# SCIENTIFIC AMERICAN



AUSTRIAN GUN IN A TUNNEL PIERCED THROUGH AN ALPINE CRAG—[See page 198.]


February 19, 1916

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Price 10 Cents

# Good-Will


In every business, but perhaps most of all in the automobile industry, good-will is a priceless asset. To the manufacturer of pleasure cars or trucks, his good name, his reputation, measures the sales possibilities of his product and hence the degree of his success.

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No car can have a reputation greater than that of its motor. As the performance of the motor, so the verdict of the motoring public.

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**Continental Motor Mfg. Co.**

**Factories:** Detroit
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***Largest exclusive motor manufacturers in the world***

SEVENTY-SECOND YEAR

# SCIENTIFIC AMERICAN

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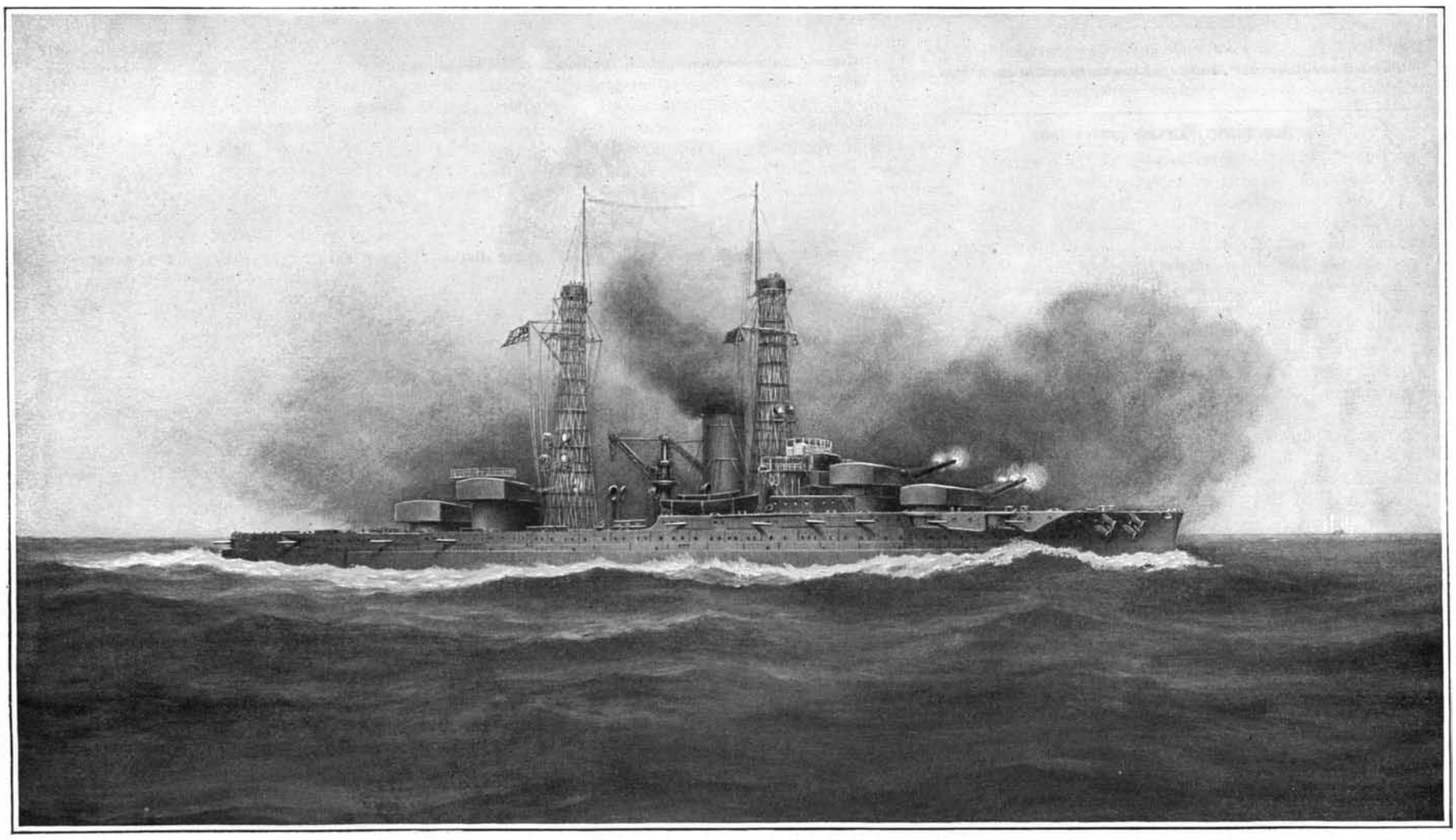

*Displacement*, 27,500 tons. *Length*, 583 feet overall. *Beam*, 95 feet. *Speed*, 21 knots. *Guns*, ten 14-inch; twenty-one 5-inch. *Torpedo tubes*, four 21-inch

**The "Nevada" and "Oklahoma" class of superdreadnoughts**

## Our Latest Superdreadnoughts

WITH the completion of the preliminary Government trials of the superdreadnoughts "Nevada" and "Oklahoma," the time of their acceptance by the Government and incorporation, as the most important units in our national naval defense, is at hand.

It is difficult to realize, in the rapid progress of naval development, that vessels of this type have relegated to the second line of battle all except eight of the battleships of this country now in service, and that when commissioned they will increase the effectiveness of the first line of defense by considerably more than 25 per cent.

The first notable improvement in the "Nevada" over the preceding types is to be found in the concentration of the main battery in the ideal four-turret arrangement, by installing three guns abreast in each of the lower turrets. The "Nevada" is the first to have the three-gun turret. However, this has now been exceeded by the four-gun-abreast turrets of the French. After it had been demonstrated that turret guns could be fired directly over other turrets and guns without injury to the personnel or equipment of the lower turret, the question of disposing the main battery on the center line was definitely settled. However, the limit of ability to mount and operate the main battery guns (except in the case of the superposed turrets in "Kearsage" and "Rhode Island" classes of predreadnoughts) was considered to be two guns abreast. With the adoption of the four-turret arrangement permitted by the three-gun turret, the forward and the after fire have been improved 50 per cent and the control and concentration of fire is better. Where the discharge of the three guns from one turret occurs, as in the salvo pictured in our illustration, the dispersion of these shots may be expected to be less than that to be anticipated as between guns in different turrets. The practically simultaneous impact on a small area of target of a successful discharge gives a hitting power much superior to that which would otherwise be obtained.

One is struck by the single smoke pipe on a vessel of this size and power, but it is a logical development of giving the maximum protection to any element of the ship requiring protection. It is rendered possible by the compact arrangement of boiler power permitted by the use of fuel oil. The "Nevada" is the first dreadnought for which oil is the exclusive fuel. This gives great advantages to the ship in the case of receiving the fuel on board. The officers and crew will view the passing of that grimy and strenuous operation of "coaling ship" with equanimity. The coal passer disappears and the fireman's most arduous labor will be the adjusting of valves and nozzles. While cleanliness will be promoted and labor reduced, and the problem of fuel storage simplified, yet coal, well disposed, affords a certain amount of protection to vital parts in a ship. Also coal is a commodity found for sale in sufficient quantities for bunkering purposes in all parts of the world. Accordingly, to take full advantage of this change it will be necessary to establish oil depots and to make use of oil tank ships.

The improvements in each succeeding type of dreadnought commissioned are the more impressive because fairly obvious, from casual view, to the average observer.

The recent discussion on the floor of the House of Representatives asked for the standardization of design for battleships after arriving at the best ship for the purpose. This is not such an unreasonable demand as might appear. Indeed, it is a contest between waiting for a superior ship or getting much sooner a very good ship. Heretofore this contest has been settled, and properly, in favor of the superior ship. Should the emergency become sufficiently acute, the time required to build could easily become the predominant factor. The best ship for the purpose known at the time of authorization of a program of construction is the last completed design.

The time allowed for the development of the design of the "Nevada" has resulted in the production of a ship very much superior in every respect, save speed, to the first dreadnoughts built for this country, as the comparative table of their main characteristics shows:

| | "Nevada." | 1st Dreadnought. |
|---|---|---|
| Length overall..... | 583-ft. | 510-ft. |
| Beam ..... | 95 ft. 2½ in. | 85 ft. 2½ in. |
| Normal draft..... | 28 ft. 6 in. | 26 ft. 11 in. |
| Displacement ..... | 27,500 | 20,000 |
| Horse-power ..... | 26,500 | 29,500 |
| Speed ..... | 21 | 21 |
| Guns ..... | 10-14 inch | 10-12 inch |
| | 21- 5 inch | 14- 5 inch |
| Torpedo tubes..... | 4 | 2 |

The notable increase in size of the "Nevada" over the first of our dreadnoughts (the "Delaware" class) has not marked the only advance attained, as improved design has contributed its quota. The improvements in the form of the ship, the reduced boiler power required to attain the desired speed, and the less weight of the new fuel required are all elements giving additional effective displacement, displacement which is consumed in additional gun power, or for defense against the same, and to take care of the new and dangerous developments in underwater warfare. While the ability to strike many blows and strike hard is the popular measure of success for the "Nevada," yet the most notable achievement of our designers has been in giving the fullest measure of protection by armor and subdivision to every really vital part. This renders the ship capable of receiving great punishment without diminishing her effective attack.

Altogether, the "Nevada" forms a very satisfactory and welcome addition to our battlefleet, and brings forward in a striking manner the large value of single units among the latest capital ships.

# 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.*

## Another Naval Invention!

WHATEVER else may be said of the effects of the European war on American life, one of the outstanding features thus far has been the numerous inventions of a military nature appearing from time to time in the daily press. And of all fields of exploitation for questionable, untried inventions, none has been so fertile as the Sunday magazine section of the metropolitan newspapers. This is readily accounted for; newspapermen are seldom technical men, and anything that is of a spectacular nature, whether it sounds feasible or not, soon finds its way into the columns of the newspapers.

The most recent instance of an ambitious invention intended to revolutionize present modes of warfare is in the form of a number of "pancake" coils bolted to the sides of a warship, so as to render it immune from torpedoes. According to its inventor, a New Yorker, if an iron or steel rod is brought in the vicinity of a powerful electromagnet, it will take a position at right angles to the axis of the electromagnet winding. Basing his invention on that principle, he proposes placing a number of electromagnets along the sides of a vessel so that torpedoes aimed at a warship thus equipped will be deflected from their course when within effective range of the magnetic fields set up in the water by the "pancake" coils. Evidently the inventor does not mean pancake coils as this term is generally understood, since his diagrams show the coils to be wound in the form of solenoids, parallel to the ship's hull.

That the scheme proposed is a most ambitious one cannot be denied. But how impracticable! In the first place, a bar of iron or steel does not necessarily assume a position parallel to an electromagnet, when brought within its field of influence. Quite the contrary. If the bar is of a small size as compared with the electromagnet, it will be attracted end on toward either pole of the solenoid. But if the bar is magnetized and in size compares favorably with the electromagnet, it may then assume a parallel position. Still, it is rather doubtful that an enemy bent on torpedoing a warship will be so courteous as to magnetize his torpedoes in order that they may be ineffectual.

Overlooking what appears to be a misunderstanding of the principles of magnetism by the inventor, the next question is that of supplying a current sufficiently powerful to energize the "pancake" coils. Anyone familiar with electromagnets is fully aware of the limited extent of a magnetic field, no matter how powerful it may be. Even with the most powerful current passing through the "pancake" coils—and it must be taken for granted that the necessary electric power, even if it ran up into hundreds of kilowatts, would be available and devoted to such a valuable end—it is absurd to believe that the magnetic field would extend sufficiently to deflect a torpedo coming head-on towards the hull of the warship, at a speed of perhaps 30 miles an hour. And as a further consideration, the nearby steel hull of the ship would practically short-circuit the magnetic field.

Finally, supposing for the sake of further argument that the proposed anti-torpedo system was effectual against torpedoes, what would be its effect in relation to mines which, as the naval losses of the war have taught, are plentifully scattered even on the high seas? A mine is certainly anything but a torpedo-shaped object, and hence the principle of parallel alinement which the inventor has discovered would here fail to be effective. Instead, may we not suppose that the "pancake" coils would have the effect of drawing contact mines against the sides of the warship, thus courting self-destruction?

It is indeed unfortunate that ideas of this category find their way into the daily press, for the non-technical public is soon deceived into believing that in time of war our country could, even with inferior equipment and personnel, meet and defeat a superior enemy because of the resourcefulness of such inventors.

## Modern Firearms

THE commonest injuries produced in war are gunshot wounds. Until fifty years ago a soldier's musket carried only about 835 feet; and this degree of efficiency had not been exceeded for more than two hundred years, *i.e.*, from 1640 to 1859. In other words, the wars of Louis XIV., the struggles of the French Revolution, the Napoleonic Wars, the Crimean War, and our War of 1812 were all fought with firearms which had no effect at a distance greater than 835 feet. In 1857, however, the smooth bore gun barrel was replaced by the rifled barrel, and this change caused an immediate increase in the carrying distance to 2,000 feet. At the time this result seemed to the whole world nothing short of a miracle; but as early as 1866 a French officer, Chassepot by name, invented a rifle having a calibre of 15 millimeters, which carried 4,000 feet. Ten years before, this accomplishment would have seemed quite impossible. On November 4, 1867, the new Chassepot rifle was submitted to a practical test. The French sent a detachment of men to occupy Rome, and to hold it against the advancement of Garibaldi. The effect of the new rifle in the engagements was so remarkable that the entire French army was immediately equipped with Chassepots.

The Chassepot rifle weighed nine pounds, and the Gras rifle, which was introduced in 1874, weighed nearly as much, but it had a carrying distance of 6,000 feet. After remaining the same for 217 years, the carrying distance of firearms was thus increased in 15 years by 5,165 feet. At the same time the firearms of the Austrians, Prussians, and Italians were also greatly improved, and a repeating rifle, firing 16 shots a minute and having a carrying distance of 9,000 feet, came into practical use.

The rifles in use to-day are much lighter, are more easily handled, and carry a distance of more than 12,000 feet at the rate of 2,700 feet per second. The revolver was first introduced in 1850; since then it has also undergone great improvement. Its carrying distance, which at first was only about 100 feet, was increased to 330 feet, then 680, and finally 4,000 feet.

In comparison with such means of defense and offense, it is interesting to call to mind the weapons of the ancients. A javelin could be thrown about 84 feet; the sling ordinarily hurled its missile 266 feet, the Balearic sling-men being famous, however, because they could hurl a stone 383 feet. The wooden bow was in use until the middle of the 15th century; by means of it an arrow could be propelled a distance of 265-330 feet, while the steel crossbow, which came into use later, carried from 330-340 feet. The old blunderbuss of the Pilgrims, which was supported on a fork, was effective for about 500 feet. The early musket carried about 600 feet. This firearm was much improved, so that it could shoot a distance of 835 feet, and this was the best the world knew until 1857.

## Have We Advanced?

SOMEBODY once wrote a book with the title "Civilization, Its Cause and Cure." The title is an attractive one and expresses, in a neat manner, a not uncommon viewpoint. A distinguished English engineer once remarked that if we cannot have modern civilization without having such darksome, festering patches as Manchester and some other English industrial towns, then the world would do well to dispense with civilization. And readers of S. K. Chesterton will remember how fiercely that gentleman combats the whole idea of "Progress." He insists that Progress is a relative term and seems to consider that we moderns are, on the whole, progressing towards Hell rather than towards Heaven. It is unnecessary to point out that many religious teachers are of the same opinion.

Yet there is another view for which something can be said, and by comparing the two we can reach a clearer idea of the validity of either. In spite of the existence of towns like Manchester and Pittsburgh, in spite of slums and sweated labor, and in spite of the war, we are now, in some very valuable respects, better off than our fathers. The valuable features of modern progress may be summed up briefly by saying that there is a greater amount of constructive thought in the world at the present time than there ever was before. Problems of all kinds, social, political and economic, which before were barely touched on, are now handled with breadth and thoroughness. The creation of the ideal world-wide state that men have dreamt about since the days of Plato is now nearer to being an intellectual possibility than ever before. We say "intellectual" possibility and that indicates at once the strength and the weakness of our progress. For while, as a scheme, this great conception of a world-state can really point to some advancement, the primitive passions and lusts of mankind seem more terribly permanent than the hardest granite. By the work of scientific men and thinkers of all kinds, we have come near to making Universal Brotherhood a feasible project and then, just before the final touches are given to the theory, mankind sallies forth in its millions bent on mutual destruction.

It is apparent that the unquestionable intellectual advance which has taken place is altogether too localized. A certain small section of mankind has carried science and speculation in general to a point never before reached, has opened to the world mightier and more magnificent vistas than ever dawned upon the most gifted men of the ancient world; but on the other hand our newspapers, our picture shows, the current amusements of the people, almost indicate a greater intellectual degradation than has previously existed in written history. Which of these two is the real tendency of the modern world? Suppose, on the one hand, we consider—say, the "History of the Science of Physics" and on the other "The Rise of the Modern Politician" and then try to decide which way things in general are going. Are things in general going anywhere?

If, out of this modern jumble, we can trace a direction which is worth while, then let us try to bring as much of contemporary life as we can into accordance with it. If we see a gleam, let us follow it. In our days the Holy Grail is searched after by little cliques; what the people in general search after we know not, unless the newspaper headlines are a correct indication.

We are inclined to the belief that the policy of *laissez-faire* and the philosophy which says "things are bound to be all right in the long run" are amongst the most expensive luxuries that man can be called upon to pay for. It is perfectly evident that the disorderly, chaotic "Progress" that has gone on ever since railways were invented, has brought about the present war. Our hope, and to some extent our belief, is that modern chaos, in bringing forth war, has died of the monstrous birth. Putting the matter without undue optimism, we can say that if the war does not show us the right road to travel on, it will at least show that the old road led to regions we have no desire to revisit.

## Phenology

THE recent publication by the Weather Bureau of two important contributions to phenology, already mentioned in these columns, calls attention to an interesting border science between meteorology and biology, information concerning which is not especially easy of access. The last edition of the "Encyclopædia Britannica" contains no article on this subject, nor does the word "phenology" even appear in the general index to that work; yet there is a large corps of phenological observers in Great Britain, and the Royal Meteorological Society, of London, has published a manual of instructions for taking phenological observations.

Phenology is the study of the periodic phenomena of plant and animal life in their relation to weather and climate. Plant phenology has been studied from two points of view. Many phenologists are content to gather statistics concerning the dates of leafing, flowering, and other phases of plant life, for different localities and successive years, and to make these statistics available in the form of tables and charts. The compilation of such data calls for a corps of careful observers, who shall note the periodic phenomena of a specified list of plants from year to year. The results of their labors possess an interest dependent upon the fact that a plant is a complex instrument, which records the combined and accumulated effects of atmospheric conditions.

The utility of phenological observations can perhaps best be illustrated by reference to a German example. In the Grand Duchy of Hesse the observations for a number of years, at various stations, have been compiled by Dr. E. Ihne, who has published a chart showing the progress of spring weather over the country in an average season. The beginning of spring is assumed to coincide with the average blossoming date of a number of native plants, and also, approximately, with the blossoming of the earlier varieties of apple. Dr. Ihne's chart shows the date of the "phenological spring" in all parts of the grand duchy, ranging from April 21st to May 20th; the latter date being recorded in the mountains only. A chart of this character is more useful to the agriculturist and the horticulturist than any compiled from meteorological observations, for it shows where the season is "early" or "late," directly in terms of plant life. It is thus possible to select early or late varieties of crops or fruits, according to the natural requirements of each locality.

Several other phenological charts have been published for European areas, but none for any part of this country. In fact, there has been no systematic collection of phenological observations in the United States on a large scale, suitable to form the basis of such charts, with the exception of the work done years ago by Prof. F. B. Hough, who organized a system of observation in New York State, and afterwards compiled observations from many other states for the Smithsonian Institution.

## Aeronautics

**American Automobile Manufacturer Enters Aeronautical Engine Field.**—It is announced that one of the leading manufacturers of automobiles in this country is about to engage in the manufacture of aeronautical engines. Already the concern has acquired a large tract of land on Lake St. Clair, near Mt. Clemens, Mich., for an aviation field. Aeroplanes will be received there within a short time and experiments will be made with regard to the engine requirements of aviation, at an early date. For the present, at least, the company only contemplates making aviation motors and not the complete aeroplanes.

**Inferiority of American Aeroplanes.**—Surely the words of Lieut. J. E. C. Scott, a British aviator and aeronautical engineer, who is in this country on a diplomatic mission for his government, are not complimentary to domestic manufacturers of airships when he states that not a single aeroplane made in the United States is capable of the service demanded at the front. He adds that not a single motor made in this country is capable of rendering the service needed by Allied aviators. He attributes the shortcomings of American aircraft to two causes: first, our constructors are careless and do not take the pains in building their machines that the French and British makers do; secondly, they have not yet learned the requirements of military service.

**Low-Flying German Aeroplane.**—In contradistinction to the greater part of the aircraft engaged in the present war which, in order to secure immunity from anti-aircraft guns, fly at high altitudes, it is learned that the Germans have devised and introduced into service an aeroplane that flies below the line of fire of these guns. It is exceeding fast and flies so low that anti-aircraft artillery cannot be trained on it so that the shells will burst with accuracy. However, in securing immunity from these guns it comes within range of rifle fire and machine gun fire, and as a protection against these it is heavily armored. Flying close to the ground, the occupants of the new German aircraft are in a position to locate accurately the position of troops and masked batteries, and secure much military information of inestimable value.

**German Biplane of Double Fuselage Type.**—An account of the capture of a large German aeroplane appears in a recent issue of the *Russkoie Glovo*, which states in part: "Some time ago on the northern front our artillery succeeded in bringing down a German biplane with two unusually large fuselages and two tails. Each of the armored fuselages contains two machine guns and a light, quick-firing gun, besides ammunition receptacles. Propulsion is by twin engines, each developing 170 horse-power. In the center, midway between the fuselages, but a little lower, is the pilot's nacelle, protected by armor. The crew of the machine consists of six men, including pilot, observer and mechanic." Evidently, this machine is a modification on an ascending scale of the well-known "Fritz" type of biplane, which has made its appearance over the western front from time to time.

**New Fokker Monoplanes.**—The German monoplane of the Fokker type, of which so much has been said of late, is not strictly a novelty; in fact, it may be said to be designed largely along the lines of fast French monoplanes which have proved most effective in the hands of highly skilled pilots. The special feature of the Fokker monoplane is that its construction is based on steel tubes covered, as a protection against rust, by something of the nature of waxed canvas. The tubes are rectangular in section, and are closed at the rear in knife edges. The engine is armored and usually of 150 horse-power. It is said that the Fokker machines have a speed of 110 miles an hour and can reach a height of 7,500 feet in 10 minutes. They are usually designed to carry one person, who is armed with a machine gun which shoots through the propeller in front. In some instances the Fokkers are fitted with two machine guns, each having a belt of 250 cartridges.

