice in the construction and maintenance of rail joints and bonds in electric railways." The paper is largely a compilation of information in the nature of data and opinions submitted by 42 electric railway concerns which answer inquiries sent out by the Bureau. Analysis of the data shows that soldered bonds have been demonstrated to be unsuccessful and are now practically obsolete, while all other types of standard bonds are capable of giving good results, but only when carefully installed. Loose rail joints are shown to be the most prevalent cause of bond failures, and as a result there appears to be a marked tendency toward the adoption of improved methods and materials in their construction. The adoption of various types of welded joints to take the place of the common bolted joint appears to be in progress in most of the larger cities.



By courtesy of the New York Railroad Club

Locomotive that burns pulverized coal, thereby effecting a saving of 15 to 25 per cent of fuel

A Coal-Dust Locomotive

By Herbert T. Walker

THE expenditure for locomotive fuel on our steam railroads amounts to nearly 25 per cent of the total cost of conducting transportation. This enormous item of expense, coupled with the ever increasing cost of all material, due to the high price of labor, presents a problem which has engaged the attention of locomotive engineers for a number of years.

Experiments made in the way of burning solid fuel other than on grates in cement kilns and metallurgical furnaces have been successful, and pulverized coal is now extensively used for such purposes; but the difficulties inseparable from the conditions under which a locomotive has to be operated are great, and it is only recently that appliances for burning powdered fuel in locomotive fire-boxes have been practically developed.

A paper on the subject was presented at a meeting of the New York Railroad Club recently, and by the courtesy of the club we are now able to give some particulars of this important step in railroad fuel economy.

In the first place, it may be stated that any solid fuel which in a dry pulverized form has two thirds of its content combustible will be suitable for steam generating purposes. Therefore, the low value coal mine and strip-pit products, such as dust, sweepings, culm, slack and screenings, and even lignite and peat, are as suitable as the larger sizes and better grades of coal. As some of the products above named are now unsalable, the great saving effected by the use of the new form of fuel will be apparent; for the total cost to prepare pulverized coal in a properly equipped plant will be something less than 25 cents per ton. This item will be more than offset by the great difference in the cost of the grades of coal purchased for pulverizing as compared with those that would be required for burning satisfactorily on grates.

The preparation of the fuel is not complicated. It must be thoroughly dry; that is to say, the moisture should not exceed one per cent, and ground to a fineness so that it will pass through a screen from number 100 to number 200 mesh.

The first locomotive of any considerable size to be fitted up in the United States or Canada (and, so far as known, in the world) with successful apparatus for burning pulverized fuel in suspension was a 10-wheel type of engine on the New York Central Railroad. This engine has cylinders 22 inches diameter by 26 inches stroke. Driving wheels, 69 inches diameter. Boiler pressure, 200 lbs. Heating surface, 2,649 square feet. Grate area, 55 square feet. It is equipped with a Schmidt superheater and has a tractive effort of 31,000 pounds. It was converted into a pulverized fuel burner in the early part of 1914. Since then, other installations have been made to a Chicago and North-Western Railway "Atlantic" type of engine, and to a new "Consolidation" type of locomotive for the Delaware and Hudson Company, which latter is probably the largest of its type in the world, its tractive effort being about 63,000 pounds.

To give the reader an idea of the pulverized fuel burning equipment as applied to a locomotive engine, we present an illustration showing the general arrangement partly in section. The prepared fuel is passed into the fuel container, 1 (which is a part of the ordinary locomotive tender), through the openings 2, 2. These openings are then tightly closed to keep out moisture, as dryness of the fuel is the prime requisite. To start the fire, the first thing the fireman does is to turn on the steam blower, 27, in the smoke box; then he places a piece of lighted oily waste in the furnace, 24, after which he starts the motor, 17, driving the fuel conveyor, 3, and then the motor, 14, which drives the air blower, 13. The screw conveyor, 3, forces the fuel into the fuel and pressure air feeder, 4, where it meets the air driven by the blower, 13, through conduits 16. The fuel and air are thus driven through a commingler, 5, conduits 6 and 7, nozzle 8 and fuel and air mixer 9. This mixture then enters the combustion furnace 24, which is the ordinary locomotive fire-box provided with a fire-brick floor in place of grate bars, and is there ignited by the lighted cotton waste. The fire-box is fitted with brick arches, 21 and 22, and auxiliary air inlets, 23. There are also induced air inlets, 11, to secure perfect combustion and a slag pan, 25, in place of the usual ash pan.

The air and fuel control regulators, 12 and 18, are in the cab within reach of the fireman, who has no need to go into the tender, but can keep his place in the cab and assist the engine driver in looking ahead for signals. The fireman's duties will be very light compared with his work required in hand firing coarse coal on the ordinary grates. This is easily understood when we recall that the fireman of a heavy modern locomotive has to shovel coal into the fire-box at the rate of about 6,000 pounds an hour, or 100 pounds per minute. This laborious work cannot be done with the care necessary to secure good combustion, with the result that quantities of coal are dropped into the ash pan, the flues are rapidly choked with soot, and clouds of smoke, unburnt coal and sparks are ejected from the stack, to the annoyance of passengers and danger to property adjacent to the railway.

The improved system will change all this, for even when the fuel contains 15 per cent of non-combustible matter only about 2.5 per cent is deposited in the slag or ash pan, and this deposit is non-combustible. Whereas, when coal is burned on grates about 15 per cent goes into the ash pan, and this residuum always contains more or less combustible matter. The saving in ash pan waste alone is an important item.

When the proportion of powdered coal and air is properly regulated, the mixture bursts into a clear, intense flame in the fire-box, having a temperature of from 2,500 to 2,900 deg. Fahr., with no visible smoke at the stack (except when the fire is first started) and making but little soot deposit in the tubes. With this system of easy and rapid control of the fire it takes less than 60 minutes to get up 200 pounds of steam pressure from boiler water at 40 deg. Fahr. When the engine is standing the fire may be put out entirely, and within an hour can be reignited from the heat of the brick arches in the fire-box.

Only one set of fuel and pressure air feeders could be shown in our illustration, but as many as five units may be placed in the ordinary tender. As each unit has a capacity of from 500 to 4,000 pounds of pulverized fuel per hour, there will be no difficulty in meeting the requirements of the largest locomotives.

It is stated that the use of pulverized fuel effects a saving of from 15 to 25 per cent in coal of equivalent heat value delivered, as compared with the hand firing of coarse coal on grates.

In conclusion it must be noted that there is a certain element of danger in the handling of pulverized coal that does not obtain with the more ineffective coarse coal. But, with ordinary care and the observance of certain established rules, it is comparatively easy to avoid trouble, as is shown by the records of industrial plants using pulverized fuel.

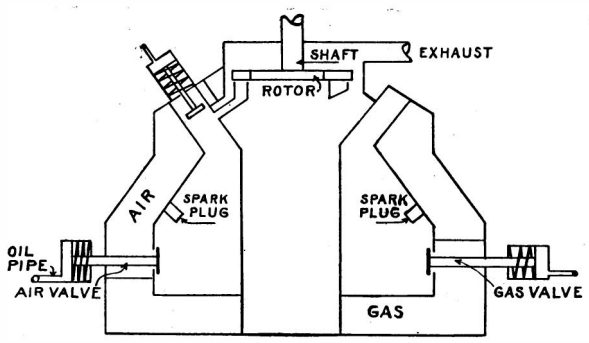
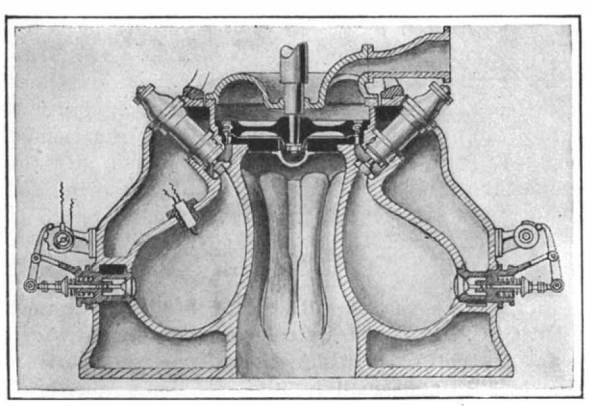


Diagram illustrating the operation of the gas turbine

There are several of the vessels shown in cross-section, together building up the base of the apparatus. Each has an air valve, a gas valve and an outlet valve



Cross-section through one of the explosion chambers of a German gas turbine

An Ingenious Gas Turbine Developed in Germany

By Sydney F. Walker

WHAT appears to be a thoroughly practicable gas turbine was worked out in Germany just before the war. A turbine furnishing about 200 horse-power was built at Hanover a few years back, and was run for three years in order that its faults might be observed. Later on, a turbine furnishing 1,000 horse-power and driving an electric generator was built at another works in Germany. It was tested and an overall efficiency of 20 per cent was claimed between the energy delivered by the explosions and the electricity furnished by the generator. The special feature of the apparatus was that the explosions took place in one set of chambers, and the expansions partly in the explosion chambers and partly in the space in which the rotor of the turbine was revolving.

The rotor of the turbine ran in a horizontal plane; a number of explosion chambers, ten in the 1,000 horse-power apparatus, being arranged around its shaft. The explosion chambers were cast together with air and gas chambers, the whole forming approximately a truncated cone, the electric generator being placed at the apex of the cone. The gas and air chambers were kept full at definite pressures. Each explosion chamber was first filled with air up to the pressure in the air reservoir; the air supply was then cut off and gas forced in also under pressure, preferably by successive strokes of the gas pump, so that the gas would form layers in the explosion chamber.

(*Concluded on page* 334)

A Typewriter That Copies With Its Own Eye

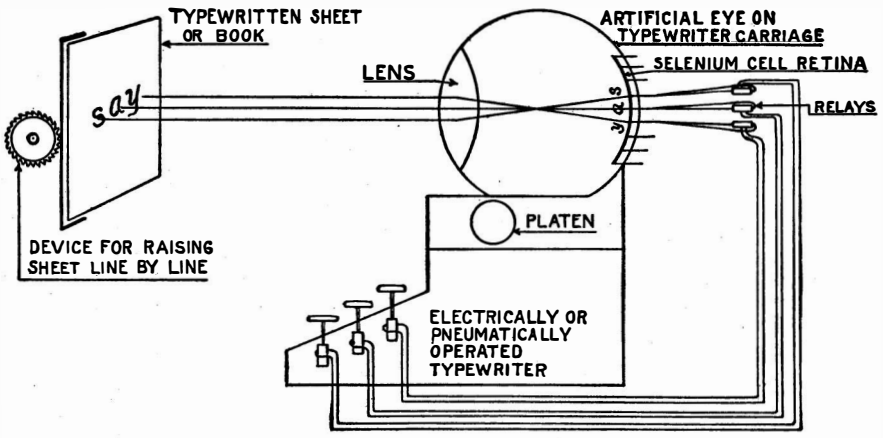
DESPITE the fact that the self-operated typewriter described in the following paragraphs has not as yet been actually constructed and tried out, not a little interest attaches to it for the suggestion it offers. Provided with a huge mechanical eye, this typewriter of the future will be capable of copying automatically any reading matter that may be placed in front of it.

The typewriter that copies with its own eye is the idea of J. B. Flower, an electrical engineer of Brooklyn whose name is not an unfamiliar one to the readers of this journal. The artificial eye is preferably attached to the carriage of the typewriter in order that it may move at the same rate of speed. It moves, step by step, over the line of printed or typewritten language appearing on a sheet of paper which is placed in front of the machine.

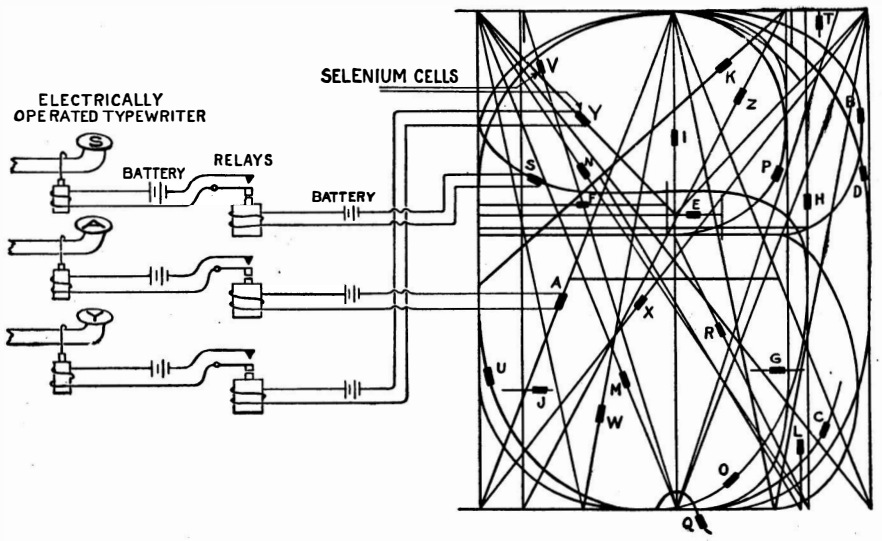
The artificial eye of the automatic typewriter must of necessity be of complicated construction. Essentially, it comprises a lens and a number of selenium cells arranged so as to form a retina similar to that of the human eye. The sheet of paper containing the copy to be duplicated is placed at a suitable distance from the artificial eye, so that a clear image of the letters will be produced on the multiple selenium cell retina. It is imperative that the eye move parallel to the read letters in order not to ruin the focus. The principle followed in connecting the selenium cells (low resistance cells) is that all the letters falling on the retina must be superimposed in one position; then the point or points in any one letter form which do not correspond to those of another letter form are the point or points which stand for that letter. These points can be connected to the typewriter for operating that particular letter form or character without chance of interfering.

The method of operating the new typewriter is to place the typewritten sheet or book of which it is desired to make a copy in a special stand or device for raising the sheet line by line. The sheet is now held in a vertical plane parallel to that of the selenium cell retina. For the sake of exposing the operation of the mechanism, it is assumed that the word being copied is "say." Upon starting the typewriter by turning on the electric current, the image of the letter "s" will appear on the selenium cell retina and its shadow will stand over the selenium cell marked *S* and no other, hence the current passing through it will decrease in amount allowing the relay armature to move, thus closing the local circuit and actuating an electromagnet which in turn operates the "s" typebar of the typewriter and prints the desired character on the paper. The carriage now automatically shifts the artificial eye over one letter space, with the result that the image of the letter "a" now appears on the selenium cell retina and its shadow stands over the selenium cell marked *A* and no other, thus causing the typing of the letter "a." Following the same procedure, the letter "y" is typewritten. For spacing, the typewriter is provided with a mechanism which, when the carriage moves over one letter space and no type key is operated, the space lever is brought into operation. Means are also provided for automatic line spacing, carriage return, paper insertion and removal, and other phases of typewriter operation.

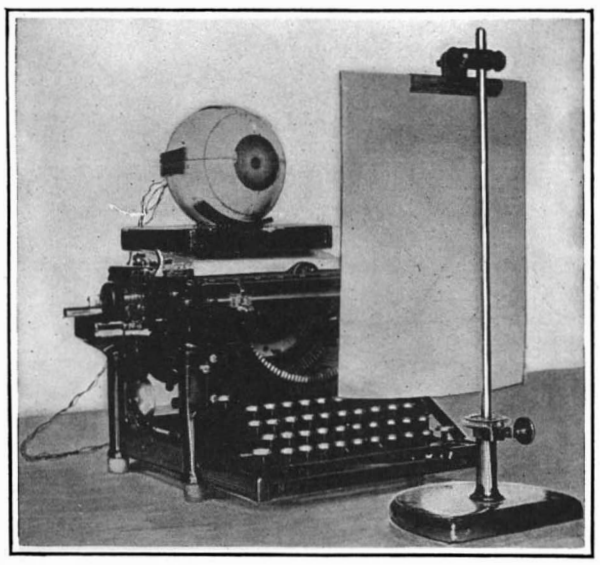
As previously stated, the reading typewriter is based on the principle that when the standard letters of the alphabet are superposed one on top of the other, there will always be one point in each letter form which is not common to any other letter form. On typing the alphabet on the typewriter with all the letters superposed, it will seem at first that the statement just made is incorrect. The seeming difficulty, however, is not a real one but is due to the small scale of typing. If the typewritten letters are magnified 50 times so that they occupy 3 inches square each, and are then superposed, all of which can be accomplished by the artificial eye, it is found that the distinguishing points of each letter form are not covered; in fact, they stand out beautifully individualistic, as is indicated in one of the accompanying sketches.



Diagrammatic scheme of the main components and their relationship in the self-operated typewriter

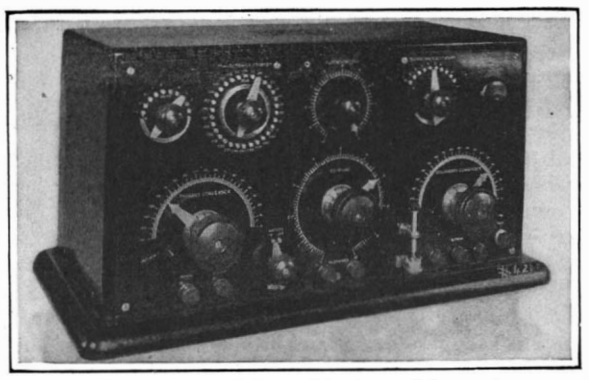


Arrangement of the selenium cells which form the retina of the typewriter eye

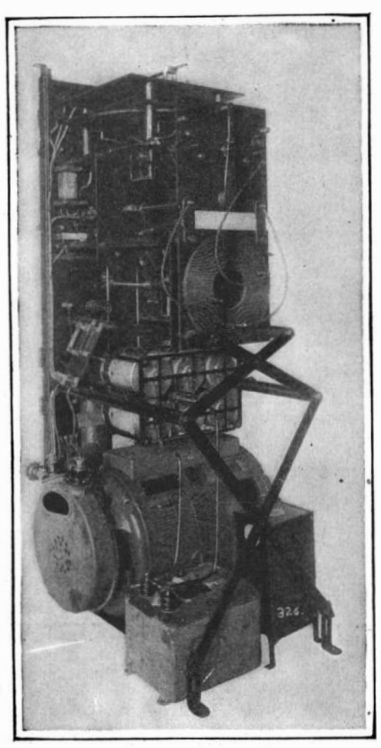


The typewriter that writes what it sees with its own eye

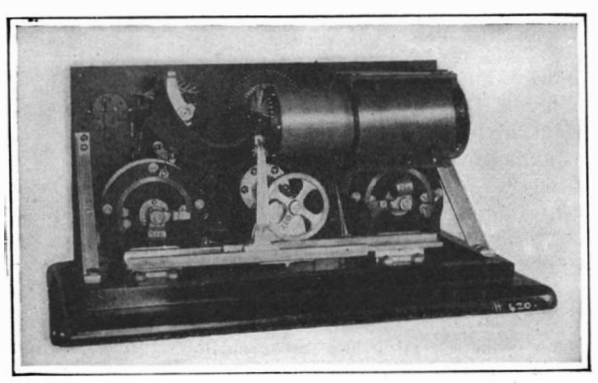
THE READING TYPEWRITER



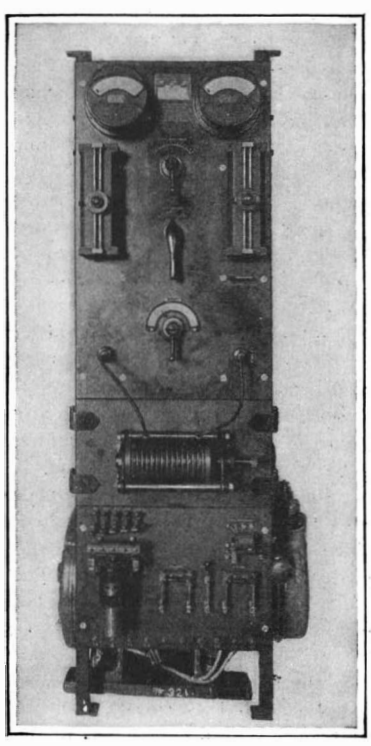
Front view of the cabinet receiving set



Rear view of the transmitter



Rear view of the cabinet receiving set



Front view of the transmitter

TRANSMITTER AND RECEIVING SET OF UNIT DESIGN FOR USE ON SHIPBOARD

Unit Design in Marine Wireless Telegraphy

By J. Andrew White

THE transition of an art into a science invariably reflects a number of epochal steps which are widely heralded in the lay press; on the other hand, small notice is taken of developments which scientific workers recognize as those having the most important bearing on ultimate achievement. By way of illustration, radio communication, or the field of the wireless telegraph, has been marked by many brilliant feats of individual skill in annihilating space and setting up odd and startling uses for the ether wave energy; but little has been heard of concerted action among engineers toward the mechanical perfection which is found in the more matured arts. From the onlooker's viewpoint, standardization of wireless equipment has been a matter for the future to take care of, a step to be taken only with the perfection of individual apparatus. Communication over distances once incredible has so occupied the attention of the world that it is scarcely known that the past few months has seen the solution of many problems in marine working, wherein the humanitarian values of the wireless telegraph have been so aptly illustrated in the past. The progress made in mechanical features is strikingly revealed in the announcement by an American wireless company that all its future equipments will conform to a standard design of the unit type, the complete transmitting apparatus being mounted on a single panel and the receiving equipment contained in a case of uniform design.

