SCIENTIFIC AMERICAN

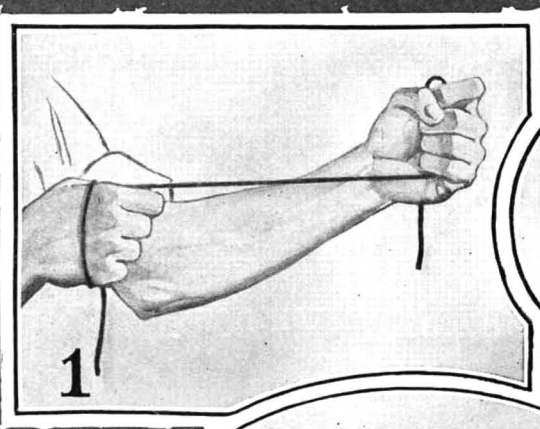
BRITISH FLEET IN ACTION OFF THE COAST OF JUTLAND.—[See pages 640-641]

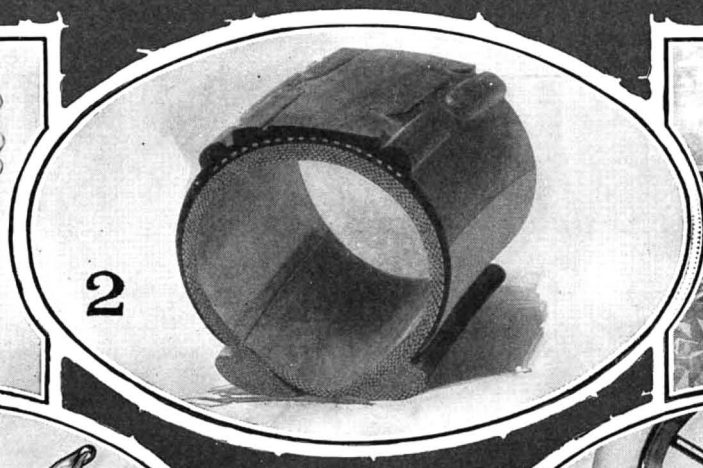
June 17, 1916

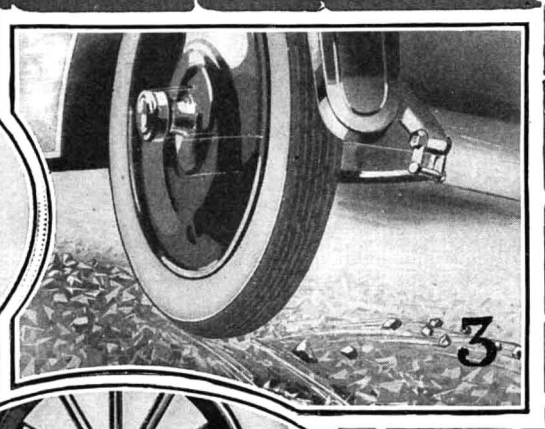
Munn & Co., Inc., Publishers
New York, N. Y.

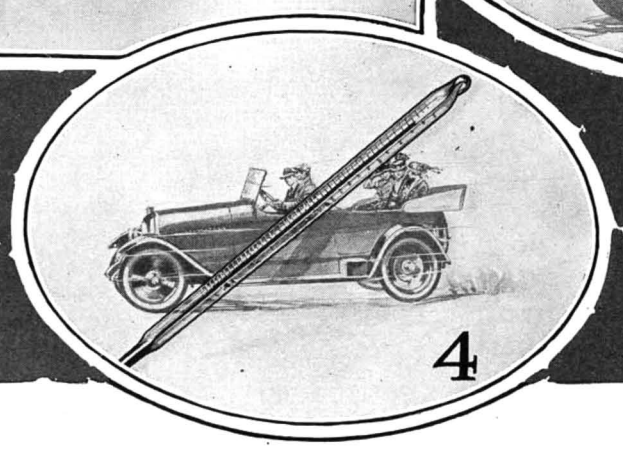
Price 10 Cents

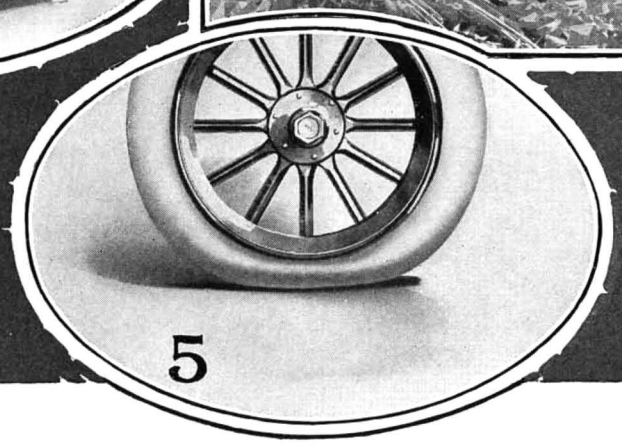
Why tires wear out too soon!











Five disadvantages of rubber—and how the Prodium Process minimizes four of them

Aside from poor fabric and poor workmanship, tires wear out prematurely for five reasons. (1) Lack of tensile strength in the tread rubber. (2) Uneven wearing down of the rubber, causing irregular worn spots and holes. (3) Chips and cuts that admit water to rot the fabric. (4) Heat caused by friction, and (5) under-inflation.

Nothing but the regular use of a tire pump or air tank will remedy the last. The other four are reduced to a minimum by the Prodium Process, a wonderful new discovery in compounding tire tread stock, owned and controlled exclusively by The Republic Rubber Co. Here's how Republic Prodium Process Tires solve the four problems.

1 Wonderful Tensile Strength

Laboratory tests show Prodium Process Rubber to be much stronger than ordinary rubber. A strip one inch thick will hold 3,400 lbs., or 20 average men.

2 Uneven Wear Eliminated

Prodium Process Tires wear down as evenly as a piece of fine steel. The cut above is a section taken out of a tire that has gone 9,467 miles. Note the thick tread still remaining.

3 Chipping and Cutting Reduced

Prodium Process Rubber is the toughest rubber we have ever tested. Illustration No. 3 shows the kind of tests we give this wonderful material. Even fresh cut rock does not chip or gash it.

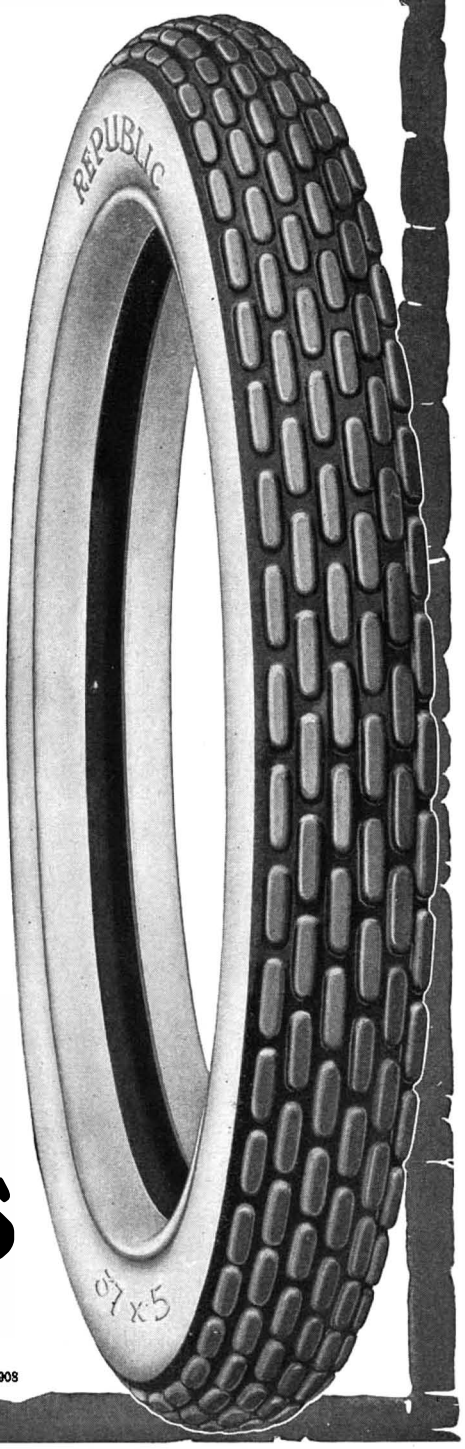
4 Heat and Friction Overcome

Heat comes principally from friction, friction from slippage. Prodium Process Rubber has remarkable anti-skid qualities, and will stand a higher temperature than ordinary rubber.

