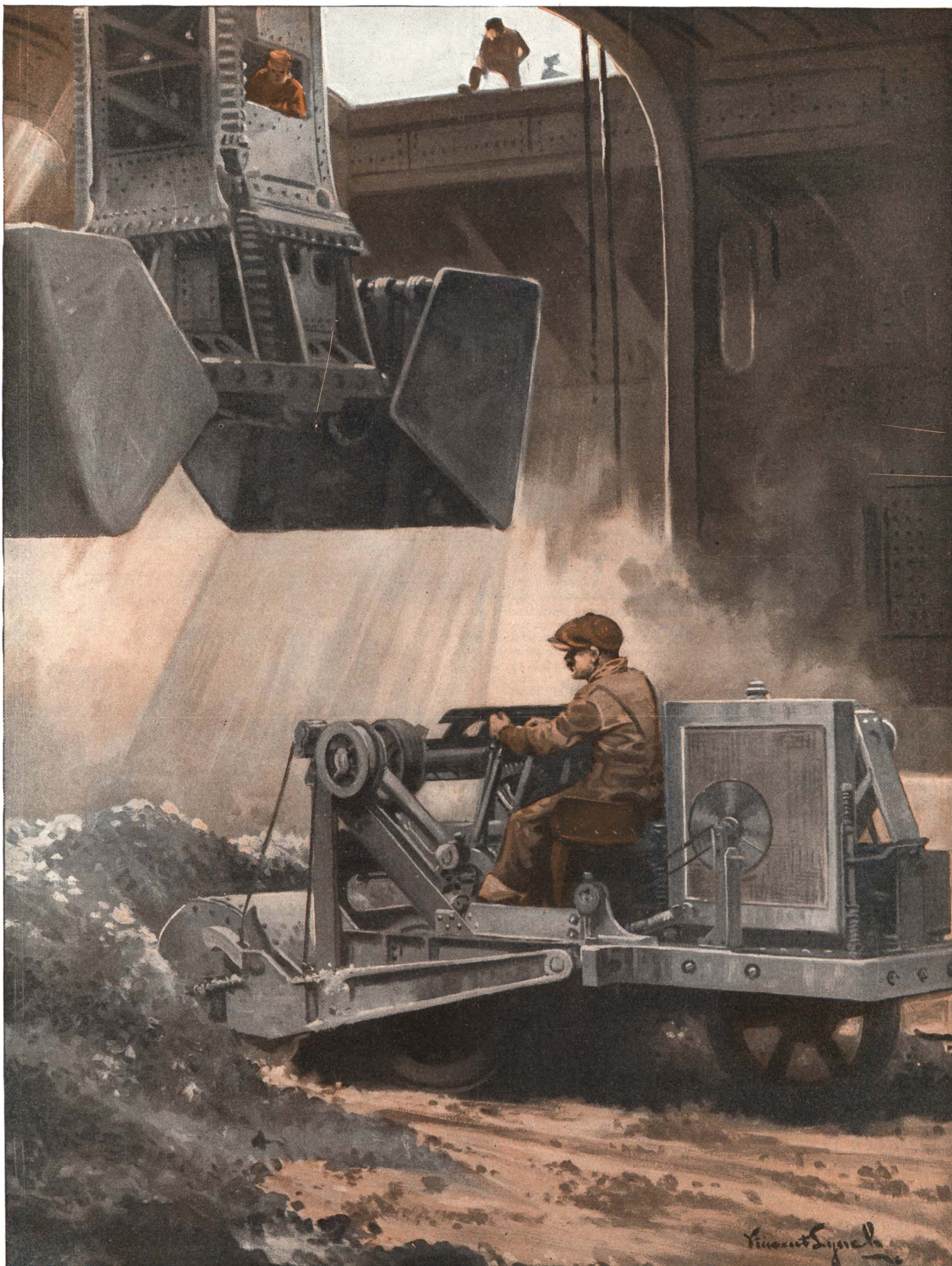


SCIENTIFIC AMERICAN



GASOLINE SHOVEL AND UNLOADER CO-OPERATING IN REMOVING THE CARGO OF AN ORE SHIP—[See Page 279.]

March 11, 1916

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

Price 10 Cents



ORDINARY OIL AFTER USE VEEDOL AFTER USE
Showing finely divided solid matter in suspension

New Lubricant Resists Heat

Intense heat in your automobile engine turns a large part of ordinary oil into black solid matter, a cause of rapid wear.

This new lubricant prevents rapid formation of solid matter in your crank case.

ORDINARY oil breaks down under the terrific heat of an automobile engine. Within a few hours black sediment is formed and part of the oil loses its lubricating value. This sediment is destroyed oil—all lubricating value in it has been killed by heat.

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

Ordinary motor oils make trouble and increase maintenance cost in direct proportion to their rate of destruction when exposed to heat.

Relative Oil Destruction

The contents of the two bottles shown illustrate 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 oils.

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 excellent chemical structure and its remarkable heat-resisting ability.

Make This Road Test

Clean out your crank case. Fill with kerosene. Run your motor about thirty seconds under its own power. Draw out all kerosene and refill with Veedol.

Then make a test run over a familiar road, including steep hills and straight level stretches.

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

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.

Friction and wear vary directly as the amount of solid matter formed within the oil. For this reason, ordinary oil runs up your repair bills. Fully 50% to 75% of repairs and 50% of depreciation are due to improper lubrication.

Veedol prevents rapid sedimentation and saves you money on all three items. The records of taxi-cab companies and bus lines that use cost accounting show that Veedol should save you from \$50 to \$115 per year on gasoline, repairs and depreciation. Your lubrication bill itself will be smaller, since Veedol wears several times longer than ordinary oils.

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 above.

Where You Can Buy Veedol

Progressive dealers everywhere have secured Veedol and can supply you. Look for the orange and black Veedol sign. If, for any reason, you cannot get Veedol at once, write direct to the Platt and Washburn Refining Co. By return mail you will receive a copy of the Veedol book, free, and name of dealer who can supply you.

PLATT & WASHBURN REFINING CO.
1805 Bowling Green Bldg.,
NEW YORK

NEW 92 PAGE BOOK FREE

Write for the new Veedol book, "The Lubrication of Internal Combustion Motors."

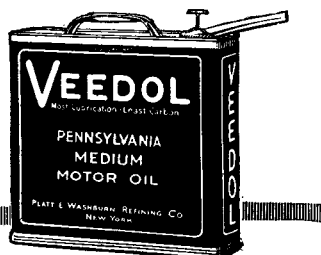
This book explains the A B C's of oil refining and finishing. It gives full information regarding the laboratory and practical service tests to which lubricants are subjected before final approval and shipment.

It describes and illustrates all types of lubricating systems used by automobiles, motorcycles, motorboats, tractors, etc. It contains a fund of useful information and scientific facts discussing lubricants and lubrication from its many angles.

This book also shows how the Veedol Engineering Department, which is at your service, is helping car owners.

92 pages profusely illustrated in colors—WRITE TODAY.

Veedol is supplied in one gallon and 5 gallon sealed cans, 15 gallon, 28 gallon and 53 gallon steel drums, and in 28 and 50 gallon white oak barrels. A special pouring device is supplied with each metal container.



The Light Eight—Type 44

You anticipate speed, fast acceleration, and a wide range of action in high gear, but scarcely expect to find the generation of power accompanied by so little vibration. The crank shaft is a massive, heat-treated carbon steel forging, measuring only 14 1/4 inches in length between the main bearings.

Price of the car, f.o.b. factory, \$1195.

OLDS MOTOR WORKS
LANSING, MICHIGAN

Established 1880

Incorporated 1899



"... after dinner, when Colonel Spottiswood's guests had eased into their deep chairs, it was the Colonel's sacred rite to produce from somewhere a certain treasured box of cigarettes of fine old Virginia."

First made for the Gentlemen of Virginia—"Richmond Straight Cuts" were the first high-grade cigarettes made in the United States. Their "bright" Virginia tobacco has an appealing, old-time delicacy never equalled in any other cigarette.

RICHMOND STRAIGHT CUT

Cigarettes—15 Cents
Plain or Cork Tip

Besides the regular package shown here, these cigarettes are also packed in attractive tins, 50 for 40 cents; 100 for 75 cents. These larger packages will be sent prepaid on receipt of price if your dealer cannot supply you.

Allen & Ginter, RICHMOND, VIRGINIA, U.S.A.
LUCKETT & YERGEN TOBACCO CO. SUCCESSORS.

PREFERRED BY GENTLEMEN NOW AS THEN



SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIV.
NUMBER 11

NEW YORK, MARCH 11, 1916

13 CENTS A COPY
\$3.00 A YEAR



Motor truck artillery train of Battery A, Los Angeles National Guard, nearing San Diego during the recent run to that city from Los Angeles

America's First Motor Truck Battery

By Joseph Brinker

PROVING the great superiority of motors over mules for the hauling of coast defense artillery, the motor truck train of Battery A, Los Angeles National Guard, recently made a 134-mile run along the Pacific Coast from Los Angeles to San Diego and maintained an average speed of 20 miles per hour, thus making in an hour's time by motor truck what would ordinarily be an entire day's trip for mules. It is said that the train, America's first organized volunteer motor reserve corps, hauled the battery a farther distance and at a greater speed than ever before accomplished over an American road.

The motor truck train was made up of an officers' car and five trucks—a one-ton truck which acted as a scout car and four four-ton trucks, the latter each hauling a three-inch field gun and caisson. Three of the trucks carried the 50 men making up the battery crew, while the fourth carried extra caissons, spare gun parts and the ammunition.

The demonstration was in the nature of a test which should go a long way toward revolutionizing coast defense, according to Capt. McComas of the battery, who said:

"We moved the entire battery to San Diego and return without a mishap and this is a feat because of the speed maintained. The guns are mounted on carriages built for shorter and slower horse travel. For long-sustained speeds the carriages should be mounted on rubber-tired wheels similar to those used on motor trucks, but the ones employed nevertheless

stood up remarkably well despite the steady running."

The guns were not mounted on the truck chassis, ready for fire, as are many of the famous French 75s now used in Europe, because the trucks were only loaned to the battery for the purpose of proving what trucks could do in rushing guns to points along the coast under conditions which prevail in time of actual war were a foreign power to attempt to land a force.

The great advantage of motorized transportation was amply shown by the proof that the battery of artillery could be rushed from Los Angeles to San Diego in less than seven hours and could go into action at once. If horses had been used to make the 134-mile

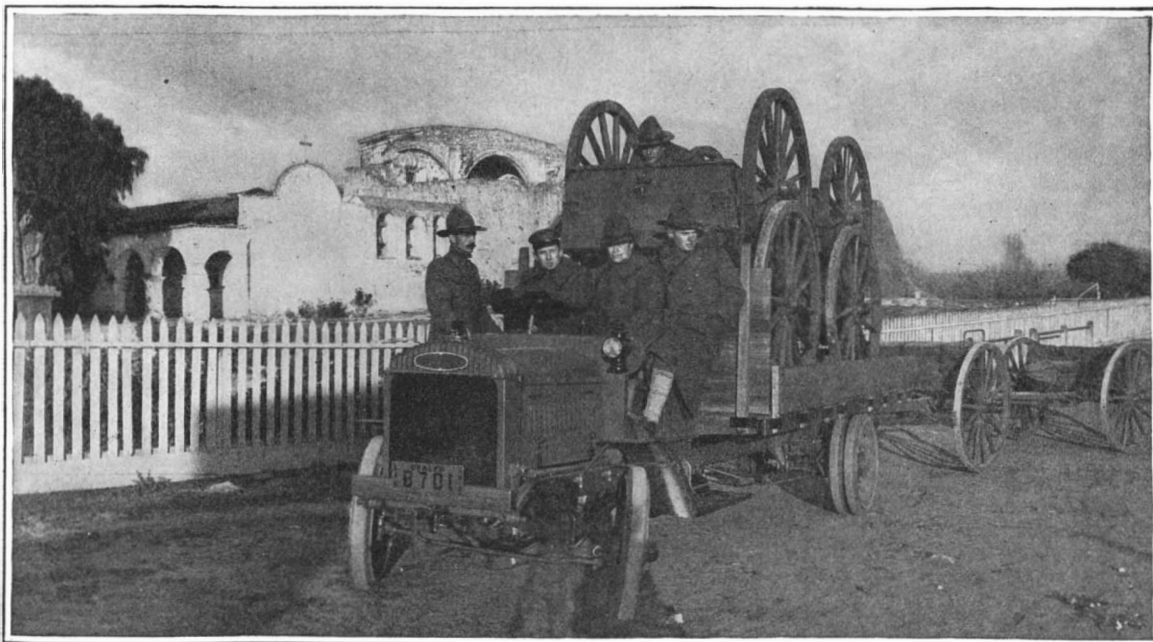
the case with the truck equipment. If the battery had been shipped by rail it would have taken at least four hours to load the guns and horses at one end and unload them at the other, or half as long as it took for the motor train to make a dash and get into action.

Much of the success of the demonstration, insofar as the speed maintained is concerned, was due to the excellent road over which the run was made. It skirts the coast between Los Angeles and San Diego and is solid concrete for almost the entire distance, being a perfect military road. It is called the King's Highway to-day, but its history dates back to the time of the Spanish occupation of lower California, when it

was called El Camino Real. In those days it joined all the picturesque adobe missions built by the gentle yet militant Padres of the Church and was used for trading between the various missions. It was traversed by the Spanish royalty on its visits of inspection, from whence it got its name, King's Highway. Without this perfect road, the average speed of 20 miles per hour maintained by the artillery train would never have been possible. It is a shining example of the value of military roads along both our coasts and the facilities they would extend to American legions in case of war.

Another startling result of the demonstration is the fact that the cost of operation of the truck train

was only ¼ cent per ton-mile for the 268 miles of the run to San Diego and back. The official figures showing the tabulated cost of the operating expenses of the trip were compiled by Lieut. Sterling Booth, Cal. N. G.



American motor truck artillery train at the San Juan Capistrano Mission on the run between Los Angeles and San Diego

run it would have taken at least two days, and then under such extraordinary severe conditions that both horses and men would have been worn out before going into action, instead of fresh and ready for work as was

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway,
New York, Saturday, March 11, 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
Copyright 1916 by Munn & Co., Inc.
Great Britain rights reserved

Illustrated articles must not be reproduced without permission

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.

Preparedness That Prepares

WE have recently been warned by President Wilson that the country is in a condition of grave danger, and that it is impossible to foretell what a day may bring forth. To many of us—to all of us, in fact, who have appreciated the sinister significance of the "Lusitania" outrage and the devious diplomacy which it has begotten—the growing menace to the United States has been only too clearly and too long apparent. Out of this conviction of peril has grown the insistent and widespread demand that emergency measures to protect the country by greatly increasing our naval and military forces be at once put in force.

Now this movement for preparedness, as everyone is well aware, had its beginnings and lusty growth among the private citizens of the United States. Congress and the Executive either ignored the movement or strongly condemned it, at least in its earliest stages. Of late the Administration would seem to have taken alarm, and this change of attitude has found its strongest and most dramatic expression in the public warnings of the President himself.

The trouble with much of the Administration's belated insistence upon the need for preparedness is that the remedial measures are too much in the future, that they fail to meet the present emergency. There are some defensive measures which can be taken at once and require no legislative action to put them in force; for it is not necessary to delay action until a complete reorganization of the military establishment or the plans for enlargement of the navy has been fully worked out. The war in Europe has now been running its course for over a year and a half, and although during that time, as we are now informed, the menace to this country has grown to a point of grave danger, the present Administration has failed to do the things immediately next to hand and make those enlargements of the military establishments for which it had full authority under the existing statutes.

To particularize, it is only necessary to consider that the United States army is to-day nearly fourteen thousand men below its statutory strength; that is to say, throughout the period of this war the Executive has had the power to bring the army up to its full strength, as authorized by law, of one hundred thousand men. On the contrary, during all this time of peril, infantry regiments have been maintained within the continental limits of the United States at less than half strength; cavalry and field artillery regiments at about 25 per cent below full strength; and the coast artillery organizations have been alarmingly short in numbers—all of which deficiencies could have been met in part, at least, by bringing the army up to its full statutory strength.

Furthermore, during these times of imminent peril our arsenals have been partially idle. Congress has been importuned, over and over again, for the special appropriations necessary to put our arsenals at work for the purpose of making good our shocking deficiency in artillery and ammunition, providing an efficient fire-control system in our coast defenses, and commencing immediately, on a large scale, the construction of new carriages to take the place of the present obsolete type of carriage that now so seriously limits the efficiency of our sea coast guns. Indeed, it might be possible, by a slight mechanical change in the existing carriages, to permit them to give the guns that full elevation which is necessary to make them effective for distant ranges—a change which would vastly increase the efficiency of our batteries at a relatively insignificant cost.

A grave and insistent danger threatening the United States? Undoubtedly. A pressing need for preparedness on a large scale? Without doubt. But why, in the name of consistency and common sense, if the

danger is so great and the need so pressing, do we fail to make those immediate preparations which can be put in force to-day, some of them without the necessity for legislation and the rest by the voting of moderate appropriations?

Battle Cruisers for the Line of Battle

SEVERAL years ago, when the first battle-cruisers of the "Invincible" type were set afloat, the SCIENTIFIC AMERICAN was greatly impressed with the obvious strategical and tactical value of this new type of warship, and we earnestly recommended the addition of a division of these ships to our main fleet. It did not take the eye of the naval expert to realize that the combination of a battery of armor-piercing guns with engine power capable of moving that battery across the high seas at a speed of five or six knots greater than that of the major units of the enemy fleet, presented a fighting unit of such range and power that the possession of one or two divisions of such vessels would exert a powerful determinative influence upon the next war, if, indeed, it did not prove to be decisive.

The publication of our articles led to a protest from the Navy Department, and we were informed by the chief naval constructor of that time that it was the opinion of the General Board of the Navy that, although the battle-cruiser possessed undoubted merits, it was nevertheless something of a spectacular and expensive luxury, and the appropriation for a division of battle-cruisers would be expended to much greater advantage if it were put into slower and more heavily armed battleships.

In those days there was a strong prejudice in our navy against the battle-cruiser on the ground that its armor was too light to enable the ship to lie in line in a general engagement, where it would stand but small chance of remaining afloat under the attack of the enemy's high explosive armor-piercing shells.

"Other times—other customs." The brilliant work done by the British battle-cruiser during the present war has fully verified the faith of its designers, and our General Board has so far reversed its earlier opinion that it is now recommending the construction of one or more battle-cruiser divisions. Admiral Knight, indeed, the president of the Naval War College at Newport, in his recent testimony before the Senate Naval Committee, went so far as to recommend that we defer the building of any more battleships until we have added to our fleet eight ships, or two divisions, of the battle-cruiser type.

Having in mind the early objection of the Naval Board to battle-cruisers on the ground that they could not enter a general line-of-battle engagement, an objection which is equally valid to-day, we suggest that our Bureau of Construction should get out a design for a battle-cruiser carrying sufficiently heavy armor, say of a minimum of twelve inches, to enable it to stand up in the give-and-take of a battleship engagement. It has been stated in some of Mr. Daniels's press notices that a design is being got out for a battle-cruiser of thirty-five knots. Such a speed would call for at least 140,000 horsepower. Having in view the all-around usefulness of such a ship, would it not be advisable, if this enormous speed has really been contemplated, to cut down the engine power to the equivalent of thirty or thirty-one knots, and utilize the weight thus rendered available by raising the armor to a minimum thickness of twelve inches? In such a ship we should have an ideal type—a line-of-battle battle-cruiser, a ship which could perform its primary functions of screening its own fleet and finding the enemy and bringing him to action, and could then take its place in the battle line of the decisive engagement.

The advisability of providing our battle-cruisers with armor of battleship thickness is even more urgent to-day than it was when the new type made its appearance. In the past few years there has been a notable advance in long-range gunnery. The British, in the North Sea fight, landed on the fleeing Germans at 17,000 yards. In his testimony before the House Naval Committee, Admiral Fletcher stated that seven out of forty-two shells fired by one ship at target practice had struck a 20 by 60 foot target, at 16,000 to 18,000 yards; and that the "Wyoming" had put three 12-inch shells through a 10-inch plate at 12,000 yards.

Criticism and Creation in Science

THE critical faculty in man is not only often distinguished from the creative faculty, but is even set over in opposition to it. A critic is often presented to us as a man who cannot create, and Nietzsche has asserted that no great creative artist can be a critic; and yet, on the other hand, one comes across such phrases as "creative criticism." Such writers as have expressed their opinions on this subject have usually confined their attention to creation and criticism in the Arts, and the conclusions they have reached seem to be somewhat confused. But if, neglecting literature, music and painting, we examine

science from this point of view, we obtain an unequivocal answer to our question: is the creative faculty entirely distinct from the critical faculty? The answer is—to adopt a form beloved by the British Parliament—most decidedly in the negative.