Aside from the interest aroused in the mechanical development revealed in this new equipment, the standardization feature opens up new possibilities in the acceleration of progress in the wireless art. Commercial operators will no longer have to master a number of types of installation, varying in arrangement, one might venture to say, with a frequency exactly proportionate to the number of ship transfers provided within the period of each individual's service at sea. Many of the staunchest vessels of to-day having been built at a time when wireless telegraphy and its legal status in maritime affairs did not have to be considered, no provision was made by ship designers for installation of apparatus or accommodations for operators. With widely varying conditions of space and location to contend with, the sets were installed principally according to the best judgment of the man assigned to the task. This objectionable condition is now obviously overcome with equipment of standard design available; and uniformity of installation and method of operation may also be expected to furnish cumulative operating experience that will prove of great value in the solution of engineering problems and safeguarding of life at sea.

From the purely commercial side the new equipment possesses many advantages over its predecesors. The

(*Concluded on page 336*)

Strategic Moves of the War, March 17th, 1916

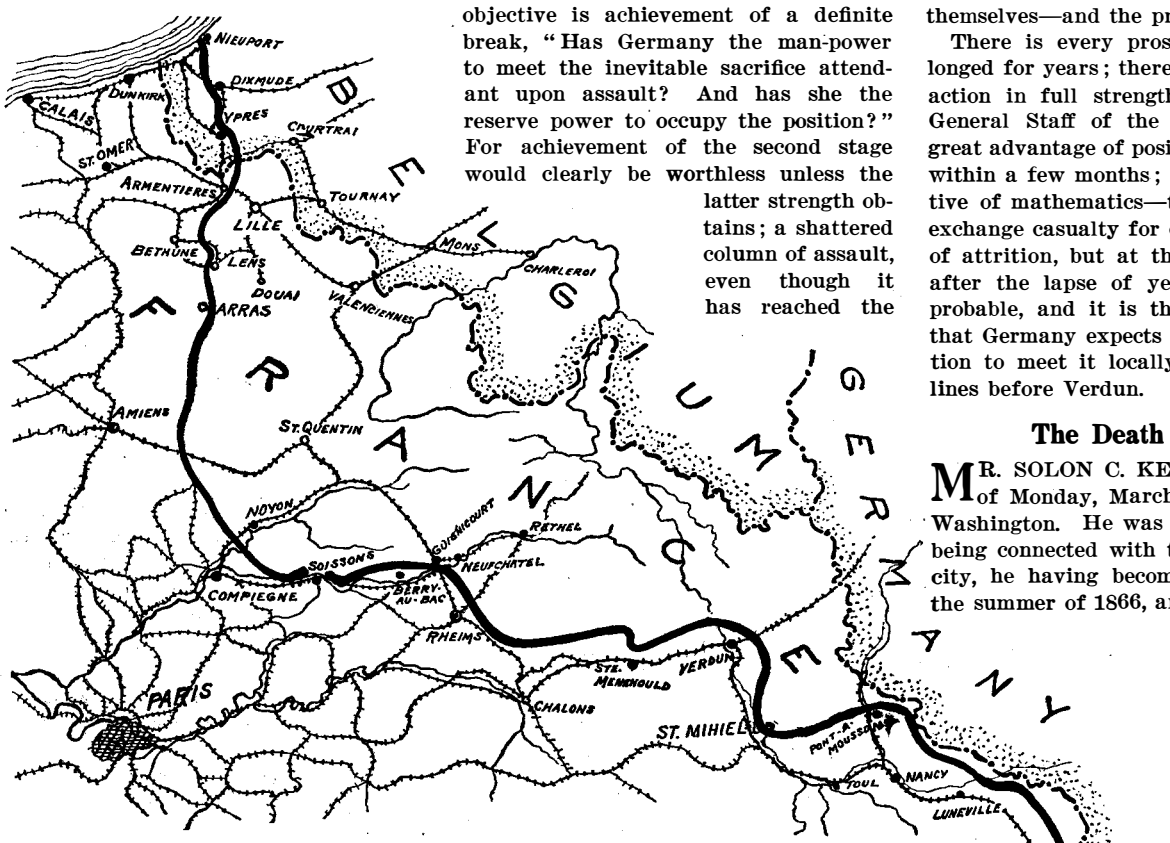
By Our Military Expert

WHILE Spring, when the ground on all fronts will be in better condition than now for offensive footings, is in the offing, the situation on the western battle line, and principally about Verdun, still challenges the particular attention of war observers.

The German assaults have continued in violence under cover of and after preparation by the most tremendous artillery fire ever utilized in warfare. There have been so far three distinct breaks in the offensive, probably necessitated by the wearing out of attacking momentum, through losses and by the wish to consolidate the ground won. At the moment these lines are written official reports declare infantry inactivity about Verdun, although the guns of both contenders maintain a heavy fire.

A rather significant condition occurs with the reported reopening of the Belgian-Holland frontier, which was closed securely some days before the storm broke around Verdun—at the same time that German troop movements were reported in strength. This may mean that the local offensive has ceased for the time being; or the report may be erroneous.

The next move by either Teuton or Entente is very much in the dark. Certain activities have become apparent west of the Verdun salient, including the taking by the Germans of a French position in the Champagne, near Rheims, over a front of some 1,400 yards, to a depth of about two thirds of a mile. This is scarcely to be taken as the initiation of another general offensive, but merely the seizing of opportunity to better local positions and incidentally keep the French attending strictly to business in sections other than around Verdun.



The battle line on the western front

At the risk of seeming repetition, the existing situation appears to warrant reiteration of the belief expressed in these columns before, that the main object of the German drive at Verdun was primarily for the purpose of strengthening the defensive position in anticipation of activity by the Entente with the coming of propitious weather. There was always the dim chance, in addition, that some part of the line might give way before the hammering, a gap be forced and material gains be assured, but any such hope must have been founded upon the chance of tactical or strategic error on the part of the defenders. It is reported that the German forces comprehended reserves held in hand for just such a contingency, which were never sent into battle during the defensive to date.

Again, public opinion and the strengthening of morale may have dictated the venture. The neutral world has rather consistently expressed the belief that Germany had come to the end of her offensive power, what with losses and the hemming in on all fronts by superior numbers of enemies to the Fatherland which but waited to take advantage of any weakening of the lines before them. A general acceptance of such belief might easily militate to sway the decision of officially neutral, potentially inimical states that would mass more force against Teutonia and open new avenues of approach. If the morale objective is a principal one, then the force of arms has been actively supplementing diplomacy; Rumania, of course, is the principal state to be influenced by such display of strength.

No military organization, no directing staff of any belligerent, surpasses those of the Kaiser. The waging of war has been reduced to as exact a science as is possibly consistent with the chances of war; the pros and cons of every project have been carefully weighed, possibilities and probabilities have been forecasted and tested, losses to be sustained in the accomplishment of a given objective have been counted with almost mathematical precision and the deductions and results have become axiomatic.

For these reasons, it is the belief of many prominent officers and military analysts that Germany did not expect to break the French line any more than she expected the Entente to break hers in reprisal; the strength of the defensive has been too well demonstrated throughout the war to warrant any such optimistic belief. When the phrase "breaking the line" is used, it must be remembered that the main line of defense is not to be found in any of the foremost trenches or positions; the clearing of ground that has been taken up previously as a sort of permanent outpost merely brings the attacking force closer to the real line of defense, the solidly held positions that must be smashed through before a gap is opened to permit the passage forward of troops.

Should an assailant be possessed of sufficient forces to push back this outpost, these advanced trenches, which may scar the earth for several miles, and then still have available enough men to pay the price in blood required for overwhelming frontal assault, and still have, in reserve, an ample force to push through the wreckage and establish itself, then a real break might be made.

The situation around Verdun exists to-day at about the completion of the first stage. The advance trenches, the permanent outpost, have been cleared along the ground immediately north of Verdun, and Germany practically faces at several points the line of defense proper. The question remains, if the objective is achievement of a definite break, "Has Germany the man-power to meet the inevitable sacrifice attendant upon assault? And has she the reserve power to occupy the position?" For achievement of the second stage would clearly be worthless unless the latter strength obtains; a shattered column of assault, even though it has reached the works, is useless unless amply supported; otherwise naught but a net loss of men would have accrued from the effort—and some traditions.

Germany possesses one tremendous advantage over her adversaries—that of interior lines of operation well latticed by a railway system primarily constructed for just such a condition as now confronts it—warring against multiple power. The German staff knows to a T just how long it takes to shift an army corps from west to east; it knows just how long a given force may be depended upon to maintain itself on the defensive. Through knowledge of these factors, troops, first line and reserve, may be withdrawn here and there, shifted to other points and used to initiate an offensive blow or stem a tide which threatens.

On the other hand, exterior lines which require that shifts of troops follow the arc convexity instead of cutting across a chord, impose an additional time element upon the force which is compelled to occupy them; if it takes four hours for interior line troops to cross the chord, five hours will be required for a simultaneous shift along the exterior lines to meet it, with a resultant gain of an hour to the interior line. General Nathaniel Forrest of Southern Confederacy fame sized the deduction up crudely but effectively in the words "Git thar fustest with the mostest men."

And this applies in the European war not only on a local front, but throughout the perimeter of the present lines. It is impossible for England or France to reinforce Russia, or vice versa; it is an easy matter for Germany to come to the relief of her Austrian ally—as she has done repeatedly.

The present writer has never claimed that Germany and her allies do not possess sufficient force for defense. Belief is entertained that Teutonia has reached and probably passed the zenith of her man-power, but for purposes of general defense there are ample troops available—backed by possession of interior lines. And if the present lines are evacuated, the more the defending line is contracted the fewer men will be required to man it.

Practically every observer anticipates tremendous activities on all fronts with the coming of fitting weather. Without doubt, plans are already elaborated for simultaneous attack on all fronts, as the one and only way to offset Germany's ability to shift troops at will. The answer to the inquiry as to why France has not launched a counter offensive to relieve the pressure on the Verdun position is probably to be found in the fact that some element of the Entente is not yet ready to actively coöperate in full strength. With one front inactive, Germany would welcome the assumption of the offensive by her enemies on another, strong in the possession of her interior lines. It might be that the assailant could be "pulled off his feet" and given a *coup de grace* even at a monumental cost—that might eliminate an enemy.

Germany was checked at the Marne by just such a condition; flushed with triumphant success, her columns of invasion in the first weeks of the war overreached themselves—and the present deadlock resulted.

There is every prospect that the war *can* be prolonged for years; there is the *possibility* that concerted action in full strength, directed by an International General Staff of the Entente, may offset Teutonia's great advantage of position and bring the war to a close within a few months; and there is always the alternative of mathematics—to sit tight, give blow for blow, exchange casualty for casualty and fight strictly a war of attrition, but at the cost of European bankruptcy after the lapse of years. Concerted action is more probable, and it is the personal belief of the writer that Germany expects it and is strengthening her position to meet it locally by the attempt to correct the lines before Verdun.

The Death of Solon C. Kemon

MR. SOLON C. KEMON died early in the morning of Monday, March 13th, 1916, at his residence in Washington. He was widely known in Washington as being connected with the office of Munn & Co. in that city, he having become connected with that office in the summer of 1866, and had he lived until the coming summer, would have rounded out fifty years of service with the firm. For many years he was manager of the Washington office, which brought him in contact with inventors from various parts of the country having business transactions with that office.

During the whole term of nearly half a century with which he was connected with the firm he had become endeared to those having business relations with him, owing to the high integrity of his character and his unswerving loyalty to the firm. In spite of physical infirmity and delicate health during the past few years, he rarely absented himself from the office and, in fact, it was with difficulty that he was persuaded to take even an occasional vacation.

The funeral service took place on March 15th, when he was buried in Glenwood Cemetery in Washington.

Brewer's Yeast as a Source of Vitamines

A RECENT report by Mr. Atherton Seidell, of the Hygienic Laboratory, U. S. Public Health Service, describes a successful process of obtaining a cheap and stable vitamine, in concentrated form, for use in treating nutritional deficiency diseases, such as beriberi, pellagra, etc. The preparation is obtained from brewers' yeast, which is pressed, autolyzed by keeping at a temperature of about 100 deg. F. for 48 hours, and filtered through paper, the filtrate then being treated with Lloyd's colloidal hydrous aluminium silicate reagent. Finally a solid residue is obtained by siphoning, desiccation, etc. The preparation has been given to pigeons in doses of 0.05 gram on alternate days, and the pigeons were thus enabled to retain normal health and weight on an exclusive diet of polished rice, which would otherwise produce fatal polyneuritis. Completely paralyzed pigeons have also been promptly cured by this new remedial agent.

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.*]

In Behalf of the Centigrade Thermometer

To the Editor of the SCIENTIFIC AMERICAN:

Seeing an article in your February 5th edition entitled "Shall We Abolish the Fahrenheit Thermometer?" and feeling inclined to comment on this subject, I beg to say that in my opinion this is indeed a step in the right direction, and though I disagree with Mr. Johnson in that there is no connection between the metric system and the centigrade thermometer, the ease with which calculations may be made on the centigrade basis should make its adoption a desired change.

This brings us back to the much discussed subject of changing our entire system from the English to the metric, and while it is generally agreed that the metric has so many advantages over the English as to make its use a great simplification, the transition looms large, and is considered impracticable or even impossible.

Therefore, would not such simple steps as the thermometer constitute a movement which would educate us up to the point where we can look upon the revolution with a little less fear.

Personally, I may be somewhat prejudiced in favor of the metric system as I am an engineer and have spent a number of years in Mexico, where it is the legal standard, consequently am nearly as familiar with the meter and kilo as with the foot and pound.

C. M. BARRON.

23 South William St., New York city.

A Plan for Military Preparedness

To the Editor of the SCIENTIFIC AMERICAN:

The great fault to be found with all plans of the administration party is their lack of thorough effectiveness. This remark is not dictated by any political bias, but is used to classify our popular propositions.

We do not wish to identify ourselves with "German Militarism," either in principle or practice, but a few members of the German General Staff introduced into our councils just now for the sole purpose of indicating the defects of the civilian ideas which dominate our viewpoint would be of great service. Suggestions emanating from our trained army and navy circles are of course necessarily thorough and reliable, but knowing the nature and temper of our Congress, these suggestions may be suspected of falling short of the actual convictions of the military authorities from whom they emanate.

Utilizing the viewpoint established by my own thorough military education, followed by service as Commandante in four of the military institutions on the Atlantic seaboard, I beg to submit some of my personal conclusions. They may be of value in influencing, at least, the general concensus of opinion.

The term "Large" when applied to a standing army (or navy) is purely relative in character.

Two hundred and fifty thousand men for Nicaragua or Cuba would be an enormous standing army, but when the term is applied to a country of vast proportions and 104,000,000 people (the wealthiest aggregate population on earth) it loses its significance. "Two hundred and fifty thousand troops" distributed along the four cardinal points of our great republic, utilizing one point as a central location would be proportionately a very small standing army. Besides the usual uses of such a standing army, 50 per cent of its officers could be used for detached engineering and educational service in times of peace. With large industrial developments impending such an army can be depended upon to control the periodical recrudescence of inevitable industrial anarchy proportioned always to the magnitude and activity of such enterprises, in a country of enormous population and wealth, inexhaustible resources and temperamental energy.

Important as is the rôle of this small army, the part to be played by our navy is incomparably greater. We are immune from invasion by any first-class power and practically released from the necessity of a *continuous line* of fortifications if we possess an effective navy. What do we mean by an "effective navy"? Properly understood it is this. Such a navy on the Atlantic station alone, as will equal any other (Great Britain excepted) in armament and *speed*. Superadded to this the fleet should be measurably superior in numbers and speed to allow for accidental circumstances which might lead to defeat of one or more of its units.

Moreover, the Atlantic and Pacific stations should muster a fleet of *equal strength* for two reasons.

First, it is not a remote possibility that some European nation may tempt Japan into an aggressive coalition.

Second, the successful "internal war" now waged by Germany vs. the United States gives us an object lesson of the ease with which the Panama Canal link between the Atlantic and Pacific naval stations may be destroyed.

The logical elimination of Great Britain as a possible adversary should be clear to every un-hyphenated, cultured, traveled American.

Note that Great Britain desires nothing that we possess, that in virtue of territorial possessions in North America she is practically a copartner in enforcing the Monroe Doctrine and bound as she is to us by ties of race and blood and the common spirit *of democracy* (in the words of her prime minister), "A war with the United States, is inconceivable"! Especially is this true after we have condoned the murderous methods of one belligerent in this war the grievance of which is far in excess of anything of which Great Britain is capable.

THE EDUCATION PROPOSITION

These state school propositions in the interest of preparedness are open to the objection urged against our adhesion to a qualified militia program. The National Guard is "good as far as it goes," of course, unless—as is apt to be the case—it misleads the general public in its ultimate conclusion. To the uninitiated the National Guard uniformed and armed may be a counterfeit of the true effective army. We may multiply military schools which will do good to a limited degree, but will be as far from the ideal as the National Guard from our armed regulars. The action of the nation in 1862 and subsequent legislation (1890), granting land grants from the public domain upon condition that certain state schools introduce military courses, shows the inevitable result, unless the Government assumes absolute control.

Over and above all such substitutes for a West Point training, we need United States schools of military and naval technology constantly operating. There should be three tributary to the army and three tributary to the navy, the *normal* number of graduates alone being not less than 1,000 per annum each. The modern warfare is rightly described as a "battle between machines." The nation possessing the largest number of these with a thorough mastery of mechanical, civil, electrical and military engineering and commercial chemistry (other things being equal), will hold the "winning card." It is well said "Chemistry is King!"

THE COURSE OF STUDY

Under as absolute a direction by the United States Government as West Point itself, although less theoretical and more practical, these institutes should be thrown open to the general public, offering educational possibilities as useful in civil as in military life. A large number of Government scholarships (requiring only *conditional* service subsequently in the regular army) could be annually dispensed. A graduate could (except in special contingencies) pass at once into civil life. His name, however, would be held and listed as belonging to a special department of the "Army or Navy Reserves." If he should personally prefer a military vocation he should command a commission, if an honor graduate, or a non-commissioned appointment, if a graduate only, on entering the army. Condensed into a course of four years (with appropriate post-graduate courses for specialism provided) the student should acquire not only knowledge of infantry, cavalry, artillery and naval tactics and aeronautics, but an exhaustive practical technical knowledge of the manufacturing of army munitions and commercial chemistry as well.

A practical education of this character is of *great value in civil life* from which these students are not necessarily withdrawn, as is the case with the graduates of West Point. A light "side line" course of hygiene and antiseptic and practical surgery could be carried through three years of the course with a post graduate course for those who desire to qualify as army surgeons.

To the average young man the opportunities presented by national schools of military and naval scientific technology would present an attraction almost irrcsistible. The large number of scholarships of course would relieve parents of expense. Beyond their limit, there could be pay entries of a substantial character, which would inevitably relieve the Government of a considerable percentage of actual costs. In the course of the regular curriculum the vast supplies of munitions necessary to the effective equipment of a large army could be economically accumulated by degrees as an incident of educational cost.