Buy one Republic Prodium Process Tire and check its mileage—observe its condition from week to week. Your odometer record and your own eyes will substantiate every statement made above.

Free sample of
Prodium Process Rubber

Write for a piece of this new material ⅛ inch thick. Pull it! Jerk it! Try to break it! We have found few hands that can tear this slender strip.



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SEVENTY-SECOND YEAR

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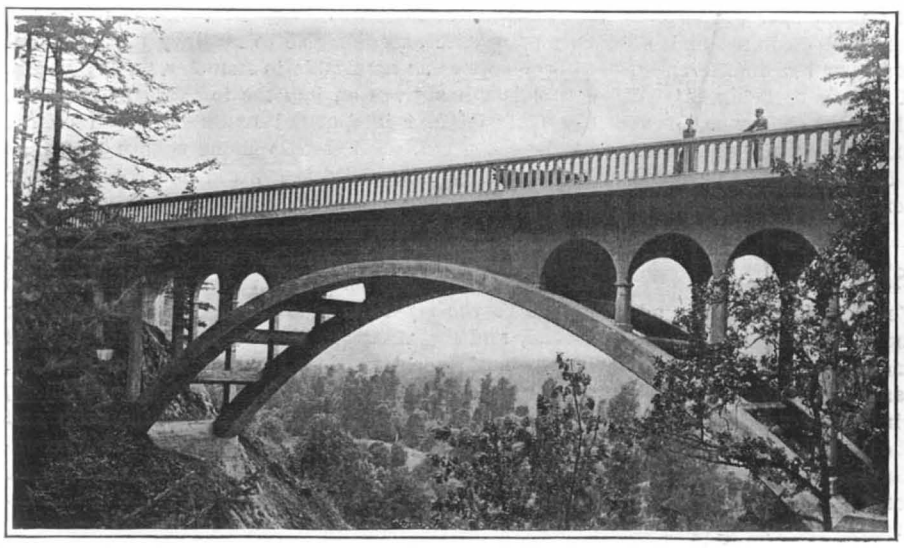
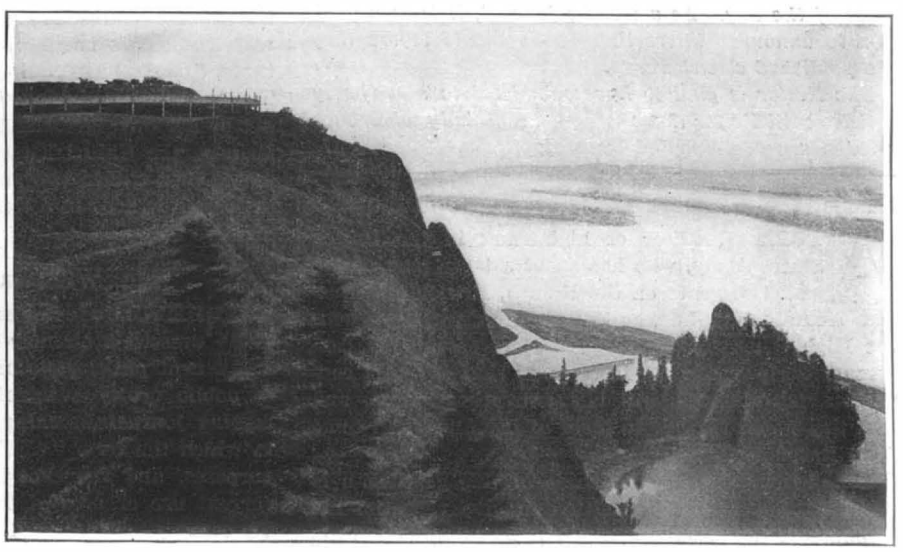


One of the tasteful bridges at Shepperd's Dell



Crown Point, on the Columbia Highway and its grand panorama

A Beautiful Link in Our Highway System

ONE of the most attractive additions that has recently been made to our new system of good roads is the Columbia Highway that extends from Portland, Oregon, to Hood River, a distance of 60 miles, for while it is not conspicuous for its length it more than makes up for this in the variety and charm of its scenery. This new scenic route along the south shore of the Columbia River was begun in 1913, and it is expected that it will be entirely completed by August of this year; but the greater portion of it is so far advanced that it is now open and in daily use, hundreds of sight seers and pleasure seekers passing over it every day in automobiles.

For many miles after leaving the city of Portland the road leads through a charming farming country, until the Columbia River is finally reached at Crown Point, a bold elevation 700 feet high that stands directly on the river bank and affords a magnificent view of the river, and a panorama of the surrounding country including an area of from 30 to 40 miles. Here space has been arranged to allow tourists to stop conveniently and enjoy the scenery without obstructing other travelers, and a promenade has been constructed of concrete around the brow of the bluff.

From this point onward the scenery is both varied and delightful, for many small streams, flowing down the steep mountains to the river, form exquisite cascades and water falls, some of which are visible to the traveler on the main road, while others are made accessible by specially constructed foot trails and tasteful masonry bridges.

It has been necessary to provide a number of bridges on this stretch of highway, most of which are of reinforced concrete construction, and great care has been taken in designing them to produce pleasing and harmonious structures in keeping with their location and surroundings. One of the larger of these bridges, at Shepperd's Dell, is shown in one of the illustrations and indicates great good taste on the part of the engineers.

The show place of the undertaking, however, is the unique tunnel at Storm Cliff, or Mitchell's Point, as it is sometimes called. At this place a barrier was encountered by the road-makers in the form of a solid basaltic cliff that arose abruptly from the river. Along its base a railway occupied all of the available space, while the old road that ran through this region climbed painfully over the crest, some 2,000 feet high, by long and steep grades. A tunnel appeared to be the logical solution of the problem, and, possibly having in mind the famous Axenstrasse, in Switzerland, the engineers arranged their plans in a similar manner, cutting a series of great windows in the outer wall of the tunnel that give some magnificent views of the nearby river.

