MURAD

THE TURKISH CIGARETTE

Everywhere—Why?

When Aladdin found the Magic Lamp and rubbed it the Genie instantly appeared.

"Bring me," said Aladdin, "the most delicious cigarette that man ever put between his lips."

In a moment he was back again.

"Murad!" exclaimed Aladdin as he saw the box under the Genie's arm. "I've smoked Murads for many years. They surely are THE Turkish Cigarette, and Turkish tobacco is the world's most famous tobacco for cigarettes."

Amargyros Corporation — *Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World*

Willys Knight

SLEEVE-VALVE MOTOR

Coupe

$1500

MODEL 84B
F.O.B. TOLEDO

IN these Willys-Knight models the economies of huge production are applied to *closed* car prices for the first time.

And now that the prices are so low, thousands of people are driving closed cars the year around.

They are just as cool for summer driving as are open cars—and they are much more comfortable and cleaner.

They have the advantage of affording complete protection against sun, wind, dust, rain or sudden cold.

The Willys-Knight motor cars are mechanically superior in that they have sleeve-valve motors and spiral bevel drive gears.

The sleeve-valve motor is quieter, more efficient and more durable than any other type.

It grows quieter, more powerful and more flexible with use.

And the sleeve-valve motor will serve you at the height of its efficiency for literally thousands of extra miles beyond the useful life of any other type of motor.

If you are buying a car this spring, consider carefully the advantages of these closed models.

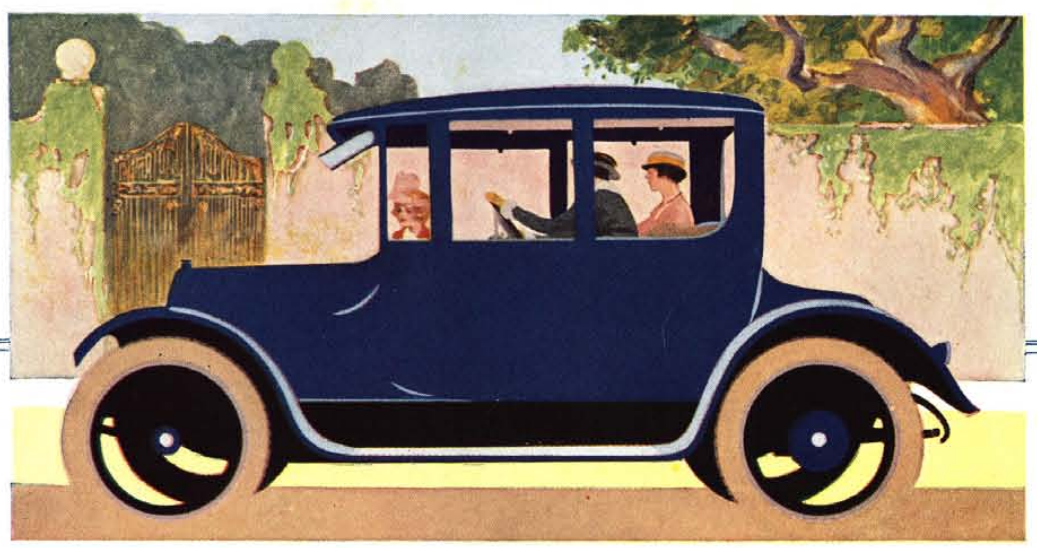
The Limousine is $1750, the Coupe $1500.

For those who prefer the open models there are the Touring Car at $1125 and the Roadster at $1095—all prices f. o. b. Toledo

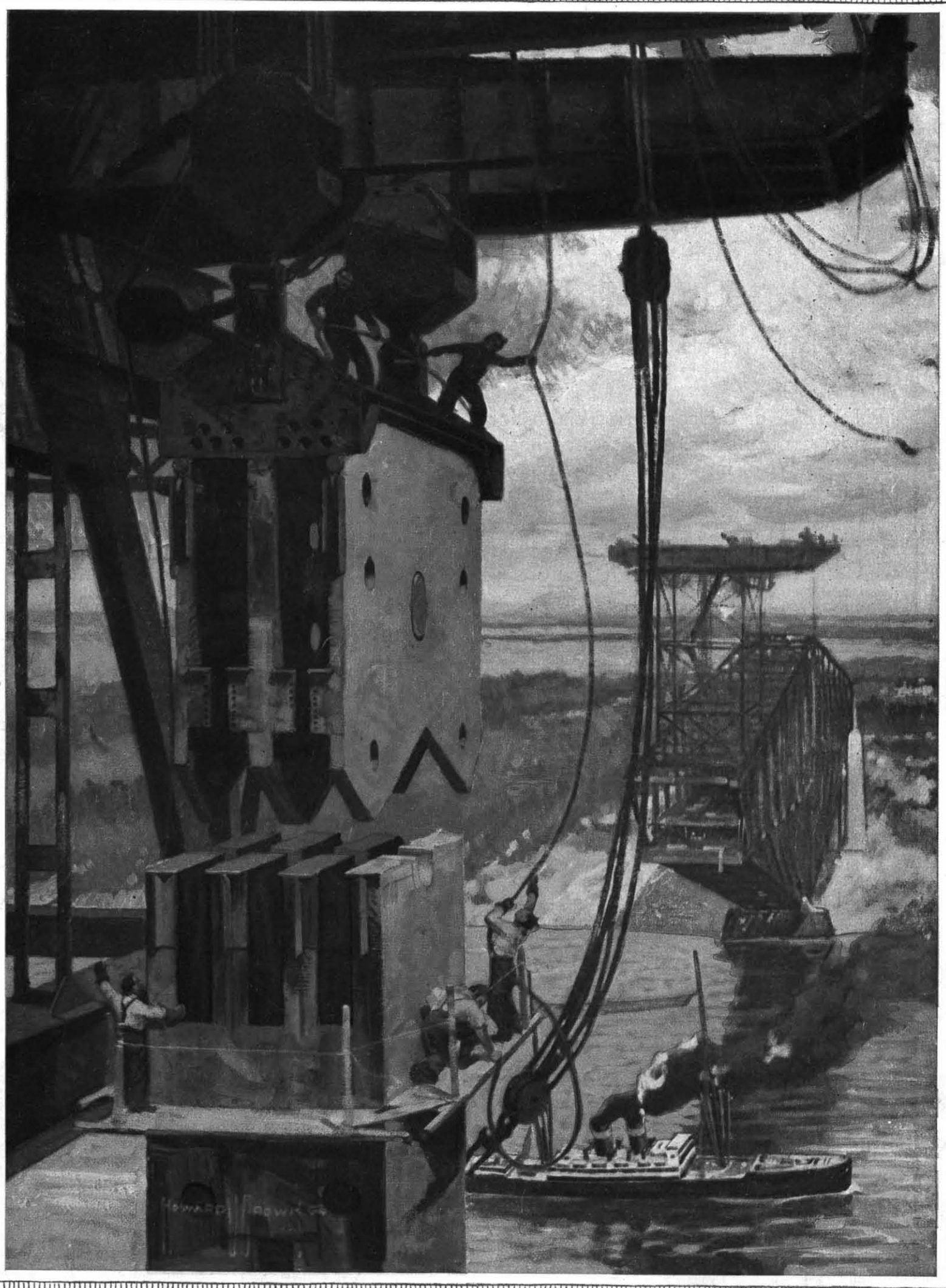
See the Overland dealer now and make sure of a prompt delivery.

The Willys-Overland Company, Toledo, Ohio

"Made in U. S. A."



SCIENTIFIC AMERICAN



May 6, 1916

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

Price 15 Cents

A STATEMENT

Concerning Final Drive in White Motor Trucks

IN VIEW of the conflicting claims for this form and that form of final drive which now confront the purchaser of heavy duty trucks, this Company, as the largest manufacturer of motor trucks in America, deems it fitting to make a public statement of its own purpose and practice in the matter.

White Trucks of over two tons capacity have always been chain-driven, and *will continue to be chain-driven* until some other form of final drive is developed in the future which is more efficient or equally efficient. In its present stage of development, worm drive will not be adopted by this Company, and White engineers now see no prospect of its basic handicaps ever being sufficiently overcome to warrant its adoption.

CHAIN DRIVE EFFICIENCY

1. White chain-driven trucks are more efficient because more power is delivered to the rear wheels.

2. They require a smaller motor for equal load capacity.

3. They consume less gasoline, getting as high as 50% more mileage per gallon.

4. They endure a higher road speed; perform more easily on rough roads, steep grades, and in heavy going.

5. They pull loads out of chuck holes and over obstructions which would stall a worm-driven truck.

6. Tire mileage is materially greater because the unsprung weight on the wheels is so much less.

WHITE TRUCK PERFORMANCE

Motor trucks have been in use long enough to accumulate a volume of motor truck experience, long enough for owners to know *actual operating value*. They can compare one truck with another. They have the records of performance; and large users who keep the most effective cost records indicate the showing of those records by an overwhelming preference for White Trucks.

That preference is well known. It is eloquently reflected in the fact that in total annual sales White Trucks predominate two to one of any other make, and among many large users they predominate ten to one.

WHITE TRUCK PREDOMINANCE

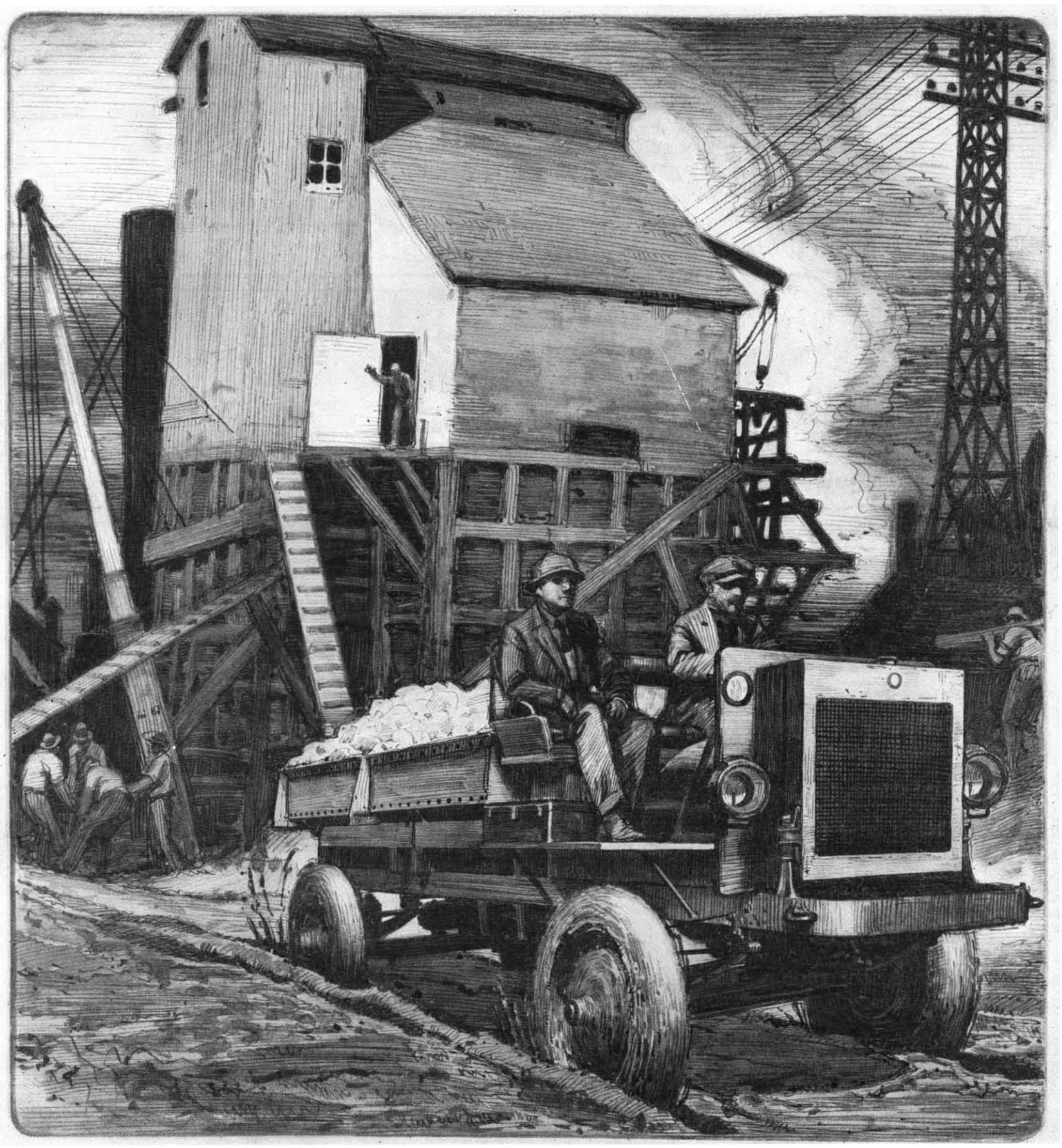
When a truck both outsells any competitor two to one and commands a higher price—its competition is severely felt by trucks of similar design, so severely in fact, as to necessitate a change in that design to escape the brunt of parallel competition. This gives rise to new theories of construction, which are adopted to arouse fresh interest rather than to improve the truck, in the endeavor to divert attention from White *performance*.

At this late stage of motor truck experience there is no need of truck buyers being bewildered by fads and theories. Over and above the conflict of all theory looms the solid fact of White Truck performance—longer life, more days in service, lower eventual cost, as attested by comparative cost records of numerous large users and by the fact that such users purchase more White Trucks every year than trucks of any other make.

THE WHITE COMPANY

CLEVELAND

ONLY GRAND PRIZE for Motor Trucks, Panama-Pacific International Exposition, San Francisco



THE United States Army and the Thomas B. Jeffery Company

united to produce the Jeffery Quad, the truck that drives, brakes and steers on all four wheels. It represents the attainment of an ideal most practical and most difficult—that of obtaining extraordinary *and* ordinary service at low cost.

The army engineers demanded a truck that would consume as little gasoline as possible. The Jeffery engineers fitted the Quad with the duplex governor—the "automatic chauffeur"—which automatically regulates the supply of fuel necessary to maintain any given speed over any kind of road or trail.

The army engineers demanded easy replaceability of parts. The Jeffery engineers made the front and rear parts of the truck duplicates of each other—and easily accessible.

The army engineers demanded a truck that could go anywhere a four mule team could go. The Jeffery engineers applied the power to all four wheels and used M. & S. Locking Differentials to make the drive *positive* to each wheel. And the Quad goes through hub-deep mud, through sand and snow, and over seemingly impassable mountain trails.

168 have already gone to Mexico to supplement the 50 previously in army service. In everything the demands for ordinary and extraordinary service at low cost are met successfully.

Business has not been behindhand in utilizing what the army helped to develop. Today the Jeffery Quad is employed in every conceivable private enterprise—from penetrating the formerly inaccessible wastes of Death Valley, to making deliveries in the narrow alleys of crowded cities. 3,500 of them have been built and put in service in all fields in two years—a record never approached by any other truck of similar capacity. For further particulars address

The Thomas B. Jeffery Company

Main Office and Works, Kenosha, Wisconsin

The Thomas B. Jeffery Company — Jeffery — Kenosha, Wis. U.S.A.

SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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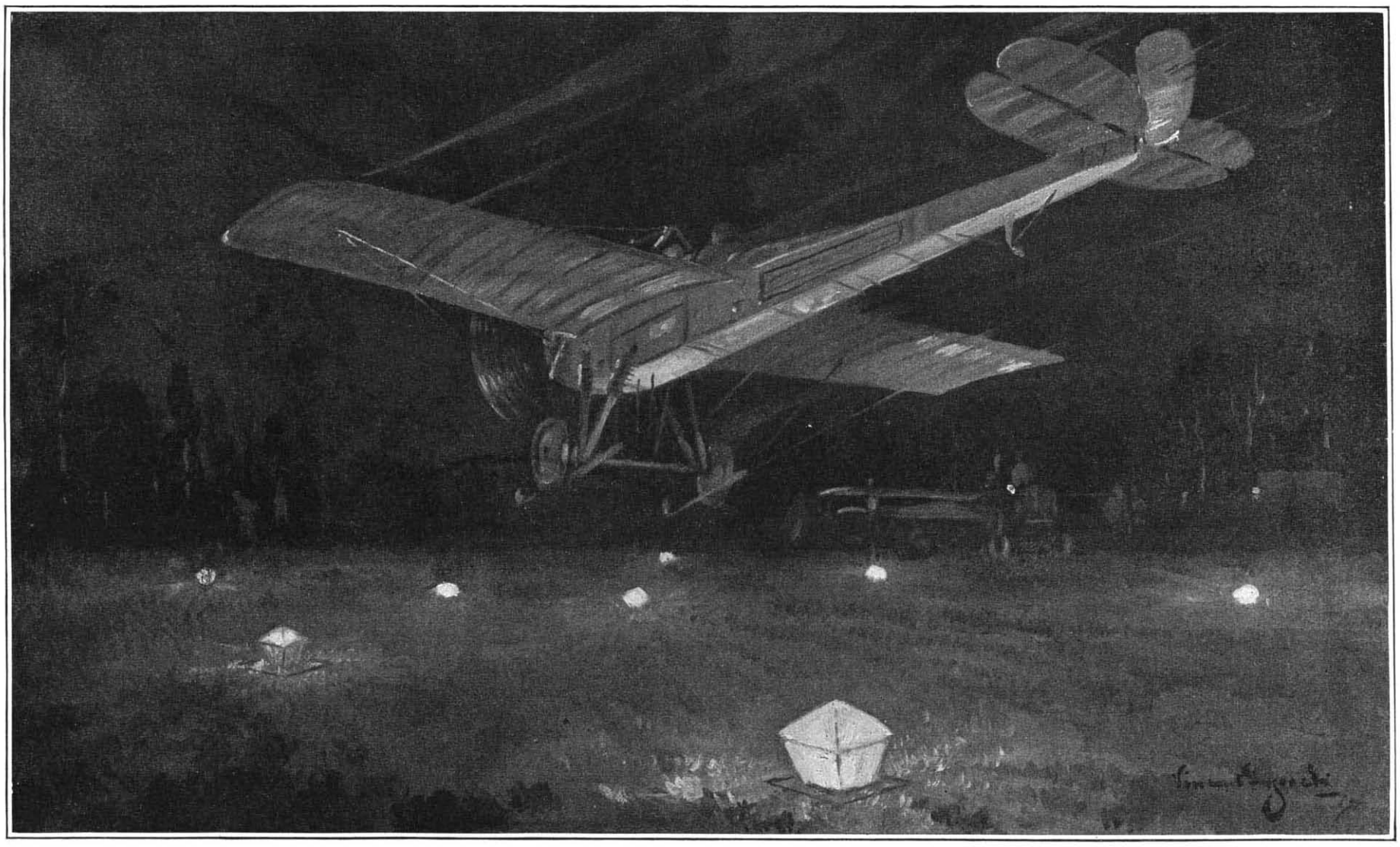


German aviator piloting his machine to a safe landing on an aviation field at night, guided by the newly-evolved beacons

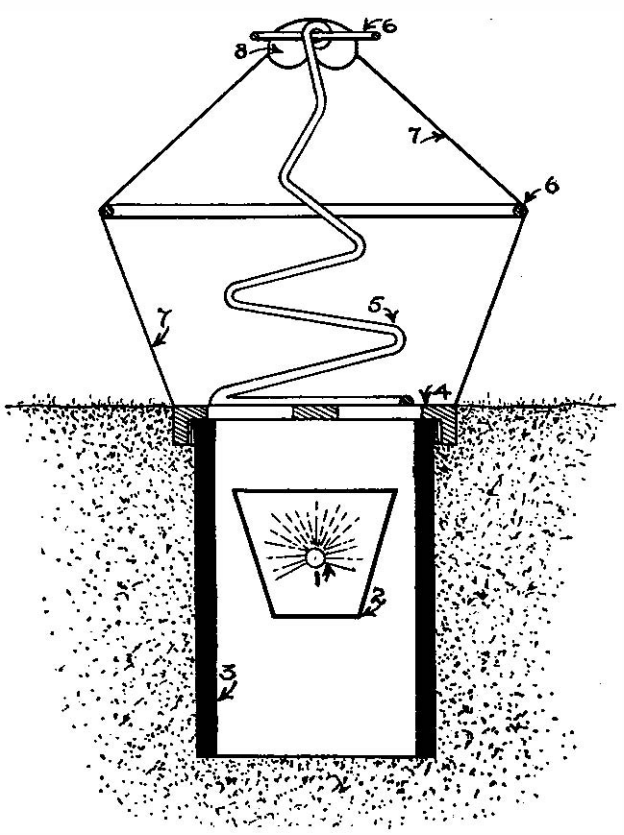
New Aviation Beacons That Make Safe the Landing of Aircraft at Night

By Robert G. Skerrett

THE Germans have lately evolved a type of lantern for aviation fields and other landing places which removes a number of the dangers to which the air pilot has heretofore been exposed in returning to earth at night. As may easily be appreciated, the proper lighting of aviation stations is confronted with a number of difficulties. Logically, it is undesirable to support the beacons on poles or towers, because the exact height of these can not be accurately judged after dark, and they are obstructions against which the airman may unwittingly strike. Further, the lights are proportionately blinding as their power of illumination is increased, and to the approaching pilot there is a zone of glare which screens the underlying ground, leaving him to hope that all is clear below.

In consequence, the aviator has had to use these navigational beacons with some reservations, and as a broad rule he has found it safest to steer wide of them in descending and really to make his landing somewhere in the neighboring darkened area. As a result, many accidents have occurred, and not a few of them, because of adventitious obstacles in the way of wagons, horses, and other bodies that have been left heedlessly or allowed to stray upon the grounds. The new beacon very effectually obviates the previous handicaps and is designed as a target, so to speak, at which the aviator can aim directly when making his landing, and should he hit any exposed part of the apparatus no damage will be done either to the aircraft or to the lantern.

The light itself, backed by a suitable reflector casting the rays upward, is placed in a pit lined with firebrick. The latter is made in the form of an open-ended cylinder and is sunk with its upper end flush with the ground. Over this opening is placed a stout iron grating through which the light can pass skyward; and upon this grid is set a wire frame covered with a stout gauze which has the property of diffusing the light projected against it, and, at a short distance, appearing in the dark like a luminous globe. The shade is held up by a spiral spring which collapses when a blow or weight is sustained by the screen. The character of the light is such that it produces an even glow and does not cast misleading shadows or occasion the equally deceptive reflections that are so common where a bare light is concerned. These lamps or beacons are placed upon the aviation field at regular intervals and spaced from 22 to 54 yards apart, depending upon the area of the landing space and the nature of the illuminant. The lamps may be electric, oil or gas.



Cross-sectional view of one of the new German aviation beacons

The shades have a maximum diameter of something like 18 inches and a total height of about a foot so that they lie low and distribute the light very evenly upon the surrounding ground. More than this, they can not be hit except by the landing wheels of the flying machine. They crush easily under such a blow, and straighten up again immediately afterwards. The grating over the pit is strong enough to support the weight of a passing wheel and its load, no matter how large the aircraft.

Steel Cars on Railway in India

THE Great Indian Peninsular Railway recently successfully experimented with one steel passenger coach, and has now constructed an entire train of that material. This train runs as the Bombay-Delhi Express, carrying intermediate and third-class passengers. Each carriage is 68 feet long and the body, including the roof, is of steel plate riveted and welded to steel supporting members, so that the whole of the body and the underframe, on which the former is built as one piece, are of steel. Inside the car proper the fittings and furniture in touch with the passengers are of wood, as are the window frames, venetians, etc., while the actual lining is of asbestos heat-resisting composition, held up with wooden moldings secured to the steel members. An interesting point is that one carriage has all its internal woodwork made of Japanese ash as an experiment.

SCIENTIFIC AMERICAN

Founded 1845

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

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

Fatuous Blindness of Germany

THE war has been a great revealer of national character, and the revelation has been full of the unexpected and surprising. Those of us who appreciated the genius of the German people for organization and efficiency, and admired that strong logical bent which enabled them to move with such directness to their great industrial and commercial accomplishments, have been dumfounded by the total lack of moral and ethical qualities, as revealed in the gospel of might and frightfulness which the Germans have preached and practised throughout the war. They alone, among the great nations of the world, seem either to have lost all regard for the approbation and opinion of mankind or to have become suddenly bereft, at least so far as morals and ethics are concerned, of the most elementary powers of reasoning.

As evidence of this, consider the violent recrudescence of the murderous raids of the Zeppelins, whose victims are almost entirely unarmed combatants, at the very time when the German Government professes to be endeavoring to meet the humanitarian views of President Wilson on the subject of submarine warfare. Everything that the President and the people of the United States have urged against the ruthlessness of the German commander of a submarine applies with equal emphasis (we are speaking now on the moral aspect of the question) to the slaying of non-combatants by the commander of a Zeppelin.

That Germany should increase her activities in the one field at the very time when she is supposed to be looking for some reasonable basis on which to diminish her activities in the other field, is the latest of those many amazing contradictions that have made the civilized world ask over and over again, "What manner of people is this?"

One of two alternatives is certain. Germany, in this wholesale running amuck among non-combatants, not only of the belligerents but of the neutral powers, is doing so either with cold-blooded but clear-headed and deliberate intent, or she is proving, on a most tragic scale, that brooding over fancied wrongs and too-long-imagined plots and persecutions, may produce insanity in the nation even as in the individual.

Submarine Nets for the Navy

A PROMINENT American business man, who has recently returned from an extended business trip among the belligerent nations of Europe, tells us he was reliably informed that the Allies had "netted" a total of 130 submarines. Not long before this our Navy Department learned, through its own private sources of information, that the total number of submarines captured or destroyed by this and other means was 127. The stout, steel chain-net, suspended from buoys at the surface, has been found to be a most effective means for keeping the submarine out of certain waters to be protected. Moreover, long sections of netting towed between destroyers or, better, between trawlers, have proved most effective in intercepting and dragging into shoal water the submarine craft of the enemy.

Many months ago Admiral Fletcher, recognizing the importance of this means of defense, asked the Department for netting of sufficient size and in sufficient quantity to enable the fleet to do some experimental work in this direction. He secured some netting, which, on test, proved to be of too weak construction for the effective stopping and catching of submarines. Outside of this, the Navy is altogether without this most valuable element in the protection of our harbors and roadsteads, and of the fleet itself, against submarine attack.

Last year the SCIENTIFIC AMERICAN suggested that, in view of the enormous damage which could be done to our fleet, to our dockyards and to the merchant shipping in our various ports, by an unheralded submarine attack, it would be advisable to provide the Navy with several miles of specially constructed netting of the kind which has proved so successful in European waters. Just now, when the international crisis which we had in our mind when we wrote that article is upon us, and when, as our President recently stated in a public speech, we are in danger of being involved in the great European conflagration, common prudence suggests that we should at once manufacture a sufficiency of submarine netting to enable us, at short notice, to close our harbors, the approaches to our dockyards and any strategic waters which we might wish to protect.

Ordinary prudence, indeed, would lead us to go even further than that and, at once, throw netting across the approaches to our dockyards and around the waters which are used as anchorage ground during our fleet maneuvers. For we should remember that the largest submarines employed in Europe to-day run from 800 to 1,500 tons in displacement. Many of our naval officers, indeed, consider that it is quite possible Germany may have built one or more type ships of 2,000 tons, designed for special long-distance service. Undoubtedly there are submarines afloat which could make the transatlantic passage without convoy, fill up their oil bunkers in the West Indies, or at some point selected by the gentlemen whose activities in favor of one of the belligerents in this war have recently become so notorious, and then make an early morning surprise attack on our dockyards, in which, particularly at this outfitting season of the year, the finest of our dreadnought fleet might be sunk at its moorings.

The Fate of the Shackleton Expedition

IN the autumn of 1914 Sir Ernest Shackleton and his party of explorers sailed away from civilization upon the bold emprise of crossing the Antarctic continent from side to side; an undertaking of both spectacular and scientific interest—"sporting feat, or whatever name it may go by," to quote the words of Shackleton himself. When he departed he hoped to complete his journey in a few months, but foresaw the possibility of being delayed for a year in starting the transcontinental trip, and hence not returning home until the spring of 1916. The plan was, briefly, to disembark in the Weddell Sea region, then recently explored by a German expedition under Filchner; leaving a depot party on the coast, the leader and five companions were to travel overland 1,700 miles to Ross Sea, where they were to be met by a party sent out for that purpose in another ship. The Weddell Sea party sailed in the "Endurance," the Ross Sea party in the "Aurora," and both were equipped with radio outfits.

Subsequent events have been a series of disappointments to the explorers' friends and well-wishers, whatever they may have been to the expedition itself. The departure was, in the first place, so much delayed that when, after a halt at South Georgia, the "Endurance" finally entered the ice, in January, 1915, it was already evident that the transcontinental journey could not be made that season. The "Aurora" left Australia in December, 1914, and, as is now known, made a landing in Ross Sea late in the following month. Neither vessel returned, after landing parties according to schedule. Moreover, the following (southern) winter went by, and nothing was heard from the expedition by wireless. Then another season of navigation passed, and at the very end of it—late last March—the "Aurora" was reported by wireless to be limping homeward. In May, 1915, a blizzard drove her from her moorings, leaving a number of men on shore and unable to rejoin the ship. From that time until the middle of last March she had drifted in the pack ice.

The present situation is, therefore, that while a portion of the Ross Sea party is on land, and has probably been able to accomplish something in laying depots over the barrier ice in anticipation of the arrival of Shackleton and his companions, it is certain that such members of the expedition as are at Ross Sea must remain there for another year. Meanwhile, nothing at all has been heard from the Weddell Sea party or its ship, the "Endurance," and their fate will remain unknown until next winter, unless they should succeed in establishing wireless communication with the outside world. It is not even known whether Shackleton's party ever succeeded in setting foot at any point on the Antarctic shore.

Lieut. Filchner and his party, who entered Weddell Sea in December, 1911, were unable to effect a landing, but their ship was caught in the ice and drifted helplessly until the following November.

If Shackleton is on land, and has not come to grief in an attempt to cross the continent, the unforeseen prolongation of his stay in the Antarctic will probably have no serious consequences, but will, on the other hand, afford the expedition an opportunity to carry out more extensive explorations than were originally planned.

Fortifications of the Future

ONE of the most startling surprises of the European War, not only to the laity, but to military men as well, was the comparative ease with which the big guns of the Germans battered down fortifications, such as those of Antwerp, which had been considered practically impregnable. Under the iron hail from the "42-centimeters," massive masonry reinforced concrete crumbled like heaps of sand before a flood-tide. As a result, the entire scheme of defensive fortifications all over the world will undoubtedly undergo serious modification. Naturally enough, nowhere more than in France has the subject received grave and anxious consideration. Already a well-known army man, Lieut.-Col. Boissouet, has contributed an article upon the subject to the supplement of a leading French encyclopedia. His conclusions are based on a careful study of present conditions and will doubtless be of peculiar interest to all the advocates of "preparedness" in the United States. He declares that the number of fortresses will doubtless be greatly reduced, while those that remain will be entirely reconstructed at an enormous expense. He advocates the razing of those not thus rebuilt according to modern ideas, on the ground that their conservation in their present condition would be more dangerous than useful. Moreover, the sale of the sites of the latter would help to defray the cost of rebuilding the former.

The main features of the newer style of defensive constructions are systems of connecting trenches and magazine batteries completely buried and masked, and protective networks of wire. He continues: "The infantry works will be analogous in dimension and organization to a German fortress (*feste*), in which there is neither a fort nor armored batteries; there will be a few batteries for the defense of the works and the concrete shelters, but these will be completely buried, with no projection above ground. The shelters, of restricted dimensions, will so far as possible receive light and air from the side towards the interior of the fortress. The line of combat will be constituted by works of this type, mutually flanking each other as well as may be. The batteries meant to oppose the attacking batteries will, as a general rule, be placed behind the infantry works. They will be simple earthed batteries, completely hidden from view, but close by them will be magazines for munitions and shelters for the various troops.

These magazines and shelters will also be subterranean, concreted, and so constructed as not to reveal their emplacements upon the surface. They will be of small size, but numerous, so that the destruction of one will not be of too serious consequence.

"All the infantry works, the batteries, the shelters, and the magazines, will be connected with each other by subterranean passages."

As regards the armament of such a fortification the author observes that it must consist of a large number of guns, which need not, however, be of large caliber, since they will not be directed upon heavy masonry and concrete. However, they must be well munitioned.

He estimates the expense as exceedingly high, not so far as concerns the cost of the trenches and the wire, but first because of the great extent of territory covered, and second because of the indispensably large number of magazines, shelters, and communicating passages required.

"Each place must cover extensive territory for several reasons, the principal one being that usually each intrenchment will have a town or city in its interior. It is not to protect such towns (with the exception of Paris), that these fortifications will be constructed; it is because the reasons that conduce to such fortification of any position—such as its being an important junction of roads, a convenient crossing point of a river, etc.—are the reasons which have naturally led previously to the foundation and growth of a city thereat."

In outlining these requisites for the forts of the future, Lieut.-Col. Boissouet has been guided by the reports of the commissions of Bourges and Châlons in 1886 and 1887, by the proposals of Gen. Langlois, by a study of the siege of Port Arthur, and by conditions actually obtaining in the present war. He concludes with the observation that when the contemplated reconstruction is undertaken after the close of the war, the first thing to be decided upon, independent of all strategic consideration, is the number of fortresses to be constructed, reminding his readers that since each will require a large and solid garrison it is advisable to have as few as are indispensable.

Electricity

Self-Regulated Electric Iron. — Equipped with a simple form of thermostat, there has been introduced an electric iron which automatically maintains its temperature at any desired point. Adjustments in temperature are effected by turning the knob, after which the thermostat member turns off the current when the heat exceeds the limit set and again closes the circuit when the temperature falls slightly below the lower limit.

Flashlamps and the War.—Attention has been called before in the columns of this journal to the wide employment of electric pocket lamps by the fighting men of Europe. According to a recent statement in the *Daily Mail*, it is learned that two London firms have produced between them no less than 2,000,000 batteries during the past year. Prior to the war only about 50,000 such batteries were made in the entire United Kingdom.

Specific Current Consumption of Gas-Filled Tungsten Lamps.—In a recent issue of the *Electrical World* there appear the results of a series of experiments made by Ralph C. Robinson on gas-filled tungsten lamps. The experiments reveal that while the mean horizontal watts per candle-power are very different for different mountings of the filament, the watts per spherical candle-power are practically constant, about 0.8. The mean horizontal watts per candle-power were as follows for the different filament mountings: V-shaped, 0.66; vertical, 0.595; horizontal, 0.082, and diagonal, 0.635.

Two New Patents on Lamp Filaments.— There has been granted to a Baltimore inventor a patent covering the use of satisfactory alloys of zirconium and iron in the making of tough, malleable and ductile lamp filaments. It is stated that these filaments also possess the property of selective radiation and have a high degree of luminosity at relatively low temperatures. A patent has also been granted to a Swiss inventor, covering the preparation of tungsten for lamp filaments. By means of a resistance furnace the tungsten is fused to a perfectly liquid condition and then rapidly cooled by air blast. It is claimed that the process makes the tungsten exceedingly malleable and ductile.

The High-Rate Discharging of Storage Cells was the subject of a paper read by Joseph H. Tracy, assistant chief engineer with a leading accumulator manufacturer, before the New York Section of the Electrical Vehicle Association recently. In this paper he pointed out that by lowering the discharge rate of a battery each time it appears to be discharged, considerably more ampere hours can be obtained from it than by continuing at the higher rate. The ability of a storage battery to discharge at a high rate was demonstrated when the speaker short-circuited a 70-amp. cell for several minutes, allowing a short period for recuperation, and then discharged again at a high rate. The current started at about 3,000 amp. and dropped gradually during each discharge.

Carbon Consumption of Electric Arcs.—A paper on this subject was read before the Royal Society recently by Prof. W. G. Duffield, who described experiments to determine the amount of material lost by the poles of a direct-current carbon arc under different conditions of current and arc length. For a given current the carbon consumption of both the anode and the cathode increases with the arc length until a constant value is reached. Using long arcs the consumption per coulomb decreases with increasing current; the ratio of anode to cathode consumption is about 1.5, increasing slightly with the current. The author also concluded that the loss of an atom of carbon from the cathode of a very short carbon arc is accompanied by the transfer between the poles of a quantity of electricity equivalent to four electronic charges, and that in long arcs the loss is due to this essential carbon disappearance plus a quantity due to combustion.

Electrically-Operated Typewriter.—There has recently been placed on the market a typewriter of standard design which is equipped with special mechanism so that form letters may be written automatically from a perforated paper record or master sheet. The paper records are perforated on another machine provided with a standard keyboard. The automatic typewriter is operated by a 1-20th horse-power electric motor, and if desired the auxiliary mechanism can be disengaged and the typewriter used in the usual way. Thus it is possible to fill in the name and address of the person for whom the letter is intended and then start the paper record mechanism running for the balance of the letter. Further, the mechanism can be shut off at any point and a special sentence or paragraph inserted. Obviously, the work produced by this machine is identical with that produced on the conventional typewriter, hence is accorded the same attention by the recipient as would a personal letter. The new machine is said to write at the rate of 130 words per minute.

Science

A Remarkable Collection of Old Pianos European and American, including a number of examples dating from the latter part of the 18th century, has been presented to the U. S. National Museum by Mr. Hugo Worch, of Washington, D. C. Seventy instruments have been thus far turned over to the museum, and to this collection will be added several hundred photographs, showing every phase of the pianoforte industry prior to 1850, making a unique assemblage of material on this subject.

An Echo of the "Karluk" Disaster.—The Department of the Naval Service, in Canada, has published in full the diary of Captain Bartlett, master of the Arctic exploring ship "Karluk" of Stefansson's expedition, from July 13th, 1913, when he took command at Nome, to April 22nd, 1914, when he arrived at Cape Serdze, after his hazardous crossing of the sea ice from Wrangel Island and a subsequent journey along the Siberian coast. It also includes a summary of later events, including the rescue of the survivors of his party from Wrangel Island. It is accompanied by a sketch map showing the drift of the "Karluk."