These institutions (and *all* depots, etc., of war supplies) should possess a mid-continental location, preferably points contiguous to the Mississippi Valley. Had Germany dominated the military policy of our republic for the last half century, who will contend that she would not have developed the magnificent possibilities of our mid-continental waterway from the Great Lakes to the Gulf. The "Gore Navigation Bill" now pending in the United States Senate would long since have been an accomplished fact. Up and down this deepened water course the continental commerce of the nations and our battleships would be passing under their own power. The deep water draught of the ocean-going vessels could be diminished by detachable caissons.

ITS GREAT VALUE

The educational preparation of a plan as above described would be of immense value to our republic. This education is now provided by no existing instrumentality under national control. Even West Point does not provide it. A man might spend his entire life in the regular departments of the army and navy and possess it only in a very limited degree. There will be a large number of young men, moreover, who will fail to "graduate" but who will nevertheless acquire during the period between their enlistment as members of the fourth class and the period in which they drop out, much that will be of value to them in the service of the nation. And a thought of supreme importance in the minds of many will be that the *commercial life* of our nation will be *steadily enriched* by a constant inflow of elements, trained and developed in body and brain and technically skilled in useful arts. Germany has possessed these elements (in the military sense) in consequence of her burdensome and enormous military system; and scientifically and technically by her numerous schools and universities, utilized liberally by her young men and inspired by the Government *at a nominal cost!* We do not desire to use Germany's methods, but we do covet her results, her exhaustive knowledge of scientific warfare, adapted to commercial uses in our peaceful civil life. We have the money—we have the brains—let us use them!

(REV.) WM. M. WALTON,
Archdeacon of Arkansas, Protestant Episcopal Church.

Concerning Leprosy

To the Editor of the SCIENTIFIC AMERICAN:

Thinking that perhaps I can throw a little light on the subject of the controversy between "Uno" and Mr. Monroe Woolley, concerning the contagiousness of leprosy, I beg to submit the following:

About the year 1890 I took a contract to erect some buildings, dormitories, schoolhouse and residence for the Sisters in charge of the young girl lepers in the leper settlement on Molokai, H. I.

Among the girls housed in these dormitories, after they were built, were three daughters of a white man named Cross, a carriage builder of Honolulu, and his wife, who was a leper. I was well acquainted with Mr. Cross.

This couple had four daughters after the mother had broken out with the leprosy; the first was taken from the mother at birth and never developed leprosy, though she was 18 years of age at the time mentioned. The other three daughters were nursed by the mother and all developed leprosy. Mr. Cross, though living in the closest companionship with his leper wife for twenty years, never developed the disease.

In the early days of leper segregation in the Hawaiian Islands, the Board of Health permitted non-leper relatives of lepers to accompany their sick relatives to the settlement upon the conditions that they were never to return and that they must make their own living. I employed a number of them on my work who had been there for many years and who had not contracted the disease. These people were called kokuis.

Dr. Strong, the resident physician, formerly the surgeon of the Spreckles steamship "Australia," told me that many of these kokuis came to him and begged him to inoculate them with the leprosy in order that they might be qualified to draw rations from the Board of Health.

A convicted murderer was sentenced to be hanged and, in order to assist in determining one phase of this question, he was given the option of life imprisonment and inoculation with the virus of leprosy. He chose the alternative and was duly inoculated and in five years developed the disease. I built a jail for his accommodation in the settlement at Kaulapapa.

Father Damien developed leprosy, but I have indubitable evidence that he did not do so by fair means. Father Damien's one burning ambition was to die a martyr to leprosy and become a saint in the calendar of the Roman Church. I was in the settlement at the time of his death. I was personally well acquainted with him and with his successor, Father Conrady.

While I was in the settlement an Englishman, whose name I cannot recall, came there bringing an old-fashioned ten-gallon kerosene case full of "gurgon oil," which he claimed would cure leprosy. He deposited the case on the porch of my house and I had quite a long conversation with him on the subject. I was satisfied, however, that the regimen he prescribed was so rigorous that no Hawaiian would undertake it if he knew it would cure him.

My men and myself were on the job about four months and mingled with the lepers with considerable freedom, though always avoiding personal contact with them, and I do not think there was a moment when any of us thought there was any danger of us contracting the disease.

I am taking my data from memory and am not quite certain of them. They could be determined by the date of the death of Father Damien, which is, of course, history.

Dayton, Ohio. J. R. FRASER.

Pancho_Villa and a battery of his field artillery

On the Trail of Villa

Our 2,000-Mile Mexican Border and Its Protection

IT is one of the cardinal rules of war, never to do what your enemy wishes you to do. In other words, do not let the enemy force you to play his game. The present border situation has forced the American Government to violate this rule. Just what the result will be, the developments of the next few weeks will show. The "waiting" from this time on will necessarily be extremely "watchful."

The ability of Villa must be recognized. He is courageous, aggressive and resourceful. His whole career has shown that he is willing to take long chances and to run great risks. After our recognition of Carranza as the head of the de facto government of Mexico, Villa had little left but his life, and that was dependant upon his ability to keep ahead of his pursuers. Having nothing to lose, his only chance to win was to involve the American Government in his trouble and to trust to his luck to get some advantage out of it. Destruction of American property in Mexico, outrages committed against Americans in Mexico, isolated and sporadic raids over the border, brought no action from the American Government. Then came the organized and, in a way, official raid upon Columbus and the attack on American troops at that point. This raid has demanded official recognition and official action on our part. And up to this point, Villa has accomplished his purpose.

Map of the Mexican border with enlarged insert of the region in which Villa is being hunted

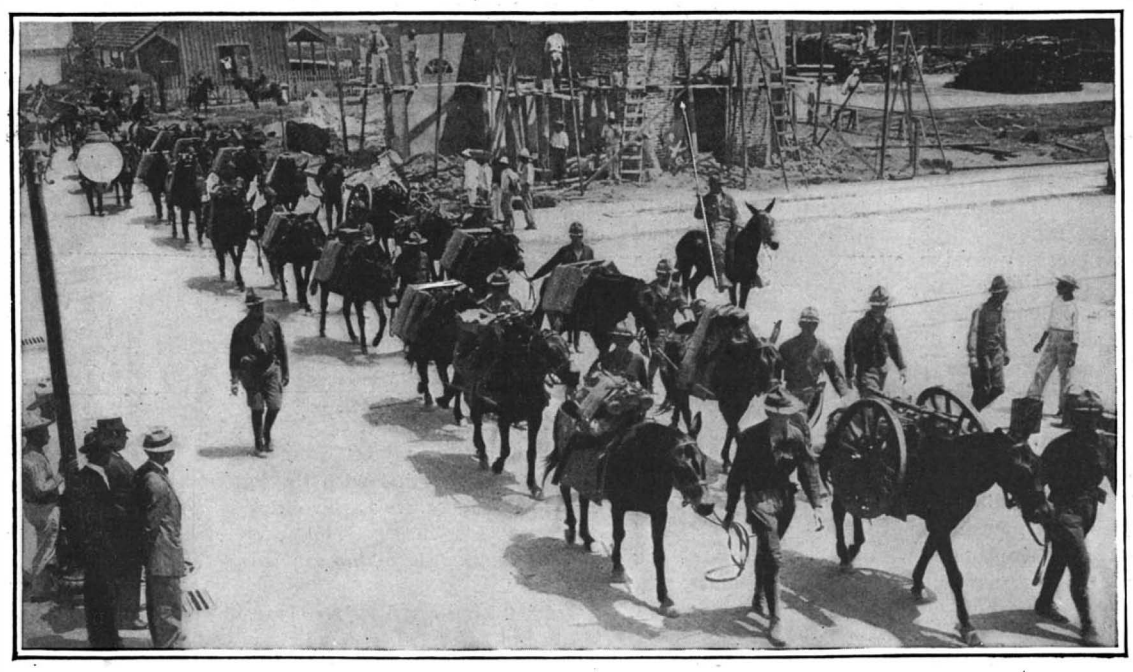
We have in the reciprocal arrangement with Carranza, a certain authorization to send our punitive expedition across the border in pursuit of Villa. As soon as this is fairly under way, it will be Villa's next move. It is fair to assume that he did not make the Columbus raid for the mere desire of being pursued both by the Carranzistas and by the Americans. Nor that he figured only that it was better to be shot by Funston's men than to face Carranza's firing squad.

The temper of the Mexican people is well known. Their attitude toward Americans has been unmistakable. It is not alone the organized brigands serving as Villa's army, nor the more numerous and better class of Carranzistas, who dislike the Americans, who are suspicious of every move we make, and who are ready for any action against the "gringoes." But the dislike for Americans affects practically all the Mexican people, except those whose business interests and connections lead them to favor the stability and security of American control.

Can Villa arouse the Mexican people to the point of general and united action? Should he do so, he has two grounds of hope. The first is to regain his lost popularity, to become the "liberatador," the idol of the oppressed people, fighting against a foreign invader. The other alternative would be to unite with Carranza, and probably Zapata, and restore the status quo of the opposition to Huerta, but this time directed against the Americans.

Villa had and has nothing to lose and everything to gain.

Carranza, on the other hand, has all to lose and nothing to gain by opposing the American policy. His desire and interest would be to capture and to punish Villa with his own troops. There are old scores to settle and a dangerous pest to dispose of. At the same time, there will be a big credit in his favor on the books of the Washington Administration, if he can do it before we become involved; if we can preserve unbroken our policy of non-intervention and non-interference. Carranza will therefore strain every nerve and use every resource of the de facto government to



American mountain gun battery on the march

Our field wireless corps at work

gain this prize, Villa's head. Should he fail in this mission, however, and should American troops come into actual contact with Villista forces, should there be an actual engagement between Americans and Mexicans, no matter under what leader Mexicans serve, or for what brand of reform or revolution they may nominally stand, it is questionable whether Carranza can hold the people down.

President Wilson does not want intervention, nor any interference in Mexican affairs. His entire course since his inauguration proves that. The American people do not want intervention. If our people did want it, we should have had it long before this. Least of all do the American troops want it, the officers and men who will have to do the work. It will be a difficult, disagreeable, thankless task. For our forces who do the job there will be no credit or reward except the sense of a hard duty well performed. Carranza does not want it. He can gain nothing by it. But Villa does want every sort of interference and action by our armed forces on Mexican soil. In the sentiment which an American invasion will arouse in the Mexican people lies his only hope.

Therefore, from now on our motto must be "careful watching."

Our army is as well adapted to a chase into mountains and across deserts as any organized military body can be. The criticism directed of late years against our army has been that it has had no training or instruction to fit it to meet a disciplined army of a first-class power; that its only experience since the Civil War has been in the Indian fighting in the West and in the irregular warfare of the Philippines. Disregarding the criticism as to the value of our training, we ought now to be well fitted for the task in hand. Our traditions, our experience and much of our training is directly in the line of our present work. There are capable and experienced officers in charge. There are troops enough to meet the present needs. These troops are all seasoned and acclimated by five years' continuous service on the Mexican border. If the future needs are greater, we shall have to follow our traditional American custom and prepare after the occasion has arisen.

After the punitive expedition, the "flying column" of newspaper accounts, has got fairly started, supply columns will have to follow. Troops will have to be left for border patrol and guard duty. How much then will be left of our available mobile army is known to everybody, for all the details of the strength and weakness of our military organization have been matters of public discussion in the past few months, discussions on preparedness. And during these same months we have discussed much and prepared little.

Army authorities have made various estimates of the number of troops which would be required to handle the Mexican problem, based on possible conditions. Nothing has been done to supply the requisite number. The protection of the border has been left to the troops available. Now there is added to their

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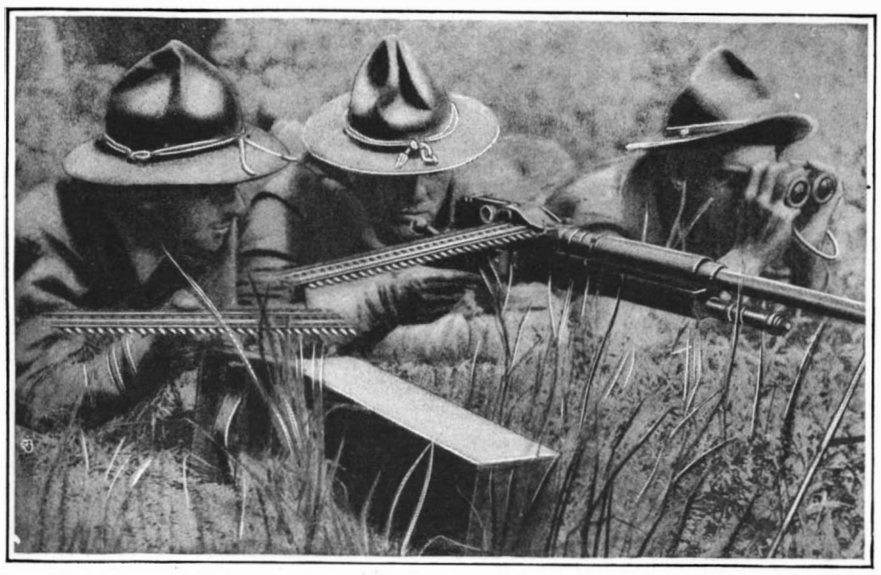

The Benet-Mercier machine gun used by our army
Cartridges are fed in from clips holding thirty rounds. The improper placing of the clip in the slot will cause a jam and failure to function.

New York's Gasoline-Electric Trucks for Garbage-Collection and Snow-Removal Service

DIFFERING from the street-cleaning equipment used in any other city in the world, the twelve motor tractor-and-trailer units now employed in the model street-cleaning district of New York city, under the supervision of Commissioner Fetherston, are designed to do all the work in that district, including the collection of garbage, ashes and paper refuse in the day, the sweeping and flushing of the streets at night, and the cleaning off of snow in winter. Aside from the multifarious work which they are designed to do and the elimination of all horse-drawn vehicles in the area in which they work, the tractors are featured by the use of gas-electric drive and by the fact that they haul huge 20-ton detachable trailers.

Gasoline-electric tractor with a front-end plow in place, ready for snow-removal work

The selection of the gas-electric type of drive on the tractors was made for cheapness and operating simplicity. While the electric tractor was highly desirable from the standpoint of ease of operation, the fact that each unit has to work 16 out of the 24 hours every day made its use impossible except by the employment of two sets of batteries, because of the mileage limitations imposed upon it by the storage battery equipment. On the other hand, the gasoline tractor with gear transmission, clutch and spark and throttle controls was impracticable because of the great number of stops in collection work, averaging from 60 to 100 per hour, and the subsequent slow acceleration between stops, the comparatively large consumption of gasoline during these periods, and the resulting necessity for drivers of a higher class.

The gas-electric type of drive, comprising a gasoline motor directly connected to an electric generator whose output is used in motors driving the rear wheels, combines the desirable qualities of both the purely gasoline and the purely electric tractor. The mileage limitation of the latter is overcome through the generation of the current by means of a gasoline motor instead of being taken from a storage battery. The simplicity of the electric is retained through the elimination of the gearset and the conventional controls of the gasoline tractor, while the comparatively large gasoline consumption of the latter, when the motor is run at normal speed during the many short stops, is eliminated by the use of a special device which automatically cuts the speed of the motor in half when there is no load on the generator.

The governor device consists of a solenoid of the plunger type, which is connected in the throttle lever of the gasoline motor by linkage. It is wired in multiple across the generator terminal through a contactor on the driver's controller shaft, which in turn is so arranged that a slight movement of the controller handle from neutral position in either direction will close the circuit, automatically speeding up the gasoline engine before the driving motors at the rear wheels begin to draw current. Conversely, throwing the controller to neutral automatically reduces the gasoline motor speed to half that when there is a load on the generator.

The solenoid device is locked to be tamper-proof. From the moment the gasoline motor is started at the beginning of the day's work, it is kept running without any attention on the part of the driver, its speed being regulated by the solenoid apparatus. All the driver has to do is to steer the vehicle and operate the controller, which gives five speeds forward and two reverse.

Perhaps of equal importance with the design of the tractors is that of the trailers for the collection of garbage, ashes and paper refuse at the same time. The trailers make use of eight double-decked steel buckets, as shown in the accompanying illustration depicting the electric crane at the river-front

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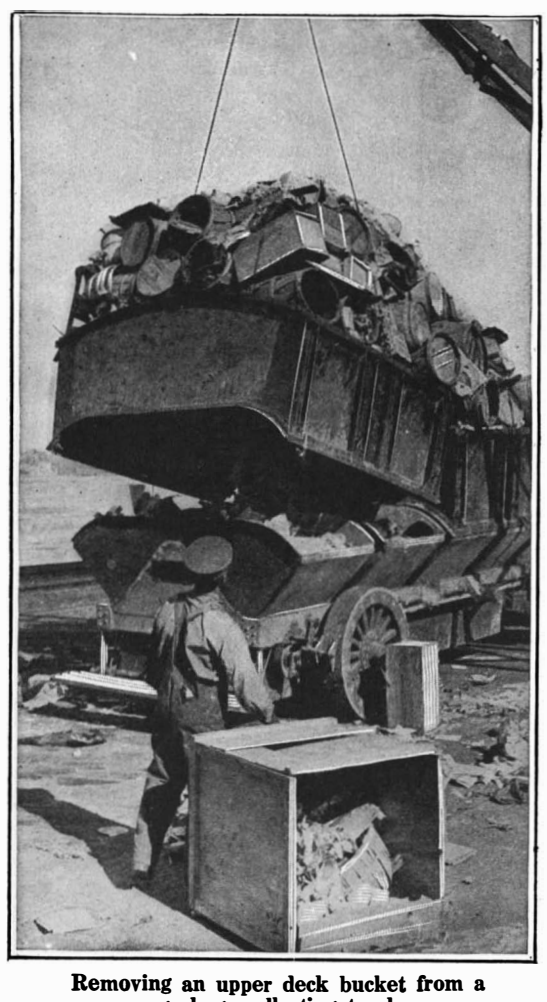
Gasoline-electric tractor and garbage-collecting truck at a disposal pier, showing method of unloading the refuse



Removing an upper deck bucket from a garbage-collecting truck

The War Game—II

Service of Security, on the March and at the Halt

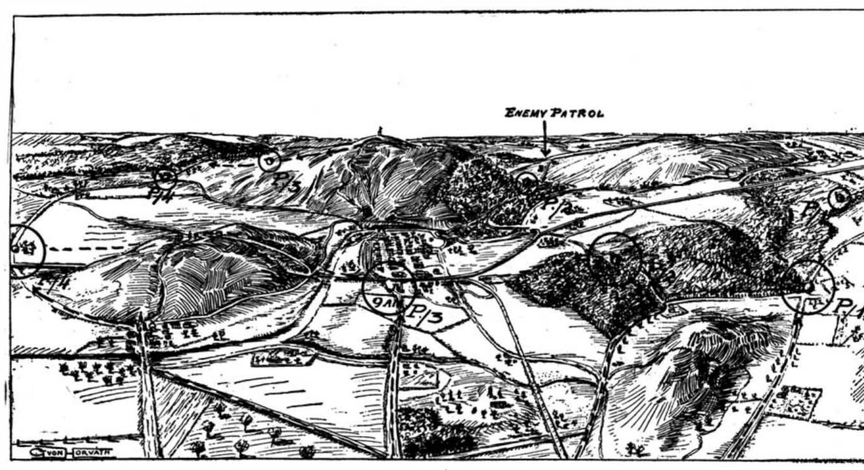
By Lieut. Guido von Horvath, formerly of the Austro-Hungarian Army

THIS *is the second number of a series of map problems which began with the* SCIENTIFIC AMERICAN *of March 11th. The army organization referred to in the first paper does not conform to American practice. Beginning with the present installment, however, the American organization will be strictly adhered to.*

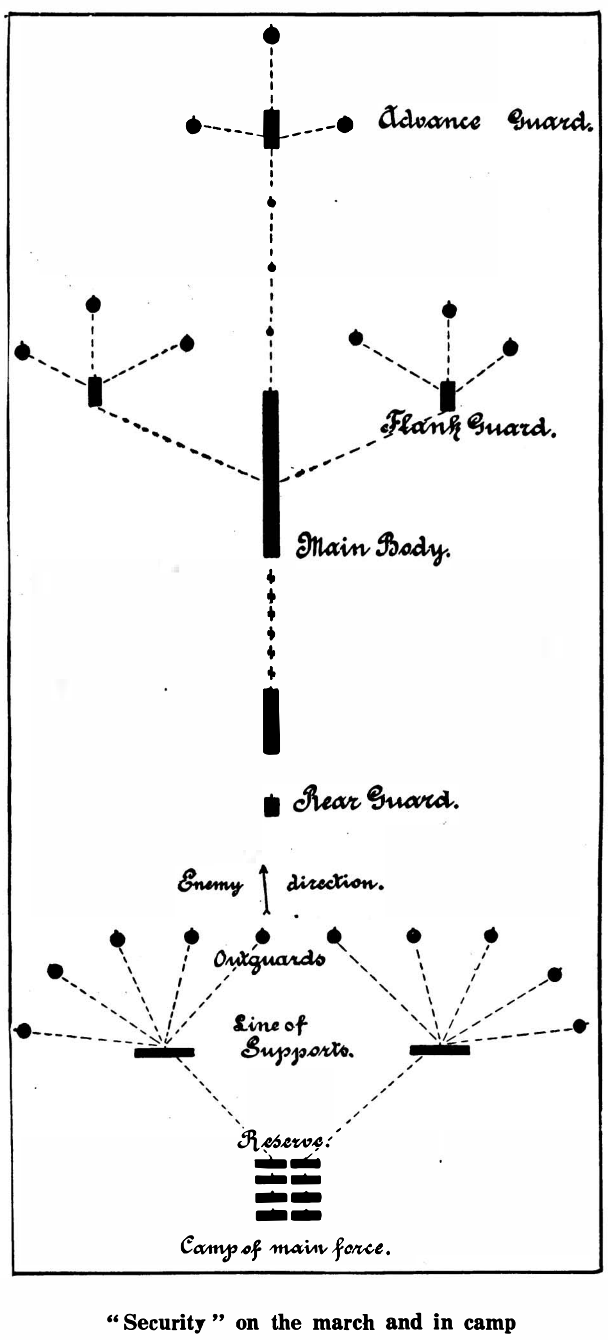
The unit of army organization is the division. It is a completely balanced unit, having in proper proportions the three fighting branches, infantry, cavalry and field artillery, with the complementary technical, sanitary and supply troops. The American division consists of

3 brigades of infantry, of 3 regiments each,
1 regiment of cavalry,
1 brigade of field artillery, of 2 regiments, each regiment having 24 guns,
1 battalion of engineers,
1 battalion of signal troops,
Sanitary troops,
Supply columns,

In column, the division occupies about 15 miles of road space. With advance guard at normal distances, it is spread out to cover about 21 miles. The total strength is about 22,000 men.—EDITOR.