**Zeppelins Built Since the War.**—According to a recent press dispatch from Berne, Switzerland, there are now some eighty Zeppelins in the German service. This statement is said to be based on information developed at Friedrichshafen, where the airship works are located. Recently, one of the latest type Zeppelins made a trial flight. It bore the number LZ-95, and in design varied considerably from the ante bellum Zeppelins. Its gondolas are said to be of plated steel. The craft is plentifully supplied with machine guns and apparatus for throwing bombs and aerial torpedoes; among the latter being a new type which is reported to be far more powerful than any heretofore developed. In fact, rumor has it that the new aerial torpedo is to play a prominent part in the event of the German warships and Zeppelins coming out from their sheltering harbors and engaging in battle with the British fleet in the North Sea.

## Astronomy

**Photoelectric Measures of Variable Stars.**—Several interesting contributions to the study of variable stars effected with the photoelectric photometer are announced in *Astronomische Nachrichten* by Messrs. Guthnick and Prager. Numerous measurements of Alpha Cygni have confirmed the suspected variability of that star, the amplitude being 0.07 mag. Evidence of variability has also been found in Alpha and Gamma Lyræ, the average amplitudes being 0.04 and 0.03 mag., respectively.

**Manuscripts of Copernicus.**—Until recently the number of known books containing manuscript notes by Copernicus was fifteen. This number has now been increased through the researches of a committee of the Academy of Sciences of Cracow, which has been at work in the archives and libraries of Sweden since 1911, and has found, among other treasures, no less than 30 books containing notes in the handwriting of Copernicus. Details on this subject have not yet been published.

**The Smithsonian Observatory on Mt. Wilson.**—The last report of the Smithsonian Astrophysical Observatory notes considerable progress in the work of the observing station maintained by this observatory on Mt. Wilson, Cal. (which is also the site of the great Carnegie Solar Observatory), where a 40-foot tower is being equipped with a tower telescope for use when observing, with the spectrobolometer, the distribution of radiation over the sun's disk. The observatory secured a Congressional appropriation of $2,000 for this apparatus. Tower-telescope observations are now made at seven different wave-lengths of the spectrum on each day that solar-constant measurements are secured.

**Latitude Variation Work at the Naval Observatory.**—The latitude variation work which has been carried on for some years at Gaithersburg, Md., under the auspices of the International Geodetic Association, was discontinued last year, and the photographic zenith tube lately used at that station has been lent to the Naval Observatory, in Washington, which will take over the work. A building of sheet-iron louver construction, with removable roof, is being erected at the Naval Observatory to house the apparatus. As we have previously reported, the work of the International Geodetic Association is one of the few international scientific undertakings that have not been interrupted by the European war.

**New Astronomical Observatories.**—Plans are on foot to erect an astronomical observatory on Volkollen, one of the highest mountain summits in Scandinavia. A citizen of Duluth, Minn., Mr. J. H. Darling, has undertaken to erect an observatory on one of the public playgrounds in that city, and to equip it with a 9-inch equatorial refractor. Plans have been drawn for an observatory in Toronto to serve as headquarters of the Royal Astronomical Society of Canada. The building is to be erected in a public park, and maintained by the University of Toronto. The proposed equipment includes a 20-inch telescope. This project is at present in abeyance, on account of the war.

**Spectrum of the Companion of Sirius.**—The idea of photographing the spectrum of the companion of Sirius is startling in its audacity, even in an age when so many other miracles have been achieved. Every student of astronomy recalls the romantic history of this star, the existence of which was predicted by Bessel in 1844, on account of the irregular proper motion of Sirius, eighteen years before it was actually seen for the first time by Alvan Clark, Jr. It has always been a difficult telescopic object, in consequence of the overpowering brilliancy of the primary. Several attempts have been made at the Mt. Wilson Observatory during the past two years to photograph the companion's spectrum. "The great mass of the star," says Walter S. Adams, "equal to that of the sun and about one half that of Sirius, and its low luminosity, about one-hundredth part of that of the sun and one ten-thousandth part of that of Sirius, make the character of its spectrum a matter of exceptional interest." The spectrum photographs have been mostly taken at the 80-foot focus of the 60-inch reflector, with the Cassegrain combination of mirrors. Although Sirius is kept behind a black metal screen, the field containing the companion is strongly illuminated by the light of the primary. The earlier photographs showed a decided maximum in the spectrum at the point where the companion was kept during the exposure, but without a distinct line of separation from the general spectrum due to Sirius. Finally, last October, a photograph was secured in which a separate narrow spectrum was found corresponding to the point on the slit at which the companion was held, and this can hardly be other than the spectrum of the companion. The line spectrum of this body is apparently identical with that of the primary, but its continuous spectrum appears to fade off more rapidly in the violet. Several astronomers have suggested that the companion shines, at least in part, with light reflected from Sirius.

## Radio Communication

**Ordering a Dinner by Radio Telegraphy.**—Perhaps the most novel application of wireless telegraphy today is that for ordering a dinner. A New York restaurant has recently announced that passengers on steamers bound for that port can make arrangements by wireless to have a table set before they arrive. To facilitate ordering by wireless, there has been compiled a list of abbreviations. Thus the tourist is now assured of a tempting meal, ready to be served, the moment he reaches the restaurant in question.

**The Tufts Radio Station** near Boston, Mass., has recently been completed and experiments are now being conducted with it. The new steel tower, which replaces that blown down last Fall by a gale, is over 300 feet high, being the largest in New England and the third largest in the United States. The tower is supported on four special insulators imbedded in 15 tons of reinforced concrete. The station is primarily intended as a laboratory for research work by a local wireless company.

**Increasing Employment of Arc Generators.**—The English *Electrician*, in a recent editorial, comments on the action of the United States naval authorities in asking for quotations for a 300 kw. arc generator, as follows: "The British & Overseas Engineering Synd. (Ltd.) write saying that for the past two years arcs of 100 kw. and 200 kw. have been installed and are operating across the North Atlantic, and there is no difficulty at all in the construction of arcs of much larger sizes. During the last two years considerable experience has been gained in connection with these large arcs, and a good many new patents have been taken out in connection with them."

**New Organization for Wireless Amateurs.**—Several weeks ago the articles of incorporation for the National Amateur Wireless Association were signed by Supreme Court Justice Ford. It is said that the purpose of the new association is to prepare for war by forming amateur wireless telegraphists into a military signal corps. One of the aims of the new organization is to direct experimental work on the part of amateurs and to maintain a central bureau of information. When it is recalled that the war in Europe has necessitated the enlistment of an unprecedented number of wireless operators, the value of the work to be done by the new organization is at once apparent.

**Wireless for Mississippi River Barges.**—A navigation company is building at the present time 36 power barges varying in tonnage from 1,600 to 5,000, which are to be equipped with wireless apparatus. These barges are intended for service on the Mississippi River between Minneapolis and New Orleans, with stops at all important points on the Mississippi River and its tributaries. Each of the barges will be equipped with a 2-kw. 500-cycle panel type quenched gap set, which is believed to be ample for a continuous range of over 400 miles. Radio communication will thus be insured between barges and shore stations, and this service is expected to be of particular value in keeping shippers advised of market conditions and directing the trans-shipment of cargoes to take advantage of favorable developments. The barges are to be equipped with four 80-horse-power engines working separate propellers. There will be an express and a slower service: the former being built for a speed of 18 miles per hour upstream, and 24 miles an hour downstream, while the slower barges will make 8 miles an hour upstream and 12 miles an hour downstream.

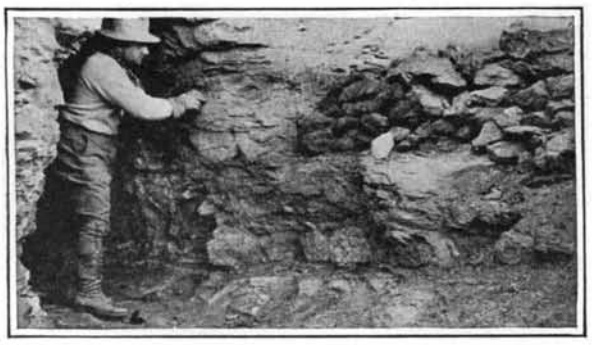
**Mobilization by Wireless.**—According to reports, on Washington's Birthday, February 22nd, the United States Government plans to carry out an interesting and important test in conjunction with the tens of thousands of wireless amateurs throughout the country. It is learned that the present plans call for the sending out of a test war message from the radio station at Rock Island Arsenal, Ill. At 11 o'clock on the night of February 21st, Central time, there will be sent out broadcast a "stand by" signal, and all amateurs are expected to receive and comply with this request. There will then be delivered by messenger a military dispatch to the Rock Island Arsenal, from the Federal Government. The message will then be seen for the first time by the wireless operator, who will thereupon flash it out to all stations within hearing distance. It is understood that one of forty-five designated stations will receive the message and then relay it to the next group of stations whose operators will also relay it to the following group, and so on. It is said that the message is to be delivered in each city or state to the Mayor or Governor, and that the purpose of the experiment is to determine how quickly an army of 3,000,000 soldiers can be mobilized. Whatever may be the actual purpose of the experiment, it is safe to predict that the efficiency and value of the amateur wireless stations and their personnel will be again proved to the Federal authorities.

Carnotite ore ready for shipment at coke ovens

# Industrial Preparedness Series

## Extracting Radium from American Ores

By Herbert T. Wade



A vein of carnotite ore, at Bull Canyon, Colo.

THAT the United States is now independent of Europe for its supply of radium has been demonstrated by the successful operation of a large experimental plant at Denver, Colo., under the joint auspices of the National Radium Institute and the United States Bureau of Mines. It is now possible to utilize in a commercial way the carnotite ores of Colorado and Utah, and obtain this valuable element which has already become so important in medicine and surgery. Indeed, aside from the war cutting off European radium, some of which was extracted from American ores, the supply available for American hospitals is far from adequate, and it was largely this consideration that led to the formation of the National Radium Institute by Dr. Howard A. Kelly, of Baltimore, and Dr. James Douglas, the well-known mining engineer, of New York city. Accordingly, when the National Radium Institute proposed to place at the disposal of the United States Government certain claims in the Paradox Valley, Colorado, leased from the Crucible Steel Company, containing carnotite, a rare metal bearing ore containing uranium oxide in large quantities, and capital up to $150,000, for constructing and equipping a plant that would turn out radium on a large scale, the Bureau of Mines gladly agreed to coöperate. The research and technical work was to be in the hands of the Government scientists under the general direction of Dr. Charles L. Parsons, Chief of the Division of Mineral Technology, and Dr. R. B. Moore, Physical Chemist of the Bureau, was placed in charge of the laboratory and refining plant which was built at Denver. The mining and concentration of the carnotite ore was carried on under the direction of an assistant mining engineer, and experimental work, analyses and measurement undertaken by a well-organized technical staff. A suitable plant was erected and equipped, and began to supply radium regularly in June, 1914, and in February, 1915, its capacity was increased by additional buildings and equipment more than 100 per cent. The plant as now in operation includes its main buildings and laboratories, a grinding and sampling mill, and a nitric acid plant.

The work of this most interesting installation has recently been described in Bulletin No. 104, of the United States Bureau of Mines, which is a substantial contribution to the technical literature of radium. Not only were former methods of extracting radium from the ores studied by the experts of the Bureau, but new methods were discovered, and it was shown that by using a new and special process the cost of producing radium need not exceed $40,000 per gram, and that 90 per cent of the radium contained in such ore as was available to the Bureau could be extracted. When it is recalled that radium has been selling in the United States for about $120,000 per gram the importance of the work may be realized.

In the preparation of radium on a commercial scale, one of three general classes of methods usually is followed: (1) Use of acid leach; (2) Use of an alkaline leach followed by an acid leach; (3) Fusing the ore with some material that will break up the ore and make the extraction of the valuable contents possible. These methods, however, the United States Government investigators, after investigation, set aside in favor of a new method which made use of nitric acid in which incidentally sodium nitrate was recovered as a by-product and from which nitric acid could be once again made. This process gives the radium at once in the form of a high grade radium-barium sulphate, which is practically free from silica and easily treated further. In addition to the radium the uranium and vanadium contained in the carnotite can also be obtained. The general process of extraction is indicated by the accompanying diagram.

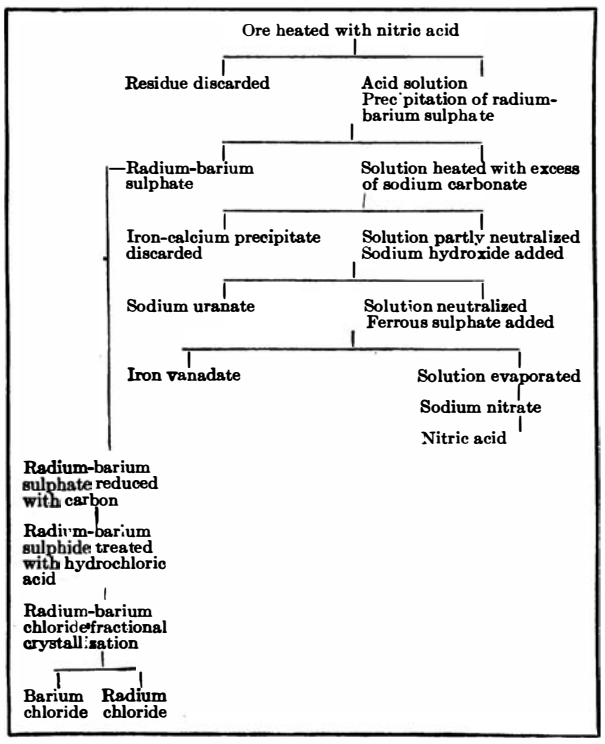
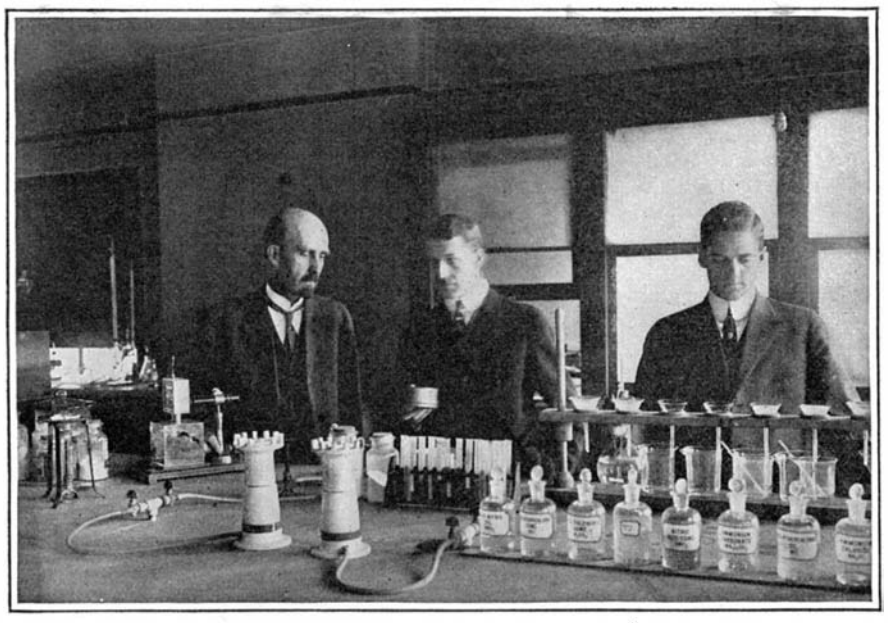
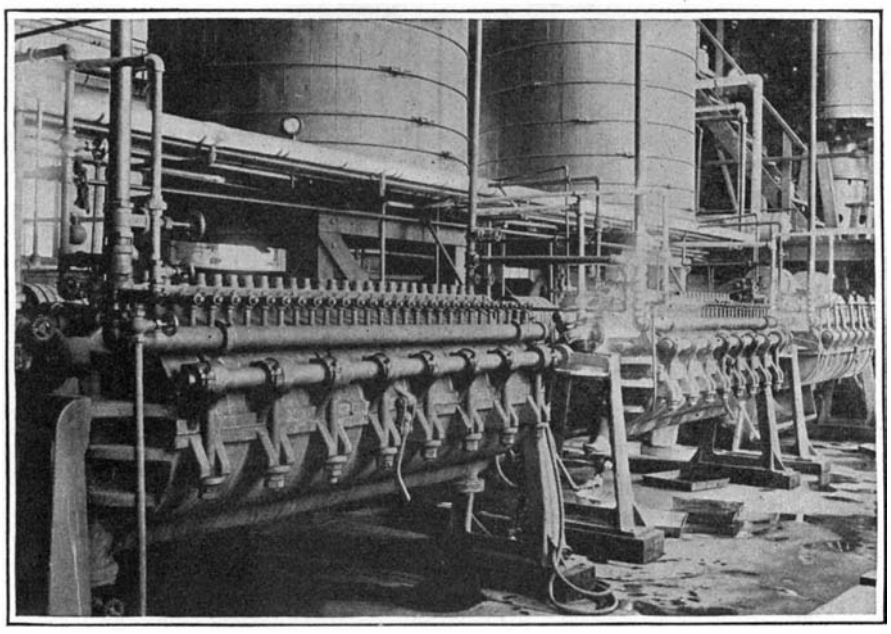



Diagram of Steps of Bureau of Mines Method of Radium Extraction



The Denver laboratory of the U. S. Bureau of Mines, showing Prof. R. B. Moore in charge of the office and Karl Kithil, special investigator



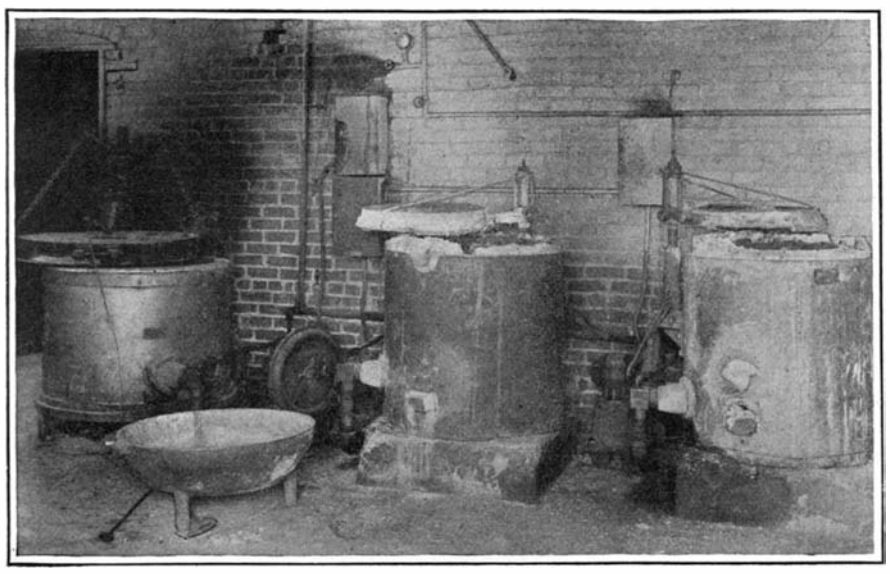
The filter presses in the new plant

The ore is first ground to 20 mesh, then leached with strong hot nitric acid. After the acid is drawn off into an earthenware vacuum filter, the remaining sand held back in the pot is given an acid wash with weaker acid and then after being dumped on the filter is washed with hot distilled water, the entire process consuming about seven hours. The filtrate is diluted with water and sodium hydroxide is added so that radium-barium sulphate is precipitated. This is further treated, and finally the radium-barium sulphates are placed in iron pans and dried in a hot air oven. These radium-barium sulphates then are refined, and the first process is to obtain a high grade sulphate, eliminating the silica and other impurities. The original sulphates are then reduced with carbon either in an electric or oil furnace, and then the sulphide is treated with hydrochloric acid, so that it becomes radium-barium chloride from which by a process of fractional crystallization the barium chloride is crystallized out, the main difficulty being with lead, which, unlike the other metal salts, requires special treatment. The barium chloride and radium chloride are then treated with ammonium carbonate, and carbonates are obtained which are dissolved in hydrobromic acid and are evaporated to give bromide crystals. After the final fraction the crystals are collected in glass tubes, which are sealed and measurements are taken from time to time. Finally by a process of higher fractionation the radium is separated and is obtained in the form of radium bromide.

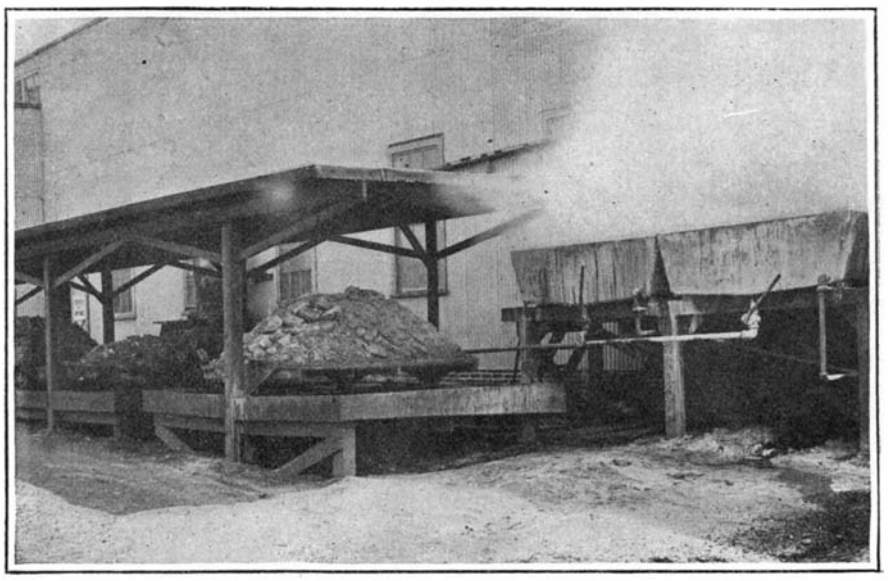
Of course, this method which is merely outlined requires infinite care and patience, and must be accomplished by frequent measurements with a special electroscope to determine the amount of radium present.

The delicacy of modern chemical method is shown in the fact that there is extracted from the ore an element that exists in it in the proportion of 1 part to 200,000,000, so that in working a process on a wholesale scale, not merely in a laboratory, there are involved refinements which are not ordinarily encountered in metallurgical operations. Accordingly when it is realized that 90 per cent and over of the radium present has been reclaimed by the nitric acid method, where anything over 50 per cent would have been considered satisfactory, the success of the work of the National Radium Institute can be realized. Up to September 1, 1915, 1,947.5 milligrams of radium in the form of high grade chloride or bromide had been delivered out of 4,774 milligrams of radium produced as sulphate. This varied in purity, running all the way from 6 to 15 per cent to high grade product of as much as 87.8 per cent. The cost of producing the radium is also considered in some detail. The average cost of 1 gram of radium based on the production up to August 1, 1915, or from 4,258 milligrams of radium element costing $155,322.09 was $37,599. In addition there were extracted 31,650 pounds of uranium oxide and 11,528 pounds of vanadium oxide. The average cost of the ore was $96.36 a ton, somewhat below the ordinary commercial value, so that had the ore cost $120 per ton, a fair value, it would have brought the cost of radium to $41,742 per gram, and an increase in cost of $20 per ton over this amount would have increased the cost approximately $4,000 per gram.