Altitude of the Aurora.—An instructive diagram is published in *Nature* of March 2 by Carl Störmer, which shows at a glance the distribution with respect to altitude of hundreds of auroras, determined by means of simultaneous photographs from the two stations Bossekop and Store-Korsnes, during the aurora expedition of 1913. In all about 2,500 determinations of altitude are shown by dots in one small diagram. Very few dots are seen below the level of 90 kilometers, while a vast majority lie between 100 and 110 kilometers. An extremely small number of altitudes exceeded 200 kilometers, though three appear to have been above 300.

Latin as an International Language.— A letter from Sir Lauder Brunton, recently published in *Nature*, advocating the use of Latin as a living international language, has aroused considerable interest and called forth many comments, of varying tenor, from the readers of that journal. One of the arguments put forth in behalf of this plan (which is by no means a novel one) is that it would reconcile the conflicting claims of classical and scientific education. We are much inclined to doubt, however, whether it would have any such result. A Latin fully adapted to modern needs would probably be so unlike the classical tongue that the humanist would contemptuously disown it.

Subantarctic Cruise of the "Carnegie."—The latest magnetic survey of the "Carnegie" has taken her into far southern latitudes. She left Lyttleton, New Zealand, December 6th, 1915, and the latest letter received from her commander is dated from King Edward Cove, South Georgia, where she arrived January 12th, 1916. During the voyage search was made for Dougherty Island, but although the vessel passed within 3 miles of its charted position it was not visible from the masthead. Captain Ault states that it has either been very much mislocated, or it has disappeared, or possibly it was an ice-island. Magnetic observations were made daily, in spite of storms, rain, snow, fog and prevailing cloudy weather.

Qualities That Indicate Hardiness in Apple Trees.— Messrs. S. A. Beach and F. W. Allen, Jr., have recently carried out extensive investigation in Iowa to determine some satisfactory index for distinguishing hardy apple trees before they are old enough to fruit. According to the *Experiment Station Record*, the results of these studies as a whole suggest that there is a rather close correlation between hardness of wood and ability to withstand cold, though the variation from this rule is great in some cases. A large amount of stored starch in the pith and medullary rays is another frequent accompaniment of hardiness, as is also large, thick petals. The length of season required by the tree to mature the season's growth appears to be the best index of hardiness. None of these features, however, appears to be conclusive.

Studies of Marine Fog made during May, 1915, aboard the ice-patrol cutter "Seneca," were described by Mr. P. V. Wells, of the Bureau of Standards, at a recent meeting of the Philosophical Society of Washington. Measurements were made three times daily of the number of persistent nuclei in the air per cubic centimeter, by the corona method of Barus. The number was found to be never less than 400, normally 1,000, and on three occasions as high as 50,000. The nucleation was generally high in cyclonic areas, leading to the inference that the nuclei at sea are chiefly salt particles; *i. e.*, evaporated spray. The amount of water in a cubic meter of fog was found, by evaporating the fog electrically and measuring the humidity at the higher temperature, to be 0.7 gram. The fog particles were found to have a diameter of the order of .0005 centimeter. A rise of 1.4 deg. Cent. in temperature would dispel this fog, and therefore a slight temperature "inversion" resulted in a shallow fog, not extending as high as the masthead.

Industrial Efficiency

Driving Screws by Compressed Air.— A leading American automobile manufacturer has found it advantageous to install a compressed air device for driving wood screws and machine screws and nuts. The compressed air engine can be fitted with any attachment best suited for the work at hand. It is reported that a saving of 75 per cent in labor cost over the usual manual operation has been effected by the installation.

Industrial Preparedness in Holland.—Industrial preparedness for the Netherlands is being advocated by the *Netherlands Exportblad*, published in Amsterdam. It calls attention to the great extent to which the Netherlands has been dependent upon the manufactures of other countries, and recommends that trade guilds be formed and presided over by practical experts in machine building, shipbuilding, paper making, brewing, and other lines, where the youth of the country may be trained to these pursuits.

Increasing Motor Truck Efficiency.— In a recent issue of *Factory* a contributor suggests a simple yet most efficacious method of securing greater service from any motor truck. He recommends the use of a number of crates or tubs, which can be loaded at any time and handled by a derrick which places them on and removes them from a motor truck. Thus the motor truck becomes practically independent of loading operations and the minimum of time is spent in loading and unloading. If a trailer is used in conjunction with a motor truck, this system of loading is even more effective.

Cigars and Cigarettes—and Fires.— During the past year it is reported that there were 1,306 fires caused by cigars and cigarettes carelessly thrown away in New York alone. The average loss per fire during 1914 was a little over $569, and if each fire resulting from cigars and cigarettes and other similar causes should equal this sum the total loss due to carelessness would be about $743,114. Carelessness with matches during the year 1915 resulted in no less than 1,314 fires as against 1,248 such fires in 1914. Ordinances have been put into effect in New York with a view to lessening the number of fires arising out of carelessness.

Government Employees Edit Magazine.— Once a month it falls to the lot of employees in one of the nine bureaus of the Interior Department of the National Government, who are members of the Home Club of Washington, to edit *The Home Club Bulletin*. The March issue, for instance, has been edited and published under the supervision of members in the U. S. Patent Office and contains 24 pages devoted to subjects of particular interest to members of the club. Aside from the pleasure which the employees of the Interior Department find in this new task, the change which it affords them from their routine work may well be considered of material benefit to them.

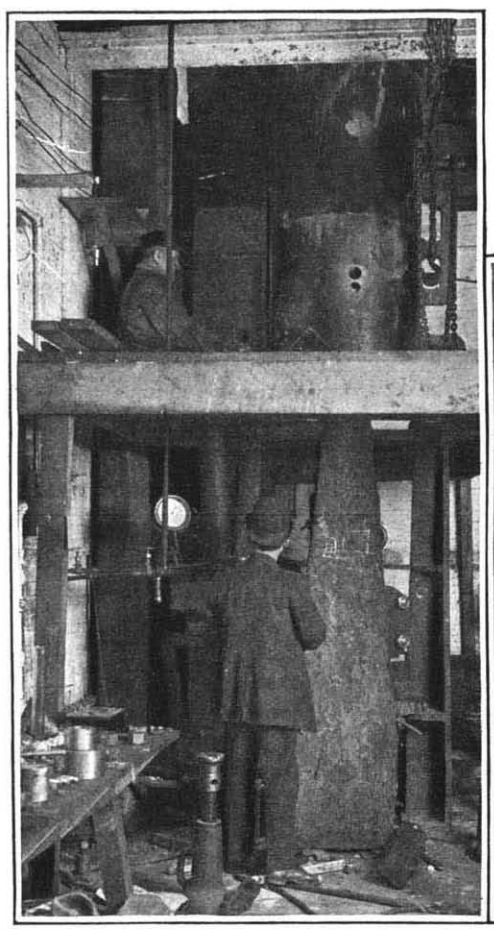
The Phonograph as an Industrial Coach.— There exists a dry-cleaning establishment in Cincinnati, Ohio, that gives its employees music at frequent intervals, with the object of speeding up the workers. There are some 300 workers in the plant, and the firm has installed a sufficient number of phonographs to provide music for them all. It is reported that in the pressing room the girls swing their irons over the work to the tune of popular marches and songs, and that much of the monotony of the work is eliminated by the music. The manager of the plant states that this novel idea in industrial efficiency originated in South America.

Corrugated Cardboard Boxes vs. Wooden Boxes.—Because of their many advantages over wooden boxes in the shipment of small articles, corrugated cardboard boxes are rapidly replacing the former. Although the cardboard boxes are strong enough to withstand heavy pressures, they weigh considerably less than a wooden one of the same size, hence they effect an appreciable saving in express or freight charges. Furthermore, the cardboard boxes, because they can be folded flat and stored in that shape until used, occupy but little space. As a typical example, it is reported that 3,000 cardboard boxes have been stored in a space which formerly accommodated but 260 wooden boxes of the same capacity.

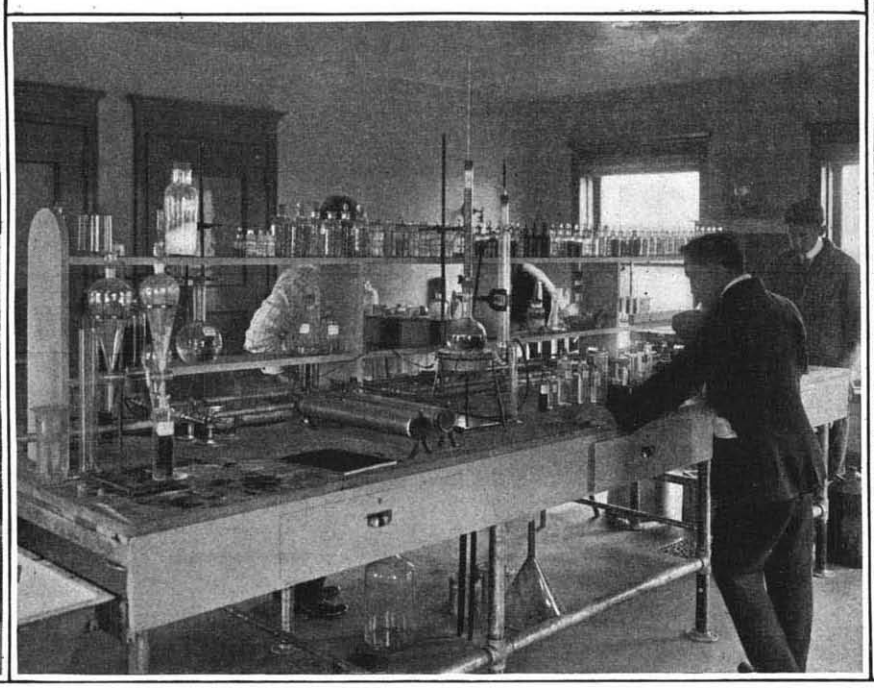
Fuel Conservation on Railroads.—Writing in the *Rock Island Employes' Magazine* recently, D. B. Sebastian discloses a number of interesting facts regarding the huge coal consumption of this representative American railroad, as well as the vast opportunities for economy and careful methods of handling in this branch of railroading. He states that the Rock Island railroad annually requires approximately 100,000 cars of coal to operate its trains. The fuel bill for the year 1915 was $6,531,592. One shovelful of coal saved out of each ten shovelfuls, which is not a difficult or impossible achievement in view of the existing wasteful methods of firing locomotives, would effect an annual saving of $653,159.20 without impairing in any way the efficiency of the railroad.

The Problem of Gasoline Supply

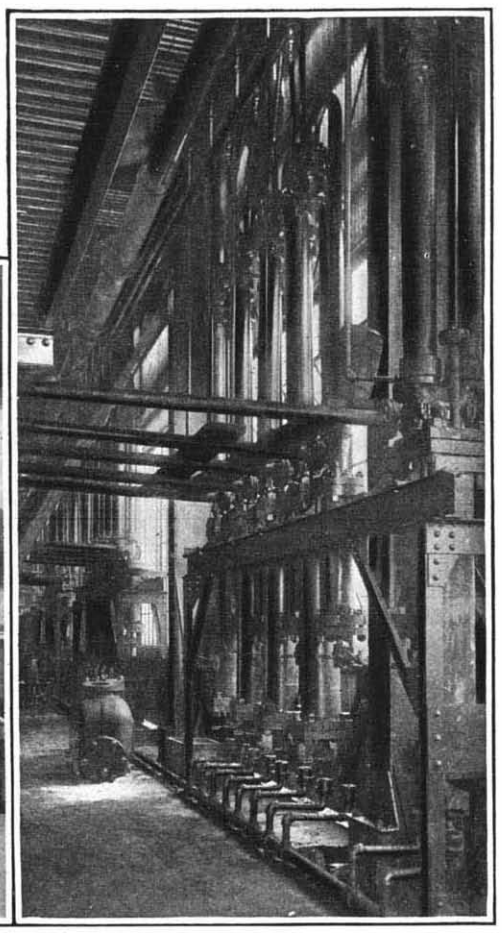
Review of Present Conditions and a Forecast of the Future



Arrangement of a small, single-tube furnace in the first experimental plant of the Rittman process



Laboratory at the development plant, showing the type of distillation apparatus used in testing cracked oil. It is imperative that the oil produced be tested at frequent intervals



Arrangement of condensers for multiple tube furnaces in an installation of the Rittman process

THE widespread and practically universal use of stationary gasoline engines, automobiles, farm tractors, motorcycles and numerous other gasoline-consuming machines renders any limiting or restricting of the motive agency, however it may be brought about, of great, if not vital, interest to practically everyone. So it is that the increased cost of gasoline presents a serious problem to automobiling, from the standpoint of the manufacturer all the way down the line to the ultimate consumer.

Conservation of the gasoline supply truly strikes the very heart of the entire automobile and allied industries. It comprehends not only the initial seeking for the treasure, but also the ultimate use of the refined product. Thus it begins with the drilling of the wells for the crude petroleum and extends throughout the industries even to the necessity of collecting statistics covering the petroleum and gasoline demand so as better to enable the producer to control his output in accordance with market conditions. Conservation also comprises the careful usage of the refined product and the avoidance, as far as possible, of wastage in the consumption of crude oil where other heating mediums can be utilized instead.

Within the limits of this article it is difficult to discuss in a technical way all of the problems that confront one seeking the conservation of gasoline. Consider, for instance, the opportunities of improvement in the production of the raw material. Existing processes of extracting oil from the earth leave much oil in the sands. This loss is still further increased if the wells are not properly drilled and cased to exclude water.

Prior to the entry by the Bureau of Mines of the Oklahoma field it was considered impossible to drill oil wells through high-pressure gas sands without wasting the gas. As a consequence, in the development of the Cushing field less than 10 per cent of gas has been utilized, and the remaining 90 per cent of gas which is allowed to go to waste is estimated conservatively to be worth $15,000,000. Obviously, there should be a rare opportunity for improvements tending to better the drilling of wells and the subsequent handling of the oil and gas. There are also opportunities for improvement in connection with the storage of oil to prevent or lessen evaporation, as well as in the separation of the oil and the gas where the two occur together under high pressure, by means of traps or other devices which would permit the recovery of the gasoline before the gas is used for fuel purposes.

The Bureau of Mines, among other things, suggests a stoppage of the wasteful burning of petroleum under boilers. It also discourages the use of crude oil in the making of artificial gas. It recommends in no uncertain words the discontinuance of the practice of burning oil in cases where substitute fuels are available. The waste not only of oil but also of natural gas, believed to be readily preventable, now exceeds millions upon millions of dollars annually. This waste is not only incident to the loss of petroleum as a result of mixture with water and the loss incident to prematurely-abandoned wells, but also to the tremendous waste from gushers and other sources of supply difficult to control under existing systems of operation.

The Secretary of the Interior has suggested in a communication to Congress several ways of relieving the situation, such as the use in internal combustion engines of heavier distillates approaching kerosene and involving the use of a successful kerosene carburetor. He also urges the general use of cracking processes by which gasoline may be produced from kerosene and other less valuable petroleum oils, apart from the quantity of gasoline already distilled from the original mineral oil. Views of an installation for treating oil by the Rittman process accompany this article. Details regarding the process appeared in the March 20th, 1915, issue of the SCIENTIFIC AMERICAN. Another of his suggestions is the development of gasoline substitutes, such as benzoin, and the utilization of oil-shale as an alternative source of gasoline. While it is true that the development of the gasoline engine as used in motor vehicles has had for one of its features the steady increasing of the mileage per gallon, still this has failed to prevent the steadily increasing demand due to the enormous increase in the production of motor cars.

Students of the subject are realizing more and more the importance of some reliable collection of statistics relating to the entire field. This is accomplished, in a way, by several departments of the Government, including the Geological Survey, the Federal Trade Commission, the Census Bureau, and the Bureau of Mines. It is believed, however, that the time is near at hand when some bureau of the Government will be especially charged with the reliable collection of statistics and the publication thereof, so that they may be readily available to all interested in the industry.

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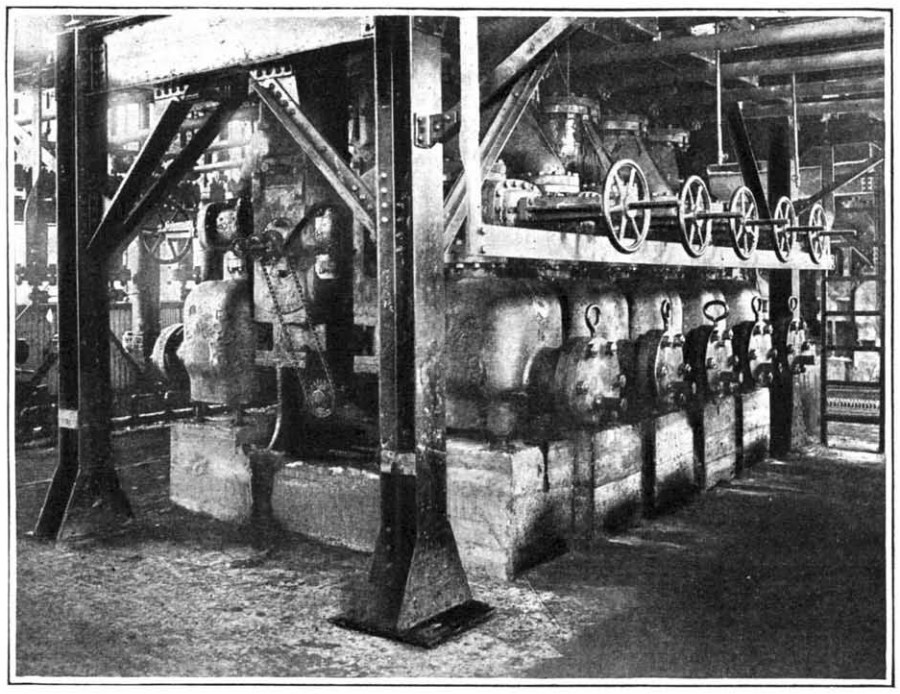
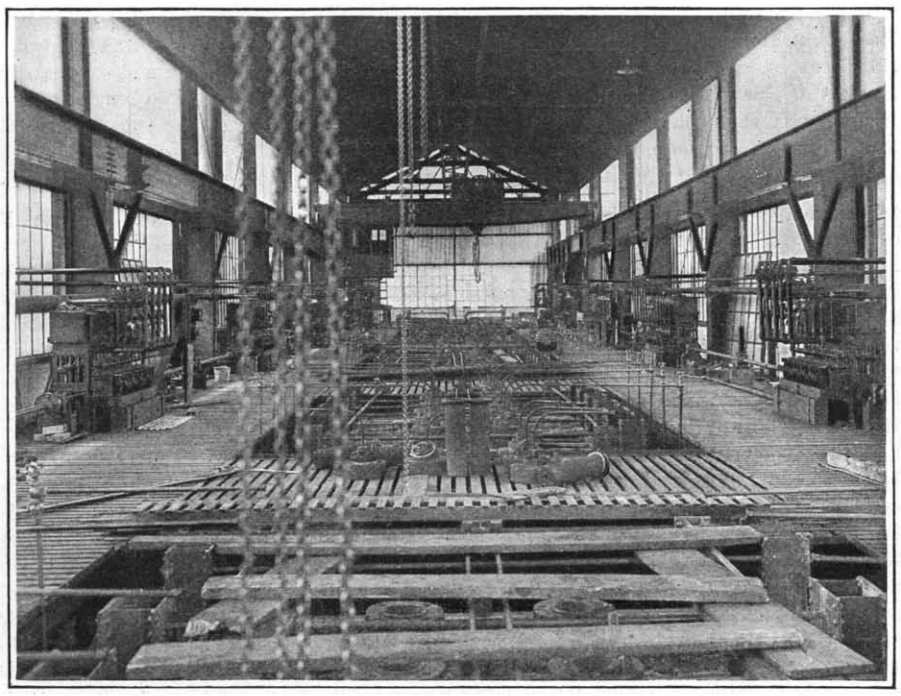
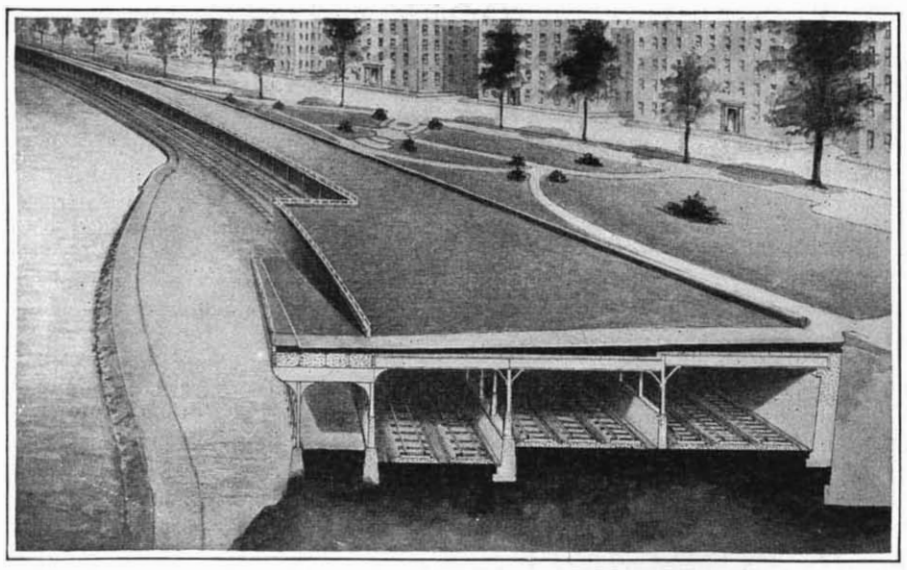


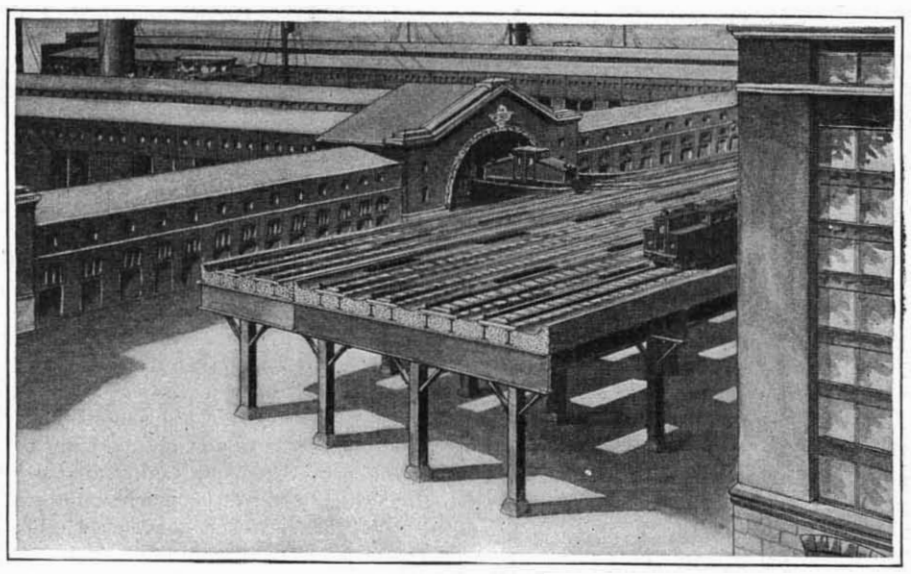
Tar necks and carbon pots of the oil-refining installation, showing arrangement of gate valves



General view from balcony of oil pumps and pressure release valves in an oil refining plant



Section of the roofed-over tracks at west 145th street showing a ramp leading to the motor boat basin



Typical section in the neighborhood of west 42nd street, showing connection with the proposed new piers

Proposed Improvement of New York's Hudson River Front

Eliminating Railroad Operation at Street Grades

NEW YORK CITY bas had occasion to regret sincerely the granting of a franchise to the New York Central Railroad, many years ago, for a street level line down the west shore of Manhattan Island and through the busy section of the city to St. John's Park. It has been paying in blood for this hastily given franchise. The yearly death toll has empbasized the pressing necessity of eliminating the railroad from its street grade. Aside from this, the railroad bas proved an eyesore along the beautiful park sections lining the Hudson River. Riverside Park might more properly be called Railroadside Park, for it is separated from Hudson River by lines of car-filled tracks.

For some time efforts have been made to remove the objectionable features of the line. In the SCIENTIFIC AMERICAN of May 6, 1911, we published plans then proposed for running the tracks of the New York Central Railroad underground through Riverside Park and providing elaborate dock facilities near the lower end of the park, which would facilitate the handling of freight between rail and steamship lines and across the river to the railroad terminals in New Jersey.

A far more satisfactory plan has just been made public by the Board of Estimate's Committee on Port and Terminal Facilities, and public hearings are now being held on the plan. It provides for putting the tracks underground through the park and residential sections and placing them on an elevated structure through the commercial sections. This will give the city a practically continuous parkway from 72d Street to Spuyten Duyvil, with no unsightly railroad line to mar its beauty. Riverside Park will be extended to the river front throughout its entire length, and there will be no commercial exploitation of the shore line. Even such piers and structures as now exist will be reduced or removed altogether.

Below Spuyten Duyvil, Inwood Hill is to be converted into a park. The Harlem ship canal will be crossed by a new swing bridge connecting with tracks that pass into a tunnel through Inwood Hill. Within the covered section from 151st Street to 133d Street the railroad will construct a freight yard. Manhattan Street will be crossed by a viaduct, and the tracks will then plunge underground again through the Riverside section. At 59th Street the line will emerge from the ground and be carried on an elevated structure for the rest of its course down to Canal Street, where a new terminal is to be built. Connection will be made between 59th and 42d Streets with the proposed new piers, the trains entering the piers on an upper level. Provision is made for the city to build two tracks paralleling the New York Central tracks from 59th Street south to 30th Street, using part of the Central's structure. A marginal way is also allowed on the west side south of 30th Street for the construction of a municipal railroad terminal. South of West 30th Street the New York Central lines will run through a private right-of-way and will be completely screened from view except for street crossings.

Between West 39th Street and West 30th Street, where the railroad now has a large yard, provision for entrances into the upper story of the reconstructed 30th Street yard has been made. This line will be kept sufficiently inshore to allow the lengthening of all piers between 41st Street and 30th Street, to 800 feet.

The West 30th Street yard, which covers the area from West 37th Street to West 30th Street between 11th and 12th Avenues, and several additional blocks west of 11th Avenue, will be also entirely rebuilt, with great incidental advantages to the city. The railroad plans to build a double-deck freight terminal designed to handle immensely increased business. At present three streets are entirely closed to traffic and the remaining streets in the section are crossed by dangerous surface railroad tracks. According to the new plan, all grade lines east of 12th Avenue are to be eliminated and streets now closed are to be opened to the water front.

The main cost of this great engineering undertaking will be covered by the New York Central Railroad. According to the report, real estate valued at about $11,000,000 will be transferred to the New York Central, which will be offset to a large extent by the transfer of real estate valued at about $5,000,000 to the city. However, most of the city's contribution consists of sub-surface easements and rights to cross streets on a slightly elevated structure, and similar grants of comparatively little value to the general public, whereas the benefits it will receive from the real estate transferred by the railroad will be of value to the whole city.

The city will make no money contribution whatever.

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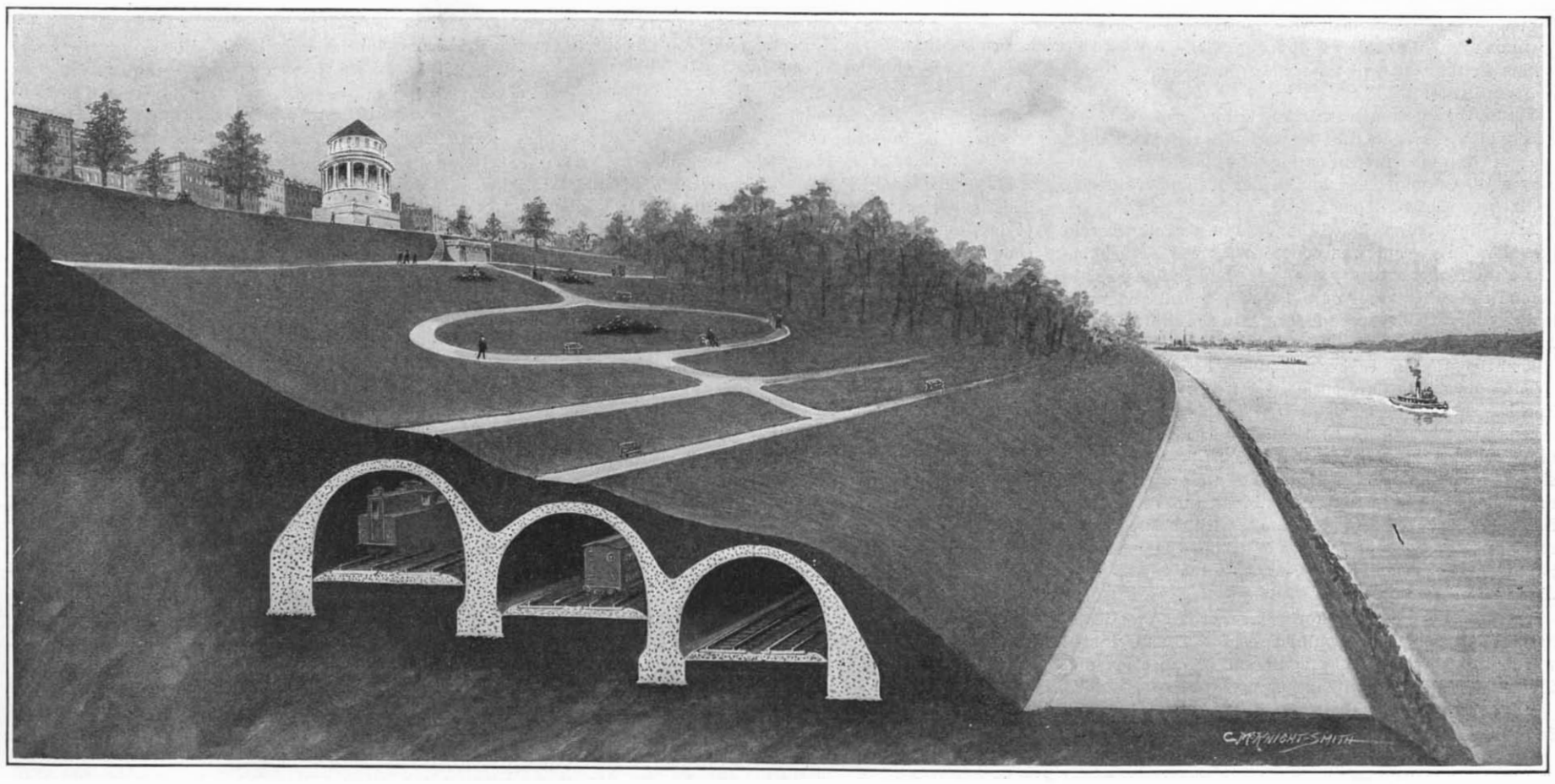


Section through Riverside Park above Grant's Tomb showing how the park will extend over the New York Central tracks to the river

Strategic Moves of the War, April 28th, 1916

By Our Military Expert

ONE of the great surprises of the war resulted from the landing last week of Russian troops in France. No positive figures as to their number have been available, but it is estimated that the force consisted of approximately 20,000 men. A second expeditionary force is reported as landed in France.

From seemingly authentic sources it is also reported that the Russian government contemplates placing at least 250,000 Russian soldiers upon French territory within a few weeks.

If this be true it furnishes considerable food for thought. The sailing of the expeditions had been kept a profound secret except to the members of the *Entente* general staffs, and much speculation as to the exact meaning of this feature of war's development resulted. The consensus of opinion of military observers, founded upon the slight data available, was that Russia wished to demonstrate her full allegiance to the Allied cause.

Some observers, principally of Teutonic sympathies, professed to see an indication of French weakening, for they argued:

"France has lost so many men that she has been compelled to draw on other resources to supply her losses."

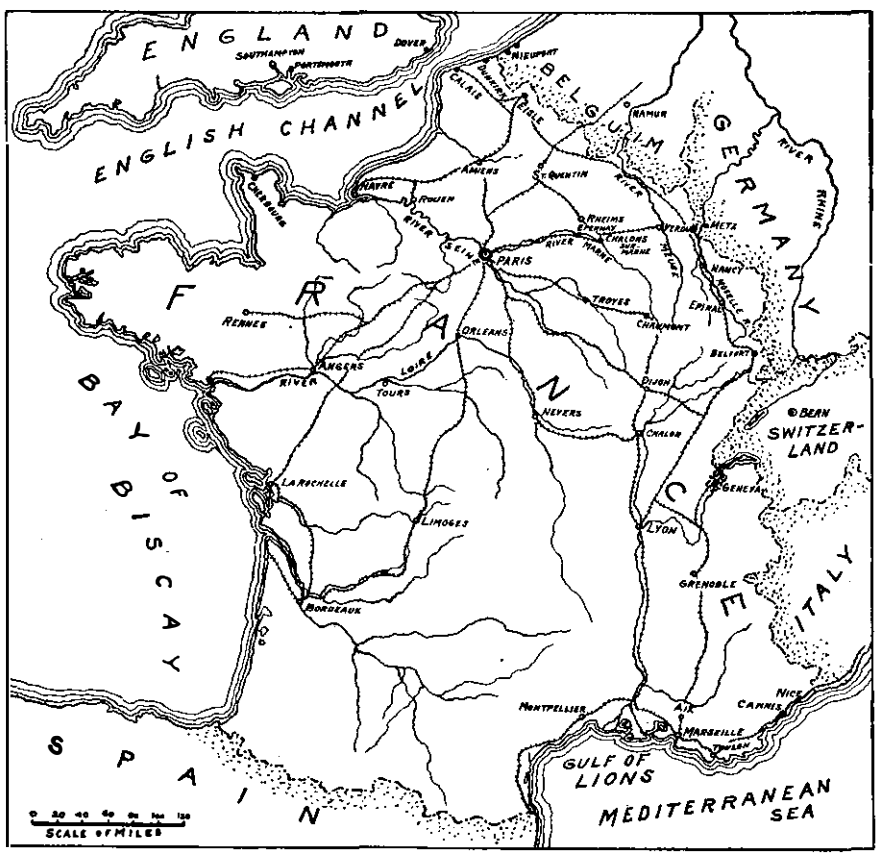
This, on the face of it is out of the question. France with at least 3,500,000 men available for service occupies not more than two thirds of the western line, the British having taken over the remainder to some distance south of the Somme River, thereby releasing French troops for service at Verdun.

There is, however, a larger and more significant aspect to the case. Russia's hordes are countless: far in excess of what her munition factories can now equip. As France and England are in a much better case, so far as equipment and its manufacture is concerned, they are naturally desirous of aiding their Eastern ally in every way by sharing their resources with Russia.

Report has it, then, that arms, equipment and munitions are to-day assembled in France for these Russian troops. Instead of sending these supplies into Russia through Archangel or Vladivostok, both of which ports are extremely distant from France and inaccessible as well, Archangel being held in a grip of ice throughout the winter, it is far easier to equip these men in France. Comparative paucity of railway service in Russia renders the handling of such imports difficult in the extreme.

The greatest significance of this movement, however, is that it seems to indicate the probable course of *Entente* action in the near future.

If Russia does send this powerful army of men to the west, deduction is forced upon one that the main effort for decisive action in the war will take place on the western line.



Where French, British, Belgian and Russian troops are striving to reach a decision with the Teutonic Allies

Verdun has demonstrated the character of the deadlock which exists in this theater of war. With magnificent courage, determination and impeccable military skill, Germany has hurled her legions fruitlessly against a rock-like defense.

After the first weeks of the Verdun assault wherein considerable ground was conceded by the French because the higher military authority had decided not to defend the salient east of the Meuse, moral and political considerations caused a reversal of military policy; and at the eleventh hour of the defense it was concluded that the line east of the Meuse be held.

The outcome to date speaks for itself. The French line has scarcely been dented since this decision was taken. It now seems as though Germany had bent every military resource in the attempt to gain a decision at this point, and it also seems almost a foregone conclusion that Germany cannot break the French line here. France opposed Germany with between one third and one half the number of troops that were engaged in the assault; the losses of the latter were absolutely appalling.

Therefore, Germany's efforts have gained practically nothing but the admiration and respect of a fascinated world, in tribute to her magnificent organization and the wonderful fight she has put up.

With the lessons of the Verdun attack fresh in mind, fully digested by the allied general staff, it is easy to see, and reasonable too, why even the millions of troops possessed by France and England should be re-enforced by contributions of men from their eastern ally. Every indication points to the launching of an enormous offensive by the *Entente* some time within the next few months. To be of any value this attack must be made on a titanic scale, and the losses which such an attack must sustain must be measured by the losses Germany has experienced at Verdun.

If any such gigantic attack is to be made there must be sufficient men available for immediate service, a portion to remain effective for carrying an attack through many successive lines of trenches after deducting the stupendous losses which must accompany it. If this attack be launched on the front of, say a hundred miles, allowance must be made for losses averaging 20,000 men a mile of front—a total of 2,000,000 stricken men. And other millions must remain available, organized, to hold and consolidate the positions won at this awful cost. Russia's quarter of a million effectives in France may therefore really constitute, with their brothers of the west a resigned sacrifice on the altar of Mars—"Ave Cæsar Imperator."

There has been much speculation as to the whereabouts of England's acknowledged 4,000,000 men under arms. While the British have taken over a considerable sector of the French line, in addition to their occupation of the Flanders front, an observer but recently returned from abroad reports with reasonable authority that there are no more than 1,500,000 British troops upon the continent. A scattered few are in Mesopotamia, Egypt, and in other portions of Africa; a more numerous body is within the lines of Saloniki. This leaves a force of at least 2,000,000 men in England to-day, undergoing and having undergone an intensive course of military training. This same observer says that it is generally known abroad that this British force is being held in hand solely for the launching of the grand offensive. France has classes not yet called to the colors, while there are enormous bodies of organized, trained troops in France to-day which have never fired a shot in this war; they, too, are being preserved for the offensive.

It is common knowledge that the losses must be absolutely staggering when "The Day" arrives. There will probably be need of every available man, and Russia seems to be supplying her quota for the slaughter, in addition to maintaining her own individual lines on the eastern front and in Asia Minor.