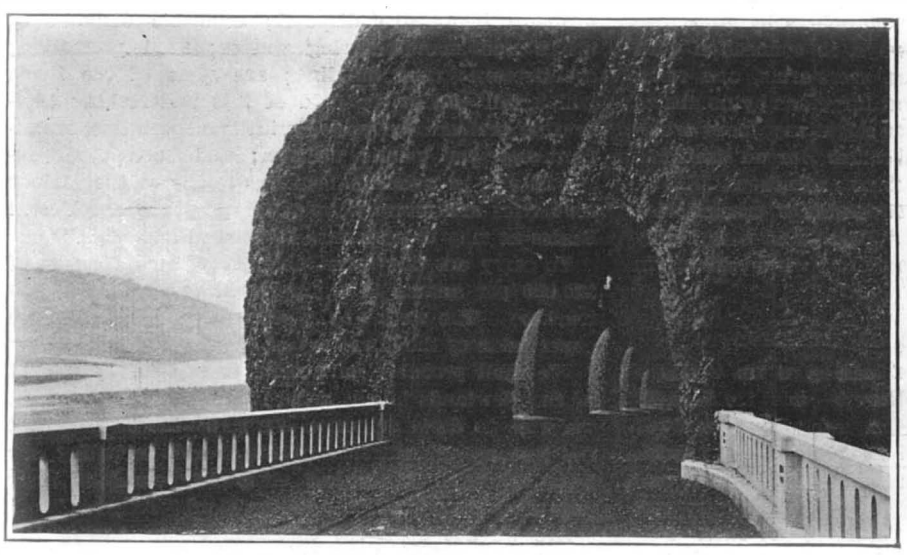
From the river the ledge arose about 500 feet, where there was a bench, or saddle of a few hundred feet in width, and above this bench the rocks extended up fully 2,000 feet more. From this bench men were lowered by ropes to blast out niches for the use of the surveyors in running their levels; and later on the contractors followed to hew out the opening for the highway, a tunnel 18 feet wide, 19 feet high, and 400 feet long. The windows, seen in one of the illustrations, are approximately 20 feet wide and 19 feet high, with substantial protecting railings of reinforced concrete. The approach to the tunnel from the east is by a viaduct of reinforced concrete 200 feet long, that spans a rocky gorge on the flank of the cliff.

This tunnel at Storm Cliff is but one of a number of openings that were cut through the projecting shoulders of the rugged hills, extending along the banks of the river for many miles in this region and lending distinction to this stretch of highway.

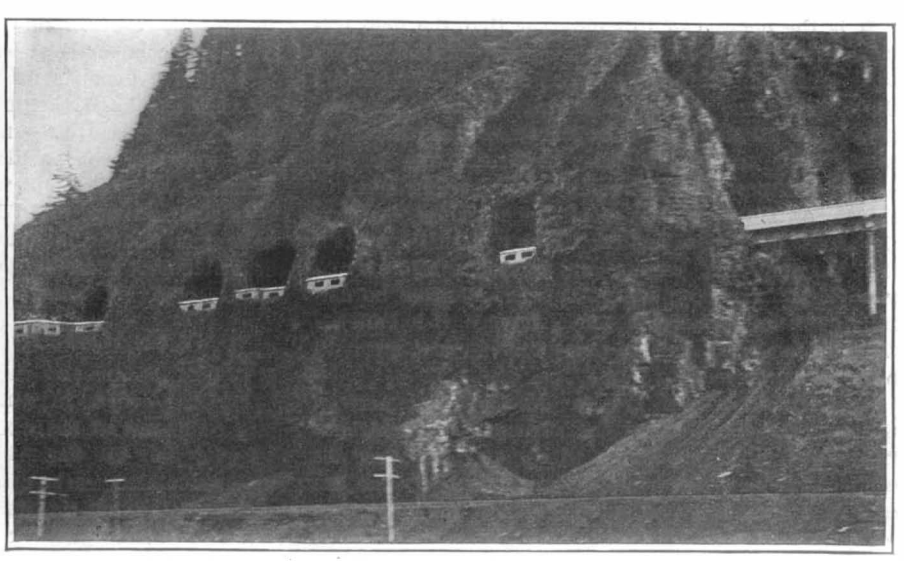
As has been said, this new piece of modern road is 60 miles long, and for its entire length it has a fine bitulithic surface 18 feet wide. In no case is the grade greater than 5 per cent, and it is claimed that this road equals, both in construction and scenery, anything of its kind in the country.

At Hood River, where the present section of the Columbia Highway ends, connection is made with old existing roads that form a route eastward to the Missouri River, midway between the proposed National Parks Transcontinental Highway, as suggested by the National Parks Highway Association and endorsed by the National Highways Association, and the Lincoln Highway. Connection is also made with the latter route at Salt Lake City; so that, while no suggestion has as yet been made of such a long extension, it is evident that such an extension of the good road would be of great convenience to those who come west over the Lincoln Highway, and who desire to continue to the coast at Washington or Oregon.

Undoubtedly the inception of the great systems of national highways that are being widely promoted lies in the rather selfish desire of the automobile tourist for more and new territory that he can cover conveniently and comfortably with his car. Still, whatever the inspiration, every mile of modern road that is built demonstrates its economical value to the farmer and the merchant and promotes a good work that is of the greatest importance in the promotion of the welfare and progress of the entire country. There is, however, one side of the good roads movement that is disappointing, and which, apparently, must be learned by expensive experience, and that is the matter of maintenance. Because a road is elaborately and substantially constructed it is too generally expected that it will last forever, and consequently it is neglected until entire reconstruction is necessary. Constant and systematic supervision and the prompt repairing of the slightest defects as soon as discovered is an essential to permanent good roads, and, moreover, is far cheaper in the end than costly rebuilding.



Entrance to the observatory tunnel on the Columbia Highway



Mitchell's tunnel through Storm Cliff

SCIENTIFIC AMERICAN

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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.

Russia, the Ultimate Decisive Factor in the War

A FORMER officer of high rank in the United States Army, who has spent a large part of the past two years on the French, British and Russian fronts, where he was in intimate association with the High Command, and is therefore thoroughly conversant with conditions, informs us that it is his conviction that the war will last two years longer, and that the decisive stroke in favor of the Allies will come from Russia.

For obvious reasons the name of this gentleman is withheld, but we are permitted to give verbatim his estimate of the situation, which is as follows: "It is my matured military judgment that the combined technical organization and resources of Great Britain and France cannot drive Germany out of Belgium and France; but I do believe that they can hold—that they can resist the drive on Verdun or any drive on Calais and can prevent the investment of Paris. All they have to do is to maintain the line until Russia is fully organized and equipped. I believe that the treaty of peace will be signed in Berlin; but not this year or next."

As regards the western front, France, according to this authority, has with the colors to-day close to 4,000,000 men, fully equipped; England, also, has fully equipped at least another 4,000,000; but the British forces are somewhat scattered, large contingents being in Mesopotamia, Egypt and Saloniki. Nevertheless, she has to-day in France over 1,600,000 men. Of these, 1,200,000 are holding from 60 to 70 miles of the western front, extending from the Belgian army far down into France. Back of Verdun are massed not far short of half a million British troops, which were taken down there by motor transport. "There is the closest cooperation between the British and French, and, recently, General Haig loaned to General Joffre 400 Lewis machine guns, which are being used in the French advance trenches at Verdun." These weapons, weighing only twenty-five pounds without the tripod, can be carried on a man's shoulders; and the moment that the enemy's artillery fire ceases, a sandbag, rock, or any projecting mound of earth on the lip of the shell craters, or upon what is left of the trenches, serves as a rest.

Speaking of the possibility of the recovery of Belgium, he stated that, a year ago, the English could have accomplished much if their whole force had been thrown into Belgium at that time. Since then the Germans have built a network of military railways parallel to their front and connecting with the main Belgian railways, by means of which they can make such a swift concentration of troops as to render the problem of breaking through so costly in men as to discourage any such attempt.

It is the opinion of this observer that the final collapse of the Central Powers will be brought about, not by a shortage of food, munitions or money, but by the ultimate and inevitable shortage of men. At present, taking all theaters of the European war, they have to maintain some 2,000 miles of front. The loss of men in the never-ceasing smaller actions incidental to trench warfare, and in great undertakings such as the attack on Verdun and the Russian offensive against the Austrian line, reaches an enormous figure; and two years from now, when the vast Russian hordes, fully drilled and equipped, move forward, it is believed that the final and decisive phase of the great war will have been reached.