The results of this investigation are of great and varied interest. It is shown



Furnaces for the reduction of sulphates and refining of sodium uranate



Recovery of sodium nitrate, showing the evaporation and crystallizing pans

that radium can be produced commercially from American ores, as the patents are available to any citizen of the United States, that there are ore deposits that may be utilized for producing the radium in greater amounts than previously, and finally that radium for use in the Government hospitals and other experimental work can be obtained from Government lands, if such still exist, or from ore purchased in the open market.

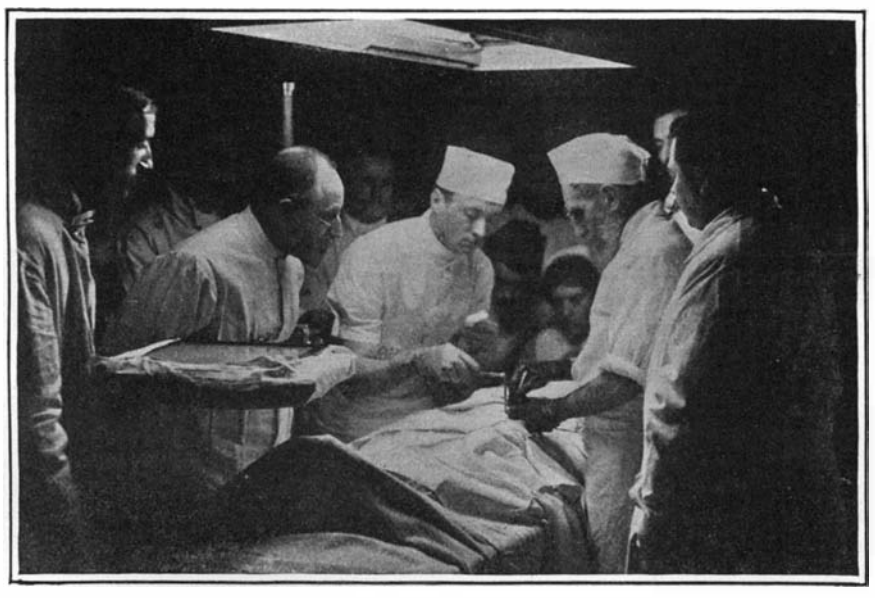
## The Use of X-Rays With Intervals of Red Illumination

**By Jacques Boyer**

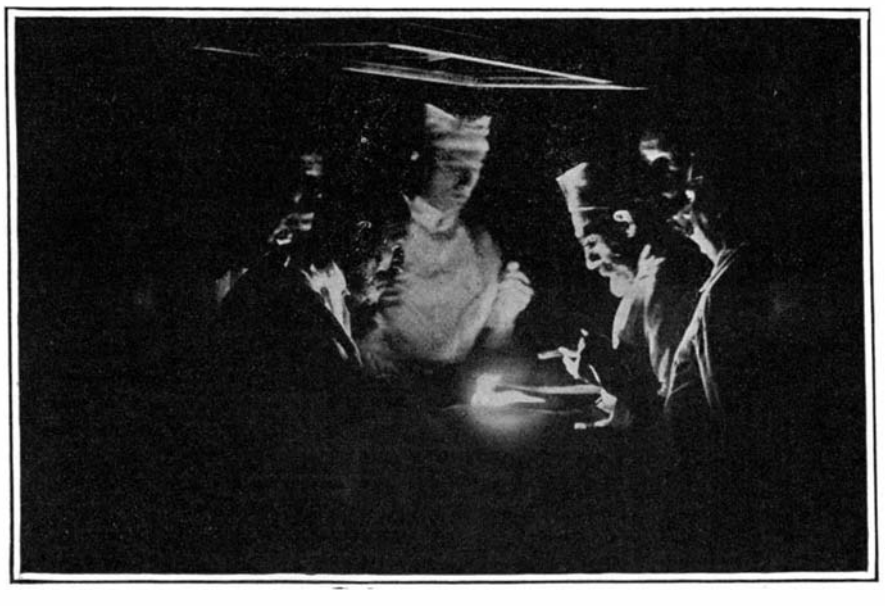
PROF. J. BERGONIE, of Bordeaux, France, to whom electricity in medicine owes a number of important advances, has recently evolved an original method of applying X-rays in surgery.

At the present time the surgeon, manipulating his instruments under the fluorescent screen, is compelled to work in darkness, although all the while he exposes himself to the harmful effects of the X-rays. On the other hand, the surgeon working in bright light is obliged to depend on an assistant who, alone in a position to see the X-ray images on the screen, guides him in his work. Because of the drawbacks of both these methods, many surgeons prefer to perform their work without the aid of the X-rays. The new method worked out by Bergonié, which is based on the law of simultaneous contrast of colors, will undoubtedly cause many surgeons to resort to the use of the X-rays in their work. The principle involved, originally formulated by Chevreul, is best demonstrated as follows:

If the eyes rest for several moments on an object of a certain shade, after which they are turned away, the eyes retain for a few instants the complementary color of the subject previously observed; this phenomenon being due to the persistence of luminous impressions on the retina of the eye. For example, observe for a few moments a red flower and then turn to a disk of white porcelain. The disk will appear to be of a greenish tint. As Chevreul has demonstrated, this phenomenon is one of the reasons for the intensification of a color impression when two complementary colors are placed in juxtaposition. Modifying the experiment just cited by taking a disk of greenish shade, it will be observed that the green is intensified by the green impression made on the retina of the eye by the red vision. Likewise, if the eyes are brought to bear on the red flower, its color will be increased with the red impression given to the retina by the green disk. In conclusion, the two colors reciprocally improve each other, and Prof. Bergonié has made use of these facts to facilitate the task of the surgeon who, in the course of an operation, utilizes the X-rays in order to see through the body of his patient.



Surgeon and his assistants performing an operation under a red light, between X-ray examinations



Examining the region of an operation by means of a fluorescent screen, which is excited by the X-rays

After being placed in a darkened chamber, Prof. Bergonié illuminates the operating room by means of an intense red light of great purity, in which there is not a single green or yellow radiation such as are emitted by the fluorescent screen of the X-ray apparatus. Due to the effect of contrast, the sensibility of the retina of the surgeon and the assistants is conserved and even increased during the period of surgical intervention using the red light. Furthermore, when the red light is supressed in order to substitute that of the X-rays from below the operating table for the purpose of exploring the region of the operation, the surgeon and his assistants are able to perceive very readily and without loss of time the greenish images appearing on the fluorescent screen. Heretofore, the employment of normal illumination during intervals has caused not only much eye fatigue to the surgeon and his aides, but has resulted in lengthening the operation because of the time necessary to accommodate the retina of the eye to the change. With the method of Prof. Bergonié, however, an operation is readily performed under red light, and when the greenish X-ray illumination is substituted, the surgeon is able to scrutinize the fluorescent screen with equal facility since the retina is immediately accommodated. To state the Bergonié method definitely: The active phases of an operation are executed under red light, while the X-ray examinations of the patient's body in the region of the operation are made in the greenish light of the X-rays for an interval seldom exceeding 30 seconds. As to the number of examinations required, this is determined by the case at hand: for instance, one case in which shrapnel was extracted from a man's heel required two radiograph examinations; another, in which a shrapnel splinter was dislodged from the region of the thigh bone, at a depth of ten centimeters, required six X-ray examinations—the patient in this instance was stout and muscular. It is of interest to note that, among other peculiarities, a pure red light causes the blood of the arteries to appear almost colorless and quite distinctive from the blood of the veins, and that when the blood becomes almost black it is an indication that the chloroforming of a patient is well under way.

For several months past Prof. Bergonié has been applying his method in the hospital of Bordeaux, where it has given much satisfaction. The luminous dome which furnishes the red light is placed directly over the operation table and is of about the same dimensions as the latter, so as to avoid shadows being cast on the patient. The dome contains 20 lamps of 25 candle-power each, the rays of which pass through red glass. Although the illumination thus furnished is admittedly poor, as may be noticed in one of the accompanying illustrations, the surgeons declare that it is sufficient for their purpose.

## Effect of Static Charge Upon Rubber

FONTANA showed that the inside volume of a Leyden jar increased during an electric charge. If the jar contains water which serves as one of the coatings, the level of the liquid is seen to lower when the jar is charged, on account of the jar's increase in volume. Later on, Korteweg and Julius showed that in the case of rubber as dielectric, the deformations vary roughly as the square of the dielectric field. The French scientist, L. Bouchet, now makes a series of careful researches as to the effect of the electric charge upon rubber, and uses a rubber sleeve which undergoes the action of the charge on both sides so as to produce an analogous effect to the Leyden jar experiment. Water contained inside the sleeve communicates with a capillary tube so that any small change in volume is readily seen in the height of the liquid in the tube, and the water level is observed by a microscope. He used a high tension dynamo furnishing 550, 1260, 1800 and 2520 volts, and the water level was noted at regular intervals during 2 minutes after the action of the electric charge, in each case. During that period, the level first lowers quickly, then more slowly and finally reaches a fixed point. The author already noted that under the action of constant mechanical pressure of about the same order of strength as here used, the same rubber piece required about 20 seconds to reach the limit of deformation. This limit is now greater in time for the electric action, and he concludes that up to the 20th second there is a combined electrical and mechanical effect, while after this point the electric effect proper is the only one which enters in.

## Game Sanctuaries in the National Forests

ACCORDING to the *Geographical Review*, Dr. W. T. Hornaday is urging upon Congress the passage of a bill authorizing the Secretary of Agriculture to take over those parts of the national forests that are not adapted for other purposes and establish in them game sanctuaries where game will be bred and set free.

# Industrial Preparedness for Peace

## III. Things Done and Undone

By Miner Chipman

JOHN A. KELLEY, Manager of the Industrial Bureau of the Chamber of Commerce of Columbus, O., is thoroughly alive to the problem of Industrial Preparedness for Peace. He offers some real suggestions in a letter to the writer under date of January 29th. This in particular: "South America offers a good field, but most manufacturers here are inclined to 'let it alone.' The Chamber of Commerce interested eight local manufacturers in banding together and hiring a salesman who is now in the Latin American countries, and making good. Several other companies have their own agencies in South America. In preparation for conditions after the war I believe that each manufacturing craft should finance its own commission to investigate conditions and suggest necessary steps for preparation. By each craft, I mean the automobile, the machine product, the glass, iron, etc. Then the Federal Trade Commission and a Permanent Tariff Commission should coöperate and take cognizance of the suggestions of the various craft commissions wherever it is thought necessary to have the assistance of the Government. But each industry must look to its own salvation. The manufacturing business of this country is too great and complex to expect the Government to take care of each branch of it. Our manufacturers must make a science of their business. There are too many 'jumping in where angels fear to tread.' Their horizon is bounded by the walls of their factories and they do not know what the spirit of coöperation means. They need education and need it badly. Our Chamber of Commerce has suggested, and urged to successful conclusion the establishment of a College of Commercial and Business Administration, and we are going to urge the State of Ohio to spend some money on this college. We have paid too little attention to the education of the manufacturer in a broad way."

The President of the Grand Rapids Association of Commerce, Mr. Charles B. Kelsey, sounds a note of warning against anti-business legislation, as follows:

"The United States has an opportunity to add many great industries as a result of the great war now in progress. One of them is that of making our own dye stuffs. All that is necessary to the permanent establishment of this important brand of industry is a settled policy which shall protect those who are engaged or do hereafter engage in the business from foreign competition, which is sure to come after the war is over. A declaration of peace will at once stop the demand for war supplies, and there will be a sharp decline in the prices of all materials and commodities that enter into this abnormal trade, and a slump in the stocks of those institutions which are largely engaged in this trade. No man can foresee just what effect peace will bring. It will no doubt stimulate trade and commerce in certain directions and injure it in others. The nations, exhausted and prostrated as they will be by their great sacrifices of men, credit and property, will strive hard by every means to regain lost trade and prestige, and we may be well assured they will leave no stone unturned to capture our markets, the biggest and richest in the world. If we are farsighted and wise, we should see that our markets are secured to our American industries. I can only indulge in a hope that Congress may do something constructive for American industry. Our experience for the last decade will not warrant more than a hope. During that time in this country there have been passed 60,000 laws, a large portion of them aimed at the destruction of business, perhaps not premeditated, but in practice that has been the result. Strangulation in some instances and a slow lingering death in others is the legacy of legislation. During these years business has been conducted under conditions of doubt and uncertainty. The watchword in Legislative Halls has been 'Vaccillation.' It would be difficult in this vast maze of laws to find any that were constructive or pretended to be helpful to business."

Mr. Kelsey is a business man. He is pouring out his heart against destructive legislation. It is well for us to give an open ear to this wail from over legislated business. Mr. Kelsey takes a whack at the "legal mind" and the lawyer legislator as he concludes his letter: "I think the greatest factor to a steady and healthy condition of business in the United States would be to retire from Congress most of the lawyers and replace them with *business men*—men of affairs, men of industry, those who have first-hand knowledge of trade and commerce and look payrolls squarely in the face. We would then get some measure of efficiency in public business—something constructive for the people. We are the greatest industrial people on earth, but few of our industrial leaders are in Washington."

The Johnstown, Pa., Chamber of Commerce has been endeavoring to acquaint the local industries with the foreign trade market through the department of Foreign Commerce of the National Government. The secretary thinks that the establishment of a non-partisan tariff commission by the Federal Government will do much to protect American industries from unfair competition after the war. Business has been on the boom in Johnstown, and notwithstanding the tremendous munition work carried on by the Cambria Steel Company, employing 17,000 men, a great deal of Johnstown's business prosperity has been in munitions of peace rather than war materials.

The Chamber of Commerce of Charleston, S. C., has been busy in arousing local interest in matters of preparedness for industrial prosperity. A recent campaign for members netted 1,000 new names to their roster. Various bureaus, under trained and well paid officials, are taking up different problems confronting Charleston's preparedness problems. The Secretary of the Chamber of Commerce very naïvely says: "The curse of individualism is dead in Charleston and the business interests of this city are now thoroughly united, working together to protect mutual interests and for the general improvement and upbuilding of the entire community." It is essential that Charleston, as represented in its local Chamber of Commerce, now remove that spirit of individualism within itself, and work for a united and universal preparedness for peace of a nation-wide significance. Although it is not suggested that "Our Town" is the slogan for preparedness for peace, we must be sure that we realize that this problem is national and not local.

John Franklin Crowell, writing in behalf of the Chamber of Commerce of the State of New York, advises me that their organization has at the present time, a large committee on Problems of Shipment during the European war, of which President Seth Low is Chairman. This is a strong committee and has given most of its attention to the subject of providing a merchant marine. Industrial Preparedness for Peace is being closely followed up by this organization.

The Executive Committee of the Philadelphia Chamber of Commerce has employed Mr. F. W. Lawrence of New York, as head of the Industrial Bureau. In outlining the functions to be performed by Mr. Lawrence, the Philadelphia Chamber of Commerce has made a splendid contribution to Industrial Preparedness for Peace. The work of the Bureau will begin with an industrial survey, advantages of which may be stated as follows:

(*From the Journal of the Philadelphia Chamber of Commerce.*)

1. Will furnish an accurate descriptive inventory of the industrial advantages and disadvantages of Philadelphia.
2. Will enable the Industrial Bureau to conduct its work more intelligently and efficiently to get the facts needed to place proper information before prospective manufacturers, and to serve as a basis for (a) remedying defects which are handicapping the city industrially, and (b) conducting a general campaign for new industries.
3. Will give information as to the percentage of manufactured goods consumed locally, furnishing a basis for developing plans for increasing the local demand for Philadelphia products.
4. Will indicate to bankers which industries already located here are capable of extraordinary expansion, if adequate financial assistance is given.
5. Will reveal the types of industry not already represented here, but which should naturally thrive in Philadelphia.
6. Will furnish comprehensive knowledge as to labor conditions in Philadelphia, including the relation of the industries requiring male and female help. Frequently industries requiring female labor suffer from lack of industries requiring labor of males with families.
7. Will enable the people of the city of Philadelphia to grasp comprehensively the industrial status of Philadelphia and to encourage every citizen to disseminate information upon the widespread industrial activities of Philadelphia, thus developing a greater civic patriotism.
8. Will show the source of supply of material entering into the finished products and indicate the opportunities for starting new industries in Philadelphia in which there is a local established market.

It is planned to bring under the supervision of the Chamber of Commerce, business executives of the city, also the department managers of the different concerns with a view of exchanging ideas and benefit from each other's knowledge and experience. The Secretary of the Industrial Bureau of the Chamber of Commerce of Philadelphia has gathered much information, showing how executives of other cities have in this way increased production, reduced production costs and at the same time raised the standard of living of the labor engaged in industry.

The Detroit Board of Commerce is a live-wire organization utilizing every opportunity to make adequate preparation for conditions following the European war. They have organized a large Salesmanship Club under the guidance of such men as Mr. Hugh Chalmers and Norval A. Hawkins and others. They are planning for a World's Salesmanship Congress to be held in Detroit in July. The Board of Commerce has also organized a School in Scientific Management in which the executives and engineers of Detroit's large and prosperous industries are taking an active part.

The Louisville, Ky., Board of Trade has issued a Report on the Need of a Merchant Marine. This report was prepared by a special committee appointed by the Board, and was mailed to all kindred commercial organizations, and to congressmen and senators. This report brings forth some very significant facts, and it will not be amiss to make the following quotations:

"The following comparison in dollars and cents per hundred pounds on tobacco in hogsheads, as of December 20th, for three representative years, is illustrative of the abnormal tax on our commerce to European ports:

| From New Orleans | 1915 | 1913 | 1910 |
|---|---|---|---|
| To Liverpool..... | $2.28 | $0.53 | $0.35 |
| To Rotterdam..... | 2.75 | .48 | .34 |
| To Havre..... | 2.15 | .48 | .38 |
| To Genoa..... | 2.10 | .50 | .31 |

"It has not been uncommon of late for the price of a ship to be made on one cargo and it is of record where a cargo of coal from the Atlantic seaboard to Sweden paid an ocean rate of $14.00 per ton.

"It is, of course, recognized that recent conditions and present ocean rates are abnormal, due to the European war, which has served to withdraw from foreign trade all of Germany's merchant vessels and to so greatly reduce England's ocean carriage of commercial tonnage. It has also had the further effect of advancing to almost prohibitive figures ocean rates of neutral vessels.

"Notwithstanding these unusual conditions, it is now well recognized that even under normal conditions the number of merchant vessels available for shipping from United States ports and particularly vessels owned by citizens of the United States, is inadequate to insure any expansion in foreign trade on the part of this country. It is also further recognized that if there is to be any substantial expansion in the foreign trade of the United States, after the close of the war, it must be through the means and by the assistance of an American Merchant Marine.

"The attention of Congress, and to some extent, the country at large is apparently centered on preparedness for war. Without offering any objection to, or adverse criticism of, reasonable preparedness against war, we express the belief that preparedness for peace should, at the same time, be the first and paramount consideration on the principle that in the present depleted financial and physical condition of the great European nations, a war with any of those countries is remote, whereas commercial preparedness is pressing and insistent at the present moment."

I am sorry to say that from a large number of officials of chambers of commerce throughout the country I have received letters indicating an indifference upon the part of the members. From a large eastern city, the Secretary of the Chamber of Commerce writes: "During the last seven months efforts have been made along every line which came to our attention to assist the business men and manufacturers as suggested by you, but we absolutely found nothing but indifference to our thoughts or action." Another aspiring city within

(*Concluded on page* 206)

# 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.]*

## Leprosy

To the Editor of the SCIENTIFIC AMERICAN:

I am glad to see that your editorial in the issue of September 4th, 1915, has given rise to some discussion of the leprosy problem, even though that discussion seems somewhat hazy, and from a medical viewpoint—may I say it?—absurd. The statements and the questions propounded by your correspondent "Uno" in your last issue are typical of the confusion in the public mind on this subject, and would seem to have called for a less evasive and a more carefully thought-out reply than that given by Mr. Wooley. Although I am not professing to be an expert in leprology, I have studied the disease in this country, in Kalihi, Kalawao, and Kalaupapa, in Hawaii; and in the interior of China, and I feel strongly that certain popular misconceptions, shared apparently by both your correspondent and your editorial writer, should be corrected.

First, in regard to the "contagiousness" of the disease. Mr. Wooley asserts that "there is a distinction between infectious diseases and contagious diseases," but he does not define the distinction. I will run the risk of repetition in order to make very clear these fundamental terms of the discussion, since a large part of the misunderstanding as to the contagiousness of leprosy even among acknowledged experts, lies in the misconception of these common terms. The word *infectious* has to do solely with the immediate cause of a disease, and has nothing whatever to do with the manner of its transference from one individual to another. The term *contagious* has to do solely with such transference, and predicates nothing as to the cause. Thus malaria is an infectious disease, because it is caused by an infection—*i e.*, the successful invasion of the individual by a harmful mico-organism, but malaria is not contagious because it is not transmitted directly from one individual to another by contact or propinquity. On the other hand, hysteria is often contagious, in that it may spread directly from person to person as in many well-known hysterical epidemics, but it is not infectious, because it is not caused by the invasion by a harmful micro-organism.

Now since the immediate cause of leprosy was discovered in the bacillus lepræ, there has never been any serious doubt as to its *infectiousness*. As to the possibilities of *contagion*, however, there have always been and there are to-day, widely divergent views. Without going into the minutiæ of the question, the following facts stand out as incontrovertible: first, that those who have been in prolonged intimate or careless contact with lepers often acquire the disease; and, secondly, that without such prolonged intimate or careless contact, it is extremely hard to acquire it.

It is astounding to meet with such a complete lapse of logic as is embodied in Mr. Wooley's rash generalization that leprosy is not contagious, a statement which he bases four-square upon the *one* fact that he and a companion "at one time spent many hours in a leper hospital in the Philippines, conversing with scores of lepers and photographing their sores and abrasions." Would Mr. Wooley declare tuberculosis to be non-contagious because he had escaped taking the disease after an equal exposure?

Now as to the matter of the cure of the lepers. Here again Mr. Wooley has made an optimistic generalization far overbalancing its very narrow foundations in fact. On the other hand, your correspondent's offhand statement that without any treatment whatever the anesthetic type of leprosy "generally dies out after 15 or 20 years" is not supported by the statistics of American workers, at least. It is true that this type sometimes exhibits remissions, and that the victim may often die from some other intercurrent illness; but these cases are exceptions. Of all the thousand methods of treatment, not one has justified itself as "a cure for leprosy."

To my mind, the nearest approach to this is the treatment worked out by Dr. Wayson, and mentioned casually by Mr. Wooley. This consists of an extremely ingenious method of auto-vaccination with the patient's own bacilli autolysed in the serum in a subcutaneous blister made by the application of solidified carbon dioxid to the skin overlying one of the leprous nodules. I have seen several cases completely cured by this method, and have photographed them (also without taking the disease!), but only a very small percentage of cases are cured by this or any other means. Chaulmoogra oil does exert a mildly beneficent action in the great majority of cases in some unexplained way, and it is the one standard remedy used in all, or nearly all leprosaria as a routine, but it cannot be called a cure.