It has occasioned considerable surprise that Russia was in such condition that these men could be spared. The deduction is forced upon one that her circumstances must be even better than currently reported. With a time-distance between Russia and France, via Vladivostok, of over a month, by Archangel somewhat less, the detachment of Russian troops is irrevocable. There can be no calling them back should Russia herself need aid, for, if any such crisis threatened, it must culminate before they could be shifted. The fact that Russia is sending troops to France, therefore, does little to offset the great advantage of interior lines which the Central Empires possess.

It is impossible for the *Entente* to shuttle troops backward and forward with anything like the ease and effectiveness which Germany has enjoyed. The German military railway system, while but a unit in the practically perfect military machine, has been the key to Teutonic success to date.

To help render this advantage less great—it cannot be voided—it seems imperative that when an allied offensive is undertaken, it must be assumed on every front, that troops may not be detached and massed by the Germans at will.

Spring, with its weather benevolent to military operations, is almost here, and the auspicious time for such an offensive seems near at hand. The eastern lines are still held immovable by the thaw; this is the condition which has safeguarded Germany in detaching powerful forces from the eastern lines to use against the west. But if reports as to Russia's "come-back" are true, the day is not far distant when the eastern line must be occupied in force to withstand assault. The tremendous *Entente* forces at Saloniki are not held there for amusement. The comparatively recent conference of the Italian Generalissimo with the Allied Powers That Be, with the summoning of additional Italian classes to the colors, seem to imply that at least there will be no abatement of activity on the Italian line. These are necessary concomitants to assumption of the offensive in France.

The coming of the Russians to France, therefore, seems to herald activities in the near future on a scale greater than ever before.

The Current Supplement

THOSE who last year read the lectures of Sir J. J. Thomson on Atoms and Ions, before the Royal Institution, will be pleased to learn that this noted scientist has delivered another important series of lectures in which he sets forth modern views on physical science in the same lucid manner which has made his previous discourses so popular. The subject of the present lectures is *Radiations from Atoms and Electrons*, and the first appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT for May 6th, No. 2105. An important enterprise of the Department of Agriculture for the benefit not only of the farmer, but of the public as well, is described in *Reducing Our Waste in Eggs*, which is accompanied by explanatory illustrations. *Aeroplane Struts* describes and illustrates various methods of making these important parts of flying machines. *The Bagdad Railway and the European War* gives valuable information on a subject about which there has been much inquiry of late. *Teaching Scientific Forestry* tells of the valuable work done by a state institution in conserving one of our most important natural industries. The article is profusely illustrated. *Great Electro Magnets* gives many details and much information about a wonderful instrument proposed for the University of Paris, and it is accompanied by numerous diagrams. Other important papers in this issue are *Physical and Mechanical Factors in Corrosion; The Effects of Electrolysis on Underground Piping Systems; The Food Supply of the German People; Sunlight a Necessity for the Maintenance of Health; The Transport of Material in the Form of Dust* and a *Mechanism of Protection Against Bacterial Infection.*

Periodical Devoted to the Study of Soil

WITH the January, 1916, issue, a new publication known as *Soil Science* and devoted to problems in soil chemistry, soil biology and soil physics has made its initial bow. While it is admitted that scores of technical papers on the various phases of soil fertility appear in the course of each year as station research bulletins or in publications devoted to chemistry or agriculture, it is claimed in an introductory note appearing in the first issue of *Soil Science* that under existing conditions the soil investigator is put to much inconvenience in keeping before him all the most important papers on soil research. In the present publication it has been aimed to gather within its covers each month the results of soil research.

Soil Science is published by Rutgers College, New Brunswick, N. J., under the editorship of Jacob G. Lipman.

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.]

Stream-line Bullets in Flight

To the Editor of the SCIENTIFIC AMERICAN:

In your paper of April 8th I notice that Major Alston Hamilton, of our Coast Artillery Corps, makes the statements: "There is now a tendency to still further modify the shape of the projectile by employing other curves than simply circular arcs for the head, and, in addition, tapering the rear portion of the projectile." And: "Tapering away the rear portion of the projectile materially reduces these eddies; but, if carried to extremes, it would cause the flight of the projectile to become very erratic."

I wish to call attention to the fact that this last statement does not conform to the laws of nature, or with what has been learned by aerostatic experiments, which have shown conclusively that the true stream-line shape, such as nature has given to birds and fish, is the proper shape for swiftly moving bodies through both air and water. It is therefore plain that the true stream-line shaped bullet and projectile, which, of course, would have to be used in combination with a gas check cup or wad, is what we will have to come to, to get the minimum air resistance. The metal gas check wad, concaved in front to fit the tail end of the projectile, should hold it straight and true while pushing it through the rifling, and there is no reason to believe the projectile would fly erratically. It is conceded that the projectile would fly with greater velocity, then it would hold its spin longer, and after spending would light head down.

Experiments made by Hiram Percy Maxim in trying to produce a noiseless-flight bullet show that the "whiplash" crack is caused by the front end of the bullet, which is a bow sound-wave. In a letter I received from Mr. Maxim, written last November, he says: "We made bullets tapered at both bow and stern. We found that they made the same crack noise that the flat stern bullet made. Apparently the bow wave is the cause of the bullet's flight noise, and the shape of the stern of the bullet will simply *affect velocity of flight*. I believe we have a right to expect from the 'cigar'-shaped bullet the advantages which you mention. I would not be at all surprised to see such a shape come into use for certain purposes. There is no hope, however, that such a shape would have a silent flight when the velocity exceeds the velocity of sound."

Mr. Maxim has likely done more experimenting in a systematic and intelligent manner in this line than any other one in the United States. Yet it seems that he went no further than the so-called "cigar" shape. He, however, had tackled only the problem of noise, and not velocity. Yet he made gas check cups and "cigar" shapes, and found that there was an improvement in velocity. Now, since velocity is what we need for range, the air resistance is hereby solved as far as we can solve it. I know of no experiments which show that a true stream-line bullet or projectile, with a carefully formed gas check cup, will fly "erratic," and cannot understand how such a conception could be gained, unless cups that collapsed were used in such experiments. In such cases the cup might pinch the tail of the bullet too tightly to drop off easily and evenly after leaving the barrel, or a too lightly constructed cup would not hold the tail true while passing through the barrel. If, however, available for your publication, it would be timely as well as interesting for you to procure from the Government information as to these experiments. It would be interesting to know why the true stream-line shaped projectile would not be an advantage, since that shape greatly reduces resistance, and it is admitted that the semi-stream-line or "cigar" sbape is decidedly advantageous.

ELI E. GREGORY.

Central City, Ky., April 13, 1916.

The National Guard Problem

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your editorial in April 15th issue, it seems to the writer that you are wrong in your main contention.

If Congress has been influenced in its action on the Hay and Chamberlain bills by fear of the political power of the Organized Militia, it has been scared by a mere "bug-a-boo." The power of the National Guard at the polls lies in the votes of the enlisted men and lower commissioned officers who make up all but a small part of its numerical strength.

The attitude of these men toward public matters has always been, and always will be, that of all other patriotic citizens. Each votes according to his conscience and they do not vote as a unit. As far as matters of defense are concerned, it is the writer's belief that if a poll of the Guard were taken, the vast majority would be found lined up in favor of universal compulsory service. No one realizes more acutely than a guardsman that he is training himself and making sacrifices while the other fellow is taking his ease, and in many cases amusing himself by slinging mud at the guardsman into the bargain. It, therefore, seems unfair to deny the militiaman a degree of public spiritedness at least equal to that of the average citizen outside of the Guard.

That the National Guard is deplorably inefficient in some states is no reason to decry its entire personnel. No one will contend, guardsmen least of all, that the Militia system as it exists is the best for National defense. It should not be forgotten, however, that the men in the Guard have been working for years without any reward, and it may be stated as a further fact that they would continue to do so regardless of any action that Congress may take. They have been striving to make as good a force as possible under the system as it existed. In some states they have succeeded much better than in others and it may reasonably be believed that under proper Federal control they all might approximate an equal and a higher standard of excellence. Is it not conceivable that Congress may have been impelled to its action by a belief that the Guard could be thus improved by paying its members and then demanding from them in return uniform effort and definite results in all the states? Such a conclusion is at least as plausible as that which holds Congress to have been dragooned by a money-hungry National Guard with its phantom political power.

The writer is open to the charge of prejudice, having been a member of the National Guard of New York State for over six years. My opinion is, therefore, largely based on knowledge of those officers and enlisted men with whom I have been brought in contact. I give it for what it is worth. The members of the National Guard of New York or any other state would never be found voting en masse for the furtherance of any measures against the country's welfare, even though a few dollars of pay were doled out to them.

CHAS. N. MORGAN.

357 1st St., Troy, N. Y.

Possibilities of the Transatlantic Flight

To the Editor of the SCIENTIFIC AMERICAN:

Having noticed in your current issue a note telling of the second attempt of Messrs. Curtiss and Wanamaker to cross the Atlantic in a single flight in a huge triplane of the former's design and construction, I am writing you in order to point out the fallacy of this undertaking and to show why the project is an impossibility at the present stage of development of aviation.

From newspaper articles it is understood that a new attempt will be made to cross the Atlantic in a continuous flight of 30 hours' duration. Without technicalities, I propose to show undeniable figures from the leading accomplishments in aviation up to the present time that the contemplated continuous flight is hardly possible as yet.

What is required to be known is the weight, resistance, and speed of the machine. With these data it is immaterial what size machine is constructed, so long as it is built upon aerodynamic lines. It is a recognized fact that the average machine does not weigh less than 11 pounds per horse-power; also that no practical aero motor has as yet been constructed that uses less than 0.6 pound of fuel and oil per h.p. hour, and that the resistance at a speed of 70 miles per hour of any machine built for the contemplated flight could not possibly be less than one sixth of the weight. Using these figures, we arrive at the weight per horse-power as follows:

Fuel for 30 hours....	18	pounds	per horse-power
The machine	11	"	" "
Pilot, etc.....	1	"	" "
Total	30	"	" "

The resistance of 1 in 6 is equivalent to 5 pounds per horse-power, and as 1 h.p represents 375 mile-pounds per hour, the resistance of 5 pounds would be equivalent to only 350 mile-pounds per hour, or 94 per cent of 1 h.p., which is in excess of any propeller efficiency.

Allowing for the reduction of weight from consumption of fuel and oil during flight, the mean resistance due to fuel can be reckoned as half, or 9 pounds, causing us to get 3.5 pounds in place of 5 as the head of resistance of the entire machine, which equals at 70 miles per hour, 245 mile-pounds, or 70 per cent of 1 h.p.

These figures prove conclusively that the non-stop flight across the Atlantic is beyond the present possibilities, and this is further proven by the fact that no machine thus far built has demonstrated that a speed of 70 miles per hour has been possible under the above conditions.

With the data given, I challenge any one to show a margin sufficient with which to accomplish the proposed flight. This can only be done when motors are developed having considerably less oil and fuel consumption and with the resistance materially reduced.

It is inconceivable to me that any person having even a slight knowledge of aerodynamics would lend their names and indorse such an undertaking, and it is small wonder that this Government is cautious in following the many suggestions and proposals put to them by some of our aero institutions.

GEORGE LANZIUS.

New York, N. Y.

Galveston's Seawall

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 15th, page 76, under the subject of "Protecting Galveston's Seawall," you published some statements with reference to the storm of last August and its results which we feel sure were made without a full knowledge of conditions and which do a gross injustice to this community.

You say: "Prior to the storm, which destroyed millions of dollars' worth of property and cost hundreds of people their lives," etc. The property loss to Galveston nowhere near approached a million of dollars. The loss of lives within the protected area of the city of Galveston was six, and none of these need of necessity have been lost had the people exercised even due diligence.

You say further: "The force of the storm entirely destroyed the beach, which is gradually rebuilding, however, and lifted the huge rocks clear of the seawall and hurled them in some instances across the boulevard —just inside the seawall 100 feet wide." No such instance as this happened.

The rest of your story is interesting from a mechanical or engineering standpoint, and had it not been for these few lines in your story it would have been entirely satisfactory, but these few lines, giving to the world as they do an exaggerated idea of the situation, are detrimental to our community, and you will agree is an injury, which I am quite sure was not intended.

Although a great deal of relief was offered by outside sources at the time of this storm, Galveston declined all such relief, and among her own citizens subscribed and collected sufficient funds to take care of all the relief of a public nature that was necessary at that time. Twenty-two thousand dollars was thus expended, and, of course, in cases of this kind there are always more or less unworthy cases that obtain a portion of the relief.

It is true, as a whole, there were millions of dollars' worth of damage done, because the storm extended as far north as Chicago, and it did more damage in Newport, Ark., and cost more lives in that immediate vicinity than it did in Galveston. It is also true that there were a great many lives lost if you will consider the storm in its entirety and include all of the territory that it affected, but the manner in which your article is written leaves the impression that this tremendous loss of property and life was occasioned in Galveston, and it is with a view to correcting this impression with you, and possibly for you to correct it to your readers, that we are addressing you this communication. May we have the pleasure of hearing from you?

H. H. HAINES,
Secretary and Traffic Manager of the
Galveston Commercial Association.

Galveston, Tex.

Hints for Exporters

To the Editor of the SCIENTIFIC AMERICAN:

As a rider to the letter of Mr. E. Anderson on South American trade, which went into details.

Business men of the U. S. A. who would acquire a clientele in Down America should remember:

That the American expressions, Do It Now, We Should Worry, etc., etc., apply only in the U. S. A.

That foreign customers expect you to do business their way.

That business in Down America is done by the formula: American way multiplied by 1x2x3x4.

That profits are based upon the equivalent of our quarter-dollar the world over. You get nearly as much as by the dollar system.

That you can meet every requirement of this trade if you only will really try.

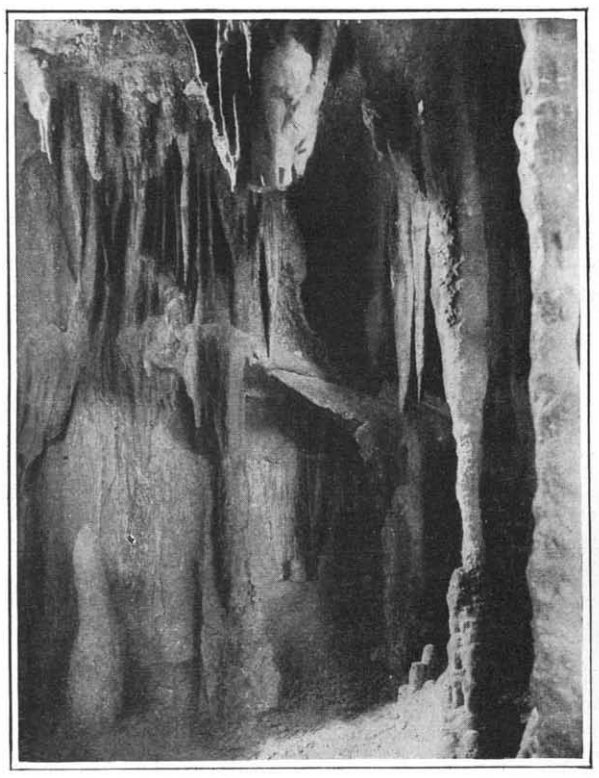
That you have every resource, ability, and equipment of the U. S. A. at your back.

And that only tact, patience and thorough study of your subject are necessary.

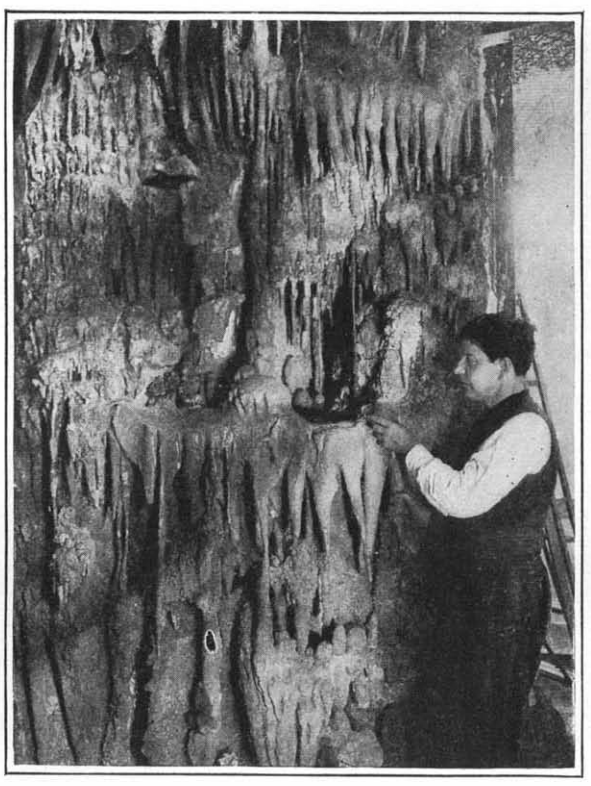
Your legislation, merchant marine, credits, etc., will follow you, only really try.

H. M. HOLLMANN.

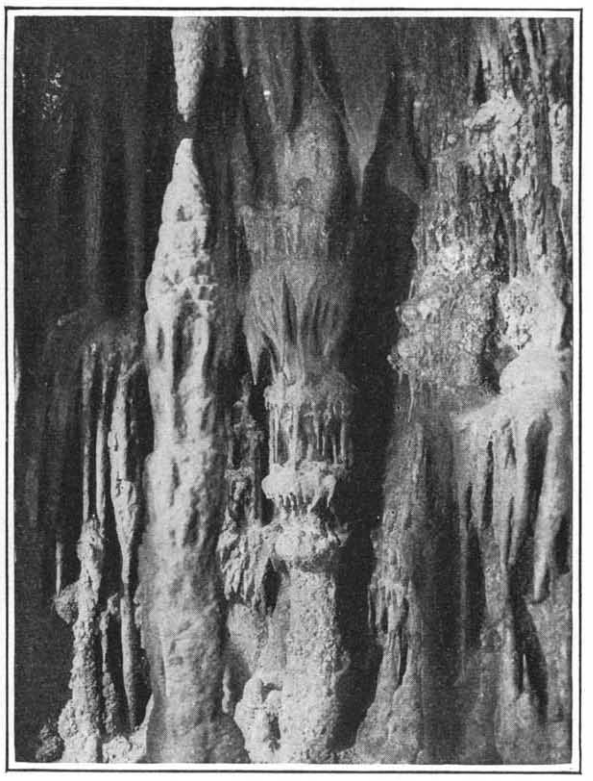
Brooklyn, New York.



A corner of the miniature cave, with a large stalagmite pillar rising from the floor



A member of the Museum of Natural History staff preparing the miniature cave



Central section of the miniature cave, showing the terrace-like formations

Building a Cave at the American Museum of Natural History

By Walter L. Beasley

ALMOST realistic and instructive cave reproduction is now being finished for the Geological Hall of the American Museum of Natural History, New York. It is a miniature of a remarkable newly-discovered grotto just explored in Weyer's Cave, Virginia.

The cave reproduction is faithful in every detail, which makes it at once an impressive and graphic representation of the original one. It is replete with beautiful and fantastic formations of stalagmites which have been carefully removed from the natural cave and transported with great difficulty to the Museum, where they have been assembled in their exact order of occurrence. Thus, as a result of the arduous tasks involved, the cave may be considered as having been virtually transplanted from its natural surroundings to the Museum, where it can be viewed and studied by the visitors.

The fac-simile cave, representing as it does the most advanced and up-to-date type of museum exhibits which impart scientific knowledge in an unusually interesting and efficacious manner, is destined to prove of exceptional educational and popular interest. The author, through the courtesy of Dr. Frederick A. Lucas, Director of the Museum, was afforded the opportunity of securing a series of advance photographs of the artificial cave scenes, which are here reproduced. These views represent the main features of the finished interior of the grotto, which occupies a space seventeen feet long, fourteen feet wide and eleven feet high.

The design, the construction of the artificial grotto, and the arrangement and setting of the many stalagmites have been skillfully performed by William B. Peters of the Staff of Preparation. Over a year of critical and painstaking labor has been devoted to the careful setting and assembling of the numerous stalagmites forming the interior.

Mr. Peters, along with an assistant, visited Weyer's Cave in Virginia in order to accomplish the difficult and somewhat dangerous task of dislodging and removing the weighty formations found on the floor and suspended from the ceiling of the cave chamber. This unexplored grotto, forming the original of the museum exhibit, when opened up was found adorned with a wealth of magnificent yellowish-red stalagmites and

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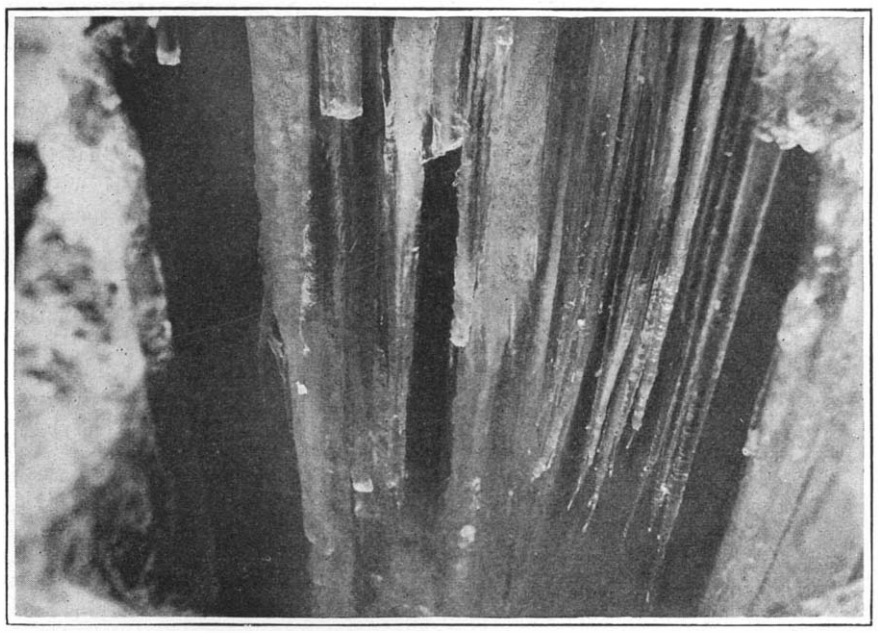

A downward view in the ice mine shaft, showing the huge icicles formed during the summer months

An Ice Mine That Freezes in Summer and Melts in Winter

By Charles Arthur Vandermuelen

UNBELIEVABLE as it may seem, there exists at Coudersport, Pennsylvania, an ice mine. It was discovered some 18 years ago by a farmer who, noting a peculiar coldness---even in the warmest weather---of a certain portion of his farm, was led to dig there in the belief that he would find a deposit of silver. The mine or cave which he unearthed proved to be 40 feet deep and from 10 to 12 feet in diameter. At present, it is entered by means of a ladder, since it is situated on the side of a hill.

Geologists are not able to explain why the mine happens to be where it is, nor why the ice should form, in seeming opposition to the laws of nature, in summer and melt in winter, as it does in this instance. The ice is formed from a peculiar cold mist which comes through openings found all the way from the top to the bottom of the 40-foot shaft. As soon as warm weather arrives, frost appears on the walls of the shaft and soon tiny icicles form rapidly, until in the warmest weather huge icicles, often 2 feet thick, reach from the platform, at the top, to the bottom of the mine. The ice begins forming in May, and in October the thaw sets in.

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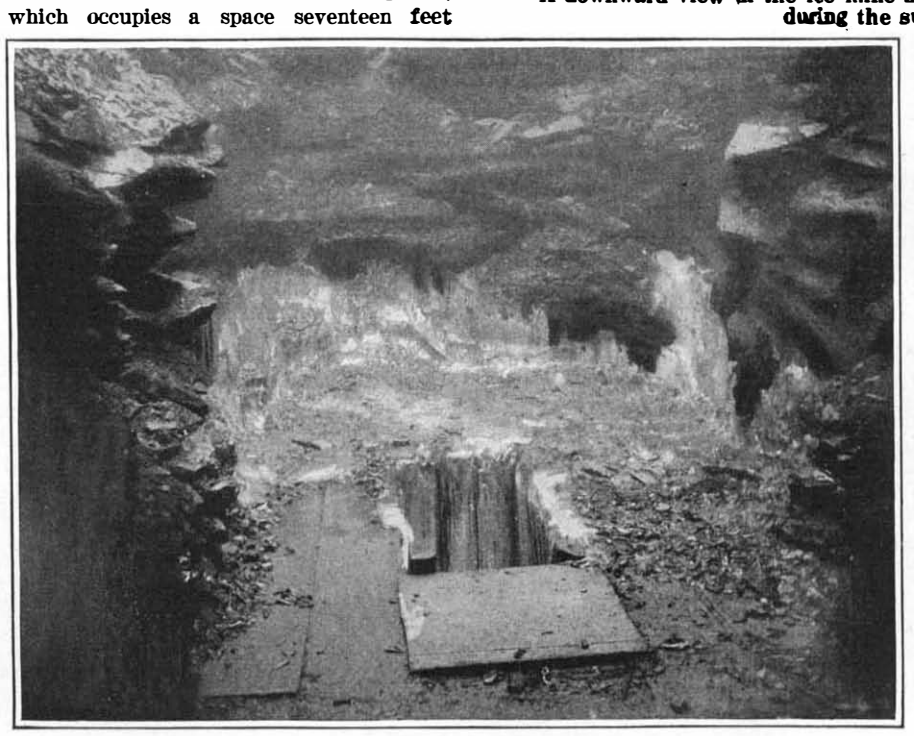
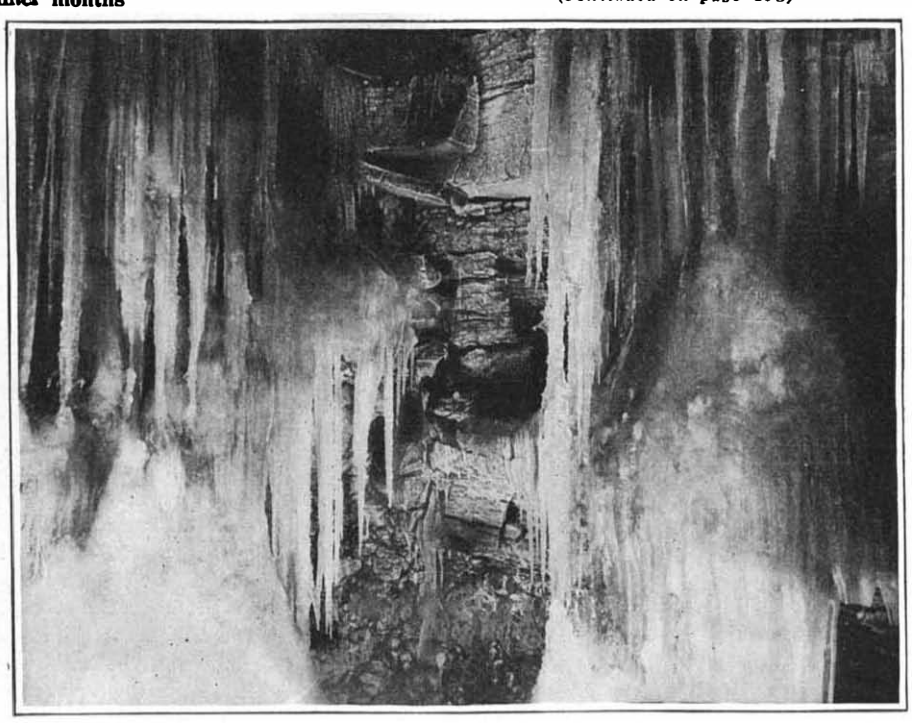
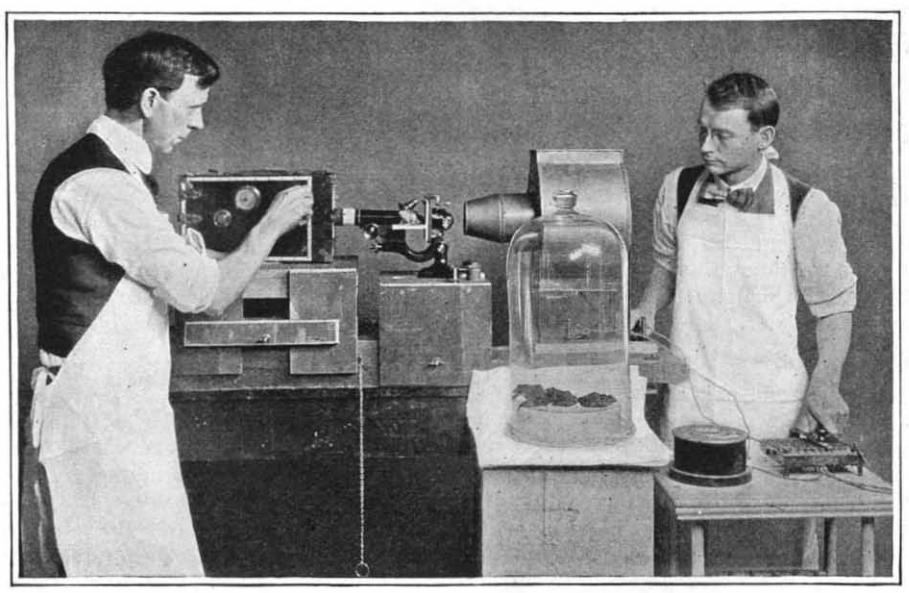


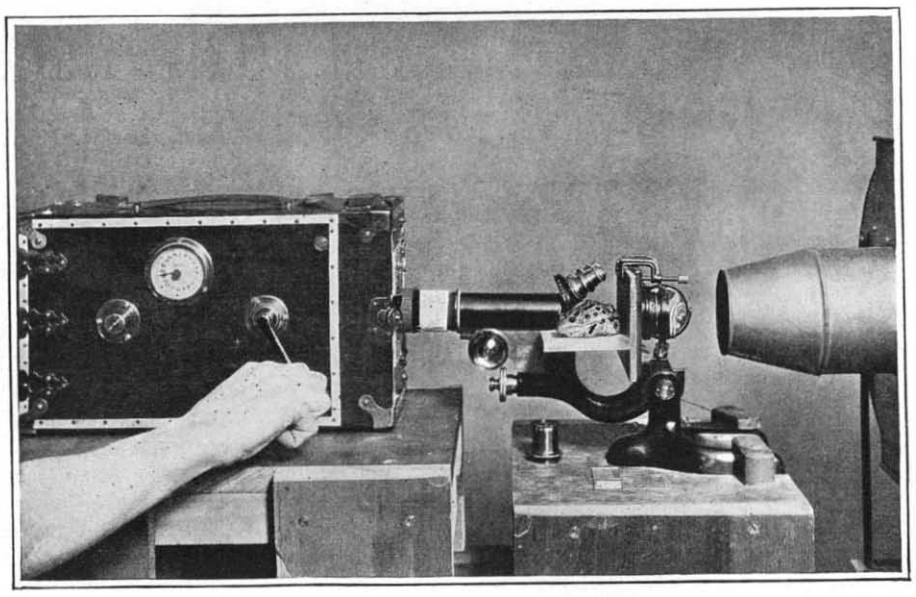
Entrance to the ice mine. The ice forms most rapidly in summer and melts in cold weather



A section of the ice mine shaft which is 40 feet deep, and 10 to 12 feet in diameter



Taking a motion picture of blood circulation in a frog's foot. The light is passed through the subject into the camera lens



The technique of taking motion pictures of blood circulation in a frog's foot, showing the arrangement of the apparatus

The Frog as an Entertainer in Motion Pictures

THE frog has always been a generous contributor to science, his foot having been observed by physiology classes for generations as a visual evidence of the circulation of blood. Advancing with science, he has broken into motion pictures and reel after reel of film showing the red and white corpuscles chasing merrily up and down in the web of his foot will now lend new interest to the physiology lesson.

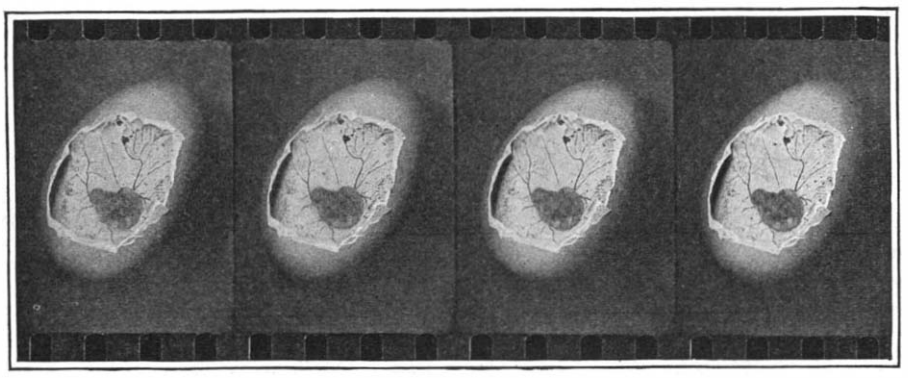
Micro-motion study of the circulation in a frog's foot has been carried out as a part of the medical research work of a Michigan sanitarium. The object was to provide a graphic demonstration of the principle of blood circulation and also to determine the effect of a large number of therapeutic measures upon circulation. In both these objects success has been reached through the use of an everyday motion picture camera and a high power microscope, a mercury lamp being used for illumination. Mechanically and photographically, the combination produces excellent results; and it is not even necessary to pin the frog's foot to the finding board, a fastening of adhesive tape being sufficient for the purpose.

The pictures obtained have proved highly interesting. The constant movement of the white and red corpuscles up and down the blood stream is made plainly evident. Although corpuscles are only 1-25,000 of an inch in diameter, they may be clearly seen when the film is projected. Color pigment in the skin of the frog shows as plainly as flies on a window pane, and the steady pulsing of blood through arteries and its gentler return through the veins may be readily observed.

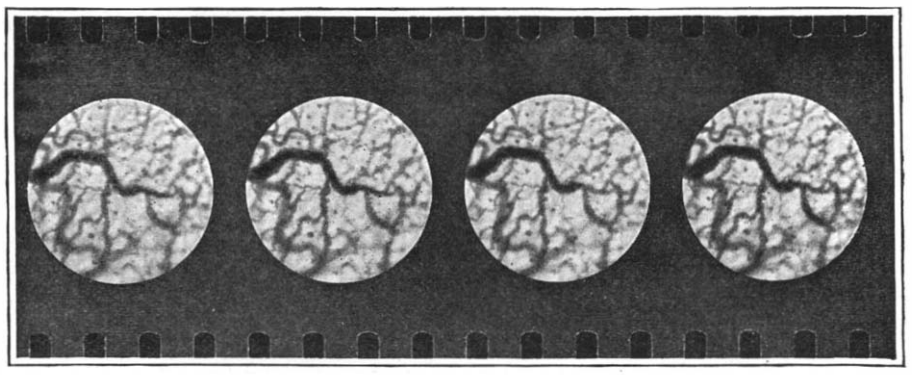
By administering various drugs, food elements, and such therapeutic measures as application of hot cloths or ice, the varying effects upon the circulation are faithfully recorded by the motion picture camera. It has been found possible to deter or accelerate the circulation almost at will. Even the heart can be stopped by interference with certain sets of nerves and started again by the simple expedient of exhilarating other nerves.

Two of the accompanying illustrations clearly depict the arrangement of the apparatus for taking the motion pictures.

General interest in the films showing the processes of blood circulation has been large. In the parlors of the sanitarium they are shown as an event of diversion for guests, and in this connection they excite as much interest as the most daring exploit of the film heroes from the celluloid settlements of Southern California or the film towns that border on the edge of the Palisades, across the Hudson River from New York City.



Filming section of an egg, showing the embryo chick. The film was intended to show the heart beat



Film section of circulation in frog's foot. The larger black stream is a small vein, while the black spots are bits of color pigment in the skin

A Double-Negative Camera Which Reproduces Images in Natural Colors

ANOTHER valuable contribution has been made toward the development of color photography, this time in the form of a camera that exposes two negative plates simultaneously through the agency of a perforated mirror. Thus there are recorded on the two negatives the red color values and the blue-green color values, respectively, of the image photographed. Subsequently, as the various phases of the process are carried out, positive prints in the form of transparencies with images colored red and green, respectively, are cemented together, the two glasses removed, and the picture mounted on paper, canvas, ivory, or any other material that may be selected.

The new camera and process of color photography are the result of years of research work and experimenting on the part of Percy D. Brewster of New York City. The point of distinct divergence between the Brewster process and other color-photography processes lies in the method of exposing the two negative plates in the camera. Hence the camera will be considered first.

As will be noted in one of the accompanying views representing a sectional view of the camera, this consists of a light-tight box arranged to hold two plates or negatives, *H*, *J* at right angles to each other. It is provided with a lens, *A*, and a shutter, *B*, of conventional pattern, mounted on a movable front board for focusing as in the ordinary camera. *C* is the bulb tube controlling the shutter, while *D* is the bellows and *E* the focusing screw. Between the lens and the negative, *H*, in a direct line with both, there is interposed a nickel or silver mirror, *F*, mounted at an angle as illustrated. This mirror is protected from oxidation, and its surface has been ground and polished to an optical flat by a well-known telescope maker. Through the mirror there have been bored some 100 holes, each at an angle of 45 deg. in relation to the surface of the mirror; for this reason the mirror has come to be known colloquially as the "Swiss cheese" plate. It is essential that any light rays that pass through the holes in the mirror should not be interfered with by the metal backing; accordingly, the sides of the holes have been countersunk at an angle of about 40 deg.

It is an established fact that light radiates from every point in the object to be photographed into the camera lens, and is projected by the lens in the form of a cone upon the sensitive plate, the base being at the diaphragm point of the lens and the apex at the plate. If half of these light rays are cut off, the remainder will form just as perfect an image of the point photographed, although, quite obviously, with only half of the light intensity, thereby necessitating doubling the exposure. This fact is taken advantage of in the design of the Brewster camera in breaking up each one of these cones of light into 20 or more parts; that is to say, each cone is made to strike possibly 10 holes and so transmit to the back 10 beams of light, *K*, which recombine to form the image on the negative plate in line with the lens. Meanwhile, the portions of the cone of light which strike the solid parts of the mirror are reflected at right angles, *L*, and these too reunite to form a perfect image on the second plate, *J*.