If we examine the scientific work of recent times we shall find that it has been almost entirely critical, and yet, although it has destroyed some of the cardinal dogmas of the old orthodox science, it has not left us a mere jumble of ruins, but has opened to us vistas wider and deeper than any we have seen before. It is as if the old pillars of science were not so much supporting a structure as obscuring a view. Let us take, as one example, the old dogma of the invariability of mass. Whatever we did to a body, the mass of that body was supposed to remain constant. If we heated it, then usually its volume became greater—but its mass remained unaltered. If it were a chemically compound substance, we could resolve it into its constituent elements, but the combined masses of these elements would equal the original mass of the substance. Experiments of great delicacy were made to test this generalization, and it emerged triumphant from all the tests. The statement that the mass of a body remains unaltered was one of the pillars of science. Criticism has sapped at this pillar, and at the present day that pillar has fallen, an irretrievable ruin, to the ground. We now regard mass as a varying quantity. The mass a body has when it is at rest is different from the mass it possesses when it is in motion; and for every variation in its motion there is a corresponding variation in its mass. Nay, even when it is moving with a uniform velocity in a straight line, it possesses, at one and the same time, two distinct masses, a transverse and a longitudinal mass. Modern scientific criticism has destroyed one of our old beliefs, but in doing so has greatly extended our scientific horizon.

We will refer to another fundamental doctrine of the old science, which has been destroyed. Nothing in the old science seemed more unshakable and more fundamental than Newton's three Laws of Motion. The last and, in some respects, the most important of these stated that action and reaction are equal and opposite. The whole of dynamics, including astronomical dynamics, phenomena ranging from a weight hanging at the end of a string to the great body of theory built up around the action of the moon on our tides, and of our tides on the moon, seemed to support this law. Yet now we deny it. We assert that action and reaction are not always equal and opposite. A body on which a ray of light impinges experiences a pressure, as was foreseen by Maxwell and Bartholdi and verified experimentally by Lebedeff. The experiments by which this result is obtained are very delicate, but there can be no doubt about the result, more especially as there is a presumption in its favor from the well-known phenomena attending the passage of a comet close to the sun, phenomena which had led Faye to throw out a suggestion of this kind. Now, the pressure calculated by Maxwell cannot be reconciled with the Newtonian principle of action and reaction, since the instant when light impinges on a body is not the same instant when light was emitted from the source. This is not all. A profound mathematical analysis by Poincaré has shown that the violation of Newton's third law of motion is a necessary consequence of any electromagnetic theory which takes account of certain optical phenomena—the partial "entrainment" of light waves.

The two cases we have given could easily be multiplied. In each case, when we came to study the genesis of the modern theories, we should find the processes of criticism and creation inextricably entangled. It is perfectly evident that certain constructive theories presuppose a criticism and denial of statements which up till then had been taken for granted. This critical and, at the same time, creative tendency in science is perhaps nowhere made more manifest than in the study of the non-Euclidean geometries. Even to the instructed mind there seemed something so obvious and necessary about the assumptions of Euclid that even to question those assumptions was in itself a considerable critical achievement. As we know, Bolyai and Lobachewsky questioned those assumptions and simultaneously created a new geometry. The influence of their work has been profound: it has radically altered the way in which we regard a mathematical axiom or postulate in the region of geometry. It was a supreme critical achievement, and was at the same time a supreme creative achievement. In scientific work, at any rate, the two kinds of mental activity cannot be clearly separated. We cannot point to a preliminary critical operation where assumptions are examined and the ground cleared, and then to a creative operation where a new structure is erected on the ground so cleared. The two processes go on together, and so far as science goes, it is perfectly true to say that we create by criticising, and that we criticise by creating.

Electricity

Multi-Telegraphing by Photography.—It is reported that a Norwegian, Frederik Dahl, has lately patented in several countries a system which permits of the simultaneous transmission of any number of words by means of an automatic photographic-electric apparatus. Experts who have examined the invention are of the opinion that it will revolutionize the existing methods of telegraphy.

Transmission Line Cables and Sleet.—After extended experience with sleet conditions, engineers of some of the most important Canadian power transmission lines have arrived at the joint conclusion that for ordinary sizes of conductors used the worst conditions may be taken as $\frac{3}{8}$ inch of sleet adhering to the wire at 32 deg. Fahr. and a wind pressure of 11 pounds per square foot of effective area. It is held that a factor of two is required under these conditions.

An Ultra-Modern Knight of the Road.—It is reported that a "hobo" is traveling along the Northern Electric Railway line in northern California, carrying with him a folding frame of iron interlaced with copper, which he connects with the third rail so as to cook his meals by electricity. Furthermore, it is reported that he also carries a long wire which can be hooked over a trolley line to supply current to the same appliance. The story is interesting and humorous; technically, it is somewhat dubious.

A Combination Electrolier and Phonograph is the latest offering of an American phonograph manufacturer. The electrolier or electric table lamp is somewhat larger than the conventional type and its base serves to hold the disk-record turntable, electric motor, talking box and other essentials. The sounds produced by the talking box are led up through the pedestal of the lamp and released beneath the glass shade, which throws them downward and outward, augmenting the volume at the same time. There is no trace of the phonograph mechanism from without when the door in the base is closed, and the uninitiated are completely baffled as to the source of the music when seeing the phonograph lamp for the first time.

Steel Tires Heated by Electricity.—A prominent American automobile manufacturer is using electricity to heat the steel tires of the wheels, which must be brought to a red heat before being placed on the wooden members. For this purpose the steel tires are laid in a steel tub surrounding a transformer coil which acts as the primary while the tires become the secondary of a transformer. It is said that motor truck tires, which are about 0.5 inch thick, 10 inches wide and 36 inches in diameter, are brought to red heat in about three minutes' time. Not only is the danger from fire greatly reduced by electrically heating the tires, but the method also lays claim to more uniform and rapid heating as well as the elimination of soot or oxidation.

Tungsten Arc Lamp of British Make.—The British *Electrician* in a recent issue describes the first commercial tungsten arc lamp placed on the market in England. It is known as the "Pointolite" lamp and is especially intended for use in projection apparatus. The light produced by the lamp emanates from a small ball of tungsten, which is placed directly over the ionizing filament. When the arc is struck the ionizing filament is immediately moved away from the tungsten ball by an automatic bimetallic support, slightly lengthening the arc and avoiding aging of the portion of filament opposite the ball when cold. The lamp in its present form can only be used on direct current. It is supplied with a resistance box, permitting of its use on circuits of voltages ranging from 100 to 250.

Lead Cables Perforated by Beetle.—A discovery of much importance to telephone and electrical engineers in the United States was recently announced by Albert Schuler, general manager of the Santa Barbara (Calif.) Home Telephone Company. After five years of persistent effort to determine the cause of minute holes in the lead armor of aerial telephone cables, Mr. Schuler established beyond question that the holes are bored by a comparatively small beetle with powerful mandibles. For years the telephone company was troubled by short circuits in the aerial cables due to minute holes in the armor, resulting from some unknown cause. Electrical experts who were consulted ridiculed the suggestion that the holes were caused by insects and laid the trouble to electrolysis. Several men who were detailed to travel along the line and watch out for suspicious bugs were soon rewarded for their trouble. They captured a number of bugs in the act of drilling into the lead armor of the cables. Specimens of the bug were sent to Dr. Van Dyke, Entomologist at the University of California, who classified them as *Sinoxylon declive*, a kind of beetle that ordinarily attacks wood, particularly live oak logs or cord wood.

Science

Search for Oil in Australia.—There is a promise of important developments as a result of long-continued efforts to find petroleum in South Australia. One of the local oil companies has driven down a pipe to a depth of 1,400 feet near Robe, and oil is now showing strongly, with little gas. Petroleum, as distinct from shale oil, has not previously been found in Australia.

The Manufacture of Viruses, Serums and Toxins.—According to a recent report of the Public Health Service, there are now 41 establishments in this country and abroad licensed to manufacture viruses, serums, toxins and analogous products for the treatment of human beings, and over 60 different products are propagated therein. The establishments producing viruses, etc., for use on domestic animals are much more numerous.

The Electrical Dissipation of Fog.—The Smithsonian Institution announces in its last annual report that it has made an appropriation to further experiments in the dissipation of fog by electricity, and that the investigations will be carried out under the general direction of Dr. F. G. Cottrell, who has already done much toward the practical precipitation of dust, smoke, and chemical fumes in large industrial establishments. As every reader of the SCIENTIFIC AMERICAN knows, the idea of dispersing fog by electrical methods has been before the public for a number of years, though it appears never to have reached the stage of feasibility, on a commercial scale. The subject has recently aroused fresh attention, particularly in the neighborhood of San Francisco, through researches planned by the University of California in cooperation with the United States Lighthouse Service. The American Institute of Electrical Engineers has also appointed a committee to cooperate in this work. According to the Smithsonian report, the essential element to success seems to be some form of electrical apparatus of very high direct voltage, with facilities for its control and ready application.

"Smoke" from Mount Hood.—From time to time press dispatches have reported that smoke has been seen issuing from the crater of Mount Hood, the loftiest volcanic summit of Oregon. The latest report of this kind came from The Dalles last October. The whole subject of this alleged smoke is discussed in the *Monthly Weather Review* by Mr. F. D. Young, of the U. S. Weather Bureau. It appears that there are three kinds of "smoke" that rise from the top of Mount Hood, and all three depend upon meteorological conditions and the peculiar topography of the mountain summit. The first is merely snow, which, when the wind is strong and in the right direction, is blown from the cliffs inside the crater rim and thrown high into the air. The second type of "smoke" consists of clouds, which drift into the open side of the crater rim and are transformed into an almost perpendicular column of vapor by the rising air currents where the cliffs converge. A third possible form depends upon the fact that there are large patches of rock within the crater hot enough to vaporize any water that may fall upon them. A hot surface of this kind lies almost directly under the cliffs forming the crater rim, and Mr. Young thinks that if a snowslide should occur that would throw a large quantity of snow on that spot the steam generated could be seen for some distance.

Macquarie Island Meteorological Station.—The meteorological station on Macquarie Island, in latitude 54° 50' S., longitude 159° E., established by the Australian Antarctic Expedition in 1912, has since been maintained at the joint expense of the Australian and New Zealand governments. It has a wireless station which is in touch with Hobart, Tasmania, and Wellington, New Zealand. It sends out daily weather reports which are of special value, because the island is a sort of a halfway house to the Antarctic continent, the conditions on which largely influence the weather in Australasia. However, the Prime Minister of Australia stated recently that it was very probable the station would be abandoned because of the heavy cost of getting supplies and equipment to this lonely spot, and also because of the difficulty of finding officers willing to undertake a duty which involves such a Robinson Crusoe-like existence. The island is 900 miles from Hobart and is situated in the west winds belt of the Southern Ocean, one of the stormiest regions in the world. A few months ago the Australian federal trawler "Endeavor," which was sent down with a relieving officer and supplies, was lost with all hands, twenty-one in number. The only visitors to the island are men who extract oil from the sea-elephants and penguins, which abound there. These spend several months there each summer, but for the rest of the year it is absolutely deserted. The island was formerly inhabited by a peculiar wingless parrot, which is believed to have been exterminated by cats accidentally introduced.

Industrial Efficiency

Importance of Proper Ventilation.—Roughly speaking, an increase in production of 10 per cent is not at all unusual in the average office, shop or warehouse, following the installation of a ventilation system. Fresh air, properly circulated, is an essential factor in successful factory management.

Cost of Labor in Manufacturing Electrical Goods.—According to the latest available reports of the Pennsylvania Bureau of Industrial Statistics, the labor cost on more than \$30,000,000 worth of electrical supplies manufactured in the state in 1912 aggregates 38 per cent of the total value. Aside from the mining and preparation of coal, this is the largest labor cost in percentage of all industries in the State of Pennsylvania.

Imports of Chemicals, Drugs and Dyes into the United States showed an aggregate value of \$5,709,141 during November and of \$75,851,879 during the eleven months ending with November, 1915, thus making the year's indicated total approximately \$80,000,000, compared with \$87,675,573 in 1914 and \$101,292,697 in 1913. With the exception of argols and gums, the imports in chemicals, drugs and dyes have fallen off to a considerable extent and the prices risen during the past year.

Oil-Engine Ships to be Constructed Here.—It is announced that two large shipbuilding firms in the East have signed contracts with a leading shipbuilding firm of Amsterdam, Holland, whereby they will construct under license in the United States a line of four-cycle Diesel type engines. For a number of years these American firms have been watching the development and progress of the Diesel-driven motor ships in both mercantile and naval service.

Temporary Factories for Munitions Trade.—Portable buildings of small size have become quite common during recent years, but a portable manufacturing plant is a comparatively recent development of this form of construction. The circumstances met in the munitions trade has caused at least one American organization to erect large factories. These structures are bolted together, although in appearance they are of the most substantial design. It is planned to disassemble and remove them to the main plant some time in the future.

Contemplated Co-operation Between Universities and Big Business.—The Chamber of Commerce in the United States is at present inquiring into the possibility of bringing about closer cooperation between the universities and large business interests. It has been suggested by W. M. McCormick, of Baltimore, that the Chamber of Commerce call a meeting in Washington of the presidents of twelve prominent universities and the heads of twelve industrial firms. The object of the meeting would be to discuss how the universities can so organize their courses of study as to make their students of immediate value to the industries upon graduation.

Inexpensive Operation of Oil-Engine Freighters.—The economies obtained in the operation of a motorship as compared to a steamer are almost unbelievable, due to the fact that there are no large boilers or stokeholds in the former and because the consumption of oil fuel is only one-fifth that of a coal, or oil, fired steamer, so the bunker and boiler spaces thus saved can be given over to extra cargo. With a tramp steamer of 10,000 tons about 600 tons of extra cargo can be carried, and at the present high rate of freights the economical advantage in a year is enormous, apart from the large saving on the fuel bill.

Routing of Periodicals Through Organizations.—In a recent issue of *Factory* there is suggested a simple yet most effective method of routing periodicals through a business organization. A form known as a "circulation slip" is pasted on the front cover of the periodical to be routed. In the first column are placed the names of the department heads to whom the copy is to be passed; the next column is for a check mark, followed by two columns headed, respectively, "See articles on pages" and "See ads. on pages"; and finally, a column for remarks. The person having charge of the routing fills out the circulation slip after reading through the periodical, following which it is passed on through the organization.

Electric Delivery Wagons Cheaper than Horses.—Records kept by a New York firm for six months disclose the fact that on the basis of cost per vehicle per day, without reference to the amount of work performed, horse wagons are the cheapest. On the other hand, continues *The Edison Monthly*, since an electric can do more work in any one day, cost of delivery per package shows the electric 5.3 per cent cheaper than horses; in bulk delivery the economy increases to 12.6 per cent. One great saving found characteristic of the electric vehicle is in the elimination of time spent between stables and the store. Electric vehicles in this instance are housed in the store basement and in one adjoining, something manifestly impossible with anything but electrics.

The War Game.—I

A Strategic Reconnaissance of Four Cavalry Patrols

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

TO learn the art of war, no other method is so commendable as to apply the rules of warfare to the war game. Its importance in the European armies is fully recognized and, during the winter season, such games are conducted by every garrison.

There was a time when the conducting of a war game and the carrying out of its details and developments was a very tedious work. The reasons for this were that an almost endless series of tables, with chances of loss by infantry and artillery fire, percentages of disabled, wounded and sick soldiers, tables for the influence of weather conditions, the passage of hinderances, etc., were used.

All this, however, was abolished quite a while ago and the chief guides in conducting these games became commonsense and simple arithmetic. To these, as a matter of course, was necessary the tactical and strategical knowledge demanded by the task itself and the influence of the modern machines of war upon the enemy, from the infantry rifle up to the guns of whatever caliber used, not forgetting the saber, the bayonet and the spade.

In military circles the war game, just as an actual maneuver, will take its natural course. In our case, when we want to enlighten the participants first in the details of tactics and strategy to be applied in that particular phase of the game, our proceeding will be slower and will dwell on smaller engagements and will gradually lead up to greater tasks, with the growing understanding of the theories of war.

The fundamental principles of war are neither numerous nor, in themselves, very abstruse, but their application is rather difficult, for, above all, they cannot be made subject to set rules. The correct application of principles is regularly the outcome of deep military knowledge, developed into instinct. However, military science is not different from any other science and talent in these lines, and above all genius, will march to the front at a lively rate.

The action of an army or any part of the same is: Fight, strategy and tactics. High sounding words as they are, they can be traced back to the same old story, where Jim and Tom, two boys, had their first scrap over an apple core.

Jim had the apple and promised Tom the core (the first diplomatic intercourse). Tom watched the apple disappear and when it looked as though the proceedings would endanger that core, then he started a diplomatic parley to secure what he believed was rightfully his. Jim, urged on by greed, declared, "There ain't goin' to be no core," which, of course, was almost equivalent to an ultimatum. Diplomacy, then and there, ended, and Tom had recourse to strategy: He picked up a broomstick and threatened Jim from the side which looked most promising for securing his aim.

Jim, at this action, quite naturally began to work along strategic lines himself: He made perfectly sure of the core, then grabbed another stick for defense, or, if a quick attack appeared more promising, he jumped at Tom with doubled fists. From here on, the mutual belaboring of each other with fists is the simplest application of ancient tactics.

This example makes it clear that both these sciences are, to a degree, inborn, and this fact gives confidence in the success of the war games, conducted by the SCIENTIFIC AMERICAN, for its readers.

To participate in these games, one has to read the theories which precede each task, then, after a short study of the terrain, illustrated by a large-scale general staff map, to proceed with the solution of the given questions. The correct solution of these tasks, with explanatory notes, will appear in a later number.

The Characteristics of the Arms Which Compose an Army

The fighting troops of an army are composed of infantry, cavalry, artillery,

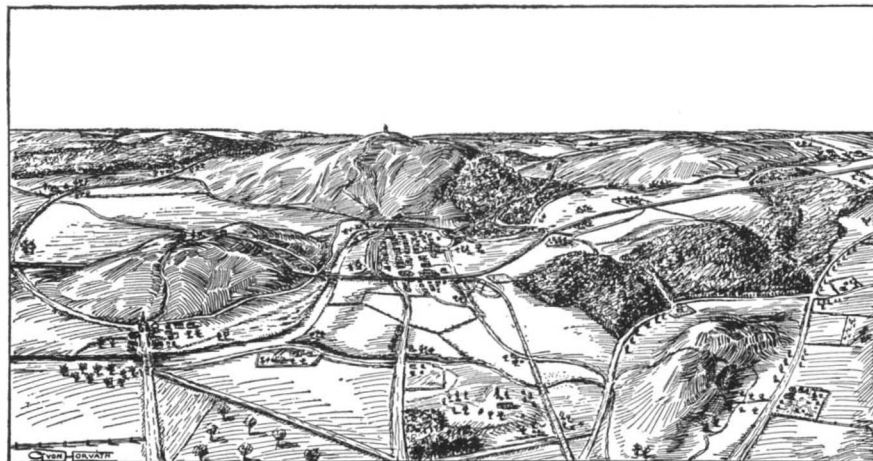
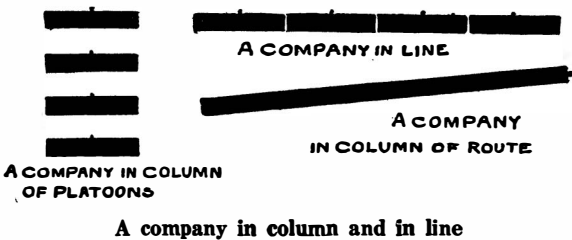
engineers, cyclists and flying corps. The proportion of these units is, under ordinary circumstances, to give a rough example: 60 per cent infantry, 20 per cent cavalry, 10 per cent artillery, 6 per cent engineers, 3 per cent cyclists, 1 per cent flying corps.

The infantry and cavalry might undertake certain tasks singly; the artillery and other units are dependent upon the assistance of the other arms. For success, the perfect coöperation of the units is most important. The cavalry, being outfitted with long-range rifles, can undertake infantry actions.

For actual field maneuvers, it is necessary to acquire terms, commands, and all the details by which a troop is brought into the demanded position and location. For the participant of these war games, it is sufficient to know the formations and the lengths of these formations.

In the following will be given the information which is absolutely essential to the disposition of any action. Generally speaking, from a layman's standpoint, there are three important formations for all arms. These are:

The gathering,
The marching, .
The fighting.