Bird's-eye view of the scene of operations



"Security" on the march and in camp

THE security of troops when approaching the enemy and when camping or bivouacking in his vicinity, demands guarding against surprise. This duty is just as important as the leading of these troops to victory. Therefore every commander should provide the best protection possible for the troops entrusted to his command.

It is evident that the service of reconnaissance, which we have explained and worked out in War Game No. 1, is closely related to the service of security, and that reconnaissance is necessary before the commander can issue the orders to protect his troops while on the march or at a halt.

Let us consider the meaning of security in this particular case. When we have reached a solution of this problem, common sense will suggest a method by which an armed body can protect itself. We can find the answer easily if we put to ourselves this question: "Against what must troops protect themselves?" The answer will be: "Against surprise."

Soldiers are not delicate beings to be sheltered and guarded against attack or battle. It is their business to be sent out to attack and defeat the enemy. A body of troops cannot do its work if it is in danger of being surprised at any time. If the troops are protected from surprise they can make themselves ready for any action of the enemy. Therefore, the service of security is so organized that the troops provide for the time in which the main body, the bulk of the fighting force, can make itself ready for a successful encounter.

The service of security divides itself into two phases, providing, first, security on the march, and second, security in camp or bivouac.

The march is protected by security detachments called Advance Guards, Flank Guards and Rear Guards. During a forward movement the duties of the Rear Guard are of minor importance, but when a force is obliged to retreat the duty of the Rear Guard is as important as that of the normal Advance Guard in a forward movement.

Security when at rest, in camp or bivouac, is protected by means of adequate Outpost detachments.

To use a simple example, let us observe the movements of a snail. As it moves slowly through the grass it pushes forward its feelers, and it does not move until these feelers give the assurance of safety. The feelers of an advancing force are its Advance and Flank Guards. They travel in front of the main body, feel out the terrain and search it for the enemy. And if this duty is thoroughly done, no surprise can reach the main body.

The distance of these security detachments in front of the main body varies according to the terrain and the strength of the main body and the location and strength of the enemy. In wooded and difficult terrain the distance will be less than in an open country, but it must always be sufficient to allow the main body to get ready and to deploy for action. The strength of the Advance and Flank Guards is determined by the same considerations.

To give an example: We return to our 27th Infantry Regiment, which has just reached Norrisville. By this we mean that the main body is in the village. Therefore, the Advance and Flank Guards are north of that place. The objective for the further march being Pottstown, quite naturally the Advance Guard will be found on the main road leading to that town, while the Flank Guards are on the roads to the right and to the left of the Pottstown road.

Here it must be understood that, in addition to the flanking detachments sent out by the Advance Guard, the main body will also, when necessary, send out its flank guards. To represent graphically the formation of an advancing force, it may be considered as a wedge.

The importance of keeping up communication between all these feelers is just as great here as it is in reconnaissance. Indeed, it is more important, for greater responsibilities are connected with the movements of larger forces. For this purpose men are posted at intervals of 100 or 200 yards between the Advance Guard and the main body, as links to maintain communication. As soon as the Advance Guard halts, the main body will halt, so to say, automatically. The halt of the main body of our column at Norrisville again means that the Advance Guard must halt when the connecting links signal forward that the regiment has halted there.

Situation

The detachment, consisting of the 27th Infantry, one battery of field artillery, one platoon of engineers, and the accompanying trains, reached Norrisville at 4:00 P.M.

Colonel K, commanding the detachment, receives there a wireless message from Captain C, at Pottstown, in which he reports that strong advance forces of the enemy have been observed north of the coal mines.

After a thorough inspection of the terrain, Colonel K decides to halt for the night at Norrisville. Through his adjutant, he sends the following order to Lieutenant-Colonel L. K.:

"The enemy has reached the coal mines north of Nehaminy River in considerable force. Our advance cavalry is in Pottstown and its patrols are in close touch with the enemy.

"Our detachment will camp in and around Norrisville.

"The Advance Guard will establish outpost on the line Clan Road to Bowers Bridge on the Conestoga Creek, both inclusive. In case of attack, this outpost line will be defended.

"The battery will take position before sunset, covering the main roads leading toward the enemy.

"Outpost will be relieved at 5:00 A.M.

"Fires must be covered before dark.

"I shall be at school building opposite church, where all reports are to be sent."

* * * * * *

By wireless, Colonel K sends the following order to Captain C at Pottstown:

"Our detachment will camp at Norrisville, with outpost on the line Clan Road to Bowers Bridge.

"Move out with your squadron at 3:00 A.M. and determine accurately enemy forces north of Nehaminy River. Signal results from Lookout Peak as early as possible.

"Messages to Norrisville."

Consideration

The reason for Colonel K's decision to make a halt at Norrisville is, quite naturally, due to a long day's march. Beside this, the topographical situation is favorable for a strong defensive position, and, on account of its open nature, it gives an assurance against surprise.

The outpost service demands from the outpost commander consideration of the following points:

1. The division of the outpost line into sections to be covered by smaller units.
2. The selection of these sections must be determined by the number of approaches toward our position open to the enemy's advance.
3. In this case it is a night service, and therefore the location of the outguards must be selected to give the best possible chance to discover every approach. A line of low ground with a sky-line in front which must be crossed by anyone coming from the direction of the enemy has the greatest advantage.
4. It is highly important that the advance elements of the outpost should reach their positions before night sets in.
5. By sending out small patrols from time to time, short distances in the enemy's direction, especially on main roads, the protection can be improved.
6. The communication between the outguards is maintained by small patrols from right to left.
7. The outpost commander, once the line is established, does well to inspect the line, make any desired corrections, and then report to headquarters.
8. Sentries from the outguards, forming the line of observation, challenge all persons approaching their posts, and allow no one to pass, either in or out, unless duly authorized.

9. A sentinel post usually consists of two men posted together, especially at night, for added security.

10. The men in the line of outguards should always be ready for immediate action.

11. The reserve usually camps or bivouacs.

A study of the illustration below will give a clearer idea of this service than further description.

The line of outguards is called the Line of Observation; the line of supports is usually the Line of Resistance.

Developments and Questions

The commander of the 3rd Battalion, Major M, having received his instructions from the Adjutant, gives orders for the immediate rest and provisioning of his battalion, then he and his adjutant ride ahead to inspect the topographical situation and to determine the sections for the supports.

1. Where will the Major find the different elements of the Advance Guard? The Flank Guards? With the aid of pins, mark these positions on the topographical map.

2. Find the line Colonel K has selected for the outpost line. Try to reason out why this line was selected. (Always keep the enemy in mind and that the Colonel wants to protect his command against a surprise by the enemy.)

An hour later, after making his inspection, Major M leads his battalion from the village, and while on the march he calls the company commanders together and gives them the following detailed instructions:

"Considerable enemy forces have been observed north of the coal mines. Our detachment will camp for the night at Norrisville.

"This battalion will constitute Outpost on the line Clan Road to Bowers Bridge. In case of attack this line will be held.

"'A' Company will form Support No. 1 and will guard the section from Clan Road to the top of Goat Hill. 'B' Company will form Support No. 2 from Goat Hill to Bowers Bridge.

"Reserve, 'C' and 'D' companies, at Railroad Fork.

"Supports will be posted at once to relieve march outpost. Location of supports will be reported as soon as possible.

"Messages to Reserve."

Now, compare the ideal plan of an outpost line with the terrain as pictured in our war map, and make an attempt to mark the points the supports of the outpost should occupy. Use stick pins.

The roads being the most important lines, especially the main roads, naturally they must receive the most careful attention. The supports of the outpost line are therefore placed with this idea in mind.

Right now let us get acquainted with the strength of an outguard: A platoon is one quarter of a company. Each platoon is divided into four squads. The platoon numbers thirty-two men, and the squad eight men. A squad will in most cases answer for an outguard, but important points, like the road leading from Norrisville to Eden, might better be by two squads. A still larger outguard, consisting of a platoon or more, is called a picket.

The distance separating outguards, especially at night, must not be too great. In open country 800 yards will answer. In wooded or covered sections, much less. Between these outguards constant patrolling is maintained from one to another.

When the positions of the supports are selected, the commanders of A and B companies will lead their respective companies to these positions: Captain C/1, commanding A company, has decided to occupy the Eden road and to stop at the northern edge of the orchard half a mile north of the road fork. After considering the terrain, he decides to send out six outguards. For this purpose he calls his officers and non-commissioned officers to him when he has reached his position on Eden Road, and gives the following order:

"The enemy has been observed in considerable force 14 miles north of here. Our detachment will camp in Norrisville. Our battalion will constitute outpost on the line Clan Road to Bowers Bridge. This company, as Support No. 1, will guard the section from Clan Road to Goat Hill. To do this I shall send out six outguards:

"Sergeant 1, with two squads from 1st platoon, in line with Zion farm, as outguard No. 1.

"Corporal C, with one squad, on hillside near fence; outguard No. 2.

"Corporal C/2, with one squad, 800 yards north of outguard Number 2, on hillside; outguard Number 3.

"Corporal C/3, with one squad, east corner of Berry farm park; outguard No. 4.

"Lieutenant L, two squads, main road to Eden, at Berry farm; outguard No. 5.

"Sergeant S/1, one squad, on Goat Hill; outguard No. 6.

"Communication to be maintained from right to left. Communication on our left flank to be established with outguard of B company, support No. 2, outguards No. 1 and No. 5 to send out small patrols three miles to the front.

"3rd and 4th platoons will remain here as support. In case of attack the line will be held.

"After establishing positions and communications, I expect reports here."

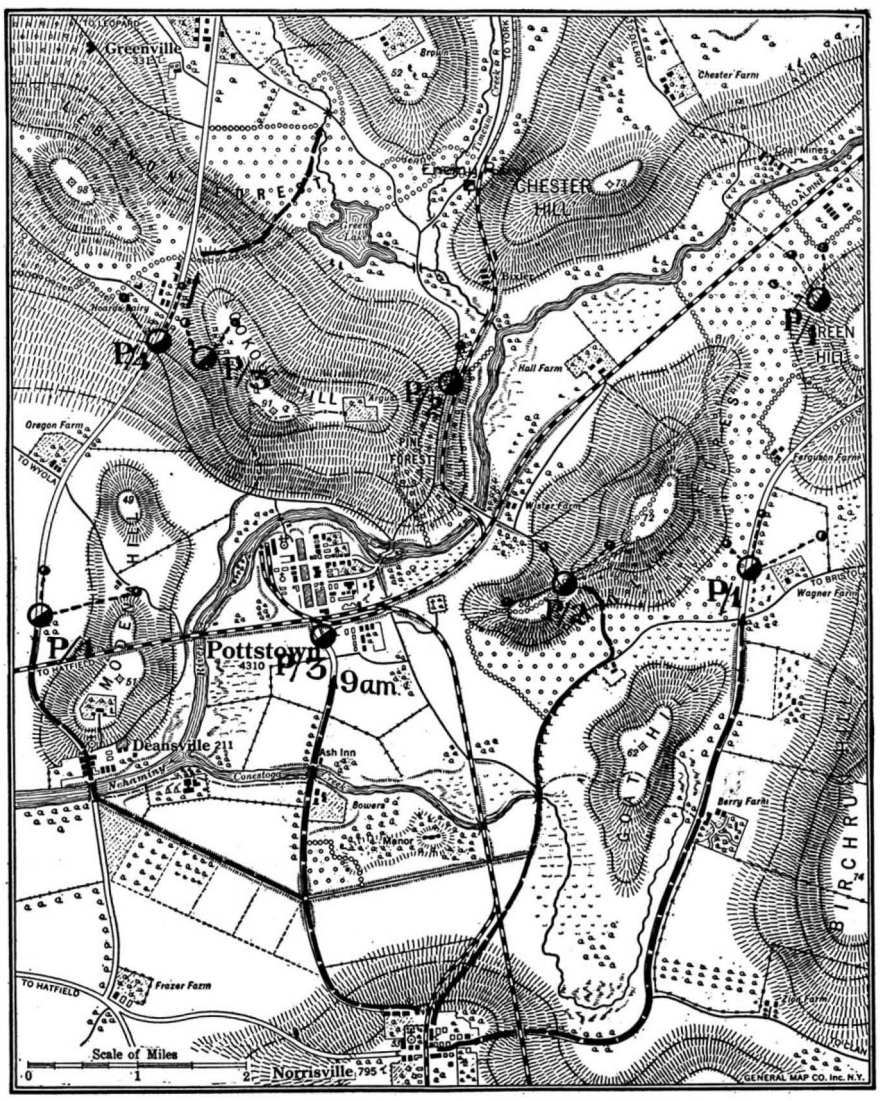
4. Mark out on the war map the sections of the outguards as established, for A company, support No. 1.

5. Supposing that you are commander of B company, formulate an order to fit the case for this company's duty and mark the result on the map.

The Result of the Outpost Service

The night has passed without event. The patrol sent out on Eden Road by Lieutenant L has encountered a small enemy cyclist squad, which was repulsed at the embankment in the road.

NORTH.



SOUTH.

Map illustrating the progress of the patrols

At 5:00 A.M. Colonel K receives by signal service from Lookout Peak report that an enemy detachment, apparently the flank guard of a large force, is camped at Chester Farm. Its strength is three battalions of infantry, half a squadron of cavalry and one battery. Their intention seems to be to follow the Nehaminy River. Our squadron had an encounter near Green Lake and dispersed one platoon of enemy cavalry and took four prisoners. Our squadron will remain in close touch with the enemy until further orders are received.

Answers to Questions in War Game No. 1

1. Lieutenant L reached the railway crossing at 9:00 A.M., and at that time the situation of the other patrols is shown on the map.

2. These men, serving as connecting links between the patrols, have to strive for high points, where they can see and signal to their next neighbor, and so on to their own patrol. This is a very trying duty for both men and mounts, yet it is necessary to carry it out as far as the character of the ground will permit.

3. Patrol 1, after entering the Paoly Forest, will be practically out of communication with the others until these woods are passed. Patrol 2, by a quick passage of the same forest, can reestablish communication as soon as it reaches the hilltop and, with it, open country. The other patrols have an easy task in this respect.

4. Lieutenant L can choose between the ferry closer to his destination and the two bridges and the island. Undoubtedly, he will choose the bridges. The ferryboat might be on the other shore, and more time be lost by taking the shorter road,—besides, the bridge gives more freedom of action.

5. The distance from the bridge to Lookout Peak is about four miles. But this distance must be considered as increased considerably, owing to the slow progress which will have to be made in climbing the hill.

6. The passage from the double bridge through Pine Forest is dangerously close to the enemy. Corporal C has to give up communication with Lieutenant L's patrol. In this case the best way would be, first of all, to take time to inspect the wooded right shore, while two men ride cautiously ahead to the fork above the railroad. This once reached, the patrol could follow and, with a quick gallop, the patrol would strive to reach the northern edge of the woods. The first action there would be to observe the terrain ahead, and then attempt to establish communication with Patrol 3.

7. Lieutenant L, once on the hilltop, will, while keeping under cover, utilize the commanding viewpoint in a search of the terrain for signs of the enemy. At the lookout tower he will do well to dismount and make another observation.

8. On sighting the enemy patrol near Timcum Creek, he will remain in observation to ascertain the strength of the enemy. Once sure that it is but a patrol, he will try to devise means of passing it unobserved.

9. To do this, the curving western slope of the hill, then the trees, finally Hoard's dairy and the forest itself, will serve him excellently.

10. Positions are traced on plan.

11. The route most promising is pointed out on plan.

12. Since he has observed only a single enemy patrol, he will not send a message till he has ascertained the strength and character of the enemy to which this patrol belongs.

Occurences of Importance

At 6:00 A.M. the detachment of Colonel K is ready for the march.

From Lookout Hill the following report is heliographed to Norrisville:

"After an unsuccessful attempt to use ferry at Coal Mines, the enemy has sent out advance guard along the Nehaminy River. This has reached Great Pine Tree and is moving southwest along river. From a prisoner we have information that the enemy's first aim is Pottstown. Several small detachments have reached left shore and entered Paoly Forest."

Almost immediately after receipt of this message an orderly arrives from the Second Division headquarters, to which Colonel K's detachment belongs, with the following order:

"Advance to Nehaminy, secure all bridges in and near Pottstown. Urgent."

The Third War Game will work out the dispositions of Colonel K.

NOTE.—While the map used with this series of war games differs from the maps used by the United States Army, in the method of showing elevations and certain conventional symbols, it has been adopted for the sake of clearness to the novice. In order to avoid confusion, however, the key to the conventional signs will be published under the map in every case. After the publication of the preliminary war games, when our readers have become more accustomed to reading maps the terrain will be shown exactly as in the General Staff maps, with elevations represented entirely by contour lines.

Tire Prices

WITH the cost of rubber, cotton and oxide of zinc, and even of lamp black steadily increasing it is not surprising that the price of tires is going up. How far this will go no one cares to predict, but the tire problem promises to be a serious one for many car owners before many months have passed.