In the foregoing discus-

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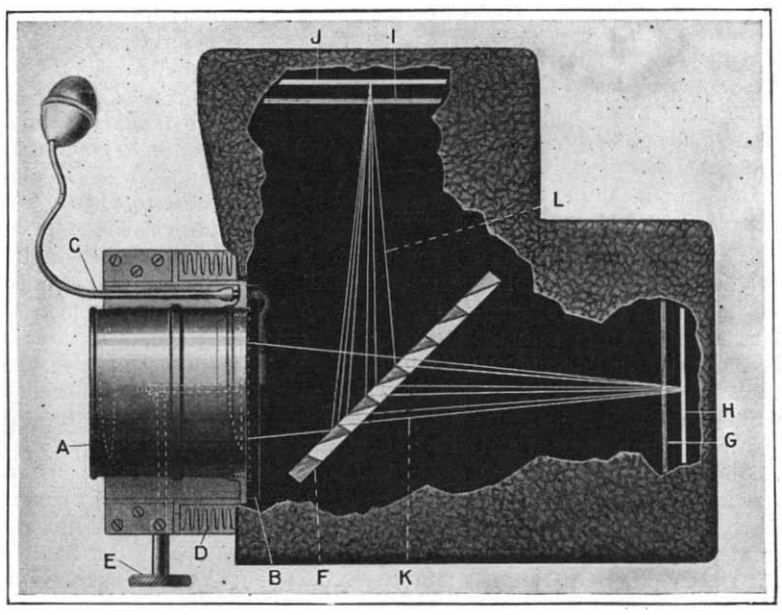
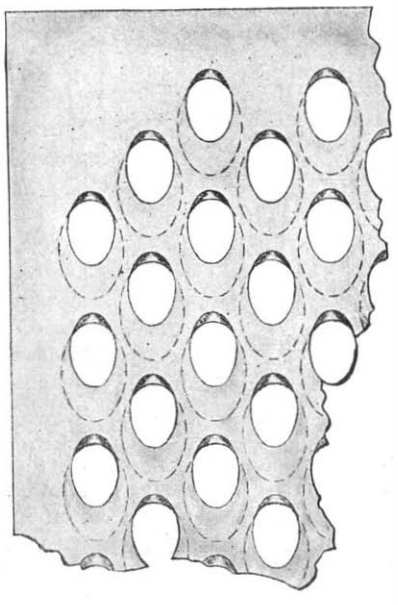


Color-photography camera which exposes two plates simultaneously, partly broken away to demonstrate its operation



The perforated mirror or "Swiss cheese" plate of the new color-photography camera

The Paper Situation

Factors That Are Responsible for the Present Stringency

By William Bond Wheelwright

AN extraordinary situation exists in the paper business. Prices of all grades are at the highest levels known since the established commercial use of wood and wood celluloses as raw material. There is an actual famine in some grades of paper, and on practically all kinds the mills are weeks behind on deliveries, and some are even declining to quote on further orders.

Some idea of the production and distribution of paper in the United States is essential to a grasp of the situation. The following summary, taken from the latest available Government Statistics of Manufactures (1909), will give an adequate idea of conditions under normal times, although the quantity would have increased 66 per cent, assuming that the same average increase has continued in the years since 1909 that obtained during the preceding decade.

Of the 4,216,708 tons of paper of all kinds manufactured during the year 1909, 27.9 per cent was newspaper; 19.7 per cent boards (i.e. box board); 18.1 per cent wrapping paper; 16.5 per cent book paper (including coated, plate and cover); 5.4 per cent building (roofing, asbestos and sheathing); 4.7 per cent fine paper (writing, bond, ledger, etc.); 2.3 per cent miscellaneous; 2.2 per cent hanging; 1.8 per cent tissue; 1.2 per cent card board; $^{2}/_{10}$ of 1 per cent blotting.

The distribution is made: first, direct from mill to user; second, from mill to jobber to user; third, from mill to broker to user—the last means is by far the least.

Under the first and third forms of distribution, the stocks, if carried at all, are stored mostly at the mills. According to the "New England Letter" for January, 1914, published by the First National Bank of Boston, the normal stocks on hand of various classes were as follows:

News Print	11½	days' supply
Boards	4	" "
Wrapping	16	" "
Coated Book	30	" "
Book	14	" "
Fine Papers	48	" "
Tissue	11½	" "

In other words, the smallest stocks are carried in the grades which mostly pass direct from mills to large consumers, such as publishers and box makers; while the papers distributed by jobbers according to miscellaneous daily needs are more liberally stocked. Furthermore, the mills which manufacture standardized grades, colors, sizes and weights of paper, maintain considerable stocks on hand from which to fill promptly the jobbers' orders.

It is obvious, therefore, that a sudden and unusual demand may only be met by immediate increased production on the part of the mills.

Productive Capacity of Mills

The normal productive capacity of our paper and pulp mills was according to the 1909 census about 20 per cent in excess of their actual production, and this condition undoubtedly prevailed up to the latter part of 1915.

According to an editorial in *Paper* (March 15th, 1916) the "Wrapping Division for the month of January, 1915, produced on an average 82 per cent of their rated capacity, while in January, 1916, the same mills produced 100 per cent of their rated capacity. In February their tonnage equaled 102 per cent capacity.

"The Writing Division in 1915 ran 82 per cent of their capacity, which figure was considerably increased by the upward tendency in the last few months of the year. In January, 1916, they ran 101 per cent and in February the figures reached 105 per cent.

"The News mills reporting to the News-Print Manufacturers' Association, showed a production a year ago of about 82 per cent capacity against 101½ per cent for February of the current year.

"Practically the same figures represent the Book Paper branch of the industry, which six months ago was running about 86 per cent capacity and for the month of February of this year shows a production of 101 per cent capacity.

"It may be asked how it is possible for any plant to run more than 100 per cent of its capacity. The answer is that the rating is based on the working days of the year, whereas recently some of the machines have been forced to operate on Sundays."

This remarkable and unprecedented response of our mills to the emergency means, it is safe to say, an increase in the production of paper equivalent to 1,000,000 tons if maintained for one year, but its continuation presupposes a sufficient supply of raw material—this aspect of the case will be considered later.

Causes of Heavy Demand

What were the causes for so sudden and unheard-of demands upon the mills and what is the prospect for their continuance?

Newspaper Situation: At the outbreak of the war newspaper circulation increased, but as advertising fell off the extraordinary demand for print paper did not reach its height, until increased advertising, increased circulation and increased demands for export came into conjunction with one another; the result was an increase of 19½ per cent in production.

The situation was aggravated by a shortage in the usual stocks on hand—caused by labor troubles last May, which resulted, while it lasted, in a forced curtailment of several hundred tons a day. The statement of George F. Steele, Secretary of the News Print Manufacturers' Association, published in *The Paper Trade Journal* of February 17th, 1916, states: "The manufacturers in addition to taking care of the decidedly increased domestic demand—have been extremely active in developing foreign trade. In fact, for the past year our manufacturers have been supplying practically all the trade of the English Colonies and South America. A good portion of this tonnage previously had been supplied from Scandinavian, German and English mills. Should war continue, there is every reason to believe that the necessities of the publishers in European countries will force them to come to us for a considerable portion of their supply—but I am pleased to say that the home manufacturers are practically all of one mind in this desire to supply home consumption first."

Book Paper Situation: In regard to the book papers the increase of production of 15 per cent in the last eight months is partly accounted for by the increased demands of magazines in which advertising has become so liberal—by a great revival of activity among book publishers and by the increased demands of direct-by-mail advertisers for their catalogues, folders, etc. On top of that is an unusual opportunity for export, which, however, has been somewhat held in check by lack of vessels, by the wish to serve home customers first, and by the precedence given to other commodities in the vessels available.

The Demand for Wrapping Paper: The demand for wrapping paper which was at a low point early in 1915 very naturally increased as business improved. The rising prices then started people up with a determination to cover for their future requirements until the mills were literally flooded with orders so that they began to decline business. This was especially true of the manufacturers of Kraft paper who depend very much upon a special foreign sulphate pulp, which has not been so extensively made in this country as the sulphite pulp. Owing to the difficult manufacturing and shipping facilities the supply of this raw material has been seriously curtailed, and prices have increased heavily.

Other Papers: The unprecedented demand for all other classes of paper would entail a very similar recital and space prevents further particularizing, but it is important to state that the difficulties surrounding the manufacture of boards and of writing papers are acute because the importation of waste papers so much used in the former and rags used in the latter, of which nearly $8,000,000 worth were purchased abroad in 1913, soon begin to diminish. In 1915 the purchases fell to about $4,000,000 and now they are almost entirely cut off.

Conditions in the Jobbing Business

As has been pointed out in the case of papers which are constantly selling to large regular users only small surpluses of stocks are ever on hand—but what were the conditions in this respect with the stocks in paper jobbers' warehouses in the late summer of 1915?

Letters received from a number of widely scattered and important paper jobbers in reply to my questions about the paper situation, present a striking unanimity of opinion. During the late dull times, stocks had been allowed to run low, consequently the sudden resurrection of demand caught the jobbers more or less unprepared, because it mounted as unexpectedly as a tidal wave. It had been generally believed that the boom would ultimately arrive. The flurry of August, 1914, which accelerated the paper market for a few weeks, died away suddenly, only to be followed by the most depressed condition the trade had experienced for years, and business dragged so long that some were undoubtedly put off their guard.

Improvement in General Business

In the meantime money had been flowing into the country and the restoration of confidence on the part of business men came quickly to a head toward the end of the year. Increased costs of colors, clay, chemicals, coal, felts, wires, machinery and labor, not to mention serious freight embargoes, were gradually pressing the manufacturer harder and harder. The first necessity for a rise in prices sprang from the color situation about mid-summer, and it was about the only reason for advanced prices that buyers seemed to find convincing. Early in the autumn the next timid, though just advances were made by the mills. There was a marked tendency to hold back from time to time and see what the other fellow was going to do.

But necessity finally forced bolder advances on the mills, and instead of scaring buyers off it had the opposite effect; for at last all began to realize what might readily have been driven home by their own experiences—that costs were mounting imperatively and the little gradual business gains were not being followed by recessions. Consequently fear seized the buyers, lest they should be caught short of materials or only procure them at advanced figures.

The succeeding condition is well summed up by one of my correspondents as follows: "I think a portion of the recent shipments of paper has been for other than immediate consumption and that stock rooms of paper consumers have been filling up with stock for months ahead. Some paper jobbers are not heavily stocked, but it is because they have been sending out their orders from stock faster than the mills send them their new goods, and when they receive the orders they now have on their books they will be heavily stocked."

Under ordinary conditions a reaction would be bound to result and in fact one is generally predicted by leading paper jobbers.

There are two factors which will have a bearing on the situation—the principal one being foreign demand.

Foreign Demand

According to Special Consular Reports No. 73, the total value of Germany's exportations of paper and paper manufactures in 1913 was $62,518,500. According to *Lockwood's Paper Trade Journal* for February 17th, Austria's exports approximate $10,000,000, Great Britain's $17,000,000—to quote more fully, "Germany and Austria, which have supplied to the outside world nearly $75,000,000 worth of paper, have suddenly been separated from their accustomed markets. Great Britain and France, which had normally exports of $40,000,000, are, of course, too busy to give much attention to their export trade, while the neutral countries accustomed to export quantities have been hampered by the difficulty of obtaining ships and the very high freight charges. Great Britain's exports of paper and paper products in 1915 amounted to less than $15,000,000 against about $18,000,000 in 1913, while in the case of France the falling off is much greater, the total paper exports being for the year only about one-half the normal."

It is apparent that a potential unsatisfied demand for paper and paper products, amounting to perhaps $100,000,000 a year, has been created.

Up to January, 1916, no striking gains in our exports of paper and manufactures of paper had been recorded. For the seven months preceding January, 1914, the sum amounted to $12,040,121—the same periods up to 1915 and 1916 showed $11,493,171 and $14,588,903, respectively. Nevertheless, the world's stocks must be extremely low, but shipments of the large export orders already booked have been retarded by the precedence given by manufacturers to their domestic business.

In this connection, the opinion of a leading exporter of paper is of interest. On April 5th, 1916, he writes me: "I believe the large business from abroad will continue so long as the European war lasts and home consumption does not require all of the product of the American mills; furthermore, that even after the European war ceases, the American mills will have greater calls for export than they ever had prior to August, 1914. I feel that a greater interest on the part of manufacturers of this country in export business, and a greater determination to have a fair percentage of their products going abroad, and going abroad whether home

conditions were favorable or otherwise, would create more stable conditions in the home market, and consequently greater benefits to the manufacturer.

"With the marked increase in prices, I believe the foreign demand in the future will not be greater than it has been during the last six months. On the other hand, if prices should ease off in this country, the export demand would exceed the demand of the last six months."

The other factor which may tend to check a severe reaction is the difficulty of immediately obtaining the necessary raw materials.

Raw Material

The fear of shortage chiefly concerns chemical wood pulps—and especially the bleached. The average monthly importations from Europe for the last seven months of the years 1913, 1914 and 1915 were 21,911 tons, 30,694 tons* and 15,753 tons, respectively. The decrease was partially offset by increases of average importations from Canada in the same years, as follows: 1913, 5,606 tons; 1914, 8,828 tons; 1915, 13,211 tons.

It may be observed that the average monthly importation from Europe for the three years was 22,786 tons, and from Canada 7,654 tons; whereas, the monthly average of European pulps imported in 1915, plus the increased monthly average of Canadian pulp, equals 20,136. The actual importation of European chemical pulp in January, 1916, was 12,985 tons, and from Canada 15,848 tons—total, 28,833 tons.

Leaving out of consideration the question of what was bleached and what unbleached, no considerable foreign shortage is indicated, especially as the principal producers of wood pulps are not at war. Further let me quote from a letter from a large importer of pulp, dated April 8th, 1916: "I do not anticipate any trouble in getting Scandinavian pulps—their asking prices just now are exorbitant—it seems to me that if the paper business should fall off somewhat here, and with the fact that there is a comparatively small shortage of unbleached sulphite, the market is apt to drop.

"The shortage is quite large in bleached sulphite, and still larger in Kraft pulp. I think that Sweden is trying to make the export of its pulp to England difficult on account of the embargo and export permissions issued at the discretion of the government. This would naturally give them more pulp for export to this country, all of which would tend to reduce the market."

A serious shortage in rags and waste papers was also encountered, as has already been pointed out. Rags comprise 7.8 per cent of the fibers used in domestic paper making, and waste papers, books, magazines, etc., 21.4 per cent. About 123,000 tons of the former and 380,000 of the latter were imported in 1913. The rag situation was especially serious because rags are absolutely essential for making the better grades of writings, ledgers, blottings, cover and roofing paper. Furthermore, they are used in the manufacture of gun cotton, and the munition makers have not hesitated to pay prices which are prohibitive for paper manufacturers. Coupled with the indifference which our people had fallen into as to saving these useful wastes—the cessation of imports created a veritable panic in this market, which has only recently begun to find relief through more active domestic collections.

Remedies

This brings us to the consideration of what steps may be taken to alleviate the situation. It would probably have been useless to hope to persuade people to desist from speculative buying after the market had assumed a "runaway" character; but it is decidedly to the point to encourage the saving of rags, books, magazines and other wastes fit for paper making. Secretary Redfield, acting through the Post Office Department, has given material assistance in this direction, and three of my mill correspondents who are heavy users of rags write that already the situation is improving, and that they expect an approach to normal prices for rags by January 1st, 1917. It would also be desirable to increase our facilities for bleaching chemical wood pulps and making Kraft pulp.

Scientific forestry should be practiced in connection with our pulp industry. Utilization of lumber wastes, which are now tremendous, should be developed further, and reforestration ought to be stimulated. In addition, new sources of raw materials, such as waste flax and other straws, sugar cane, etc., should be exploited. The Government has for some years been carrying on valuable experiments in this direction through the Forest Products Laboratory and the Bureau of Plant Industry assisted by the Bureau of Chemistry. The increasing costs and scarcity of timber point to a not very distant time when annual crop wastes will become commercially profitable for paper making.

In fine, everything possible should be done to make this country independent of others for its fibers, chemicals, clays, dyestuffs, and shipping.

* Note.—Unusually large quantities of foreign pulp were rushed to this country in 1914 in anticipation of future difficulties.

How May the Permanent Success of Our Dye Industries Be Secured?

By George H. Bruce, A.M.,L.L.B.

THERE have appeared in the columns of the daily press and of this journal, and those of other scientific and technical magazines, many articles by able and learned writers, telling in detail the conditions in which the businesses using dyes, colors and intermediates were in at the beginning of European hostilities; how characteristically enterprising, able and venturesome business men proceeded, at the expenditure of much effort and money, to prepare to overcome this calamitous condition. This with the only hope that they would receive the coöperation of the consumers and of the Federal Government.

Statistics have been given showing the marvelous development of these industries, and estimates have been ventured as to how many months or years might pass before these new businesses would be able to take care of the situation in a substantial way.

Most of these writers, while gathering their data most carefully, very conservatively discounted the figures, with the result that they were invariably much below the real facts, but all of these writers have hesitated to speak with any degree of positiveness of the future. Not that the progress had not been little short of miraculous, but that they were uncertain of two things of vital importance.

First: The possibility of securing adequate protection for these infant industries; secondly, the attitude of the consumers on this question of tariff and of the higher price for domestic goods. And right here lies the crux of the whole matter. The manufacturer will go just so far and no farther until the future is made reasonably safe.

True, millions of dollars have been expended in the establishment of plants, and temporarily they are reaping their reward, but only after passing through the fire. At the outset these industries, except in a few instances, were absolutely new in this country. Machinery was not to be had readily, and when procured was invariably found inefficient, unreliable, faulty or expensively perishable. The machine people were also going through the experimental stage. The manufacturers had to contend with inferior raw material, frequently incompetent help; the chemical questions could only be settled by literature, always a most unsatisfactory way, because trained talent that could solve difficulties was not easily obtained; the little tricks and short cuts that experience brings were as yet unknown, and so, bravely and determined, they worked away while the plants experimented, and they saw their dollars go down the sewer in the shape of defective products.

These same experiences were gone through generations ago in Europe, but never to the extent that they have been in America in the brief period of twenty months. There appears to be no question that long established plants in Europe, having overcome the chemical and mechanical difficulties, discovered the most satisfactory machinery and economical units with low cost of labor, and abundance of cheap raw material, can produce and undersell the American manufacturers.

This condition would continue unless the latter had adequate protection that would also be prohibitive to foreign imports for a period of four or five years, when, by processes of acquisition and elimination, he had discovered the best methods, the cheapest processes, the most desirable machinery; had well trained help and cast aside the crude, expensive, half experimental methods that must of necessity be pursued for some time in any new and untried industry.

How, then, is this protection to be had? Never through the unaided efforts of the owners of the infant industries, but through the earnest, honest and persistent coöperation of the consumers. Without this the effort is useless, and we must meet this situation face to face.

The future of the dye, color and intermediate industries in this country is in the hands of the consumers. If, blind to their own interest, they fail to see their future safety in sustaining these enterprises, then unquestionably these undertakings must die by the wayside. Some will, because of present abnormal prices, perhaps make money for a time, and, having paid up the cost of their plants, write them off, and be able to exist for a time, but they must all end in the junk heap eventually unless the proper support is forthcoming.

Is the ordinary consumer sincere in his protestations of allegiance to his brother, the manufacturer? Here and there is found a man who is willing to pay more for domestic goods and to continue to do so that the industry may prosper and become a permanency and save him from dependency on foreign manufacturers, but unfortunately this is not general. Even some organizations, protesting their avowed purpose to secure commercial independence for the country by liberal tariff, are either grossly ignorant of the necessities or else insincere, if judged from the so-called tariff bills which they are fathering.

An analysis of proposed so-called protective tariff bills reveals to any one familiar with the manufacturing end that they offer no protection at all, because for all the reasons alluded to above the European manufacturers could still undersell the American and make a profit.

Would the American consumer then willingly pay more for American goods? A few, "Yes," the majority, "No." If you have the confidence of the average consumer, he will frankly tell you he feels he should buy where he can get satisfactory goods cheapest. That if he does not, he cannot compete with others in the business who buy cheaper, and that self-defense is the first law of nature. He will go further and say that while he buys from the American manufacturer now in these necessitous times, that on the resumption of normal imports he would again buy foreign goods, giving as reasons that the foreign manufacturers could dictate, because, if by combination they would refuse to sell scarcer and finer goods unless the same market was open to the commoner ones that the purchaser would then be helpless, and at the mercy of the foreign manufacturer.

Confessedly, it will be some years' work under the most favorable and promising conditions before American manufacturers will produce the finer colors and synthetics, hence the nurturing of those industries in the meantime becomes a serious problem.

If the consumers could be made to see that not only their individual industries, but the very life of the country, depend upon the commercial success and supremacy of the United States, they might be willing to suffer temporary inconvenience to foster these businesses that promise prosperity and independence.

We might well take a page from the book of experience of European industries, especially in the lines under consideration. We find first, absolute unity among manufacturers; specialization, with certain houses covering certain lines without conflicting or cutting by other houses; the Government coöperation, and the home consumer absolutely loyal to the producer. The self-sacrifice is willingly made where necessary, the thought that the mother country or fatherland will be benefited being sufficient inducement and reward, a splendid commentary on the loyalty and patriotism of these people.

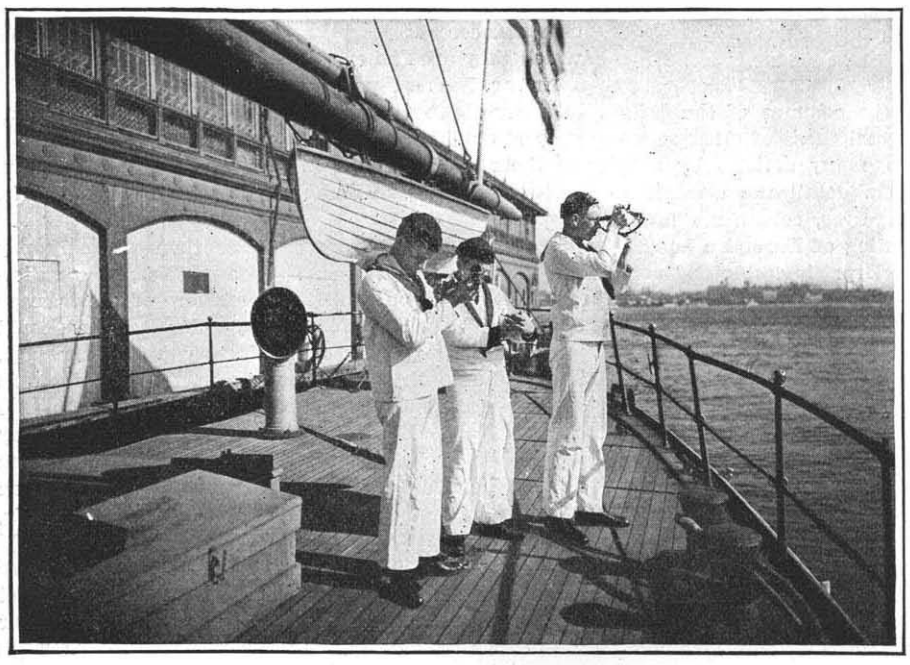
Here is the remedy for the condition and what would spell future prosperity for this country: Adequate protection prepared by a permanent commission of men devoting their time, thought and research to this work only, and these men must be devoted to their work, free from political influences and bosses, free to act upon their knowledge and conscience, and they must be paid liberally enough to secure able men, who can thus afford to enlist themselves in the country's cause. The appointment should be long enough to warrant men's devoting the best years of their lives without the fear that the changes of administration will send them out as derelicts after all other means of adequate livelihood are lost to them. Neither partisan nor bipartisan boards should be considered as such. The men should be selected first, and their particular political belief be a matter of their own concern, as may be their religion.

In securing able men who can and will devote themselves to so important a cause, the appointing power and the representatives of the people should be big enough to get the men, the right men, irrespective of their personal beliefs; nor is it desirous that such a commission be composed of experts, so-called, which ordinarily spells narrowness and non-receptive minds. Rather let us have men with minds fresh, willing, able and receptive. Students who, with the departmental data available and the desire to get the best results for the people, will pursue all the ramifications of the subject. With such men, and they are plenty, it matters not whether they are from the North, East, South or West, nor how they vote or what church they may attend, we will get honest work, with no axe-grinding.

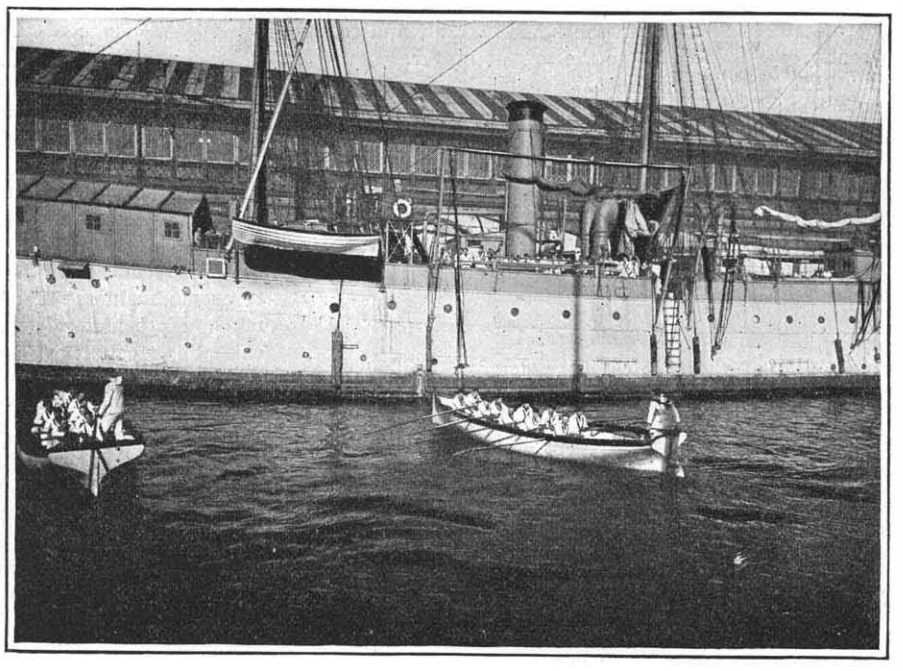
There never has been a tariff but has been evolved in the councils of one party as opposed to the other, with numerous pet constituents carefully covered, lacking both justice, equality, necessity and greatest general benefit and scientific construction, and these conditions will always prevail until a permanent body devoted to the work takes it in hand.

We must also have willingness on the part of the consumers to pay more for a time for domestic goods, and equal willingness on the part of the ultimate consumer to pay a slight advance to build up these industries because of the benefit it will bring this country by the permanent establishment of vast and necessary plants indirectly bringing to him his share of the general prosperity.

(Concluded on page 486)



Learning to use the sextant



Bringing a ten-oared cutter aside

Our Nautical Schoolships

Conditions Show That We Are Far Behind Our Commercial Rivals Abroad

By F. S. McMurray, Supt. N. Y. State Nautical School

THERE are but two Nautical Schoolships in the United States devoted to educating and training Americans for responsible positions on shipboard. The gunboats "Ranger" and "Newport" have been loaned by the Navy Department to the States of Massachusetts and New York, respectively, for this purpose. These vessels are inadequate both in size and type for the best results in training purposes, and their annual output is limited to 100 cadets collectively, who enter our mercantile marine as petty officers or cadets, serving therein until they become of age or gain requisite experience for positions as officers or engineers of commercial vessels. Conditions have changed since the time when shipmasters received their initial training in the forecastle. The sailing ships of former days were in themselves excellent schools for developing traits necessary in men of the sea, such as courage, physical and mental activity and the knowledge of ship handling and navigation under a variety of conditions of difficulty and danger. It is no longer practicable or possible for American youths to enter our mercantile marine service under suitable conditions for advancement to command, unless preliminary training of an educational nature, applicable to sea life, is obtained in these schoolships. Because of the universal employment of foreigners in subordinate capacities on our modern commercial vessels, where the English language is seldom spoken in the forecastle, and the disappearance of the old-time skilled seamen, forecastle experience does not produce suitable training for the advancement of Americans to high position on shipboard.

Conditions abroad are far different. The maritime countries of the world have long since recognized the need of special educational measures for training officers and commanders of commercial ships, maintaining schools of a high standard for the purpose and developing the training ship method to a state of efficiency greatly superior to our activities in this line. Great Britain has 18 schoolships including some operated by public subscription. Others are operated solely by steamship companies for their own personnel. Germany bas adopted similar measures. The German Schoolship Society of Bremen has been operating five training ships, two of wbich were assigned to the sole use of the North German Lloyd Steamship Company. They have lately issued a statement to the effect that their work is continuing unhampered despite war conditions, and they are prepared to furnish German mercantile shipping with trained officers and seamen to man vessels and extend the country's trade immediately upon cessation of hostilities. In the meantime 200 cadets and 20 officers from the training ships have been assigned to the Imperial Navy, where they have been placed on the U-boats and destroyers, positions to which only the most efficient men are assigned. Japan takes a leading part in this educational work for the sea. The Nautical School at Tokio compares with our Naval Academy at Annapolis in efficiency and their training ship, "Tasei Maru," one of three, is a large four-masted auxiliary ship with twin screws, especially constructed for training purposes, which makes long ocean cruises about the world. Even Belgium, Brazil, Peru, Chili and the Argentine lead this country in nautical training, with the operation of suitably equipped training ships, that they may not be dependent upon foreigners for the manning and direction of their commercial ships.

The importance of this work is directly proportionate to the locality and magnitude of maritime activity. The State of New York, through which over half the foreign and domestic water-borne commerce of this country passes and in which is owned and operated a majority of American shipping, is supporting but one training ship, which is quite inadequate to meet present demands for its output and its accommodation. This school has lately been threatened with abolishment in the interest of economy in state expenditure, though its annual maintenance expense is but $80,000.

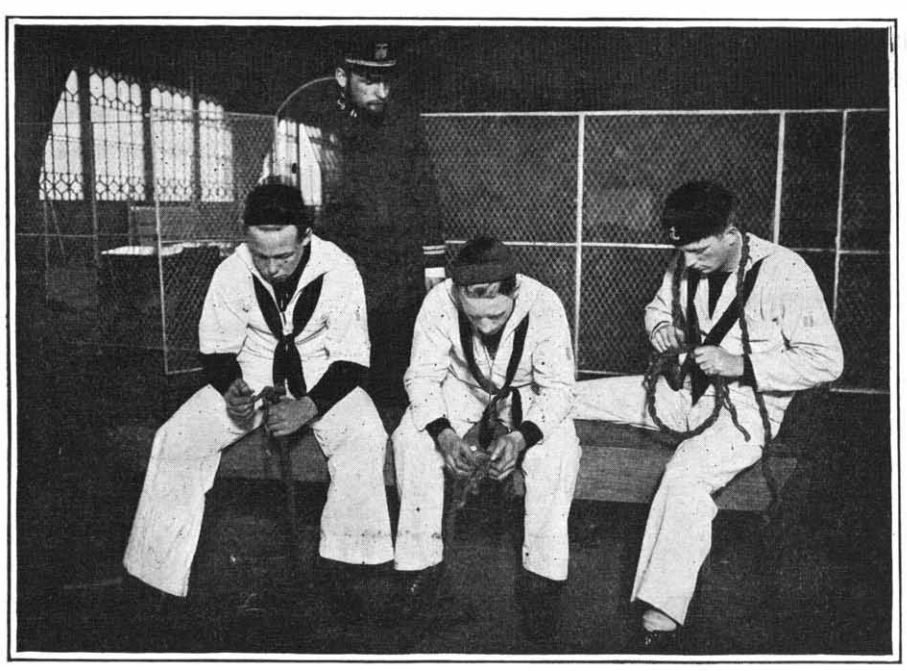
The New York Nautical Schoolship has been in existence for 42 years and has sent into sea service many of the ablest young Americans now serving our commercial interests afloat. Several of its graduates have become commissioned officers in the Navy and Revenue Marine, five are now at the Naval Academy. Several are in command of Naval Auxiliary ships, Government craft connected with the Lighthouse Service, Army transports and commercial vessels.

At the present time, with 230 ships under construction in American shipyards or contracted for, with a present demand for trained shipmasters and officers in American vessels so great that a suspension of our citizenship laws was considered necessary and ordered by our President, to permit aliens the command and officering of such admitted-to-registry ships as have been acquired since the commencement of the European war, and with a shortage of officers in our domestic shipping which has caused great annoyance to local shipping companies, through the levying of fines by our Federal Government, amounting to over $100,000, for failure to comply with the law wbich requires full complement of officers on shipboard, there is a crying need for additional support and extension of facilities in Nautical Schoolship training.

The negligence or apathy of our Federal Government toward shipping necessities, and especially this important feature among them, is incomprehensible, in the face of such legislation as the Hardy Act, passed in March, 1913, which required an additional or third officer on all American ships of over 1,000 tons.

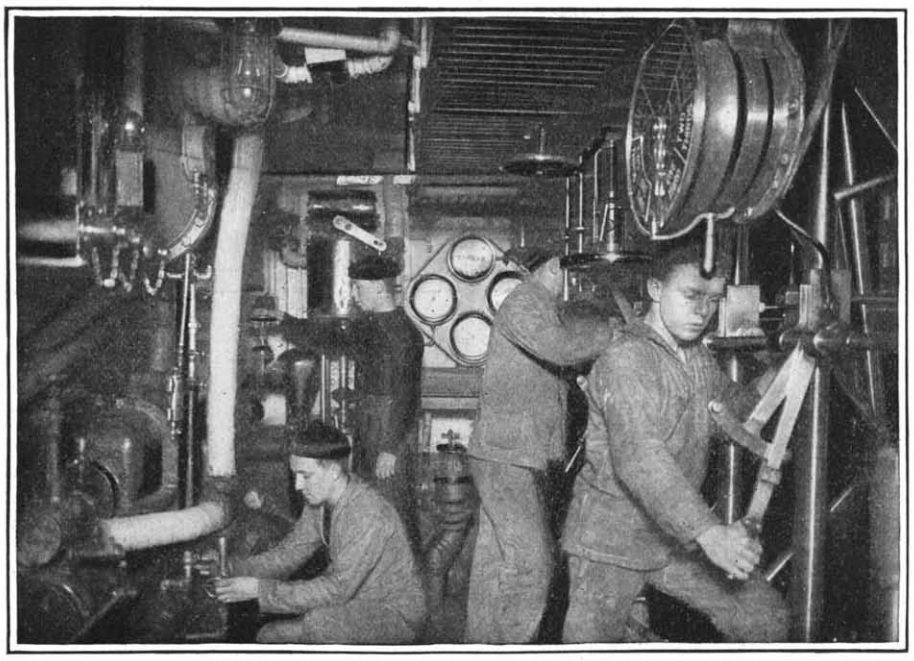
An investigation of foreign methods in educating men for the extension of the trade and commerce of the world will show that we are far behind our commercial rivals in tbis respect, and do not seem to realize the necessity of sending able and educated men to sea in charge of our commercial shipping.

The report of the German Schoolship Society for 1915 states that it is regarded as one of the important institutions in Germany and that it has been one of the principal assets from which Germany has established its great merchant marine. Money and effort have not been spared to make their training sbips modern and useful. Even the latest motors for propelling have been installed in order to familiarize cadets with the very latest mode of navigation.

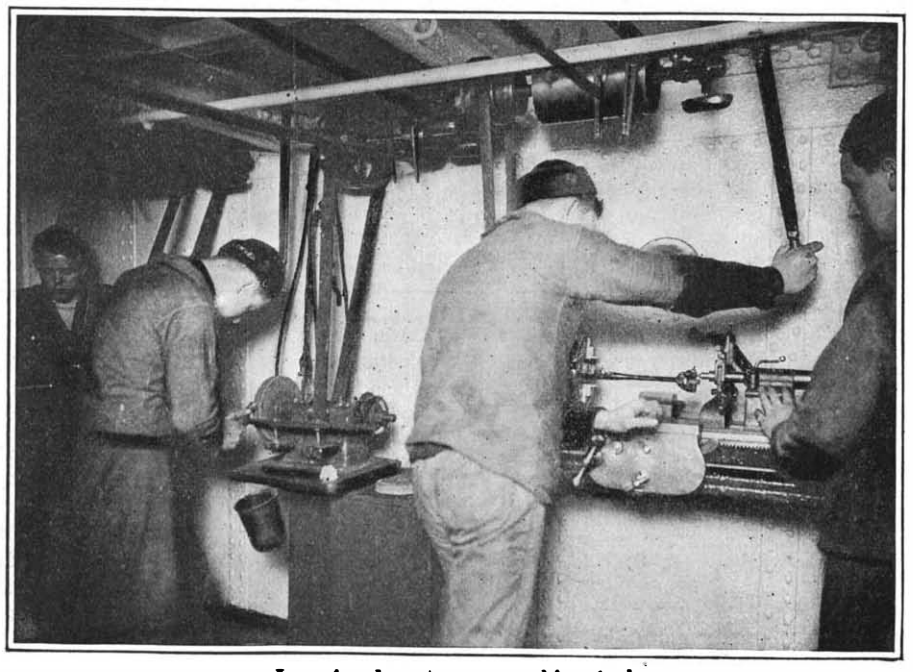


Class in rope splicing

The apprentices at dinner



Instruction in the engine-room



Learning how to use machine tools

At this critical period of our national struggle to regain a foothold upon the sea, with legislation enacted favoring shipboard labor, something must surely be done to increase the efficiency and improve the status of the men in authority on American ships. The urgent need of these indispensable men and adequate facilities for their education and training, commensurate with the civilization and commercial growth of this great nation, indicate a grave economic loss.

If our seaboard states cannot afford due support to this educational and vocational training for an industry of such importance to them, its continuance and enlargement should be undertaken by private means, endowment or public subscription as is done with other educational institutions or with some of the training ships abroad.

The civic value alone of these training ships should warrant their support in the interests of good citizenship, through furnishing the many youths who desire a sea life with a disciplinary training on shipboard amid suitable moral influences and surroundings favoring their physical, mental and moral growth. The experience which forms an undeveloped boy into a self-reliant, thoroughly disciplined, capable citizen in a short period of intensive training, for civil or specialized military duty, is a valuable service to the community.