Topographical map of the region where the reconnaissance is to take place

NORTH



— Good road.	— Railway.	— Barbed wire fence.	— Infantry.
— County road.	— Railway in winter.	— River and ferry.	— Cavalry.
— Trail.	— Embankment.	— Creek.	— Artillery.
— Bridges.	— Buildings.	— Mine.	— Aeroplane.
	— Church with spire.	— High point.	— Cyclist.
	— Marsh.		
	— Stone fence.		

Military map of the region pictured above with explanation of signs employed

For example, we shall take a company. The company is formed of four platoons, each numbering, let us say, 40 men. It gathers in column, marches in columns of fours or twos, and fights in line. (See accompanying sketch.) By taking four matches, it is very easy to understand the general principles of the leading of a company for war games. These principles apply as well to cavalry and, to a great degree, to artillery, also.

According to the questions involved, the necessary explanations will be given at the very points of application, thus avoiding unnecessary repetition of explanations. In regard to distances, we shall do well by figuring the length of a company in line or in marching order as 100 yards long. The depth of a column of platoons is 16 yards. Now, to dwell for a moment more on this question, since the battalion is formed of four companies, the distance will be four times as long, with a trifling additional distance for space.

The regiment is formed of four battalions, the brigade of two regiments, the division of two brigades. To each division, a regiment of cavalry is added. The artillery has, in place of company, the term battery, and one battery consists of six to eight guns. A division might have four to eight batteries at its command. A company of engineers, a squad of cyclists and two fliers and an additional train will constitute the full complement of the division.

All this understood, we can return for a minute or so to the example of Jim and Tom to get the necessary momentum for our first attempt at a war game.

Strategy and Tactics

At that moment when the diplomatic intercourse between the two boys has ceased, their minds were set on ways and means by which each could acquire the aim in mind.

To use an authority, according to Clausewitz, strategy is the science which teaches the art of applying battle to win the aim of war, and tactics is the knowledge of directing the action of the arms. Therefore, we could state that strategy is the planning of the war and tactics is the fighting it out. Whereas strategy might not be influenced by certain battles, victorious or otherwise, tactics concerns itself with even the smallest skirmishes among advanced posts.

This will make it clear that between Jim and Tom, very little strategy was wasted, and their main actions belong, more or less, to tactics.

Let us suppose that the scene between the boys took place in the back yard. Jim was sitting on the fence and Tom was leaning against the shed wall, a few

(Continued on page 288)

A Remarkable Belt for Conveying Sugar in Bulk

THE gigantic conveyor belt shown in the accompanying illustration is of peculiar interest for the reason that a similar belt has carried 2,000,000,000 pounds of sugar.

Confronting a sugar refining company some ten years ago was the problem of catching and carrying 125 pounds in a lump from a fall of 4 feet, at the rate of 3,200 per day. The solution of the problem was arrived at in the form of a 36-inch, seven-ply belt, which was installed at that time. Since its installation it is estimated that the belt has carried over 2,000,000,000 pounds of sugar before exhibiting any signs of wear. True, the belt is an enormous one and represents a large investment, but the service it has rendered is said to have exceeded all expectations.

Recently, the same sugar refinery installed the new gigantic belt which appears in the accompanying illustration. The man shown standing beside the belt is 5 feet 11½ inches tall. The belt is 1,443 feet long, 36 inches wide and weighs 11,983 pounds.

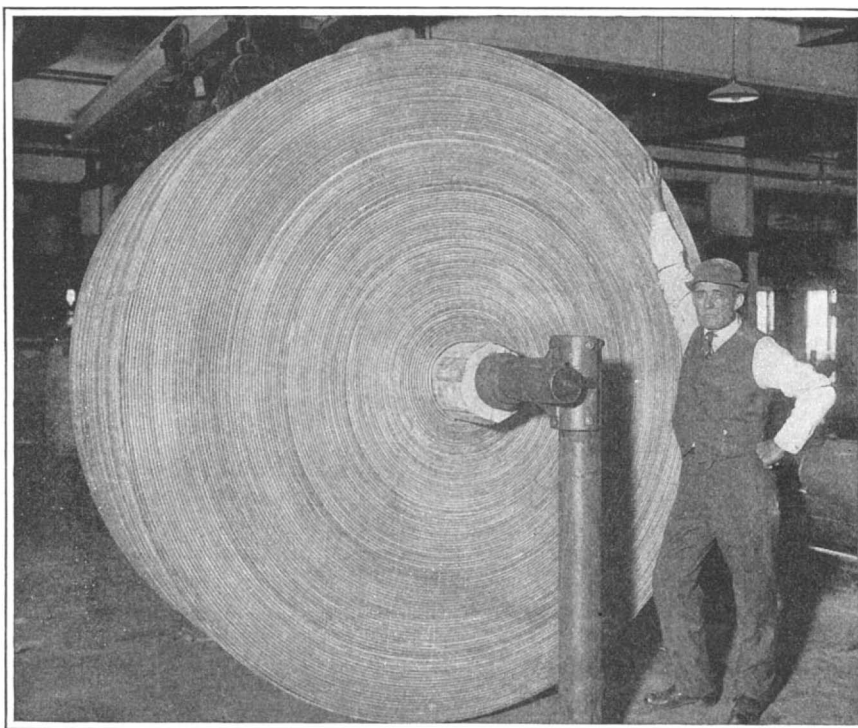
It is claimed that, estimating eight hours run without any delays, a bag of sugar will drop into the belt every nine seconds; and if the speed of the belt is such that it can make 26 to 27 revolutions every eight hours, the bags will rest at intervals of 12 feet apart. At this given speed, therefore, the belt will carry a continuous load of 60 bags or 7,500 pounds, and every nine seconds its heavily burdened surface will receive the sudden jolt and strain caused by 125 pounds dropping 4 feet. Such service is unusual in its severity and certainly ample proof of the astonishing strength of the belt.

Electrically Operated Coal Cutter of English Design

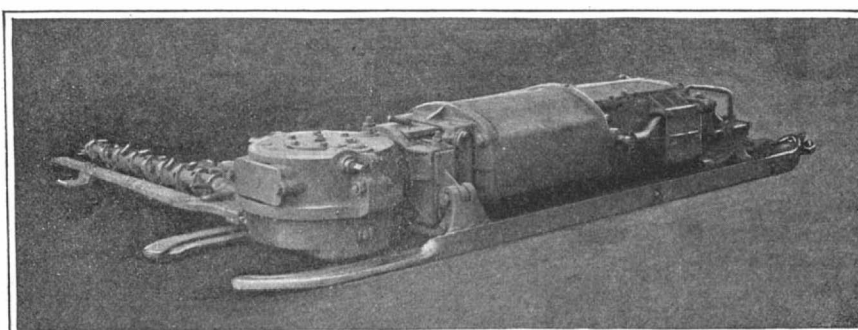
THERE recently has been brought out in England an electric coal cutter for which many interesting claims are made; in fact, the machine is said to represent the very latest progress in equipment of this nature.

The new machine, which is known as the Pick-Quick, is of the rotating cutter bar type. It is designed to occupy as little space in height as possible, so that the machine can be made to work upon coal seams of slight thickness—as low as 16 inches, for instance; and it is adapted to all the different conditions which are to be met with in this class of work, thus permitting of its operation in cases of exceptional difficulty where other types of coal cutter fail to work satisfactorily.

Either alternating or direct current motors are mounted on the new coal cutter, depending on the nature of the current supply available in the mines. The motors are of an unusually rugged construction and provided with casings to effectively keep out dust and moisture. The motor drive is laid out so as to work in an easy manner, and there is an absence of shock when the tool grips as sometimes happens with other types of coal cutter. Such is especially the case with the alternating current motors, and the three-phase motors of the coal cutters start up with a small current and allow of using a squirrel-cage armature, this being of course of a much more substantial build; and it is claimed that the collector ring armature, which was required for other machines using a long cutter bar, can now be dispensed with. Owing to the fact that there is no gripping of the cutter bar in the present case, the motor does not need to be designed for a



A gigantic conveying belt that is destined to carry over two billions pounds of sugar



An English coal cutter of the rotating cutter bar type, electrically operated

heavy overload, which is obviously an advantage.

The Pick-Quick coal cutters are made in three different sizes, according to the kind of work which is to be done, and the power of the motors ranges from 12 to 26 horse-power. The motors operate on 450 volts for both the direct and alternating current types, and require from 22 to 50 amperes. The net weight of the machine with the medium sized cutter bar is from 1.4 to 2.8 tons. It may be added here that the adjustment of the machine and cutter bar can be carried out so as to adapt it for working in different positions.

A Gasoline Shovel which Helps Unload Ore Ships

IN order to expedite the work of unloading ore ships with an ore handler, there has been em-

ployed a considerable number of men in the past, whose duty it was to shovel ore from the remotest corners of the hold towards the jaws of the ore unloader. Obviously, this feature of the unloading activities has added considerably to the expenses of handling ore.

Now comes a substitute for the human ore handlers in the shape of a gasoline shovel. As may be seen in the accompanying illustration, this machine consists of a substantial three-wheeled truck driven by a powerful gasoline engine. The operator sits in front of the engine, where he can obtain an unobstructed view of the shovel member mounted in front. The shovel may be raised or lowered by means of cables that wind on a drum.

The gasoline shovel is so designed and constructed as to admit of ready maneuvering about the hold of an ore ship. The operator can shovel ore from the remotest corners to a position within convenient reach of the ore unloader which dips through an open hatchway. Not only does the gasoline shovel replace a number of men in this form of work, but it also accomplishes the task in a shorter time than the usual allotment of laborers to each ore vessel.

Special Course of Instruction on Storage Batteries for Naval Men

LAST Fall an electric storage battery manufacturing concern of Philadelphia initiated a scheme of instruction for the officers and men operating the submarines of the United States Navy. As a result, during the months of November and December each of these men spent one week in hearing lectures on storage battery design and operating delivered by the engineers of the battery company and were

also given instruction in shop methods. Over 100 officers and men took this course. About five weeks' time was devoted by the concern to this work, and the men and officers expressed great appreciation of the help thus received.

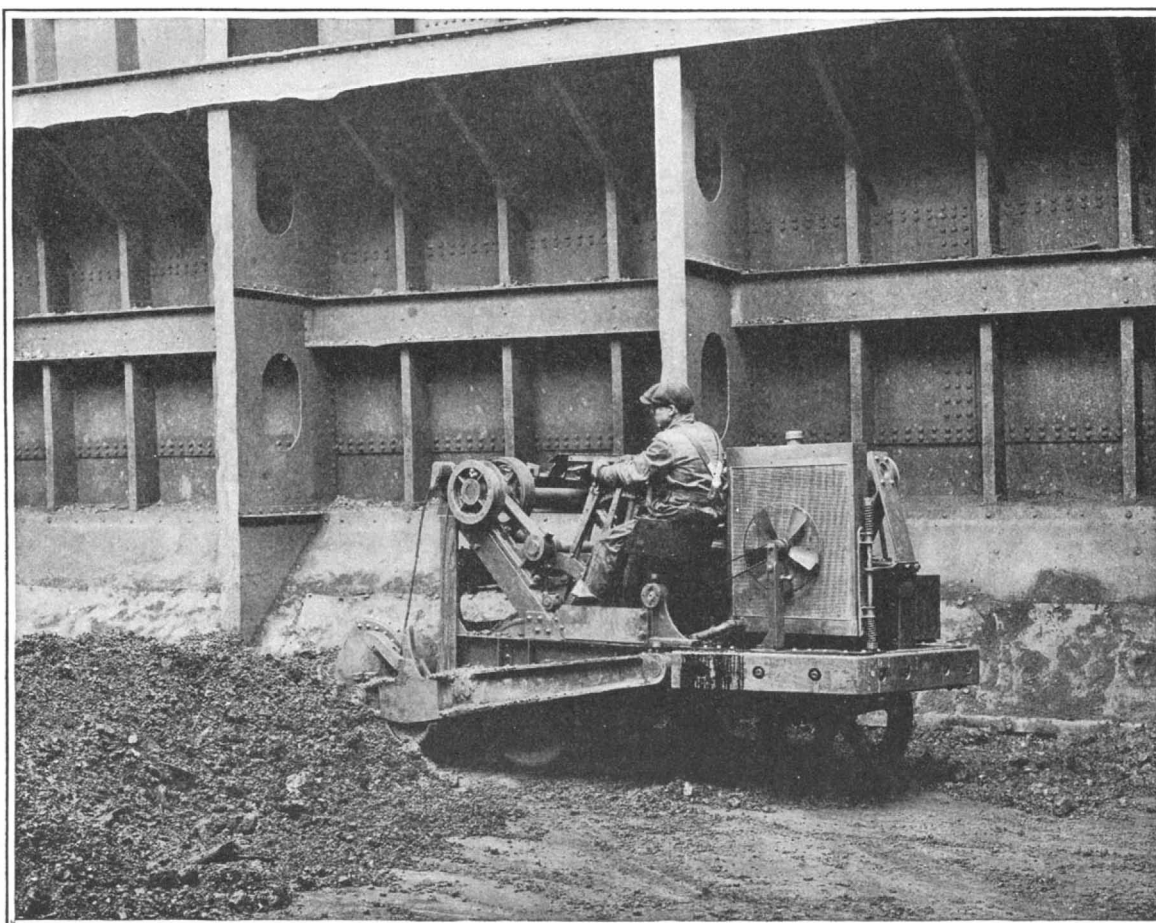
The course of instruction was originally laid out by the storage battery concern and approved by Admiral Grant, chief of the submarine "Flotilla," and his aide, Captain Yates Sterling, Jr. It was then sanctioned by the Hon. Josephus Daniels, Secretary of the Navy.

Since the storage battery is a vital feature of every modern submarine and usually the least understood of all the equipment of such craft, the course of instruction that has been given the naval officers and men in this subject is highly commendable.

Rapid Development of the Tilefish Industry

IN its investigation of the possibilities of the tilefish industry, the United States Bureau of Fisheries finds that there is some reason to believe that the fishing grounds extend some distance toward Cape Hatteras, although up to the present time they have been developed only as far south as about the latitude of Atlantic City. In the extension of the field the zone in which both the depth and temperature are suitable is probably much narrower than farther north.

The commercial fishery for tilefish continues to develop. During the month of January 398,000 pounds were landed at New York in 17 trips by six fishing vessels, or an average of 23,400 pounds per trip. This is an increase of 135 per cent over the amounts landed during December. The price remains uniform at an average of about six cents per pound to the fishermen.



View in the hold of an ore ship, showing a gasoline shovel in operation for the purpose of bringing the cargo from the remotest corners to within reach of the ore unloader

Strategic Moves of the War, March 3rd, 1916

By Our Military Expert

THE ominous quiet of the past few months on the intrenched fronts was broken at last, as expected. With another attempt to maintain the initiative, Germany has hurled at least eleven army corps, half a million men, against the defenses of Verdun, the key to the entire French position south of Rheims.

It is entirely conceivable that the price in blood that must be exacted from the launching of this venture would be justified by success. The direct road to Paris from Metz, the shortest line of general approach from Germany proper, lies through Verdun. It covers the line of the Meuse, it controls most important lateral railway communications, it is the keystone of the great defensive arch outlined by the positions of Rheims, Verdun, Toul and Epinal, even Belfort on the south-most flank. But it is almost inconceivable that, with the present development of the defensive in warfare, Verdun should fall. France has learned not to place its faith in mere defensive walls—an error that materially shortened the Franco-Prussian war. The cupolas, parapets, emplacements and turrets of steel and concrete which stud the various forts about Verdun, are by no means the principal reliance. They house guns, and only great, accurate shells may destroy them, as at Liege, Namur and Maubeuge. Yet they must be destroyed ere triumphant infantry, the backbone of an army, can sweep over them in assault successfully. But the trenches and approaches, through which reinforcing troops may stealthily be brought to a threatened point, safe from the curtain of fire inevitably poured in from hostile guns, to prevent reinforcing of the line, are the arteries of the system. Line after line of trench, with shelters and bomb-proofs, are strewn broadcast in successive lines. The first may fall and if the enemy continue to pour in troops, the second, the third, the fourth, until a gap appear in the line of forts; but the toll will have been so heavy that only prohibitive resources in flesh can win through.

When its present position in the line is considered, it is evident that Verdun, defensively, is more of a detriment than an asset to France. As the *Woevre* salient, peaked at *St. Mihiel*, juts into the French line, so does the *Hautes de Meuse* sector, its rounded nose encircling Verdun, project saliently into the German line. It forms an initial point for the undertaking of attack upon Metz should the Entente decide to assume the offensive; it is a danger, a threat. But to man this Verdun salient the French line must be extended to almost double the length it would be were the line straight across from the *Argonne* to *St. Mihiel*, requiring double the number of men to occupy it.

Germany's object in this attack is then probably twofold; first, to make the effort to break through and pour unending legions upon Paris, and so materially affect the general situation that terms of peace may be more readily considered by the Entente, or even bring the war to an end. Secondly, in default of success in entirely breaking the line, but by gaining possession of Verdun and the salient, the position might be materially strengthened at a saving in much-needed men to hold it and compel the retirement of the French lateral positions to a less threatened line. In that event, the menace against Metz would be removed.

The Kaiser has launched his attacks directly upon the Verdun salient, with sufficient demonstration of activity to north and south to hold opposing troops in place, so that reinforcements may not be stripped away and hurried to the endangered sector.

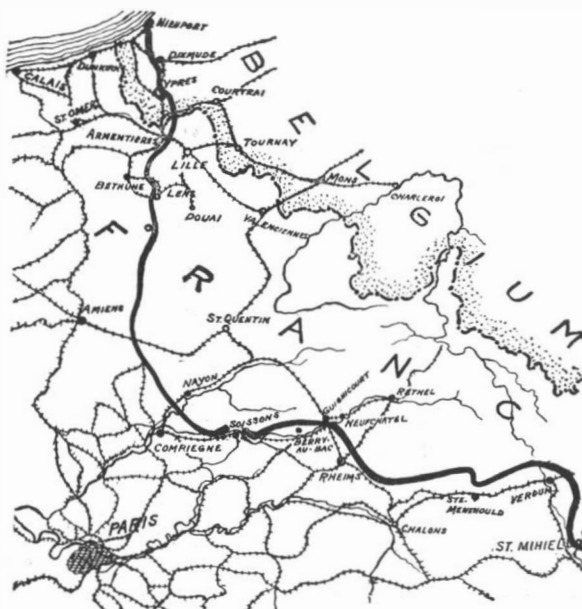
The objective appears to be the northern flank of the salient. The recognized manner of attack of such a position is to batter in the sides and, if possible, so threaten its defenders by a *cul-de-sac* as to compel their speedy retirement.

Twenty forts and thirty-some smaller defensive works form the *enceinte* of the Verdun defenses. Farthest advanced of the forts in the direction of Metz, except for lesser works somewhat to the southeast, Ft. de Douaumont fell before the combined, sustained rain of shell, great and small, poured in by the German batteries and the mad assaults of infantry regiments, after the outer lines of intrenchments, held with comparatively light force, had been driven back. The original line ran from Consenvoye on the Meuse almost eastward, then sagged to the southeast beyond Ornes. It was thrust back on the right, in the vicinity of the river, until it lay through Consenvoye, Brabant to Samogneux, thence eastward to Beaumont and Ornes

and beyond. The defending line to the westward of the Meuse was then compelled defensively to retire to Bellincourt, Forges, Regneville and Champneville at the river again, as the troops to the eastward were forced back toward the southern extremity of La Cote de Pouvre, south of Louvemont, south of Fort de Douaumont almost to the lines of Forts de Sauville and de Vaux.

A blinding snow storm developed after the attack was launched, which, while it may have aided the attack by the concealment it afforded, also made rapid advance impossible. Along the southern and eastern sides of the French salient attacks were also made, but the result achieved at the moment these lines are written seems to indicate merely a demonstration in force.

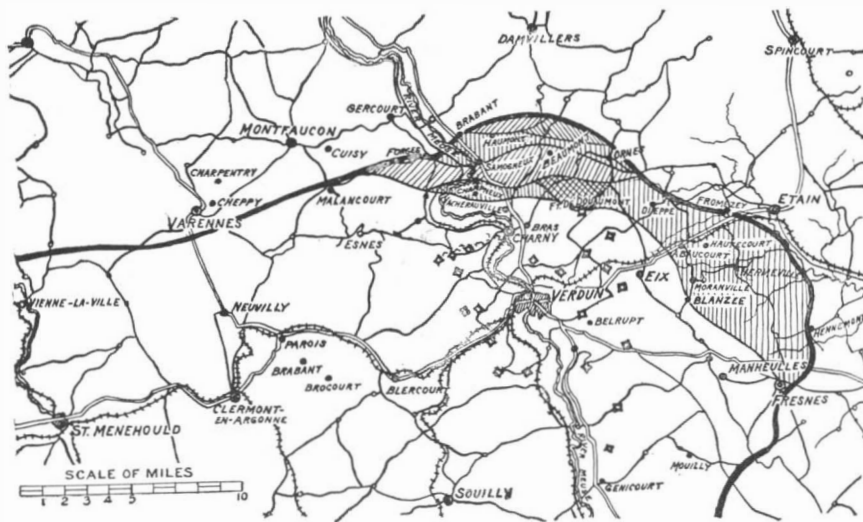
The outer shell of the first defensive line has scarcely



Relation of Verdun to Paris

been cracked. Without doubt effort will be made to reduce the various forts with heavy artillery, and thus widen the gap; but there still remains to the east of Verdun a number of forts and many, many trenches. Back of these the Meuse flows, a forbidding natural obstacle. And the bulk of the Verdun forts lie west of the Meuse, behind the river and the assault.