As an offset to her gradual decrease in effectives, Germany is steadily growing stronger in munitions. "Germany is accomplishing with materials what she could never have accomplished with men." Take the case of the machine-gun equipment. At the start Germany had 50,000 of these; to-day, in spite of large losses, her equipment is believed to stand at 75,000. It is her plan to provide one machine gun to each twenty men on the front line. The Allies are making desperate efforts to match this equipment; both Great Britain and France have now, or soon will have, 32 machine guns per 1,000 men, which works out to about two thirds of the German equipment. Russia is far behind this ratio, but is gradually picking up.

"Italy," says our informant, "is the great disappointment of the war. She never contemplated such a fight with Austria as that in which she is now engaged. She thought she could hold the mountain passes against the remnants of the Austrian army. She is poorly munitioned and financed; and the reported extensive equipment of heavy artillery is largely a myth."

As to Russia, which this high military authority believes will be the ultimate decisive factor in the war, the present conditions are that she has 9,000,000 of men with the colors undergoing intensive training, and, of these, 5,000,000 are equipped more or less indifferently. The work of equipping the Russians is being carried out by her own factories and by those of France, Great Britain, the United States and Japan; and it is estimated that within two years' time the 9,000,000 troops of Russia will be in a condition to move forward for a decisive blow.

What is "Sleet"?

THE United States Weather Bureau has addressed a circular letter to a number of prominent philologists and meteorologists, as well as to public utility companies and the editors of engineering journals, seeking their advice as to the way in which the term "sleet" should be used for official purposes, and requesting information concerning the current use or uses of the term in different parts of the country. The immediate reason for this inquiry is that the Bureau is contemplating an investigation of the causes and the prevalence of ice deposits on telegraph, telephone and electric transmission wires; a phenomenom to which the expression "sleet" is now very commonly applied in this country.

The Bureau states that a search of dictionaries and of a large amount of technical and non-technical literature reveals the following facts:

(1) In England "sleet" means usually, though not invariably, a mixture of raindrops and snowflakes.

(2) In the United States the term "sleet" has nearly always been applied by meteorologists to some form of water (other than snow) that is in a frozen state before reaching the ground; viz., either small particles of clear ice (often mingled with rain or snow), or little snow-like pellets, differing from true hailstones, but often called "winter hail" or "soft hail." (The latter form of precipitation is called *Graupel* in German, and, under the influence of German writings, American and English meteorologists have used this word to some extent. The French equivalent is *grésil.*)

(3) Non-meteorological usage in this country varies. The uses noted above under (1) and (2) are more or less common, but there is also another, in accordance with which the term "sleet" is applied to a coating of ice, formed on terrestrial objects by rain which freezes after contact with such objects. In England such an ice coating is usually called "glazed frost," and this term has been adopted for official purposes by the British Meteorological Office. Another name for such a deposit is "silver thaw." This curious expression has been known in both Great Britain and America for a very long time. It occurs in Cartwright's Journal (1792) with reference to the prevalence of the phenomenon in Labrador. Last, but not least, when the deposit is heavy, and especially when it results in the breaking of branches, wires, etc., the phenomenon as a whole is very commonly called, in this country, an "ice storm."

On referring to the dictionaries we find very little authority for applying the name "sleet" to a sheet of ice produced by falling rain, yet the term is almost universally used in this way nowadays by American electrical companies and railways, in connection with troublesome deposits on wires, cross-arms, and rails. On the other hand, the public at large has by no means abandoned the earlier—and, one might say, more orthodox—uses of the term. The Weather Bureau itself has generally identified sleet with frozen raindrops.

In short, several quite distinct forms of precipitation have gone under the name of "sleet," and it is highly desirable that these should be clearly differentiated in the scientific vocabulary.

The Coming Age of Research

THERE are two ways of looking at the cataclysmal events in which Europe—and incidentally the rest of the world—has lately been involved. Viewing only the dark side of the picture, one beholds an incalculable waste of human life and welfare, and a repudiation of the guarantees of Christianity and civilization boding ill for the future of our race. Fortunately, however, the picture has another side. The tragedy of the great war is, to contemporary vision, so appalling that one who should sweepingly characterize it as "a blessing in disguise" would perhaps be taxed with heartless flippancy; yet that many blessings have already sprung from it, as by-products, while others, still nascent, promise splendid development upon the restoration of peace, must be evident even to the most pessimistic observer.

This is not the place to forecast the social and moral consequences of the war. We should like, however, to dwell for a moment upon the hopeful outlook which science now enjoys, notwithstanding the misfortunes which it has, in common with other human activities, suffered in the general *débâcle.* That which science has especially gained from the war is prestige. Neglect of science in certain quarters has brought such retribution to the negligent ones that the lesson will probably never need to be repeated. This is true not only of science as applicable to military purposes, but also of science as applicable to industry.

The war has given an impetus to scientific research, the material and intellectual fruits of which cannot yet be estimated. Is it too sanguine a hope that they may actually indemnify the world for all that the struggle has cost?

This impetus has manifested itself in two ways: first, in the increased attention which various manufacturers have been forced by recent circumstances to devote to the scientific side of their own industries; second, and especially, in the elaborate plans adopted by various governments for the promotion of research on a national scale. Thus, the British government, besides organizing research on behalf of the army and navy, has developed a scheme for an "advisory council on industrial research," which will control all government activities under this head.

This means, among other things, that the universities and other educational establishments will be encouraged by the government—if necessary by means of state subventions—to train even specifically for particular lines of research.

In Australia steps have been taken to form a new official body which is to be known as "the Commonwealth Institute of Science and Industry," and which will exercise much more extensive powers than those intrusted to the British organization, since its duties will not be merely advisory; but it will assume direct control of a vast amount of research and practical work in behalf of Australian industries.

In Japan a national laboratory for physical and chemical research has just been established. Other government undertakings of analogous character are reported to be in prospect in various foreign countries.

Lastly, in our own country an interesting scheme for scientific industrial research under government auspices has recently been evolved along lines differing considerably from those of the projects above mentioned. On March 9th Senator Newlands introduced a bill (S. 4874), now in the hands of the Senate Committee on Agriculture and Forestry, which provides for establishing "experiment stations in engineering and in the other branches of the mechanic arts" in connection with the "land grant" colleges throughout the country. These stations are designed to do for industrial research what the agricultural experiment stations are doing for agricultural research. Under the terms of the bill, "it shall be the object and duty of said experiment stations to conduct original researches, to verify experiments, and to compile data in engineering and in the other branches of the mechanic arts as applied to the interests of the people of the United States, and particularly of such as are engaged in the industries; also to conduct researches, investigations and experiments in connection with the production, transportation, extraction and manufacture of substances utilized in the application of engineering and of other branches of the mechanic arts to industrial pursuits: Water supplies, as to potability and economic distribution; sewage purification, and its ultimate inoffensive disposal; economic disposal of urban and manufacturing wastes; flood protection; architecture; road building; are some of the items which fall within the field of this undertaking engineering problems connected with transportation, manufacturing and public utilities; and such other researches or experiments bearing directly on the various industries and occupations of the people of the United States as may in each case be deemed advisable."

To carry out this formidable programme the sum of $15,000 per annum is appropriated to each state and territory. The work of the stations is to be under the supervision of the Secretary of the Interior.

We shall probably have more to say on the subject of the Newlands bill at some future time. At present we wish to draw attention especially to the fact that the leading governments of the world, including our own, appear to be at last completely cured of their once deep-rooted aversion to the word "research."