How Gun Pressures Are Measured

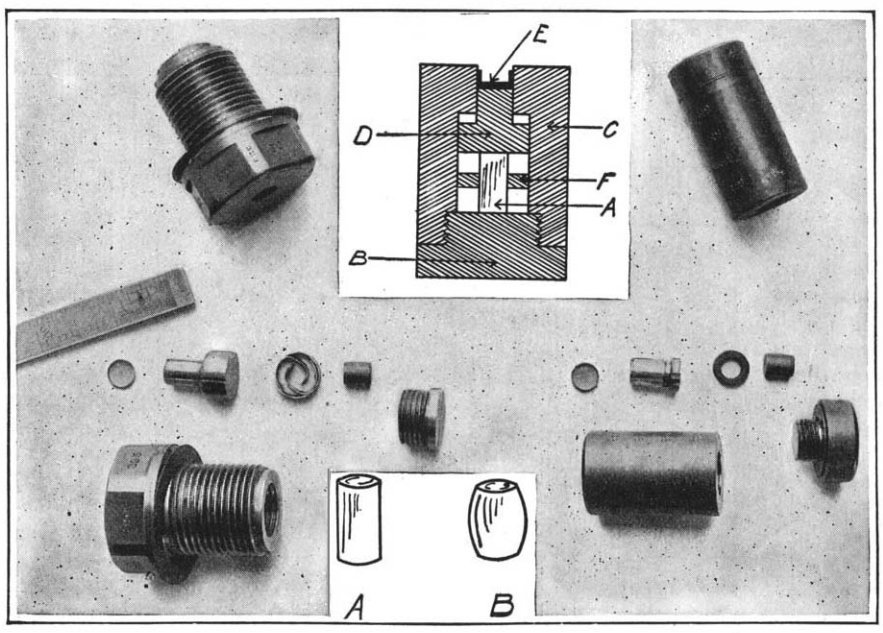
By Geo. P. Jewell

IF we desire a steam boiler to withstand a working pressure of 100 pounds to the square inch, we use material that should not give way until a pressure of at least 200 pounds is reached; we actually test the boiler with a pressure of perhaps 150 pounds which will probably develop any defects and yet not injure the boiler if the material is sound. After the boiler is in service a gage is used to keep the fireman from letting the pressure exceed the 100 pounds for which it was designed.

An almost parallel case exists in gun construction. The pressure that will be required to drive out the projectile with the proper velocity can be computed and the parts of the gun can be so proportioned that they should not give way until perhaps twice this pressure has been reached. After the gun is made it must be tested with a pressure well above that intended to be used normally but not great enough to injure the parts if they are of sound material. While the gun is in service a gage is not kept on it continually as with the boiler; but the same purpose is accomplished by testing each lot of powder to know that it will not give a greater pressure than intended.

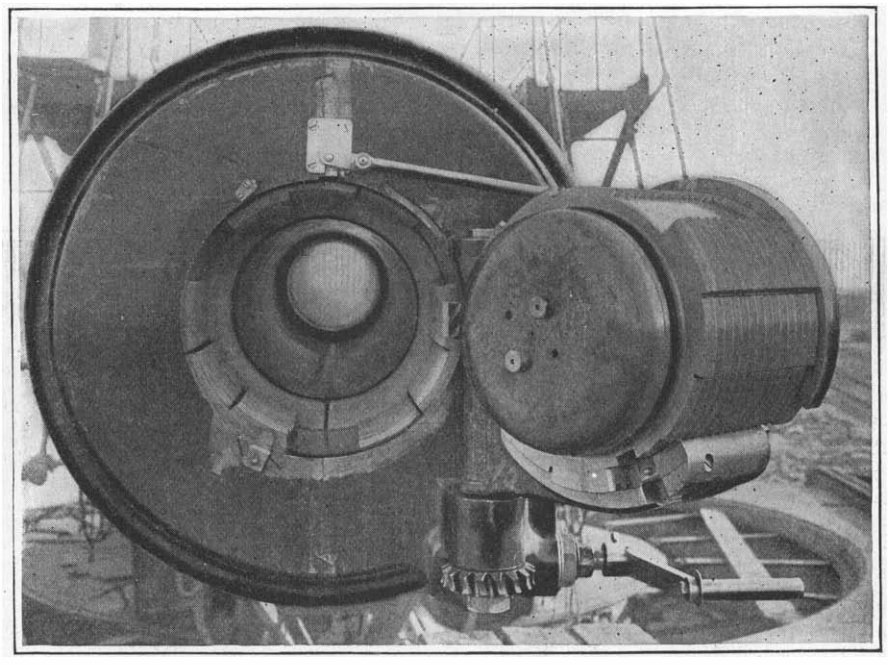
In both cases gages are necessary, but the instruments for measuring the relatively low and continuous steam pressure at low temperature obviously will not be suitable for recording the almost instantaneous pressure of hot powder gas at perhaps 40,000 pounds to the square inch. The gage used for the latter purpose is shown in cross-section in one of the accompanying sketches. The various parts going to make the gage are shown in one of the photographs.

In the first drawing, representing a sectional view of the gage, the housing *C* is made of steel sufficiently strong to resist the pressure of the powder gas as it is placed inside of the gun close to the breech block or screwed into the latter when the pressure is to be measured. The actual record of pressure is the amount that the copper cylinder *A* is compressed by the steel piston *D* upon which the powder pressure acts directly. *E* is a copper cup to prevent gas from entering the interior of the gage. The area of the piston exposed to pressure is for convenience one tenth of a square inch. This means that if the pressure in the gun is 30,000 pounds to the square inch the actual pressure on the copper will be 3,000 pounds. In the lower drawing of the first illustration appears one of the copper pressure cylinders, which are of about the size of the rubber eraser on a lead pencil, before and after firing.



Constructional details of the pressure gages used to measure the pressures attained in guns

The various components of the pressure gages are shown in the photographic por on of the illustration. In the sectional view, appearing in the upper center, the parts indicated are: *A*.—Copper recording cylinder; *B*.—Closing cap; *C*.—Steel housing; *D*.—Piston; *E*.—Copper gas check; *F*.—Rubber or spring steel ring to hold copper in place. In the lower center drawing appears a copper recording cylinder, before and after being subjected to the pressure from a gun discharge.



Breech mechanism of a 14-inch gun, showing the mounting of two pressure gages on the face of the breech plug

The copper pressure cylinders are made from carefully selected metal to insure strict uniformity, and samples from each lot are subjected to varying pressures in a testing machine. The amount the samples have been shortened by the different pressures is recorded so that a table can be prepared from which the pressure can be readily ascertained after the amount the copper has been shortened in the gun has been measured. For example: if the copper measured .500 inches before firing and .485 inches after firing, the difference would be .015 inches; and the table would show that the pressure was perhaps 15,000 pounds to the square inch.

In practice it has been found that better results are obtained if the coppers are compressed beforehand in a machine with about the pressure corresponding to that expected in the gun. Accordingly, the coppers are supplied already compressed with pressure corresponding to those in the gun of 10,000 pounds, 14,000 pounds, etc. A 14,000-pound copper would not be shortened by any pressure in the gun less than 14,000 pounds. If a gun pressure of 33,000 pounds is anticipated a 30,000-pound copper is used, and so on. Two gages are usually used to check each other, and if the coppers are carefully placed in the gages the two will agree surprisingly well, generally within a few hundred pounds and frequently even more closely.

Putting the American Paper Industry on a Scientific Basis

ACCORDING to a statement appearing in a recent issue of *Commerce Reports*, the attempt to place the paper industry of the United States upon a more scientific basis in its manufacturing processes received material support at the first annual meeting of the comparatively new Technical Association of the American Pulp and Paper Industry. The paper expert of the United States Bureau of Standards was among the large number who attended the sessions, and the Bureau's coöperation with the work of the association was tendered. Methods of test and standard specifications for raw materials and finished products were discussed, interesting papers were read, and plans were made to evolve from the organization a clearing-house for technical problems arising in the paper industry.

During the month of February last the Bureau of Standards made tests on 144 samples of paper for the United States Public Printer, 115 for the various executive departments and independent establishments, and 26 for persons and firms who had applied to the Government.

There have been various other instances in which the services of the Bureau were extended in matters relating to the industry. Assistance was given the Smithsonian Institution in obtaining samples of the highest-grade papers. The problem of increasing the opacity of book papers was taken up.

War Game—VIII

The Effect of the Successful Double Envelopment

By Lieut. Guido von Horvath

THE enemy might choose to fight to the finish, which means the point where his power of resistance is exhausted. In this case the enemy will be either driven from the battlefield or taken as prisoners of war.

A wise commander, unless he has orders to hold out till the last man, will, however, endeavor to release himself from the enemy's grip, and to withdraw before his forces are completely crushed.

To make the last decisive encounter of the Blue and the Red forces on Lookout Hill graphically clear, we shall attempt to picture the actions from the layman's point of view. To this end, we shall place our war correspondent in the Observation tower on Lookout Hill and reproduce his report of what he has seen from 6 A.M. on June 8th, till the engagement passed beyond the range of his vision.

"Lookout Hill, 19— June 8, 6 A.M.

"Since four o'clock the first battalion has been in close touch with the enemy. I had permission to accompany this battalion, and at 4:30, with the battalion reserves, we climbed the rather steep southwestern slope of Lookout Hill.

"The enemy artillery sent a few shrapnel in our direction, but suddenly the fire ceased and almost simultaneously another battalion from the main body of our brigade extended our left flank.

"From this moment on it was a rapid dash forward, till the crest of the hill was reached. Once there, a mean flanking artillery fire hit us from the forest edge. It was a staggering blow and for a while we lay panting, helpless; many men were wounded in the line with me, and one shrapnel after another burst with terrible accuracy over us. It seemed a year before something else happened: another dash forward, and I climbed on all fours toward the Lookout tower, which was but a few hundred yards to the right. During these moments of intense fire action, something must have happened to the enemy's battery, for its shells ceased to come toward us.

"I later learned the reason.

"Encouraged by the seeming lull, I decided to climb the Tower. It is a well-built steel frame tower and I shall never forget the impressive picture I beheld from its top.

"The Blue forces, like waves, rolled forward to the right and to the left. The Red artillery lost two guns, the very two which had been shelling our enveloping battalions, but four more guns were busy shelling the right wing of Colonel K's forces.

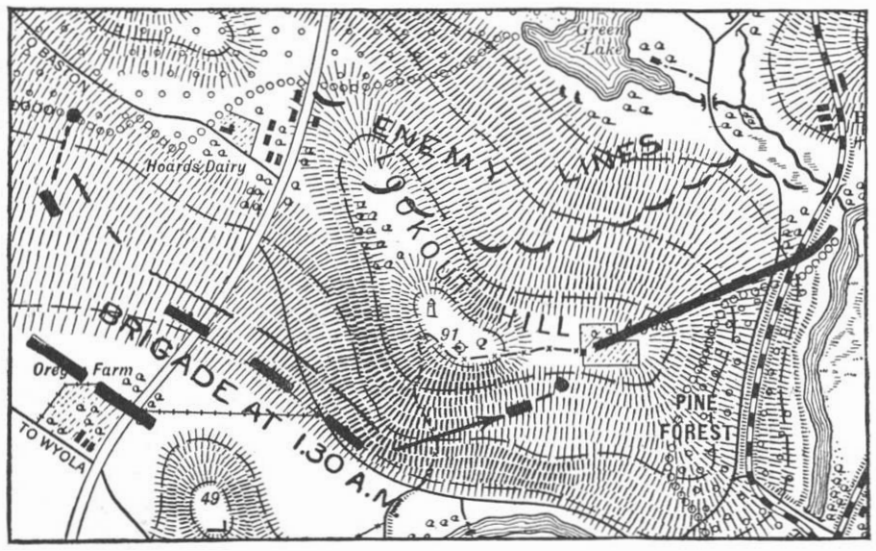
"Over the bridge, slightly to the east of the lake, went straggling Red cavalrymen, losing heavily, but finally gathering behind the lone house near the lake, from which position they retired toward the forest edge.

"Other troops were hard pressed by our forces and lost many in wounded and dead, whose inert bodies dotted the green, flower-bespangled hillside and meadow around Green Lake.

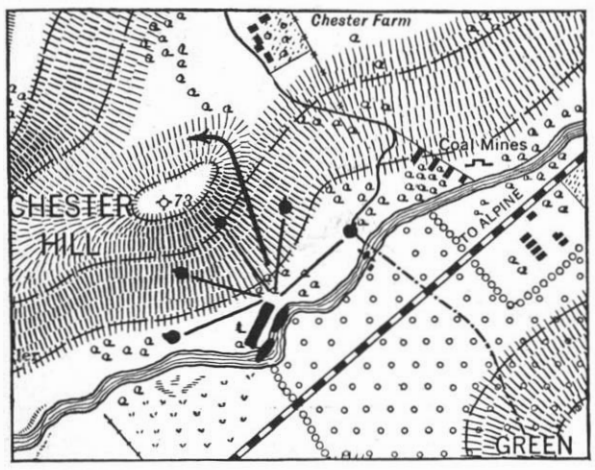
"In less than 40 minutes there was not a Red soldier in sight, except these staggering, struggling or dying men on the ground. Yet, though the Reds were not visible, they were far from inactive, nor did it seem that they were ready to give up. A deadly fire was pouring from their splendid defensive line along the forest edge.

"I wondered how all this would end. It seemed to me that the Reds must expect reinforcements, or they would have hastily retreated in order to avoid the stifling, enveloping forces which were drilling into their right wing troops with a steadily increasing impetus.

"With me in the Tower was an artillery officer, with a telephone instrument hanging from his neck. He noted my badge and paid no more attention to me. From time to time he spoke into his instrument, which



Answer to question 1 of War Game VII



Answer to question 2 of War Game VII

searching point after point, in an effort to locate these batteries. We, also, lost a gun; the shattered wheel of the upturned cannon lay in a heap with four artillerymen. One caisson was hit point-blank by a shell and there was an explosion. While my eyes swept from place to place over this everchanging field of action, I suddenly saw heavy reserves push by the Tower and I realized that our solitude here was to be invaded.

"Brigadier General L. G., with his staff, had arrived. The General glanced around with deep concern; he searched the northeast with bare eyes, then hastily unslung his field glasses. I wondered. The anxiety on his calm face presaged grave events to me. We knew there were strong enemy forces in the north. At an impulse I followed his direction with my own powerful marine glass.

"'There! There, now!' I heard the aide exclaim.

"The right wing of our forces pushed forward, nearing the lake. Farther north, on the forest edge, there appeared to be some motion among the Red forces.

"Again I heard the aide speak: 'It is all right. In ten minutes we shall see!' He laughed and lit a cigarette.

"The General remained in silent watchfulness. Suddenly I grasped my glass and directed it toward Chester Hill. There, behind the railroad and the Bixler buildings, like a line of blue ants, a skirmish line of Blue forces started forward.

"At exactly 6:15 A.M. the first bullets snapped into the left wing of the Reds.

"What a change it made, this sudden attack from an unexpected quarter!

"As I searched the firing line of the Reds, I saw that something was happening there. Suddenly there were only two enemy guns in action. No, the other two were not hors de combat, they were dashing at a gallop, back up the Greenville road. Moreover, troop after troop of Red cavalry were evacuating the forest edge. That gigantic machine stretching over miles began to draw together. Our left wing dashed forward, the center followed, a rapid fire was delivered by the right flank and the artillery.

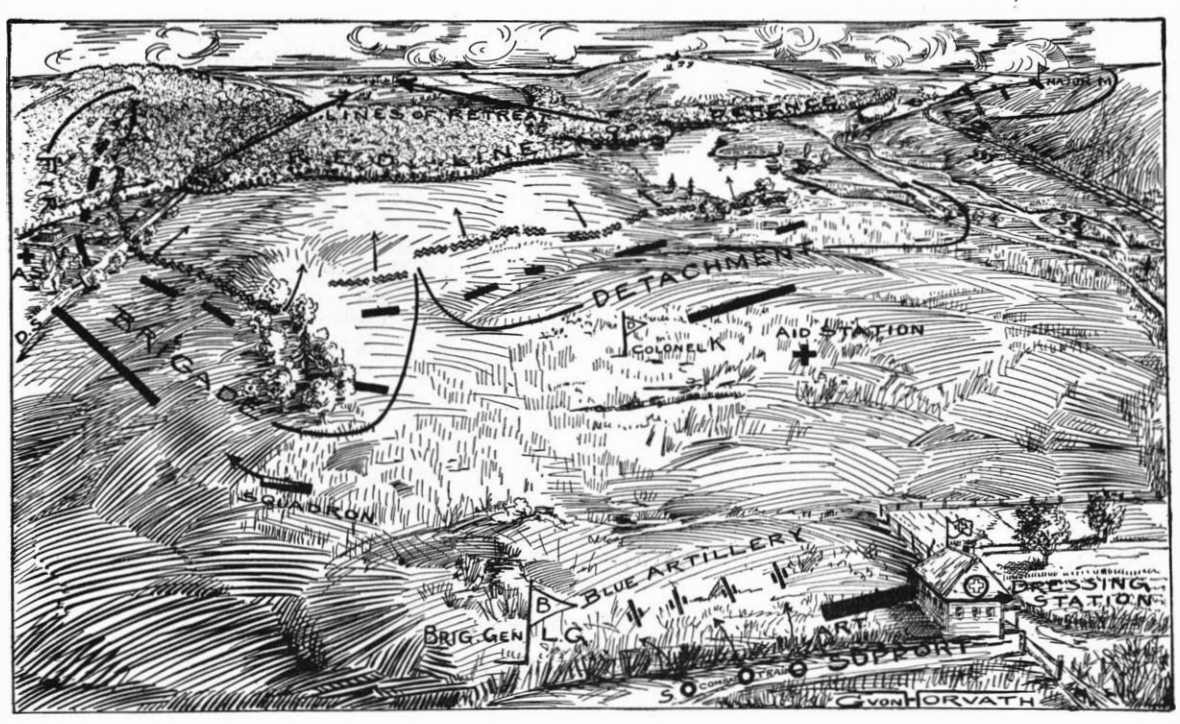
"While the left pushed on, the right, up Timcum Creek, also moved on and all of a sudden the firing practically ceased. Our soldiers dashed forward, and were swallowed by the green forest.

"Far behind the northern edge of the forest the two guns which had escaped were unlimbered and their shells began to burst over their former defensive line. A few minutes later one of our shells silenced one, then the other, while two squadrons of Red cavalry retreated toward Greenville.

"At 7:30 A.M. the battle of Lookout Hill was won by the Blue forces. The larger portion of the regiment of Red cavalry successfully retired, but the infantry of Lieutenant Colonel LC suffered heavy losses in dead, wounded and prisoners."

* * * * *

The accompanying sketch shows the situation at 6:15 A.M., when the envelopment of the enemy's left flank was first felt by the enemy.



The attack, with double envelopment

Sketch of the Positions and Lines of Advance, as seen from Observation Tower on Lookout Hill.

The Duties of the Victor

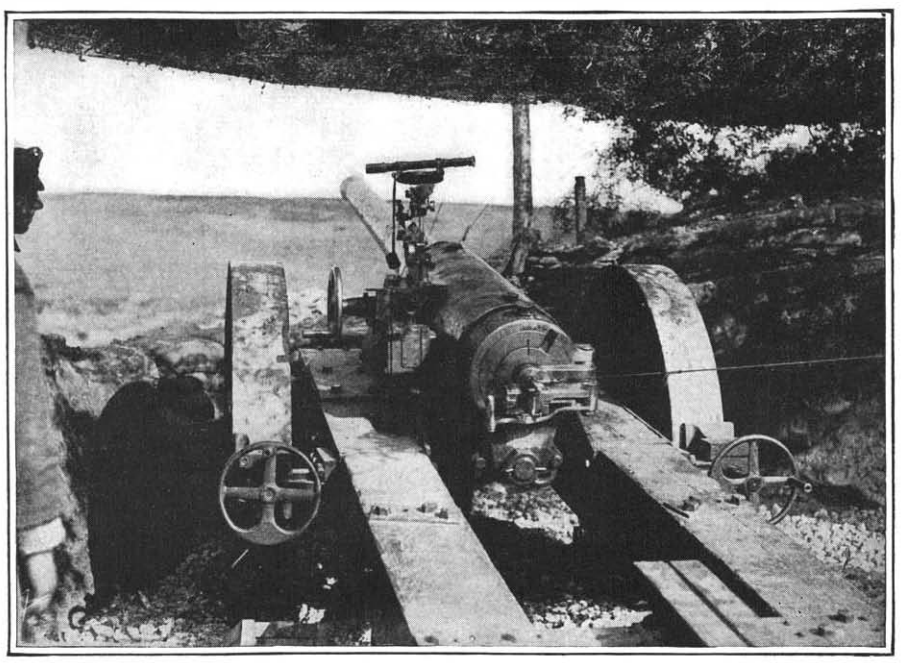
In the foregoing, we have shown the successful assault of superior forces, which brought a decision through action brought a hush and thunder from behind Argus Farm; soon a little cloud appeared near the forest edge, just to vanish again.

"The enemy batteries were well masked behind the trees and I could see how our guns were, so to say, a double envelopment.

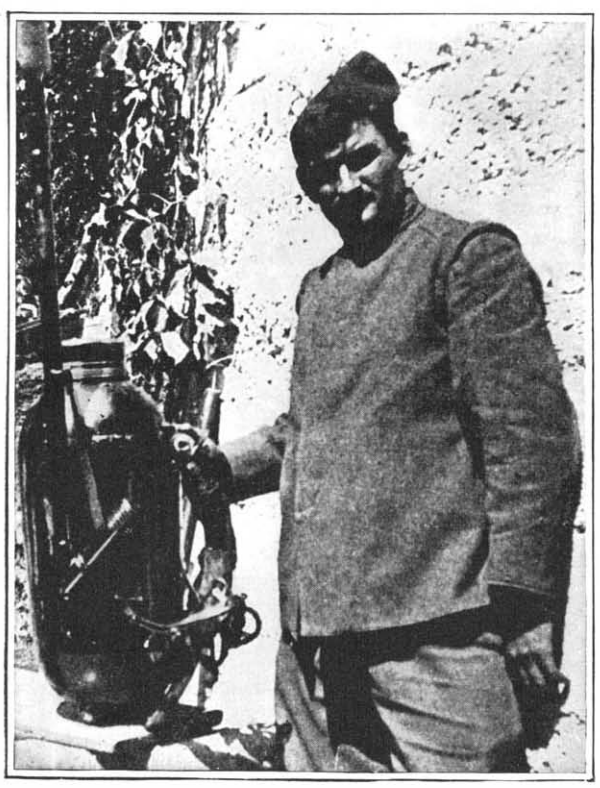
The enemy has been beaten, and has attempted to avoid complete annihilation by a hasty retreat. Now the success which has been gained by the Blues must

(*Concluded on page* 486)

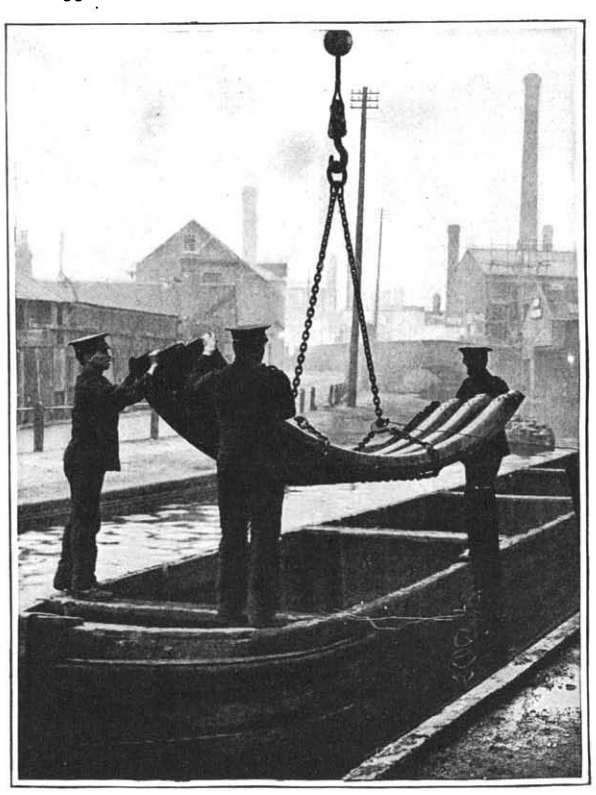
Assembling a heavy artillery wheel with a hydraulic apparatus



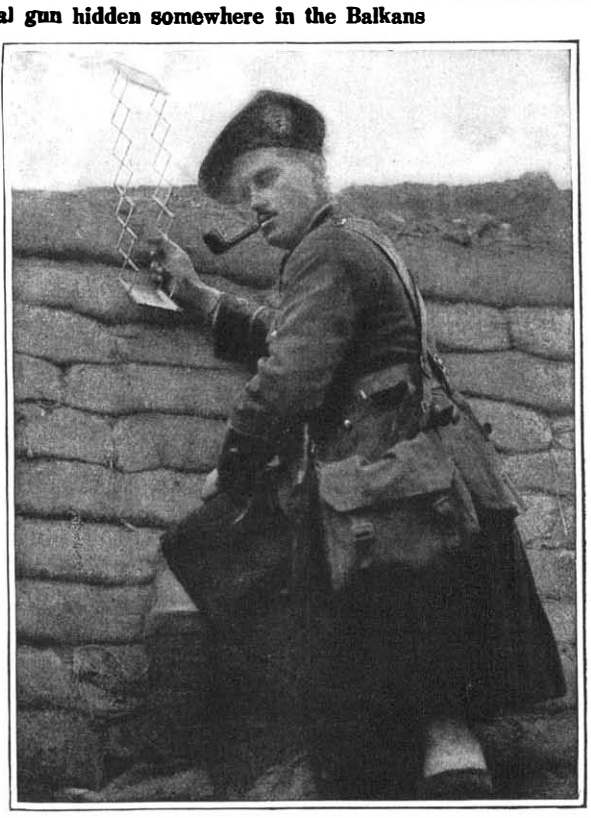
A British naval gun hidden somewhere in the Balkans



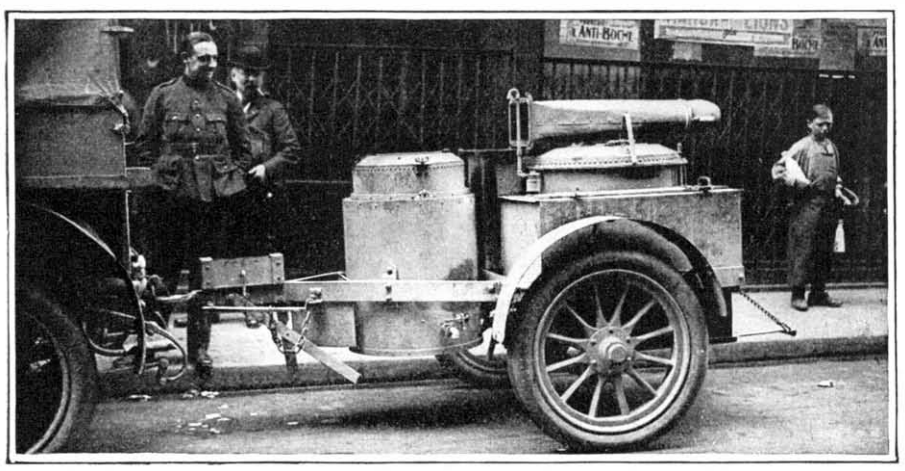
Gas apparatus captured from the Austrians in the Alps



Sheet steel plates for trench covers



Folding periscope for trench use



A coffee percolator on wheels for the Belgian army

Shower-bath truck presented to the French by Russia

Periscopic attachment for rifles

Running to man the anti-aircraft guns

SOME NOVEL INVENTIONS OF THE PRESENT WAR

Cartridge Cases of Steel

Has Germany Found a Substitute for Drawn Brass?

By Edward C. Crossman

WITHIN the memory of quite a few thousand somewhat aged but sprightly gentlemen, the Northern and Southern States of the almost United States argued out a little political difference with rifles using paper cartridge cases. To be technical, these were not cartridges at all, but merely paper packets to join bullet and correct powder charge in one. The soldier bit off the end of the paper, poured down the powder from the muzzle end of the rifle, then rammed home paper and bullet. At times when excitement pressed he forgot to pull the trigger or to cap the gun, and accumulated three or four loads; then, when he finally did perform the correct operation all the way through, the results were astonishing if not pleasing.

Ten years later when the French and Germans flared into what in comparison with the present war was little more than a skirmish, ballisticians and rifle designers had carried the paper case to its highest development after which it was promptly dropped. Prussian shot inaccurately if spitefully at Frenchman, with the Zundnagel, the needle gun, a strange and wondrous weapon, a breech loader using a paper cartridge which in turn contained 74 grains of dirty black powder, and a generous man-stopping slug of lead weighing 478 grains. A steel cylinder, the bolt of the modern rifle of which the needle gun was forefather, was unlocked by turning it through a quarter circle by means of the bolt lever or handle. The paper case was slipped into the chamber of the barrel, and the bolt closed behind it. In the base of the bullet was placed a little fulminate of mercury, sensitive to blows, the primer of the cartridge. Inasmuch as the powder charge lay between the bolt and the bullet, the needle of the gun to fire the cartridge, had to stab through the powder before reaching the primer, and the effect was truly beautiful.

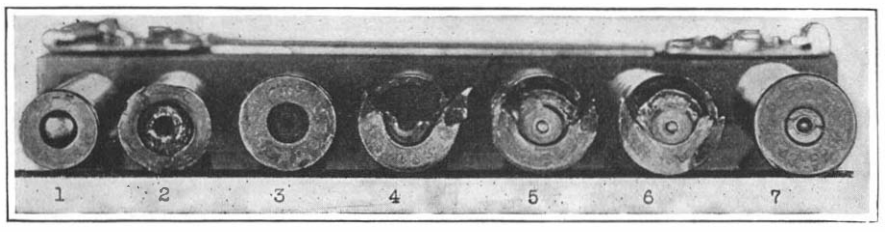
When the trigger was pulled a needle impelled by a spiral spring in the bolt, stabbed viciously through the paper base of the cartridge, through powder, and into the fulminate on the bullet. Whereupon the 74 grains took fire, and a 16-gage slug departed from that rifle on its wobbling career, while fireworks of sorts spouted from the breech of the rifle until after a couple of such seances the canny Hans took to firing the gun from the hip.

Said fireworks were the result of insufficient sealing of the breech by the bolthead and the paper of the cartridge—insufficient obturation as the artilleryman has it. The gun would fire all of 500 yards, but at 200 yards was not always certain of hitting the landscape once in three shots. Some times the needle, right in the midst of the fire which it produced, would burn or break off, a natural result of steel exposed to the constant heat of burning powder around it.

On the other side of the small space separating the two sets of gentlemen, Jean was better provided with the chassepot, another bolt rifle of crude design and paper cartridge, but more sensibly having the primer at the base of the cartridge, not at the base of the bullet. The bolt carried an india rubber washer to help keep the gas from the face of the soldier.

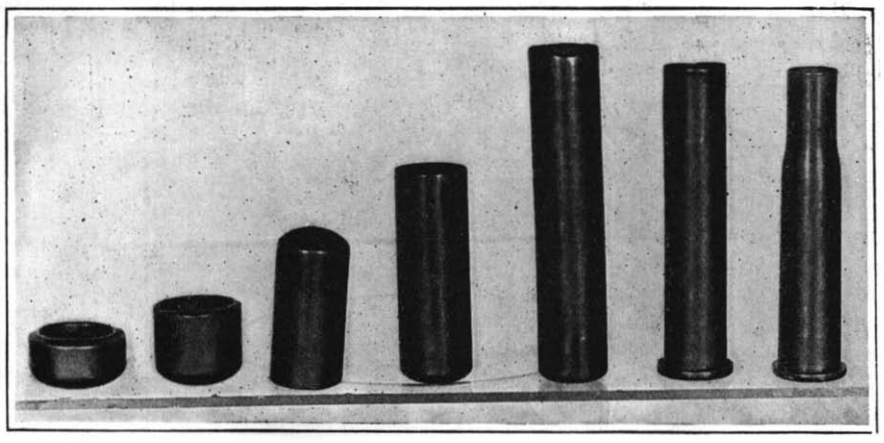
At that stage of the world's progress ballisticians knew better than to use paper cartridges, but both French and Prussians were the victims of the usual slowness of army boards to take up improvements, particularly when the boards are made up of Colonel Fussy and General Mossback, both of whom had seen service with the old weapons and did not believe better could be had. The problem that confronted the ballisticians and designers of those days was to find some way to seal the breech of the breech-loading rifle. Paper, skin, linen, rubber, all failed, but finally the inventor of the pinfire cartridge hit on a combination of a solid paper case with a base of brass, the progenitor of the modern shotgun case. To this day in the huge four and eight bore black powder British express rifles the paper and brass case, the modern shotgun case, still is used.

But in the military rifle this did not prove a happy combination, and the paper case was tried and abandoned by the British in the old Snider in the '60's in favor of a case made of coiled sheet brass, rolled very thin. It was crude, but it served the purpose of sealing the breech of the rifle. Although Mauser developed the solid drawn cartridge case of brass or copper before the end of the Franco-German war in the seventies, the British clung to their faulty and crude coiled brass case until it was finally discredited by the Egyptian campaign of 1888.



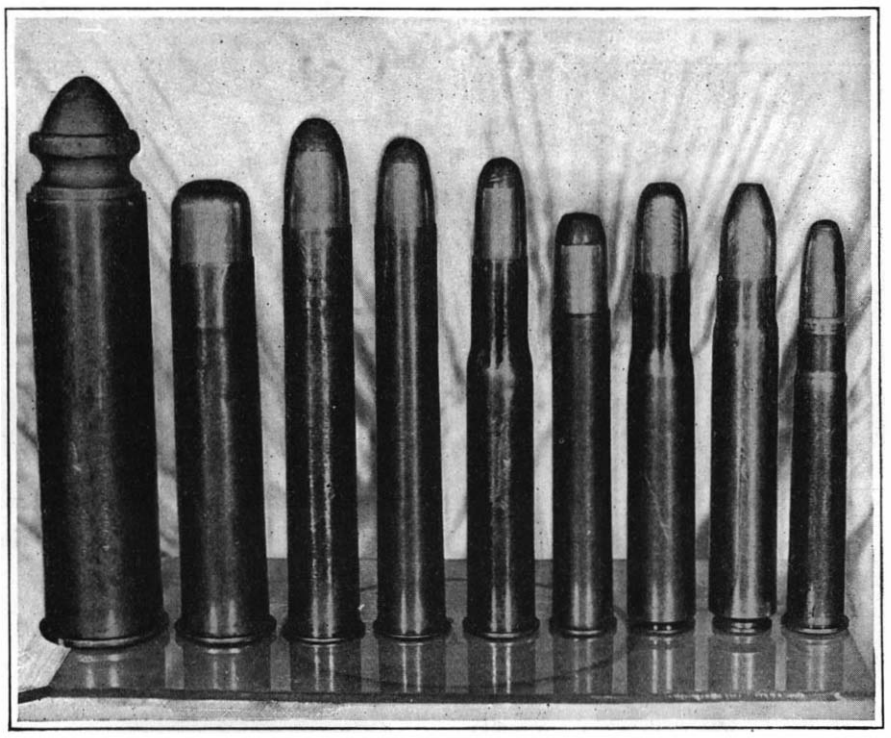
Some examples of the weakness of the brass cartridge case

1, American service case before firing. 2, American service case fired with chamber pressures higher than 90,000 lbs. per square inch; case has flowed sideways, primer pocket greatly enlarged, case ready to burst. 3, Ross .280 case with primer pocket enlarged. 4, 5, 6, same cases that have burst under high pressures. 7, old type rim case which, properly supported, stands more than the modern rimless case which protrudes slightly from chamber.



How cartridges are made

From a flat disk the cartridge is gradually evolved by a series of punch or draw presses to the finished form.



Some examples of modern solid drawn brass cartridges

The coming of the solid drawn brass cartridge case marked the real development of the breech loading rifle, and it has been the standard from 1870 to the present great war, in which the Austrians alone have fired one and a half billion rounds of ammunition so prepared.

The modern cartridge case must serve to hold powder, bullet and primer and it must seal the breech of the rifle against a gas pressure of as high as 60,000 pounds per square inch of chamber area. Not only must it do this, but it must be of such temper as to spring back from the chamber walls after being driven into every minute crevice by this terrific pressure, and practically free itself before the strain of the primary extraction is put on it by the extractor of the bolt of the rifle or machine gun. This temper must not be too high because then the neck of the case will split, make that case useless for future reloading, possibly stick in the rifle, or possibly break off, disabling the gun. It must be of such uniformity in dimensions both in its loaded and unloaded state as to function surely through the mechanism and the chamber of the machine gun firing 600 rounds per minute. Too much "tolerance" between case and chamber walls results in split if not broken cases and disabled gun. Too much or little length—headspace—will result either in misfires in the machine gun or else in failure to close, and a balk. All of these things are measured in thousandths of an inch.

The anxious effort of the British to shut off copper from Germany, and the diplomatic correspondence regarding it, and the hope of the British that copper shortage will prove one of the deciding factors of the war are all because of the importance of the little brass cartridge case.

The modern case is made of a mixture of copper and zinc—spelter—to give the right temper and tenacity under the high modern pressures. The first stage of manufacture is the stamping out of little brass disks from sheet brass—little 25-cent pieces done in yellow metal. Then the disk starts through its gauntlet of draw presses and annealing ovens. A draw press is merely a solid machine containing a die and a punch. The die gives the little disk its first shape under the pressure of the punch, this a shallow little brass cup. Then a series of the presses gradually draws out the cup to the shape and thickness of the finished case, without the head. As drawing tempers and makes the brass brittle, frequent annealing in special furnaces is necessary, and after each annealing, cleaning and washing of the cups. The final operations trim the case, form the head upon it, form the primer socket, pierce through the fire or flash passage, and then reduce or neck down the shell to the proper bullet caliber. It is necessary finally to anneal the mouths of the shells after this necking down.

That almost perfection has been attained in all these many automatic machinery operations, let the fact of the successful use of machine guns testify. The machine gun is utterly at the mercy of its ammunition. The cases made in the United States Army Arsenal at Frankford, Pa., will stand reloading 25 times without giving way.