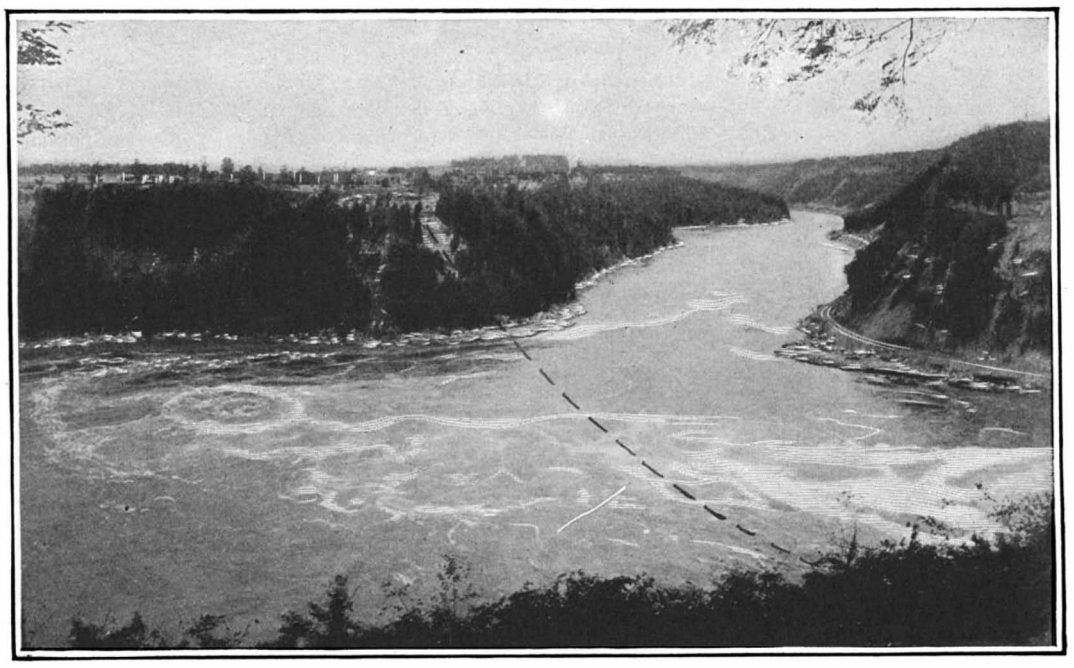
Over the Whirlpool by Aerial Cable

Describing an Aerial Scenic Railway Recently Completed at Niagara Falls

By Chas. W. Person

AN aerial scenic tramway 1,800 feet long, built exclusively for transporting passengers across the Whirlpool, has been almost completed at Niagara Falls, Ontario. It is one of the longest, and probably the safest, aerial cableway in the world. The only other installation of its kind is at San Sebastian, Spain, where tourists are transported across a gorge, from a trolley terminus to an otherwise inaccessible view-place and casino overlooking the Bay of Biscay.

The Whirlpool, next to the Falls itself, is the most popular scenic attraction for tourists. According to guide books of Niagara Falls, it is a "maelstrom, a vortex of water, swirling in gradually narrowing circles to a depressed center." Instead, the force of the water pouring into the basin raises it in the middle to a distance of three feet above the outer surface. The Whirlpool is the natural result of the mighty body of water rushing into a confined space and seeking an outlet. Bodies, driftwood, everything, in fact, that goes over the Falls must eventually find its way to the Whirlpool, where, after circling for days, perhaps, it is either thrown out upon the bank or carried by the outlet to Lake Ontario.



The Whirlpool, Niagara Falls. Thompson's Point appears directly opposite, and New York State at the right. The dotted line indicates the location of the new cableway

Situated about three miles below the Falls, the Whirlpool is almost entirely within the Province of Ontario. The sharp yet thickly wooded cliff that encloses it is a part of the river bank on the Canadian side, so that both ends of the cableway are in Ontario. Happily, however, New York State comes in for consideration, for the boundary line between it and Ontario forms an acute angle, which is intersected by the cableway about 60 feet within the apex. Because the bed of the river is owned by New York State and the water by the Federal Government—two factors which are small enough in themselves, but which loomed up large in the light of subsequent negotiations—the promoters had to secure permission from Washington and Albany, after they had the sanction of the Province of Ontario and of the Victoria Park Commission of Niagara Falls.

The design of the anchorages was governed largely by the fact that the cableway was not allowed to cross the tracks of the Niagara Belt Line Railway, and by the further restrictions of the park commission that the cliffs on either side must not be altered or defaced, and that no towers or structures of any kind could rise above the level of the tracks of the railway which runs along the cliff.

The design of the cableway is based upon Spanish patents, and the enterprise has been financed entirely by capitalists in Spain. The system used is the invention of Torres y Quevedo, an engineer who has gained considerable European fame in aeronautics.

The Torres principle is not altogether new to construction engineers in this country. It has been applied previously in Canada and the United States to single cables for industrial purposes, but not to multiple cables for passenger traffic. It bears the dual distinction of being the only cableway of its kind in the world, and the only one in America.

Coming down to the actual engineering and construction features themselves, the passenger car is suspended from a running gear which travels on six parallel carrying, or track, cables, each of which is fastened securely at Colt's Point. At the other terminus, Thompson's Point, each track cable passes over a grooved sheave and is fastened to a counterweight or stretcher. These six counterweights are boxes 12 feet high by 6 feet 7 inches wide by 11 feet deep, made of riveted steel. Each box contains four cast iron pieces of 195 pounds each and 200 pieces of 90 pounds each, making a total load of 18,780 pounds, which, with the weight of the box itself, makes a 10-ton counterweight for each track cable.

The boxes are so constructed that they move up and down freely in steel guides. Thus, a sudden load thrown onto the track cables would cause the boxes to rise and the cable span to sag, but the tension in each cable is always 10 tons, regardless of the load on the track cables; that is, regardless of the load on the passenger car itself. For the sake of further illustration, if the load on the car is increased, the counterweights rise and the sag in the cables is increased, the cables taking such an angle that the vertical components of the forces acting along them are always equivalent to the weight of the car and its load. Of course, this is disregarding the variations of tension due to the inertia of the stretchers, but they are negligible.

The track cables consist of 1-inch crucible steel rope, made up of seven round strands, surrounded by 16 locked coil strands. As these are too stiff to bend over the sheaves at Thompson's Point, each one is fastened, by a standard socket 10 feet in front of the sheave, to a 1¼-inch Monitor plow-steel cable, made up of six strands of 19 wires each, and these latter cables are bent over the sheaves and fastened to the counterweight boxes.

At Colt's Point each track cable is fastened by a standard threaded clevis and socket to a 2-inch rod. These six rods are bent around a concrete block weighing 741 tons, which is built into the sheer face of the cliff, and are fastened securely at the bottom of pits, which are left open to permit of inspection at any time of the nuts, washers, etc.

One of the most novel features of the whole installation is that each track cable is entirely independent of the others. This is of the greatest importance. It means that the breaking of any one cable would not be at all serious, as the other cables would support all the weight of the car without any increase in their tension. In the event that one of the cables should break the car would drop several feet suddenly, and, after a few vertical oscillations, would assume a new position of equilibrium. Consequently, the breaking of one cable would not endanger the lives of the passengers, and the breaking of two cables at the same time would be nearly as improbable as the simultaneous breaking of two cables belonging to totally separate installations.

The passenger car now in operation at San Sebastian holds only 14 passengers, all standing, whereas the car constructed for Niagara provides seating space for 24 passengers, and standing room in a raised aisle in the center of the car for 21 more besides the conductor. When empty the car weighs 3½ tons; when fully loaded, 7 tons. It is 10 feet 10 inches wide, 24 feet long and 23 feet high. It was manufactured complete in Spain, and assembled here. At the Thompson Point station recently it carried a test load in the form of 223 cast iron weights of 90 pounds each, or three times its maximum passenger load. The car is so constructed that should a track cable break at a point just above the car, it would in all probability drop without hitting the passengers, as the carrying wheels extend beyond the basket. Besides, the framework above the basket protects the passengers.

The car is propelled by a ⅞-inch 6 by 19 plow-steel traction cable, fastened to one end of the car. The cable passes over a sheave on Colt's Point, runs back across the Whirlpool, over a sheave in front of the Thompson's Point station, and to the driving sheave. From here it passes around three sheaves, to one of which is fastened a 10-ton counterweight box, arranged in guides similar to the track cable counterweights, and this creates a tension in the cable

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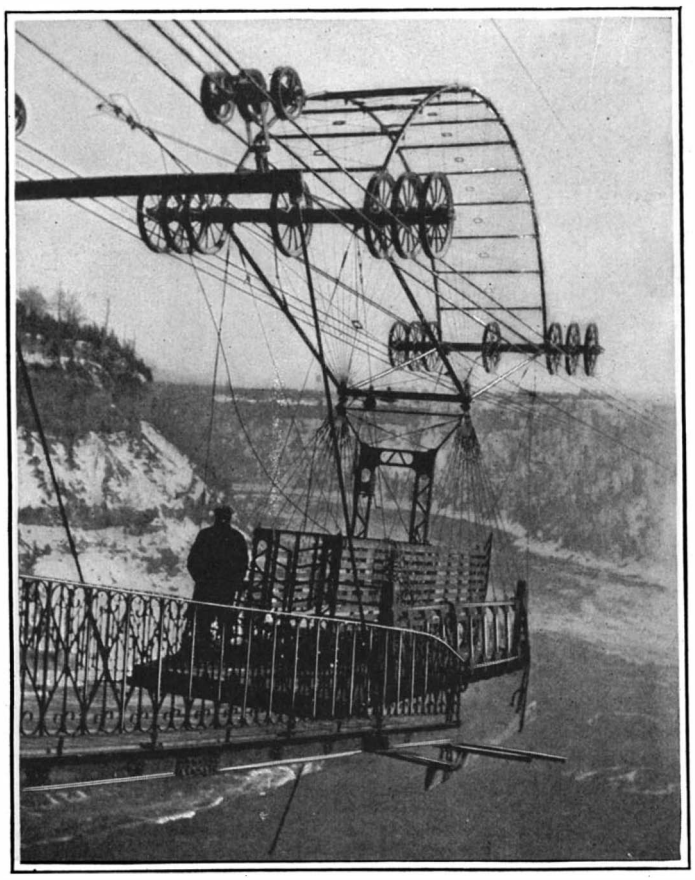
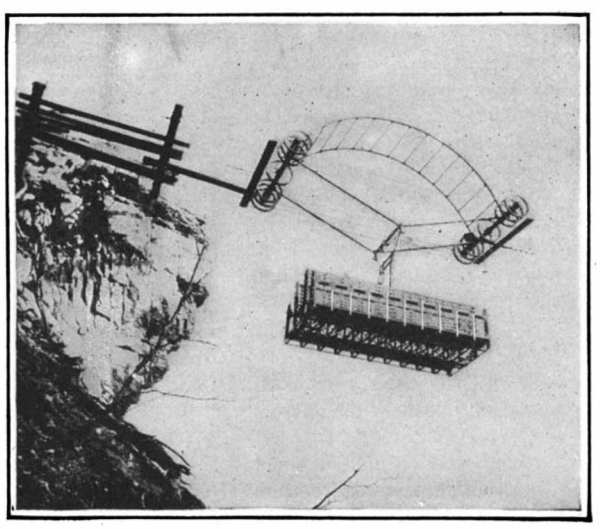
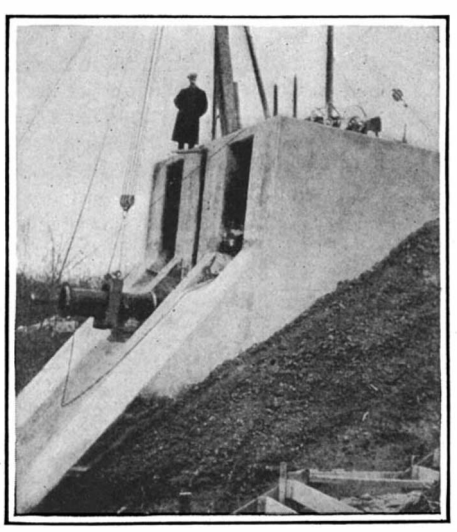


Landing platform and car at Thompson's Point



The cable car as seen from below



Cable anchorage at Colt's Point

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.

Of Interest to Farmers

ROTARY GRAIN CLEANER.—C. QUESNELL, 659 Pettygrove St., Portland, Ore. The invention is particularly embodied in the means for supporting and also shifting or adjusting a series of horizontal rotary rollers, to vary the distance between them, as required for different sizes of grain; also in the means for automatically communicating motion from one roller to another.

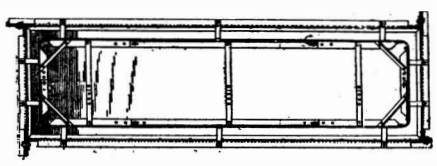
NEST.—W. A. KUNTZ and L. M. CHRISTOPHERSON. Address W. A. Johns, Wolsey, S. D. An object here is to provide a sanitary and cool hen's nest that may be opened for the entrance of the hens and to the nest compartments therein and closed at night to prevent dirt from dropping into the nest as well as prevent setting hens from occupying the nest.

HOG OILER.—R. F. ARMSTRONG. Address the Atchison Stock Powder Co., Atchison, Kan. The roller furnishes a rough surface, and the hogs soon discover this, and will rub themselves against it. It rotates as they rub and may also move vertically, and when this occurs the valve will open and a portion of oil or dip will flow down upon the facing of the roller and be transferred to the hog. The oil flow is sufficient to keep the facing saturated, and any character of dip may be used instead of oil.

Of General Interest

PROTECTING BELT FOR BABIES.—M. B. STERN, 246 E. 50th St., New York, N. Y. This invention provides a simple, convenient, inexpensive, and efficient belt, wherein the child has ample freedom until it tends to slip out of the belt, when the belt automatically tightens and grips the child, preventing its slipping out from the belt while unattended in seats on chairs or in carriages.

CONCRETE BURIAL VAULT FORM.—L. P. DUNN, 1527 South 20th St., Terre Haute, Ind. The molds in this invention are made of steel plates, and are adjusted to make four or more sizes of vaults. The adjustments are effected mainly by the omission of parts, thus making it as convenient to make one size of



CONCRETE BURIAL VAULT FORM

vault as easily as another. The sides are braced so as to prevent any spring in the molds. The core is provided with clamp clutches, thus making it easy to set up and take down the core without injuring the raw vault. The lid is so made as to prevent seepage due to carelessness in sealing or to broken sealing.

MOISTENING DEVICE.—D. G. BEECHING, 210 E. 23rd St., Brooklyn, N. Y., N. Y. The invention provides a device of sanitary nature, the same including a reservoir to hold a body of water and a flexible apron or diaphragm stretched across the top thereof and normally spaced from the water, said apron being depressible so as to touch or pass beneath a portion of the water for the purpose of carrying a film of water upwardly for subsequent use in sealing envelops or analogous purposes.

TOOTH BRUSH.—H. REICHE, P. O. Box 755, New York, N. Y. This brush is so inexpensive that it may be thrown away after being used a single time. A sufficient amount of dentifrice is incorporated in or combined with the brush to provide for a single operation only. Thus the construction is far more sanitary and cleanly than the brushes which are now used indefinitely or until worn out.

SYRINGE.—J. H. PRUITT, Callicoon, N. Y. The purpose here is to provide a sanitary and scientific device which will glide easily, which will smooth out the mucous membrane and allow any medication to reach the entire surface, thereby soothing and relieving any congestion and which will also carry off anything unhealthy.

Of General Interest

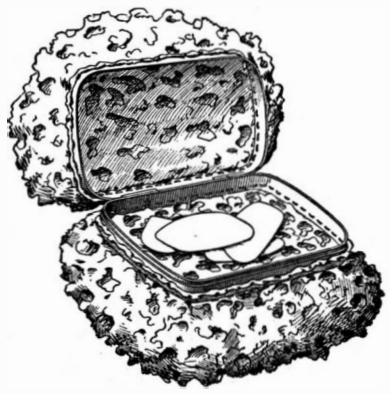
PENHOLDER.—S. GRISWOLD, Camp Point, Ill. The penholder has at its forward end a sheath or case adapted to co-act with the front end of the holder, to hold a pen, the case being removable, and provision within the case and rearward of the pen-holding front end, whereby the pen may be held at the front in proper position for writing, or may be removed and housed within the sheath and held therein when the pen is not in use.

BURGLAR ALARM.—H. BASEVITZ, 1235 South California Ave., Chicago, Ill. In the present patent the invention has reference to burglar alarms, and the object thereof is the provision of a simple, inexpensive, and efficient alarm which is adapted to fire a cartridge when an unauthorized person is trying to force a closure protected by the said alarm.

REVETMENT.—D. McD. SHEARER, Box 132, Greenville, Miss. This invention relates generally to revetment mats for the protection of subaqueous river banks and shores from current and wave erosion and to promote soil stability, and the object thereof is to provide a practical, economical structure of mat, the units of which are of concrete, whereby it may be placed in strong currents and in great depths of water.

REVETMENT MOLD.—D. McD. SHEARER, Box 132, Vicksburg, Miss. This invention provides a mold particularly for use in connection with the formation of the revetment mat embodied in Mr. Shearer's application Serial No. 879,644, said mold including novel means for supporting a reinforcing fabric or bonding wires therein about which the several blocks of the mat are cast, said blocks being spaced in order that the mat will be rendered flexible.

TOILET ARTICLE.—R. F. HOBBS, care of Hobbs Wall Paper Co., Hoboken, N. J. Among the principal objects which the present invention has in view are: to provide a box-like member for use as a soap receptacle; to pro-



TOILET ARTICLE.

vide means for uniting pieces of sponge, separable to receive therebetween soap in free contact with both pieces of sponge; and to provide means for uniting several relatively small sponges to form a larger sponge.

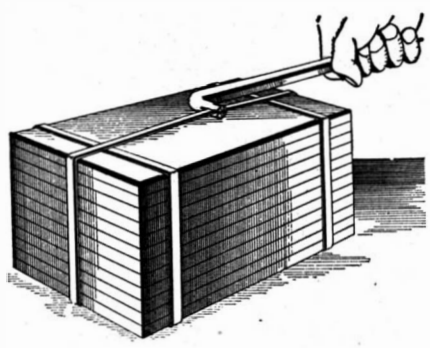
Hardware and Tools

GAGE.—E. G. FOX, 651 Fleet St., Kenosha, Wis. This inventor provides a device for use in obtaining measures of distances between fixed points, wherein a support is provided having indicators mounted for movement toward and from each other, each indicator having means whereby it may be secured rigidly to the support.

LOCK.—H. KORN, Aeolian Hall, 33 W. 42nd St., New York, N. Y. This improvement provides a lock for containers which acts as a plug and which is formed with outwardly extending locking arms or bolts. It provides a lock with a pair of locking arms or bolts, one arm or bolt being pivotally mounted on the other, the arrangement of both bolts being such that a single key will cause the simultaneous actuation of both bolts.

DEVICE FOR CLAMPING CLOTH.—N. H. WILLIAMS, 57 St. Charles Ave., Atlanta, Ga. The invention relates to a clamp to be used by cloth cutters for clamping the cloth on a cutting table. It provides means of simple and strong construction that may be readily adjusted to clamp the cloth and positively hold the same from slipping.

BOX STRAP FASTENER.—C. H. PETERMANN. Address H. W. Robinson, Attorney, 226-229 Hennen Bldg., New Orleans, La. The main object of the invention is to provide a tool of durable but simple and inexpensive construction, by the use of which a box strap or



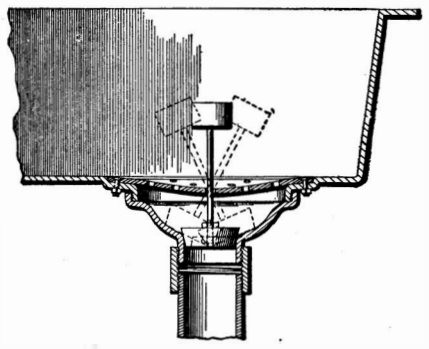
BOX STRAP FASTENER

similar device may be readily tightened by overlapping portions thereof. A further object is to provide means within the tool for holding a nail or similar fastening device, which is adapted to be driven through the overlapped portions of the strap.

SYSTEM OF HOT WATER DISTRIBUTION.—J. A. WILLIAMS, Aurora, Mo. This improvement provides a system of hot water distribution in which the usual hot water tank is employed, whereby hot water may be drawn when desired directly from the heating coil without interfering with the continued circulation of the water through the tank and coils.

LAWN SCARIFIER.—W. A. GORMAN, 1495 Union St., Brooklyn, N. Y., N. Y. In this invention use is made of a handled body and teeth carried by and projecting on opposite faces of the said body, the teeth on one face being longer than on the other face to allow of breaking the ground with the longer teeth, and to subsequently reduce the broken ground by the shorter teeth on reversing the implement.