Are we not upon the threshold of an Age of Research such as the world has never before known?

Electricity

Testing Illuminants with a Camera.—An American company has recently been conducting a series of experiments on comparative illumination by means of photography. In each instance a photograph is taken by the light shed by the illuminant, and the plate developed for comparison with others. Obviously, the exposure in each instance is identical.

Electric Portable Saw Mills.—It is reported that electrically operated mills of the portable type are rapidly gaining in favor among lumbermen. In localities where water power is abundant and has already been partially converted into cheap electric power the portable sawmill is especially popular. According to the president of a firm which is manufacturing electric portable sawmills, the demand is fast increasing in the South and West at the present time.

The Use of Zinc Wire in Germany is a subject of much discussion at present in the electrical periodicals of Germany, due to the increasing scarcity of copper and because iron wires are not always satisfactory. Considering the conductivity of copper to be 100 per cent, that of aluminum is 58.4, that of zinc is 28.5, while that of iron is 12.5. Rules are given on the use of zinc wires in house installations and on the use of zinc cables and zinc bus bars, in the German periodicals devoted to the electrical trade.

Intensive Culture by Means of Electric Light.—Lecturing before the Royal Institution of Great Britain, Prof. F. Keble recently stated that Germany, Italy and California were great seed-growing countries on account of their high intensity of sunlight. Since experiments have demonstrated that the yield of crops may be increased materially by artificial light, Prof. Keble suggests that perhaps in the distant future it will be possible to reinforce the obscure daylight that exists in England by the light secured from electric lamps.

Proposed Electrification of Canadian Railroad.—According to a statement recently made by an official of the Canadian Pacific Railway, a plan of electrifying its lines through the mountains on the British Columbia division is now under consideration. Ability to haul heavier loads with greater speed on steep grades, the unimpaired efficiency despite intense cold and snow, and the economies effected in operating expenses are among the inducements offered by electrical operation over steam operation.

High Gasoline Cost and Electric Vehicles.—Among other things, the increasing cost of gasoline is rapidly popularizing the electric vehicle to a degree never before attained. According to the Electric Vehicle Association, the average cost of electricity per mile for a 5-ton unit has been found to be as low as 4 1-10 cents. Consequently an electric truck on this basis operating 35 miles per day would cost $1.43 and for 50 miles per day $2.05 for current. And it should be remembered that in the case of the electric vehicle, in marked contradistinction to the gasoline vehicle, the greater the number of units in operation the lower will be the cost of motive power. In recent years electric current has been steadily diminishing in cost.

Electric Pocket Lamps in Verdun Fighting.—Attention has been called before in these columns to the wide employment of electric pocket lamps in the present war. According to a special correspondent of the New York *Times*, electric pocket lamps have played an important rôle in at least one engagement around Verdun, namely, the retaking of the Haudromont quarries by the French, of which he says in part: "Under ground in the quarries the darkness was absolute save when bursting grenades showed brief visions of carnage and terror. Friend often grappled friend, until the French adopted the plan of fastening an electric pocket lamp to the tunic button. The light gave the Germans a better mark, but enabled the French to rally together and sweep the foe back in the final rush en masse."

Electrified Oat and Potato Crops.—According to the *Electrical Review*, a Miss Dudgeon of Dumfries, Scotland, has for some years conducted important experiments and observed the effects of electricity upon the growth of potato and oat crops. Most satisfactory results were experienced with the potato crops in three successive years, the increased yield per acre with electricity being 1,204 pounds in 1912, 1,456 pounds in 1913, and 2,576 pounds in 1914. In oats the difference was most conspicuous right from the beginning of the experiment, and the electrically treated crops suffered less than others from the drought which prevailed. The difference amounted to 31 per cent in grain and 31 per cent in straw in favor of electricity. The Dumfries experiments prove that under the influence of the electric discharge the ingredients in the soil are more soluble and more easy of assimilation; that by the aid of electric current sap is enabled to flow more vigorously and the formation of sugar and starch increases; also that respiration, absorption and evaporation are accelerated.

Science

German Geographical Studies in Poland.—The German provisional government in Russian Poland has established, with headquarters at Warsaw, a "geographical commission," which will undertake elaborate investigations of all branches of Polish geography, including geology, climatology, ethnography, etc. Prof. Dr. Max Friederichsen, of the University of Griefswald, has been appointed scientific director. The commission proposes to publish a geographical handbook of Poland, and also a series of memoirs on special topics under the title "Beiträge zur Landeskunde von Polen."

Aeroplane Mail Service.—Bids were opened on May 13th at the Post Office Department, in Washington, for aeroplane mail service on seven routes in Alaska and one in Massachusetts, with the disappointing result that the only bid received was for service between Seward and Iditarod, Alaska, a distance of 380 miles, at $45,500 a year. This route, with overland transportation, now costs the Government $22,865 a year, but other routes where it is proposed to try aeroplane service cost as much as $100,000. The proposed aeroplane route in Massachusetts is from New Bedford to Nantucket. The lack of bidders is ascribed to the fact that aeroplane manufacturers are busy with war orders.

The Nutritive Value of Highly Milled Flour.—The U. S. Public Health Service has stirred up a hornets' nest among the milling interests of the northwest by the publication of a paper by Messrs. Voegtlin, Sullivan and Myers, which, under the innocent title of "Bread as Food," severely arraigns the dietary character of the highly milled corn and wheat flours now commonly used in this country. It is claimed that the vitamines (which now figure so conspicuously in the literature of dietetics) of the grains in question are chiefly located in the bran and germ, which are largely eliminated by the modern roller process of milling; and deficiency in vitamines leads to the prevalence of such diseases as pellagra and beriberi. The Northwestern Millers' Association has protested against the publication of the paper above mentioned (which is a preliminary announcement of data to be published in a bulletin of the Hygienic Laboratory), declaring that the conclusions of its authors are unwarranted by the facts.

The Araroba or Goa Powder of Brazil forms the subject of an interesting report from Consul Robert Frazer, Jr., stationed at Bahia. The world's supply of this powder is said to come entirely from the State of Bahia. From it is obtained the substance known as chrysarobin, used in the treatment of skin diseases; especially psoriasis. The trees from which this product is obtained grow wild and are known locally as *amargoso do matto*. The substance is found in the form of a pulp or small solid masses in crevices of the heart-wood, and is said to be a morbid growth. The trees are felled and split open, and the damp lumps of araroba are removed, dried and finally powdered. It is of a bright yellow color when extracted, but turns to various shades of yellowish brown. In some cases a single tree yields as much as 60 to 65 pounds. A very caustic liquid is found in the tree in connection with this substance. Both the araroba powder and this liquid are very dangerous to handle. Mr. Frazer states that "those engaged in the work for any length of time, although protected by gloves and masks with glass eyepieces, invariably lose their hair, eyebrows and eyelashes, and sometimes even become blind." The powder is packed for transportation in hermetically sealed tins, enclosed in wooden cases.

Precautions Against the Introduction of Plant Diseases.—A recent paper by Mr. G. R. Lyman describes the difficulties with which the Federal Horticultural Board has to deal in the inspection of plant material imported by the U. S. Department of Agriculture for experimental and introduction purposes. Commercial importations do not, as a rule, present any serious difficulty, as the variety of host plants involved is not great and the importations are usually from countries where the diseases are well known. The importations of the Department, on the other hand, come from every part of the world, and the variety of host plants is almost unlimited. Both host and disease may be new and hence potentially dangerous. There is a specially constructed inspection house in Washington where all such importations are received, and the packages are opened in the presence of the inspectors, all wrappings being burned. After a rigorous examination the material is passed, if apparently clean, burned if dangerous diseases are found, ordered fumigated, where pests can be thus eradicated, or, lastly, ordered grown in quarantine. There is a special quarantine greenhouse, adjoining the inspection house, where suspicious plants may be isolated and all plants are grown under close observation.