There is a very great need for public enlightenment on the subject of leprosy, for the minds of most men are still under the thrall of the ancient biblical terror, and "Unclean! Unclean!" is still the first thought in the layman's mind. The danger from the presence of uncontrolled lepers in the community, the needless fear, and its resulting inhumanity, can all be eliminated only by a campaign of education. The mastery of the disease itself can be entrusted to the steadfast and clear-thinking men whose lives are devoted to this end.

LOWELL C. FROST, M. D.

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## The Submarine Question

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 22d, Mr. F. A. de Peyster, of New York, takes exception to a statement of mine that submarines "are worthless practically for defence," etc. The question of value is one of effect upon strategy.

In regard to the Dardanelles operations: The submarines which were operating there were of the seagoing type. What they accomplished in the destruction of two enemy battleships was spectacular, but unimportant. Now for what they did not accomplish. They did not prevent the continued bombardments from the sea, the supplying and reinforcing of the enemy army, or its successful withdrawal from Gallipoli. The failure of the Allied operations at the Dardanelles was in no way due to the submarine. Rather it was due to the early naval attack unsupported by a military expedition, and the consequent loss of the chance for a surprise attack.

"Why have not the English dreadnaughts entered the Baltic?" They are needed in the North Sea, with the Grand Fleet. In forcing the entrance to the Baltic, the British sea planes would be used for locating the defending submarines and then their destroyers would go submarine hunting. Submarines have been located by air-craft at considerable depths. Granted that a few blows might be got home by the submarine defence; but they would probably not be sufficient to change the preponderance of battleships, which decides sea control. It is hardly to be expected, however, that any serious attempt will be made to force the Baltic. A look at the map will show the Kiel Canal. To-day the British fleet by its battleship strength holds the German fleet to harbor, or the Baltic. It is not injuring the Allies' cause, and control of the Baltic is not vital to their success. Now supposing that England got foolish and despatched her fleet, or one half of it, to the Baltic. What would be the probable outcome? Germany would have a fighting chance, to say the least, against a divided enemy; and would probably accept battle either in the Baltic or the North Sea. Probably the North Sea, as the Baltic is no more vital to her success than to that of the Allies. The choice would fall to Germany, thanks to the Kiel Canal. If the whole British fleet were despatched to the Baltic, there would be no battle, only an invasion of England.

While it is true that British submarines have entered the Baltic and the Sea of Marmora, and done considerable damage, of what effect has it been on the outcome of the war? About as much as the raids of the Confederate privateers against the commerce of the North in the Civil War. The submarines which have accomplished these stunts are of the sea-going type.

Mr. de Peyster says, "I believe no dreadnaught of the present design can operate near a hostile port, if that port has submarines." For months battleships have been operating at the Dardanelles. Then, sea control does not depend upon the capital ships operating near hostile ports. The dreadnaught is built for high sea operations, which decide sea-control. Picket boats, destroyers and light cruisers are sufficient for watching hostile ports.

The submarine question should be considered as to its probable relation to general engagements. The modern fleet submarine, so called, is able when in the afloat condition to keep up with the fleet at medium battle speed—20 knots. In this condition they are vulnerable to almost the lightest gun on the enemy's fleet. When submerged they would be unable to keep up with a fleet steaming at speed in action. While a submarine screen might be thrown out and efforts made to draw the enemy fleet across it, they would probably fail. The submarines would be located by the air scouts and the admiral would fight shy of them. If the enemy fleet withdrew too far, or was beaten, the submarines would fall prey to the destroyers.

As a commerce raider the submarine has made good. This is its present sphere, and for a time at least its principal one.

While the successes of the submarine have been spectacular, the things which they have failed to accomplish should not be overlooked. They have not seriously interfered,

First, with the commerce of the Allies.

Second, with the transport of millions of Allied troops over seas.

Third, with the Allies' control of the seas.

Considering these three questions, it is evident that they have failed to seriously effect the outcome of the war. The construction of "85 coast defence submarines" can not be too strongly condemned. One of the big lessons of the Great War is the discrediting of the "coast defence" type of ship. Naval coast defence begins, and ends, upon the high seas, with the battle fleet.

ROGER L. GORDON.

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## Labor and the National Guard

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest the controversy between "patriot" and "citizen" over the question of exempting the National Guard from strike duty. That a patriot and a citizen should differ on this question, is easily understood by everyone who understands both sides of the question.

There is a correlative aspect, however, which it seems to me makes such exemption expedient, whether approved on moral grounds or not. To understand this aspect it is not necessary to consider the validity of the objection which labor sympathizers have to the use of the National Guard for strike duty. It is only necessary to recognize that such objection is very widespread, and that it is based upon reasons which appear to labor, so valid and important that labor sympathizers will oppose, with all the force in their command, any system of preparedness which does not give assurance that the preparations will not be used in industrial disputes.

It has been suggested that the reason why American men do not enter the National Guard is because they object to even the small modicum of discipline that is there required. This is doubtless a reason deterring many, but the industrial reason would appear to be still more potent, because it is so widespread, and because it is founded upon strong and fundamental convictions.

So important does labor consider this question, that many thoughtful labor leaders suspect that the desire to have a strong national guard is influenced by the desire of industrial leaders to have a strong military force ready at hand to suppress inconvenient strikes.

The question of adequately preparing this country against invasion is one of such vital moment that the entire country should be united upon it. For this reason every collateral question which is causing serious opposition to the main subject should be separated from the main subject in order that the latter may be settled separately.

It may or may not be desirable to have an armed force for the maintenance of order in time of strikes. The conflict on the subject is irreconcilable because it is not a matter of mere difference of opinion, but a fundamental difference as to the objects of government. Because the conflict is irreconcilable it is futile to discuss it, unless we care to plough deep into the subsoil of society. It is moreover unnecessary in a discussion of preparedness. If such a force is needed, we can provide it whenever we can get sufficient unanimity of opinion to come to a conclusion. It does not need to be the same force as that provided for protection against a foreign foe. It is a needless befuddling of the issue to discuss this question as thought it were part of the subject of preparedness. When such a force is needed, let us provide a special force for it, and let there be no question in the discussion as to what the force is to be used for. This is all irrelevant to preparedness.

In the meantime, it is believed that a large, well organized national guard could be built up as a protection against invasion. Without such opposition from the labor sympathizers, if a clause be inserted in the enlistment papers, providing that the recruit can refuse to act, and terminte the enlistment whenever he is ordered to serve in an industrial dispute. It would appear that such a clause could be so worded that the serviceability of the troops for national defense against a foreign foe would not be impaired. At the same time the insertion of such a clause in the enlistment papers, would take away all foundation for the contention of labor sympathizers as to the real motives behind the demand for a larger national guard.

A measure introduced proposing to create a national guard with such a proviso in the term of enlistment, would probably receive no organized opposition from labor, and yet would furnish the national protection which we seem to be needing. The presentation of such a measure before Congress would neither be a disapproval nor an approval of the use of an armed force in industrial disputes. It would be merely a recognition of the fact that such a problem is distinct from preparedness, and one which should be separately considered, so that the question of preparedness need not be imperiled.

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French 155 mm. gun in action

# The Masking of Artillery In the Field

## Various Expedients Used by Artillerymen to Conceal Their Guns from the Winged Scouts of the Enemy

By Martin Wells

Naval gun hidden in Argonne

THE extensive use of the aeroplane in modern warfare is, more than any other factor, responsible for the urgent necessity for concealment of pieces of artillery in the field.

Since warfare began to develop tactics that contemplated more and more the use of artillery, it has long been a custom to mask batteries in certain positions, even when the range of these weapons was not as great as that of the present military rifle. The element of surprise accounted for the deception, for when positions of importance were to be held or when armies were so small that maneuvers included ambuscade, guns were carefully concealed from the prying eyes of ground-scouts and patrols that they might inflict more punishment than if they had been cautiously approached and also reap the benefit of shock to morale. In those days of the muzzle loader, the guns were often kept in a wood, drawn back behind bushes and undergrowth, to be pushed by hand to the front at the *denouement*. Emplacements were frequently masked by brush during our Civil War, especially along rivers where slight and semi-permanent fortifications guarded the watercourse from inroads of lightly armed gunboats or stealthy landing parties.

But the range of artillery has increased almost incalculably since those days of hand-to-hand combat on all occasions. To-day, the artillery almost invariably is to be found well in rear of the line of trenches, scattered in definite arrangement by units and groups

These artillery units are all connected with one central station, through a ramification of lesser points of concentration, and the fire of a given sector can be controlled and directed upon any desired point. A complex system of wire communication is established, usually with two or more lines in case of damage occuring to one of them. Each battery has its field telephones and from the observation stations range and direction are given, with the objective, and the result of fire for correction of aim is at once communicated to each gun employed in the attack or defense.

As the guns, owing to their rearward position, are therefore secure from ground reconnoisance, the aeroplane has taken over the former duties of the cavalry and patrols, which were supplemented by the magnification of field-glasses. To-day an aeroplane soars aloft, a mere speck in the blue, and the terrain of the enemy's position unfolds like a wonderful relief map beneath. Equipped with high power glasses, each gun and ammunition supply station would be clearly discernible were they not concealed in some way from view.

Many expedients have been utilized for this necessary concealment. The cover drawing of this issue illustrates a device adopted by forces engaged on the natural geographical line of demarcation between the contending states, where spurs of the Alps, lesser and greater, form canyon and crag in bewildering complexity. To guard the passes, each contending force has been compelled to drag guns up precipitous walls, by man power amplified by mechanical measures.

A battery hidden under heaps of straw

Natural cavities in the sheer rock walls have been enlarged, or new ones blasted out, the embrasure protected and screened by enormous blocks of rock, cemented into a concrete whole. The cover picture shows a gun as being near the entrance of one of these mountain emplacements; the liberty taken with fact is merely to show the gun, for normally, it would be deep in the recess, concealed from view and protected by the length of the tunnel from any inimical shot that failed to center directly on the bull's-eye of the small aperture. The shock of discharge in this confined space is so terrific that the gunners must make every possible provision for protection to hearing and nerves.

Afield, behind the battle lines, the artillery chain is concealed by various expedients designed to give as casual and natural an appearance of innocence as possible—especially from aloft.

What might present the indisputable appearance from an aeroplane of a field of grain freshly mowed, with the cuttings being stacked, is probably a line of guns above each of which a shock of grain is coned on a skeleton frame. Beside it, carefully covered with deceptive-appearing material, and sunken into the ground like the accompanying gun-pit, is to be found the bomb-proof in which the gun crew lives, eats and sleeps. Sometimes these sheltered earth-caves are 10 feet beneath the surface of the ground.

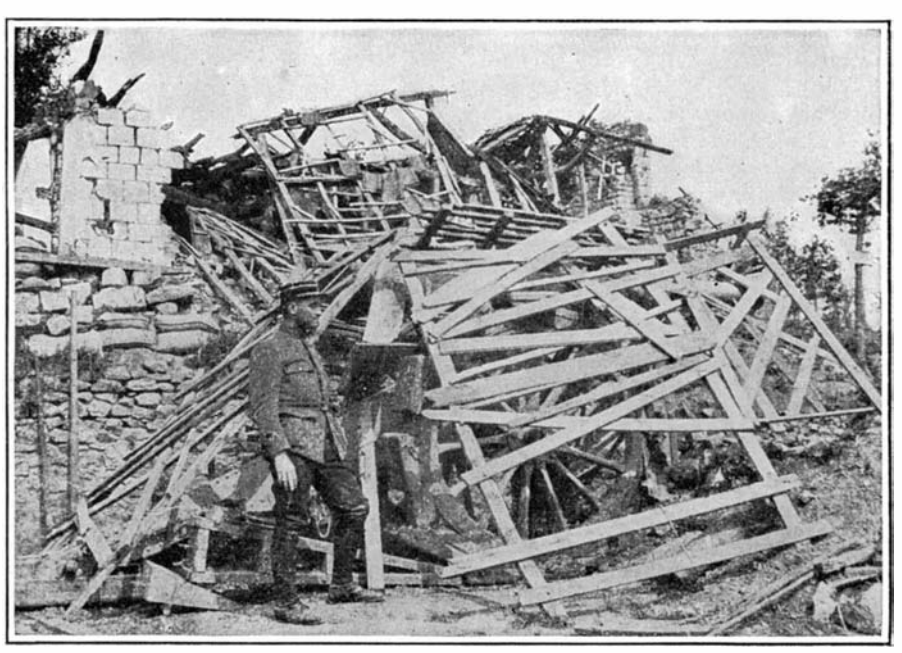
The reconnoitering aeroplanes have adopted the habit of suspecting everything except a body of water, and wherever a protuberance exists within the enemy lines, upon location of it by an aircraft, a hail of high explosive shell is apt to land immediately with almost inhuman accuracy.

In the protection, whenever an aeroplane is flying above a position it has become the rule for the gun crews to take shelter at once, unless the forward line is engaged in either direct attack or defense. And when an artillery position is once suspected of having been located by the enemy, the gun is shifted under cover of darkness to another spot.

Sometimes small houses are used as gun emplacements, the pits being dug through the floors and the guns being fired through hinged ports along the foot of the walls.

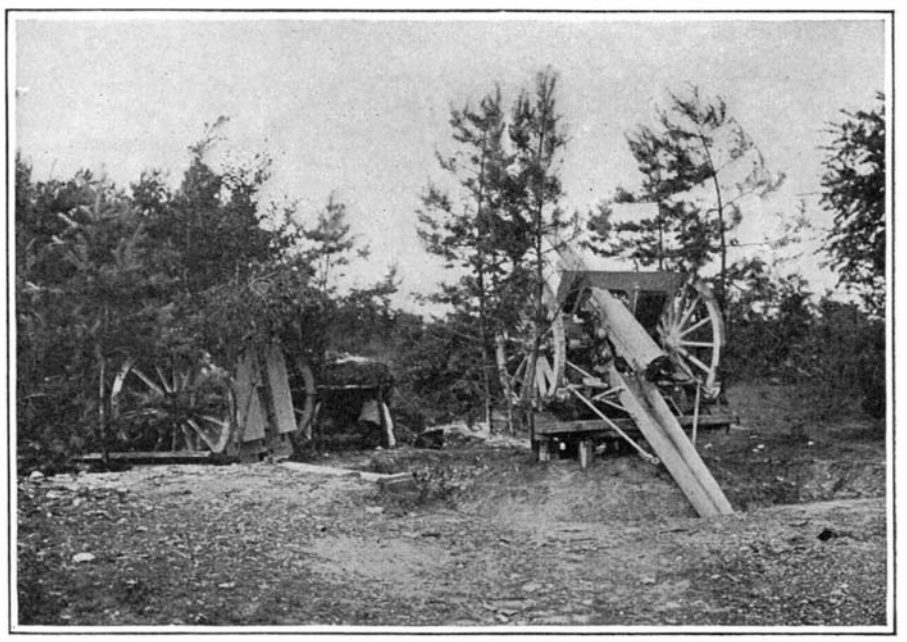
Where small ridges occur, as among the hills of the Vosges, a cut is sometimes made in them, the top roofed over with the brush and evergreen to appear as though the ridge were continuous and a gun is hid beneath.

Almost indistinguishable in the thicket



The ruins give shelter to a formidable gun

Russian heavy artillery in action



Ready to fire at aeroplanes

The gun carriages are painted as neutral a tone as possible, one calculated to blend with the surroundings of the piece. Frequently the paint is mottled, it having been found that broken colors become much more indistinguishable at short distances than solid ones. This neutral tone or mottling permits what seems nearby as inadequate concealment to be in reality very effective. Brush and poles, even branches stripped of leaves, merge into an innocent appearing blur from aloft.

A thicket of evergreen anywhere near a battle position is sure to mask a number of guns, and the thicker the brush, the better.

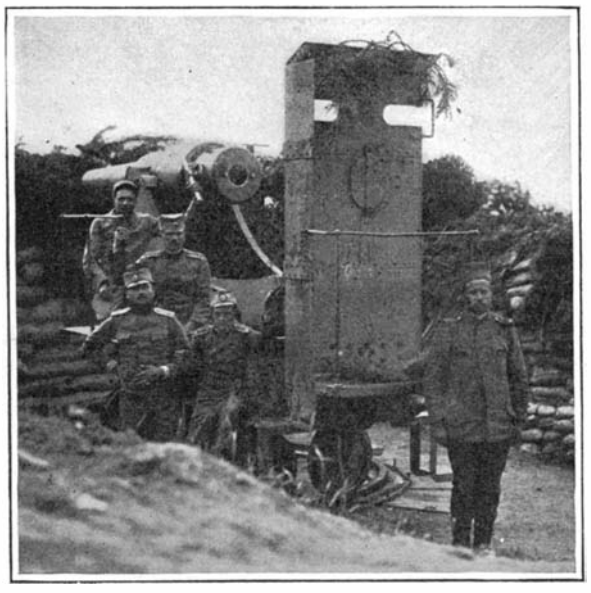
It has been reported by observers who have been fortunate enough to receive permission to visit the battle fronts, that they were positively startled to almost stumble over the muzzles of concealed guns, great and small, on their walks. A wood that appeared so thin that it could be seen through, sheltered several batteries; and the observers, raising foot to step across a log among brush, accidentally brushed it in passing, disclosing a steel muzzle crouched in waiting.

Direct fire is scarcely ever used to-day in warfare, unless in the desperate attempt to stem a tide of defeat. Indirect fire almost entirely is employed, where the guns are concealed from view from their targets or the enemy position, safely hidden behind the crest of a hill, far down the slope, or in the rearward valley itself.

The observation stations are often a mile away from the batteries, the posts of the observers being on an eminence, in towers or in an armored nest high in some great tree, with a multiple system of wires leading down from the instruments.

These observation posts are much more eagerly sought by opposing guns than even the guns they are placed to direct; for with the destruction of a single, detached observation post, its battery becomes temporarily blind until another post can be established. For this reason, now the batteries are usually connected with several observation points, that the loss of one may not cripple the fire.

Captive balloons are often used behind the batteries or even in advance of them, for observation of fire. Whenever the artillery is to open an attack, aeros invariably ascend, to scout over the enemy position and report the accuracy of the fire. Most of the machines now communicate their observations by radio, though there are signals, represented by darts and swoops of the aircraft themselves, that can be made to tell a slower story. Smoke bombs and glittering metal disks are sometimes dropped directly over a position which it is desired to bring under fire, but, on the western battle front, at least, each inch of the ground is so well known, so thoroughly plotted on the maps, that it is frequently unnecessary for the aeroplanes to do more than rise to a convenient height behind their own lines, whence they can easily see whether bodies of troops are on the move, and warn the guns accordingly.



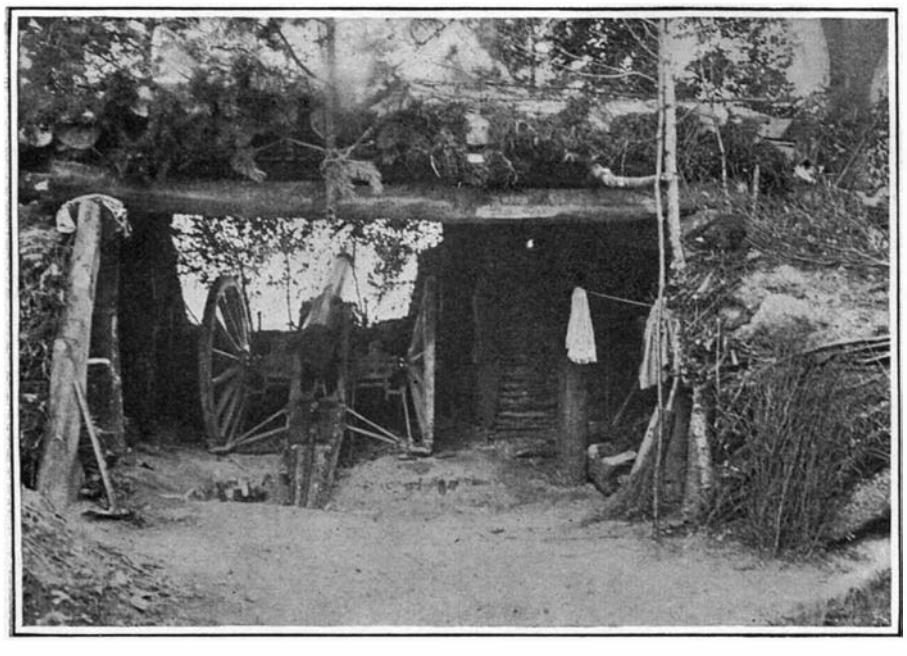
A Russian gun in the Serbian army

## The Current Supplement

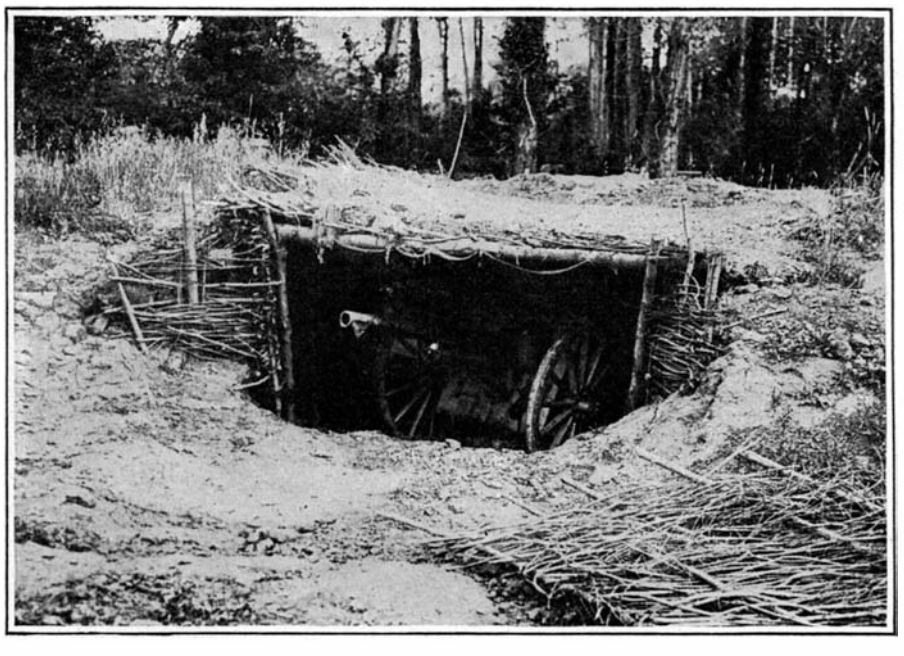
THE conceptions of atomic physics are difficult to understand, and there are many problems in relation to the subject still to be solved. The article on *Mysteries of Matter*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2094, of February 17th, 1916, is a review of some of the properties of the atom which will form a welcome addition to the various articles on the subject that have recently appeared. *Modern Science and War Surgery* is an interesting description of some modern methods of treating the wounded by sun baths and electric heat. It is accompanied by a number of excellent illustrations. *Engineering-Education Faults* discusses a subject that is attracting attention among the profession. *Coöperation in Foreign Trade* deals with existing commercial conditions, and problems that confront the American exporter, a subject of vital interest to the whole country at this time. *Kopak, A New Textile Fibre* describes the source and processes of preparation of a material that has been found valuable for a number of purposes. The article is fully illustrated. *The Simplex Calendar* is one of the perpetual class in which many will be interested. *Aiming With the Rifle* tells of some of the difficulties encountered, and makes suggestions for overcoming them. The paper is illustrated by diagrams. *English Measures of Length* gives an interesting history of the origin and development of many of the standards so generally used in this country. Other articles of general interest in this issue are *Battery Versus Magneto Ignition*, *The Distortion of Iron Castings*, *The Locomotive and the Revolutionist*, *Imitation the Pioneer of the Genuine* and *Emulsions and Emulsification*.