There is another way of defending Verdun, however, beside a mere passive defense—the counter attack. It may be the plan of that wise military council, the French General Staff, to permit Germany to batter away at the gates, secure in the strength of the de-



Successive stages in the advance on Verdun, from February 22nd to 28th

fenses, and wear the attackers away by the process of attrition.

But it does not seem unreasonable to expect the delivery of a counter attack at some other point, possibly to the north, less probably to the south, near Belfort. There is massed now in the vicinity of Verdun the flower of the Kaiser's hosts, veteran corps recalled from the Balkans and from the Russian front. Their places have doubtless been taken by reserve corps where necessary; and while it is improbable that other lines have been materially stripped elsewhere, there probably remains no great body of reserve corps to hurry to another threatened point.

England must have at least a million men on the Continent—more likely a greater number; France must have at least three and a half million men under arms.

With the front from the Channel to Switzerland held in the enormous strength of 7,000 men per mile, a most liberal estimate, a million more are still available for utilization in attack.

No one dares say that this will be done, or should be done. France has fought her fight, and fought it magnificently, and with the fragments of detail we possess in this country it would be the height of presumption to pretend to issue self-important dogmas as to what should be done. It is only suggested that at the moment an opportunity seems to exist for a vigorous counterthrust, perhaps upward through the *Champagne*, perhaps eastward through *Artois* and *Picardie* toward St. Quentin and Cambrai, or along the Oise; less probably, on account of the barrier of the Vosges, well to the southward through the *trouée* of Belfort toward the Rhine valley and Strassburg. At the north a successful break through Dixmude and Ypres would compel the German evacuation of Lille and the section of the line to the southward.

And the other fronts must not be ignored. If Russia has come back, as is currently reported, if Saloniki is held in the force they say is there, the recently organized allied Military Council, the Entente general staff, may call for a concerted effort on every front that will shake the foundations of Europe.

Demand for New Peat Fertilizer in England

THE commercial demand for homogen, the new peat fertilizer that is being experimented with in the United Kingdom, is already greater than the supply, according to a report published by the Canadian Department of Trade and Commerce. Offers at \$73 per long ton are being made, but the plant available for producing the fertilizer is limited.

Experiments at Kew Gardens and at an experimental station in the Lea Valley have given some remarkable results. Plants apparently dying have been restored to more than normal growth. Four potato sets, weighing a few ounces in all, placed in a small box of moss litter and watered once a week with the extract from bacterized peat, produced three pounds of potatoes in eight weeks. One tomato plant so treated had 16 pounds of tomatoes on it at one time. At the experimental station in Lea Valley 18 cucumber plants treated with manure and bone meal yielded 484 pounds of fruit. Eighteen others grown in 9 parts of ordinary soil mixed with 1 of bacterized peat gave 644 pounds of fruit, 71 pounds being marketed before a single cucumber was ready from the other crop.

Tobacco Fertilizer from Indigo Plant

THE residue of the indigo plant, after the extraction of the indican, known commercially as indigo, is used in the Karachi consular district of India, and probably also in other parts of that country, as a fertilizer for the tobacco plant. This substance is known as "seeth."

The roots of the tobacco plant require free access to air. Seeth breaks up the ground in a way to allow the air to penetrate. Experiments have been made recently by the Agricultural Research Institute in Pusa, India, with the object of securing better results from seeth. The substance has been used for years by the natives, but little scientific work has been done in India until the last 10 years. The experiments so far indicate that tobacco soil in which seeth and bits of broken tile or broken chatties (baked-clay water jars) are mixed produces better crops than soil under no special treatment.

The cost of the treatment mentioned above is moderate and the results achieved warrant the extra expense. A plot of tobacco land near Pusa was treated in this way nine years ago and has shown

marked superiority over adjoining plots ever since. Indigo has had a remarkable "bloom" since the war began, and the amount of seeth available has increased.

Cleaning Machine Parts Without Use of Benzine

FROM Germany comes the report that machinery and parts of same may be cleaned quite as satisfactorily and perhaps cheaper without benzine or benzol than by the old method. The following is recommended:

The parts of machines should be boiled in soda lye, then brushed while the lye is still hot, and afterwards rinsed in hot water. Caustic soda is recommended as better than ordinary soda, since it causes the fat or grease to dissolve quicker. In order to dry the hot parts it is generally only necessary to let the remaining particles of water evaporate.

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.]

Conserving Public Water Power

To the Editor of the SCIENTIFIC AMERICAN:

I write to ask your help to defeat a most serious attack on our public resources. Since the fight over the Alaska resources was won there has not been so pressing a threat against the conservation policy as the present effort in Congress to give our public water powers for nothing into monopolistic control.

The Shields Bill, now before the Senate, gives to the power interests without compensation the use of water power on navigable streams. The amount of water power these streams will supply is larger by far than all the power of every kind now in use in the United States. It pretends to, but does not, enable the people to take back their own property at the end of fifty years, for in order to do so under the bill, the Government would have to pay the unearned increment, and to take over whole lighting systems of cities and whole manufacturing plants. Private corporations are authorized to seize upon any land, private or public, they choose to condemn.

Bills which gave away public water powers without due compensation were vetoed by President Roosevelt and President Taft. The Shields Bill would do precisely the same thing to-day.

Another water power bill, the Ferris bill, relating to the public lands and national forests, was in the main a good bill as it passed the House. As reported to the Senate, it encourages monopoly by permitting a corporation to take as many public water power sites as it may please. Under it the corporations could not even be kept from fastening upon the Grand Canyon, the greatest natural wonder on this continent. This bill takes the care of water powers on national forests from the experienced and competent Forest Service and gives it to the Interior Department, thus entailing duplication and needless expense.

In my opinion, there is undue carelessness as to the disposal of public resources at present in Washington. The water power legislation now before the Senate is too favorable to the men who, as Secretary Houston's admirable recent report shows, control through 18 corporations more than one half of the total water power used in public service throughout the United States. The water power men charge that conservation hampers development. The Houston report shows, on the contrary, that the most rapid development is in the national forests, where conservation is best enforced. On the other hand, 120 public service corporations own and are holding undeveloped and out of use an amount of water power equal to four fifths of all there is developed and in use by all the public service corporations in the whole United States.

As I said in an open letter of January 29th to the President:

"Natural resources lie at the foundation of all preparedness, whether for peace or for war. No plan for national defense can be effective unless it provides for adequate public control of all the raw materials out of which the defensive strength of a nation is made. Of these raw materials water power is the most essential, because without electricity generated from water power we cannot manufacture nitrates, and nitrates are the basis of gunpowder. There are no great natural deposits of nitrates in the United States as there are in Chile. It would be folly to allow the public water powers, which can supply this indispensable basis of national defense, to pass out of effective public control."

A concerted movement is on foot to break down the conservation policy. Feeble resistance or none at all is being made by official Washington. Unless the press and the people come to the rescue, the power interests are likely to win. This is a public matter wholly removed from political partisanship. Your help is needed, and that of your paper. For nearly ten years this fight for the public water powers has gone on. We ought not to lose it now.

GIFFORD PINCHOT.

Milford, Pike County, Pa.

Neutralizing Superfluous Lime in Cement Mortars

To the Editor of the SCIENTIFIC AMERICAN:

In one of the July numbers of the SCIENTIFIC AMERICAN you have published an article about the neutralizing of the superfluous lime in cement mortars.

Kindly note that the Dutch engineers and architects have been doing this for many years, however, by the very simple method of adding "tras" to the mortar. "Tras" is a puzzolans of first order, and it is obtained by grinding tuffstone. Good tuffstones are found in volcanos. In Europe the best tras is found near Andorra, in Germany, and here in Java on the Moeria volcano.

If tras is added to the cement mortars, the concrete remains even in sea-water absolutely intact, and for many, many years its surface will remain as smooth as if new.

The reason I write you the above is that in America doubtless tuffstone also is found. MATTHIEU.

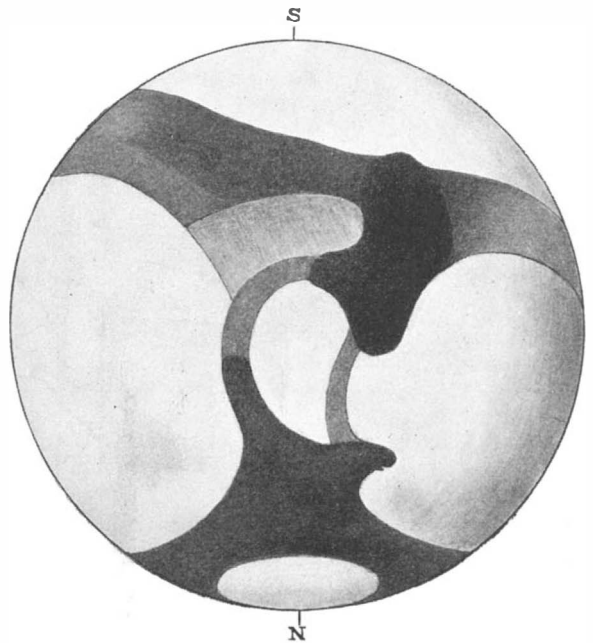
Soerabaya, Java

The Canals of Mars

To the Editor of the SCIENTIFIC AMERICAN:

In Prof. Russell's interesting series of astronomical articles, he makes the statement that the Canals of Mars can "only be seen with instruments of very high power." SCIENTIFIC AMERICAN, January 29th, page 129. This statement is perfectly true with regard to the great majority of the canals, but there are a few that can be seen with a very modest equipment, and, in fact, have been seen here without difficulty in our 3-inch finder with a magnification of 180.

Thinking that some of your readers might be interested in looking for them, and satisfying themselves of their existence by the most convincing of all possible arguments—that of seeing them for themselves—I have computed the times when two of the most conspicuous ones will be visible in March. They may be seen for a couple of hours before and after the computed times. The computation is for Eastern Standard; those using Central Standard must subtract one hour from the figures given in the table; those using Mountain and Pacific Time, two and three hours, respectively.



Telescopic view of Mars

1916, E. S. T.		
Day.	Hour.	Minute.
Wednesday, March 8.....	6	39
Thursday, March 9.....	7	16
Friday, March 10.....	7	52
Saturday, March 11.....	8	29
Sunday, March 12.....	9	06
Monday, March 13.....	9	43
Tuesday, March 14.....	10	20
Wednesday, March 15.....	10	57
Thursday, March 16.....	11	34
Friday, March 17.....	12	10

With a good 3-inch telescope the difficulty of seeing them depends chiefly on the condition of the atmosphere at the time. A high power should be used and a night selected when the stellar images are good and there is little twinkling. Great clearness is not necessary and a light haze over the heavens may even be an advantage rather than otherwise. The accompanying sketch will give the observer an idea of what should be seen. The left hand canal is named Thoth, the right hand one Nilosyrtis, while the very black spot is called the Syrtia Major. The brilliant elliptical spot at the bottom is the northern polar cap.

WILLIAM H. PICKERING.

Harvard Astronomical Station, Mandeville, Jamaica, B. W. I., February 14th, 1916.

The Need of Organizing Our Resources

To the Editor of the SCIENTIFIC AMERICAN:

I have read with extreme interest all President Wilson's speeches made during his recent tour, and the one that I think should appeal to all sober-minded citizens is the one he made at "Kansas City" on February 2nd. I will quote from his speech. "Some men in Washington are questioning if we could get the 500,000 men for which the Government is asking." Would they volunteer? Why, I believe you could raise 500,000 men in almost any state. I believe you could get 5,000 men right here in this audience.

We have got voluntary enlistment in America, and in looking at the recruiting tables for the last five years it seems as if the army does not attract many of our young men to the ranks. To me this seems perfectly natural. The American loves his independence, and he likes to be free at all times to go where and do as he likes, but once he joins the army he is held for his time of service; and this does not appeal to the average young man.

There is not a shadow of a doubt that let the country be in any danger there would never be any lack of good spirited young men to make a large enough army to defend our country and our rights. But when trouble breaks out nowadays it does so very suddenly, and very often from entirely unexpected directions. Let us take an example of Great Britain. She thought herself perfectly protected by her huge navy, and still with her voluntary enlistment system she maintained a regular army about equal to our own, and before three months of war were over she had lost almost every one of her old enlisted officers and men of the regular army. England has had no trouble getting recruits up to a certain stage, and it is not the lack of men so much as it is a lack of organization that has held her back, and she has had all her lessons to learn since the war started. It must always be borne in mind that once the call for volunteers goes out, thousands of men will leave their work, no matter what it is and join the military ranks for training, and it will take many months to get your men so organized as to keep your factories working to their capacity. Great Britain has had to recall and replace thousands of men from the trenches who were good tradesmen and who enlisted at the first call, and in this way the whole organization of the country was upset from the very beginning. I trust the army observers that we have in Europe are learning all they can about the industrial difficulties as well as the war experiences of the contending armies. Of course, we are practically self-supporting, and that no doubt counts, but events travel so fast that the first few weeks very often count most. I will quote a paragraph taken from "The London Times History of the War," January 11th, 1916:

"With the outbreak of war came a remarkable rush of recruits to the colors. No better evidence of England's unpreparedness for war can be imagined than the complete lack of any adequate provision for dealing with this rush. During the first week of the war pathetic scenes were to be witnessed at the recruiting stations. After hours of weary waiting, sometimes in heavy rain, it was no uncommon thing for as many as 700 men to be left standing outside one station alone when the doors were closed. Nothing could exceed the enthusiasm of the would-be recruits. On August 10th it was reported that 1,100 men had been enrolled in London alone in the previous 24 hours and that 500 or 600 had been left over. Large numbers of reservists applied to extend or renew their service. One officer of the new army started with three officers, one a young regular and two straight from the officers' training corps. Upon them fell the duty, one wet night, of receiving about a thousand recruits, nearly all quite raw, who were deposited by train at the depot. There were about 45 to 50 tents ready, but there were no blankets, practically no arrangements for cooking, and the new recruits had nothing but their civilian clothes and their enthusiasm. Think of it, you who have managed a big office or factory, you who have organized political campaigns or governed schools and colleges. A thousand miscellaneous, unknown men, from every class in society, from a hundred different trades, a hundred different towns and villages, of whom a mere handful had the least conception of military discipline, and all of whom were glowing with the rather hectic enthusiasm of patriotic self-sacrifice. In late autumn and winter it rained, and round the huts which had taken the place of the original tents the trampled earth turned into loose mud a foot deep, which made the camp intolerable."

Now, would it not be a good idea for Congress to appropriate a few hundred thousand dollars, and print hand bills to be put up in every post office, the bills to be divided off into columns, and get every patriotic citizen to enter his name and answer the following questions: Age, citizen, or not. Occupation. Have you been accustomed to a rifle; if so, what make? Have you got 300 rounds for same? Have you an automobile; if so, what make? Age of same. Seating capacity. Can you handle dynamite? Have you good knowledge of roads, woods trails, water springs, swamps, bridges, and natural obstacles within 10 miles of your home? Can you ride and drive? Have you telephone connection? Would you be willing to attend a week's field drill every year in your district? Would you be willing to enlist your services in case of need? If so apply to (name nearest recruiting offices). Now, as this is a voluntary army system, what better way is there of finding out just where your willing men are, and to keep them in touch. Then, if they left that district, to advise the postmaster, and then re-enter their names at their next town or village. I am sure the thousands of officers from the military academies would take delight in giving men a week's drill in marching, trenching, first aid, etc. There is not a finer body of men in the world for material for soldiers. The average American is a good shot, can camp anywhere; and a great number of the country workers are expert bridge makers and dynamiters. Let us take our lesson now, and, at all costs, let us be prepared, not by only having an army of 500,000 men, but by having the whole country and resources organized. Let this be the first plank in every political platform: The absolute safety of our country. Be prepared.

E. ANDERSON.

Sebago Lake.

Modern Bread-Baking

The Loaf Untouched by Human Hands in the Process of Making

THE baking of bread from flour or parched grains by means of heat is the most ancient of human arts. Calcined remains of bread, made from coarsely ground grain, have been found in the Swiss Lake dwellings. Egyptians, during the reign of Herodotus, baked elongated loaves of bread, which had curiously enough, seeds sprinkled on the top like our modern rye breads. In the excavations of Pompeii, loaves of bread were discovered, round in form and stamped with the baker's name. Bolters for sifting flour, dome-shaped ovens and peels for charging and discharging the ovens, not unlike those used by bakers today, have also been excavated from the ruins. It is remarkable that an industry producing such an important commodity as bread, and an industry old as civilization itself, should have developed so slowly until comparatively recent years.

Probably no other trade has made such slow progress as had the baking industry up to the last quarter of the nineteenth century. However, during the last 25 years it has made marvelous advancements through the use of automatic machinery and the scientific developments of its processes. A few years since it was estimated that 20 per cent of all the bread consumed was produced by the baker—the other 80 per cent being baked in the home. This condition is rapidly changing and in the very near future, at least 80 per cent of all the bread baked will be produced in modern sanitary bakeries. Recent inventions and scientific discoveries, the establishment of sunlight bakeries with their scrupulous cleanliness, the sanitary handling of the finished product and the modern system of delivering fresh bread each day, naturally enough stimulate the increasing demand for baker's bread. The popularity of the bread will continue to increase because of the constant improvement of the product, due to the baker's better knowledge of fermentation, better knowledge of all the ingredients entering the loaf, more sanitary methods of production, and because of the absolute cleanliness in the handling of the baked loaf.

The modern baker uses an absolutely pure, uniform grade of flour, pure compressed yeasts (instead of the uncertain ferments which cause sour and otherwise undesirable fermentation), pure water and the best available material for shortening, dough-kneading machines, regulated so as to produce uniform mixing and a uniform temperature of the dough, devices for maintaining a uniform temperature and humidity of the fermentation-room, and complete automatic machinery for scaling the dough into loaves, molding them into the desired

shape, placing them into pans and conveying them into the oven and out again. He has also recognized the value of the wrapping machine which wraps each individual loaf in germ-proof paper, keeping it absolutely pure and clean until it reaches the consumer.

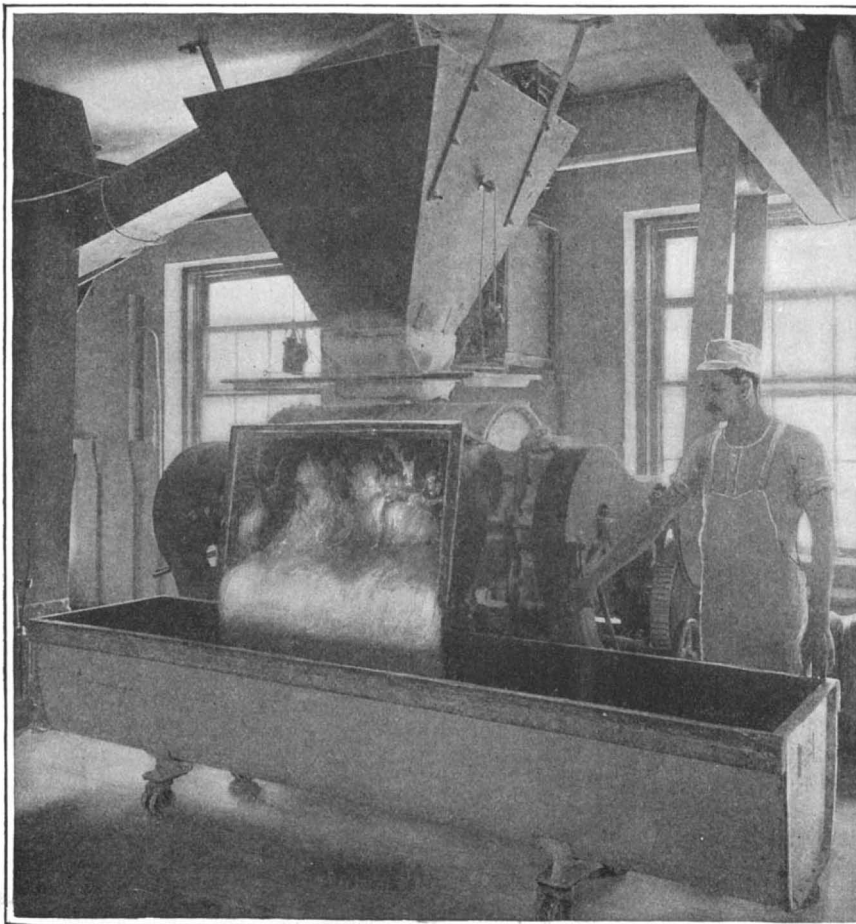
The greatest triumph for modern baking has resulted in the development of a completely automatic plant, by which the bread, during the process of manufacture, is positively untouched by human hands. This achievement is all the more noteworthy because of the difficul-

ties that were overcome in constructing a machine that would handle such a plastic and everchanging mass as the loaf in its formation. This automatic plant increases the capacity of the bakery, lowers the cost of production, insures the utmost cleanliness for the finished loaf, and produces a pure, uniform, nutritious and wholesome loaf of bread. Of no little interest, too, is the manner in which the raw materials are handled before reaching the automatic plant. The flour on arrival is usually stored in a cool, dry, well-ventilated basement for three or four weeks to condition and give it the proper age. When ready for use, it is dumped into a hopper to be conveyed to the top floor of the building where it is delivered to the blending and bolting machines which thoroughly mix it and, at the same time, remove from it, wood, nails, fiber, etc., before it is automatically weighed into the kneading machine. The other ingredients—water, sugar, shortening, salt, malt, milk and yeast, that finally become the finished loaf—are also weighed automatically into the kneader which works and churns them thoroughly into a uniform mass of dough, absolutely the same throughout in temperature and composition.