Automobile Notes

A Practical Speed Indicator.—It is stated that in some places in England motorbus companies are compelled to fit their vehicles with a hooter that automatically gives warning when a speed of twelve miles an hour is exceeded.

Automobiles and Game Destruction.—Evidence is accumulating, especially from the western states, that the automobile has become an important factor in the extermination of game of all kinds, as its speed and ground covering abilities enable sportsmen to make hunting expeditions more frequently; and moreover, many motor owners who ordinarily take no interest in sporting, have taken to game killing as a new and, to them, novel use of the machine, all of which is hastening the exit of our rapidly disappearing wild animals and birds. It is also claimed that the automobile is being widely utilized to enable their owners to violate the game laws and evade the game wardens.

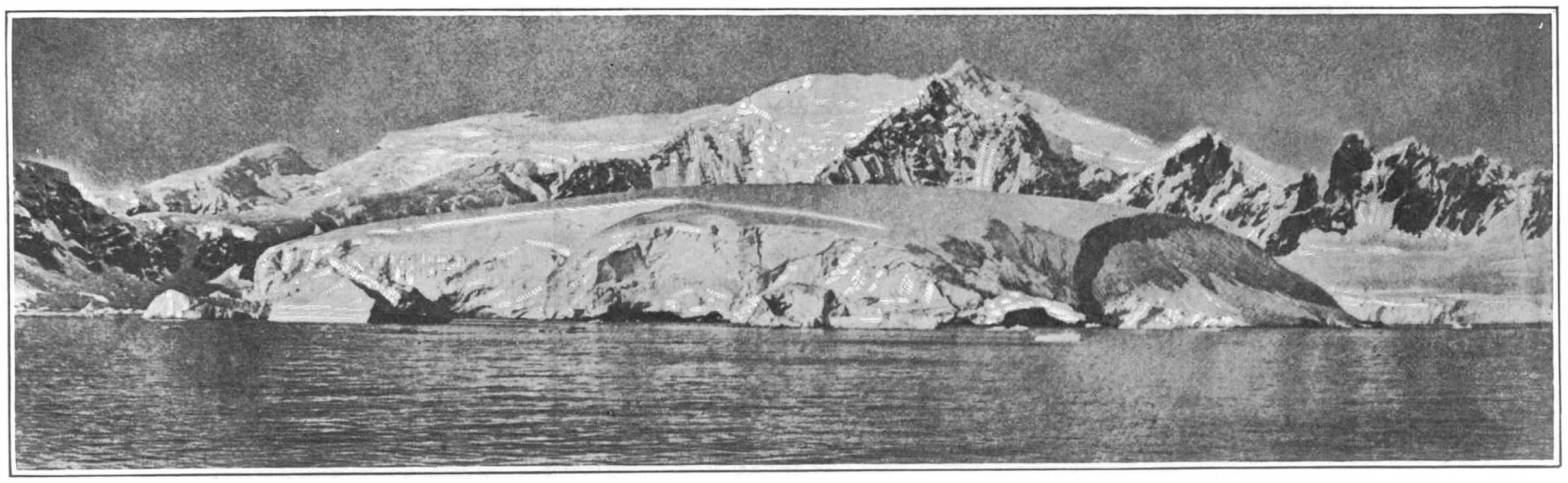
A Good Roads Photographic Contest.—The National Highways Association announces a prize contest for photographs that can be used for demonstrating the needs and advantages of good roads. The contest is open to everyone, whether a member of the association or not, and any number of pictures can be submitted. The photographs must be of some road within the United States, and may show good or bad roads, as long as they tell a story. Cash prizes to the amount of $2,600 are offered, ranging from $500 to $5, there being 166 prizes in all. The contest is open until November 7th, and particulars can be obtained by addressing "Good Roads Everywhere Photograph Contest" National Highways Association, Washington, D. C.

Lubricating Gear Boxes.—Speaking of gear-box lubrication, *The Auto* says, "The majority of modern cars have their gear-box designed to retain oil as a lubricant, which for this purpose is preferable to grease. In regard to quantity some experiments conducted at the National Physical Laboratory showed that this had a considerable effect on the efficiency. Running on top gear, a certain car gave the following results: With the gear-box full of oil 74 per cent of the power delivered to the gear-box was transmitted to the propeller-shaft; 90 per cent when three quarters full; 94 per cent one half full, and 97.5 per cent when one quarter full." Of course, if the supply of lubricant is kept as low as indicated here it would be necessary to make renewals frequently and systematically.

The Popular Light Car.—Although the cyclecar was a fizzle, as was anticipated by everyone acquainted with motor mechanics and road conditions, there is an undoubted demand for a small car that is reasonably light in weight and moderate in power, combined with as complete simplicity as is compatible with convenience and efficiency. The people who want such a car are not merely those who cannot afford anything larger, but there are many owners of big, high-powered cars who realize that it is not reasonable to wear out a big car that is costly to buy and expensive to operate on trivial errands that can be much better and more conveniently done with the smaller machine; and this demand will increase as people get over the habit of buying a new car every year.

Is the Chamois Dangerous?—A number of statements have been published to the effect that the pouring of gasoline through a chamois skin in a funnel will generate enough electricity to ignite the gases, unless the funnel is grounded on the tank. This is contradicted by Professor Foley of the Indiana University. He says, however, that when the atmosphere is very dry, as it usually is on a cold, clear day, a man may become charged by scuffling about on a clean, dry floor, or his clothing may become electrified by friction, as noticed sometimes when combing the hair. Under such circumstances, pouring gasoline through a funnel, whether or not there is any chamois in it, gives rise to induced charges that are quite too complicated to undertake to explain in a few words. Such charges might fire the gas.

Thermo-Syphon Cooling.—An advantage claimed for the thermo-syphon system of cooling in cold weather is that the cylinders are brought to a correct operating temperature very quickly, as the circulation of the water through the radiator does not begin until the water in the cylinder jacket becomes sufficiently hot. The quantity of water in the jacket is quite small, and consequently but a short time is required to warm this up to a working temperature, after which the circulation proceeds so gradually that the cylinder temperature is not affected by the passage of the remaining water in the circulation system. The pump, on the other hand, begins to circulate the water as soon as the engine is turned over, and consequently the cylinders do not reach their best operating temperature until all of the cooling water in the system has been heated.



Dr. Cook photo.

A view of Ranco Land in the Strait discovered by the Belgian Antarctic Expedition

Shackleton's South Polar Expedition

The Value of His Scientific Observations

By Henryk Arctowski

IN February, 1914, Sir Ernest Shackleton laid down before the Royal Geographical Society of London his programme of a new Antarctic expedition. The purpose of this expedition may best be appreciated from Shackleton's own statement. He wrote: "My object is to cross the South Polar Continent from sea to sea—from the Weddell Sea to the Ross Sea. The crossing of the South Polar Continent will be the biggest Polar journey ever yet attempted. . . . From a geographical point of view, the complete continental nature of the Antarctic can be absolutely solved by such a journey. . . . The geological results will be of the greatest interest to the scientific world. . . . The expedition will take continuous magnetic observations from the Weddell Sea right across the Pole. . . . All branches of science will be most carefully attended to, and the net result scientifically ought to be a large increase to human knowledge; but, first and foremost, the crossing of the Polar Continent will be the main object of the expedition."

This bold project of a trans-Antarctic expedition was most favorably received, and apparently without great difficulties Shackleton secured the necessary funds for the realization of his project.