## Artificial Silk

WHAT appears to be an original method of producing artificial silk is due to the Japanese inventor, Kishi. The process is based on the use of the commercial substance known as chrysalis oil or essence, and the important point is that this oil shall be refined by a special method so as to have it in the pure state. The substance thus obtained is mixed with a solution of nitro-cellulose, which latter comes from mulberry bark or other parts of this tree, and he specially recommends the use of mulberry paper. A solution of cellulose of this origin is obtained by dissolving in a proper solvent such as alcohol and ether. The silk fibre is made from this liquid on the customary process by forcing it through a very fine hole, and he claims that such artificial silk comes the nearest to the original in lustre, and it has great flexibility.



Carefully concealed from the eyes of aviators



One of the French 75 mm. guns hidden in the Aisne

# Strategic Moves of the War, February 12th. 1916

By Our Military Expert

THE long-looked-for activity on the western front seems on the point of culminating in a stroke of some description, whether only for the purpose of enabling Germany, if succesful, to secure a firmer footing against an expected assault in force, or whether it is the institution of another attempt to break through to the channel or Paris.

If it is one of the latter objectives which actuates the movement, at once it challenges attention to the magnificent organization, resource and daring of the Kaiser's legions, which, surrounded on all sides, with every front exposed to risk more or less grave, and despite the tremendous losses which have been sustained since the initiation of the war, and it makes the curious wonder where on earth the men can come from to warrant the attempt.

It has been reported by American observers returning from abroad, where they have had an opportunity to make rather accurate estimates, that for a direct attack upon any of the solidly held lines, the losses to be met will run, for the assailants, between twenty and twenty-five thousand men per mile of front. On the eastern front a slightly less average percentage may be estimated, through the opportunity, though slight, for maneuver. In addition to the losses that must be sustained, at least seven thousand men per mile must be provided to hold the position once it is taken. Therefore, an attack, to be endowed with the elements of success, should be in strength of between 27,000 and 30,000 men per mile of front.

The average telling range of field artillery may be assumed as about 7,000 yards—about four miles; if, then, a successful attack is to be delivered, it must be on so broad a front that the artillery which will be brought to bear against it from the flanks of the broken line will not be able to reach at least a part of the cleared line. Twice four miles is eight miles—and a gap of two miles in the middle of the line, that may be held fairly unmolested, makes necessary a front of at least ten miles for the assault.

Suppose we split the difference and call the strength per mile for the assault 30,000 men. Multiplied by ten miles, the result, 300,000 men, at least must be massed on this comparatively narrow front before the factor of success can be counted upon.

Following the wanderings of the western front, the distance is approximately 460 miles—each yard of which is held and must be held. Probably 3,000 men per mile can defend this on the average; therefore a minimum of 1,380,000 must be actually on the line on each side, or immediately in rear, to furnish local reserves and supports. But, in addition, at least as many more must be within call, general reserves, that can be shifted from point to point to strengthen a threatened sector, make local assaults or initiate an offensive return. Therefore at least 2,760,000 men must be normally considered as on each side of the western battlefront.

If a general offensive is to be launched, even only on a ten mile front, in an effort to break the line and turn connecting positions by the securing of some strategic point, these 300,000 men must be provided; in other words, about 24,000 men per mile of attack front in addition to the forces already engaged at that part of the line.

If these are taken from the general reserve, other parts of the front must be proportionately weakened; if they come from another theater of war, the same obtains. It is therefore much more desirable that these troops for assault be brought up from the interior, or that new troops replace veterans on another line to release the latter for the more gruelling task of storming.

Let us consider some figures on relative strength. Without going into details of composition, actuaries tell us that the nations of the Central Powers have a total population of 140,000,000, from which a manpower, estimated on a certain percentage of the population varying from six to twelve per cent, due to local internal conditions, of 14,800,000 men is available for the battle line.

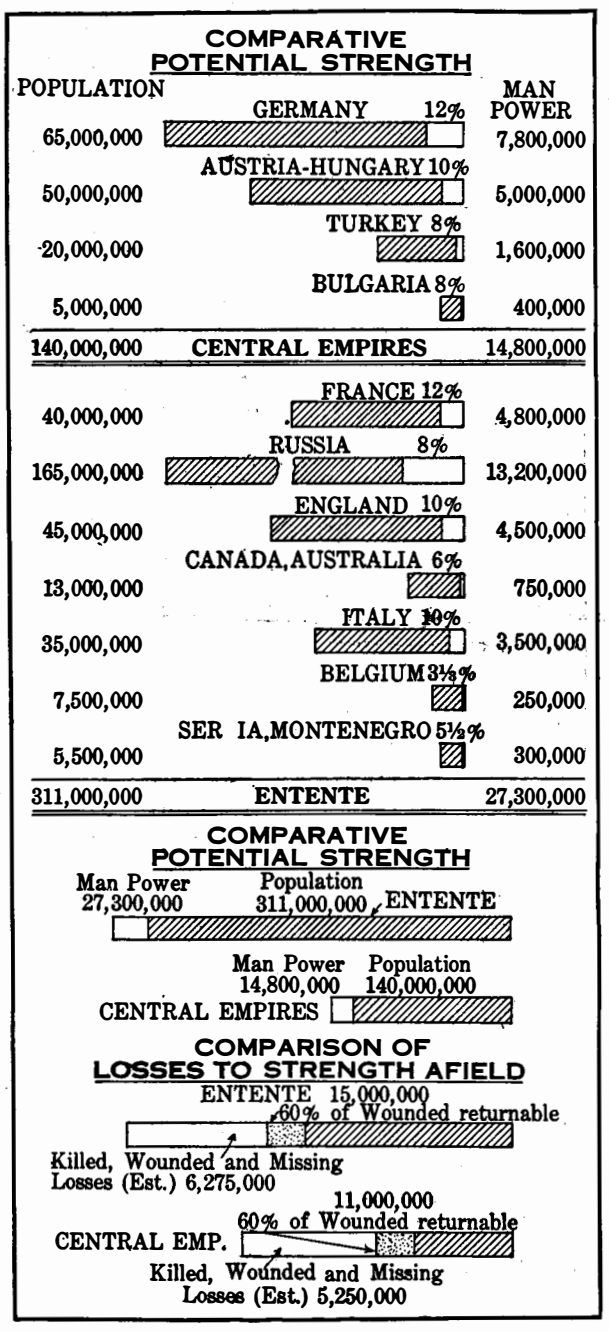
Of this strength, it is estimated that there are now 11,000,000 men of Teutonia in the field, about as follows: Germany, 6,000,000; Austria-Hungary, 3,700,000; Turkey, 1,000,000; Bulgaria, 300,000.

This leaves Teutonia a reserve as yet not actively drawn into the conflict of 3,800,000 unaccounted for.

Eliminating Germanic forces in the Balkans, the length of line occupied by German troops fronting Russia is approximately the same as on the western line, though it is to be doubted if as many German men are fronting Russia as are massed in France and Flanders. Counting them equal, however, for convenience sake, 5,520,000 German troops are in position on the two lines, leaving of the 6,000,000 men afield but 480,000 available for special attacks. And when they are once gone, if unsuccessful, there remains very little man-power to replace them.

These figures have taken into account no losses. Some idea of the horrible losses sustained in attack may be gained when it is considered that in the British and French offensive at Loos alone the admitted Entente casualties in killed, wounded and missing amounted to 190,000 men—and that on comparatively small fronts.

The full losses sustained by the Teutonic allies are estimated to amount now, for the entire war, in killed, wounded and missing to something like 5,250,000 men, leaving available for action the difference between this number and the greatest estimated strength of 11,000,000—or 5,750,000 plus that percentage of wounded who have been or will be able to return to the front; possibly sixty per cent of the total. As the number of wounded has so far proved to be more than the sum




**Resources in men of the warring nations**

of the deaths and captures, it may safely be estimated that at least 1,800,000 men wounded and recovered may be counted among those available for duty. With the untouched strength, these should give available to-day about 7,550,000 men for Teutonic activity. It seems as though this were hardly enough for the task of general offensive.

On the other hand, the Entente nations, with a population of 311,000,000 (excluding Japan from all calculations) have a potential man-power strength of 27,300,000. Russia, of course, with her vast population, is accountable for about fifty per cent of this number. But her quota has been figured on a basis of but eight per cent—and she is accredited with only 7,000,000 men afield out of a possible strength on the eight per cent basis, of 13,200,000—about half, in fact.

The Entente strength afield is counted as follows: England, 2,000,000; France, 3,500,000; Russia, 7,000,000; Italy, 2,000,000; Serbia and Montenegro, 250,000; Belgium, 250,000, without counting losses.

The Entente losses are greater than those of the Teutons, especially in prisoners, for the Russ losses by capture when their ammunition failed them and the German armies were running wild over Poland and Galacia, were stupendous. In round numbers, the Entente losses are estimated as follows: England, 550,000; France, 2,000,000 (although M. Longuet, a French Socialist Deputy, is reported as having placed them at the stupendous total of 2,500,000); Russia, 3,000,000; Belgium, 100,000; Italy, 500,000; Serbia and Montenegro, 125,000—a total of 6,300,000. This should leave the Entente with 8,700,000 men, plus the wounded returned to duty, about the same as Teutonia's in number—less, in proportion to the loss, through excess in captures—1,800,000, leaving thereby for active service at the present, about 10,500,000 men.

It will be seen that in proportion to present strength, the Entente forces are numerically stronger than those of their opponents, the advantage increasing rapidly as the losses on both sides mount higher with each month of warfare; and while Teutonia is estimated as having drawn upon her potential man-power to within 3,200,000 of its limits, the Entente has summoned but 15,000,000 men out of a potential strength of 27,300,000—leaving 12,300,000 as yet untouched.

The deduction is entirely obvious; if the war is prolonged until one side is worn away, even if the Entente losses are somewhat in excess of those of Teutonia, the time will come when, theoretically the Central Powers will not have a man to place on the line while the Entente will yet have millions.

There is a physical limit to the number of men that can occupy a given space—on the line of battle, for instance; and so far, Teutonia has had and still possesses sufficient numbers to man her defenses. Her organization of the keystone of the federation, Germany, was well-nigh as perfect as human military ingenuity can build; not only was general military service the order of the day, but all railway and commercial activities, as well as the system of finance were directed to the end of supporting the bayonet. Germany was able to distribute here instructors with their sound methods, among her allies of lesser military ability, with the result that from start to finish the closer-knit federation of Teutonic strength has triumphed to the limits that modern warfare sets for a drive against solidly entrenched lines.

On the other hand, the Entente powers, while possessing a tremendous preponderance of man-power, were not prepared, were not organized for war—and the present war far exceeds in size and ferocity what any man had considered as a possibility—and they have had to spend the entire time intervening since the outbreak of hostilities in just barely holding off the powerful assaults of their foemen while arming.

Once the arming is complete—and observers tell what common sense suggests; that it is progressing rapidly—let the losses give and take, let them wax high to shocking proportions; and vastly superior numbers, properly armed, must inevitably tell.

It looks very much as though the beginning of the end—which may be delayed a year or more—is in sight.

## Decorative Process

AN industrial process has been in use for producing decorative ornaments which consists in the employment of a first layer of mortar preferably of a dark color, upon which is applied a second and thinner layer of another and usually lighter color, then a suitable design is scratched through so as to uncover the second layer, thus producing an effect in two colors. But such material has been very fragile up to the present and would not stand the wear. An improved process consists in the use of an underlayer in cement mortar or ceramic paste upon which is put a second layer of the same, then the design is scratched through as before. The material in the shape of a brick, tile, or slab is then baked in the furnace so as to become hard, and in this way the decoration can be used without fear of damage from weather or other causes.

## Sugar-Beet Regions of the United States

THE Bureau of Plant Industry states in its last annual report that it has been making a general survey of the recognized sugar-beet sections of this country, with a view to determining whether and to what extent these regions are well suited to the industry. The investigation included not only a study of the soil, climate, and water conditions, but also of labor, marketing, crop competition, and other factors of a general nature bearing on the problem. It appears that there are 77 existing sugar-beet sections in 17 states, and that the majority of these are well located with reference to the factors that make for success.

## A New Process in the Art of Filtration

WHAT is undoubtedly an important step forward in the art of filtration is due to the efforts of F. K. Atkins and his sons of New York City, who have succeeded in evolving two types of centrifugal filter presses that possess many unique features and make possible a new and improved method of filtration.

The first type of Atkins filter press, which will be designated as type A for the sake of convenience, comprises essentially a revolving bowl containing the filtering elements; the bowl being closed up when in operation so as to receive under pressure the liquid to be filtered. The filtering elements, which revolve with the bowl, are covered top and bottom with filtering medium, thus exposing a large percolating area to the liquid supplied under pressure. The filtering medium may be of any suitable material—filter cloth, wire cloth or any other material best adapted to the liquid to be filtered.

In the type A machine the unfiltered solution is fed in through a valve-controlled pipe at the top, from a main or under pump pressure. Since the bowl revolves at comparatively low speed, to the supply pressure for forcing the liquid through the filtering medium there is added that due to the rotary speed imparted to the materials under treatment, as well as that due to a vacuum condition produced in the filtering elements, resulting from traps in the nozzles through which the filtered liquid is centrifugally released. When aeration is desired, it is accomplished by means of sprinklers in the nozzles.

The disk-like filtering elements revolving at a somewhat higher speed than the unfiltered liquid in the bowl, causes the continual scouring of the solids from the surface of the filtering elements; the solids being deposited on the bowl wall by the agency of centrifugal force. This feature of the machine permits of continuous filtration with a comparatively clean filtering medium, in contradistinction to existing methods, which, as an unavoidable feature of their operation, are constantly building up a cake of solids on the filtering medium, which hampers the percolation and reduces the capacity in direct proportion to the density of the cake.

An annular valve surrounding the bowl and actuated by a wheel opens up outlet ports in the periphery, through which the solids are centrifugally released while the machine is in operation. Means are also provided for cleaning the filters by surface- and reverse-washing within the machine.

For a better understanding of the action of the machine the accompanying illustration of the type A filter press may be referred to. In this drawing, *H* is a yoke, *I* is the gate, and *J* the connecting posts. *K* represents the outlet ports for releasing the solids, when the gate is raised, by the centrifugal force. *L* indicates the wire cloth covering of one of the filter elements, and *M* the expanded metal which acts as the reinforcement. *N* are the filter elements which are overlaid with filter cloth and revolve with the bowl. *O* is the outlet for the filtrate, while *P* is the outlet for the solids.

The conventional milk and cream separator, it will be recalled, employs centrifugal force only for the separation of the two liquids, but the centrifugal filter press, in the way of contrast, employs both centrifugal force and filtration concurrently, in this way achieving the rapid separation of the solids from the liquid.

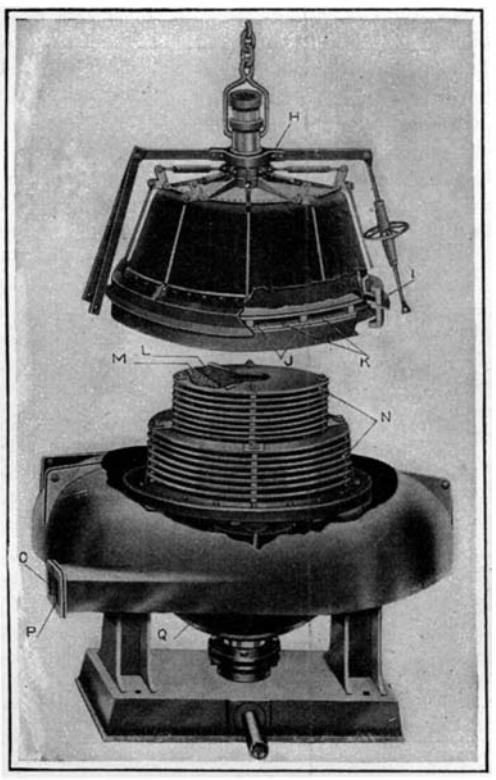
The type B filter press is of simpler design than the type A, although no less efficient in applications for which it is intended. It comprises a pressure tank provided with a removable cover; a hollow spindle, mounted to permit of rotation; hollow, disk-shaped filtering elements attached to the hollow spindle so that they may rotate with the latter, through which the filtered solution is drawn off; and radial pipes and traps. The arrows in the accompanying illustration indicate the direction in which the liquid travels. The liquid to be filtered is fed into the machine through a valve-controlled pipe, while the solids are collected in a hopper-shaped chamber at the bottom, from which they may be drawn off at intervals. Means are provided for reverse- and surface-washing of the elements within the machine. The type B machine is of remarkable simplicity, and in comparison with stationary filters has large capacity.

The parts of the type B filter, as shown in the accompanying sectional view, are as follows:

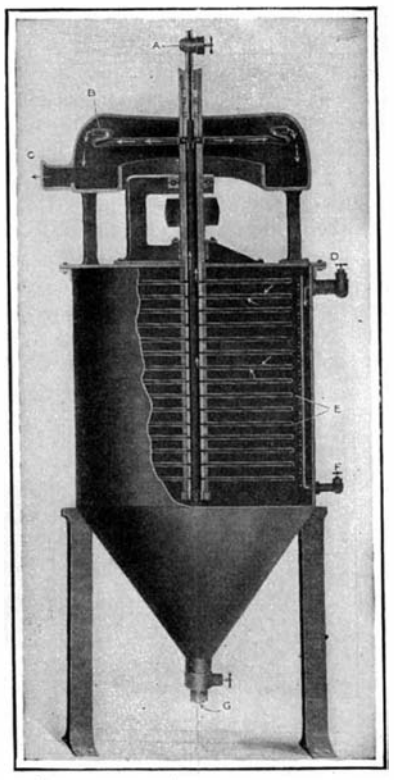
*A* is the inlet for reverse-washing water supply, *B* the liquid trap which gives the vacuum pressure, while *C* is the trough for receiving the filtered solution as discharged from the machine. *D* presents the inlet for the unfiltered solution. *E* are the filter elements covered with filter cloth, which are attached to the hollow shaft. *F* is the inlet for surface washing of the filter cloth while in the machine, and *G* the draw-off for solids.

Both types of Atkins filter presses are designed to employ wire cloth as the filtering medium. This material is readily cleaned under the centrifugal influences and has a much longer life than the ordinary filter cloth, thus greatly simplifying the work and reducing materially the cost of filtration.

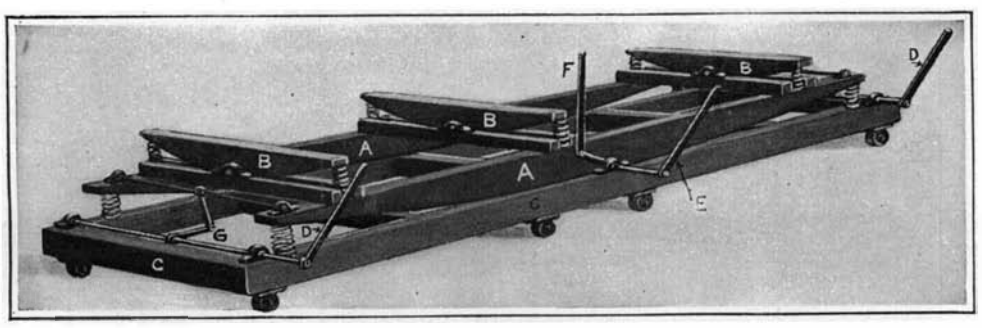
The uses of filter presses of the foregoing mentioned types are many, of which the following may be mentioned: In filtering all the different solutions in chemical works and the liquids in sugar refineries and in breweries; in dewatering the slimes in cyanidation; in filtering the inflow to the textile mills and the effluent therefrom for the recovery of leadite; in round houses, boiler and locomotive works, paper mills, ice plants, bath houses, hotels, hospitals, public buildings and blocks, and in filtering water for drinking purposes. Mounted on an automobile truck, the filter presses may be used for filtering water for the use of soldiers in the field and for construction gangs generally. Small types, which are being designed for use in homes, using stone as the filtering medium, will insure a supply of pure and safe drinking water to households.



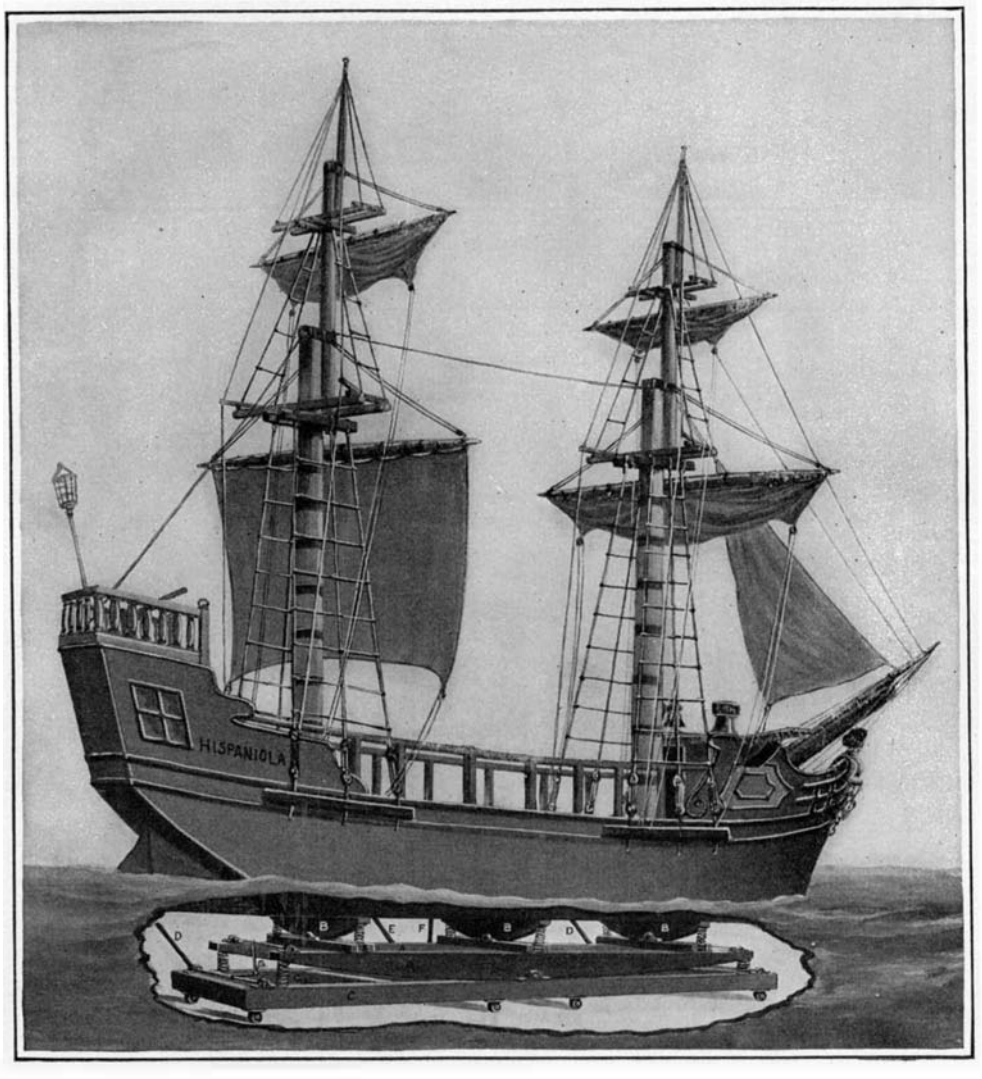

Partly broken away view of the Atkins filter press, designated as type A




Sectional view of the new filter press, known as the type B




Details of the cradles




The "Hispaniola" in "Treasure Island," which rolls and pitches at will

## "Treasure Island's" Realistic Ship

IN 1881, when Robert Louis Stevenson was staying at Braemer in Scotland, he wrote "Treasure Island" for his twelve-year-old step-son, Lloyd Osbourne. The cold was intense, everyone went to bed to keep warm, and Stevenson with the rest sat up regularly in bed, writing on a board on his knee. "The Sea Cook, or, Treasure Island; A Tale of the Buccaneers." He had no conception of what was to be the outcome of this masterly creation. It soon dropped its fore-title and became "Treasure Island."