KITCHEN SINK PLUG.—E. GROOM, 478 Roselawn Ave., Portland, Ore. This inventor provides a plug to stop the outlet in a kitchen sink, which may be readily applied to the ordinary drain pipe having a strainer plate in the base of the sink over its inlet, and having its

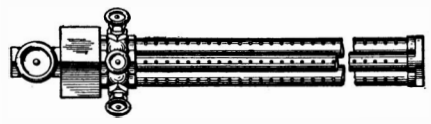


KITCHEN SINK PLUG.

end outwardly flared and screwed into the base of the sink. It provides a device which may be securely attached to the strainer plate so as to prevent accidental displacement or loss of the plug.

SUGAR BOWL.—C. BYERLEY, 102 W. 74th St., New York, N. Y. This invention relates to improvements in sugar bowls and the like and has more particular reference to means for discharging a measured quantity of granulated sugar or like material so as to obviate unsanitary conditions due to the use of spoons by various persons for obtaining sugar from a bowl.

SPRINKLER.—C. C. COOK, 123 E. Magnolia St., Stockton, Cal. This invention provides a sprinkler in which a plurality of sprinkling elements are used and independently controlled, said elements being adapted to throw



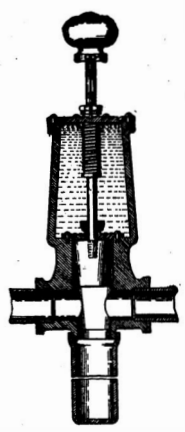
LAWN SPRINKLER.

the spray in different directions, thus providing a structure which may be used adjacent a pavement or in narrow spaces without throwing the water beyond the space desired.

INSECT TRAP.—S. KELTONIK, 203 Chesnut St., Johnstown, Pa. This invention relates to traps of a kind suitable for capturing flies and other insects, the more particular purpose being to enable the operator, at intervals, to readily drive completely into the trap such insects as have started into the trap but have not passed the portions thereof which prevent the retrogression of the insects.

Heating and Lighting

CUT-OFF FOR CONDUITS.—J. GILLEN. Address care of Daniel A. Gillen, Mitchell and N. 15th Sts., Flushing, N. Y. The invention pertains to cut-offs for gas pipes or the like, and has particular reference to means for shutting off the flow of gas between a street main



CUT-OFF FOR CONDUITS

and the interior of a building in an emergency such as of a fire or the like. The invention includes a valve casing in which the main pipes are connected on opposite sides and having a valve seat, the valve plug being arranged to drop by gravity so as to obstruct the flow of gas or other fluid through the main.

Household Utilities

SPOON.—A. E. LYCAN, R. R. No. 1, Box 20, Kooskia, Idaho. The inventor seeks to provide the spoon or its equivalent with a handle having a special form for preventing the handle from easily slipping upon the edge of a pan or dish, and in doing this for preventing the handle from becoming submerged in the contents of the pan or dish.

WASHBOARD.—T. W. CLEMMENTS, care of Haysler Mfg. Co., Fredonia, Kan. This washboard is so constructed as to permit of any number being packed for shipment whereby the same will occupy a minimum amount of space. Another object is to provide a form of shelf for holding a cake of soap thereon and at the same time permitting the complete drainage of water and suds therefrom.

CLOSET DOOR FOR STOVES.—A. OHNEMUS, Quincy, Ill. In this patent the invention has reference to an improvement in oven doors of the type in which various portions are finished in various different ways, as for instance, some by being enameled and others by being nickel-plated and polished, etc.

HOSE CONNECTION.—K. O. MUEHLBERG, 714 S. 15th St., Manitowoc, Wis. This invention relates to means for connecting gas, water, or other hose cocks, stoves, or other devices, and an object is to provide such connections which are positively proof against leakage. A further object is to adapt the connection to metallic, flexible hose, and in such manner as to form a component part thereof, although readily removable therefrom.

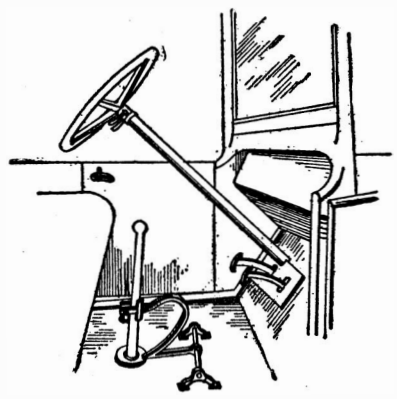
Machines and Mechanical Devices

DEVICE FOR REMOVING STUCK DRILLS.—R. C. CAMERON, P. O. Box 20, Bishop, Cal. The device has a sleeve with an outer thread with means for securing a drill in the sleeve so that the sleeve may be turned relatively to a second sleeve having an inner thread with which the first thread meshes. By this means it is possible to move the first sleeve together with the drill, longitudinally of the second mentioned sleeve, thereby withdrawing the drill.

METHOD OF WAXING SILK THREAD.—C. A. HAMMOND-KNOWLTON, 120 E. 16th St., New York, N. Y. The invention has for an object the provision of the steps or method whereby wax may be forced into the body of the thread. It provides a method for not only forcing the wax into the body of silk thread, but for removing the excess wax so that the finished product will be a silk thread completely impregnated with wax.

PARABOLIC MIRROR GRINDING MACHINE.—T. A. CORRY, care of Ferrocarelles del Sur del Peru, Arequipa, Peru. The invention relates to machines or apparatus for the manufacture and finishing of special forms of reflecting mirrors, and has particular reference to machines for concaving and polishing parabolic reflecting mirrors such as are used particularly for reflecting telescopes, headlights, etc.

AUTOMOBILE LOCK.—W. J. MILES, 1221 Foster Bld'g., Denver Colo. This invention is an improvement in automobile locks, and has for its object the provision of a mechanism capable of attachment to existing motor ve-



AUTOMOBILE LOCK.

hicles without change for holding the gear shift lever of the vehicle in neutral position—that is, in that position where none of the gears are in mesh, during the absence of the owner from the car or whenever else desired.

DITCHING MACHINE.—C. HUNGERFORD, Soldier, Kan. In this case the invention relates to machines for ditching or grading, and has particular reference to means of this character adapted to be drawn ordinarily by horses or a traction engine and designed for various specific purposes.

ELEVATOR SAFETY DEVICE.—P. J. PROKOP, 536 W. 145th St., New York, N. Y. The invention relates to elevators used for transporting passengers and freight from floor to floor in buildings, particularly that type employing suspension cables for the car, and the main object thereof is to provide means for automatically stopping a car in its descent in the event of the breakage of the cables.

SAFETY DEVICE FOR ELEVATORS.—A. J. ROSELL, 69 Underhill Ave., Brooklyn, N. Y., N. Y. The inventor provides a device for elevators arranged to prevent accidental opening of a shaft door unless the cage has reached and stopped at a landing, and to lock the controller in the cage against being actuated while the cage is at a landing unless the door for this landing is first in closed position.

PUMP.—S. A. STONE, Chillicothe, Mo. An object in this instance is to actuate the plungers independently, and in opposite directions at different times by any suitable means; a further object is to telescope the stems for the plungers, one within another, but in such manner as to be independently operable.

BLOW-OFF VALVE.—S. KAHN, 83 Court St., Newark, N. J. This invention provides a valve structure of a compound nature embodying

the characteristics of the now well-known check valve to retain the air within the tube and having also an auxiliary valve mechanism permitting any excess pressure over the predetermined degree to be discharged while the first mentioned check valve becomes seated, retaining the precise desired amount of pressure within the tube.

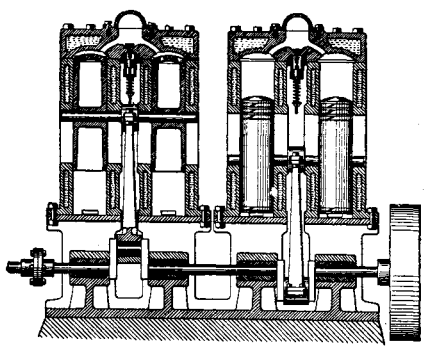
AUTOMATIC SWITCH FOR CONTROLLING THE OPERATION OF PUMPS.—K. SORGE, 224 E. 80th St., New York, N. Y. This invention has special reference to an improved pumping apparatus and more particularly to an improved means for automatically controlling the operation of electrically operated pumps, such as beer pumps, used for storing a tank with air under pressure or otherwise.

Musical Instruments

WHISTLING MUSICAL INSTRUMENT.—J. J. STANTON, 25 Wright Ave., Port Richmond, S. I., N. Y. This invention has reference to pneumatic musical instruments known as calliopes. An object of the invention is the provision of a simple and compact musical instrument in which the strength of the tones may be varied by varying the pressure of the air supplied.

Prime Movers and Their Accessories

INTERNAL COMBUSTION ENGINE.—S. S. ERICKSON, 643 138th St., New York, N. Y. The improvement has for its object the employment of a number of power units, such as cylinders and pistons mounted therein, said pistons being all operatively connected with a single crank shaft and a single crank thereon by means of one connecting rod and one wrist



INTERNAL COMBUSTION ENGINE

pin. One of the features of novelty disclosed is the construction of the frame, whereby the wrist pin may be quickly and easily removed from service position without tearing down, or disassembling the engine.

SPARK PLUG.—H. J. BUTLER and L. P. CASPER, care of the latter, 18th and Ormsby Sts., Louisville, Ky. This invention provides a plug adapted for use in an explosion engine of any character, and wherein mechanism is provided in connection with the plug for preventing the collection of carbon or other deposits between the points of the electrodes clean and bright to insure a fat hot spark.

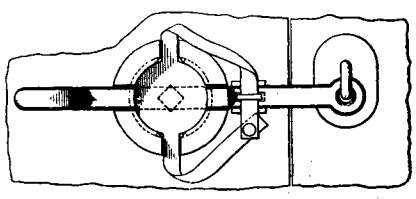
ENGINE VALVE.—F. F. EMORY, 78 Pleasant St., Fitchburg, Mass. This invention relates to steam engine valves and the means for operating the same, and more particularly to that type of engine valves commonly known as puppet valves having double seats. An object is the provision of a valve having suitable guides whereby it is effectively guided to its seat.

SPARK PLUG.—F. MOENCH, Rushville, Ill. The present invention has reference to spark plugs, the object being to provide a substantially integral structure which will be strong and durable in use, neat and simple in appearance, and which may be more readily and economically manufactured than the spark plug now in use.

Railways and Their Accessories

CIRCUIT BREAKER.—F. F. HUDSON, Dec'd. Address D. M. Crawford, Builder's Exchange, Memphis, Tenn. An object here is to provide a circuit breaker by means of which a circuit on the engine which is kept normally closed may be broken at predetermined points along the track by the provision of certain additional parts to those carried by the ordinary truck.

SEAL LOCK.—P. STOREY, care of C. P. R., Taft, British Columbia, Canada. In the present patent the invention has reference to seals for the doors of railway freight cars, and some of the main objects thereof are to provide such

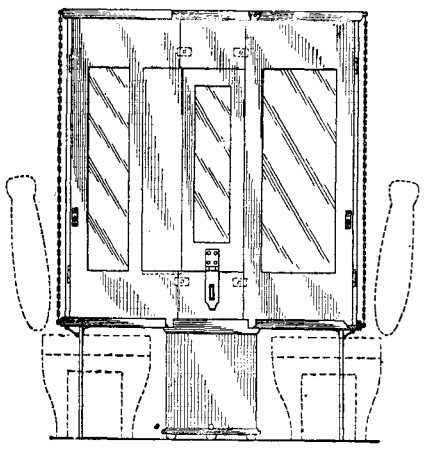


SEAL LOCK

devices which are quickly and easily sealed, wherein there is no possibility of removing the sealing medium without destroying the same, which are highly efficient, and which are comparatively inexpensive.

TRAIN STOP SYSTEM.—L. A. GLADDING and J. H. SULLIVAN. Address the former, P. O. Box 764, New Milford, Conn. This invention relates to a train stop system of that type in which the propelling power is cut off and the brakes set when a train passes a signal set to danger position, when a drawbridge is open, when two trains are within a danger zone of each other, and other conditions under which accidents, collisions or the like are likely to occur.

PORTABLE STAND.—W. J. CARMINE, 515 W. Monroe St., Jacksonville, Fla. This invention relates more particularly to stands for railway trains and depots for vending of publications, soda water, stationary, tobacco, etc. In the vending of goods on trains, loss by theft and other causes is frequent, owing to the inadequate provision made for the proper storage



PORTABLE STAND

and safe-guarding of the supplies furnished to the vender; and it is important to provide a portable folding structure that may be temporarily set up in the space between two car seats, and afford ample accommodation for the storage and display of goods in large variety and in desirable quantities.

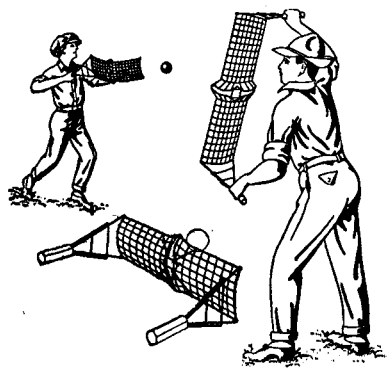
EMERGENCY ENGINE STOP MECHANISM.—T. W. VICKERS, R. F. D. No. 1, Box 36, El Cajon, Cal. This invention relates to apparatus for automatically stopping an engine or train when the traffic conditions are such that a collision or other accident might occur; and it relates more particularly to a stop mechanism of that type whereby the propelling power is cut off and the air or other brakes set to stop the locomotive, car or train.

TICKET HOLDER.—A. MORTEN, 77 Broad St., New York, N. Y. The holder is more especially designed for holding a number of tickets, such, for instance, as are issued for use on street cars, elevated roads, subways, etc., and the ticket holder is arranged to permit the user to conveniently carry it in a vest pocket and to allow the user to rapidly remove the tickets singly whenever it is desired to do so.

Pertaining to Recreation

CAROUSEL.—W. F. MANGELS, West 8th St., Coney Island, Brooklyn, N. Y., N. Y. This carousel is of the portable or knock-down type; and the invention provides a novel form of annular platform for the figures and other passenger carriers, the platform being made in sections which detachably interlock with the platform suspension rods, which rods are formed with a special form of hook for engagement with the platform sections.

GAME DEVICE.—H. ACCHERSHAUG, 246 Manhattan Ave., New York, N. Y. The use of this device provides exercise for the player; provides means for augmenting the propelling force applied to an article to be thrown; provides means for attaching the ball or other article in flight; and provides attaching and

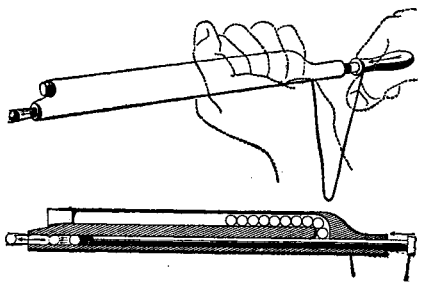


GAME DEVICE.

throwing sections in the same device. The engraving shows a player pitching the ball with tremendous force horizontally at his opponent who uses his "net" as a shield and catches at the same time. The game may be enjoyed wherever there is a vacant lot and a wall and in reality it is hand-ball on a grand scale.

CABINET.—W. B. COOK, Aeolian Hall, 42nd St., New York, N. Y. This invention relates to cabinets for moving picture projection apparatus, stereopticons and the like, and refers more particularly to a device which consists of a cabinet comprising side and end walls, a reversible and adjustable top adapted to support a projection apparatus or similar instrumentality, and means for holding the top on a plurality of adjusted positions.

TOY GUN.—N. B. HARMON, JR., Long Beach, Miss. This invention relates to toy guns presenting a repeating toy cannon of simple construction using the pop-gun principle. This



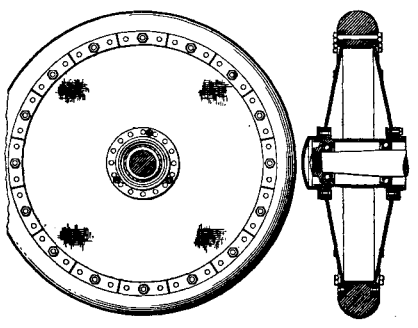
TOY GUN

invention can be made in exact models of European field and siege guns; it makes a very loud report; and it throws its balls to a considerable distance, say over an ordinary house.

Pertaining to Vehicles

AUTOMOBILE SIGNAL.—C. P. CARPENTER, and J. A. BOHL, Address the former, 82 Franklyn Ave., North Plainfield, N. J. This device is especially adapted for use as a rear end signal for automobiles or like vehicles. It is of a practically automatic operation, and indicates to persons in the rear of or following an automobile so equipped that the automobile is about to turn to the right or to the left.

VEHICLE WHEEL.—C. F. ERICKSON, 549 Carlton Ave., Brooklyn, N. Y., N. Y. The present invention has reference to vehicle wheels and refers more particularly to the resilient, non-pneumatic class of wheels. The



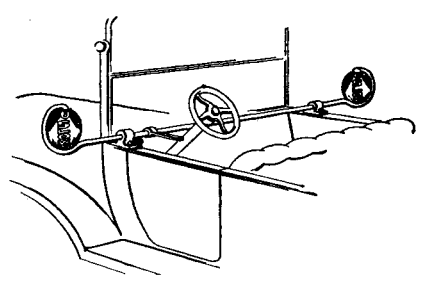
VEHICLE WHEEL

object of the invention is the provision of a simple, strong and inexpensive vehicle wheel which is characterized by a resilient rim connected to the hub by diaphragms of pliable or substantially inelastic material.

TRAFFIC SIGNAL FOR VEHICLES.—A. D. SCHNAARS and C. L. JOLY. Address the former, 81 Sea View Ave., Jersey City, N. J. This invention provides means whereby cautionary and directive signals are automatically disclosed coincident with the operation of a manually-guided and controlled vehicle; provides a device having a containing case for normally concealing the directive members, said case being reduced in its structural dimensions; provides means whereby the stop indication is preceded by a cautionary indication; and provides for duplicating certain of the signals at the front end, as well as at the rear of the vehicle.

LIFTING JACK.—G. A. PIPER, 2115 Miami St., Station A, Omaha, Neb. The invention provides a quick-acting jack in which the movable part thereof is made in two elements operating simultaneously by a single lever but having a different range of movement, whereby the total lifting action of the jack is materially increased compared with the normal height thereof, and whereby the power is materially increased.

SIGNAL FOR VEHICLES.—W. BLACK, 4844 Constance St., New Orleans, La. This invention has reference more particularly to means



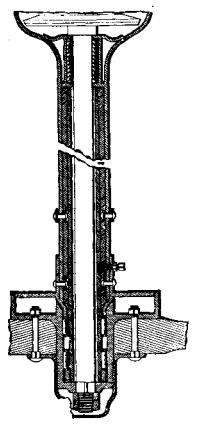
SIGNAL FOR VEHICLES

for indicating to another vehicle in the rear the anticipated movement of the vehicle provided with the signal. It provides an efficient signal to promote the safety of vehicle traffic; and provides a signal for vehicles wherein electric energy is utilized for illumination of the sign and wherein there is a closed circuit only when the signal is in operative position.

GEAR CHANGING AND LOCKING DEVICE.—F. P. ROESCH, Douglas, Ariz. The invention provides a device, more especially designed for use on automobiles and other power vehicles, and arranged to permit the device to change the speed gear and to securely lock the same in adjusted position by means located at the steering post, thus enabling the driver to pay attention to the roadway ahead without detraction when manipulating the changing and locking device.

SEAT SPRING.—M. G. ADAMS, Box 204, Hamlet, N. C. This invention relates to the suspension of vehicle seats, more especially the rear seats of automobiles, and one of the main objects thereof is to provide means for insuring a practical stability of such seats with respcet to the body and running gear of such vehicles, thereby providing a maximum of easy riding quality for passengers, and enhancing the enjoyment of riding.