He left Buenos Aires on board the "Endurance" on October 26, 1914, and in February, 1915, the last word was heard from him.

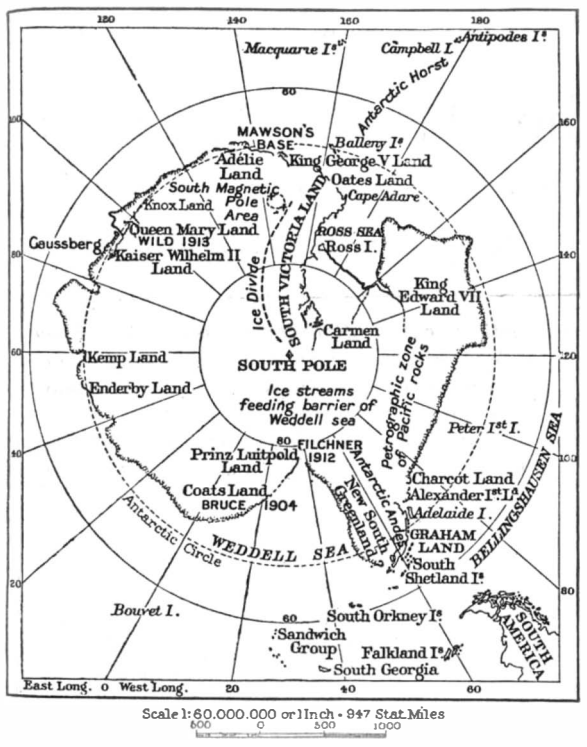
As we all know from the cablegrams that reached New York on June 1 and 2, Sir Ernest Shackleton met most adverse ice conditions in the Weddell Sea, and although he succeeded in discovering new land, he was prevented from accomplishing the object of his expedition.

No attempt at a trans-Antarctic journey could be made. The "Endurance" was beset in the pack in January, and from then on the ice-fields remained closed and the ship was adrift. Shackleton speaks of strong gales and then of the normal "blizzards during the winter." The "Endurance" drifted southwest, reaching a farthest south of 77° in long. 35° W. Then the zigzag drift across Weddell Sea continued northwest. In June and July intense ice pressure was experienced. In August and September the "Endurance" was the focus of active pressure, and in October the ship was finally crushed by the ice, and sank on November 20.

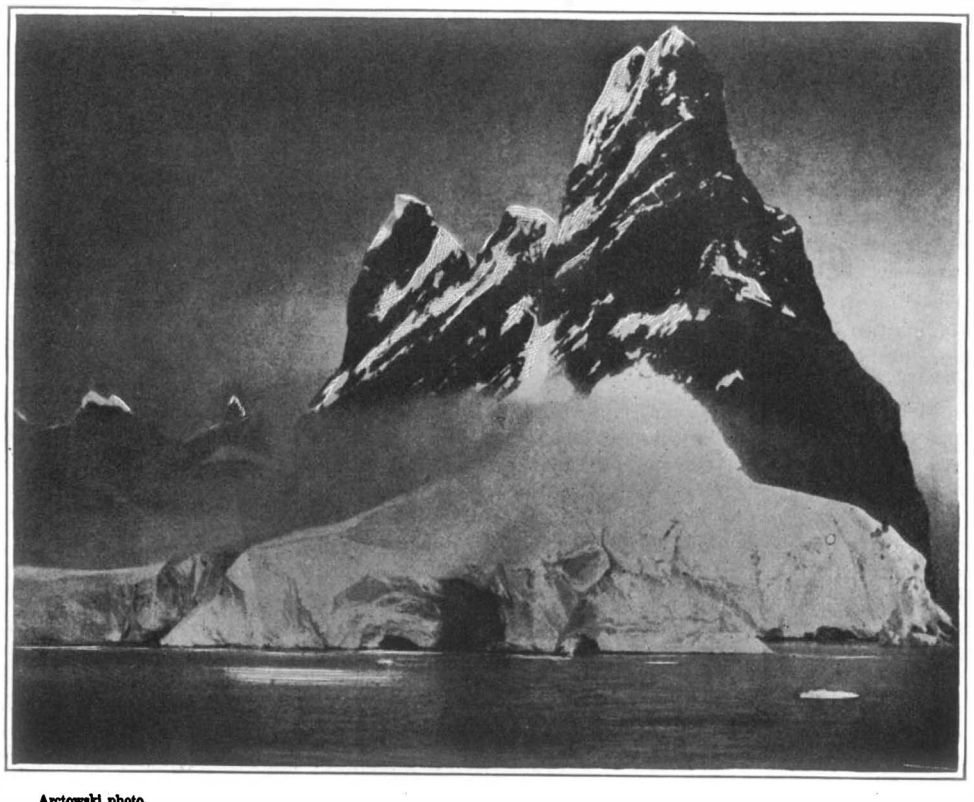
Much credit is due to Shackleton for having brought back his men across the ice and sea to the South Shetlands and for having successfully reached South Georgia in a boat journey.

Evidently a relief expedition will promptly be sent from the Falkland Islands or Argentina to rescue the main party, left on Elephant Island, and it is to be hoped that succor will reach these gallant men in time to prevent more suffering.

I think that probably none of the so numerous Polar expeditions has been more successfully conducted, and at the same time I may venture to say that in the history of Antarctic exploration it would be difficult to find another example of an expedition having accomplished so little of the programme originally set forth.



Professor David's sketch map of the Antarctic continent



Arctowski photo.

Cape Renard, a typical mountain of the Antarctic Andes

It seems evident that Shackleton counted too much on good luck and did not sufficiently take into consideration the possibility of adverse ice conditions.

Personally, I think, however, that Shackleton's programme was not wrong and that he could have succeeded if the year selected for his enterprise would have been the right year. In other words, I suppose that there are years, perhaps only exceptional years, when Weddell Sea is navigable to its most southern latitudes during the summer months, but that probably more frequently it is practically entirely covered with heavy pack-ice. Moreover, I would say that the study of these changes of the ice conditions of Weddell Sea may be of great scientific importance, and that the meteorological and oceanographical observations made by Shackleton's expedition will probably be of greater value than the observations that Shackleton would have made in a journey across the Antarctic continent.

I have to explain this statement. The prevailing winds observed near the Gaussberg by the German Antarctic expedition of von Drygalski have been easterly or anticyclonic winds. On board of the "Belgica," southwest of Graham Land, I observed in 1898 and 1899 a well-pronounced annual variation of the wind roses. During the winter months west and southwest winds predominated, while during the summer winds from the northeast and east were most frequent. It follows that while the continental anticyclonic winds, also observed by Mawson on Wilkes Land, extend south of Africa, all the year round, as far and even farther north than the Polar Circle, in the southwest of Graham Land, on the contrary, such winds predominate only during the summer, while during the winter the sub-Antarctic cyclones travel farther south, so that all wind directions may be observed. In other words, the Antarctic barometric high pressure area shifts periodically, and in the Weddell Sea, where all the ice drifting with the winds from the east towards the west is accumulated, the ice conditions must be greatly influenced by the changes of the intensity and extent of the Antarctic anticyclone that may occur from season to season or from year to year.