For two generations old and young have been entranced by the interest of the plot and the sparkle of the dialogue, and above all by the rapid-fire action which carries us along from chapter to chapter irrespective of the bed-time hour. Now we have in New York at its quaintest theatre (The "Punch and Judy"), holding an audience of only 299, a beautifully sustained production with all parts played by artists of rare ability under the direction of Charles Hopkins, whose wife gives a charming interpretation of "Jim Hawkins," the cabin boy on the eventful expedition. The first scene opens at the "Admiral Benbow" with Bill Bones singing the well-known pirates' refrain,

"Fifteen men on the Dead Man's Chest—
Yo—ho—, and a bottle of rum!"

Then we come to the quay at Bristol when the awful pirate crew, including Long John Silver, who contributed the first part of the name to the first title, ships before the mast on the "Hispaniola" and the lines are cast off. In time we arrive at Treasure Island, in

(*Concluded on page* 206.)

# The Motor-driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M. S. A. E.

*This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles*

## The Electric Taxi-Cab

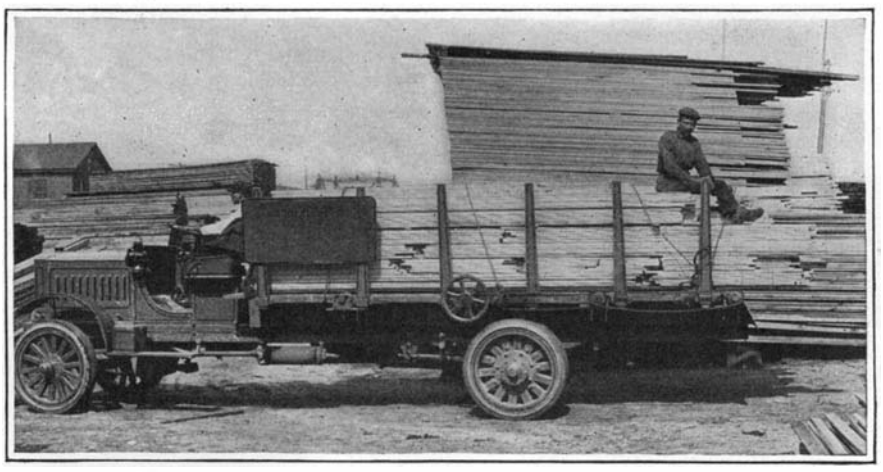
AN electric taxi-cab service has been in successful operation in Detroit for several years and they have demonstrated that they are entirely practical and very popular with the public. About two years ago, one electric cab was built as an experiment and owing to the lack of coöperation between the taxicab company and the manufacturers of electric vehicles the company was forced to develop its own designs. A cab has been constructed which follows the lines of the conventional gasoline taxi-cab in outward appearance. It has a wheel base of 121 inches, the interior of the cab body proper has a space about 68 inches long and 50 inches wide which enables the vehicle to carry from four to five passengers very comfortably. The body is a limousine type as experience demonstrated this to be preferable to the landaulet type. The operating cost has not exceeded $0.20 a mile, this including driver's wages, overhead, tire expense, garage expense, depreciation and, in fact, every expense that is incidental to the operation of the taxi-cab business. The company has decided to depreciate this model over a period of ten years which is twice the reputed life of the gasoline engine propelled cabs. In order to operate the electric cabs 24 hours a day, charging boxes have been installed at the cab stands so that whenever the cabs are standing idle they are being charged. Special cord pneumatic tires are used which are said to not only increase the mileage, but to materially reduce tire expense as well as the amount of current consumed. It is said that these cabs have a maximum speed of 25 miles per hour which is sufficient for the requirements of an urban taxi-cab service.

## Truck as Track Wrecker

A FIVE-TON gasoline truck equipped with a winch and derrick was recently put to a novel task in Cleveland. A stretch of highway was being built and before finishing the road surface it was necessary to remove an unused length of car track. The method by which the rails were lifted was not only very simple but was accomplished with a minimum of time and labor. A special pair of rail lifting tongs was utilized to grasp a length of rail and was attached to the boom of the derrick. The winch, which was operated by the engine power, was started and the rail easily lifted from the ties. After demolishing a section of the track the truck loaded the rails on its own carrying platform, a feat that was easily accomplished by the derrick integral with it.

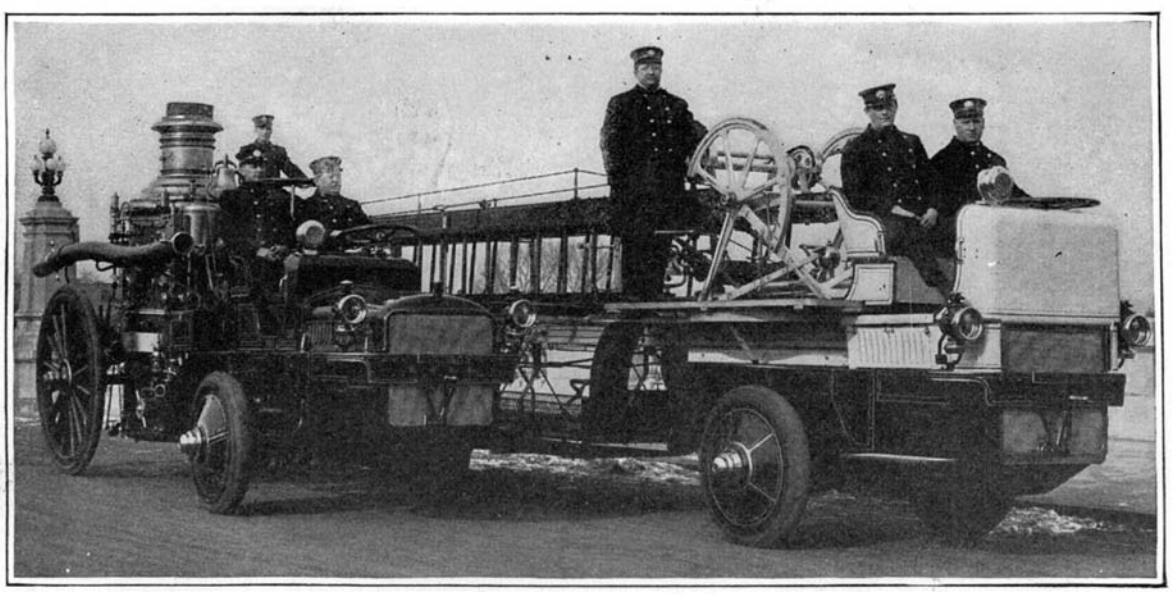
## Motorizing Horse-Drawn Fire Apparatus

THERE are many communities having very efficient and practically new horse-drawn fire apparatus that are considering motorization in order to keep up-to-date. There is no question at the present time regarding the effectiveness of mechanical power for propelling all forms of fire fighting apparatus from the chief's lightest runabout to the heaviest water tower or hook and ladder truck. There are a number of excellent automobile fire trucks offered at the present time, these incorporating all of the latest approved features of automobile engineering combined with the latest developments in fire apparatus construction. Appropriations for the purchase of new apparatus are not easy to obtain when the authorities realize that their horse-drawn equipment is much too good to be sacrificed on the second-hand market. A large business has been developed in converting horse-drawn apparatus to motor-driven by means of front wheel drive tractors. These are really two-wheeled fore-carriages in which the wheels combine directive and tractive functions. The entire power plant, transmission system and controlling elements are incorporated with the tractor, which is so designed as to be easily connected to the frame of a steam pumping engine or other apparatus. The attachment can be made at relatively small expense, because the only charge is for the power plant and auxiliary devices, whereas in buying new apparatus the department must pay for the fire fighting part as well as the propelling mechanism. Two examples of converted horse-drawn apparatus are shown in accompanying illustrations. One of these is a steam pumping engine, the other is a water tower.



Truck equipped with special platform to handle lumber expeditiously

Five-ton truck used in track wrecking



Horse-drawn fire apparatus motorized with two-wheel drive and steer tractor

## Motor Truck Queries

S. C. T. writes: I would appreciate your views on the following: I have one 30 h.p. 1911 model touring car which I desire to change into a one-ton truck, if possible. Kindly furnish estimate of cost to change. What gears do you have to change? How much does the horsepower decrease? Any other information that you can think of that will help us.

Answer. We do not believe that it will be practical for you to change your car into a one-ton truck unless you make some radical changes in the construction. In the first place, the frame, axles and wheels are not strong enough to carry a load of a ton. You would experience considerable trouble, due to failure of important and costly parts, and the cost of making the change would be nearly as much as that of purchasing a second-hand truck of the capacity you desire. While you have ample engine power, the other parts of the chassis are not sufficiently strong. You can, however, make a very efficient delivery wagon of about 1,250 pounds capacity without materially changing the construction. The frame should be strengthened by means of truss bars under each side rail and auxiliary or overload springs of the coil type should be placed between the members of the full scroll elliptic springs now on the rear of your chassis. It will not be necessary to change any of the gearing to obtain satisfactory service, as you have a large margin of power available. An express type body can be made by your local wagon builder for about $50.00 and considerable carrying capacity obtained by allowing a 2-foot overhang at the rear end. The rear axle could be provided with a heavier truss rod to advantage and oversize tires fitted to the rear wheels. All of the changes enumerated, including repainting, should not cost over $100.00.

E. W. M. writes: During the recent cold snap we had the misfortune of having the water in our truck cooling system freeze and not only bursting the radiator but also the water jacket of our four cylinder block cast motor. We have had a discussion relative to the best method of repairing the latter. My partner insists that a mechanically applied patch will be preferable to repairs by the oxy-acetylene process, because this is apt to distort the cylinders. The water-jacket wall is not seriously damaged, there being a crack about five inches long in it. The cylinder walls are not damaged at all. What do you advise?

Answer. While the autogenous or oxy-acetylene process has been developed to a point of great efficiency at the present time, it would seem that satisfactory results would be obtained by the mechanical patching method in this case, as it would be less expensive than welding and not requiring the use of a hot flame as the welding process does. Before cylinders are welded it is necessary that they be carefully preheated prior to the application of the welding flame. If this is not carefully done the bores of the cylinders are apt to be distorted. There are two common methods of repairing cracked water jackets without recourse to a welding flame. In either case

(*Concluded on page* 206)

## 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.

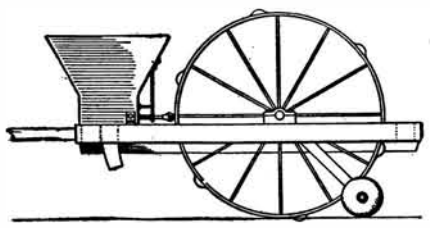
### Electrical Devices

RECEIVER HOLDING ATTACHMENT FOR TELEPHONES.—W. A. DELANO and ELEANOR R. BELMONT. Address the former, 4 E. 39th St., New York, N. Y. This invention relates to attachments to telephones for holding the telephone receiver in such relation to the transmitter that a person can use the telephone without the necessity of supporting the receiver to the ear by the hand, and as a result both hands will be free for any desired employment during a telephone intercourse.

### Of Interest to Farmers

HOG RING.—W. L. CHAMBERS, Brookville, Ind. Among the objects of this invention, in addition to providing means to prevent a hog from rooting and interfering with fences or the like, is to provide a means to prevent a hog from catching and killing chickens and to break a hog from the habit of catching chickens.

UNIVERSAL PLANTER.—O. L. FREISINN, Santa Rosa, Cal. This inventor provides a planter having a delivery hopper providing means which may be automatically operated by a ground wheel for delivering seeds at predetermined spaced intervals; provides a planter having an automatically operable device for planting the seeds at spaced intervals, and means for covering the seeds; and provides an arrangement whereby the planting rows may be spaced at desired distances apart.



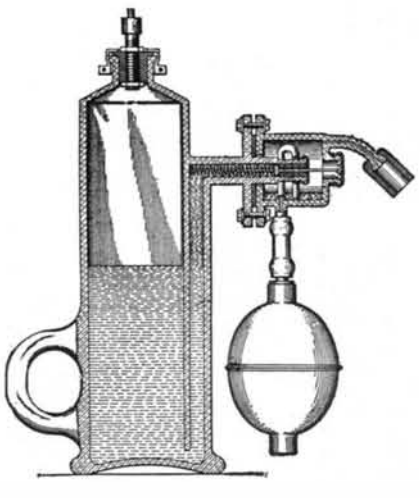
UNIVERSAL PLANTER.

### Of General Interest

PUMP ATTACHMENT.—W. S. BRIGGS, 1106 Farman St., Omaha, Neb. This invention relates more particularly to the connection between the upper portion of a pump casing and its standard, either a windmill or a hand pump, of the type employing an annular groove around the upper portion of the pump casing and a standard including a cap which fits the grooved upper end of the casing and is connected thereto by bolts having portions projecting into the groove.

BARREL RACK.—A. S. LEO, care of Odell Cider, Vinegar & Packing Co., Atchison, Kan. This invention provides a barrel rack and truck for use in connection with barrels and similar receptacles containing vinegar, molasses, oils, and other such heavy contents, whereby the barrels may readily be supported in position for emptying, and may if desired be shifted from place to place expeditiously and with little exertion on the part of the operator.

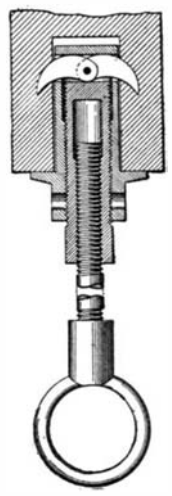
LATHERING DEVICE.—G. ZINGALI, 37 Glenridge Ave., Montclair, N. J. The invention relates to barbers' appliances and has particular reference to a means for generating and dispensing lather. It provides a means for supplying lather to a customer's face in a most sanitary manner, the lather being supplied to the face without the necessity of any part of the apparatus coming into immediate contact, and whereby the danger of contamination due to previous contact with another customer is avoided.



LATHERING DEVICE.

PROCESS FOR THE MANUFACTURE OF BROWN WOOD PULP AND HALF-CELLULOSE FROM RESINOUS KINDS OF WOOD.—J. AKTSCHOURIN, Aktschourin-Tupik, Russia. In the present improvement the invention enables the alkali which serves for the treatment of the resin product to be completely utilized, and the object of the invention is also to obtain a product which is itself valuable in the form of a brown wood pulp.

PIPE HANGER.—L. A. GRIMES, 97 Day St., Orange, N. J. This invention has particular reference to devices designed particularly for supporting pipes for automatic sprinkling systems in buildings. Obviously, however, the hanger means may be employed for supporting other devices than water pipes. It provides an anchoring means adapted to be readily and easily applied to floor beams or joists in a positive and secure manner; and provides a means for easy and effective inspection, whereby the inspector may determine whether the work of installation has been properly performed.



PIPE HANGER.

ICE CREAM DISHER.—S. E. SURFACE. Address M. O. McLaughlin, Pres. York College, York, Neb. This invention relates to an ice cream disher and one of the principal objects thereof is to provide a disher or scoop which may be used to advantage in filling cones without wasting the cream, as well as being useful in measuring ice cream for dispensation in dishes.

CANDY PACKAGE.—L. HIRSCHFELD, 416 W. 45th St., New York, N. Y. The purpose in this case is to provide a package formed of individual or separate sections united by paraffined joints to prevent the sections from sticking together and whereby the individual sections can be easily separated when consuming the candy.

BUILDING CONSTRUCTION.—A. DUARTE. Address Humberto Barcho, 904 Ave. P, Brooklyn, New York, N. Y. This invention provides a construction wherein the supporting walls are completely formed and anchored by masonry; and provides matched parts which may be assembled and when assembled anchored in service by means of a pouring, setting cement and key members through which the setting cement extends.

GUN CARTRIDGE AND PROJECTILE.—E. E. GREGORY, Lewisport, Ky. This invention relates to a device for use in gun cartridges to serve as a wad and gas-check in shooting stream-line bullets or other projectiles, including bombs. The device is cup-shaped, and it may be made in various sizes and modifications in regard to details of shape and construction.

BUILDING CONSTRUCTION.—DR. ARTHUR B. COON and A. VAN DE SANDT. Address the former, 20 Urquhart Bld'g., Little Rock, Ark. This invention has for its object the provision of a new form of anchor and tie for connecting an ornamental facing to a building of brick, stone, cement, or the like, of simple construction and low cost, yet efficient for the purpose.

PROCESS OF PRODUCING SOLUBLE SALTS OF ALUMINUM.—M. W. COOLBAUGH and E. H. QUINNEY, Rapid City, S. D. Address Schrardes and Lewis, Lawyers, same place. This invention refers to improvements in processes for producing soluble salts of aluminum from kaolin and other silicious and argillaceous earths, rocks, or minerals containing no potash or not sufficient potash to make its extraction of commercial importance, in which compounds of aluminum exist in an insoluble form.

CONCRETE BURIAL VAULT FORM.—L. P. DUNN, 1527 South 20th St., Terre Haute, Ind. The invention relates to molds for making burial vaults, watering troughs, etc., from concrete and other plastic materials, and has for its object to provide a mold of steel plates and angle-iron which may be quickly adjusted in length, width, and height, whereby to permit of the formation of structures of different sizes and dimensions.

UTERINE SUPPORT.—C. G. HALL, Washington, D. C., care of A. Pfeifer and Brother, Little Rock, Ark. The invention has for its purpose the provision of a support that may be worn with comfort and convenience, and that may be adjusted to suit varying conditions. It may be easily removed and replaced, and will afford a perfect support.

### Hardware and Tools

COUPLING FOR CONNECTING PIPES AND FAUCETS TO RECEPTACLES.—W. M. ST. ELMO, San Juan, Porto Rico. The coupling is constructed with a hollow shank having a point at its end for penetrating the receptacle, there being a plurality of levers fulcrumed around the shank, arms of which close the openings in the sides of the shank when the shank is pushed through the opening in the receptacle, the other arms of the levers being adapted to be engaged by a nut meshing with a thread on the shank for holding the first mentioned arms of the levers against the inner side of the receptacle while the nut having a gasket, is turned home against the outer side of the receptacle.

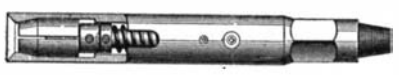
LOCK AND LATCH.—J. O. KAFADER and F. KERR. Address the former, Fort Bidwell, Cal. The invention relates to means for preventing unlawful or unauthorized entry into buildings, or rooms or closets therein, trunks, chests, etc. A further intent is to engage a key or tool used in such unauthorized entry and hold the same against removal by locking the lock bolt against movement in either direction.

PIPE CLAMP.—G. H. NAYLOR, 729 Wallison Ave., Nevada, Mo. In this case the invention relates to pipe clamps, and has reference more particularly to a flexible pipe clamp which comprises a flexible member adapted to encompass pipes of different diameters, with means for gripping or releasing the flexible member from the device.

HOSE PIPE COUPLING.—H. FORSMAN, c/o T. J. Borell, Box 9, R5, Fresno, Cal. The invention provides for uniting hose sections; provides means for locking said sections in united relation; provides means for drawing the sections together to prevent leakage thereof; and provides means for locking the sections in service relation.

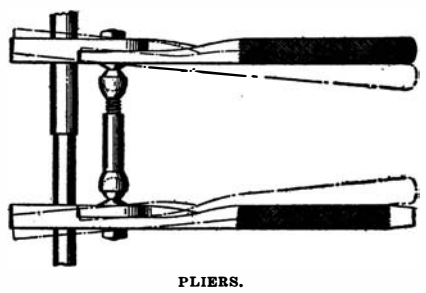
CLASP.—H. E. GRABAU, 351 E. 83rd St., New York, N. Y. The invention has for its general objects to improve and simplify the construction and operation of a clasp so as to be reliable and efficient in use, comparatively simple and inexpensive to manufacture, and so designed that a firm grip can be obtained by the clasp.

TOOL FISHING SOCKET.—C. A. RASMUSSEN and R. M. CLARK, care of Burmah Oil Co., Ltd., Khodonng, Yenangyaung, Burmah, India. An object in this invention is to construct the socket so as to be readily detached from a tool so firmly lodged as to resist all efforts at removal, and refusing to yield to pulling and jarring, and to allow the withdrawal of the socket only from the well; and a further object is to provide a frangible element within the socket, which does not interfere with the normal operation of the socket, but which, when broken, renders the tool attaching devices of the socket inoperative to allow of the withdrawal of the socket from the well.



TOOL FISHING SOCKET.

PLIERS.—F. H. RIGGS, 100 Jones St., Rochester, N. Y. Among the principal objects which the present invention has in view are to provide a tool for drawing the ends of wire or similar articles together; to provide hand-operated pliers disposed in paired arrangement adapted for contracting or expanding the ends of articles gripped thereby; and to provide means for expanding and contracting the interval between individual pliers.



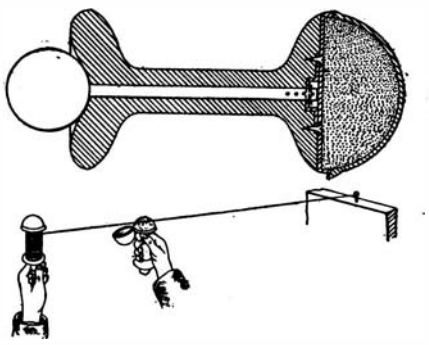
PLIERS.

GRASS TRIMMER.—C. C. LIPPEN, 530 Dupont St., Roxborough, Philadelphia, Pa. This invention provides a trimmer which may be employed in compact spaces incapable of accommodating a lawn mower or other wheeled grass-cutting implement or mowing machine, as well as providing for the facilitation of cutting of grass, hedges, or the like in such places where the usual shears are used by avoiding the tedious and tiresome operation incident to the use of the latter, and also permitting the running of the device along a straight or rectilinear line of grass or hedge to be trimmed so that a true cut can be made.