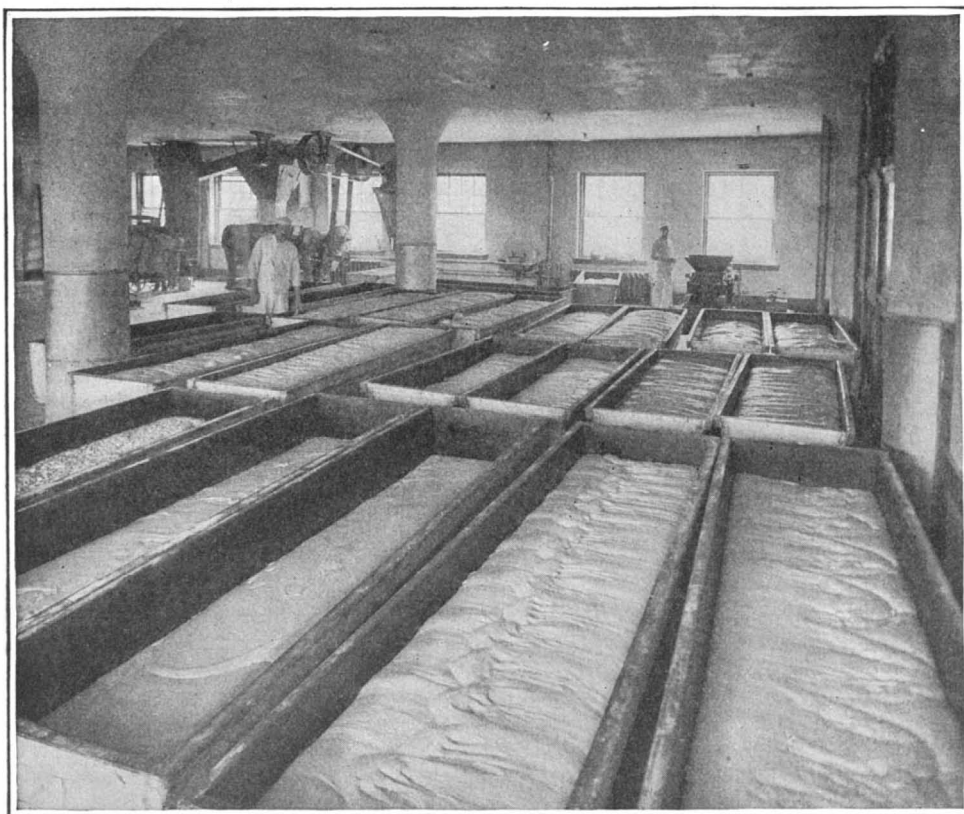
A continuous blast of cold washed air passes into the mixer and acts upon the dough during the mixing. This whitens the dough materially, aids in developing the gluten, and cools the dough which would otherwise become too warm under the high speed mixing. The dough is mixed 15 to 25 minutes and is then discharged from the kneader into a trough, where it is left to rise three to five hours in a room abundantly supplied with sunshine and fresh air, and the temperature under perfect control. During the rising, the dough becomes permeated with carbon dioxide gas and the glutinous material is highly developed so that it produces a loaf of maximum value. The matured dough is then dropped through a chute into a hopper below ready for the automatic plant.

The hopper delivers the mass of dough, often weighing over 1,500 pounds, to the dividing machine, which scales off six loaves at a time and always of uniform weight. These six loaves are then delivered to the rotary turning-in machine which molds the dough into a round mass and at the same time closes up the pores of the dough by putting a soft outer skin upon it. This prevents it from sticking to the boxes of the first proofer into which it is dropped. The proofer consists of an endless series of boxes, six each, and

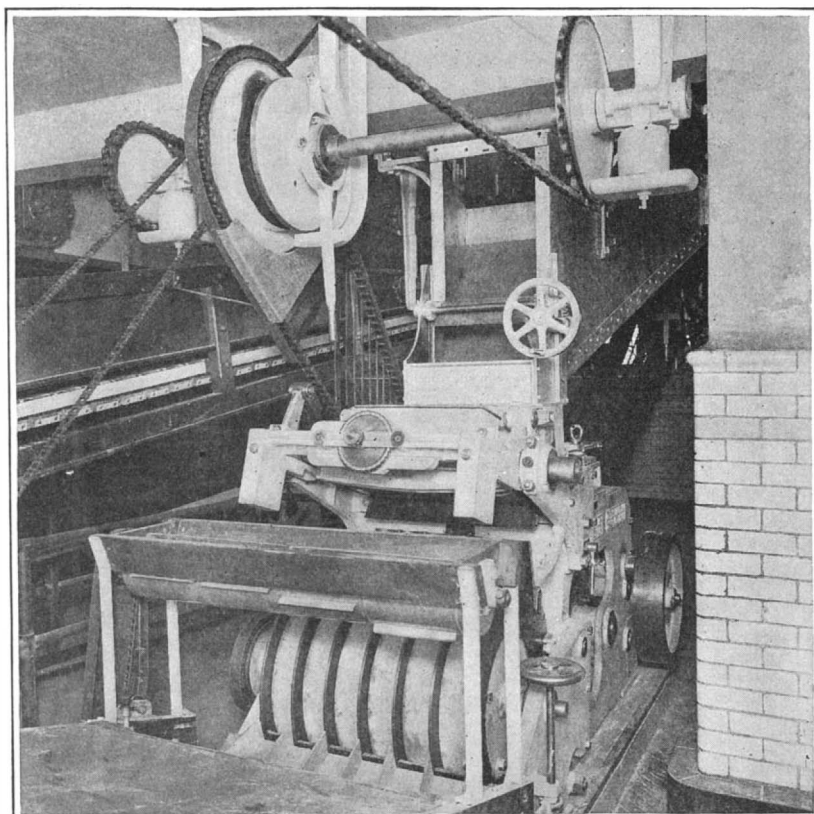
each canvas-lined. Here the dough, through oxidation and loss of moisture, develops a soft outer skin making it possible for the rounding-up machine, which receives the loaves automatically from the first proofer, to mold the dough perfectly into a round ball. The dough comes from this machine completely closed with a firm outer layer and passes continuously to the second proofer by a conveying belt which drops it into an endless conveyor provided with canvas-lined boxes (six abreast). Here the dough remains, each



Discharging a batch of dough from the kneader into a trough in which the dough is left to rise



Dough rising in a well-ventilated sunlit room



Automatic dough divider with hopper and rotary turning-in machine

piece in its individual box, but travels continuously for fifteen minutes, expands and recovers completely before it is automatically delivered in regular succession to the molding machine. This machine molds the loaves and automatically places them into pans, which in turn, are conveyed to the steam proofer. The dough now expands to the desired height in the open pan before entering the oven to be baked. The steam proofer is so constructed that any desired degree of humidity or temperature can be attained. When the plant is in full operation the proof box carries 4,000 loaves and is never empty—loaves enter continuously at one end and pass out at the other, ready for the oven.

This brings us to the final step of the automatic plant—the traveling oven. This is the most wonderful achievement of the whole process. The loaf of bread which, up to this stage has been kept so scrupulously clean and pure and developed to the highest degree possible under modern scientific methods, now goes to the oven for its completion into a nutritious and wholesome loaf.

It is truly a wonderful sight to see the continuous stream (5,000 every hour) of unbaked loaves automatically enter the traveling oven at one end and emerge from the other perfectly baked loaves, most attractive in appearance with their golden brown color and characterized by their uniformity of size and composition. Every precaution necessary for the production of a perfect loaf has been taken in constructing this oven. The top or bottom of the loaf can be baked more thoroughly, if conditions so require, by merely pushing or pulling a damper. Steam can be injected or withdrawn from the oven at will and, by pressing an electric button, the speed of the oven can be increased or decreased.

The nice, crisp, well-browned and thoroughly baked bread is then—as it comes from the oven—conveyed to another floor, usually below. Here it travels continuously on canvas belts until it is thoroughly cooled, before being wrapped by wrapping machines, which wrap each loaf with a dust-proof and germ-proof wrapper. This insures for the consumer a clean, pure and wholesome loaf of bread.

The advent of the automatic baking plant adds another decided improvement for the production of better bread. It comes rather opportunely since, at this time, the public is demanding cleaner, purer and more sanitary food products. The modern baker realizes this condition and is ever ready to meet it by installing such devices which will improve his product. The rate at which the automatic plant is being installed in this country is truly astonishing—over fifty have been installed within the last five years. A New York company was the pioneer in this field and was the first in this country to adopt it: just as it was the pioneer in establishing sunlit and well-ventilated bakeries, and mechanical devices for keeping the bread absolutely pure and clean during the process of manufacture. It was also first in maintaining research laboratories for developing the science of bread-making.

The Current Supplement

THE frontispiece illustration of the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2097, March 11th, 1916, is an interesting picture showing the construction of a large sewer that was built of reinforced concrete, the valuable material that is being so widely adopted in place of brick and stone masonry, and which is being applied to so many purposes. The accompanying article, which is illustrated by diagrams, shows some structures in which reinforced concrete has been employed, and how it is used. Another article describes and illustrates how the large amount of concrete required for the extensive foundations of the new Field Museum, in Chicago, was handled. The two articles are quite char-

acteristic of modern engineering methods. *The Structure of the Earth* is an able paper on a subject in which interest will be undiminished for many years to come. *Ocean Temperatures in the Vicinity of Icebergs* tells of some investigations made with a view of making possible safer ocean navigation, and includes the examination of the salinity of sea water and the detection of bergs by echoes. *American Built Locomotives Abroad* describes and illustrates a number of machines of different types that have been recently built in American shops for foreign users, showing interesting

articles in this issue are *The Uses of Tungsten*; *Automatic Looms*; *Currency in China*; *Pasteurized Milk in the United States* and *Gelatine as a Food for the People*.

Compressed Paper for Shoe Soles in Germany

IT is reported on reliable authority that on account of the scarcity of leather a substitute consisting of compressed paper with a thin leather covering has been used for shoe soles in Germany. The price of this product is given as 70 cents per pound and the wares have been advertised as being considerably cheaper and more lasting than leather. It has been ascertained that this advertisement, however, is not correct, and the public has been advised accordingly. Unscrupulous dealers using these paper soles have been warned against misleading the public.

In a recent meeting of the Board of Guilds in Liegnitz, it was claimed that raw hides are cheaper now than before the war, although a pound of leather still costs \$1.66 to \$1.90. The enforced slaughtering of cattle and the opening of new sources of supply have added to the leather stock of Germany, thus maintaining comparatively moderate prices for this commodity.

Contest to Improve Housing Conditions of Immigrants

WITH the aim of arousing interest in the subject of housing conditions of immigrants in industrial towns, as well as to produce carefully worked out and entirely practicable housing plans and standards which it will be possible for employers and workmen and communities alike to demand and insist upon, there has been inaugurated a housing competition and public exhibition under the auspices of the National Americanization Committee, with the coöperation of the various societies and institutes of architects and engineers.

Prizes aggregating \$2,100 are offered for plans, sketches, grouping and arrangement, for the housing of immigrants in industrial towns. The prizes are divided into two groups. The first covers plans for the housing of workmen in industrial communities not exceeding a population of 35,000. Entries in this class include plans for (1) single family houses; (2) combined family and lodging houses, which will permit separation of the family from the lodgers; and (3) boarding houses or community dwellings for numbers of single men or of single women. The second group offers prizes for a satisfactory substitute for the derailed freight and cattle cars now used to house construction gangs on railways.

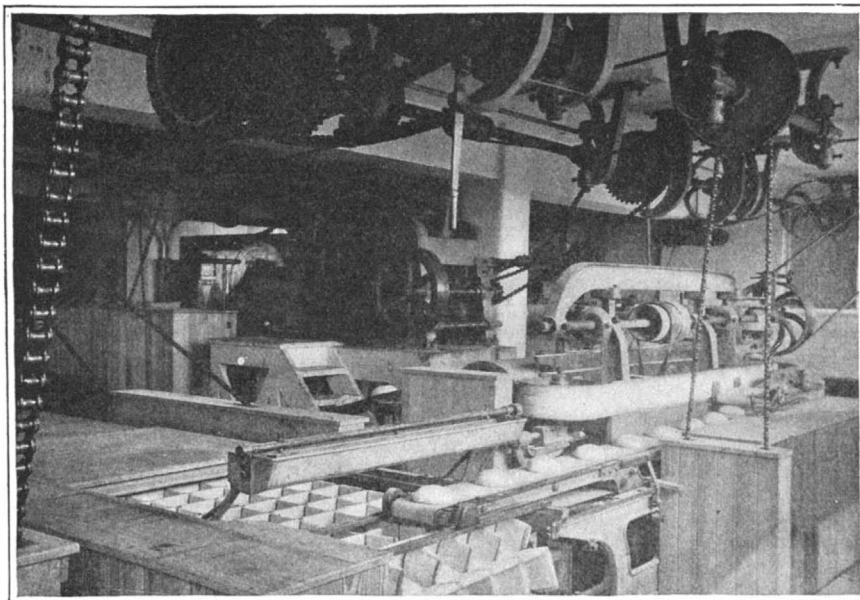
In announcing the competition, the Committee calls attention to the fact that new communities clustered around new industries are being produced in this country with phenomenal rapidity. It is the small industrial town at present, not the large city, in which the "congestion" problem of the country is centered. Men flock by thousands to places where there are plenty of jobs—but no dwellings.

Norwegian Cannery to Manufacture Tin Plate

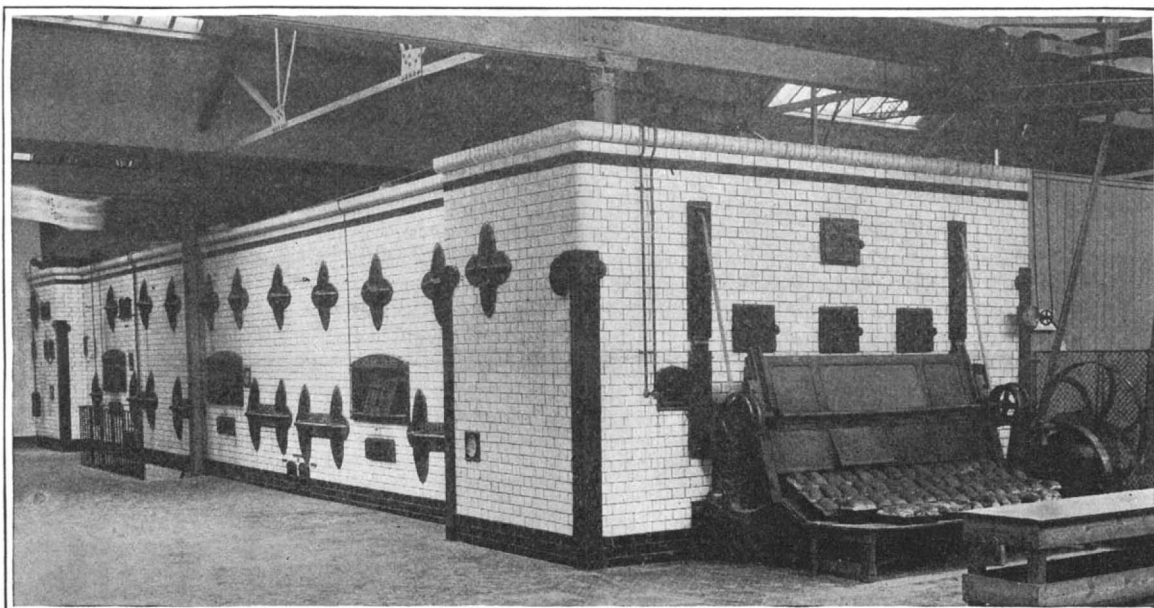
THE fish cannery of Stavanger, Norway, who have been trying to become independent of foreign countries for their supply of tin plate, have been successful in their attempts to secure sufficient

capital for the erection of a rolling mill in their city.

More than 30,000 tons of tin plate are used annually in the Stavanger district alone. The plans for the new mill will provide for yearly production of at least 30,000 tons. This enterprise will cost more than \$1,000,000 and will employ 400 to 500 men. The electric machinery to be installed will produce 1,600 horse-power, but the maximum production will probably not be reached for three or four years. No attempt will be made to begin construction until after the close of the European war, because of the difficulty of obtaining raw material.



Automatic rounder-up and proofer handles the dough in a human-like way



The baked loaf being automatically discharged from the traveling oven



Wrapping machine which wraps each loaf with germ-proof and dust-proof paper

composite designs. The paper on *The Importance of Geographical Research* is concluded. *The Calorimeter as an Interpreter of Life Processes* is a brief study of the fuel requirements of the human individual in health and in disease. *The Development of Military Small Arms* briefly reviews the history of portable fire arms, and is by a recognized authority on the subject. It is fully illustrated. *Concussion Blindness* describes a serious trouble resulting from the nearby explosion of heavy shells and mines, which has come into prominence of late in the war areas of Europe. Other valuable

The Naval Losses of the Germans and their Allies

A Fleet of Thirty Major War Vessels Lost by the Central Powers

[The Naval losses of England and her Allies were shown in our last issue.—EDITOR]

THE opening of the great war found Germany the second naval power in the world. However, the ranking is deceptive in that the actual fighting value of her fleet was scarcely one half that of the English fleet. The addition of the fleets of the several Powers engaged to that of the main naval contestants has not perceptibly changed this proportion.

With that logical and painstaking reasoning that has distinguished every German military effort, it was decided not to dispute the mastery of the seas with the disproportionate forces available, but to dispose them in certain other lines so as to more nearly employ the total enemy forces under hazardous conditions.

Such naval actions as have occurred, where disproportionate forces were engaged, have resulted in the practical annihilation of the weaker antagonist and demonstrated the wisdom of the policy adopted.

At the outbreak of the war the Germans found themselves with important ships in two localities where they were blocked off from home ports. In the Mediterranean the "Goeben" and the "Breslau" were hard pressed by both the French and the British fleets in those waters. They successfully eluded their opponents and reached the then neutral waters of Turkey without an engagement.

In subsequent operations with the Turkish fleet around Constantinople and in the Black Sea, there have been numerous reports of the destruction or serious damage of these vessels. These reports have not been confirmed.

In the Pacific there was the cruiser squadron off South America. The first engagement of their own choosing resulted in the destruction of Admiral Craddock's cruiser squadron. The English then dispatched a squadron under Vice-Admiral Sturdee, which finally encountered the Germans off the Falkland Islands and sunk the "Scharnhorst" and "Gneisenau," armored cruisers, and the light cruisers "Leipsic" and "Nürnberg." The "Dresden" was driven back to the Pacific, where she was finally destroyed.

The remaining war vessels of Germany unable to return home were employed as commerce destroyers until destroyed or interned to avoid engagement with enemy war vessels. The spectacular character of their work and the fact that American citizens, American vessels and American merchandise were involved in the captures caused special interest to be taken in the careers of these commerce raiders. The "Emden," "Karlsruhe," and "Kaiser Wilhelm der Grosse" were sunk while engaged in this work. The converted cruisers "Prinz Eitel," "Frederick" and "Kronprinz Wilhelm" sought refuge in Hampton Roads and involved considerable diplomatic negotiation on the part of this country until finally interned.