AXLE HOUSING.—F. C. DIBBLE, Burns, Ore. This invention provides a housing so arranged that in case of breakage of a spindle,

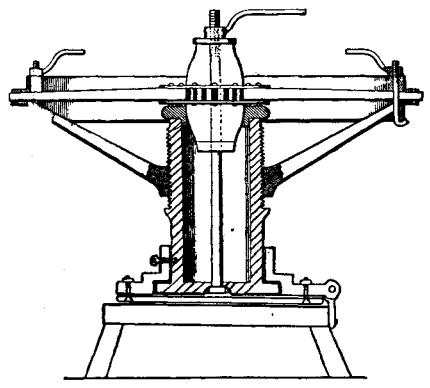


AXLE HOUSING.

the broken spindle may be detached and removed and replaced by a new spindle in a minimum of time with the ordinary tools carried by the driver, and without expert attention and without the necessity of providing a new housing for the axle, thus eliminating a large item of expense, a considerable loss of time, and delay and loss of use of the vehicle.

TRUCK.—H. C. GUSTAFSON, Arlington, Iowa. The invention provides a front truck for hand controlled vehicles, wherein the truck is pivotally connected to the body of the vehicle to permit the vehicle to be guided, and wherein brake mechanism is provided capable of being operated from the front end of the truck for applying or releasing the brakes, and wherein a sliding handle frame is provided capable of being expanded or contracted and having latch mechanism for holding the same in adjusted position.

WHEELWRIGHT MACHINE.—O. B. GRAVES, 10th and Maple Sts., Coffeyville, Kan. This invention relates to an improvement in wheelwright machines, and one of the principal objects of the invention is to provide a machine or wheel chuck by means of which a wheel may be respoked, retired, bolted, dished, and

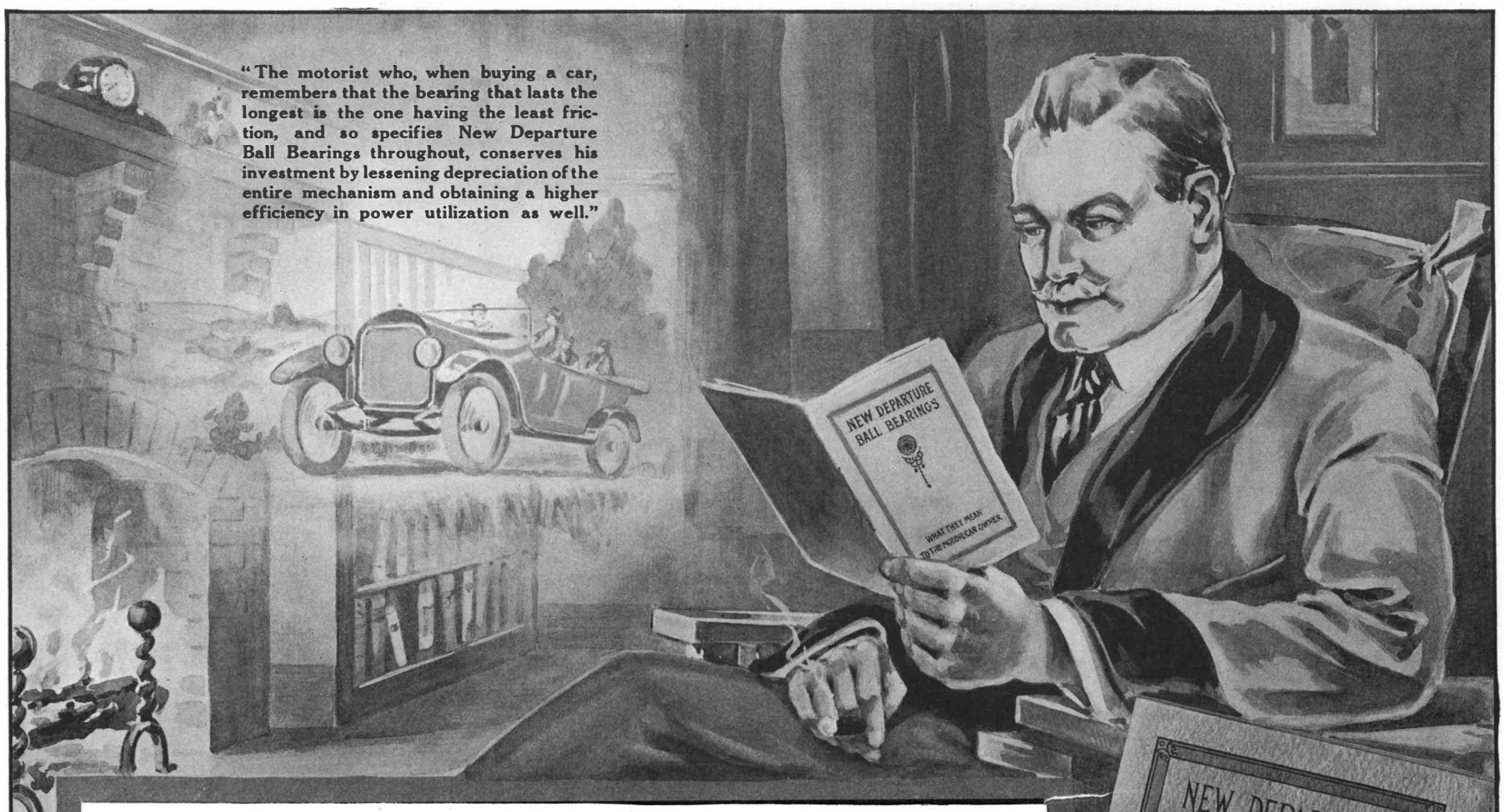


WHEELWRIGHT MACHINE

riveted with a degree of accuracy and rapidity not ordinarily attainable with machines of this nature. The machine may be mounted in such a manner that it may be swung bodily upon a pivot so that the rim of a wheel mounted on the machine, may be rotated within a receptacle filled with water for shrinking the rim onto the felloe of the wheel.

ATTACHING AND CONCEALING MEANS FOR VEHICLE CURTAINS.—F. GRUNDY, care of Sterling Top and Equipment Co., 518 W. 57th St., New York, N. Y. The invention comprehends the provision of pockets along the edges of the top adjacent to which the curtains are attached and designed to be folded or otherwise compactly arranged to be retained in the pockets in a relatively concealed position, but in such manner as to be capable of being readily lowered when they are desired to be used.

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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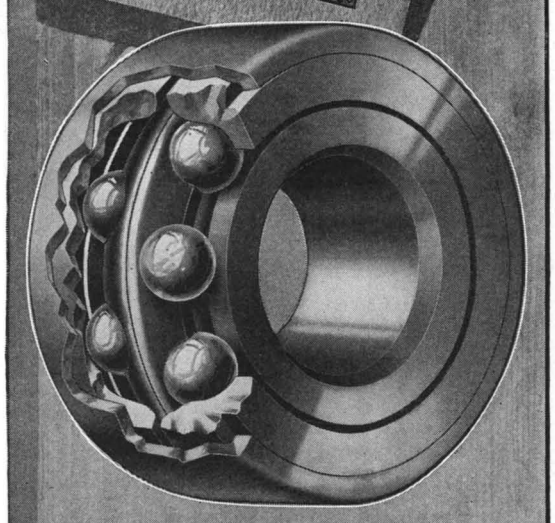

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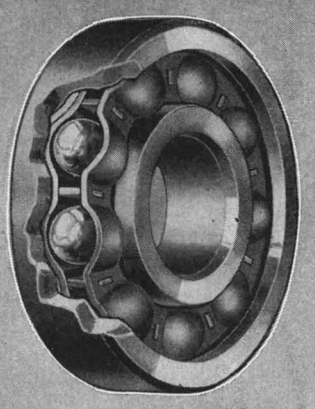

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Scientific American War Game

What do you know of the science of war?

Knowledge of military strategy and tactics is obtained by a game of war played with pins and blocks and paper strips upon a contour map. The game is as scientific and absorbing as a game of chess. We invite our readers to participate in such a game.

Owing to the interest this series has aroused we have decided to run the articles weekly instead of every other week as announced last week.

WAR HAS BEGUN!

I.

In the SCIENTIFIC AMERICAN of March 11th we published the first paper of the war game series. Enemy patrols had been observed ten miles beyond "Lookout Hill." To gain information about the enemy, four cavalry patrols were sent out from the detachment stationed at "Norrisville."

II.

This week (page 328), the reports of the cavalry patrols are announced, the detachment which has moved forward, encamps for the night and takes measures to protect itself against surprise attacks. What measures should be taken?

III.

April 1st. The detachment now moves forward to a strategic position to engage the enemy in battle. What disposition should be made of the artillery, infantry, and cavalry?

IV.

April 8th. In this issue battle is joined, and our readers move over to the side of the enemy to learn of the measures taken by the enemy to defend itself.

In each installment problems are presented for the readers to ponder over. Military science is as exact as that of chess. These problems have definite answers, and the answers in each case will be found in the following installment.

This war game series is being conducted by Lieut. Guido von Horvath, formerly of the Austro-Hungarian Army, who is eminently fitted to teach military tactics by reason of his training at the Military Geographical Institute at Vienna.

In strict military parlance the first installment of the series are known as "map problems." A real war game will follow, when two military tacticians will be pitted against each other in military maneuvers. Announcement of this game will be given later.

The articles are written so that laymen can understand them.

Copies of the enlarged colored map covering the terrain of the war games, which appears on the cover of this number, may be had for 10 cents each.

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Our Vanishing Export Trade in the Products of American Forests

(Concluded from page 319)

lost importance on this side. The much-considered and anticipated impetus to American shipping may perhaps be an aid to it in any case. Such we will hope it may be. It is an interesting and an important trade, and we would like to hear again the clatter of American wooden shoes along Dutch streets, and see as formerly the railroad trains of other lands traveling across some rough-hewn ties that came from the forests of North America.

An Ingenious Gas Turbine Developed in Germany

(Concluded from page 322)

When a definite quantity of gas had been forced into the explosion chamber, the quantity being controlled by the governor, according to the load, the charge was fired by a number of electric sparks passing between pairs of platinum points arranged in different parts of the explosion chamber. The idea was to fire the charge simultaneously at different points, and, if possible, to fire the different layers mentioned above. When the charge was fired, the products of combustion were expanded by the heat liberated in the usual way; and when the pressure due to their expansion reached a certain figure, an outlet valve was opened. The outlet valve was practically a gate, swinging on hinges, that could be opened outwards by the pressure of the hot gases, and that was arranged to be closed mechanically. The hot gases passed through the outlet valve and thence through a channel leading to a nozzle.

The rotor was arranged upon the same lines as the De Laval and Curtis steam turbines. It consisted of a disk carrying a number of buckets upon its periphery. The hot gases formed in the explosion chamber were expanded down during their passage to the rotor, by the aid of the conical-shaped nozzle, to several pounds below atmospheric pressure. The large volume of hot gases thus formed swept through the buckets of the rotor in a similar manner to that in which the large volume of low pressure steam flows through the buckets of the De Laval and Curtis turbines. A fan was placed in the exhaust, which enabled the pressure of the gases to be reduced to the low figure mentioned. After the hot gases had performed their work in causing the motor to revolve, cold air was again forced into the explosion chamber, and through the passages leading to the rotor, but not through the rotor itself. The cold air performed the offices of scavenging and of cooling the explosion chamber. After the cold air had been flowing through the explosion chamber for a certain time, the outlet valve was closed mechanically, and the air then proceeded to fill the explosion chamber, ready for another explosion. The 200 horse-power experimental turbine that was made at Hanover had its valves worked mechanically by rods and cams taking their power from the axle of the turbine rotor. In the 1,000 horse-power turbine, however, the valves were worked by oil pressure, a servo motor being employed. The arrangement of the servo motor was very ingenious. It was something on the lines of the well-known distributor employed on motor cars for directing the ignition to different cylinders. The apparatus consisted of two concentric cylinders. The outer cylinder had a number of apertures leading to the valves of the explosion chambers; there were as many apertures as valves to be controlled. The inner cylinder was hollow; a pressure of oil being maintained inside it by means of a pump. It had one aperture and was caused to revolve, and as its aperture came opposite the apertures in the outer cylinder, the oil pressure was delivered to the different valves in succession. Thus the pressure was delivered to the air entry valve of an explosion chamber, then it was cut off, and the opposing spiral spring closed the valve, the oil pressure passing on to the gas valve which was opened and closed in its turn, and so on. The explosion

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chambers were arranged to operate one after the other, but not so that those adjacent to each other would fire consecutively. As was to be expected, the 1,000 horse-power turbine was by no means perfect. Troubles arose with the working of the valves, and the writer understands that a firm in a neutral country is improving the turbines.

The turbine was tried with almost every kind of fuel—with gas from a town's gas works, with gas from a producer, with blast furnace gas, with oil of various specific gravities all taken from petroleum, and with coal dust. Coal dust apparently was the only fuel employed that was not satisfactory, and the writer understands that the reason was the same as that which led to the failure of coal dust in the cylinder of an internal combustion engine; viz., the formation of a certain amount of coke. With gaseous and oil fuel, there was no difficulty about obtaining complete combustion. With coal dust there was; and the minute quantity of unconsumed ash or coke led to the valves not working properly. When oil fuel was employed, a spraying apparatus actuated by compressed air was added, very much on the lines of that used with the Diesel engine. The exhaust gases also, which though expanded down below atmospheric pressure, still carried a large quantity of heat, were employed to raise steam in a boiler, the steam being used either to drive the gas and air pumps or for the gas producer when gas was taken from a producer for the test.

It is claimed for the gas turbine that it will occupy a much smaller space than a gas engine to furnish the same power, and in view of the fact that electricity is becoming more and more the agent for the delivery of power, rotary motion as against reciprocating motion must be an advantage. The following are some figures that were given out, comparing the relative spaces occupied by, and the weights of, the gas turbine and a reciprocating gas engine, to perform the same amount of work:

The gas engine with blowers and gas boiler, it was claimed, was about a third of the weight of a reciprocating engine to furnish the same power, and it occupied less than a third of the space.

It is claimed also that once the difficulties inseparable from a new form of apparatus are overcome, the gas turbine may be constructed in very much larger units than the reciprocating gas engine. It is claimed that gas engines up to 10,000 horse-power should be possible, while it is remembered that 2,500 horse-power is at the present time practically the limit with reciprocating gas engines.

On the Trail of Villa

(*Concluded from page* 327)

duties an invading expedition with its necessary supply.

The international boundary line is about 2,000 miles long. El Paso, the base for the scene of the present trouble, is about midway east and west. Columbus and Hachita, the reported starting points of the expeditionary forces, are about 100 miles to the west of El Paso. The physical difficulty of guarding such a line as the boundary can hardly be overestimated. In addition, it must be remembered that an army is not a police force, is not trained for and is not intended to do police duties. An army works en masse. It is organized and trained for the purpose of meeting and defeating the organized military forces of the enemy state. It is not its ordinary function to prevent highway robbery or cattle stealing. It can punish the perpetrators of such crimes, as it now proposes to punish Villa, cost what it may. The protection against violence and crime which an army provides is based upon the fear which it inspires. That fear is caused by the feeling that any overt act will be followed by a swift, sure and terrible punishment. Our border army has inspired no such fear. It has been tied down by a policy of very unwilling inactivity and non-interference. The border Mexicans have felt that they could take almost any liberties with it which they wished. And they

have taken these liberties until now they have gone too far.

We have kept our army on the border for five years. For all that time the hands of the army have been tied. Now we must be willing to pay the price which our past policy demands.

New York's Gasoline-Electric Trucks for Garbage-Collection and Snow-Removal Service

(*Concluded from page* 327)

dump lifting off the upper deck. The lower buckets are arranged in two longitudinal rows of four each, set into the trailer frame. On top of these are two other buckets with V-shaped bottoms and side doors. The latter are opened to permit the men to dump the cans of garbage or ashes into the eight buckets on the lower deck, the paper and other refuse collected being thrown directly into the two upper buckets from the sidewalk.

In unloading at the disposal pier, the upper buckets are lifted off first, dumped into scows and then set down on the pier floor. Then each of the lower buckets is hoisted out and dumped in a similar manner. They are then loaded back onto the trailer in the reverse manner, when the unit is ready to return to its next point of collection.

The sweeping and flushing of the streets and the plowing of snow in the winter is to be done by special trailers, but the city authorities have not yet appropriated the money for the purchase of these. The tractors were used to plow snow during the recent storms, however, by uncoupling the trailers and applying the conventional front-end plows as shown in one of the accompanying views.

Unit Design in Marine Wireless Telegraphy

(*Concluded from page* 323)

panel sets are of the noiseless quenched gap type and the occupants of suites de luxe on ocean liners need no longer fear a series of sleepless nights brought on by the nearby crash of the wireless key. Nor will the relaying of messages figure so prominently in the daily routine; the high pitched musical note which replaces the former rasping crackle can be read by the receiving operator through static which would make unreadable a note of lower frequency. Obviously, this penetrating note is also of great advantage in handling message traffic in congested waters and will make for more efficient communication in difficult harbors such as that of New York.

The 2 kw. 500 cycle transmitter, as clearly shown in the illustrations, has all the regulating and manipulating appliances readily accessible; with the turn of a single handle to the desired position a change of wave length from 300 to 450 or 600 meters can instantly be effected. This switch adjusts all circuits and enables the operator to secure flexibility of control in eliminating interference. A wattmeter which indicates the amount of energy consumed at the terminals of the transformer is also mounted on the upper section of the panel. By its side is a radiation meter which indicates the current flow in the aerial circuit, and below a motor field rheostat for variation of the speed of the motor-generator, and a generator field rheostat to vary the generator voltage. Between these rheostats is an indicator handle which effects the variation of inductance in the aerial circuit and indicates the amount in turns. At the lower end of the section a handle is provided for the variation of coupling between the closed and aerial circuits. A switch which permits transmission on extremely lowe power completes the upper section equipment.

A second or center section of the panel is mounted on hinges and carries the quenched spark gap; this section can easily be swung open from either side whenever it is necessary to remove or replace the condenser jars.

The starting appliances, control switches and protective devices are all mounted on the lower section.

Both quenched and rotary spark gaps are used, the latter being mounted on an extension of the armature shaft at the

generator end. The rotary is of the synchronous type with the same number of spark terminals as the generator has poles. Both quenched gap and rotary are served by a pressure blower mounted on the rotor, furnishing air to the quenched gap and ventilating the rotary gap itself. The closed core type of transformer is provided with a protective spark gap at the terminals of the secondary, which permits a discharge to the grounded case of the transformer when the potentials become excessive.

The various elements for the reception of signals are contained in the receiving tuner illustrated. A crystal detector is used. When the receiving circuits are thrown into operative position by the antenna switch the primary circuit of the transformer and the generator field opens and the motor stops. When the switch is thrown to transmitting position the receiving circuits are automatically short-circuited and thus protected from the transmitter. The motor-generator may be kept running continuously by closing a single pole switch.

By the addition of storage batteries the set can be operated independent of the ship's power when this fails, as is often the case in shipwreck.

Over the Whirlpool by Aerial Cable

(*Concluded from page* 330)

which adjusts any slack caused by the rising and falling of the car. After passing around another groove in the driving sheave, the traction cable passes out to the other end of the car.

The 8-foot driving sheave is turned by a 75-h.p. electric motor, through a 30 to 1 worm gear, giving a speed to the car of about 400 feet per minute when the controller is at full speed. Although the trip can be made in about 4½ minutes, it is planned to permit it to occupy 6 minutes by running at half speed part of the time.

For provision against a possible breakdown of the motor or interruption in the power supply, there is a clutch in the driving shaft by means of which the motor can be disengaged, and a 5-h.p gasoline engine engaged both through a worm gear and through sprocket wheels. The speed at which the gasoline engine would haul the car would be very slow, but it would be ample to meet the emergency.

Another safety device which is unique concerns the automatic control stop at each terminus, which stops the car with out jar within 3 feet 4 inches. The traction cable runs longitudinally through the 5-inch pneumatic cylinder and through the center of the piston. Just ahead of the car on the traction cable is a clamp which strikes the face of the piston, and engages with it in such a manner that the car cannot slip back from the landing platform. In fact, the car may be said to be locked the moment it comes in contact with the automatic control stop.