PERMUTATION LOCK.—S. BLAZEK, 402 E. 72nd St., New York, N. Y. The lock is more especially designed for use on satchels, valises, trunks, doors, and other articles and devices, and is arranged to permit of engaging the keeper with the locking bolt irrespective of the permulation mechanism of the bolt and to prevent disengagement and unlocking unless a person is in the possession of the combination of the lock.

RECEPTACLE HOLDER.—G. H. CHRISTENSEN, 4037 Hirsch St., Chicago, Ill. This invention relates to receptacle holders or supports, and more particularly to a device for detachably suspending a can or other receptacle for containing washing powders and the like in a convenient place where the same is readily accessible when it is desired to use the contents thereof.

CHALK LINE SPOOL.—E. E. BAILEY, 129 Flower City Park, Rochester, N. Y. This invention is an improvement in spools or rotary holders for chalk lines, which are used by carpenters. The holder comprises a flanged spool having a chalk-holder proper secured to one end, a central shaft on which the spool is mounted and secured rotatably, said shaft having one end constructed as an enlarged disk, as and for the purpose specified.



CHALK LINE SPOOL.

### Household Utilities

BRACKET FOR GLASS PERCOLATORS.—R. S. DARLING, 29 Murray St., New York, N. Y. This improvement has reference to percolators and particularly to percolators of the glass type, and has for an object the provision of an arrangement of bracket for holding the parts together and for allowing a proper manipulation of certain of the parts.

APPARATUS FOR AGITATING MATERIALS.—J. H. GENTER, 13 Golden St., Newburgh, N. Y. This invention provides an apparatus more especially designed for use in households as a flour sifter, dough mixer, egg beater, ice cream freezer and the like, and arranged to allow convenient and quick interchange of the parts to permit using the apparatus for the various purposes.

WASHBOARD.—J. W. HOLLAND, 252 Central Ave., Newark, N. J. This invention relates to a washboard provided with yielding means against which the person using the board may bear so that the said means will yield to the pressure of a washerwoman instead of offering an unyielding resistance which is liable to result in injury.

FLY TRAP.—G. C. SKELTON, care of C. P. Ford, 718-719 Kitridge Bldg., Denver, Colo. This invention relates to an improvement in fly traps. One of the principal objects of the invention is to provide a fly trap particularly applicable to a window screen, the trap being of such a nature as to be built in the door or screen, to form a part thereof.

NAPKIN HOLDER.—C. H. RUTHERFORD, Jerome, Ariz. In this patent the invention is an improvement in napkin holders, and has for its object to provide a holder of the character specified, capable of being supported from the waist of the wearer and having means for supporting a folded napkin.

BRACE FOR WINDOW FOOD BOXES.—A. F. BERNADAC, 511 E. 78th St., New York, N. Y. This invention relates to improvements in window food boxes, and has to deal more particularly with an improved brace for rigidly holding the window box in either of its extreme positions without danger of the wind causing it to swing back and forth.

SLACK ADJUSTER FOR CLOTHES LINES.—T. T. DUNN, 71 William St., Wallingford, Conn. The inventor provides a pulley of peculiar construction journaled in a U-shaped frame of novel form adapted particularly for coöperation with said pulley, one end of the frame being adapted to be secured to a building or other fixed object or to one end of a looped line, while the loose end of the line is adapted to pass partly around the pulley and then be extended laterally for coöperation with the frame.

DISPENSING SUGAR BOWL.—M. D. GREEN, 1191 E. 19th St., Portland, Ore. This invention provides a bowl with means for preventing the admission of insects, dust, or other foreign matter thereto; and provides a dispensing apparatus, simple in construction, readily cleaned, and easily attached to the body or containing receptacle of said bowl.

### Machines and Mechanical Devices

SLIP JOINT FOR SUCKER AND PULL RODS.—J. B. DUNLAP, 618 N. Boston Ave., Tusla, Okla. The invention provides a joint so arranged that the rods may be connected directly by moving them laterally with respect to each other, and without the use of screw threads or the like, thus dispensing with the time necessary to screw or unscrew the rods, and with the danger of stripping the threads, and with the liability of loose joints from worn threads.

CABLE EXCAVATOR.—A. D. HADSEL, Commercial Trust Bld'g., Philadelphia, Pa. Among the objects of the invention is to provide in combination with a slack cable trackway adapted to be raised or lowered and tightened or slackened, a special and novel type of bucket adapted to be dumped either automatically or semi-automatically by simple manipulation of the power attachments.

GREASE CUP.—E. M. ERB, 22 Morris St.,

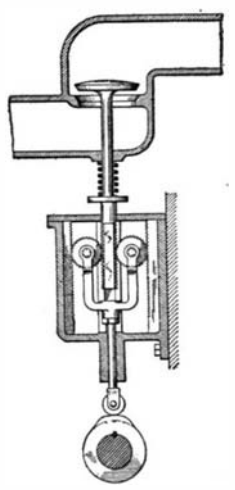
Jersey City, N. J. This improvement has reference to grease cups, and relates more particularly to a cup retainer intended to prevent the loss of the cup proper by the vibration of the machinery to which the grease cup is attached, and which may cause the cup to move on its plunger.

CLUTCH.—A. W. WARSEN, 1440 E. 15th St., Brooklyn, New York, N. Y. In this case the invention relates to power transmission means, and has reference more particularly to means for coupling a driving and a driven member. An object is to provide a clutch which is characterized by spreading fingers adapted to double the pressure on the friction surfaces.

TRANSMISSION LOCK.—J. MCDONALD. Address McDonald & Cameron, care of Trinity Motor Co., 1915 Commerce St., Dallas, Texas. The invention has particular reference to a mechanism for locking the transmission of automobiles, motor cycles, motor boats, and the like. It provides a lock casing attached to the transmission casing and having the gear shifting rods extending therethrough and adapted to be locked by a novel mechanism including a sliding bolt for each rod.

CHANGE SPEED GEARING.—R. W. COMPTON, Box 399, Higbee, Mo. This improvement relates to machine elements and has particular reference to gearing adapted for automobiles or other machinery where a change from one speed to another is desired or where varying speeds in one direction may be provided for in addition to the reverse drive.

VALVE GEAR.—R. B. SMITH, 103 Glenwood Ave., East Orange, N. J. This invention has for an object the provision of an arrangement whereby a valve may be opened to the usual extent and held open an appreciable time. Another object is to produce a valve gear or



VALVE GEAR.

mechanism for multiplying the movement of the valve shaft whereby a cam occupying a predetermined number of degrees of a circle may open and close the valve and also provide a period when the valve is held stationary in its maximum open position.

SAFETY DEVICE FOR POWER PRESSES.—N. SHEFF, care of Mr. Crain, 518 W. 145th St., New York, N. Y. The purpose here is to provide a device for use on foot or power presses and similar machinery, and arranged to prevent the movable press head from descending to final position as long as the operator's hand or hands are in position between the press head and the fixed die.

METHOD OF GATHERING PEAT.—T. RIGBY, Station Hotel, Dumfries, Scotland. This invention is an improvement in methods of gathering peat from peat bogs and delivering it where required. According to the invention, Mr. Ribgy proposes to cut the peat by means of any suitable excavator in the first place, to pulverize and disintegrate it in a peat-cutting machine in the second place, and finally pump it in the condition of pulp along a suitable pipe to the point at which delivery is desired.

DRAWING BAIT FOR WINDOW GLASS MACHINERY.—P. J. PAQUET, 1300½ 13th St., Jeannette, Pa. The invention relates more particularly to what is known as cold bait, that part of the machinery which is lowered into the molten glass and which thereafter, during the blowing of the glass, forms the head of the cylinder, and communicates with the interior of such cylinder so as to provide for the introduction of air to the cylinder continuously during the blowing operation.

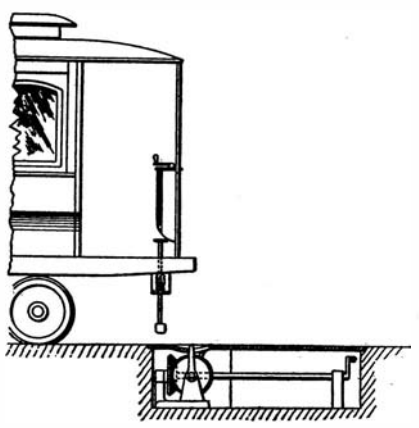
AUTOMATIC EMERGENCY, RETURN CHECK AND STOP VALVE.—T. B. FORD, 407 Broome St., New York, N. Y. The inventor provides an automatic emergency, return check and stop valve arranged to provide a check against the return flow of the steam into the boiler from the main, to isolate the main from the boiler in case of the sudden drop of the pressure in the main, and to allow of manually closing the valve whenever it is desired to do so.

MANUFACTURE OF BARRELS FOR SHOT GUNS AND RIFLES.—F. B. WARNER, 96 Chambers St., New York, N. Y. This inventor provides improvements whereby a highly ornamental Damascus barrel is produced and the barrel is not liable to become pitted through the action of nitric or other acids incident to the use of smokeless or nitro powders in the shells fired by the gun or rifle.

GOPHER TRAP.—A. F. RENKEN, Kramer, Neb. In this improved trap the spear is formed with a spindle actuated by a torsion spring, the spindle being disposed along a tubular body or frame and having at one end a spur to spear the gopher and at the opposite end an integral arm to be restrained by a latch adapted to engage a pivoted trigger.

### Railways and Their Accessories

RAILWAY SWITCH THROWER.—S. LEVY, 60 Matlock St., Paterson, N. J. This invention relates to railway appliances, and has particular reference to means for controlling the position of a switch point from the car, and the term car in this case covers any type of railway rolling stock from which the movable



RAILWAY SWITCH THROWER.

switch point may be operated or controlled. Therefore, an object is to provide an attachment for the switch point adapted to be operated by the actuation of one or the other of several plungers carried by the car and adapted to be depressed by the motorman or other operator, according to the direction in which the switch point is to be moved.

### Pertaining to Recreation

SHOE LACING.—E. W. LUCAS and C. J. SAUNDERS, care of Garden City Golf Club, Garden City, L. I., N. Y. This invention relates to sport shoes such as are used by golfers and others, and it has to deal more particularly with improvements in the means for lacing the shoe, and in this regard the invention is not necessarily limited to sport shoes.

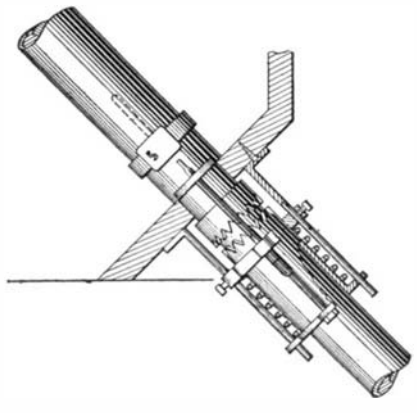
PUZZLE.—J. L. ALLEN, Box 907, Buffalo, N. Y. The main object here is to provide a puzzle wherein the movable object consists of a sphere concealed by an inverted box representing any well known vehicle, animal or the like, and which box serves to affect the normal movement of the sphere and is itself affected thereby to defeat efforts made to deposit said movable object within a suitable repository provided therefor.

### Pertaining to Vehicles

AUTOMATIC AIR CUSHION.—G. W. MACKINNON, 96 St. Botolph St., Boston, Mass. The invention relates to carriages and wagons and has particular reference to automatic cushioning devices for use between the frames and the axles of automobiles or other vehicles, whereby the shock incident to the bouncing or recoil of the springs is avoided. The objects are to make a car ride easier by eliminating all swaying motion; to do away with pneumatic tires; and to make a car ride continuously on an air cushion with solid tires.

TRACE CARRIER.—L. H. CHASE, 232 Fillmore St., Denver, Colo. This invention provides for embodiment in harness rings or frames, trace carrier elements of strong and simple form arranged to receive the trace ends in a manner to effectively prevent their accidental displacement and at the same time to present an ornamental appearance.

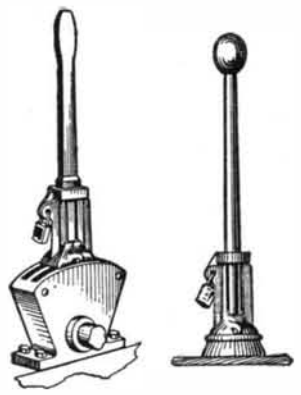
AUTOMOBILE LOCK.—G. RISDON, 224 Bergen Ave., Jersey City, N. J. The improvement refers to locks suitable for use upon automobiles and other vehicles, and used for the purpose of enabling the operator to leave the



AUTOMOBILE LOCK.

vehicle in such condition that it cannot be made to travel except when unlocked. The invention provides a locking mechanism to be used in connection with the steering post in order to prevent the latter from being turned.

LEVER LOCK FOR AUTOMOBILES.—W. J. MILES, 1221 Foster Bld'g., Denver, Colo. The invention relates to improvements in means for locking levers against movement when set in a predetermined position. The invention is intended for use in locking the gear shift lever of an automobile in neutral posi-



LEVER LOCK FOR AUTOMOBILES.

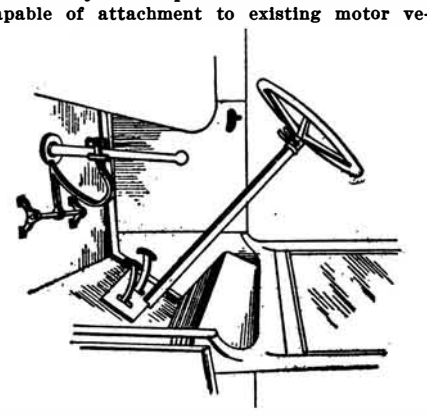
tion in order to prevent the movement of the machine by its own power when the lever is so locked. In other words, the object is to lock the gear shift lever against movement by an unauthorized person or one not holding a key to the padlock, which is employed in securing the parts of the device in the locking position.

ROLLER BEARING.—N. G. KIMBERLEY, Tottenham. Address J. D. Sprundt, 3 East India Ave., London, E. C., England. This invention relates to roller-bearings of the kind comprising two sets of hollow tapered rollers which run within an outer casing or the like on correspondingly tapered outer and inner paths associated with an axle or the like, one of which inner roller paths may be adjusted relatively thereto, the rollers of each set being mounted on pins, the ends of which engage rings constituting a cage or frame for the rollers.

SHOCK ABSORBER.—B. J. DRYER, 15 Broad St., New York, N. Y. The invention relates to a shock absorber or cushioning device of the compressed air type and is adapted to be used in a supplementary capacity to the usual suspension springs of vehicles by being interposed between and connected with such springs and the vehicle body so as to cushion both the downward and rebound movements of the body. Mr. Dryer has also invented another shock absorber for vehicles, and it deals more particularly with the combined hydraulic and pneumatic shock absorbing devices and is adapted to be interposed between the vehicle body and its supporting springs.

TIRE PUMP.—W. G. WILKES, 505 Seal Ave., Biloxi, Miss. One of the main objects here is to provide means which may be automatically actuated by the normal operation of a wheel of the vehicle, and a further object is to provide means for throwing the pumping means into or out of operation at will, during the movement of the vehicle.

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



AUTOMOBILE LOCK.

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

DUMPING MACHINE.—E. L. GARY, Anamoose, N. D. An object here is to provide a machine adapted to be driven ahead of and to dump its load ahead of the source of propulsion, means being provided whereby the machine can be drawn after the source of propulsion subsequently to dumping of the machine.

BABY CARRIAGE.—G. DICK, R. F. D. No. 2, Muncie, Ind. This invention provides a carriage which may be quickly and easily transformed from a four-wheel carriage to a two-wheel or sulky carriage, the carriage being designed to travel on the two wheels, except when going over a curbing or the like when the carriage may be quickly converted into a four-wheel vehicle to provide for an easy passage of the curbing.

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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.

## NEW BOOKS, ETC.

MODERN CHEMISTRY AND ITS WONDERS. By Geoffrey Martin, D. Sc., Ph. D. New York: D. Van Nostrand Company, 1915. 8vo.; 351 pp.; illustrated. Price, $2.

This is a companion volume to the author's "Triumphs and Wonders of Modern Chemistry," and treats of certain important and fascinating things which were omitted from the earlier work for lack of space. It aims at interesting the cultured general reader in some of the more marvelous conquests of scientific chemistry, and narrates the "romance" of such things as explosives, sugar, alcohol, coal tar, and common salt. The mystery of the periodic law is set before the reader, and the light thrown upon this law by recent advances in the study of radio-active elements is clearly shown. The practical applications of chemistry to industry, particularly in their more sensational aspects, are described in the text and embodied in the numerous illustrations.

INDIVIDUALITY IN ORGANISMS. By Charles Manning Child. Chicago: The University of Chicago Press, 1915. 12mo.; 213 pp.; illustrated. Price, $1.25 net.

Is the unity of a living organism strictly comparable to that of a complex machine, or does this unity itself determine, construct and harmonize its own elements and modes of action? The author of "Individuality in Organisms" absorbingly discusses the question of what constitutes an organism and an individuality; his experiments and deductions indicate an entirely mechanistic conception, yet one which differs in many respects from the usual anti-vitalistic theory. Such involved conditions and ramified investigations cannot be briefly summarized; it can only be said that the author presents and brings into correlation many diverse elements, and in comparatively simple language, supporting his views so ably that his work is worthy of the closest study.

TRANSACTIONS OF THE AMERICAN CERAMIC SOCIETY. Volume XVII. Arthur S. Watts, Editor. Edward Orton, Jr., Secretary, Columbus, Ohio. 8vo.; 815 pp.; illustrated.

The first fifty pages of the Report disposes of the membership list, the financial statement, and the rules of the Society. The main division of the volume is given over to the papers read at the Detroit meeting held in February of last year, together with the discussions these papers called forth. The presidential address dealt with "Our Industry and the Foreign Trade"; sixty-eight other speakers are reported in full, their subjects ranging among all the varied and intricate problems of clays and their working. Many of the papers are illustrated, and many carry charts of fire clay tests, weight losses, temperature curves, and viscosity.

THE PROBLEMS OF THE COMING PEACE. By Felix Mlynarski, Ph.D., Delegate of the Polish Supreme National Committee to America. New York: Polish Book Importing Co., 1916. 8vo., 172 pp.

Dr. Mlynarski is a writer of authority on sociological subjects; his arguments in the present little work stress underlying conditions and causes that are not usually considered, or at least that are generally slighted. He, perhaps, goes to an opposite extreme in this emphasis, but in the determination of what shall constitute peace with justice—the particular problem with which the author is concerned—his attitude must command attention, and the breadth and depth of his survey of history and his forecast of probabilities must be conceded.

AN INTRODUCTION TO APPLIED MECHANICS. By Ewart S. Andrews, B.Sc. (Lond.). New York: G. P. Putnam's Sons, 1915. 8vo.; 316 pp.; illustrated.

Applied mechanics, as the author states, is a difficult subject to teach, and most students will agree that it is not a subject easy to master. The author places the blame for this condition of affairs squarely upon the text-book, condemning the old-style text as "a kind of exercise ground for algebraic manipulation," and charging the more modern works with falling into the opposite error of presenting too much engineering application of the principles of mechanics without sufficiently explaining these principles. His text leans toward graphical conceptions, and should prove acceptable in the junior class work of the engineering college, or to any institution offering a comparable course.

COLOR AND ITS APPLICATIONS. By M. Luckiesh, Nela Research Laboratory. New York: D. Van Nostrand Company, 1915. 8vo.; 357 pp.; 129 illustrations, 4 color plates. Price, $3.

Without any claim to exhaustiveness, this work includes many phases of its interesting subject. The treatment is condensed, but generally adequate, and presents laws and theories; mixture methods and terminology; analysis; photometry and photography; and the effect of environment on color. It touches also upon color effects for the stage, in the art of painting, and in what we have come to know as "color music." Altogether, a wide field of related facts and suggestions lies between the covers of the volume and makes it a work of strong appeal to all who are in any way interested in this subject, or in one of its many applications, artistic, industrial, or scientific.

## Industrial Preparedness for Peace

(*Concluded from page* 196)

50 miles of New York has renewed the activity of its Board of Trade, but, as the president of the organization writes, "It is difficult to make the citizens see the point."

One public spirited citizen says it is of no use to attempt to get his fellow citizens interested in preparedness for industrial prosperity. Like Micawber, they are waiting for "something to turn up." Something will turn up undoubtedly! I would be ashamed to quote from some of the letters I have received from presidents and other officials of boards of trade and chambers of commerce. The officials are not to blame. It is that deadly indifference to progress, method, and scientific staff preparation which has sent only too many "old and established" business houses to the junk-pile. Have you ever walked into one of those offices, where the boss has been running the business for "forty odd years" and brags about the antique policies which, in reality, are undermining its stability? Whenever I go into one of the tombs of business, where the mummied forms of past glories are laid out in conspicuous array, I am reminded of the words of the poet:

"Standing like Druids of old, with voices sad and pathetic,
Stand like harpers hoar, with beards that rest on their bosoms."

One of the greatest business failures of the last century was primarily caused by the mummification of policy, and the habit of resting upon the glories of a great name. If a man had known just when and how to save this great institution from that dismal failure, and had offered assistance to the heads of that corporation, he would have been looked upon with a benign and fatherly attitude, and in tones of eternal authority advised:

"Sir, we have been in this business for 66 years, we have made many millions of dollars. Our name stands the highest in banks and commercial circles. How can you, sir, hope to advise us?"

The indifference of business men to great commercial and national crises is the result of the habit of building a shell about themselves, like a clam or an oyster. It is, at first, constructed for protective purposes, but becomes at last, a barrier against the friendly influences of coöperative and intelligent help. My friend Sam Murray tells a story of Jim Noonan, a half-witted fellow, who was sent out into the woods to bring in the sap-kettle. Jim hitches up the team of mules to a stone-bolt and drives out into the woods. It is a very cold day, the wind is strong and biting. Jim manages to get the heavy iron kettle upon the stone-bolt, and walking back of the load, drives the mules toward home. In order to get out of the cold blasts of the wind, Jim conceives the idea of riding in the kettle. He climbs into it, and makes himself cozy and comfortable. Now there happened to be a culvert in the road, which rose in the form of a ledge for about 9 inches above the level of the roadway. Jim had forgotten it in the pleasure of his security from the wind. When the blunt nose of the stone-bolt struck the culvert, something happened. It all happened so quickly that poor Jim imagined for a moment that he had passed into the land of eternal night. The "inverted" bowl of Omar had suddenly pressed itself down upon him. He was in a cell much more secure and oppressive than that of the Prisoner of Chillon. The mules returned home with the stone-bolt, but Jim and his kettle were missing. The hours passed. When darkness fell it was thought best to send out a searching party. By the flickering light of many lanterns, they finally came upon a strange and marvelous phenomenon. The kettle was slowly making its way, inch by inch, in little jerky moves, toward home. Poor Jim! For the sake of getting in out of the wind, getting away from the cold and biting blasts of winter, he had taken shelter in the spacious depths of the kettle. So long as he could ride in the kettle, right side up, it was a splendid thing, but when reversed, and he had to bear the burden of its ponderous weight upon his shoulders, he had to work his way, inch by inch, in the darkness of his dome-like cell.