Eventually all of the vessels engaged in this work were disposed of.

The first offensive naval effort on the part of the Central Powers in home waters consisted in the sowing of mines. Several of the mine layers were lost in this operation, the principal one being the "Königin Louise."

The enemy ships destroyed by mines and the restriction of navigation effected, amply compensated for the losses sustained.

Naval operations in the Baltic find the situation reversed, with the Germans dominating. In the operations there the cruiser "Madgeburg" was lost, and it is reported, but not confirmed, that a battle-cruiser of the "Moltke" class was torpedoed in the attack on Riga in conjunction with the land operations for the capture of this point in the great drive of last year. If true, this would form the most important naval loss of the Central Powers. In the Turkish naval operations the success of the land fortifications and mines was offset by the sinking of the battleships "Messudiyeh" and "Barbarossa" by submarine attack, and the loss of the "Mejidich" by a mine.

The major losses in the Black Sea were in Turkish troop ships.

The attempted raids on the English coast were stopped by the destruction of the "Bluecher" and the injuries to the battle-cruisers whose speed was sufficient to render such a raid possible. However, the chances are that they would have been discontinued because the damage possible to inflict was so small compared to the risks involved.

The attacks on the part of the English on the German fleet at its bases have resulted in the destruction of the battleship "Pommern" and the protected cruisers "Mainz," "Köln" and "Ariadne."

The major naval efforts of the Teutons have been in the submarine campaign directed mainly at commerce. It is probable that the protection afforded the Allied high sea fleet and transport service by their

auxiliary service has prevented a greater toll of war vessels.

The auxiliary patrol service has been very effective, and the number of U-boats destroyed has been variously estimated at from thirty-five to seventy-five. Which-ever total is correct the initial activity on a large scale has been followed by a period of comparative quiet. In recent times the Mediterranean has offered the best field for their activities, due to the immense problem of troop transport for Gallipoli, Saloniki, Egypt and Mesopotamia.

The announced intentions of the German government would indicate that a sufficient number of submarines was again available to pursue with vigor the campaign against commerce which had temporarily lapsed.

In the naval war both sides have shown great daring and ingenuity. The greatest possibilities for property destruction rest with the Central Powers, owing to the amount of ships of the enemy exposed to attack and the difficulty of protecting the vast expanse of water which is utilized for this commerce.

The present status of naval operations leaves the Entente in control of the situation, with the Central Powers mainly endeavoring to harass and destroy commerce which the Entente control renders possible.

A large number of smaller vessels of little military value and numerous destroyers have been sunk in the occasional encounters in the various theaters of naval operations.

A complete list of all vessels lost forms an imposing total for the contestants on both sides of the struggle. Of the casualties known and reported the Entente Allies have the larger number of more important ships. However, the Central Powers have not reported any vessels damaged from internal or external cause except where engagements with the enemy have occurred. Also, numbers of Central Power vessels are listed as sunk on the official reports of their enemies only.

Altogether, the offensive power of the contestants has not been materially changed due to the casualties incurred in carrying out their naval warfare. The real and important changes in this respect are the vessels which have been added to the fleets since the outbreak of the war. There has been great activity in warship building. There have been important departures in types and construction, due to the lessons the various actions have taught. But of the numbers built or the departures made very little has been permitted to filter through to the outside world.

A New Use for the Seismograph

By Robert G. Skerrett

THE seismograph as a means for determining the duration and the violence of distant earthquakes has served its purpose for a long time. Latterly, a series of these have been so employed that they could locate by triangulation the approximate source of the disturbance. This, of course, being deducted from common knowledge of well-established "faults" in the earth's crust. Through these combined agencies earthquakes thousands of miles away have been spotted, so to speak. But now comes a far more novel adaptation of seismological instruments; this time as a military aid.

Prof. Belar, an Austrian scientist of repute, and for the past 20 years an investigator of seismological problems, has had recourse to his special instruments to record the earth shocks due to gunfire. It just so happens that his work of latter years has been at Laibach, where he has been in charge of the seismic observatory. Now Laibach is about 50 miles away from one section of the Isonzo front where the Austrians and the Italians have battled so desperately. There, some of the heaviest artillery duels have been fought, and knowing something of the awful might of modern ordnance it is not surprising that the sensitive instruments at the Laibach Observatory have felt and recorded some of the tremors that have passed through the earth after each bombardment.

Prof. Belar has watched his seismographs day by day as the struggle raged, and through them he has been able to give the world the first "autographic war records" born of earth shocks following the firing of heavy artillery. Such readings may not seem at first blush to have any practical value, but we are informed that from a military point of view the facts are quite to the contrary. The seismograph has really proved to be a sort of scientific spy and capable of telling immediately things of the utmost importance about the enemy's strength and the distribution of his batteries. This is really the climax of an extensive series of experiments.

About eight years ago, Prof. Belar approached the Austrian military authorities and laid before them a scheme for the military use of the seismograph. At the instance of Archduke Leopold Salvator, Inspector-General of Artillery, tests were promptly undertaken, and the results were decidedly astonishing. The first measurements for determining accurately earth shocks due to artillery fire were made at Gurkfeld, in June of 1907, with especially constructed instruments. In order to get as complete a series of records as possible, the seismographs at that time were placed at different ranges from the guns and howitzers. Topographical conditions were also taken into account. The graphic records disclosed a marked difference between the shocks following the discharge of the weapons and the impact of the projectiles. The tremors induced by the "kick" or recoil of the piece are commonly recorded in the form of short waves which look something like the last three letters of the word "shift" written by hand, while the wave motion resulting from the explosion of a projectile on impact is much longer and has the serrated appearance of a hastily penned "unwritten." It was found possible even to distinguish the direction of the source of the vibrations and also to establish the caliber of the gun if the observer of the seismograph had available a comparative diagram based on previously studied effects of different sized weapons.

The apparatus now employed by Prof. Belar, which is hardly bigger than a typewriter and easily carried about, is so responsive that the inventor is able to identify any street noise, and by a glance at the record can tell whether the cause of the registered wave was a cab, a team of horses, artillery drawn through a distant street, or a train of cars. The records are such that a person once familiar with them—like a stenographer's notes—can see at once what caused them.

It seems that Prof. Belar can readily distinguish the earth shocks occasioned by Austrian guns from those produced by the foe's weapons. That the modern mount of siege pieces and the like do not materially lessen the blow delivered to the earth is proved by the fact that the recoil of the present-day gun is hardly less noticeable than that of the weapons supported on the older carriages. This is something of a revelation. Again, it seems that the apparatus is capable of making a record which is a visible index of the number of guns employed on any firing line.

Of course, the Laibach Observatory is too far removed from the Isonzo front to make legible records of the sort just described, because the observer, for that purpose, must be within 35 miles of the firing line and, at the same time, should be in telephonic communication with his own artillery so that he can isolate the wave records made by the foe's ordnance. Such is the general character of the apparatus which Prof. Belar has constructed for field service. It seems to be well established that the Austrian authorities are very favorably impressed, and well they should be, for what is more important than to be able to locate the enemy's batteries and to determine the number and the caliber of guns thereof? The study of earthquakes has in this case led to both a novel and an extremely ingenious adaptation of the seismograph.

Prof. Belar has gone still further, and a modification of his apparatus is used for the detection of the approach of enemy craft, and especially for giving warning of the coming of submerged submarines. In this field he has recourse to a "feeler," as he calls it, carried well out from the shore and placed under water—the "feeler" connecting with the detector or seismograph on land. The vibrations set up by the beats of the propeller of the advancing vessel are picked up by the "feeler," and the character of the wave-records on the recording cylinder serve not only to distinguish broadly different kinds of vessels but to locate their positions and distance away.

Cheap Fireproof Roofing in Demand in the Philippines

A CORRESPONDENT writing to the *Commerce Reports* from Manila recently states that the problem of a cheap roofing material which will be fireproof and suitable to replace nipa and grass—the roofing materials of the poor in the Philippines—has not yet been solved. There are many acres of short-fibre asbestos in the islands, but as yet no machine or process has been developed for turning this raw material, which is in very accessible places, into suitable roofing.

A local cement factory turns out a good product, and the asbestos beds are on the same island. Modern machinery to work the combined material into required lengths and thicknesses, as well as the process for making the combination, is wanted.



WAR VESSELS LOST BY GERMANY, AUSTRIA AND TURKEY, DURING THE PRESENT WAR, UP TO MARCH 1st, 1916

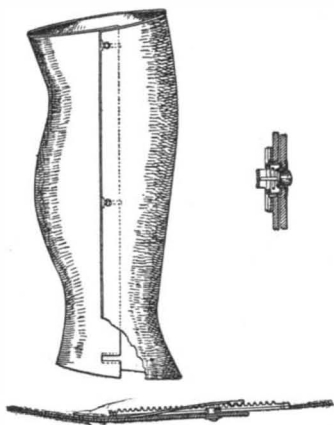
- | | | | | | | | | | |
|------------------------|---------------------------|------------------|------------------------|--------------------------------|-------------------------|---------------------|--------------------|-----------------------|---------------------------------------|
| 1. <i>Bluecher.</i> | 4. <i>Yorck.</i> | 7. <i>Mainz.</i> | 10. <i>Dresden.</i> | 13. <i>Mejdteh.</i> | 16. <i>Zenta.</i> | 19. <i>Leipzig.</i> | 22. <i>Jaguar.</i> | 25. <i>Luchs.</i> | 28. <i>Hela.</i> |
| 2. <i>Scharnhorst.</i> | 5. <i>Prinz Adalbert.</i> | 8. <i>Köln.</i> | 11. <i>Nürnberg.</i> | 14. <i>Messudieh.</i> | 17. <i>Bremen.</i> | 20. <i>Ariadne.</i> | 23. <i>Ilia.</i> | 26. <i>Cormoran.</i> | 29. <i>Kaiser Wilhelm der Grosse.</i> |
| 3. <i>Gneisenau.</i> | 6. <i>Friedrich Karl.</i> | 9. <i>Emden.</i> | 12. <i>Barbarossa.</i> | 15. <i>Kaiserin Elisabeth.</i> | 18. <i>Koenigsberg.</i> | 21. <i>Undine.</i> | 24. <i>Tiger.</i> | 27. <i>Albatross.</i> | 30. <i>Cap Trafalgar.</i> |

RECENTLY PATENTED INVENTIONS

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

Pertaining to Apparel

LEGGING.—C. E. ROGERS, Box 334, Covington, Va. This invention relates to leggings for military and other purposes, and has reference more particularly to a legging which comprises a body having an underlying and an overlying part, the parts having co-acting, locking members, both concealed by the over-



LEGGING

lying part. The legging can be used by soldiers, equestrians, hunters and others, is capable of the uses to which leggings are ordinarily put, is strong and durable, is light in weight and is comfortable when worn, and attractive in appearance.

MATERNITY SKIRT.—G. BAER, 510 6th Ave., New York, N. Y. In this class of skirts it is necessary to alter the appearance, either by the gradual enlargement of plaits or by destroying the location of certain arrangement of the fabric and thus destroying the original balanced effect of the skirt, or for other reasons, and it was in order to overcome this that the invention was conceived.

Electrical Devices

PROTECTING DEVICE FOR ELECTRIC CONDUCTORS.—M. H. LOUGHRIDGE, Pleasant Place, Teaneck, N. J. This invention relates particularly to the ends of conductors which are led under ground; and provides a device which will form an efficient shield for the end of the said conductor at the point where it emerges from the ground, and prevent the same from being injured, and guard against the admission of water to the conduit or other covering of insulation in which the conductor itself is located.

Of Interest to Farmers

BET HARVESTER.—A. F. DJUBERG, Consul, Saskatchewan, Canada. This invention provides a vehicle having means thereon for topping the beets, means for raising the beets out of the ground, means for conveying the beets to a hopper, means for conveying the tops to a basket, means for discharging the beets and tops in separate piles at desired times, and means for rendering the parts inoperative at will.

Of General Interest

STREET INDICATOR.—H. W. VERNON and R. F. LUTZ. Address Carroll D. Smith, Blue Rapids, Kan. A card holder is provided having separate cards bearing the names of different streets. The cards are supported to drop by gravity to a position to bring the street name thereon into view. The cards are sustained by movable supports adapted to be actuated by electro-magnets to release the cards, and co-acting selective devices are provided on the trolley and along the conductor to energize the magnets for controlling the respective card supports. The cards are restored to their original positions by lifting means which in the preferred form comprises an air cylinder and a piston. Valve means are under control of electromagnets automatically energized at the proper time.

REFILLABLE POWDER PUFF.—KATHERINE K. BAKELAAR, 239 Main St., Passaic, N. J. This invention provides a puff arranged to permit the user to fill the puff with any kind of face powder of the user's choosing, to prevent the powder from coming out too freely, and to allow the user to readily apply any desired amount of powder to the face and to rub it over the desired space on the face.

FRONT SIGHT.—N. BISBEE, Glencove, Wash. This invention relates to guns, rifles and other firearms, and provides a new and improved front sight arranged to permit the user to take correct aim during the dawn or in dark forests or under other conditions in which the ordinary front sight becomes indistinct.

DESK.—H. E. BENNETT.—Williamsburg, Va. The invention relates to desks, especially those which are used for school purposes. It provides a desk which may be easily adjusted at various inclinations, and which is supported at one end. The desk has novel supporting and guiding means for the adjustable desk top or writing surface.

BUILDING BLOCK.—W. J. GRONERT and W. C. REID, care of Elkhart Musical Instrument Co., Elkhart, Ind. The invention is an improvement in building material and has

particular reference to a novel construction of plastic block. The block is so constructed with tongue and groove fittings that a wall may be erected and perfectly aligned without the necessity of employing a skilled mason.

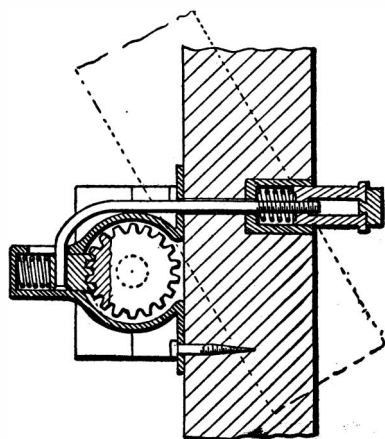
FLUE STRUCTURE.—G. C. ROYSE, 5006 S. Prospect St., Tacoma, Wash. The improvement refers to flue structures and more particularly to one embodying a flue lining and blocks so formed as to be readily incorporated into the structure and readily fitted around the flue lining in a novel manner to receive a binding material securing the blocks together and to the flue lining.

COLLAPSIBLE CORE FOR CONCRETE CULVERTS.—A. E. CAMBLIN, Stella, Neb. The present invention relates generally to collapsible cores for concrete culverts adapted in use to freely support mold boards upon which culverts or like structures are erected of concrete or plaster materials of this nature, the primary object being to provide certain improvements in devices of this character, particularly over this inventor's co-pending application No. 715,322, and Patent No. 1,142,669.

Household Utilities

COLLAPSIBLE FORM FOR CISTERNS.—C. L. CRAIG, Lock Box 403, Washington Court House, Ohio. This invention relates particularly to sectional adjustable molds utilized in the formation of water storage cisterns and other structures of this character, and the primary object is to provide an arrangement by which a cistern may be constructed of cementitious material within the ground, without the use of bolts, nuts and special tools and without the use of calculating instruments or skilled workmen.

MIRROR LOCK.—S. F. GOSS, 1805 Pacific St., Portland, Ore. The main object of this invention is to provide a mirror lock adaptable



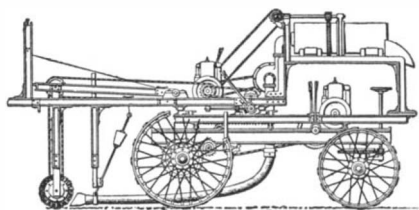
MIRROR LOCK.

to all styles of dressers having a swinging mirror, which will lock the mirror at any desired angle and which will be simple but positive in its action. A further object is to provide a device which will be inconspicuous upon the dresser frame, and so not detract from the appearance of the dresser.

LIQUID SOAP DISPENSER.—A. G. CARLING, 119 W. 64th St., New York, N. Y. This invention has reference more particularly to a device which comprises a reservoir for liquid soap or the like, an ejector communicating with the reservoir and operable at the will of the user to dispense soap from the reservoir, and means for so mounting the reservoir and the ejector that on a predetermined position thereof the ejector is inoperative.

Machines and Mechanical Devices

SWEEPING DREDGE.—H. R. WALKER, P. O. Box 322, Nome, Alaska. The main object of this invention is to provide a device whereby it is enabled to sweep "bed rock" either hard or clay, where the water of a stream



SWEEPING DREDGE.

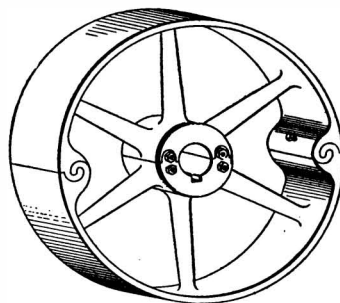
is not of a prohibitive depth and whereon gold or other placer mineral has been deposited by the action of the water. It also provides means whereby the sweepings may be drawn by a concentrator or amalgamator, or suitable containing means by suction.

COIN TRAY AND LOCK MECHANISM.—E. Fox and R. S. Fox, York, Pa. The invention relates to a coin tray and lock mechanism of the kind suitable for enabling a number of persons to severally produce different amounts they have collected, readily count the same and place the amounts thus counted in convenient shape to be counted subsequently by another person and in the meanwhile to keep the money fully protected.

LUBRICATING PULLEY.—H. G. VANCE, 4261a Moffit Ave., St. Louis, Mo. This invention relates to means for lubricating pulleys, applicable to various forms of such pulleys, wherein the lubricating member is required to be locked to the shaft of the pulley. The

primary object is to provide a lubricating member with means which automatically prevent its rotation within the pulley and obviate the necessity of set screws or other fastening members for securing the same to the shaft.

WHEEL.—S. MICHAND, Cleveland, Maine. The invention has for its object to provide a wheel of the pulley type, wherein the wheel



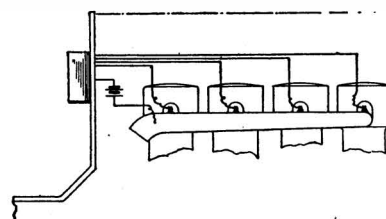
WHEEL.

comprises a hub, a rim, and spokes connecting the hub and the rim, and is composed of sections, the hub portions of the sections having interlocking mechanism for preventing movement of the portions longitudinally of the axis of the wheel, and the rim sections having interlocking mechanism for preventing circumferential displacement of the sections with respect to each other.

Prime Movers and Their Accessories

PISTON RING.—I. R. HICKS, Hallsville, Mo. The invention provides a ring which while flexible, contractible, and expansible to permit its easy insertion and removal will yet make a fluid tight joint both between the piston and the cylinder walls and between the ring and the piston, and wherein the arrangement is such that there is nothing to score or cut the cylinder wall during the reciprocation of the piston.

EXPLOSION INDICATOR FOR INTERNAL COMBUSTION ENGINES.—C. T. HAAS, Tucumcari, New Mex. This invention relates more particularly to indicators utilized in connection with automobile and other engines,



EXPLOSION INDICATOR FOR INTERNAL COMBUSTION ENGINES.

for indicating the explosions of each of the several cylinders of a multi-cylinder motor, the object being to provide an indicator with means for operating the same under actuation of the exhaust gases from the several cylinders, whereby lack of full explosion of any of the several cylinders may be at once detected.

Railways and Their Accessories

COMPOUND RAIL.—O. C. THOMPSON, 850 N. 2nd Ave., Phoenix, Ariz. This invention provides a compound rail adapted to be easily assembled and disassembled for removal



COMPOUND RAIL.

of worn parts; and adapted to be maintained in locked position by action of the car wheels passing over the rail. It provides a compound rail including a resilient filler upon which a tread portion in the form of a cap or facing plate is locked, said cap or facing adapted to be removed when worn.

CLAW BAR.—J. G. VINSON, Address W. G. Duncan, Jr., care of W. G. Duncan Coal Co., Greenville, Ky. The invention provides a bar wherein a lever or handle portion is provided having a claw for engaging a spike and having pivotally connected with the end adjacent to the claw a shackle having a hook for engaging the tie, and having a convex rocking surface between the heel and the claw, the pivotal connection between the shackle and the lever being adjustable to permit the relative arrangement of the shackle and the lever to be varied.

Designs

DESIGN FOR A SOCKET COVER AND GLOBE FOR ELECTRIC LIGHT FIXTURES.—B. SCHWARTZMAN, 15 Laight St., New York, N. Y. Mr. Schwartzman has also invented new, original and ornamental designs for the following cases: Design For A Canopy For Electric Light Fixtures. Design For An Electric Light Casing. Design For An Oval Back For Electric Light Fixtures.