The gates at both ends of the car, which are operated by the conductor by means of a crank, cannot open until the clamp has engaged with the stop piston, releasing a ratchet under the car. Even then only the right gates can be opened; that is, the gates at the end of the car where the clamp has engaged. When the car starts the clamp is disengaged by another crank, but this cannot be done until the gates are shut. This is contrived by interlocking discs enclosed in a locked box on the car. The pneumatic cylinder is supported by a counterweight, so that its weight does not rest on the traction cable.

A further illustration of this safety device is afforded by the two limit switches at each terminus. The first is always struck by the floor of the car, and affects the controller so that the power is turned off and cannot be turned on again in the same direction, and so jam the car against the station. The second limit switch is hit only when the first fails to operate, and when the motorman fails to turn off the controller, and when the pneumatic cylinder does not bring the car to a stop. This second limit switch acts directly upon the circuit-breaker, bringing the car to rest within 3 feet, and without letting it come within dangerous distance of the station.

NEW BOOKS, ETC.

EGYPT OF THE EGYPTIANS. By W. Lawrence Balls. New York: Charles Scribner's Sons, 1915. 16mo.; 266 pp.; illustrated. Price, $1.50 net.

Despite the author's deprecatory admission that nine years' residence does not necessarily qualify him to write of Egypt and the many contradictory features it presents, the volume he gives us is a remarkably well-written and intense study—not of the Egypt of the tourist, but particularly of those four things which, according to a recent statement of His Highness Sultan Hussein Kamil, "make Egypt the country most blessed of God in all the world—the generous Nile, the unfailing sun, the miraculous yielding land and the industrious fellaheen." The volume summarizes the country's history, sketches its scenery and antiquities, discusses its products and its possibilities, and gives some idea of the problems confronting the British Protectorate. The system of irrigation is the subject of careful explanation, and constitutes perhaps the most interesting section of the book.

ENGLISH RAILWAYS. Their Development and Their Relation to the State. By Edward Cleveland-Stevens, M.A. New York: E. P. Dutton and Co., 1915. 8vo.; 332 pp.; 2 maps. Price, $2.25 net.

This study was undertaken with the conviction that a detailed historical account of the consolidation of English railways would possess a distinct practical value. No attempt is made to deal with problems of the present; instead, a groundwork of impartial information is offered, upon which the student may erect his own superstructure and arrive at his own conclusions. In compiling this history many sources have been drawn upon, and a list of the more important of these sources prefaces the account. Railway amalgamation is dealt with in all its phases, and the legal aspects of the situations are made clear by quotation from, and reference to, unimpeachable authorities. In conclusion, the author tabulates the geographical and single-track mileage and the paid-up capital of eleven leading companies, emphasizes the negative quality of past legislation, and shows the heavy burden which inflated land values and public opinion have imposed upon the English roads, with their obvious relationship to transport costs.

PRACTICAL PERSPECTIVE. By Frank Richards, Associate Editor American Machinist, and Fred. H. Colvin. New York: The Norman W. Henley Publishing Co., 1916. 58 pp.; illustrated. Price, 50 cents.

These brief papers lay down rules for the use of isometric perspective in shop drawings. The method is not, of course, put forward as a substitute for the mechanical or working drawing, but it offers advantages in certain cases, and enables a workman quickly to grasp the actual shapes and relationships of various parts.

ANTHRACITE. An Instance of Natural Resource Monopoly. By Scott Nearing, Ph.D., University of Toledo. Philadelphia: The John C. Winston Company, 1915. 12mo.; 251 pp.

Dr. Nearing gives us a very explicit statement of the anthracite situation; he discusses costs in definite figures, condemns monopoly in natural resources, and treats the subject from both the worker's and the consumer's points of view. It is a well-written and studious treatise, worthy of the attention of the 10,000,000 families who largely constitute the consumers of the output.

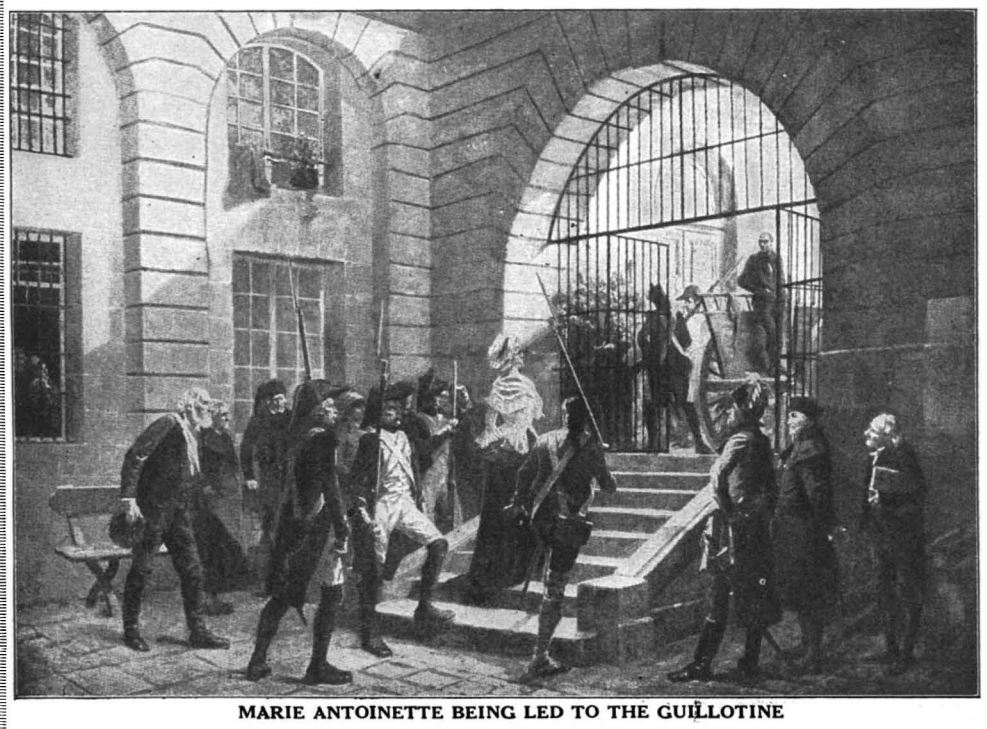
THEATRES AND MOTION PICTURE HOUSES. By Arthur S. Meloy, Architect. New York: Architects' Supply & Publishing Company, 1916. 8vo.; 121 pp.; illustrated. Price, $3.

The large increase in the number of buildings devoted to public amusement, and particularly in picture houses, makes this monograph on theatre construction and equipment timely and valuable. The work takes up fireproofing features, "sight lines," or the radius of vision, the pitch of floors, the planning and location of stairways, exits, and fire escapes, and methods of seating; the proscenium arch and curtains, and the stage, receive their due share of consideration. Tables give the seating capacity and stage dimensions of numerous theatres, and the comparative laws of various cities. There are many good plates of exteriors, and the author's line drawings serve to make his comments immediately understandable to the reader.

PLANE AND SOLID GEOMETRY. By Webster Wells, S.B., and Walter W. Hart, A.B. New York: D. C. Heath & Company, 1916. 8vo.; 467 pp.; illustrated.

Wells's "Essentials of Geometry" is the basis of this text, in which great care has been taken to align the methods of the older work with modern scientific and pedagogical modes of thought. Each section first presents the fundamentally important theorems which naturally constitute a minimum course; these are followed by supplementary applications, from which a selection may readily be made. Most of the propositions are succeeded by well-chosen exercises, quite sufficient for a shorter course. In the chapters devoted to solid geometry the mensuration theorems for the common solids are given first place. This emphasis, and the inclusion of certain natural applications of solid geometry in the exercises, give the work a practical trend.

After the European War—What?



MARIE ANTOINETTE BEING LED TO THE GUILLOTINE

Are you alive to the real meaning of what is going on in Europe?

This cyclone of war is rocking and wrenching every ship of state—is tearing up by its roots the ornamental plants of modern society—is wrecking the flimsy structures which man, in defiance of the lessons of the past, has erected to prop up his boasted civilization.

How many princely families will go down in the wrack of this convulsion that is upheaving the very rocks of European life?

In how many European capitals will the old cry, "The King is dead, long live the King" give way to the thunderous chorus of the *sans-culottes*, "The King is dead, long live the Republic," that ushered in the French Revolution as told by eye-witnesses of those terrifying scenes in

SECRET HISTORIES OF ROYALTY

A Topsy-Turvy World

The courts of Europe were the stage where the whole political and human drama of the country was enacted.

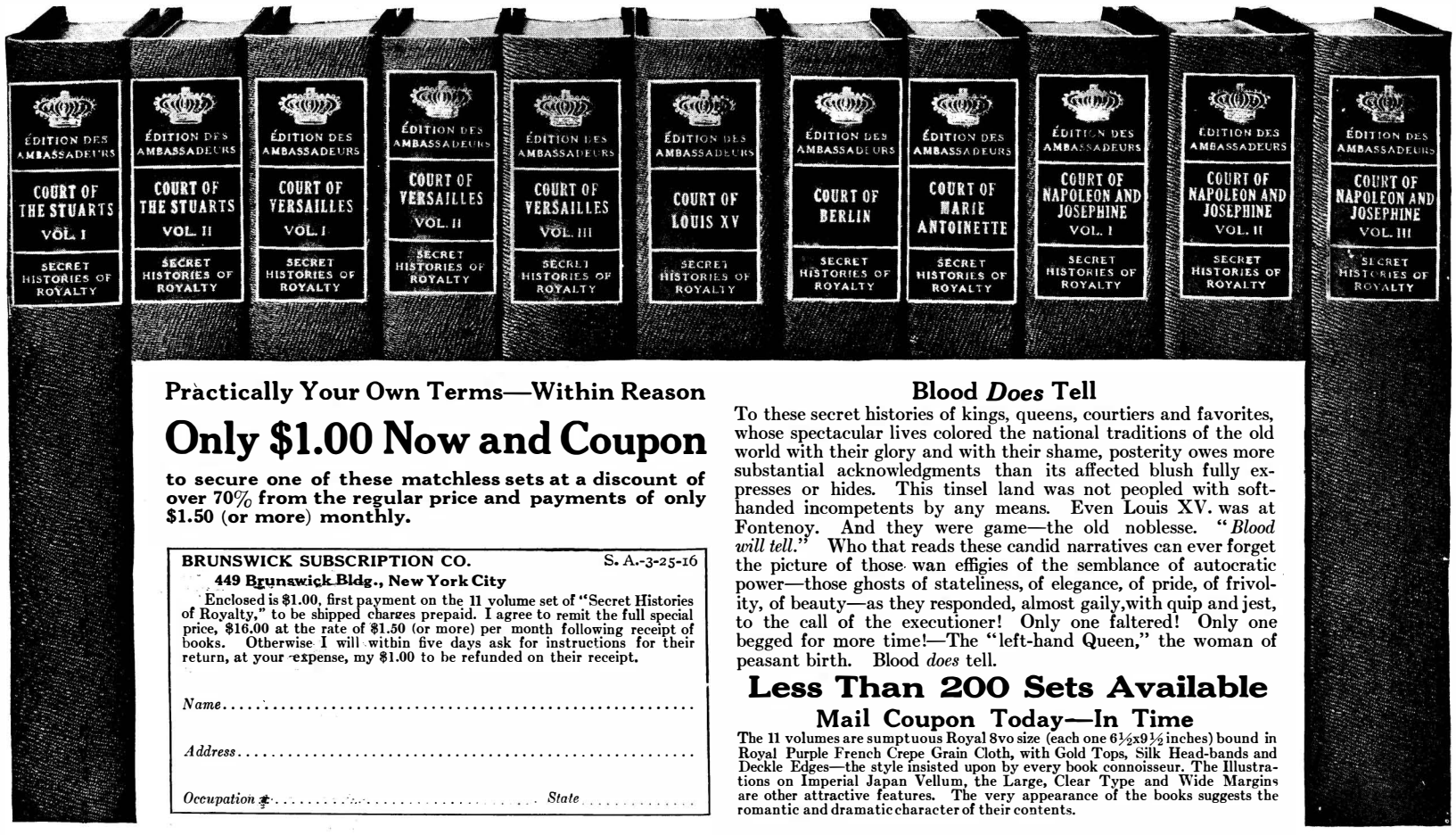
The conscious nether world revelled in envious awe as it got glimpses of those distant spheres of Royalty, and gloried as it found their demigodded denizens frail. Under Louis XV. the court of France became an ante-chamber or dressing-room, littered with the bandboxes and rouge-pots of the royal mistresses, and the monarchy of old France made its final exit from the stage leaning on the arm of a courtesan, Mademoiselle Lange, as she was known in the underworld of Paris—but read the whole story, as she tells it herself, with all the naïveté of a moral sister to Manon Lescaut. The spectators—the people—hitherto silent, now began to hiss and be moved. The "sharp female newly born, and called La Guillotine" was the instrument through which they expressed their disapproval. The gutters of Paris ran red with the blood of high born dame and noble cavalier.

Royalty in Undress

Only in our own day, so to speak, have these secret histories been allowed to appear. The anecdotes set down in their journals by the authors of these memoirs would have cost them their lives or their liberty had they ventured to publish them in their own day. Had Louis XIV. known what kept the busy-body Duke so often in his study—could he have read those pages in which were mirrored all the court intrigue, gossip and scandal of Versailles—could he have seen his brilliant court stripped therein of its gilding and tinsel, and his own royal person pictured in undress, without his crown, even without his wig—there would have been a new lodger in the Bastile.

These brilliant memoirs of the Court of Versailles are without their equal in the world in richness, variety and human interest. The press abounds with allusions to them. From them the stage takes its plots and the novelist his characters. To know them is a liberal education.

AN UNPRECEDENTED BARGAIN



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Blood *Does* Tell

To these secret histories of kings, queens, courtiers and favorites, whose spectacular lives colored the national traditions of the old world with their glory and with their shame, posterity owes more substantial acknowledgments than its affected blush fully expresses or hides. This tinsel land was not peopled with soft-handed incompetents by any means. Even Louis XV. was at Fontenoy. And they were game—the old noblesse. "*Blood will tell.*" Who that reads these candid narratives can ever forget the picture of those wan effigies of the semblance of autocratic power—those ghosts of stateliness, of elegance, of pride, of frivolity, of beauty—as they responded, almost gaily, with quip and jest, to the call of the executioner! Only one faltered! Only one begged for more time!—The "left-hand Queen," the woman of peasant birth. Blood *does* tell.

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New Lubricant Prevents Rapid Formation of Black Solid Matter in Your Engine

The heat in your automobile engine turns part of ordinary oil into black solid matter—the greatest enemy of lubrication, a cause of rapid wear.

Ordinary oil breaks down after a few hours use, forms black sediment and loses in lubricating value. Ordinary oil cannot stand up under the terrific heat of an automobile engine. The sediment is destroyed oil—all lubricating value in it has been killed by heat.

Solid matter means friction. The sediment has an inactive or negative effect. It partially crowds out the remaining liquid oil. This under-supply of oil to the metal surfaces causes friction—heat—wear—loss of power and expensive repairs.

When tests are run with the same motor under precisely the same operating conditions using different lubricants, a remarkable variation will be found in the amount of oil destroyed by heat. This is shown by the amount of black sediment which settles out of each after standing.

The oil floating above the sediment is red in color by transmitted light and may be assumed to be as serviceable as when fresh.

The volume of sediment formed, and the rapidity with which the oil is destroyed depend upon its chemical structure. Oils which have a non-heat-resisting chemical structure are unfit for use in any type of automobile or other internal combustion motor.

Such oils make trouble and increase maintenance cost in direct proportion to their rate of destruction when exposed to heat. Consequently the amount of oil used and the cost of lubrication per mile depend not on the price per gallon but on ability to resist heat.

Relative Oil Destruction

The contents of the two bottles shown illustrate clearly the relative durability of ordinary oil and of Veedol, the new lubricant that resists heat. Veedol deposits only a small fraction as much sediment as ordinary oil. The operating temperatures shown on the sectional drawing of the motor bring out forcibly the intense heat to which motor lubricants are subjected.

There is a fundamental difference between ordinary oils and Veedol.

Ordinary oils are unstable and therefore unserviceable because of non-heat-resisting chemical structure.

Special processes of manufacture developed by this company and the use of Pennsylvania paraffine-base crude oil give Veedol, the new lubricant, its unusual chemical structure, and its remarkable heat-resisting ability.

ORDINARY OIL AFTER USE — VEEDOL AFTER USE

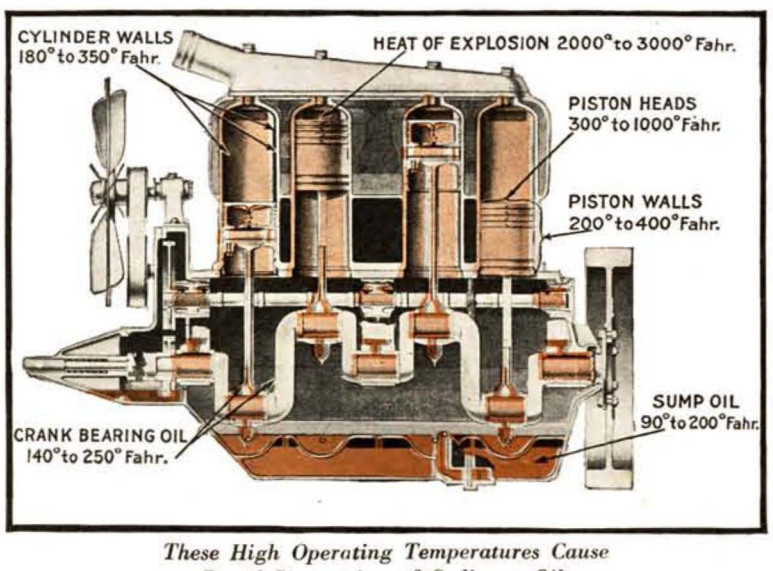
Showing Finely Divided Solid Matter in Suspension

Make This 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 slowly 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.

The exact amount of fuel and oil in the car should be recorded and a reading of the speedometer taken before starting. Then let a test, be run over a familiar road including steep hills and straight level stretches, for any distance up to five hundred miles or more.

You will find that your motor has acquired new pickup and hill-climbing ability, due to the maximum mechanical efficiency made possible through Veedol.



These High Operating Temperatures Cause Rapid Destruction of Ordinary Oils

You will find your mileage on both gasoline and oil increases. You will reduce your carbon trouble. Your motor will have more power.

What It Means In Actual Saving

The average mileage of all automobiles is conceded to be approximately 6000 miles per year, and the annual expense of operating the typical or average car ($850 car), as figured by an expert statistician, is approximately $416 per year.

Depreciation, repairs and gasoline come to about $268.

This new lubricant resists heat and prevents rapid sedimentation. This means less wear, less expense, more power.

Solid matter in your oil means friction and wear. Friction and wear mean expense. Thus expense varies in direct proportion to the amount of black solid matter formed by the oil. For this reason, ordinary oil runs up your repair bills, lessens your gasoline mileage and by shortening the life of your car, materially increases your depreciation costs. Engineers state that fully 50% to 75% of repairs and 50% of depreciation are due to improper lubrication.

Veedol prevents rapid sedimentation and saves you money on three of the greatest items of expense.

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If you are interested in saving money you will be interested in making your own tests of this remarkable new lubricant.

Get a five-gallon can of Veedol and make the road test described.

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Progressive dealers everywhere have secured Veedol and can supply you. Look for the *orange and black Veedol sign.*

Any Veedol dealer will give you a copy of the Veedol book free. This book explains how Veedol resists heat and specifies the right body of Veedol for your car.

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This book also shows how the Veedol Engineering Department, which is at your service, is helping car owners. 92 pages profusely illustrated in colors.

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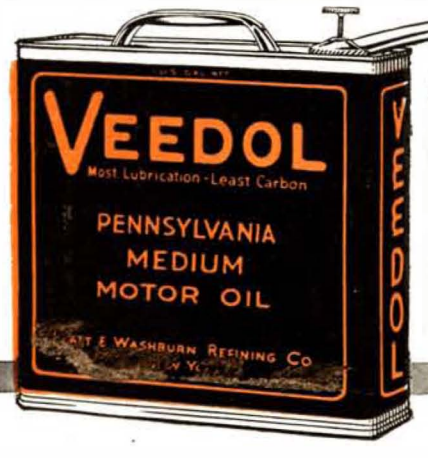

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