I can never forget Sam Murray's story about the syrup kettle. I have found so many, many business men laboring along over the roads of business, hidden in the shell of their own making.

The boards of trade and the chambers of commerce of the cities and towns of the country can perform a great service to the business interests of the various communities. The officials of these organizations, however, must have real assistance, real coöperation, from every business man in the community.

It is the duty of such officials to lift the kettle off the backs of all those poor devils who are trying to get home—out of the wind.

## "Treasure Island's" Realistic Ship

(*Concluded from page* 201)

reality the "Isle of Pines" south of Cuba, and the crew has mutinied in good old pirate fashion. Then comes the fight at the stockade and finally the "Hispaniola" gets adrift in the next scene and the audience is treated to the sight of Black Dog and Israel Hands—unhung pirates of the deepest dye—and they look the part—fight to a finish while Jim Hawkins in the rigging is tossed about as he saves himself from Israel Hands with his pistol. The rest of the story, brimful of charts, mystery and "pieces of eight," need not detain us for our interest lies with the good ship "Hispaniola."

A vessel on the stage is usually a ridiculous example of the stage carpenter's art. It comes alongside and makes a few breezy attempts at rising and falling and all is still; but not so in "Treasure Island" where we have an animated boat 32 feet long which trembles and pitches and rolls and creaks worse than a 26-knot Channel steamer before the war. The ship was designed by Mr. George Vivian and built by Mr. Henry L. Gebhart, and shows much clever designing, especially since it can be dismantled for transportation purposes.

The ship is brought in mounted on a truck *C* running on casters. On this truck is a horizontal cradle *A* with curved ends adapted to give the boat a fore and aft pitching effect by means of the levers *D* and the rocker shaft *G*. The play is limited by chains and springs. On this cradle rest, at right angles, three more athwart-ship cradles *B*, which support the ship. These cradles serve to give the ship a rolling effect through the levers *E F*. While normally four men can give realism by actuating the boat, in practice it is found that a few stage hands can apply strength to advantage in simulating the effect of the choppy seas of the Caribbean. The scene from the front of the stage is excellent; the mechanism and operatives being masked by sea-green cloths. An electric fan helps the flag to flap merrily and the curtain goes down to delighted applause from those in the bijou playhouse.

## Motor Truck Queries

(*Concluded from page* 202)

a small hole should be drilled at each end of the crack to prevent it spreading any further. The neatest method involves drilling and tapping a series of holes and screwing in finely threaded brass rods. A hole is drilled and tapped and the rod screwed in and cut off flush with the surface of the water jacket. A neighboring hole is drilled so that a portion of the plug just screwed in is cut away; this is tapped and another piece of rod screwed in and cut off. This operation is continued until the crack is completely filled with the brass plugs. These are filed flush and a layer of solder sweated over the surfaces. If the cleaning is carefully done the solder will adhere to the cast iron of the jacket as well as to the brass plug. Another method is to use a piece of brass plate about an inch and one half wide and an inch longer than the crack. This is fastened to the water-jacket wall by means of a series of small machine screws which

fit into tapped holes drilled in the water jacket. Before permanently securing the patch a piece of sheet rubber packing is cut to conform to the patch and punched with holes to match those in the plate. The screws are coated with red lead, as is the under surface of the rubber packing, and the plate is securely applied to the cylinder casting to hold the packing in place between it and the water jacket. If this repair is carefully carried out it is not only neat but inexpensive.

J. F. W. writes: We are engaged in the lumber business and have recently purchased a three-ton truck fitted with a stake platform body. We would appreciate any suggestion you could offer for fitting up this body, particularly with our requirements in view, to facilitate loading and unloading the lumber.

Answer. A very economical way of loading lumber, and one that also permits the truck to be kept busy, is to make a series of cradles that will fit your truck platform and to load these cradles when they are on the ground. In this way the cradles can be loaded while the truck is making deliveries, and are lifted in place on the platform when the truck is ready to receive them. Unloading will be considerably facilitated by providing a series of rollers along the truck platform. This is illustrated on page 202. These may be turned by suitable gearing actuated by a hand crank, and if a pair of the rollers are interconnected by means of a driving chain the load will be easily shifted by turning the rolls. These rollers also facilitate handling the loaded cradles as they may be lifted by any suitable means and rolled in place on the truck platform.

## A New Wood Pulp Process

THE chief element of cost in the production of the paper on which our daily newspapers are printed is chemically prepared pulp of wood, though this constitutes only about 15 per cent of it, the remainder consisting of the entire substance of the tree, excepting bark, branches and knots. A small proportion of clay and sizing is added to give the fabric a surface and make it take the ink well. The chemical pulp referred to is cellulose in a more or less pure condition, made by boiling wood under pressure in a solution of bisulphite of calcium, from which it gets the name sulphite pulp.

The discovery of any process for lowering the expense of production of even the cheapest of papers will in these days of advancing prices for all commodities invite the interested attention of paper manufacturers, who are faced with the problem of overcoming high production costs caused by the growing scarcity of raw materials and the general advance in price of labor as well as supplies. The tendency is to cut down the amount of chemical pulp employed and increase the proportion of the ground raw wood.

Under ordinary conditions, where ground wood alone is used as the body of newsprint paper, trouble is experienced in the formation of the sheet on the paper machine. The rosin which remains adherent to the wood when it is reduced to pulp by the action of a grindstone, clogs the wire meshes of the paper machine and reduces the speed of manufacture; it also causes trouble by making the paper stick to the presses. Then the fibers which are disintegrated by mechanical pressure are never of full length, but are invariably short and lacking in the quality of toughness that is characteristic of fibers produced by boiling the wood in solutions of bisulphite of lime, caustic soda or sulphate of soda, to form chemical pulp, or sulphite.

Various attempts have been made to improve the grinding process so as to overcome the destructive cutting action of the stone on the wood fibers and impart pliability and smoothness to the resulting pulp. The endeavor has been made to incorporate mineral loading material, like china clay or talc, by feeding it with the sprinkling water at the point of contact with the grindstone and the pulp wood, the idea being to soften the friction of the stone and obtain a crushing rather than a cutting and disintegrating action, but with no pronounced success.

The most promising invention having to do with the manufacture of a ground wood pulp, which can be used alone or with a greatly diminished proportion of chemical pulp for the production of printing paper, provides for a preliminary treatment of the pulp wood with hot water under pressure in a closed receptacle. This is the subject of German patent No. 288,639, class 55a, granted to Leopold Enge, of Niederschreiberhau, in the Riesengebirge. In this process, by a manipulation of pressures and temperatures, and without the use of chemicals, the inventor obtains a ground wood pulp as white as the ordinary ground wood pulp made by the standard process, which possesses the tough characteristics of sulphite pulp and is, indeed, deemed capable of replacing sulphite pulp in the manufacture of newsprint paper.

The element of novelty in the process invented by Enge consists of the treatment of the pulp wood before grinding with hot water under pressure, the hydraulic pressure being maintained at a higher degree than the steam pressure and equivalent to the temperature of the water. For many years boiled wood has been employed in England in the manufacture of a coarse wrapping paper known as "Nature brown," the pulp obtained by cooking wood under ordinary conditions at temperatures above 212 deg. Fahr., being greatly discolored. Discoloration of pulp by the new process is negligible, and the quality of the product is said to be vastly improved.

According to the patent specifications, it is immaterial in the Enge process whether the contents of the wood boiler are first raised to the treatment temperature and then put under pressure, or whether pressure is applied initially and the contents subsequently raised to the treatment temperature. The period of treatment is said to be shortened when the pressure is applied after the heat in the boiler registers 212 deg. Fahr. At this temperature the equivalent steam pressure in the boiler, completely filled with wood and water, is 29 lb. per square inch. As soon as the boiling point of water is reached the supply of superheated steam is shut off, and hot water is pumped in until a pressure of 147 to 191 lb. is registered, thereby preventing any further boiling of the water. It is of importance that the contents of the boiler be not subjected to a heat in excess of the equivalent steam pressure. In other words, the pressure must be inceased as the temperature rises, since if the pressure falls the water boils and discoloration of the wood will ensue. With an average temperature of 230 deg. Fahr. at 147 to 176 pounds per square inch pressure, maintained for six hours, a light colored strong pulp can be ground that is said to be admirably adapted for news and book papers. The final treatment in the boilers before the wood is ready for grinding consists of the application of direct steam for a period of two hours at a temperature no higher than 230 deg. Fahr.

The wood as it comes from the boiler after this parboiling process will be found to be three times as heavy as wood cooked by the older steaming system already referred to, as it is heavily saturated with water, having been cooked to the core. The grinding of the wood is effected with stones of the same grain as that used for ordinary white mechanical pulp. As the fibers are more swollen and softer than those of ordinary ground wood the perforations in the centrifugal apparatus for the extraction of surplus water are enlarged to .043 inch. The pulp must be beaten smooth and smeary, rather than coarse and short.

The new process has excited the liveliest interest among paper manufacturers both in this country and in Europe; the periodicals of the pulp and paper industry are publishing articles descriptive of the process and product, and eminent experts in paper technology have considered the subject one worth devoting their time to investigating.


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.

(14048) J. J. C. asks: I am writing to ask whether or not there have been any practical applications of inventions of electric motors which use a non-magnetic metal. If you know of any applications, about what has been the efficiency in respect to other motors, that is standard motors? I have witnessed the demonstration of an electric motor which uses an aluminum disk outside of the coil in place of an armature of the regular type. It has a very high speed and delivers a lot of power to pulley wheel. The inventor claims an efficiency equal to the standard motor for the amount of current consumed. The coil is circular, in form of a large doughnut. The soft iron core is wrapped at a number of separated intervals with insulated copper wire. This coil is held stationary from its center by an expanding foot fastened to a base support. The armature is replaced by two aluminum disks which fit face to face like inverted saucers, partially surrounding the coil. These disks are keyed to shaft which passes through their center as well as through the center of the coil, in such a position that they can revolve about the coil. The present application uses an a. c. current three phase. For the weight of the material in the motor it delivers more power than any standard motor I have tested. I was not equipped for meter tests. Its strong points are cheapness of manufacture and low upkeep cost, and inability of being burned out by overload or shorting. I have personally held the motor while full load current was passed into it. After a little the aluminum disks will warm up and probably if held long enough would get hot. Any information in regard to non-magnetic metals being used in motors, I will be much obliged for. I append a rough sketch in order to better explain the appearance of the motor. A. The motor which you describe is an alternating current motor with a rotary field. Such a field generates by induction currents in the disk which causes it to rotate with the rotation of the field. A number of rather spectacular experiments have been developed from this phenomenon. It looks strange to see a metal disk rotating rapidly with no visible driving force. The motor will not run with a direct current. The disk heats because much of the current generated in it is converted into heat. The disk may be of any metal. Magnetism has no connection with the rotation. The motion is produced by the action of the rotary field, causing electric currents in the disk. Motors made upon this principle do not have simple disks of metal, but have some form of coils which is equivalent to an armature, although it is called a "rotor," since it turns. The action is that of a transformer, the field, or "stator," as it is called, is the primary and the secondary is the arrangement of conductors which carry this induced current. In some forms the name "squirrel cage" is given to it, from its resemblance to the rotating drum of a squirrel cage.

(14049) F. K. J. asks: How many types of detectors are there in common use and what does each, briefly, consist of? A. The most common detectors are the crystal, electrolytic, magnetic and valve types. The former consists of a suitable crystal possessing certain rectifying properties, on which rests a fine point of wire. There are also other variations of the crystal detector in which two crystals are employed in contact with each other. The crystals employed in these detectors have the power of allowing all impulses of a certain polarity to pass through them, while other impulses are barred, causing them to seek another path which is offered by the telephone receivers connected in the circuit. The electrolytic detector, although in common use several years ago, has been practically abandoned. In sensitivity, however, it ranges very high, but the simplicity and cleanliness of the crystal detectors caused their adoption in preference to the former. The electrolytic detector consists of a suitable container for a weak acid solution—usually a 20 per cent solution of nitric or sulphuric acid—to which contact is made in some suitable manner, while into the liquid or electrolyte dips a fine, hair-like piece of platinum wire, connected to the other side of the circuit. A battery and a pair of telephone receivers are employed in connection with the electrolytic detector. The potential is adjusted by means of a potentiometer—a form of rheostat or adjustable resistance—until the bubbles of gas formed at the point of the wire practically insulate the point and prevent the further flow of battery current which is then on the verge of breaking down the thin film of insulating gas surrounding the point. According to the generally accepted theory, the feeble, high frequency current of the received waves, flowing to the point of the platinum wire, is of sufficient power to penetrate through the gas film,

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which, as already stated, has just been able to hold back the battery current. The momentary breaking down of the insulation allows battery current to also pass, which causes the signals to be heard in the telephone receivers. However, the instant the high frequency current stops, the battery current causes the gas to again form and insulate the point. It will be appreciated that the action of this detector is entirely automatic. The magnetic detector consists of two windings, one placed over the other, connected respectively to a pair of telephone receivers and to the aerial and ground connections through the tuning apparatus. Through the common center of both coils passes a continuous and moving band of soft iron wires, driven by a clockwork motor. Two horse-shoe magnets are placed near the two windings and the iron wire band. As to the operation of the magnetic detector, it is best expressed by J. A. Fleming in his work, "The Principles of Electric Wave Telegraphy," as follows: "When the band is driven forward the portion of the band nearly opposite to the magnet poles becomes magnetized, but, owing to magnetic retentivity or hysteresis, that portion, in virtue of the motion of the band, is shifted forward in the direction of rotation, and is not therefore suited symmetrically with respect to the poles. If an electric oscillation passes through the oscillation coil, it annuls the hysteresis of the iron, and this magnetized portion slips back suddenly into a position exactly opposite to the magnetic poles. This amounts to moving a magnetic pole through the coil connected with the telephone, and it creates an induced current in this latter coil, and hence a sound in the telephone. The extreme sensitiveness of the telephone to induced currents bestows upon the whole apparatus a very great power of detecting feeble electrical oscillations. When used to detect electric waves, the oscillation coil is connected in between two aerial wires or between one aerial wire and the earth." Lastly, the valve type of detector is perhaps of greatest interest because it is fast replacing all other forms of detectors. Briefly, the gas valve—taking the Audion as an example since that form is the most generally used—consists of a miniature electric lamp, with a filament of tantalum or tungsten, a small plate of nickel arranged parallel to the filament, and a grid-shaped wire interposed between the filament and the nickel plate. In the standard form of Audion there are two filaments; one filament is used until it becomes exhausted and the other is then pressed into service, resulting in the doubling of the life of the lamp. The filament is supplied with current from a storage battery usually of a potential of about five volts. A rheostat is inserted in the filament circuit so that the current can be accurately regulated, for the sensitivity of the detector depends to a great extent on maintaining the filament at a critical temperature. Another battery is also required in the operation of the Audion; this battery being composed of a large number of cells furnishing current of a potential variable from 15 to 40 volts. The positive or + lead from the high tension battery is connected through a pair of high resistance telephone receivers to the nickel plate in the Audion bulb; the negative or — lead, on the other hand, leading to one side of the filament. The other side of the filament is connected to the tuning apparatus. The grid is also connected to the tuning apparatus. The Audion is not that of a simple rectifier or valve, but rather that of a true relay device. The high frequency oscillatory current of the incoming signals appears to bridge the Audion detector as long as it flows through it, enabling the high tension current of the telephone circuit to flow across the gap and cause audible signals to be heard in the telephone receivers.

(14050) P. M. C. asks: I am in the compressed oxygen business and often a question comes up that cannot be settled without a reliable formula; for instance, a short time ago I had the occasion to find the weight per cubic foot of oxygen at 72 degrees F. I was unsuccessful and have not located one. Can you direct me to a text-book that would give formulas for determining this weight, and for all formulas concerning compressed gases, high-pressure cylinders, etc.? A. The weight of a cubic foot of a gas at any temperature is found from its weight at the freezing point and its expansion by heating. If the pressure remains the same and the expansion is due wholly to the change of temperature, the weight will be inversely as the volume. Thus if a cubic foot should expand to 2 cubic feet at the same pressure, the weight of a cubic foot would be reduced to one half its former value. For moderate changes of temperature all gases expand very nearly the same. This expansion for each degree Fahr. is 1/459 of the volume at the freezing point. If a gas is heated to 72° Fahr. it will expand 40/459 of its volume at 32° F. There will remain in the original cubic foot of space 419/459 of the gas, and it will weigh 419/459 of its former weight. One cubic foot of oxygen weighs 0.0892 lbs. Avoir. and 419/459 of 0.0892 lbs. will be the weight of a cubic foot of oxygen at normal pressure and 72° Fahr. You will find the weights of a cubic foot of most gases on page 176 of Kent's Mechanical Engineer's Pocket Book, which we send for $5.00 postpaid. For a compressed gas, you can find the weight per cubic foot at atmospheric pressure, or approximately 15 lbs. per sq. in., from the table. For each 15 lbs. gauge pressure the weight of gas increases proportionately. At

15 lbs. on the gauge one volume has been pumped into the cylinder, at 30 lbs. two volumes, etc., and the weight increases accordingly. This is true only if the gas is allowed to cool to the original temperature after it has been heated by the pump in compressing it.

(14051) O. L. M. asks: I desire that you give me correct information as to the shortest day of the year and the longest. Also what are the correct dates that the sun crosses the equator line. A. The phrase "shortest day" and "longest day" have two senses. They may refer to the time from sunrise to sunset, and they may refer to the time from midnight to midnight, or noon to noon. If your inquiry is for the shortest time from sunrise to sunset, the shortest day is the day of the winter solstice, which in 1915 was December 22nd and in 1916 will be December 21st. The fact that February has 29 days this year moves the date of the winter solstice back. The longest time from sunrise to sunset is that of the summer solstice. In 1915 this was June 22nd, and in 1916 it will occur on June 21st. If the longest time from midnight to midnight is intended by the inquiry, that day is January 2nd in 1916, the day when the earth is nearest the sun and is revolving swiftest around it. The shortest day in 1916 is July 3rd, when the earth is farthest from the sun and is moving slowest. The sun crossed the equator last September on the 23rd. It will cross the equator March 20th in the morning, and again on September 23rd, when autumn begins. These events vary in the month and do not occur on the same day of the month. It is, however, commonly stated that the equinoxes occur on the 21st of March and September. This statement is not accurate.

(14052) W. F. V. asks: 1. How many cubic feet of hydrogen and oxygen gas can be obtained from one cubic foot of water by the electrolytic method; also what amperage and voltage is required to produce this amount of hydrogen and oxygen in a given length of time? 2. Is there any chemical that can be mixed with the water that will hasten decomposition, or aid the electric current to tear apart the elements that compose water? 3. What is the largest amount of hydrogen and oxygen that can be produced in a given length of time by any method now known? 4. Is there any books that deal with this subject exclusively and where can they be had? A. 1. One cubic foot of water contains about 1,230 cu. ft. of hydrogen gas and half as many cu. ft. of oxygen gas. For the commercial production of these gases by the electrolytic method an e. m. f. of about 3 volts is employed. To separate a cubic foot of water into oxygen and hydrogen about 244 kilowatt-hours are required. 2. If iron electrodes are used, the water should have about 15 per cent of sodic hydrate dissolved in it. If lead electrodes are used, sulphuric acid is added to the water. These substances are not used up in the process but serve to render the water a conductor of the electric current. Pure water only is added from time to time as it is decomposed into its gases. 3. The quantity of gases produced in a given time is limited by the size of the apparatus. If you wish a large quantity you must have a large outfit. 4. We can furnish you with Englehardt's Electrolysis of Water, translated by Richards, for $——.

(14053) F. P. C. asks: Can you give me a formula for preparing a glue or cement for use on paper, that is transparent to a certain extent, that will be insoluble in cold or hot water, and that will not stain the paper to which applied? A. Our Cyclopedia of Receipts, which we send for five dollars, postage paid, contains a large number of receipts for waterproof glues, which are insoluble in hot or cold water. They generally are made with a chromate and become insoluble by the action of light upon the glue after its preparation. You will find these receipts upon pages 311, 312 and 335.

(14054) C. E. E. asks: If a body of water at a temperature of 40° were absolutely confined in an unbreakable vessel, and the temperature lowered indefinitely, would the pressure caused by the crowding of the molecules lower the freezing point sufficiently to keep the liquid from crystallizing? A. Water cannot freeze unless it can expand, and if ice is compressed to the volume which the water had before it froze it will turn back to water. Ice can be melted by pressure only at a temperature lower than 32 degrees Fahr. The experiment has been performed many times. This is expressed in the books by saying that the freezing point of water is lowered by pressure. This is true of very few materials. Most substances have their freezing points raised by pressure and melting is prevented by pressure.

(14055) W. B. C. asks: Kindly advise me if there is any difference in the thermal conductivity between cast iron and wrought iron; in other words, will one transmit more B.t.u. than the other? Is the thermal conductivity of a substance dependent on its thickness entirely? All this in connection with a hot air furnace. A. The conductivity for heat is about one quarter greater in wrought iron than it is for cast iron at the same temperature. The thermal conductivity of the same material in different thicknesses would vary with the thickness. That is, if a definite difference of temperature were maintained on the opposite sides of a plate of metal, the amount of heat which would pass through the plate per minute would vary as the thickness of the plate.

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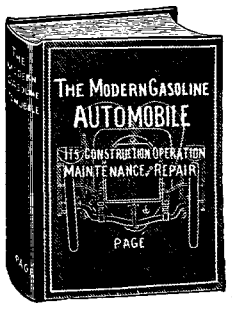


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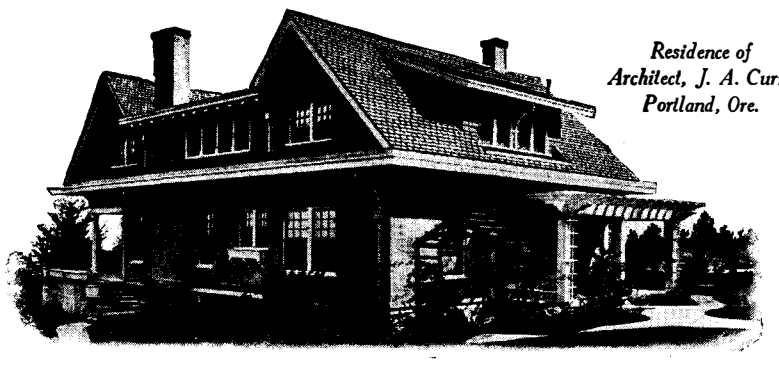

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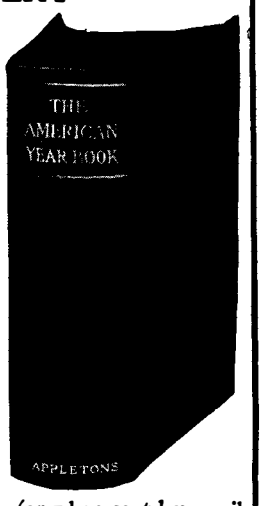


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