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.

LEGAL NOTICES



INVENTORS are invited to communicate with **Munn & Co.**, 233 Broadway, New York, or 625 F Street, Washington, D. C., in regard to securing valid patent protection for their inventions. Trade-Marks and Copyrights registered. Design Patents and Foreign Patents secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over seventy years ago.

All patents secured through us are described without cost to patentee in the **Scientific American**.

MUNN & CO.

233 Broadway Woolworth Building New York
Branch Office: 625 F Street, Washington, D. C.

Annual Subscription Rates for the Scientific American Publications

Subscription one year.....\$3.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama.

Subscriptions for Foreign Countries, one year, postage prepaid.....\$4.50
Subscriptions for Canada, postage prepaid 3.75

The Scientific American Publications

Scientific American (established 1845).....\$3.00
Scientific American Supplement (established 1876)..... 5.00

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS WANTED

AGENTS. 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 438 N. Clark Street, Chicago, U. S. A.

BUSINESS OPPORTUNITIES

ALL PLOWING AND CULTIVATING is changing from horse to gasoline power. I am ahead of everybody with an invention giving control of all power drawn plows. The patent office allowed 39 claims or new features on this invention. I will give an interest for assistance to secure foreign patents. For further particulars address Box 152, Diamond Springs, California.

RETIRED MANUFACTURER will represent machinery specialties for Eastern Pennsylvania and vicinity. Exclusive territory on a commission basis. Communicate with Henry M. Kolb, 809 Widener Bldg., Philadelphia, Pa.

WANTED.—THE NAME AND ADDRESS of a manufacturer who has facilities for manufacturing tobacco pipes in large quantities. For further particulars address "Tobacco," Box 773, New York, N. Y.

DULL RAZOR BLADES

BECAUSE we can't convince by words how fine our work and service are, we'll re-edge 3 safety razor blades free—return in Handy Mailing Case with "Inside Facts on Resharpening." Parker-Warren Eng. Lab. 107-t W. 42d St. N. Y.

INVENTIONS MARKETED

YOUR INVENTION may come within our Laboratories' work. If so our Business Department will consider it. Copy of patent with stamps for return will receive prompt attention. McCormick Laboratories, Dayton, Ohio.

PATENT FOR SALE

FOR SALE.—2-IN-1 CASTING MINNOW. Patented recently. Can furnish a working model if a party desires one. For further particulars address Arthur Burkman, 210 W. 8th St., Traverse City, Mich.

Learn Scientific Farming

More money is wasted by not knowing HOW to farm than is lost by the ravages of fires and floods. **EXPERIENCE IS A GOOD TEACHER**, but he charges a mighty stiff tuition fee.

If you are farming or thinking of farming, why not learn the farming game as you would any other business game? If you have not the time or think you are too old to spend two or three years in an agricultural college, take a course in the

CAMPBELL CORRESPONDENCE SCHOOL OF SOIL CULTURE

and learn the principles and practices of **SCIENTIFIC FARMING**. You don't have to leave home—just use your **SPARE TIME** that otherwise would be frittered away.

The west is full of opportunities for the man who knows the farming game from a scientific standpoint.

You know all about **BURBANK** and you have heard of **CAMPBELL** the great soil wizard. You can learn what he has learned and in much less time.

Send for our **CATALOG NUMBER FOUR** and a copy of **CAMPBELL'S SCIENTIFIC FARMER**. If you are looking for **AGRICULTURAL INFORMATION** you will find what you want. Address

CAMPBELL CORRESPONDENCE SCHOOL, Billings, Montana

Don't Blame it All on the High Price of Gasoline

THE COST of running the average motor car is making even the careless man think.

The average dollar spent for fuel delivers *less than 15 cents' worth of ride*—85 cents is burned up in friction, dead weight and complicated mechanism—35.9 per cent. is wasted in cooling the motor alone.

The radiator of the average car weighs 75 lbs; the water, 48 lbs; fan, piping, pump and the rest of the 177 water-cooling parts add more weight.

This means *more horse-power* in the engine to move the car. More horse-power means *heavier engines* and a heavier engine means *heavier weight* throughout to carry it.

The average water radiator contains 5,000 cells and 6,000 to 10,000 soldered

joints, to say nothing of the bladed fan, geared water pump, hose, piping and pipe connections—all costing money for maintenance, for care and attention.

The automobile is a mechanism of which *every part* does some work. It may not rotate, but through jar and vibration over the roads there is *friction loss*.

The Franklin System of Direct-Air-Cooling does away with all these encumbrances, friction, dead weight and complication.

The Franklin Automobile, under practically all conditions of driving, delivers *more mileage* per gallon of gasoline than any other car of the same size.

This is a matter of current fact and every-day record.

Franklin Air-Cooling *cools*. It utilizes an *ever-fresh cooling medium*. The harder the engine works, the greater the volume of cooling air that is drawn over the cylinders.

Whether the car is standing still, moving slowly in low gear or going on high speed, the *turbine fan flywheel* is at all times drawing in *sufficient air to cool the motor*. It does not depend on the forward rush of the car.

Franklin Cars are in service in the *coldest* and *hottest* regions on the earth's surface—in Alaska, South Africa and the Indian Empire.

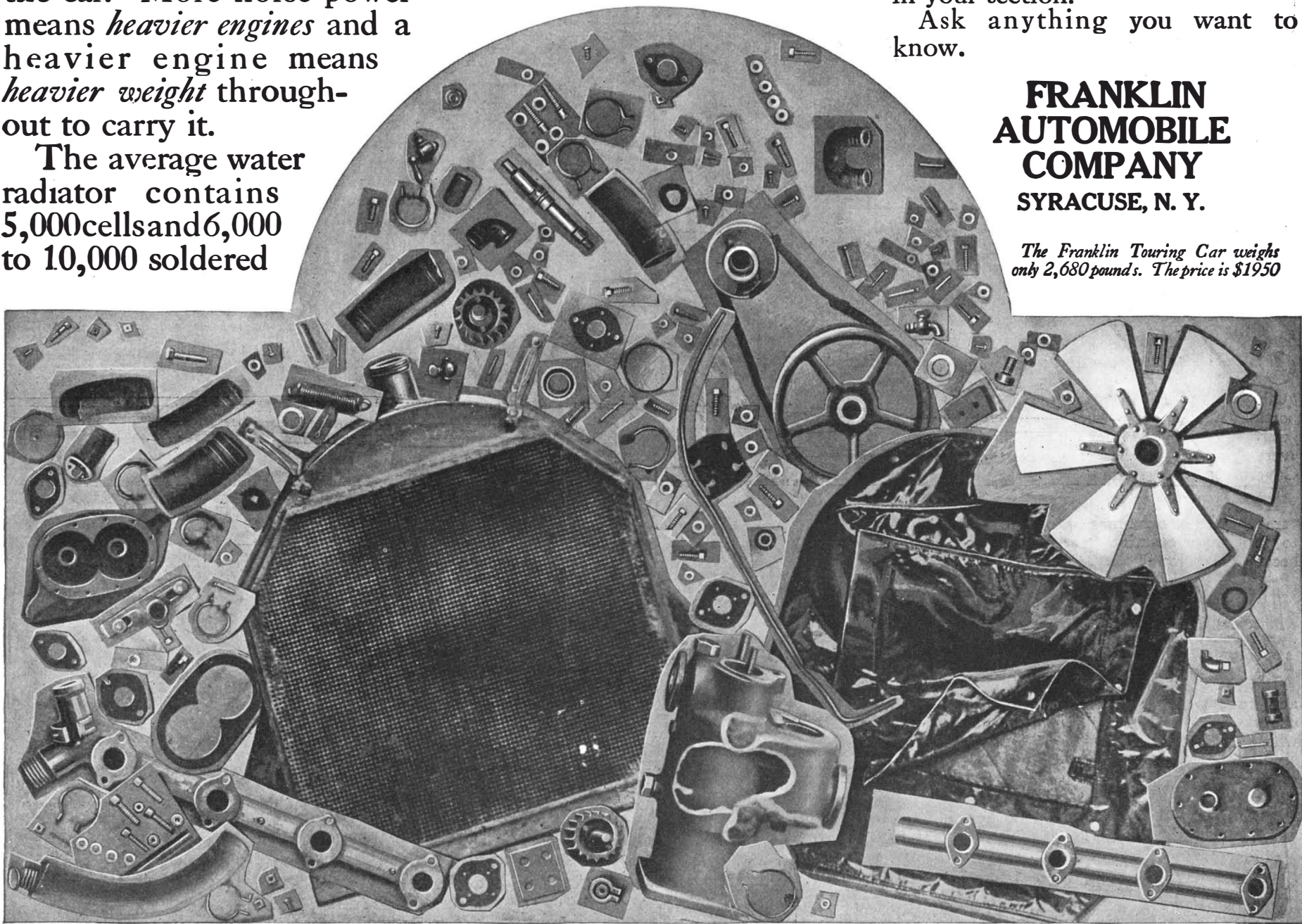
They are in daily use in *every city* in this country and delivering to their users *more comfort* and *more economy* than any other cars they ever owned.

Get acquainted with the Franklin owners and the Franklin dealer in your section.

Ask anything you want to know.

**FRANKLIN
AUTOMOBILE
COMPANY**
SYRACUSE, N. Y.

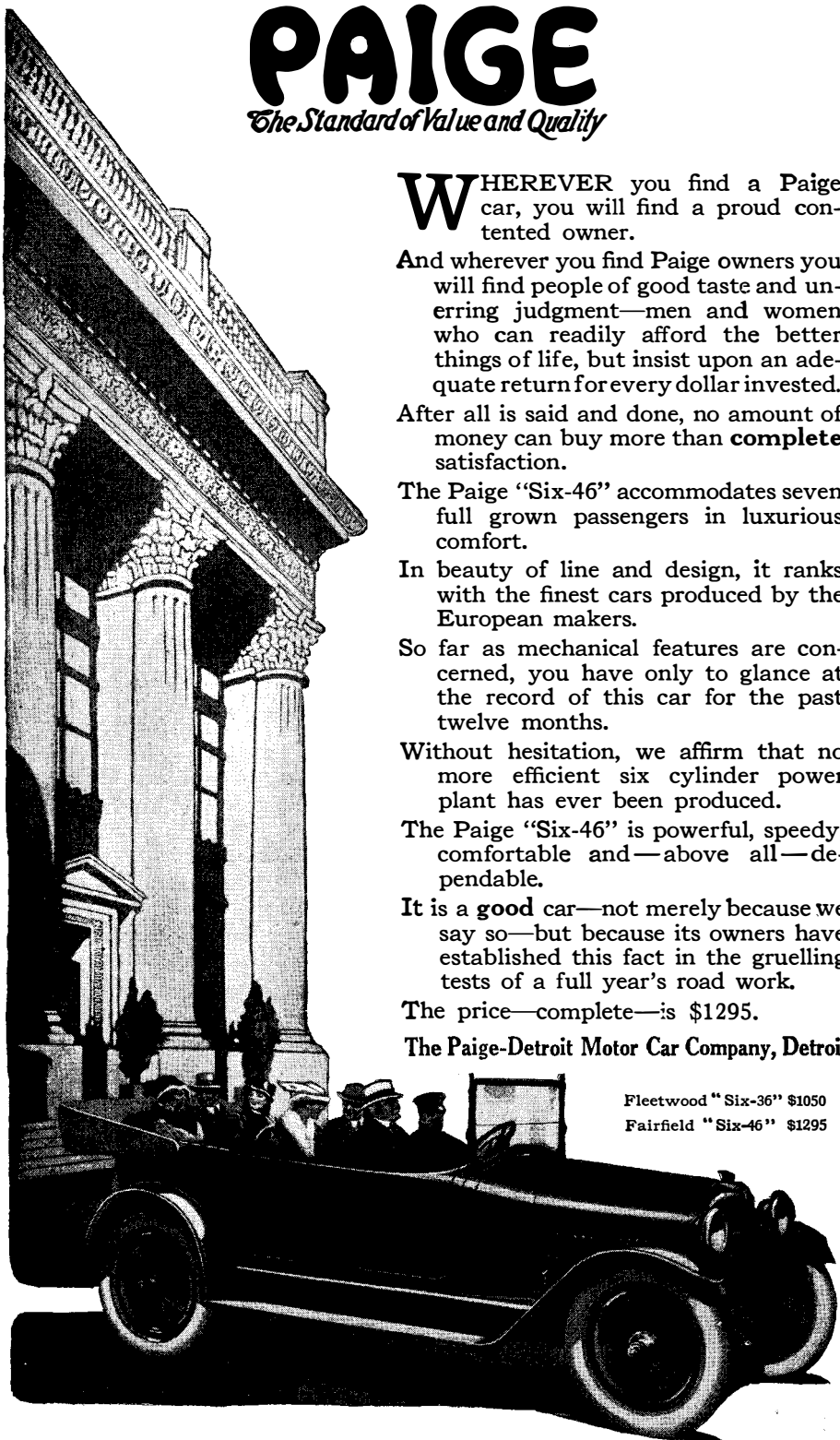
The Franklin Touring Car weighs only 2,680 pounds. The price is \$1950



These are the 177 water-cooling parts eliminated by Franklin Direct-Air-Cooling. The Franklin System of Direct-Air-Cooling *does away* at once with all boiling, all freezing, all leaks, stoppages and failures to cool—all cooling troubles of every kind due to whatever cause. It *does away with the dead weight* of radiator, pump, hose, pipes, pipe connections and water, and with the excessive weight of frame to carry these parts. It gives the Franklin owner *more useful power* for his gasoline money than any other car of the same size. It makes possible the Franklin *scientific light-weight*, flexibility and balance, which give the Franklin Car its notable ease of control—about the one car which anyone can drive all day without undue fatigue.

PAIGE

The Standard of Value and Quality



WHEREVER you find a Paige car, you will find a proud contented owner.

And wherever you find Paige owners you will find people of good taste and unerring judgment—men and women who can readily afford the better things of life, but insist upon an adequate return for every dollar invested.

After all is said and done, no amount of money can buy more than **complete** satisfaction.

The Paige "Six-46" accommodates seven full grown passengers in luxurious comfort.

In beauty of line and design, it ranks with the finest cars produced by the European makers.

So far as mechanical features are concerned, you have only to glance at the record of this car for the past twelve months.

Without hesitation, we affirm that no more efficient six cylinder power plant has ever been produced.

The Paige "Six-46" is powerful, speedy, comfortable and—above all—dependable.

It is a good car—not merely because we say so—but because its owners have established this fact in the gruelling tests of a full year's road work.

The price—complete—is \$1295.

The Paige-Detroit Motor Car Company, Detroit

Fleetwood "Six-36" \$1050
Fairfield "Six-46" \$1295

Tested Hourly!

CHEMISTS whose authority is supreme make tests every hour, day and night, to safeguard the high quality of ALPHA Cement. They certify to exact proportioning of raw materials, thorough burning, and grinding to flour-like fineness; and they make sure that every shipment will *more than* meet the United States Government standard and every other recognized test.

Every ALPHA dealer welcomes the opportunity to sell cement that is to be subjected to the most exacting tests for strength, because he knows that every bag of

ALPHA THE GUARANTEED PORTLAND CEMENT

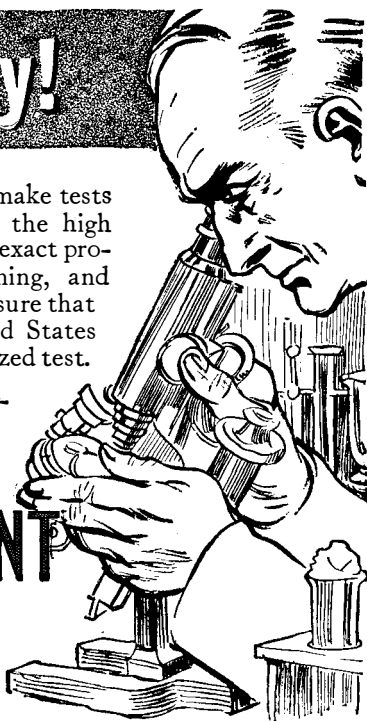
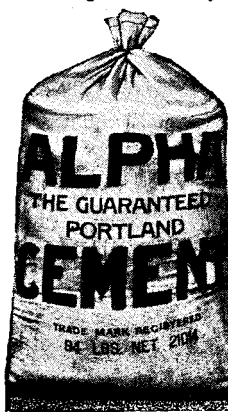
is sure to be of full binding power.

In selecting the cement for your farm and home improvements, is it not well to choose the product of a manufacturer whose present-day output represents 25 years of experience in cement-making; who has made the chemist a man of real authority in all plants; whose system of hourly tests, beginning with quarry operations, makes it impossible for cement of low binding power to be shipped?

Ask your dealer for ALPHA, the Guaranteed Portland Cement, which costs no more than any other high-grade cement, and have him give you the 80-page illustrated book, "ALPHA Cement—How to Use It;" it will tell and show you how to do all kinds of concrete work. If you do not know the ALPHA dealer, write us, mentioning what you plan to make or build. Address Dept. S. ALPHA PORTLAND CEMENT CO., EASTON, PA.

Sales Offices: New York, Philadelphia, Boston, Pittsburgh, Baltimore, Savannah

CONCRETE FOR PERMANENCE



The War Game.—I

(Concluded from page 278)

yards away, watching Jim's movements. This situation will enlighten us in regard to a very important element: that of distance. Tom had to cover those few separating yards before he could reach his enemy and, in their case, as in modern war, this action had a significance, for the approaching of the enemy is one of the most important questions. Of course Tom knew all about Jim, he knew that Jim was a husky lad, not easy to handle, therefore, to improve his own chances, he took that broom stick which stood handy in a corner.

In war times, such information as Tom had is not so easy to get. The distance from the enemy is problematical, and to gain a definite knowledge of its whereabouts is dangerous and difficult, yet absolutely necessary. Timely information regarding the dispositions of the enemy and the topographical features of the scene of operations are essential factors toward the success of any war. This is our reason for selecting a strategic reconnaissance for the first war game. This is also the natural order of things: first, we are out for the information, but while gaining it, we approach the enemy. The strategic reconnaissance develops into a tactical reconnaissance and this, in due time, is followed by the advance to the battle, the attack and the defense.

A Strategic Reconnaissance of Four Cavalry Patrols to Establish the Strength and Disposition of the Enemy

In carrying out a strategic reconnaissance, two means are at the commander's disposal: the dispatching of independent cavalry troops for this purpose and the use of air craft.

The aeroplane will, through its swiftness, often solve a problem in a few hours which, if cavalry alone were used, might take days. Nevertheless, the influence of weather and other conditions make it imperative to rely more on the cavalry than on air craft. Therefore, in this article, we shall handle the action of an independent cavalry reconnoiter.

The aim of reconnaissance is to get all the information about the enemy that is available, and to deliver this information safely and quickly to the commander. Above all, it must be understood that this expedition is not a fighting expedition; but, if fighting is the best means of accomplishing the assigned task, then fight it must be and a successful fight, at that.

The commander of the independent cavalry will receive strict instructions concerning his mission, always with perfect freedom of action. He must then dispatch such patrols as he considers necessary. The number and strength of these patrols will vary with the circumstances of each case. The best strength for a patrol is ten to twelve men; larger units would find it difficult to escape observation.

This understood, we shall proceed to the first task in the war games.

Situation

Captain C, commander of a squadron of hussars, independent cavalry, has reached Norrisville, at 6:30 in the morning, to undertake a strategic reconnaissance north of Nehaminy River. While at rest there, he receives information from a scout aeroplane that small patrols of the enemy have been seen north of Lookout Hill. This being important news, he decides to send out four reconnoitering patrols at once. For this purpose he selects Lieutenant L, Sergeants S and SS, and Corporal C. These four men he leads to the northern edge of Norrisville, from where a good view can be had toward the north and, after a short study of the country and his general staff map (see perspective and map) he gives them the following order:

"The enemy is approaching from the north. Small patrols have been observed 10 miles behind Lookout Hill. Our main forces are 25 miles south. To gain information regarding these patrols and the following enemy forces, I am going to send out four patrols.

First Patrol.—Sergeant S, on the road

MOSLER VESUVIUS PLUG

"Perfect Spark Plug Construction gives Perfect Motor Operation"—A. R. MOSLER

The Vesuvius Plug is designed and constructed to develop greater power, and insure absolute certainty of operation in any motor, under all conditions. Mechanically perfect, sturdy and powerful, it is—

Guaranteed to outlast the motor.
\$1.00 each, in round metal box.
"Mosler on Spark Plugs"—a book that tells the right plug for your motor sent free.