To guard against the danger of shells that have been annealed by being swept up in some bonfire on a rifle range and that would stick in the rifle or machine gun because of their soft condition, all empty cases before being reloaded are put through a sort of reversed scleroscope at the arsenal; this is an inclined steel plate upon which the fired cases are dropped from a little elevation. The normal cases, still possessed of the right temper, bounce over a little fence from the steel plate; the annealed cases, being soft, fail to clear the boundary and are thrown out.

But while brass cases are mechanically perfect, they have reached about the end of the strength of brass, and rifle pressures are going up and up. Between the army rifle and the velocity of 4,000 feet per second, with the resulting danger space of about 1,000 yards over which the sights of the rifle need not be changed, there stand these obstacles: Erosion of barrel steel through very high chamber pressure; metal fouling, caused by the friction of the cupro-nickel jackets on the steel of the barrel; flowing of the brass case under the high powder pressure.

Improvements in powder by American makers and future improvements in steel will take care of the first; alteration of the jacket composition of the bullet or some system of lubricant applied by means of the powder, will obviate the second, but the third can be taken care of only by the substitution of a different metal from brass.

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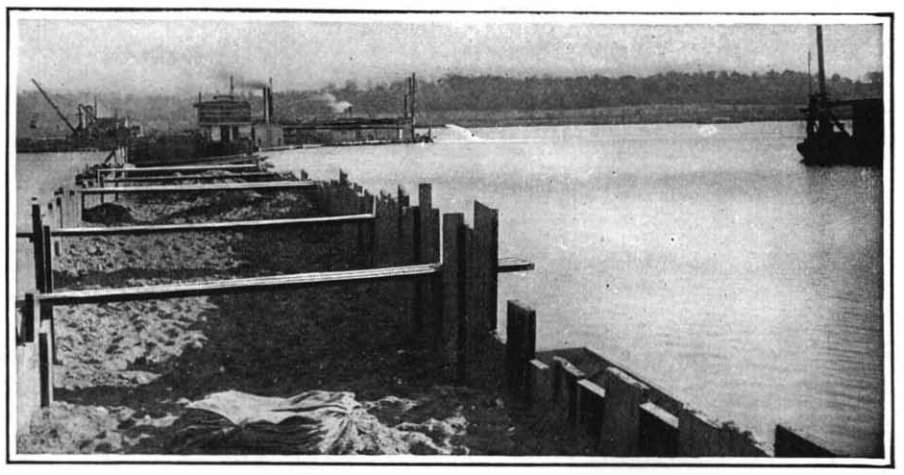
Dry dock excavating. Engineers at work in the river bed of the Mississippi protected by cofferdams



View of pumping fleet in operation at lower end of cofferdam, showing wing of cofferdam extending shoreward

Blasting a Canal Through a River Bottom

Cutting Through the Rock Bed of the St. Claire Rapids

By O. R. Geyer

FOUR or five years from the present time the last great terror of the Mississippi River will have gone the way of the famous Hell Gate rocks and other equally noted obstructions to navigation; the trials and tribulations of the pioneer river boat captains and pilots will then be but a memory. Some months ago United States engineers began blasting a canal 250 feet wide, 3 miles long and 6 feet deep through the solid rock bed of the St. Claire rapids, the most treacherous spot along the 2,000 miles of waterway to-day. This is the greatest project of its kind ever undertaken by the Government, which is paying $1,300,000 for the novelty of digging a canal through a river.

The canalization of the Le Claire rapids will be one of the greatest single improvements ever made along the river and will remove the last great barrier to a six-foot channel. It will make the art of navigation on the Mississippi as safe as steering one's course down the main street of his home town. Boats of heavy draft will be able to pass the rapids at any time during the day or night, even during low water stages, instead of being subject to Government orders which forbid the passage of the rapids in the night time as at present. Since the first steamboat chugged its way up the river about 70 years ago, river craft have been moored just above or below the rapids at the approach of night time.

The jagged rocks have slashed the bottoms from many a boat, as well as wrecking countless rafts which attempted to pass this dangerous stretch of water. Millions of feet of lumber have been slashed into ribbons while being "rafted" over the rapids, and the Government's timely work is expected to give considerable impetus to the movement for the revival of inland navigation.

The work was gotten under way last fall and the work of blasting the rock bed has been carried on without intermission since that time. The Iowa shore is utilized as one bank of the canal while the other bank is formed by a cofferdam nearly three miles in length which connects with a closing dam at the lower end of the canal. The lock which will be used in raising the stage of the river through the canal will be one of the biggest engineering works ever attempted on the river. The closing dam at the lower end will be 400 feet in length, 78 feet wide at the base, 12 feet wide at the top and 22 feet high. The lock will be 80 feet wide and 350 feet long.

The Government engineers began their task with the most complete equipment, the construction camp on the Iowa shore below the town of Le Claire being built on a lasting scale. An immense electric centrifugal pump, two steamboats, two dredge boats, a steel drill boat, three unloading derricks, building boats, seven-ton steam shovel, three locomotives, locomotive crane, numerous dump cars, three portable air compressors and seven jackhammer drills comprise the major equipment. Since last fall 5 miles of railroad track have been laid in the river bed and along the top of the long cofferdam.

The big pump has emptied the water from a tract of about 85 acres on the river bottom, and dry rock excavation has been carried on all winter. The first section of the cofferdam was 8,680 feet in length and has been closed in at the lower end. When this section of the river bed was exposed to the air for the first time, clammers reaped a veritable harvest as the river bed was lined with clams.

Before the cofferdam is completed 2,000,000 feet of heavy timbers will be used in construction work. Heavy yellow pine planks are used in making sectional cribs which are sunk on the line of the river wall of the canal. This work has required all the skill at the command of the large force of engineers and workers, owing to the fact that the water is about 26 feet deep and the current so swift that none but the best work can withstand its terrific force. Steamboats pushed barges loaded with gravel and sand alongside the cribs and dumped their loads with the aid of the unloading barges. Heavy rock was dumped alongside the dam to provide protection from the ice and swift current, but despite these efforts ice jams and high water have caused several breaks in the cofferdam. One of the latest was on January 23rd, when a break occurred about midway in the dam, allowing the pit to be flooded. About three weeks' time was required to repair this damage.

Both dry and subaqueous excavating work was carried on during the early part of the winter, but after cold weather set in this work was limited to dry rock excavation. This feature of the work will require a year's time, as it represents about half of the canal area. About 300,000 cubic yards of rock and gravel, mostly the former, will be excavated by the United States engineers. Of this amount 197,000 cubic yards of rock will be removed by dry excavation. An important aid in the underwater work is the special drill boat which can bore three rows of holes with 28 holes in each row at one time. Blasts of 400 pounds of dynamite shoot columns of water 50 and 75 feet into the air and attract hundreds of visitors along the Iowa shore.

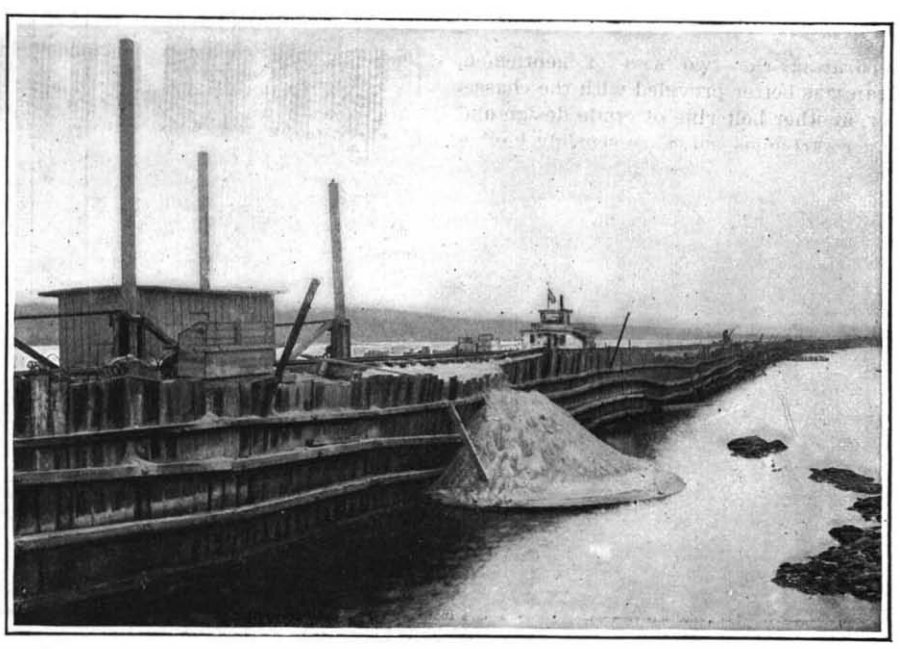
At the lower end of the canal is Smith's island, which forms part of the outer wall of the canal. Levee walls nearly a mile in length will be built on the island to protect it from the high water which will be backed up by the dam at the lower end of the canal. This work will not be begun until steam shovel excavation is completed in 1917. Work then will be begun on the lower end of the cofferdam and the closing dam and lock.

The work is in charge of H. E. Reeves, assistant engineer. The Government camp and storage yards are located near the head of the canal. The best of accommodations are given the men who will make this their home for several years to come. It is expected that the canal will be ready for use by 1921, its completion being delayed somewhat by the fact that only a small portion of the appropriation is available each year.

The Platinnm Industry of Colombia

ACCORDING to the report of the United States Consular Service at Cartagena, platinum is found in Colombia near the headwaters of the Atrato and San Juan Rivers in the Intendencia del Choco. Nearly all the streams of this region yield the metal, but the gravels of the Condoto River, it is said, pan out more richly than do the others. Platinum is also found, although in smaller quantities, in the fluvial sands of the Department of Tolima.

Extreme lower end of cofferdam, June 30th, 1915, showing rough timber work on floating pontoon fastened to anchored spud boats

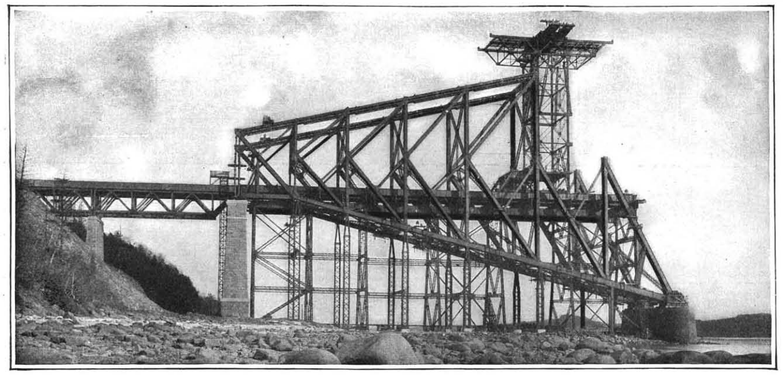


A section of the two-mile longitudinal dam, with watertight core of the cofferdam rock piled against it to prevent ice damage

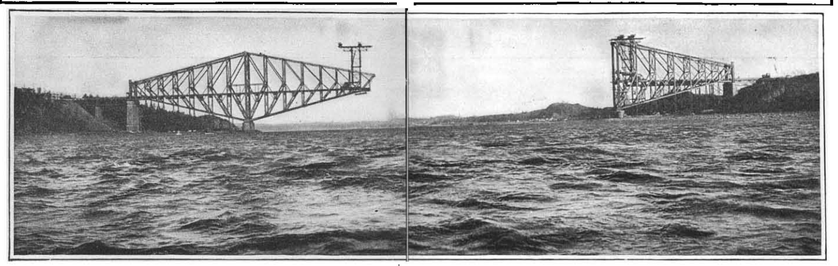
The New Q uebec Bridge

Progress of Erection of the orld's Longest Cantilever Span

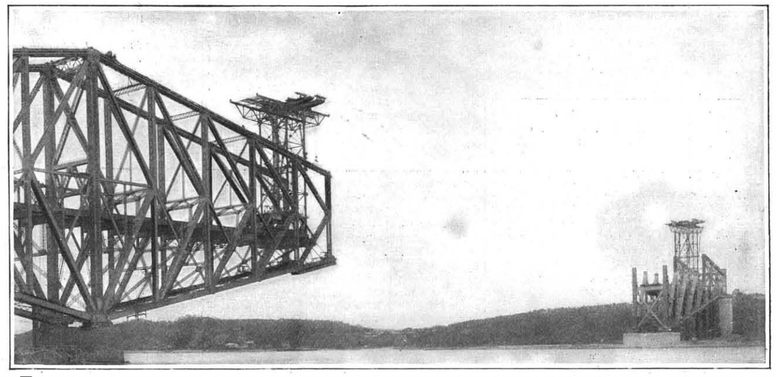
By A. Meyers



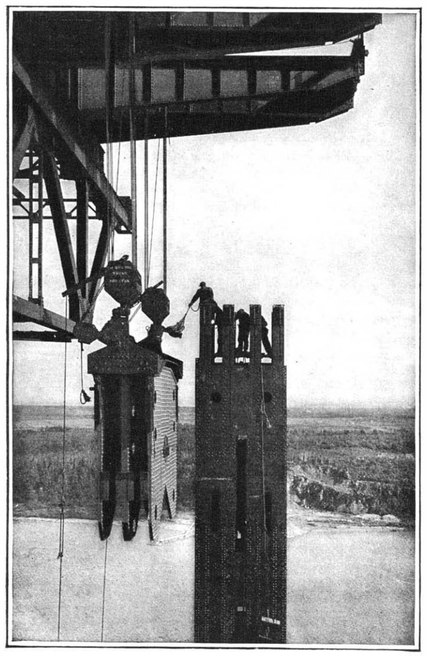
The traveler on its last trip to the main pier, placing the upper member of the north anchor arm, November, 1914



Status of the bridge last November when work was halt cantilever and the structure should be r or the winter season. Work is now proceeding on the south y to receive the center span next September



The north cantilever arm and the south anchor arm in the process of erection. Note the "flying bridge" supporting the last placed section of the bottom chord



Placing one half of the main link, connecting the cantilever and anchor arm top chords, at the top of the main post, 350 feet above the water level

ON the 12th of November, 1915, when the last member of the north cantilever arm was put in place, the third season's work in connection with the erection of the superstructure of the new Quebec Bridge was brought to a satisfactory close.

The season of 1915 was remarkable on account of th great amount of tonnage handled, the rapidity of erection, and the clock-like regularity of the advancement of the work. Except at times, from the inclemency of the weather and high wind, there was practically no unforeseen delay of any consequence, and the work progressed according to schedule in a manner that attested to the careful and well thought out plans.

During this, the third season's work the tonnage erected, amounting approximately to 30,000 tons, was over twice as much as that put in place during the seasons of 1913 and 1914 combined.

During the summer of 1913 the approach spans on the north shore from the abutments to the anchor pier were fully erected by means of a derrick car. These spans were erected partly on wooden and steel falsework and the longer spans partly cantilever. The last supports for the longer approach spans were at the first panel point past the center on the side nearest the anchor pier. Here they rested on sandjacks on top of the steel bents. When the spans were completely erected they were lowered onto their shoes on the anchor pier by means of these sandjacks.

During the fall of 1913 and the following winter the 1,000-ton traveler, standing over 200 ft. high, carrying two electric traveling cranes capable of lifting 110 tons each, and four 70-ft. 30-ton derrick booms, was erected just back of the north abutment. This traveler was completely finished by May, 1914, and one week later it was moved over the approach spans to its first position over the anchor pier. The approach spans had previously been equipped with special brackets carrying a special line of outside stringers for supporting the traveler track, and also at several points had been reinforced to carry this excessively heavy concentration.

From its position over the anchor pier the traveler, on May 21, 1914, began its work of erecting the falsework and superstructure of the north anchor and cantilever arms, which it finished, as stated above, on November 12, 1915, consuming in actual working time some fourteen months, during which time it erected, including falsework and bridge material, approximately 35,000 tons of steel.

The traveler on the first trip out to the main pier erected the inside staging which carried the main bridge floor material and extra lines of girders for the traveler track, and also erected the outside staging which supported the main trusses, sway and lateral bracing of the anchor arm.

This work was completed early in July, and on the 18th of that month the erection of the main shoes on the north main pier was begun. Each of these shoes weighed about 450 tons, and was shipped in sections weighing up to 50 tons. The lower story is made up of four steel castings, each casting weighing about 40 tons. The middle and top stories are made up of four webs running 9 inches thick in places, spaced to correspond to the webs of the bottom chords, compression diagonals and main post. These webs are reinforced and supported by heavy cross diaphragms, spaced about two feet centers. Extreme care was taken to insure a perfect bearing on the bridge seats for these shoes, and in placing them exceptional precautions were taken to see that they were properly alined.

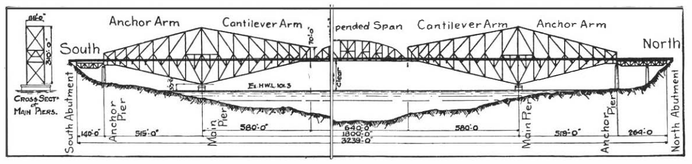
The shoes being erected, the bottom chord, some pieces of which weighed over 100 tons, with its lateral bracing was next laid from the main pier to the anchor pier.

The traveler was then brought back to the main pier and commenced the placing of the web members below the middle or "K" joints. This work was finished by November 18th, and the traveler started on its last trip to the main pier, completing the erection of the upper portions of the trusses and sway bracing except the last two panels next the main pier.

The work on the north anchor arm for the season was then brought to a close—December 3, 1914.

The work on the south shore during the season of 1914 consisted of the erection of the south approach span, the mode of erection being similar to that followed for the north shore approach spans, as described above. Also about two thirds of the south shore traveler were erected before the close of the season.

In connection with the erection of the anchor arms, after the bottom chord had been completely riveted up in a straight line, it was jacked down to a curve sufficient to bring the top chord panel points about one inch closer together than the normal shop lengths of the eyebars demanded. This was accomplished by slotting the pinholes in the eyebars ½ inch in the direction opposite to the bearing surface. The pinholes at the upper ends of the main tension diagonals were slotted 2 inches in a similar manner. The purpose of this camber was to avoid as far as possible any difficulty that might arise in driving the huge pins used for connecting the main members.



Diagrammatic view of the bri Note the suspended center span

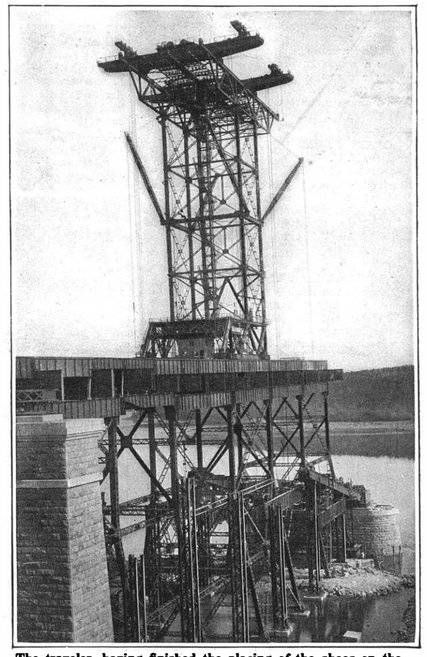
Work on the north shore was resumed in the spring of 1915—about the middle of April. The erection of the anchor arm was completed, and on May 3rd the placing of the main posts was begun. Each post, standing 310 ft. high, weighing approximately 1,000 tons, was shipped in 27 pieces. The two were assembled simultaneously, and the work of erection was completed by May 31st. The outside dimensions of these main posts are about 10 ft. by 10 ft., and although there were six full horizontal field splices in each post, the final distance, center to center of end pins, was as nearly accurate and the bearing surfaces of the pins as nearly horizontal as it was possible to measure.

In the erection of the cantilever arm, which was begun on June 9th, the panels are completed as the traveler advances, the final bracing for each panel being put in by the rear booms of the traveler. On account of the large section and the length, the bottom chords are fully spliced twice between the main panel points. This necessitated that they be supported while the different parts were being assembled and lined up on what is known as a "flying bridge." This "flying bridge" is attached at the shore end by a pin driven through a temporary bracket which is bolted to the bottom flange of the chords already placed and the front end is tied back to the compression diagonals by means of yoking girders and links. The adjusting of the chord for riveting and driving of pins connecting the chords to the tension verticals was made by means of jacks placed on this bridge. As each panel was completed the bridge was taken up by the cranes of the traveler and moved ahead to its new position.

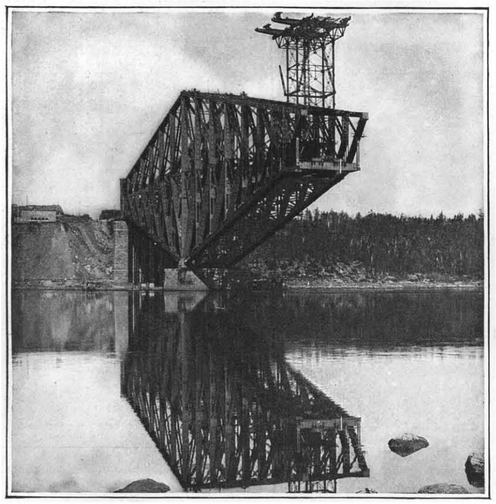
The operating schedule for each panel of the cantilever arm was approximately as follows:

With the traveler standing with its front legs at a main panel point, the "flying bridge" was moved forward into position; the first panel section of the lower chord placed with its portion of the bottom lateral

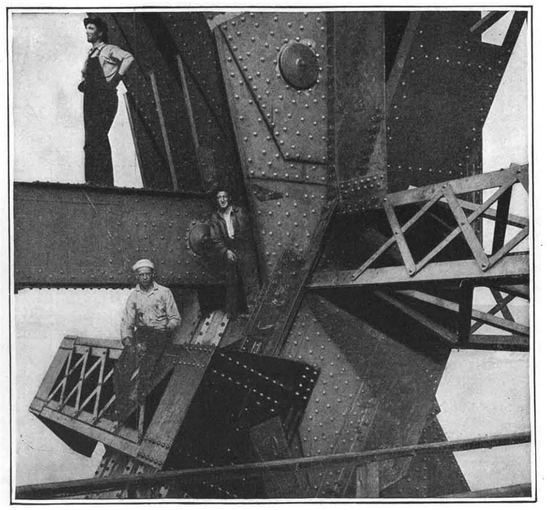
(Concluded on page 490)



The traveler, having finished the placing of the shoes on the main pier, is laying the bottom chords of the anchor arm on the outside staging



The north anchor and cantilever arms, completed November, 1915



Showing the enormous size of the details at the middle or "K" joints

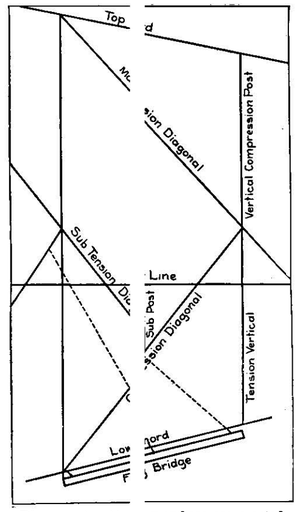
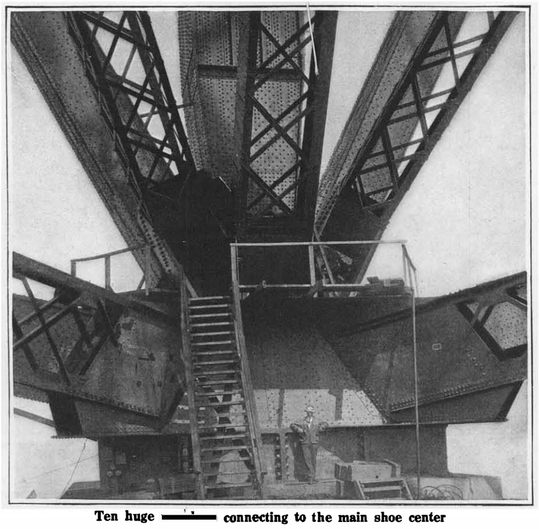
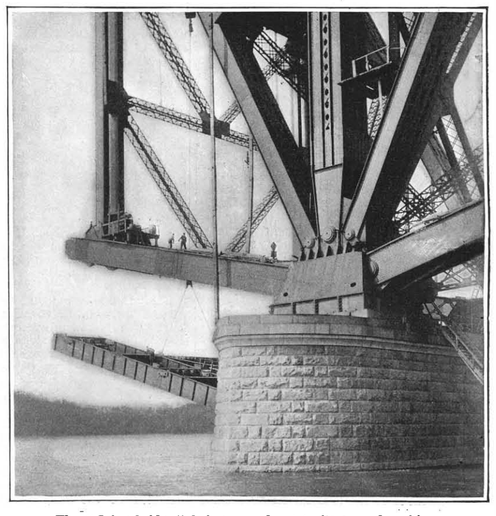


Diagram showing members are erected



Ten huge ——— connecting to the main shoe center



The "flying bridge" being moved out to its second position

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

REVERSIBLE CUFF.—S. GERSON, care of Hartman & Levene, 309 Broadway, New York, N. Y. This invention relates to shirts and similar garments, and provides a cuff of soft material and of doubled-up type, and arranged to permit of wearing the cuff reversedly or turned inside out, thus allowing its use for a long time prior to laundrying it, or in case the original outer face becomes threadbare or torn.

Of Interest to Farmers

POTATO PLANTER.—A. REICHERT, Auburn, Wash. This invention provides a planter, including a revoluble feeder wheel and mechanism for securely rotating or "kicking" the wheel at equal intervals, whereby the potatoes carried by the wheel will be deposited at equally spaced intervals in a delivering tube, irrespective of the size of the potatoes, so that they may be conveyed through the tube to the ground and uniformly planted at equal distances and depths apart.

MANURE WAGON.—B. V. CORNELIUS, Route 1, Village Springs, Ala. The invention pertains more particularly to devices for distributing manure in the liquid form. It provides a wagon having separate compartments, one for carrying manure and one for water, the parts being so arranged that leakage from the manure mingles with the water and may be discharged therewith for purposes of fertilization.

GRAIN SEPARATOR.—H. BUISSON, Fort Totten, N. D. This improvement relates to the separation of the bad from the good grains, in agricultural activities, and the main object thereof is to provide mechanical means for accomplishing this result. It provides a machine for this purpose, which is readily operated by hand, but which may also be power driven.

COUPLING.—G. F. WINTER, Lihue Mill, Lihue, Kauai, Hawaii. This invention relates to sugar cane mills, and provides a coupling more especially designed for coupling together the sections of the square driving shaft for the upper roller, with a view to render the said driving shaft flexible to allow the upper roller to yield in case foreign matter pass with the sugar cane between the rollers.

COMBINATION GRIT FOR FOWLS.—H. VON UFFEL, Prince George Hotel, New York, N. Y. This invention relates to a feed for fowls in the form of a combination grit, in which the particles of grit proper are enriched with a certain fixed coating or covering of any suitable substance which is easily assimilated. The coating may consist of a substance containing either a food or a stimulant, or both.

Of General Interest

WORK SUPPORT.—MARY A. KEATING, 161 W. 25th St., New York, N. Y. This invention relates particularly to a device for use in the school room for acting as a support for sheets, pencils, and objects to be drawn, as well as other suitable articles. It provides a supporting clamping member designed to be secured to a desk or other support which will resiliently clamp an article in place so as to hold the same in view continually.

PROCESS OF PRODUCING SOLUBLE SALTS OF ALUMINUM.—M. P. COOLBAUGH and E. H. QUINNEY. Address Schrader & Lewis, Rapid City, S. D. In this case the invention has reference to improvements in processes for producing soluble salts for aluminum from kaolin and other siliceous and argillaceous earths, rocks, or minerals containing no potash, in which compounds of aluminum exist in an insoluble form.

PORTABLE STEEL BUILDING.—J. R. ASHLEY, 1790 Broadway, New York, N. Y. This invention reinforces a portable steel building structure; balances the load carried by the roof; stiffens the side wall construction of the building without materially augmenting the weight thereof; cheapens the cost of construction; and simplifies the labor of assembling the parts of which said building is composed.

TIME EXPOSURE CALCULATING METER.—W. H. EDMUNDS, 23rd and Market Sts., Denver, Colo. This meter is for use in connection with a photographic camera for calculating the time of exposure necessary to produce the best results under prevailing conditions. The invention provides a device designed to be located in a particular position upon a camera, the operation of the meter depending for accuracy upon its proper position on the camera.

SELF-FILLING FOUNTAIN PEN.—W. I. FERRIS, 173 Broadway, New York, N. Y. This improvement relates to self-filling fountain pens, and deals more particularly with operating means for the deflating presser bar for the ink sack. Another object of the invention is to provide a novel, inexpensive, and reliable spring for the presser bar.

BOND MATURITY CALCULATOR.—G. H. HEWITT, JR., 66 Broadway, New York, N. Y. The invention relates to means for determining the terms which bonds, promissory notes, or the like, have to run from the present date to the date of maturity, the primary object being to provide a device having relatively movable parts with data arranged thereon and adapted to indicate, by a simple adjustment of the relatively movable parts, the number of years, months, and days to the date of maturity.

SUPPORT FOR CEMENTITIOUS MATERIAL.—E. FLAGG, 109 Broad St., New York, N. Y. The invention relates to means adapted to form supports for cementitious material partitions while the same are in process of setting. It relates more particularly to vertical supports which will carry the plastic mass, and which will permit the same to plumb under the action of gravity.

PAPER BAG.—S. S. STEIN, 8 W. 36th St., New York, N. Y. In the present invention the improvement has reference to paper bags, and refers more particularly to handles therefor, whereby a number of bags can be conveniently carried together without any danger of losing any of the bags or the contents thereof.

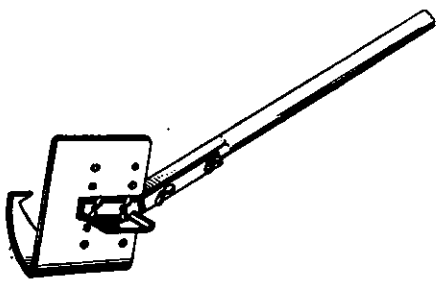
LEG SETTING DEVICE.—M. SCHNUG, Bonduel, Wis. The invention relates to portable means for setting a fracture of the lower leg of a human, either right or left, and the main object thereof is to provide such a device which may be readily assembled and unassembled whereby, when not in use, the parts will occupy but small space.

LIMB SETTING DEVICE.—M. SCHNUG, Bonduel, Wis. This invention is designed for setting factures of the upper leg or hip, right, left, or both, and in the reduction of which it is necessary to have the body elevated in order to be enabled to put a bandage or plaster cast around the leg, hip, or back, and at the same time to maintain the leg or legs under tension and in proper anatomical line.

Hardware and Tools

COMPOSITE FILE.—H. GETAZ, P. O. Box 910, Pittsfield, Mass. One of the objects of the present invention is the provision of a new and improved composite file, more especially designed for use by metal workers, and arranged to allow convenient sharpening of the cutting edges when dulled by use.

LAWN-EDGER.—C. W. HALL, 4423 Buni St., Denver, Colo. In this case the invention is an improvement in that class of lawn-edgers and trimmers which consist, broadly

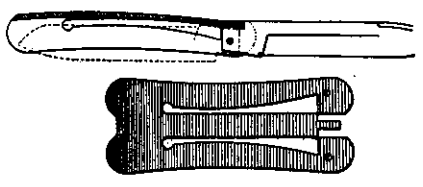


LAWN-EDGER.

stated, of a curved blade secured to a handle and provided on one side with a lateral gage, which runs on the curb or edge of the sidewalk, and is adjustable vertically to vary the depth of cut made by the blade.

DENTAL APPLIANCE.—T. H. RAGATZ, Prairie du Sac, Wis. The invention has particular reference to a novel device for cleaning teeth. It provides a rotary flexible container adapted to receive the cleaning material and to be placed over the tooth to be cleaned, said container being rotated by an endless flexible belt or cord.

POCKET KNIFE.—J. F. KNOWLTON, 1113 3d St., Hibbing, Minn. This invention relates to knives such as pocket knives including a handle, or to be disposed in line with the handle for use. It provides a knife, the complete handle of which including the spring will be cheaply produced in single structure. The in-



POCKET KNIFE.

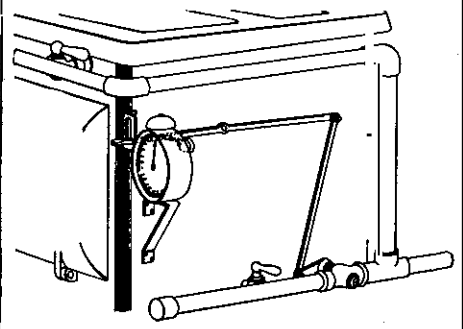
vention produces a single handle blank with members thereon to constitute the sides and spring, and the blank is then bent and swayed to bring the side members into proper position with the spring constituting the whole back of the handle.

Household Utilities

TOASTER.—G. H. CARLTON, Mason City, Iowa. The invention relates more particularly to that type of toasters which embodies toasting plates having means whereby to support the same in superposed relation above a burner and the like on which bread is disposed for toasting, the object being to provide means whereby the heat rising from the burner will be distributed over the entire lower surface of the toasting plate.

IRONING BOARD.—R. B. PALMER, 28 Gold St., Norwich, N. Y. This improvement refers to a structure having folding supports for the board, the supports including braces pivotally connected at one end, and having means whereby to detachably connect the opposite ends of the braces, to variously adjust said braces whereby to vary the height of the board or adapt it for other purposes such as a bedside table.

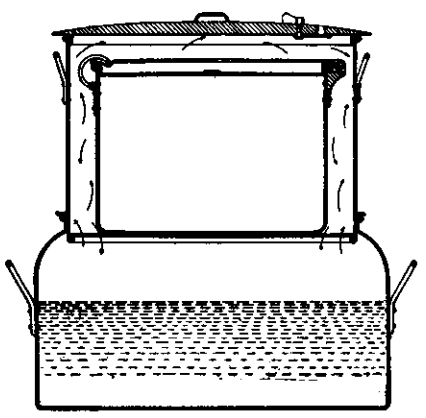
TIME CONTROLLED CUT-OFF VALVE FOR GAS RANGES.—H. SIMKE and J. A. STELLER. Address the latter, 803 E. Walnut St., Bloomington, Ill. This invention provides a clock controlled valve so designed that when



TIME CONTROLLED CUT-OFF VALVE FOR GAS RANGES.

applied to a gas range it is possible to heat the range for a predetermined time, and when the time limit is reached the clock will automatically effect the closing of the gas valve to stop the heating of the range. The clock-actuated mechanism is operatively connected with the cut-off valve, and is capable of being set for actuation after the lapse of a predetermined interval of time, according to the food to be baked or roasted. The timer or clock is more simple and easy to operate for this special use than if it were a common alarm clock.

COOKING UTENSIL.—W. F. CURRAN, Box 1049, Waco, Tex. This improvement relates to double cookers for domestic cooking purposes.



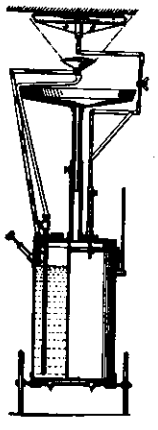
COOKING UTENSIL.

The ordinary double boiler, by reason of the wasteful escape of steam, tends to dissipate the water in a short time, and is liable also to boil over, so that the utensil requires constant attention. The prime object is to provide a domestic double boiler, which may be used for continuous cooking for a long period, without replenishing the water supply.

INSECT CATCHER.—S. H. PATTERSON, 121 N. 21st St., Philadelphia, Pa. Use is made in this invention of a funnel provided with a barrel, and having an air channel leading from the barrel to the edge of the funnel, and a handled plunger movable in the barrel for forcing an air blast through the air channel to dislodge an insect on a ceiling, wall, or other support, and against which the finger is pressed.

Machines and Mechanical Devices

MACHINE FOR CLEANING CEILINGS.—S. GOTTLIEB, care of Sackler and Lavitt, 257 Broadway, New York, N. Y. This improvement provides a machine of a portable nature adapted to be moved about on a floor or



MACHINE FOR CLEANING CEILINGS.

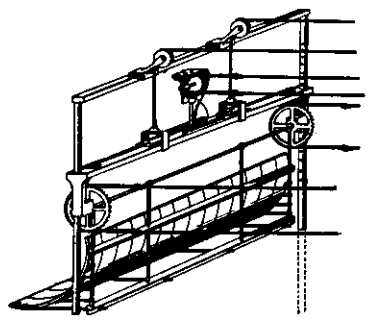
other analogous support, such machine having facilities for brushing a ceiling or sweeping dust, dirt, cobwebs, or the like from the same by means operable by the operator standing on the floor.

SUBMARINE TORPEDO DISCHARGING DEVICE.—H. W. HILLE, 306 Wells Fargo Bld'g, New Orleans, La. This invention provides a means whereby a torpedo or bomb may be discharged when the submarine moves into close proximity with its target, so that there will be no danger of the torpedo or bomb missing its objective. It provides a means of such a nature that a torpedo may be readily inserted within the tube from within the submarine and while the same is submerged.

WHEELED SCRAPER.—O. P. HALLOCK. Address M. V. Liddell, 1408 South 8th St., Springfield, Ill. This invention has particular reference to machines for excavating and conveying the excavated earth from the point of excavation to the point of deposit. While this machine is particularly adapted for road making purposes, it is by no means to be limited to any particular art.

AUTOMATIC JOINTER.—G. E. TOMLINSON, Winchester, Ky. This invention relates to woodworking machinery, and has particular reference to edge trimmers or jointers. It provides a machine for jointing the edges of staves for barrels or hogsheads so as to joint both edges of pieces or strips of lumber of random width automatically or in a continuous operation.

WAVE MOTOR.—K. FOUSEK, 505 East 9th St., Austin, Tex. This invention provides a wave motor, which includes an apparatus installed in a wave disturbed liquid and a power



WAVE MOTOR.

converting mechanism connected thereto by flexible elements and adapted to convert the energy received therefrom into such form that it may be conveniently utilized. It provides a wave-actuated buffer plate in the path of motion of the waves, and so mounted that it may be raised or lowered and locked at any intermediate position, all of which is under control of the operator located at some distant point.

SEWING MACHINE.—J. PARTMANN, 38 W. 3rd St., New York, N. Y. This improvement provides a compact sewing machine in which the lever has two arms extending from its fulcrum in the same general direction, one of the arms being connected with the driving shaft by a link and cam, and the other arm serving to operate the needle bar.

CHECK CONTROLLED DEVICE.—S. F. MIOTON, 2523 Esplanade Ave, New Orleans, La. The invention relates to coin or check controlled devices, and is designed especially for use in connection with the automatic gasoline service disclosed and claimed in a former Letters Patent granted to Mr. Mioton. The invention provides a mechanism which is peculiarly adapted for detecting bogus or bad coins or checks which are too heavy or too light.

SOUND CONTROL FOR TALKING MACHINES.—V. W. WECZERZICK, 857 Union St., Brooklyn, N. Y., N. Y. This invention provides a device for controlling the volume of sound arranged in the gooseneck of the talking machine or at some other convenient point in any part of the quantity or volume of sound tube, whereby the tone is affected according to the movement of the controlling device.

AUTOMATIC RETURN CHECK AND STOP VALVE.—T. B. FORD, 40 Broome St., New York, N. Y. This inventor's object is to provide an automatic return check and stop valve used in steam pipes and arranged to prevent sticking and chattering, to dispense with the dash pot, to permit convenient adjustment for operating at slight differences of boiler and main pressures, and to provide a visible means for the attendant in charge to see whether the valve is properly working or not.

PIPE SADDLE.—J. G. HAYDEN, care of Flora Water Co., Flora, Ind. Mr. Hayden's invention relates to a form of pipe saddle adapted to pipes of different diameters. The invention eliminates the objections inherent to the old form of saddles, and provides a connection which is absolutely tight, irrespective of the size of the pipe, or the inequalities of the surface of the same.

HYDRAULIC VALVE.—W. L. MARSHALL, Washington, D. C. The inventor provides a hydraulic valve which allows the greatest possible discharge with the least weight of material in the moving parts, with the least motion and friction, and with forces acting on the valve which are balanced or in equilibrium in every direction and at every position of the valve.

Prime Movers and Their Accessories

FUEL HEATING DEVICE FOR INTERNAL COMBUSTION ENGINES.—L. A., E. T. & E. L. STRAUBEL. Address Straubel Machine Co., Green Bay, Wis. The invention provides means whereby the fuel supplied to an inter-

(*Concluded on page* 484)

A Record of *Good Roads* That Every *Taxpayer* Should Read

The Old Macadam Road

In the old days before the automobile, the roadway that MacAdam invented a hundred years ago was good enough for anybody. It was hard, smooth, fairly dustless and easy to maintain at slight annual expense. Its durability varied, of course, with the traffic but it would go for some ten years or more without serious reconstruction.

The Automobile Arrives

Then came the automobile storming down MacAdam's smooth highway with a vicious abrasive thrust of its powerful rear wheels and scattering MacAdam's expensive materials to the winds.

And macadam roads promptly went out of date.

There are still some road builders who are trying to make them serve in this day of fast traffic, and find that they are either the custodians of melancholy lanes of loose stone or are engaged incessantly in expensive repair and reconstruction.

Tarvia Roads

To make the road once again stronger than the vehicle, modern engineers employ bitumens of which the best known and most used is Tarvia.

Tarvia is a tough, coal tar preparation. It is not an oil and does not track or smell. It is not a dust-layer but rather a dust-preventer. Its use also adds greatly to the life of the roadway since it cements the road into a tough, slightly plastic matrix that withstands automobile and horse drawn traffic to an extent that is remarkable.

How long will they last?

How long the Tarvia bond would withstand traffic has not been known till recently but some of the early Tarvia roads are now ready to testify. For instance:

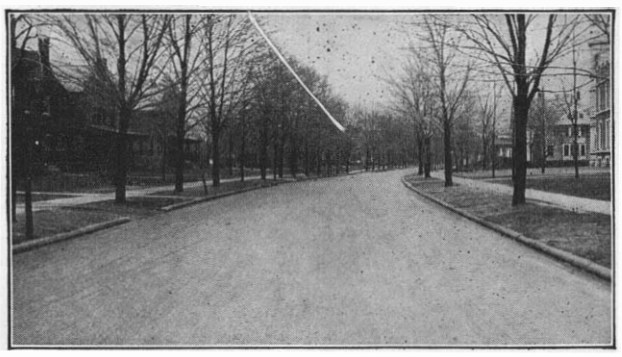
Newton Boulevard, Newton, Mass., Treated with "Tarvia-A" nine years ago. Still in good condition.

A nine year record

Newton Boulevard, Newton, Mass., was tarviated for five miles in 1906 and 1907. It is a great automobile thoroughfare and before that time its maintenance was difficult and costly. The original 1906 treatment has never been renewed and repairs have been too insignificant to compute. At the most an inexpensive renewal of the top coat of Tarvia will make it good for another long period.

A ten year record

Bellflower Avenue, a fine residential street in Cleveland, Ohio, was built with Tarvia in 1905. The photograph below of this paving was taken in 1915



Bellflower Ave., Cleveland, O., Constructed with "Tarvia-X" in 1905. Note its present good condition after 10 years!

showing its fine condition after ten years service without renewal or repairs, a record obviously impossible for plain macadam on a city street like this.

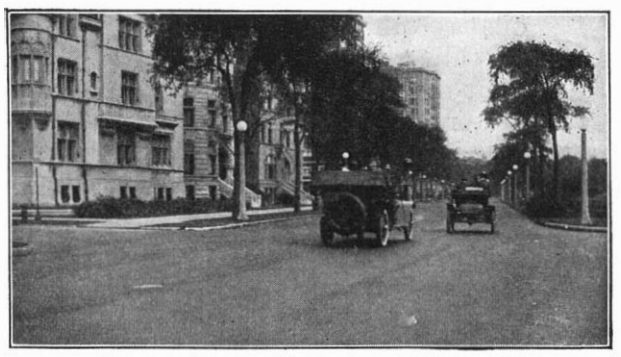
A six year record

This was on the fashionable Lake Shore Drive in the city of Chicago where plain macadam would probably not have lasted through a *single winter.*

As to the future

Such veteran Tarvia roads are the forerunners of a host that will be recorded a little later when the great mileages of Tarvia work that were built in 1909, 1910 and 1911 have reached a ripe old age.

Those early Tarvia roads were crude compared with the more scientific and more durable construction of today.



Lake Shore Drive, Chicago, Ill., Reconstructed with "Tarvia" in 1909. Heavy traffic but still good in 1915 as above.

Different grades of Tarvia

Tarvia is made in three grades: "Tarvia-X" for new or rebuilt roads and pavements, "Tarvia-A" for surface application, and "Tarvia-B" for dust prevention and road preservation.

A word to taxpayers

You, as a taxpayer, are paying for roads. If you have dusty plain macadam, you are paying enough to secure durable, dustless Tarvia roads, for the latter, owing to the saving in maintenance expenses, cost no more in the end.

Remember that dusty roads are not signs of economy, but of wasteful and antiquated methods.

Fac-simile of label appearingon"Tarvia -X" barrels.

Special Service Department

In order to bring the facts before taxpayers as well as road authorities, The Barrett Company has organized a Special Service Department, which keeps up to the minute on all road problems. If you will write to the nearest office regarding road conditions or problems in your vicinity, the matter will have the prompt attention of experienced engineers. This service is free for the asking. If you want *better roads* and *lower taxes*, this Department can greatly assist you.

Write our Service Department for illustrated booklet and further information

The Barrett Company

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Pittsburgh Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle Peoria
THE PATERSON MANUFACTURING COMPANY, Limited: Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

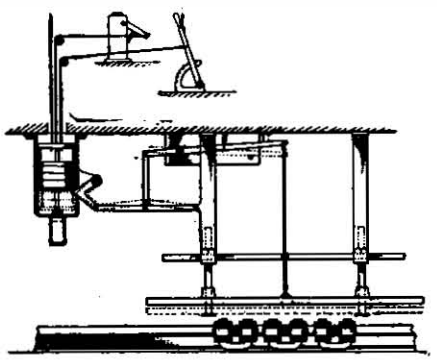
(Concluded from page 482)

nal combustion engine may be heated to a high temperature before introduction within the working cylinder, and without producing an amount of friction in the passage of the fuel as would tend to destroy or impair the free circulation thereof.

CARBURETER.—D. CAHILL, 108 Quai de Courbevoie, Courbevoie, Seine, France. The invention relates more particularly to those of the type wherein a choking member, operated by hand and controlling the admission of the mixture of air and liquid fuel to the combustion chamber of the engine, is connected with a similar choking member designed to vary at the same time the sectional area of the passage for the air only, or both the sectional area of the air passage and that of the passage for the fuel.

Railways and Their Accessories

AUTOMATIC TRAIN STOPPING DEVICE.—G. H. ENNIS, Derby, Conn. This inventor provides magnetic means for stopping a train in which there is no actual contact between the devices carried by the engine and those



AUTOMATIC TRAIN STOPPING DEVICE.

distributed along the track. He provides a device in which the magnetic devices distributed along the track act upon an armature in such a manner as to release a weight, the release of the weight serving to actuate the throttle lever, the brake lever, to blow the whistle, or to actuate electrical mechanism for the controlling of the motor, in case electricity should be used instead of steam.

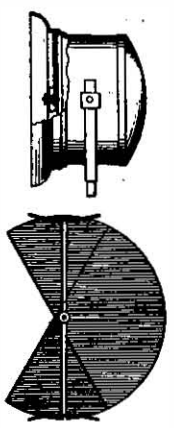
REINFORCED LOCOMOTIVE DRIVING BOX SHOE.—J. C. LYONS, P. O. Box 735, McComb, Miss. The improvement is in reinforced locomotive driving box shoes, and the invention has for its object to provide a shoe of the character specified, wherein steel reinforcing plates are cast on the shoe, to strengthen and reinforce the same, to prevent damage in use.

GONDOLA CAR.—T. H. WATTS, 106 3rd Ave., Altoona, Pa. The invention provides an apparatus which embodies a construction for retaining the pivoted doors of the car in closed position, and which, when operated, will greatly facilitate the opening and closing of said doors, the mechanism for such operation being so arranged that substantially a third of a complete revolution of the operating crank is all that is required to open or close the door.

Pertaining to Vehicles

OIL RING.—W. J. FRANCKE, New Brunswick, N. J. This improvement relates to oiling devices for shafts or other revolving elements of high-speed motors and other machines and devices. It provides an oil ring arranged to permit of conveniently placing it in position in the bearing and on the shaft or other revoluble part without disturbing the same.

ADJUSTABLE DIMMER.—E. W. BRANDQUIST, 48 Berwick St., Orange, N. J. An object in view in this case is to provide a dimmer for lamps especially of the automobile type, which may be quickly applied and removed, and which also may be adjusted to give different degrees of dimness. A further object is to provide a bodily removable dimmer formed with adjustable sections, whereby part of the lamp may be dimmed and the remaining part left uncovered.



ADJUSTABLE DIMMER.

TRACTOR VEHICLE.—J. A. MONTGOMERY and H. HANSEN. Address the former, Ukiah, Cal. This invention relates to traction vehicles and has particular reference to tractor wheels having an endless flexible belt tread and a main load supporting wheel coöperating with the said tread. An object is to simplify and generally improve this class of devices in respect to the reliability of operation and durability.

LANTERN HOLDER.—J. E. EASTMAN, Pittsfield, N. H. This invention relates to means for holding an ordinary lantern on a vehicle to constitute a vehicle lamp, so that a separate headlight of special construction will not need to be employed on the vehicle, and the ordinary lantern employed for the purpose will be available for its ordinary uses when detached from the vehicle.

PNEUMATIC TIRE APPARATUS.—G. E. BATCHELLER, 1612 Broadway, New York, N. Y. An object here is to provide a means for furnishing a pressure fluid for the flexible inner bag for coöperating with the aforesaid apparatus, the operation of which is thoroughly satisfactory, and whereby a vastly larger number of cures may be had from a single pressure fluid bag than may be had by the apparatus commonly in use.

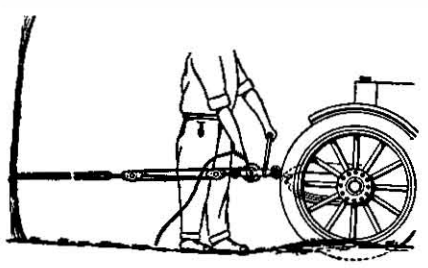
VEHICLE HOIST.—L. TOWNSEND, Flat B, 117 Cherry St., Evansville, Ind. The invention relates more particularly to hoisting means whereby an automobile can be raised slightly from the ground. The object is to provide a vehicle hoist which can be easily adjusted to various lengths of vehicle wheel bases, and whereby the height to which the vehicle can be raised can be also adjusted.

VEHICLE TIRE.—J. T. FITCH, Helper, Utah. The invention relates particularly to tires for motor driven vehicles, and provides a substitute for the conventional pneumatic tire which is of no greater initial cost, of very low maintenance cost, which prevents accidents now due to blow-outs, which enables repair of any required portion of the tire without removing the tire entirely from a wheel, and which possesses all the advantages of the pneumatic tire without any of its disadvantages.

RESILIENT WHEEL.—T. T. CHALONER, 540 W. 47th St., New York, N. Y. This invention provides a construction which gives the desired resilient effect both radially and laterally. It provides a resilient wheel with a radial resilient structure and resilient bracing members so that the tread portions of the device may yield substantially in any direction for accommodating the wheel to different conditions of road.

TRUCK.—A. D. COX, Box 14, Winterville, N. C. This invention relates to an improvement in trucks, and provides an improved truck which may be readily handled by a single person in transporting farm products particularly, from one place to another, and which may be readily loaded and unloaded.

AUTO PULLER.—J. W. LA VAKE, Eustis, Fla. For use in pulling an automobile from its stalled position, the puller, which is so compact it can be kept in the automobile, is attached by means of an anchor member to any suitable anchorage, a tree, fence post, rock, telepbone pole, land anchor or driven stake.



AUTO PULLER.

A hook is passed through or around some substantial part of the automobile and secured thereto by an engaging hook through a link. Means provide for taking several bights of a cable passed around a drum. The operator then grasps the free end of the cable with one hand and with the other, through a crank, a shaft and certain gears actuates the drum. This causes the two blocks to approach each other and hence the speedy extrication of the machine.

Designs

DESIGN FOR A BODY FOR ELECTRIC FIXTURES.—S. SHAPIRO, 15 Laight St., New York, N. Y. The fixture has a body formed with a large bulged central portion from which extends a bead which, in turn, has a rounded upper portion terminating in a stem. A ring-shaped section extends from the bulged portion, and is bent to form a recess and a downwardly projecting conical portion, which, in turn, has projecting therefrom an inverted cup-shaped bottom.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—C. BASTOW, 25 Madison Ave., New York, N. Y. The design comprises a perspective view of New York city looking from the bay showing the Statue of Liberty, the East River bridges and conspicuous features of the city. At the corners are floriated panels and above and below, there are chain borders. At one end there are views of the U. S. Sub-Treasury and Grant's Tomb, each in a floriated oval panel.

DESIGN FOR A DINING TABLE FIXTURE.—I. TIGER, Ferndale, N. Y. This design presents a circular base from which a vase-like holder rises centrally, together with a series of smaller auxiliary holders rising from lateral arms and terminating short of the top of the central holder, there being on the arms outwardly disposed horizontal opposed semi-circular members.

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.

PHONE: 192 REGENT

J. E. Jewell. 163a & 164. Piccadilly

London, W. 6th January 1916

To the Managing Director,
CADILLAC MOTOR CAR MANUFACTURING CO.
Detroit. Mich. U. S. A.

Dear Sir

Having in May last decided to purchase a new car, I was in the usual position of uncertainty that most would-be purchasers are in as to the car one can get as the best value for money.

I happened to see in the "Saturday Evening Post" one of your very clearly - and to my mind - very fairly worded advertisements, and immediately went to see your polite and courteous Manager, Mr. Bennett , with the idea of looking over the chassis of one of your new 7 seater 8 cylinder cars - I think you call it type 51.

I took my engineer with me (in whose ability I place very great confidence) and we had a thorough examination of the chassis and loose parts, and both came to the conclusion that apparently a better constructed and more carefully thought out engine, etc. would be practically impossible to find. As a matter of fact I placed an order with Messrs.Bennett for one of your cars.

I may add that I have been a very keen motorist since the year 1903, and have possessed several cars of British and French make, and have at the present time two other English-made cars as well as your 8 cylinder.

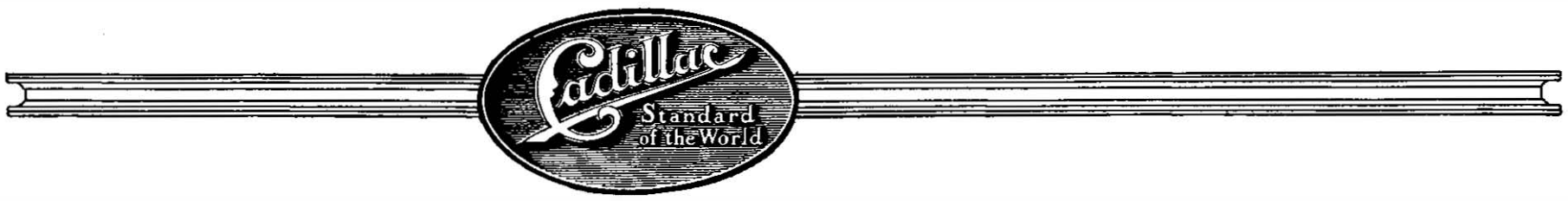
It may interest you to know that we took delivery of your car early in August last, and at time of writing she has done between 5 and 6 thousand miles, and up to the present we have never had occasion to lift up the bonnet, unless it has been to show an interested motorist the details of your engine. What I wish to say more particularly is, that in the whole of my motoring experience I have never struck a car that has given such complete and general satisfaction as the "Cadillac" has done, and I feel quite entitled by my experience to give an opinion. I do not know whether it is your firm, or another firm in America that makes use of the phrase : "One has not enjoyed the pleasures of motoring until he has ridden in a"... but if it is your firm, I have the greatest pleasure in thoroughly endorsing your statement: if it is not your firm that makes use of the above phrase in its advertisements, you are, in my opinion, thoroughly entitled to do so. Comparisons are always odious, but my experience of the "Cadillac" is that it is value for money in every sense of the word, which, I regret to say, I have never yet found in the purchase of any other car. It gives one a certain amount of pleasure to be able to write about an article that one finds all right: my previous experience of motor-cars was like taking a dip in the lucky tub - you paid your money and you either got a decent or a bad car ; but from what I know of several people this side who are the happy possessors of a "Cadillac" I may say in all fairness to yourself , that I have never heard one that had anything detrimental to say about your car.

You may possibly think it strange that I take the trouble to dictate this letter to you : you do not know me, and I do not know you ; but I think it only fair to yourself to let you know that you have at least got one very ardent admirer and happy owner of a "Cadillac".

I hope to be in New York the first week in February on my way to Pasadena, Calif. and if possible would like to have an opportunity of looking over your works in Detroit. Am not sure yet whether I shall have time enough to go to Detroit to do so, neither do I know whether you allow strangers to go over your works, but if you do, I should be very pleased indeed to do so if possible. A letter will find me if addressed to the Waldorf Hotel, 5th Avenue, New York.

Faithfully yours,

J. E. Jewell



How May the Permanent Success of Our Dye Industries Be Secured?

(*Concluded from page 473*)

Can such revolutionary conditions be brought about? "Yes," but only by patient and persistent campaign of education with the consumers, the public and the manufacturers, for there is yet much for the last to learn. He must learn something of the methods of the foreign manufacturer, to whom there is no such thing as waste, where everything is utilized.

Too many American manufacturers are allowing millions of dollars to be wasted in the air or down the sewer because they have not learned how to utilize all their material. The European manufacturer on inspecting an American chemical works is apt to have heart failure on viewing the almost criminal waste of material, labor and dollars. Only time can change these things. In the interim the manufacturer must be helped, encouraged and educated.

Esprit de corps, alike among the manufacturers and the consumers, must be firmly established and a patriotism now absent must be engendered in the hearts of the whole people. These can best be done with the coöperation of our Federal Government, that has at its command, not only able, willing and untiring experts, but the most complete compilation of data, valuable alike to the manufacturers and to the consumers.

Finally, this campaign, already started by the Bureau of Foreign and Domestic Commerce, must be pushed on vigorously in all directions, for there is no work in our whole Federal system comparable with the prosperity of its industries, else we may be confronted with a situation the newer manufacturers already fear and are tentatively preparing for, the necessity of abandoning the manufacture of dyes, intermediates and colors through want of support. These industries will not fail, if they do fail, because of lack of capital, enterprise, genius or earnest desire, but because of the failure of the consumer and the whole people to appreciate the opportunities and privileges offered to coöperate in making this the greatest nation in the world by giving it commercial supremacy.

War Game—VIII

(*Concluded from page 476*)

be fully utilized. Before attempting to go into the details of this phase of the war business, let us see what is the most important duty of the victorious forces.

Tactics, strategy and the whole military organization is built up on the desire to destroy the enemy army. This means to kill, to disable, to take as prisoners the enemy soldiers; to destroy, to burn or to capture the enemy artillery, ammunition, or any other property. Simple and ancient ideas which have never changed since the first war.

This understood, we might consider the methods of present-day tactics to accomplish the above aims.

It must have been apparent from the war correspondent's report that, while Lieutenant General LG was in the tower anxiously awaiting the outcome of the combat, he has no means left to influence it to any great degree. He has made his plan and put it into action; then he must wait to see the outcome of his arrangements.

A slight deviation from the pre-arranged plan might have caused an entirely different result, as far as the final outcome was concerned. Now his efforts have been successful. His preparations have borne fruit. Now it is his duty to take a hand again.

The first thing to do, after the successful assault by the infantry, is to reorganize these forces. With the converging assault and the different forces, the line will not be a unit, but a mass of intermingled troops. Nevertheless, if well trained, these troops will form a firing line as soon as the enemy position is taken. Usually they will not take cover, but will fire standing or kneeling, for, if the enemy is forced to a hasty retreat, there is very little chance to receive enemy fire. Very

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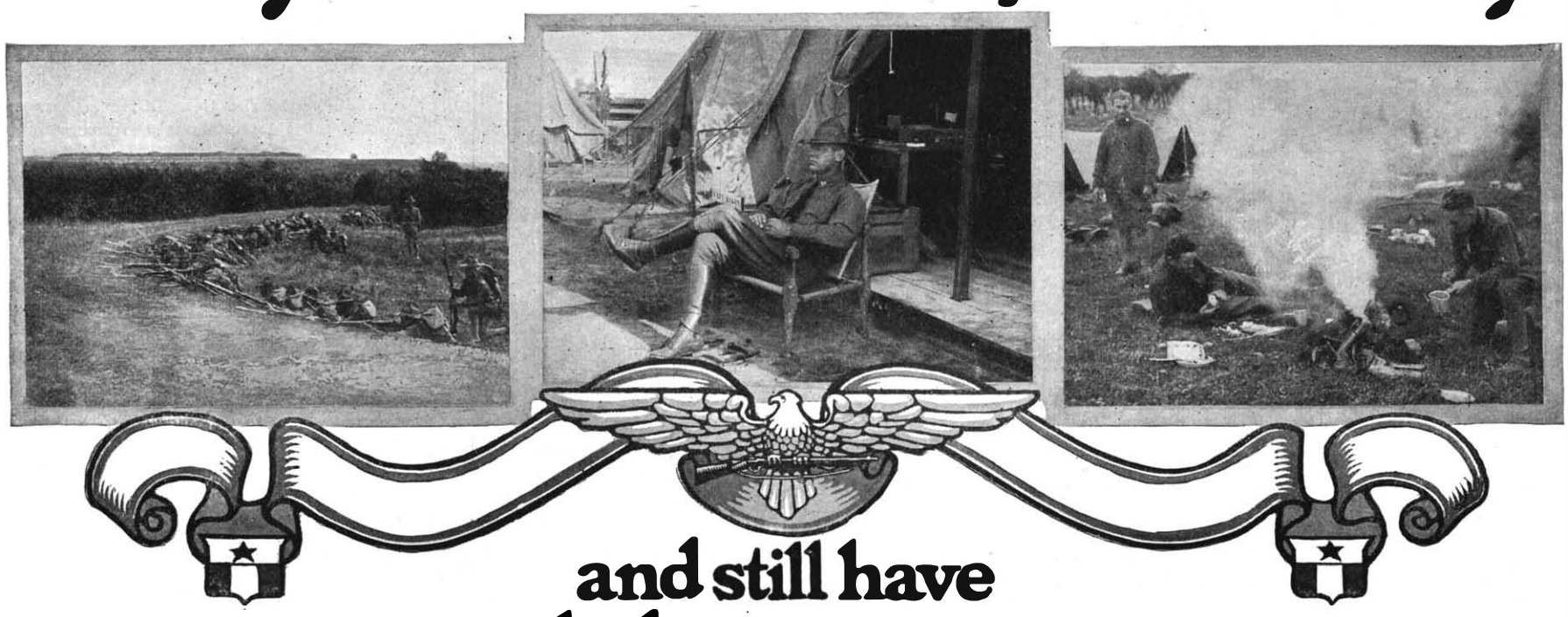
Give your vacation to your country



and still have the best vacation you ever had

The Military Training Camps at Plattsburg and elsewhere last summer were a great success.

Over 4,000 men, many of them prominent, rich, successful, left businesses, or gave up vacations, and were well repaid.

They learned enough of military service to be valuable to their country in case of war. Their vacation benefited them mentally and physically.

This summer you have an opportunity to do the same thing. Will you do it?

Fifteen Camps at Seven Points

Every man who is willing to make this splendid sacrifice will now have full opportunity.

Camps have been established at the following points:

Plattsburg, New York—June, July, August, Sept.
Fort Oglethorpe, Georgia—May, June, July.
Monterey, California—July.
Salt Lake City, Utah—August.
American Lake, Washington—August.
Ft. Benjamin Harrison, Ind.—July, August, Sept.
San Antonio, Texas—June.

There will also be a camp for boys between 15 and 18 at Plum Island, L. I. New York in July.

Practically every able-bodied man of good moral character, between the ages of 18 and 45 years, is eligible. Plan now to spend four weeks this summer at the camp nearest to you. You will enjoy a clean, healthy, active life in the open air, with work enough to make you tired at night and hungry at meal times. You will associate with men like yourself who are alive to the needs of your country, and who are leaders in this work because they are leaders in everything they undertake.

Richard Harding Davis

who "did his bit" at Plattsburg last summer, said:

"The business men who to my mind are really successful are those who left office and home, if only for a month, to carry a pack and to sleep on the ground at Plattsburg. They enrolled, not because they are crazy for war, but to prepare against war, to assist our government in preparing against it, to make war impossible, to insure peace."

The Expense Is Small

The War Department furnishes tents, equipment and arms. United States Army officers instruct and drill the men. The board, $25.00 for the four weeks, uniform $12.80 (not including shoes), and railroad fare are all that you will have to pay.

Where else, for so little money, can you get camping, outdoor life, plenty of exercise (rifle practice, hiking, swimming), first-class food and good fellowship?

The Reward Will Be Great

Every man will spend at least four weeks in the camp. He will learn as much of modern military science as can be taught in that time. Those in charge are commissioned officers of the United States Army, and they know their business. Association with them and with your fellow volunteers will be an experience you will look back to with pride and pleasure the longest day you live.

Camp life is hard work, but exhilarating. Every man who went to Plattsburg feels that it was worth while as an outing, even if the good time had not been sweetened by the thought that he was doing his duty.

Employers Are Coöperating

Many of the largest businesses in the country are making it possible for their men to attend these camps. They are giving every man who is willing to go four weeks' vacation and full pay, without jeopardy to his position and future advancement. Every one is doing his part. Will you do yours?

Write for full information, descriptive booklet with pictures by the best known artists, and enrolment blanks.

Plan with your employer or your partners or your subordinates to be away for four weeks this summer.

Persuade every man of your acquaintance that he should go also.

Military Training Camps Association
31 Nassau Street, New York City
OR
Officer in Charge, Military Training Camps
AT

Headquarters, Eastern Dept.
GOVERNORS ISLAND, NEW YORK

Headquarters, Central Dept.
CHICAGO, ILL.

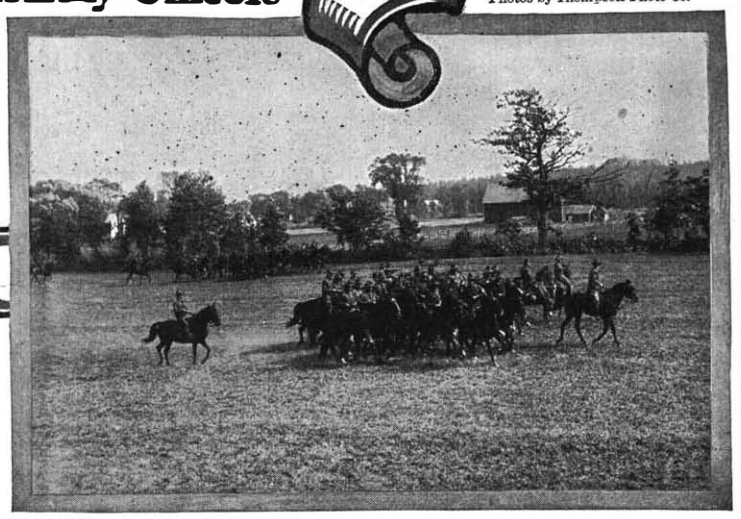
Headquarters, Southern Dept.
SAN ANTONIO, TEXAS

Headquarters, Western Dept.
SAN FRANCISCO, CAL.

Federal Training Camps
Under the instruction of U.S. Army Officers

Pictures taken at Plattsburg

Photos by Thompson Photo Co.



likely, enemy artillery fire will be directed on the lost line, but this must be considered only after attending to other more important matters.

With well-trained forces, the last reserves thrown into the line to carry forward the assault will be in the best formation for the pursuit. These troops must start out immediately and pursue the enemy, unless reserves are at hand who have not been used. In our present case, the pursuit will be difficult on account of the forest, which offers a good shelter and an easy retreat for the enemy.

As soon as a force is started on the pursuit, no time should be lost in reorganizing the rest of the troops. They should be reformed if possible into their original units under their own officers and a relentless pursuit should be carried on to the finish.

It is extremely important that the victorious forces shall not remain longer than is absolutely necessary in the newly acquired positions.

The enemy artillery is sure to shell their old position with great accuracy, knowing the exact distance.

The next important step is to move our artillery forward, to have it always on hand in case of unexpected events.

Under the given circumstances, there seems to be very little chance for a counter-attack, but a good commander will never leave a single thing undone. The squadron of Blue cavalry should be sent to keep as close a touch with the enemy as possible. In this case, it is their duty to harass the retreating columns by attacking and cutting off stragglers, thus securing more prisoners.

This completes the problem which began in the First War Game, printed in the issue of March 11th, and has shown the readers through the most vital tactics in field service.

Penetration of the Enemy's Line

General Situation:

A western Red detachment, consisting of five battalions of infantry, two squadrons of cavalry, one and a half batteries of artillery and a company of engineers, after an unsuccessful engagement on the 12th of June, 19---, at Bristol, retired directly west, closely followed by Blue cavalry patrols.

On the 13th, this detachment reached Pottstown.

At 3:30 P.M., General G receives from Division Headquarters at Wyola, the following order:

Division Headquarters,
Wyola, June 13, 19—, 12:30 P.M.

Large invading enemy forces are slowly moving toward Pottstown, with the evident intention of seizing factories there and in Deansville.

To hinder this advance, intrench from the Nehaminy Island bridges south with right resting on Conestoga Creek. Consider the dams south from Manor and utilize the creek for securing your right flank.

Our 4th Division is holding the river line north of Nehaminy.

Reports should be sent to headquarters where I shall remain.

GENERAL LG.

General G, whose rear guard has halted at the southern edge of the small woods south of Pottstown, immediately mounted his horse and, accompanied by his staff, rode out to inspect the territory.

This inspection gave him the following general ideas:

There is level ground, with good and clear foreground to be defended.

The construction of a dam at the Conestoga bridge by the engineers will inundate the swampy land and eventually the whole low territory south of dams.

This will give a strong front to defend and, by utilizing the barbed wire fence nearby, to build obstacles before the trenches, it could be still more improved.

After considering these matters he gives the following order to the waiting adjutants:

Superior enemy forces are slowly moving west. Their aim is Pottstown and Deansville. To hinder their advance, the detachment will entrench on this line (he points it out) from these bridges south to creek. Fire trenches to be built by 1st, 2d, 3d Battalions and communicating trenches by 4th and 5th Battalions. The artillery will prepare and mask a position behind Ash Inn.

First platoon of engineers will dam up Conestoga creek at road bridge. Second platoon will construct from available barbed wire in front of fire trenches.

Second squadron to move east and to reconnoitre as independent cavalry. First squadron to advance to Norrisville and secure our right flank.

A screen of infantry patrols to be sent out.

Headquarters City Hall, Pottstown, where I shall remain

The adjutants carry these orders to their respective commanders and the machine begins to work out General G's order.

Through the efforts of a spy, these orders were copied and a day later, on the 14th of June, 19---, at 10 A.M., were in the hands of Brig. Gen. LG, at the moment when his detachments' advance guard has reached Ferguson Farm on the Eden Norrisville road.

Brig. Gen. LG's detachment consists of two regiments of infantry, one regiment of cavalry, two batteries of artillery and one platoon of machine guns.

At 10:15 A.M., he receives the following report from a cavalry patrol:

N. W. Corner Paoly Forest, opposite cemetery. June 14, 19—, 8:20 A.M. The enemy, apparently a brigade strong, is entrenched between Pottstown and Conestoga Creek on level land.

There seems to be no sign of artillery.

I shall remain in observation.

Lieutenant L, 2nd Cavalry.

Five minutes later:

Goat Hill No. 62, June 14, 19—, 8:30 A.M.

After an encounter with enemy patrol, which we have dispersed and made two prisoners, I have observed enemy entrenched south from Pottstown to Conestoga Creek.

Artillery positions are masked in small wood before Ash Inn.

The whole territory south of Goat Hill is inundated and impassable.

I shall remain here in observation.

Lieutenant FL, 2nd Cavalry.

Brig. Gen. LG has received orders that Pottstown and Deansville are to be secured at any cost.

All this demands one action, a frontal attack, with an attempt to penetrate enemy's line.

The territory in which these operations are to be carried out is rather advantageous for the Blue forces. There are fine artillery positions at hand, also a chance to approach effective range through the forest.

Question

Question 1. Brig.-Gen. LG has made up his mind to attack enemy and to break through his trench line at the small woods directly in front of western edge of Paoly Forest. When will he issue his order?

Question 2. What will be his order to effect this operation?

Question 3. What influence will the inundated territory have in regard to his left flank?

Question 4. The whole regiment of cavalry is sent ahead to Norrisville to attempt a flanking maneuver and to reconnoiter farther west. What will Colonel C's (of the cavalry) order?

Answers to Questions in War Game VII

Question 1. See map.

Question 2. See map.

Question 3. Major M's detachment on the two river boats will reach the landing point between 1 and 2 o'clock in the morning. But, considering the difficulties of landing his two battalions without a pier, it will be 5 o'clock in the morning before the two battalions will be in column of march.

Question 4.

On board River Boat—date—

The enemy, two regiments strong, is facing our forces on the northern slope of Lookout Hill.

We shall land at the river bend near large pine tree and envelop the enemy left flank.

The engineers will assist in the landing.

1st Battalion to land first and to provide security for the detachment.

We shall march north at 5:30 A.M.

I shall march with advance guard.

Question 5. It will move north in secured march, then, at the command of Major M, front toward west. In this way the deployment will be quicker.

Question 6.

The enemy is in close contact with our main forces. Patrols 1, 2, 3 and 4, advance under cover to crest of Chester Hill, and remain there in observation.

Reports to be signaled to main column.

Question 7. The detachment did not reach crest of Chester Hill till 5:55. All this time they could hear the crackle of rifle fire and the booming of artillery. Once the enveloping detachment reaches the position where the attack can be carried out, Major M, after explaining the situation, will give the following order:

We will attack the enemy's left flank, along Tincum Creek.

The 1st Battalion will advance against the

enemy's line in the direction of the Lone House.

Second Battalion, as reserve, will follow behind the center. I will be with the reserve.

[*The first of this series of War Games began with the issue of March 11th. A war map in colors, covering the terrain of these War Games, was published in the issue of March 25th. Copies of this map may be had for 10 cents each.*—EDITOR.]

Cartridge Cases of Steel

(*Concluded from page 478*)

The present American service rifle develops a chamber pressure of about 50,000 pounds per square inch. The German Mauser goes nearly to 60,000. Because of the rimless case used and the form of the bolthead, the case is not solidly supported during firing, but it is free to flow out around the bolthead when the pressure gets high enough to make brass flow.

In the American service rifle, when the pressure gets up beyond 60,000 pounds per square inch, the first sign of trouble is the dropping of primers from the cases, caused by the shell flowing sideways around the head and enlarging the primer pocket. Sometimes this allows gas to get into the bolt mechanism and blow the striker to full cock. A number of riflemen, holding their heads close to the firing pin and wearing glasses, have had their glasses broken by the sudden rearward thrust of the firing pin from the escaping gas.

Still higher pressures rupture the brass case at the groove or cannelure, and this may blow open the rifle if the gas gets out at the right spot to lift off the top of the receiver and release the top locking lug of the bolt cylinder. The first sign of too high pressure, as I say, is the flowing or stretching sideways of the brass case at the head. However, rimmed cases, solidly supported by most carefully machined blocks, extending all round the rim and not allowing the brass to flow in any direction, have stood chamber pressures of 80,000 pounds per square inch. This is an impossible form of construction with the rimless case of the modern military rifle, and the necessary tolerance allowed in economical machine manufacture.

So much stronger is the locking mechanism of the modern rifle, and so easy is it to make this still stronger if necessary, like the interrupted screw form of bolthead used on the Canadian Ross rifle, that we may say that the brass case is the weak point of the modern rifle. Both from the standpoint of economy and of strength the steel cartridge case would be desirable if we can make steel function through the draw presses with the facility of the brass cup. The very fact of the ductility of the brass in the draw press is what makes the same brass yield to high powder pressures. It is evident that if we are to gain ground in this department, add strength to the case, we must be prepared to machine some material or other which is also less amenable to the blandishments of the press. Steel is immensely more economical than brass, which is largely copper. The economy may disappear if the speed of machines has to be cut down and the wear on the tools becomes excessive and the reloading of the cases becomes impractical through the rust, and corrosion through powder residue.