A. R. MOSLER & Co.
New York New York

Quality makes it— "The Indestructible Plug"

"HOW TO JUDGE ENGINES"

A Valuable Book Free!

EVERY man who has any idea of buying a Kerosene or Gasoline Engine should have this book.

Discusses different types of engines; how constructed; how operated; how cylinders and other parts should be made to give greatest efficiency.

It has taken 30 years of engine building experience for me to learn the facts in this book. Yours for the asking.

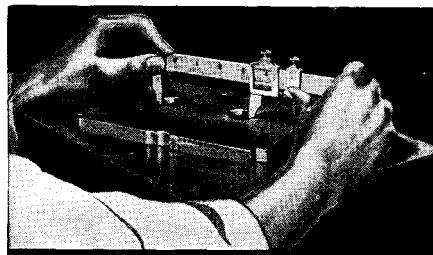
My 1916 Model Engines are the greatest value I have ever offered. All sizes pull from 30 to 50% over factory rating.

WITTE Engines—built by experts. Free Trial—Easy Terms.

ED. H. WITTE, WITTE ENGINE WORKS,
2471 Oakland Avenue, Kansas City, Mo.
2471 Empire Bldg., Pittsburgh, Pa.

Valuable Books of Instruction and Reference
Scientific American Cyclopedia of Formulas—Concrete Pottery and Garden Furniture—Scientific American Reference Book—Experimental Science—Handy Man's Workshop and Laboratory

MUNN & CO., Inc., Publishers, Woolworth Bldg., New York



This Man Must Have Instruments of Precision

HIS work demands tools of extreme accuracy—his job depends upon them. When he wants tools or instruments that he can depend upon he goes to the leading dealer and asks for Starrett Tools by name.

Starrett Tools

are mathematically accurate. Every engineer, machinist and high-class workman whose work requires accuracy knows Starrett Tools to be standard. The time saved in accurate fitting and machining is of value not only to manufacturers but makes the man with Starrett Tools a better workman.

Send for Free Catalog No. 20-B.



THE L. S. STARRETT CO.

"The World's Greatest Tool Makers"

ATHOL, MASS.

New York London Chicago



"Not the name of a thing, but the mark of a service"



Depend on any lamp
marked MAZDA

THE MEANING OF MAZDA—MAZDA is the trademark of a world-wide service to certain lamp manufacturers. Its purpose is to collect and select scientific and practical information concerning progress and developments in the art of incandescent lamp manufacturing and to distribute this information to the companies entitled to receive this Service. MAZDA Service is centered in the Research Laboratories of the General Electric Company at Schenectady. The mark MAZDA can appear only on lamps which meet the standards of MAZDA Service. It is thus an assurance of quality. This trademark is the property of the General Electric Company.



RESEARCH LABORATORIES OF GENERAL ELECTRIC COMPANY

that this hill is the dominating point. It is, except on the eastern slope, barren; therefore if the enemy is near, an undue exposure might hinder the pursuance of the duty of this reconnaissance.)

8. Lieutenant L, on reaching the pinnacle of the hill, beholds an enemy patrol at the corner of the forest, almost touching the railroad dam, opposite to a house on the hillside. What will he do?

(Remember that the main consideration and duty of the patrols is to get information and not to fight.)

9. Which direction will the lieutenant follow to escape observation by the enemy? (Consider terrain situations.)

10. Trace with your pins the positions of the four patrols at this moment.

11. What route will Lieutenant L follow to pass on, unobserved, to reach a point behind this enemy patrol?

12. Will he send a report to his captain?

The solution of these questions will be logically solved, from a military standpoint, in the issue of March 25th.

The Result of the Reconnaissance

At 4 P.M., in Pottstown, Captain C receives the personal report from Sergeant S that on the plateau directly north of the coal mines an enemy battalion, with one battery, two platoons of cavalry, is encamped, with an outpost on Hill 59, another at coal ferry. This latter was put out of action by Patrol 1.

No news has been received from Patrol 2.

Patrol 3 reports, by an orderly, that the enemy has ambuscaded Patrol 2 and, except for two men, all have fallen or been taken prisoners. These two survivors reached Patrol 3, which is in touch with superior enemy patrols.

News comes from Patrol 4 that it has reached Greenville, no enemy observed, though rifle shots were heard in the east.

At the same time, the 27th infantry regiment, with one battery, has reached Norrisville.

The next game will deal with the protection service of this detachment near the enemy, and the tactical reconnaissance of independent cavalry in force.

Notes for Inventors

Economical Home Heating.—The manipulating of a furnace varies with the point of view. It may be regarded as a pleasant exercise and, if the imagination is strong enough, be robbed of many of its terrors, or it may be regarded a part of the business of life and be accordingly dignified, but in considering the economical side of the proposition it has been interesting to note after a perusal of a very useful Bureau of Mines bulletin entitled "Saving Fuel in Heating a House," that no suggestions are made as to modifying or improving the apparatus either to simplify or to render more effectual the valuable suggestions as to firing and otherwise controlling the heating fires. There appears to be here a field for invention for those skilled in the furnace art in the production of mechanical features, which will aid in carrying out the useful suggestions, as to manipulating the fires, found in the scientific and at the same time highly practical bulletin. But apart from such suggestion the bulletin "Mechanical Paper 97" contains much that will be educational to the fairly expert as well as to the beginner in furnace management.

Makes Baton Sound a Note.—Peter A. Fair, of Helena, Montana, has secured patent No. 1150856 in which a baton is provided with a tuning fork at one end which can be sounded by the operation of the baton.

Death of a Safety Razor Inventor.—Frederick A. Kampfe, well known as an inventor in the safety razor art, died recently in Washington city where he maintained a winter residence. Mr. Kampfe was born in Dresden, Germany, in 1851, and early in the modern safety razor activity entered the field and has since been well known in the industry.

ADVERTISING CLASSIFIED

LATHES AND SMALL TOOLS

"STAR" Large Line of Attachments
For Foot or Power **LATHES**
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
Send for Catalogue B
SENECA FALLS MFG. CO.,
695 Water Street
Seneca Falls, N. Y., U.S.A.

The "BARNES" Positive Feed Upright Drills

10 to 50-inch Swing
Send for Drill Catalogue
W. F. & Jno. Barnes Co.
Established 1872
1999 Ruby Street Rockford, Illinois

**Strong Patent
Diamond Holder**

The up-to-the-minute Holder—with six points and a "shock absorber." Worth knowing about. Send for circular.

MONTGOMERY & CO., Tool Mongers
105-107 Fulton Street New York City

WANTED—TO BUY OR RENT

—model of Submarine, Battleship, or Ocean Liner. Must be cheap. State full particulars, size and weight. Send photo if possible. C. CHILO, Gen. Del., Chicago, Ill.

RADIUM Spinthariscopes, showing radium scintillations, \$8. Radiscopes, for testing waters, ores, etc., for radium, \$7.50.
Extra Strong Phosphorescent Zinc Sulphide, \$2 per tube.
Luminous Radium-Sulphide mixtures, \$5 per tube. Postpaid.
HAMMER RADIUM COMPANY
Radium and Radium Specialties
1840 California Street DENVER, COLORADO

Rameses.

A very peculiar
cigarette. You
may not like it.

But be very sure
that you will
form a strong and
definite opinion one
way or the other.

The reason for the
constant changing
in brands among
cigarette smokers is
a certain soft neutrality of flavor
characteristic of
most varieties. The
only variation in placid
mediocrity is on the box.

If almost any decent
brand satisfies you, you
probably will not care
for Rameses, "The
Aristocrat of Cigarettes."

But if you are seeking a
very definite and distinctive
cigarette, unlike
others—unforgettable—the
one cigarette for
your personal and individual
taste—then you
are coming to Rameses.

Soon.

Remember, Nobody ever
changes from Rameses.

Magical Apparatus
Grand Book Catalog. Over 700 engravings 25c. Parlor Tricks Catalog Free.
MARTINKA & CO., Manufacturers, 493 Sixth Avenue, New York

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery.
The VILTER MFG. CO.
899 Clinton Street Milwaukee, Wis.

Experimental and Model Work
Electrical Instruments and Fine Machinery. Inventions Developed. Special Tools, Dies, Gear Cutting, Etc.
HENRY ZUHR, 32-34 Frankfort St., New York City

THE SCHWERTLE STAMP CO.
STEEL STAMPS LETTERS & FIGURES.
BRIDGEPORT CONN.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO.,
286-300 Sheffield Ave., Brooklyn, N. Y.

MODELS CHICAGO MODEL WORKS
166 W. MADISON ST. CHICAGO, ILL.
ESTABLISHED 1867. WRITE FOR CATALOGUE OF MODEL SUPPLIES.

CULTIVATING a taste for good reading is as much a part of a young lady's education as the study of her text-books. It supplements and broadens her desire for knowledge.

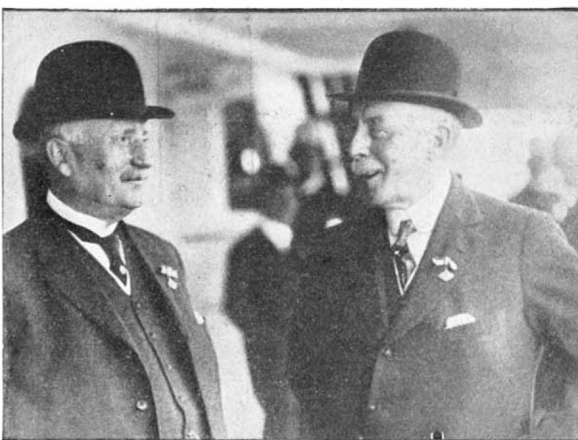
The announcements of the best schools can be found in Scribner's Magazine every month. If detailed information is desired, address

**Scribner's Magazine
School and College
Service Department**
Scribner Building, Fifth Avenue
Room 818 - - New York



From a photograph made especially for SYSTEM

FREDERIC W. Upham's success as President of The Consumers Company, which serves the City of Chicago, he attributes, in part, to "our willingness to exchange business methods with other concerns." His article, "Why Customers Come Back," in a recent issue of SYSTEM interested hundreds of thousands of business executives. "Time spent in contributing of our experiences," Mr. Upham says, "is well repaid by the ideas we get from reading its pages ourselves."



From a photograph made especially for SYSTEM

PRESIDENT Farrell of the U. S. Steel Corporation greeting President Johnson of the Baldwin Locomotive Works at the recent Foreign Trade Convention. Speaking of SYSTEM, the Magazine of Business, as a monthly convention of the business methods of large and progressive concerns, Mr. Johnson writes: "I have gotten ideas which are suggestive and interesting." Mr. Farrell will tell in March SYSTEM the story of how his company has made partners of its men.



From a photograph made especially for SYSTEM

WHILE waiting to see Mr. John G. Shedd, President of Marshall Field & Company," writes a SYSTEM subscriber, "I noticed that SYSTEM was one of four magazines in the waiting room, and when I came into his private office, SYSTEM was the one and only magazine on his desk." Another business man reports that "On a recent tour of America's great distributing centers, SYSTEM was favorably discussed by many chief executives of large department stores."



From a photograph made especially for SYSTEM

THIS is a glimpse into the office of Irving T. Bush, President of the Bush Terminal Company. "I have never known SYSTEM to get out an issue that could fail to start a progressive business man thinking," Mr. Bush says in a recent letter, "For myself I read it and like it—you would find it on my desk often."



From a photograph made especially for SYSTEM

AN interesting insight into the way the President of the Regal Shoe Company stimulates initiative among the executives of his large organization is the statement of Mr. E. J. Bliss that "frequently I send copies of SYSTEM to some of my associates and ask them to read what I have found most interesting. SYSTEM is a bully good magazine."



From a photograph made especially for SYSTEM

FROM this office overlooking Lake Michigan, H. W. Gossard directs the activities of what his continued energy has made a large year-round corset business from a small seasonal one. "Personally, I find SYSTEM mighty helpful," Mr. Gossard says, "and I notice also that some of my associates are putting SYSTEM's ideas at work, with evident success."



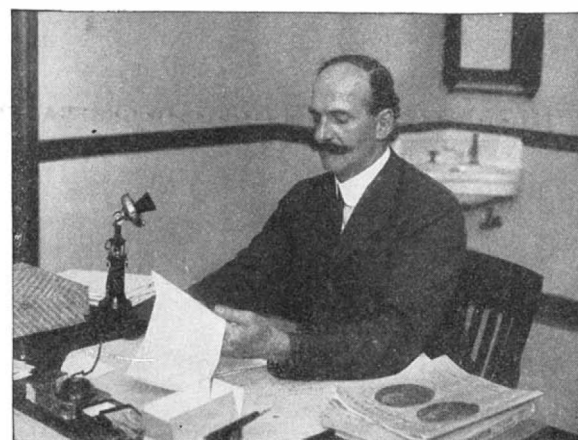
From a photograph made especially for SYSTEM

THIS is Charles A. Whelan, one of the dynamic partners who built up from a small Syracuse cigar stand the United Cigar Stores of today. "The topics of which SYSTEM treats cannot be left out of successful business. I read it at home, but often take its enlightening suggestions to my office." In a coming issue Mr. Whelan will tell of some of his unique policies for feeling the public buying pulse.



From a photograph made especially for SYSTEM

A PERSONAL sketch of William Wrigley, "the man who made \$32 grow to \$13,000,000," appeared in February SYSTEM, and many other business managers have already profited by Wrigley's original ideas. This article is one of a series in SYSTEM which month by month is detailing the methods of the unusually successful men in business, for the inspiration of nearly half a million business men who read SYSTEM.



From a photograph made especially for SYSTEM

GENERAL Thomas Coleman DuPont set the financial world agape a few months ago by selling his interest in the great DuPont Gunpowder Company and buying a controlling interest in the Equitable Life Assurance Society. "Why did you do it?" SYSTEM asked Mr. DuPont. His answer through SYSTEM's pages revealed a new conception of the business man's opportunity for public service.

WILL YOU READ THE MARCH ISSUE OF SYSTEM?

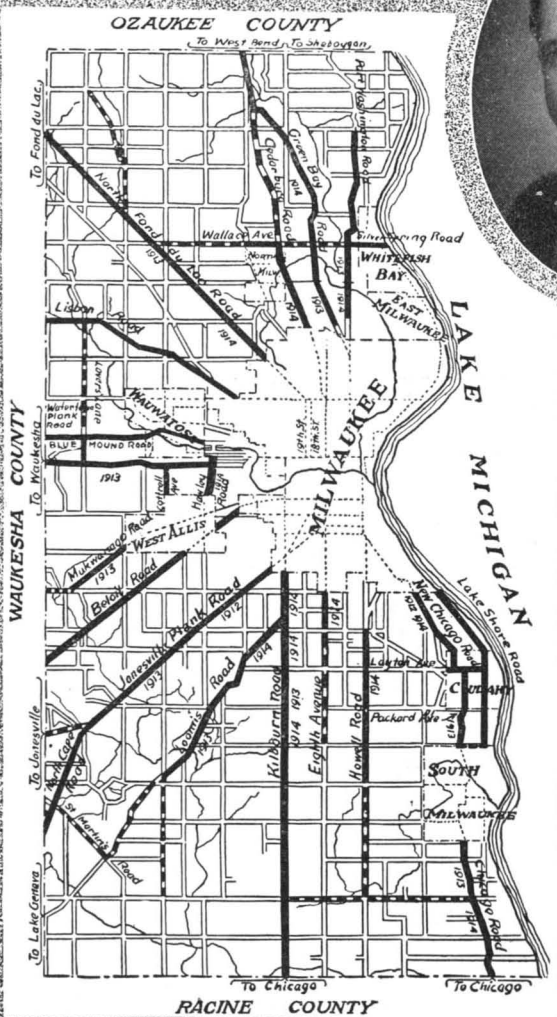
BUSINESS men throughout the country are planning to increase sales, collect money, hold down costs, buy, meet competition and increase their personal efficiency with the new and unusual business ideas packed into the March number of SYSTEM, the Magazine of Business. Prominent among contributors are President Farrell of the U. S. Steel Corporation, President Runnells of the Pullman Company, President Shonts of the Interborough Rapid Transit

Company, Ex-Senator Burton and President Kelsey of the Title Guarantee and Trust Company. Nineteen complete articles of timely interest—six departments packed with short cuts—graphic illustrations—hundreds of business ideas, plans, policies—in this big March issue and all by men who know. If not a regular reader, decrease your expense, increase your sales and multiply your profits by getting a copy of March SYSTEM today.

SYSTEM
THE MAGAZINE OF BUSINESS

IF YOUR NEWSDEALER IS SOLD OUT, WRITE YOUR NAME AND ADDRESS BELOW, AND MAIL WITH 10 TWO-CENT STAMPS TO THE PUBLISHERS, A. W. SHAW COMPANY, CHICAGO OR NEW YORK OR, IF ABROAD, LONDON

Map of Milwaukee County, Wisconsin, showing Concrete Roads. Heavy lines indicate finished roads, dotted lines work under construction during 1916.



H. J. Kuelling,
County
Highway
Commissioner
of Milwaukee
County, Wis.



A Stretch of the Blue Mound Concrete Road, Milwaukee County, Wisconsin

86 Miles of Concrete Roads in Milwaukee County, Milwaukee, Wisconsin

HERE are a few facts about the concrete roads of Milwaukee County, Wisconsin, that are of national interest. Read them carefully and remember them the next time roads are discussed in your community. Better yet, tear out this page; it's worth keeping.

Concrete roads are hard, permanent roads constructed of sand and hard crushed stone or pebbles cemented permanently together with Portland Cement into an even, solid wear-proof surface. Unlike other "improved" roads in which the broken stone is merely pressed together, the concrete road hardens with age into a monolithic mass which is unaffected by the summer heat or the spring flood and resists the wear of traffic. Cement-bound roads will not "run" in hot weather, automobiles will not lick up and remove the binder. Cement is a permanent binder and is an integral part of the road.

In four years there have been built in Milwaukee County over 86 miles of concrete roads. These roads have been built after the most exhaustive investigation, and in preference to any other type of road. In 1915, out of approximately 42 miles of new roads over 39 miles were built of concrete.

Milwaukee County has much in common with every community—its roads extend from the city far out into the country, they receive every kind of traffic, wagons, automobiles, motorcycles, carriages, and heavy city trucks. The concrete roads of Milwaukee County have increased property values, reduced hauling costs, and reduced road taxes for repairs and maintenance. They give satisfactory service every season of the year, in every kind of weather. They are unaffected by the hardest travel, free from holes and ruts, dustless in Summer, dry and mudless in the Spring, open all Winter. Why not build of concrete in your County?

In New York State, the cost of the 16-foot concrete roads, based on 200 miles laid under all conditions in 1914 and 1915, averaged \$9,500.00 per mile for all concrete work and surfacing. Including drainage, grading, etc., the total cost varies from \$12,000.00 to \$15,000.00 per mile. Ordinary macadam roads cost about \$9,000.00 per mile; but macadam is not a permanent road. It will soon rut and wear, the binder will wash out, or be sucked out by passing vehicles, running the maintenance cost into large figures.

The concrete road is inexpensive to maintain. The figures from the 1915 report of the County Highway Commissioner of Milwaukee County show an average repair and maintenance cost of but \$58.00 per mile per year. Out of this small sum approximately \$23.00 per mile has been expended for the maintenance of road shoulders, etc., **leaving the actual road maintenance cost but \$35.00 per mile.**

When concrete roads are properly laid this low maintenance cost is not unusual but customary. The combined maintenance and repair costs on improved roads, other than concrete, of Massachusetts, Rhode Island, Connecticut, New Jersey and New York for eight years averaged \$608.00 per mile per year.

When roads are built in your community build of concrete and you will have roads that are permanent, satisfactory, inexpensive to maintain; roads that will increase values, reduce the cost of hauling and serve you every day in the year.

Read what H. J. Kuelling, County Highway Commissioner, of Milwaukee County, Wisconsin, said:

"Our idea of concrete roads, generally, for country road construction, is shown by the fact that out of approximately forty-two miles of road to be built in 1915, we will build about thirty-nine miles of concrete. As shown by our report, the increase in traffic is very marked, and without a doubt there is also a very marked increase in property values and general prosperity along the roads."

If there is anything you want to know about the cost and maintenance, haulage statistics, repairs, etc., of the Milwaukee County Concrete Roads write to Mr. Kuelling personally at his office in the Pereles Building, Milwaukee, Wisconsin.

CONCRETE FOR PERMANENCE

PORTLAND CEMENT ASSOCIATION
111 West Washington Street, Chicago
116 New Montgomery St.
San Francisco

Southwestern Life Building
Dallas, Texas

Commerce Building
Kansas City

Our well illustrated and informative booklet "Portland Cement Concrete Highways" will be sent free of charge on request, and we invite correspondence relative to concrete road construction and maintenance.