But regardless of the economical side of the argument, if we add strength to the rifle and permit of still higher pressures and ergo higher velocity, steel cases would be worth while. And, if through some such calamity as has befallen Germany, the supply of copper is cut off, then making cartridge cases out of steel is greatly to be desired even though no other advantage be gained than that of an unlimited supply of raw material.

Some years ago there came reports of German and French experiments with steel for cartridge cases, while I have before me samples of cases of this material made experimentally by Sir Charles Ross, of the Canadian national rifle factory. Nearly a year ago, the Ordnance Department of the United States Army undertook the manufacture of steel cartridge cases, doubtless actuated by the consideration I have mentioned, the possible shortage of copper or spelter in case of war. The manufacture of the cases was never put on a regular basis, but enough were made on the regular machines set out for the manufacture of the brass cases, to demonstrate that the steel cartridge case is entirely practical. One is led to wonder whether Germany has not found the process practicable or whether her shortage of copper is not so great as it is reported to be.

At the American Frankford Arsenal of the Army they made both steel service rifle cases and the clips to hold the five cases together as they are issued to troops. The Chief of Ordnance of the Army reports as to this work:

"Two thicknesses of sheet steel were used, the steel being planished on both sides. The cups were made without difficulty on draw presses, using the same punches and dies as are used for cartridge brass. Annealing after each operation was essential, and special precautions had to be taken to prevent scaling, by annealing in boxes packed with iron filings. The ordinary speeds of machine were used as it was not desired to make any extensive changes, but this resulted in considerable loss on account of scratching by the dies.

"For permanent manufacture the speeds would undoubtedly have to be very much diminished. Great care had to be taken with the lubricant, only the very best quality giving good results.

"As might be expected, a number of modifications in the amount of the annealing were experimented with. The earlier cases were defective in that there was a swelling of the head sufficient to cause leaks. Experiments were conducted only far enough to determine the practicability of the process and to overcome evident defects in order that the department might have the necessary knowledge to quickly undertake the manufacture in quantity, if desired."

Sample cases from Frankford, before me, show work of the highest quality, the cases being as uniform in wall thickness and head as the best made brass cases. The lightness of these cases is noticeable as compared to cases of brass, for the same rifle.

Steel cases would of course offer some difficulties outside of those of manufacturing. A protective coating of some sort would seem essential to prevent rust from perspiration from the bodies of the soldiers, and from the rain and dew to which soldiers are exposed. Their behavior in a rifle is still a matter of conjecture, but extraction should be easier and there should be less chance for the occasional clean rupture of the case in the chamber of the machine gun, leaving the forward part in the gun and putting that piece effectively out of commission until it is removed with a special tool.

It is not at all improbable that the Germans have not found practical what the Frankfort Arsenal has been able to do without much trouble. The German never yet has equaled the quality of the ammunition turned out from this Government arsenal, and the German never has turned out powder equal to the latest product of the American Du Pont Co., the progressive burning variety. Despite his painstaking thoroughness, it is not the Teuton alone who makes improvements in war material.

The New Quebec Bridge

(*Concluded from page 481*)

bracing, followed by the lower sections of the compression diagonals with their sway bracing. The subtension diagonal was then erected and the pins connecting it to the compression diagonal and the main "K" point were driven. The subpost carrying the floorbeam and the floorbeam itself were next placed and the floor system from the main panel point to the sub-panel point laid. The traveler was then advanced until the front legs rested over the sub-panel point. In this position the second panel section of the lower chord was placed on the "flying bridge." The upper halves of the compression diagonals with their sway bracing were next erected, followed by the portal and vertical post sway bracing in the panel to

the rear of the traveler. The main tension diagonal with field splices completely riveted up was then hoisted into position and the pins driven. This was followed by the tension vertical, the vertical compression post and the supporting trusses with top chord eyebars in the order named. The top chord pins at the shore end of the panel were then driven, and the last truss pin connection was made by jacking up the bottom chord from the "flying bridge" and driving the pin connecting the tension vertical at the "K" joint. The erection of the sway bracing for the tension vertical, the floorbeam connecting to the tension vertical, and the floor system from the sub-panel point to the main panel point followed immediately. The traveler was then moved out into position to repeat the operation for the next panel.

The work done on the south shore during the season of 1915 was as follows:

The south shore traveler was completed by June 1st. The inside staging was then taken down on the north shore, transferred to the south shore, and re-erected, together with separate outside staging for the south shore anchor arm trusses. The placing of this material was completed by July 9th, when the erection of the main shoes was begun, followed by truss material in the same sequence as described above for the north shore.

Profiting by the experience gained on the north shore, very much better time was made in erecting this material, a saving of some six weeks being effected. The anchor arm trusses, together with the main post and links at the top of the main post, were completely erected by the end of the first week of November, 1915. The inside falsework was then removed and sent back to the shops at Rockfield, P. Q., to be remodeled for use in the erection of the suspended span in 1916 at Sillery Cove—about three miles below the bridge site.

The suspended span, 640 ft. long by 88 ft. wide, weighing in the condition of floating in approximately 5,000 tons, will be erected on falsework and raised on six scows 32 ft. by 160 ft., having a draft, when carrying a load, of about 8 ft. The span will then be floated to the bridge site, where it will be hoisted into position by means of eight 1,000-ton hydraulic jacks, placed in pairs on jacking girders at each cantilever corner, together with plate hoisting links. Each operation of these jacks will lift the span about 2 ft. Altogether, the span will have to be hoisted vertically about 130 ft. The time consumed in this operation is not expected to exceed twenty-four hours.

If nothing interferes with the schedule mapped out, it is expected that the south cantilever arm will be completed and ready to receive the suspended span about the end of September, 1916, when, after many years of effort, this great steel bridge—the largest in the world, and the last link in the National Transcontinental Railway System between the Atlantic and Pacific Oceans—will have been finished.

The Problem of Gasoline Supply

(*Concluded from page 466*)

It is said that one concern spends more than $150,000 each year collecting and tabulating statistics relating to the production, distribution and consumption of petroleum and its products in the United States alone. If the statistics are of sufficient importance to justify their collection and tabulation by a private concern, does it not indicate a field in which the Government should seek to supply all parties engaged with corresponding information? Such a service would be of interest not only to the industries themselves but also to the country as a whole.

The only hope for the speedy reduction in the high prices of gasoline, according to Van H. Manning, the director of the Bureau of Mines, Department of the Interior, lies in the immediate development of the so-called Rittman cracking process and similar processes. He declares that the prevailing prices may not only continue for some time but will undoubtedly reach higher levels before there is any permanent relief. He points to the fact

that the oil companies, in competition to supply the United States Government for the next fiscal year, have offered gasoline at 31½ cents a gallon for the whole year, and argues from this that, if the United States, using vast quantities of gasoline, is compelled to pay this much, the private consumer will have to pay much more. Furthermore, Mr. Manning says that with a rate of production the same as in 1915 the crude oil supply of the United States, from which we are getting our present supply of gasoline, will be exhausted in 27 years.

"And what is still more important to the situation, present indications forecast a decreased production of gasoline from crude oil for 1916 rather than an increased production. The daily production of crude oil for February in the Mid-Continent field, which produces 75 per cent of our refinable crude oil, was 40,000 barrels less than the average daily production for 1915, and 20,000 barrels less per day than the average production in 1914, and this is in the face of a strong incentive to find new fields given by the rising market of the past six months, which has culminated in record high prices for that field of $1.55 per barrel for the crude, with, in some cases, a premium exceeding 40 cents per barrel.

"The demand for gasoline has outstripped the demand for all other petroleum products with the result that these other products, amounting to about 75 per cent of the production, are being sold for less than the cost of production. In other words, 25 per cent of the production, consisting chiefly of gasoline, must pay all costs in addition to the amount that is lost in marketing the remaining 75 per cent.

"We are exporting at the present time 20 per cent of our entire production of crude petroleum, including 16 per cent of our gasoline production. We are burning 25 per cent of our petroleum under boilers, which is a shameful and criminal waste of precious natural resources, and we are using another 20 per cent of our crude petroleum inefficiently in competition with coal as in the manufacture of artificial gas. Three fourths of the entire amount of artificial gas in this country is made from petroleum. This gas could be made from coal, except that the gas manufacturers are able to make it at less cost from petroleum, owing to the lower cost of oil as against coal. It is needless to say that petroleum should not be used for this purpose.

"The solution of the problem is conservation—our petroleum resources being put to their proper uses. Let us stop this wasteful foolishness of burning petroleum under boilers and the use of crude oil in the making of artificial gas. If by means of cracking processes, such as the Rittman process, our kerosene and fuel oils, which we have been using in competition with coal and selling for less than the cost of production, can be converted into gasoline, the present production of crude petroleum would be more than ample to supply our present demands for gasoline. Not only that, but the general adoption of these processes would result in extending the life of our petroleum deposits, based on present demands, from 27 years to more than 100 years, at the same time reducing and stabilizing the cost of gasoline to the consumer and preventing the rapid fluctuations in price. Ten different refineries are now installing the Rittman process and more companies are considering doing so. This is but a drop in the bucket, but the situation is hopeful.

"The importance of petroleum cannot be measured by dollars and cents. Figures cannot convey an idea of the dependence of many industries upon petroleum products of one kind or another. Lubricating oils, all of which come from petroleum, are absolutely necessary to our very existence. It has been computed that the machinery of the nation requires approximately one gallon of lubricating oil to each 300 horse-power per day, roughly speaking. Every automobile built but adds to the demand for lubricating oil; every ship launched, every car, every locomotive, must be supplied with lubricants, and petroleum is the only known source of supply. To-day we are burn-

ing this precious lubricating oil under boilers as fuel oil, without adequate financial reward and with utter disregard to the nation's future requirements. One student of the oil situation says that through the wasteful use of petroleum resources the United States is now confronted with a national crisis of the first magnitude, and he may not be far wrong."

Proposed Improvement of New York's Hudson River Front

(*Concluded from page* 467)

The railroad, in addition to paying the cost of eliminating its grade lines, will expend close to $15,000,000 for improvements that are wholly of a municipal character. For instance, it will pay the cost of tunneling and covering its tracks along Riverside Park, for covering the main tracks in Manhattanville and in Fort Washington Park, as well as for tunneling and covering tracks at Inwood Hill.

The plan appears to be an excellent bargain for the city, and is probably the best solution of a problem that has been particularly vexing for a great many years.

Building a Cave at the American Museum of Natural History

(*Concluded from page* 470)

stalagtites in various shapes, so colored by the percolating water through the red clay soil. The chamber was 80 feet from the floor of the cave and obviously most difficult of access, requiring the building of an improvised stairway for getting in and out of the grotto. A month or more was consumed in the important and dangerous operations of sawing and breaking off the great array of formations existing in clusters—in some instances huge fluted masses and great pillars reaching from floor to ceiling. These, in most cases, were tinted a delicate salmon color. Two hundred and fifty boxes of material were secured and shipped to New York; besides these, numerous photographs and sketches were made to serve as studies and guides to construction.

Mr. Peters, with artistic and technical skill, has succeeded in imparting to the cave reproduction both pictorial beauty and scientific accuracy of detail. As an educational feature the grotto is unique: this display tells the entire story of the grotto in a few feet of space. From the ceiling of the cave hang stalactites from 3 to 4 feet in length, some of which are in the shape of huge clusters of grapes. Adjoining the walls are large sheets measuring 6 feet long and 3 feet wide at the top, narrowing down to almost a point at the bottom, which are so transparent that when a light is placed behind them a beautiful striped design, somewhat similar to an Indian blanket, is obtained. From the floor rise stalagmites from 1 to 6 ins. in height, some of them joining stalactites hanging from the ceiling, thus forming a solid pillar. The side walls contain small grottos or recesses in which hang thin white stalagmites in process of formation. Above and below these recesses are curiously shaped formations which somewhat resemble fish and hence have been given the collective name of the "fish market." Adjoining is a column 5 feet high, rising out of a fountain formation. This terminates in a large fluted or fan-shaped mass that hangs like a canopy. Water will be caused to drip from the joints so as to furnish to the visitors a vivid impression of how stalagmites and stalactites are formed. To the left are large sheet formations joining wall and ceiling. Lights have been introduced behind these to bring out their beautiful patterns. The largest and most wonderful specimen of the eave formations is a huge fluted mass resembling in shape an elephant's head. It stands 9 feet high and is almost transparent, although it has many folds and ridges. It weighs in the neighborhood of 1,750 pounds. Electric lights have also been placed in back of it and striking effects produced through its transparent fluted sections.

The entrance to the cave has been so arranged as to allow visitors to enter inside for a distance of about 5 feet; the remaining portion will be inclosed in

glass. The various sections, walls, ceilings, stalagmites and other features have been so deftly set that the closest scrutiny fails to detect any of the joints. In keeping with the original cave, clay has been used in modeling the floor formation, and this also will be employed on the exterior.

An Ice Mine that Freezes in Summer and Melts in Winter

(*Concluded from page 470*)

A shelter was erected over the mine some time ago; but it had to be removed, as the ice melted when the sun's rays were kept from the mine.

The mine has been nsed as a cold storage piant by the wife of the farmer, and she claims that eggs have been kept seven month in the natural refrigerator and at the end of that period found to be in perfect condition. During the summer the temperature of the mine ranges from 25 to 30 deg. above zero. This mine, notwithstanding the fact that it is open at the top, is warm enough on the coldest winter's day to keep vegetables without freezing.

The ownership of this natural curiosity has recently changed hands; and now the business men of Coudersport are coöperating with the new owner in an effort to attract more tourists to the place. They are planning an extensive advertising campaign, which will include advertising in automobile guide books. Important improvements on the roads, buildings, and the park surrounding the ice mine are to be carried out before the coming summer. The contemplated opening of the new road running directly past the mine, the Jersey Shore Turnpike, will make visiting the mine and grounds particularly convenient to autoists in the East.

A Double-Negative Camera Which Reproduces Images in Natural Colors

(*Concluded from page 471*)

sion the path of only one point of light from the image photographed has been traced from its source as a point to its expansion as the base of a cone in the lens and its reconversion to a point at the surface of the plate. It must be remembered that a countless number of rays are received by the lens in the making of a photograph and that probably millions of rays pass through each of the holes in the perforated mirror to form the images on the two plates.

It should be explained here that all ordinary photographic plates are color blind, as it were, to everything except blue and violet. They are made color sensitive by treating them with rare dyes, such as pinacyanol and pinachrome, in the weakest sort of solution—one part dye to about one million parts of water, for instance. The first of these dyes makes the plate sensitive to red and orange light rays; the other, to green and blue.

A green filter, *G*, is interposed in front of the direct plate in the color-photography camera, so as to record the object by green light on that plate, while a red filter, *I*, is interposed in front of the plate that is acted upon by the reflected rays or beams of light. Thus it becomes possible to record simultaneously the same object on the two negatives. The exposure in the studio is from two to eight seconds, while in sunlight it is as fast as a fiftieth of a second.

Owing to their sensitiveness to red light, the plates are developed in total darkness. The plates of course appear in black and white; one represents the red record and the other the green record of the object photographed. Both negatives record exactly the same object and register exactly the same size. The point of variation rests in the fact that the red values of the photographed object are recorded with greater density on the red negative while the green values are recorded with greater density on the green negative.

From the two negatives two positive prints in black and white are secured by contact printing, in a manner similar to that followed in making a lantern slide. Following, the image on the positive plate printed from the green negative is dyed red, while the positive from the red negative is dyed green. If a little thought is given to the subject it soon becomes apparent why this reversal in the dyeing is necessary.

The new method of coloring the positive plates was discovered by Mr. Hoyt Miller through many researches made for this process. By this treatment the black and white positive is converted into a pure dye image and the opaque black silver eliminated in a few seconds' time. At the same time the transparent portions of the positives, which form the whites in the final picture, are protected from the slightest discoloration. Plates of great luminosity and brilliancy are secured, with the result that when combined they form a sharp and perfectly colored image without the slightest discoloration in the whites.

The two positive plates, perfectly registered and now cemented together to form the complete picture in the form of a transparency, are ready to be transferred from their glass supports to any other form of support that may be selected. This work is accomplished by carefully removing the emulsions from the plates and stripping them onto their final support, which may be paper, canvas, porcelain or ivory, the latter in the case of a miniature.

Specimens of the work produced with the Brewster camera aud process are most faithful in the reproduction of the image, and the hues found in some of the pictures represent a wide range in the color scale despite the fact that only two of the three primary colors are used. It is the opinion of the inventor of the process that its use is not limited to the taking of photographs: he believes it will eventually find its way into the printing and lithograph trades as a more expedient, less expensive, and a more faithful method of color printing.

NEW BOOKS, ETC.

PRACTICAL ELECTRICAL WIRING. By John M. Sharp. New York: D. Appleton and Company, 1916. 12mo.; 256 pp.; illustrated. Price, $1 net.

In this manual the student is introduced to the principles and practice of wiring for and installing the required fittings for bells, motors, telephones, and lights. The method of distributing current by different systems is simply explained; there are wiring tables and data that will be of material assistance in actual work, and methods are suggested that may lead to a saving of time and material and an increase in profits. There are also abstracts from the National Electric Code, and throughout the work an effort has been made to comply with the rules of this Code.

COLOUR. A Handbook of the Theory of Colour. By George H. Hurst, F.C.S. Second edition, revised by H. B. Stocks, F.I.C., F.C.S. London: Scott, Greenwood & Son, 1916. New York: D. Van Nostrand Company. 8vo.; 160 pp. Price, $3 net.

"Colour" is a British manual particularly addressed to artists, painters, dyers, calico-printers, and decorative designers. The cause and effects of color, and the results obtained from various mixtures and combinations, are carefully explained, and there are chapters on such subjects as the physiology of light, contrast, and the measurement of color. The numerous plates adequately convey the appearance of the absorption spectra of dyes, the effect of mixing colors, color contrasts, and the three-color process of printing. Those craftsmen who care to possess more than a merely superficial knowledge of their work will find in this volume much illuminating and interesting exposition, and will be helped to a firmer grasp of those principles that so greatly contribute to artistic and satisfying results.

THE PRACTITIONER'S MEDICAL DICTIONARY. By George M. Gould, A.M., M.D. Third edition, revised and enlarged by R. J. E. Scott, M.A., B.C.L., M.D. Philadelphia: P. Blakiston's Son & Co., 1916. 8vo.; 962 pp.; illustrated. Price, $2.75.

The various Gould dictionaries need no introduction to the profession, and this revised and enlarged edition of "The Practitioner's Medical Dictionary" is worthy of the highest praise. A nice discrimination has been exercised upon the work, resulting in the retention of all the terms in current use, with the addition of many of the words of allied sciences; yet the volume has been kept well within a handy size and weight. Derivations are carefully given, and pronunciation, instead of relying upon diacritical marks, is indicated by a phonetic respelling. The definitions are sharp and accurate, and the type clear. This edition presents no less than 20,000 new terms, bringing the total number of words up to more than 70,000.

Notes and Queries.

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

(14090) A. A. L. asks: Will you kindly tell me through your Notes and Queries column how to fasten the tinfoil pieces to the plates of Wimhurst machines? I have tried shellac and glue without success. The shellac dries around the edges first, and never dries directly under the foil. Is tinfoil used on commercial machines, and how is it put on? If not, what is used and how is it put on? Thanking you in advance. A. Shellac is commonly used for cementing the tinfoil sectors to the plates of Wimhurst machines. We have machines which were made 20 years ago, and have given no trouble. We presume the shellac is dry by this time. You might use a cement which is melted by heat and then hardens when cold. Such cements are made for tire cements. Heat the plate and the tinfoil with the cement upon it. It can then be applied without cracking the plate, and, when cold, the sector will be firmly attached to the glass.

(14091) A. E. W. asks: I have seen it stated in books on astronomy that there is a shift of the spectrum lines toward the violet when the earth is approaching a star, or the star approaching the earth, and that this shift is caused by the *decrease in wave length*. For instance, such is stated in Young's "General Astronomy" (ed. 1900), Sec. 321. Now, if the earth is at rest and the star approaches it, there will be a decrease in wave length and an increase in wave frequency; but if the star is at rest and the earth approaches it, there will be an increase in wave frequency, but the wave length will remain constant. Now is there a spectrum shift in the second case as well as in the first? If so, it would seem to me to be purely a question of wave frequency, and not of wave length at all. A. The Doppler-Fizeau principle is stated as follows: When the distance between an observer and a body which is emitting vibrations is increasing, then the number of vibrations received in a second is decreased, and their wave length, real or virtual, is correspondingly increased, and *vice versa*, if the distance is decreasing. It matters not whether the star is approaching us, or we, the star, or both be in motion, only the change in the distance which separates us from the star is concerned in the result. Then, too, the velocity of light is not changed, and there must be a change both in the number of vibrations per second and in the wave length. One of these cannot change without producing a change in the other, and in an inverse order. An increase in the number of vibrations must produce a decrease in the wave length. If the wave length is decreased the spectrum lines must be moved toward the violet, and an increase in the wave length must move the lines toward the red. This has now been so carefully worked out that a change of distance of less than a half mile a second can be detected. This matter is treated much more fully in Young's "Manual of Astronomy," than in his earlier book, the "General Astronomy." We send the "Manual" for $2.50 postpaid.

(14092) C. P. asks: Kindly send to me any information dealing with the subject of electro plating and liquid chlorine. A. At 141 deg. Cent. chlorine gas is liquefied by a pressure of 83.9 atmospheres. Above that temperature it cannot be liquefied. At ordinary temperatures 18 deg. Cent. it is liquefied by 16.5 atmospheres. In the cylinders in which it is shipped the pressure is much greater than this, and the chlorine must be in a liquid state. The liquid chlorine is sold and shipped in tubes to any part of the country. Copper plating is fully covered in "Modern Electroplating" by Van Horne, which we send for $1.00, and shall be pleased to fill your order for the book. This book gives the full directions for preparing the work for the plating and finishing of the article.

(14093) H. F. W. asks: 1. We use your magazine for supplementary work in high school physics. The latest article I have found on the Edison storage battery is in the January 14th, 1911, number. Does that article correctly describe the last Edison storage cell? 2. Have you recently published an article in which the distinct vision of birds, such as eagles, is explained by assuming that they have eyes which are not sensitive to short waves of light? If so, will you refer me to the article? 3. The chief forecaster of the Weather Bureau here stated that the forecasts concerning time and height of tides, and the exact position of the moon in the sky at a given future time, are as uncertain as the weather forecasts. Is it true that astronomers do not know where the moon will be at any future day? 4. Our local paper states that the bright star south of Orion, about 6 feet from the horizon, is Canopus. If we cannot see it every year, why can we see it now? A. 1. There has not been any considerable change in the

Edison storage cell for quite a time. We have not had any article on this cell recently. An article appeared in the SUPPLEMENT, No. 1879, on the manufacture and performance of this battery, which is later than the date you name. This will doubtless interest you. The paper can be had from the Wilson Company. 2. We do not recall any article, such as you describe, on the vision of high-flying birds. 3. The opinion which you quote that astronomers cannot foretell the tides and the position of the moon at a future time any better than forecasters can foretell the weather is far from fact. The eclipses of the sun and the moon, both of which are calculated from the position of the moon at that future time are calculated for centuries ahead. The tides are calculated by a machine for any port in the world with wonderful exactness. This machine is in the Coast and Geodetic Survey, Washington, D. C. It is described in the SCIENTIFIC AMERICAN, Vol. 110, No. 10, where it is called a "Great Brass Brain," and it deserves that name. It can predict the tide, its height and time, taking into account as many as 35 components which influence its height, its rise and fall, and its time. It is stated in that article that a tide was predicted for Aden, employing 35 components. and that the error was only .02 feet. This is surely nearer than the Weather Forecaster can come in predicting a storm a year before the time. 4. The bright star about which you inquire is Canopus, but it is not 6° above your southern horizon. The declination of Canopus is —52° 39′. The latitude of your place is a little above 34°, so that the elevation of the Equator is about 56° with you, and the declination of Canopus taken from 56°, leaves about 3° 30′ as its elevation above the horizon. To this must be added the refraction, which makes its apparent altitude a little more than 4°. A degree at the horizon is distorted or magnified, just as the sun and the moon are at their setting by an optical illusion. People rarely think of this. Stars appear farther above the horizon or farther apart than they would be judged if they were high in the heavens. This star should be seen on clear nights every year in February at your place.

(14094) M. J. asks: What is the relative frequency of letters and numerals in the English language? A. In cryptography, the relative frequency of letters in the English language is taken as follows:

A	B	C	D	E	F	G	H	I	J	K
20	4	8	11	33	6	5	16	17	1½	2

L	M	N	O	P	Q	R	S	T
10	8	19	21	6	¼	18	17	23

U	V	W	X	Y	Z
8	3	5	1	5	—

The frequency of numerals is not subject to the same laws governing the frequency of letters.

(14095) C. A. S. asks: 1. Is there any formula for figuring forces exerted in a cam action such as is applied in a punching machine from the moment the pressure is exerted to the completion of the action? 2. Why does a drill become magnetic when drilling steel or cast iron? A. The cam is a revolving inclined plane. The pressure exerted by a punching machine is calculated as it is in the inclined plane and the screw. The force applied multiplied by the distance which it moves and divided by the distance the punch moves gives the total pressure. If the shape of the cam is such that the punch moves more slowly at one time than at another you must find the distance the force and the cam move during the same time at each part of the stroke. Steel is magnetized by the action of the earth upon it. A steel wire suddenly bent will be slightly magnetized. A steel bar given a sudden shock, for example a blow when it is held nearly vertical, will be magnetized. All iron or steel standing vertical or nearly so becomes magnetized by the earth's magnetism. The stress and jarring of the drill magnetizes it.

(14096) E. J. B. asks: A discussion has arisen between myself and friends, viz.: My opponents contend that gasoline and kerosene can be ignited by a lighted cigar, cigarette or lighted pipe. I content that this cannot be done. We have decided to let you be the judge to say which is right. A. It would not be difficult to determine the answer to your question for yourself by experiment. Try it and find out whether a cigar will ignite gasoline vapor, and if you find it will not then try and see if it will ignite the gasoline itself. Do the same with kerosene oil. A small quantity in a saucer will be sufficient for the test. You will find that a cigar will not ignite gasoline vapor, and that the cigar will be quenched in gasoline and extinguished as completely as it would be in water, without setting the gasoline on fire. Good kerosene oil will extinguish a lighted match in the same way.

(14097) W. S. B. asks: I wish to ask a bit of information. Last August a year a lot of mirrors were mounted in a new concrete building, yet damp. Later the mirrors became streaked, whitish, and now they are being stripped with nitric acid and are found to be pitted and shows more plainly after being polished with rouge. The chemicals used in making the mirrors are nitrate silver wet with ammonia, precipitated with tartaric acid to the plate after it has been washed with a weak solution of "Tin Muriate," C. P., afterwards covered with a coat of shellac, on which is put a coat of mirror paint. Now what caused the pitting? Could it be that the fumes from the

(14098) C. H. B. asks: I address you for the purpose of finding out, if possible, something relative to the nature of water that never freezes, and seemingly never varies in any season. There is a small stream running through this section for many years, clear as crystal, palatable, etc. The water is quite cool in the summer period, and it never freezes; recently it was 30 deg. below zero, and not the least indication of freezing. I might add, it flows steadily all the time through a wooded, hilly section. A. Springs from sources so deep that they do not freeze will flow winter and summer. The water is cooler than the air in summer and warmer in winter. There are many such springs throughout the country. There would not seem to be any peculiarity in the water. If it contained minerals in solution the minerals would crystallize out and would be recognized. Usually such spring water is very clear and sparkling.

(14099) S. A. D. asks: 1. Will you please inform me, through your Notes and Queries column, where I may obtain the best and most up-to-date book or article on the design and manufacture of Storage Batteries? I would like to know particularly the weight of active material per ampere hour of capacity, the weight of grids per ampere hour, weight of necessary electrolyte per ampere hour, and the total cost per ampere hour for the best type of lead plate battery and, for comparison, the same data for the Edison Battery. 2. Also, I would like to secure through your inquiry column the name and address of a manufacturer of glass cloth, or woven glass fibers. 3. May I call your attention to some errors which I have noticed recently in your answers? Referring first to No. 14050 in the issue of Feb. 19th, 1916, in reply to P. M. C. asking for a method of calculating the weight per cubic foot of oxygen at 72 deg. Fahr. It seems to me that your answer is in error in two respects: First, you state that the expansion for each degree is 1/459 of the volume at the freezing point and that when heated to 72 deg. it will 40/459 of the volume at 32 deg. Now the absolute Fahrenheit temperature of the freezing point is not 459, but 491, and therefore the expansion per degree will be 1/491 of the volume at the freezing point, and when heated to 72 deg. it will expand 40/491 of the volume of 32 deg. Second, you state that there will remain in the original cubic foot of space 419/459 of the weight of gas originally in the space. Applying the correction just noted, this would be 451/491. That this is not correct can easily be seen by considering a somewhat simpler case. Assume a certain weight of gas occupying 3 cu. ft. of space; let it be heated until the expansion is 1/3 of the original volume; the new volume is then 4 cubic feet, and it is evident that the original 3 cubic feet will contain, not 2/3, but 3/4 of the total weight. That is, the original volume becomes the numerator and the expanded volume, the denominator of the fraction expressing the proportional density, whereas your solution takes the original volume as the denominator, and the original volume minus the expansion as the numerator. The correct proportion is, therefore, 491/531 of the original weight per cubic foot. Of course, the simplest solution is to apply directly the law that the density of a gas is directly proportional to the pressure and inversely proportional to the Absolute Temperature. In this case, since the pressure is assumed to remain normal, the formula is $D_{72} = D_{32} \times 459 + 32/459 + 72 = 0.0892 \times 491/531 = 0.0824$ lbs. per cubic foot. 4. Referring next to query No. 14003 in the issue for January 1st, 1916, second part: The question is, What would be the result if a gun capable of shooting a bullet at the rate of 60 miles per hour is fired from the front end of a train moving at the rate of 60 miles per hour at a man on the rear end of the same train? Your answer is that the man at whom the bullet was fired would be killed if the aim was good. This seems to me to be in error in two respects. In the first place, the bullet would not strike the man for the following reason: As correctly stated in your answer to the first part of the query, a bullet fired under these circumstances would have no velocity relative to the surface of the earth, and, on account of the action of gravity, would begin to drop toward the ground. Now, if the train is of moderate length, say, 440 feet, it would require just 5 seconds for the man on the rear to arrive at the place where the bullet was fired. In this interval the bullet would have time to fall under the acceleration of gravity a distance of 400 feet, if not obstructed. In the second place, if by some means the action of gravity could be prevented, the bullet would remain suspended in space at the place where it left the gun and the man, on account of the motion of the train, would rush forward and strike it. But the result would hardly be disastrous, as the velocity of impact would be only 88 feet per second (equal

(14100) H. J. Ellis asks: I should like information concerning the lead aluminum rectifier, or some other electrolytic rectifier, especially as to the "peculiar quality of aluminum which permits a current to pass in only one direction," and the salt used as an electrolytic, also the chemical action. A. You will find in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1644 and 1767, articles upon the theory and construction of an electrolytic rectifier using lead and aluminum plates and ammonium phosphate as the electrolyte. These papers can be had from the Wilson Company. The action is due to the formation of a film of oxide upon the aluminum plate which prevents the flow of current from the aluminum plate to the lead plate. When the current flows from the lead to the aluminum oxygen is carried to the aluminum plate, and the oxygen combines with the aluminum forming aluminum oxide. When the alternations are reversed the film of oxide prevents the flow of current, and thus only those alternations from the lead plate can pass. The result is a pulsating direct current. The apparatus cannot be employed for large currents.

(14101) R. M. W. asks: May I trouble you to answer a question to settle an argument? If the sun should be suddenly demolished, could we under any circumstances get heat enough to keep us alive? With the modern heating plants do you think great enough heat could be obtained from coal, oil, or electricity? A. The heat sent out by the sun is enormous. On every 5 feet square in the Torrid Zone the heat is equivalent to 1 horsepower, while the sun shines. To put it in another way, upon the deck of a steamer in tropical seas enough heat falls to drive the vessel at about 10 knots an hour, if only it could be utilized under the boilers. We do not think man could produce enough artificial heat to replace this amount if the sun should be destroyed. The figures we gave above are from Todd's "New Astronomy," which we send for $1.45 postpaid. Abbott's "The Sun" is also a very valuable and recent work. We send it for $2.50.

(14102) C. W. B. asks: Light and heat both come from the sun, apparently, traveling together as if one and the same product. (1) What is the difference between light rays and heat rays of the sun? A few miles above the earth the temperature is zero constantly, and I assume that temperature continues to grow lower as the distance from the earth increases until absolute zero, 459 deg. below Fahrenheit is reached. (2) Now, in going so many million miles through this intensely cold temperature, why is not the heat of the sun completely absorbed or destroyed before it reaches the earth? A. The radiation from the sun is not absorbed in external space, because there is nothing there to absorb it. When it enters the air of the earth or strikes another planet in space then absorption begins. The atmosphere absorbs about four tenths of the sun's radiation. This is no different from radiation on the earth. The heat from a red hot ball does not heat the air very much, not so much as it would your hand held at the same distance at one side of the ball. This is a characteristic of radiation that it does not heat the intervening medium. See Carhart's "College Physics," page 392. The only difference between light and heat is one of wave length. The short waves affect the retina, the long waves affect us as heat.

(14103) J. W. S. asks: For the benefit of one of our teachers, will you kindly explain why the Mississippi apparently flows upward from its source to its mouth? If you can, cite me to an explanation, will you do so? If you have answered the question in Notes and Queries, send me a copy of the best answer, and I will be glad to forward price. I used to save my files, but in recent years I have given my copies away after I had used them. A. The question of the flow of the Mississippi River may be answered by

saying that the sea is level. The Mississippi River at its mouth in the Gulf of Mexico is at sea level, while at Minneapolis it is about 790 feet above sea level. This gives the facts in the case. Now, upon what is the statement based which is made so often that this river and all rivers which flow toward the Equator flow up-hill? It is based upon the fact that the surface of the earth is farther from the center of the earth at the Equator than it is farther from the Equator. This bulging at the Equator and flattening at the Poles is caused by centrifugal force when the earth was plastic, and the same force keeps both the solid earth and the water in their present positions. This water surface is a level surface. Water will not run along it. If the land is elevated above this surface, water will run down to this surface and no further. The Mississippi River is above this surface along its whole course to the sea and runs down hill all the way.

(14104) H. D. T. asks: 1. If a flying machine moving at its maximum speed and at a distance of a mile or more from the earth's surface, drops a bomb, will the bomb fall straight down to the earth, or will it keep the momentum of the machine and drop on a slant? Why? 2. If the same machine is a mile high and stationary and drops a bomb will the bomb strike a point which is directly under the machine when the bomb is dropped? Why? 3. Does the revolution of the earth during the time taken by the bomb to drop a mile change the relative position of the bomb, and earth, or, in other words, does the atmosphere through which the bomb falls travel with the earth in its revolution, or is the atmosphere stationary? A. A bomb dropped from a flying machine retains the forward motion of the machine while it is drawn down to the earth by gravity. Excepting for the resistance of the air it would travel forward as fast as the machine and land on the earth below directly under the place to which the machine has come, if the machine has maintained a straight course after dropping the bomb. This is in accordance with Newton's "First Law of Motion"—"Everybody in motion continues in uniform motion in a straight line unless compelled to change by some outside force." When the bomb leaves the machine it has the same forward motion as the machine, and it keeps that motion till it strikes the earth, which compels it to change its motion. 2. A bomb dropped from a flying machine which is at rest a mile high will strike the earth several feet to the east of the point directly under where it was dropped. All bodies dropped on the earth fall to the east. All shots fired deviate to the right of the direction in which they are fired. If fired to the north they deviate to the east; if to the south they deviate to the west. This is well understood by gunners and carefully allowed for. The cause of all these deviations is found in the rotation of the earth upon its axis. A bomb falling goes from a place where the earth is rotating faster to a place where it is rotating slower, and it retains the eastward velocity of the place from which it was dropped. It therefore moves to the east, and strikes the earth to the east of the point from which it was dropped. In the SCIENTIFIC AMERICAN, Vol. 112, No. 21, page 482, you will find an article in which it is stated that a shell fired to the north 12.4 miles will deviate to the east 525 feet. This is quite enough to have it miss a large target unless proper allowance is made. We can send the paper for ten cents. 3. If the atmosphere moves while the bomb is falling it will carry the bomb with it, and alter the results we have given above. Above we considered only the results of the earth's rotation and gravity. The air moves with the earth excepting for winds. It is not stationary with the earth moving through it. Were this the case we should have a hurricane all the time, which would strip the earth of every thing on its surface excepting the solid rocks.

(14105) W. & R. asks: Some few years ago when I was a regular subscriber to the SCIENTIFIC AMERICAN, there was a fluid blue print formula that we would like to have. Can you help us to it? Will remit the price upon receipt of advice. A. For a liquid blue print process, for solution No. 1, take of citrate of iron and ammonium, 80 grains to each ounce of water; for solution No. 2, take of ferricyanide of potassium, 40 grains to each ounce of water. Keep these in separate bottles till they are to be used. Then take equal parts of both solutions, and mix, after which the mixture must be kept in a dark room. It is better not to mix the solutions long before using, and to mix no more than is needed at one time. The quantity depends upon the amount of paper which is to be sensitized at one time.

(14106) S. S. asks: Kindly let me know where the day begins and in what part of the globe? A. Theoretically, the day begins at the 180th meridian, but practically the date line is an irregular line drawn so as to include the islands on either side of this meridian in the country near them to which they belong. Thus the date line slants to the west near Behring's Strait so as to take in on its eastern side the Aleutian Islands, which belong to the United States. Further south it bears to the west again to include on its eastern side the Hawaiian Islands, which belong to the United States, and which lie to the west of the meridian. Other detours are made to give islands to the south the same day as Australia.