But with the course of years the general distribution of the atmospheric pressure may vary slightly. Such changes have been observed and studied by Hildebrandsson, by Lockyer and others. I myself have devoted much time to the study of the North American data. It follows from all these researches that the variations from normal conditions observed in one region of the globe are influenced and influence the variations observed simultaneously, or later on, in other regions. It follows that in the course of the years the center of the Antarctic anticyclone must change its position, and that for

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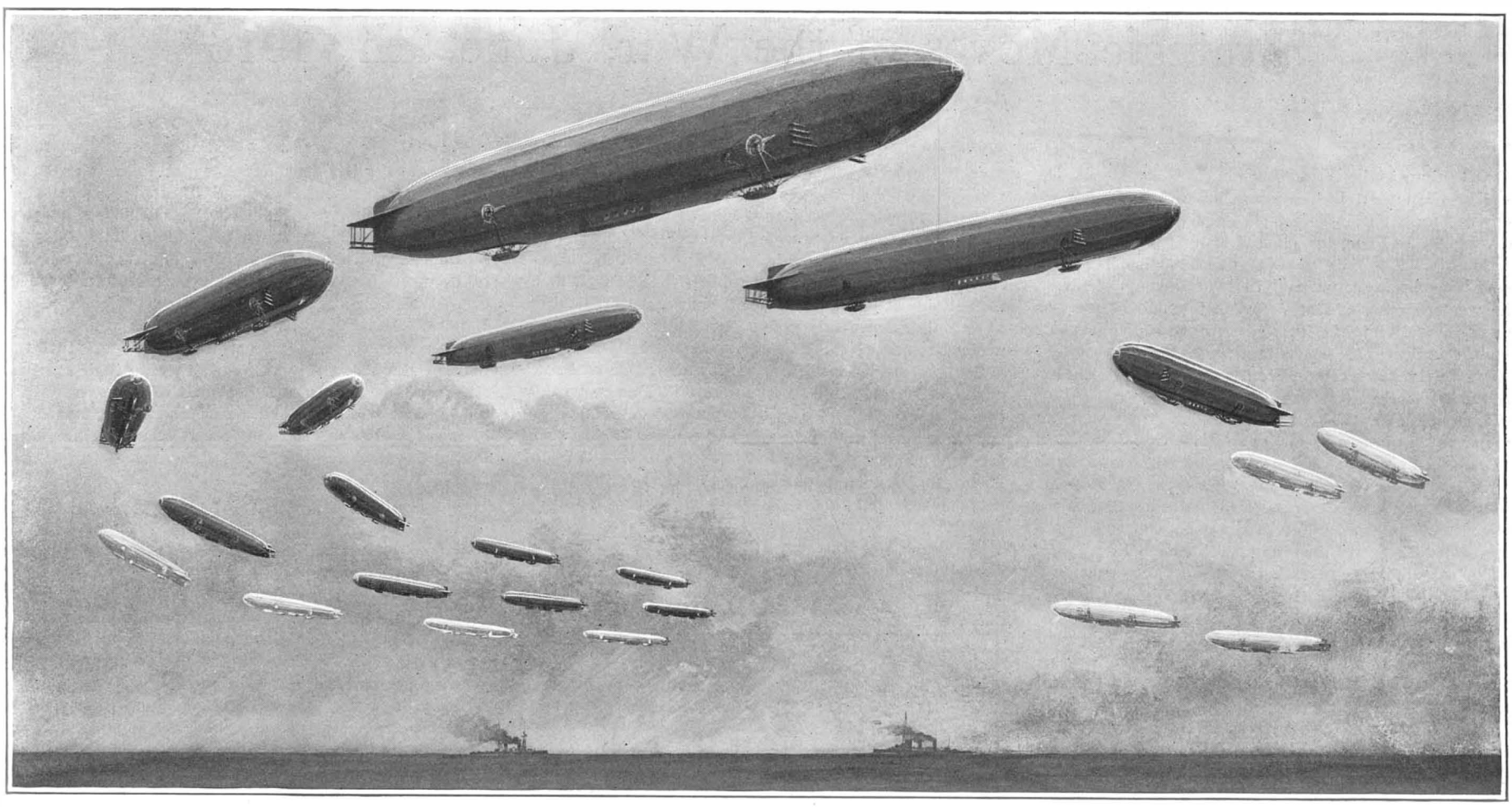

Comparative Zeppelin strength of Germany, France and Great Britain at the outbreak of the war. On the left, thirteen German ships in commission and four (in white) building; on the right, above, one French ship built and two building; on the right, below, two British ships building

Mastery of the Air vs. Control of the Sea

Zeppelins as Observation Towers for the German Fleet

By Baron Ladislas d'Orcy, Member, American Institute of Aeronautical Engineers

THE following article was written three weeks ago. Since then the great battle off the coast of Jutland has been fought. The advantage possessed by the German fleet in the early hours of the engagement bears out the author's contention that Great Britain's near-sighted navy, though master of the sea, is badly handicapped by Germany's mastery of the air above the sea, which gives the German fleet an eighty-mile radius of vision.—EDITOR.

THERE is such a thing as *air power*. When a squadron of German Zeppelins* is capable of crossing the 400 odd nautical miles which separate Germany's North Sea coast from English shores, when it can discharge two tons of shells per vessel, ward off British fighting aeroplanes and safely return to port without being seriously interfered with—which is mostly the case—then that airship squadron indubitably proves the existence of air power.

Sea power is chiefly a matter of construction, training and numbers; so is air power. Only a fleet comprising vessels of all types in due proportion can effectively exercise sea power; the same rule applies to air power. To rely only upon aeroplanes and anti-aircraft guns for fighting Zeppelins is just as contrary to sound military science as it would be to intrust the defense of a maritime country entirely to coast batteries and mosquito craft.

To be sure, air power does not yet impose itself with as overwhelming a force as sea power; but this is due only to circumstances, as aircraft, being still in the initial stage of their development, cannot yet fully exercise the functions for which they are ultimately intended. Some future day air power will surely dispute sea power and finally become supreme; and there are already indications at hand where air power is beginning to overlap on sea power.

By opposing faster and heavier-gunned battle cruisers and a larger number of dreadnaughts to those of Germany, Great Britain has paralyzed German shipping and has bottled up the Kaiser's High Sea Fleet in the Kiel Canal: she thus rules the seas. Still an inferior German battle cruiser squadron succeeded several times in raiding English coast towns, escaping—save once—without being intercepted and forced to fight. Why? Simply because while England rules the seas, Germany rules the air above the seas, or more correctly speaking the air above the North Sea.

Great Britain has no Zeppelins, *i. e.*, rigid airships capable of great endurance, for reconnoitering the North Sea; and as seaplanes do not possess a radius of action sufficient to carry out this duty, Sir John Jellicoe's Grand Fleet has to rely on its 30-knot scout cruisers, whose range of vision is limited to 20 miles, for gathering information about the enemy's whereabouts. Observation balloons and kites offer but poor substitutes for long range airships, whose speed and movements are independent from naval vessels, whereas balloons and kites are anchored to their mother ship and therefore are largely dependent on the latter's speed.

Now turning to the German "system" we find that a fleet escorted by Zeppelins, flying at a height of 5,000 feet and at a speed of about 60 knots, can detect the enemy at a distance of 80 miles, *i. e.*, at a range four times greater than the one possessed by British naval scouts. The enormous tactical advantage gained thereby for the Germans has well been illustrated by the latest naval raid on Lowestoft, where, owing to their scout airships, the Germans were able to keep at a safe margin from the British battle cruiser squadron's ever-watchful "eyes."

Such is the influence of air power upon sea power. This extraordinary situation, where a fleet, gun for gun and ship for ship the superior of its foe, cannot prevent the latter—for lack of swift information—from raiding the shores of the country which is top dog on the sea, makes it worth while to examine the underlying causes which brought about this condition.

For the past ten years the great military nations of Europe were all engaged in building up airship fleets; but it seems, in the light of subsequent events, that Germany alone realized from the beginning the exact nature of the advantages a persistently followed up airship policy would confer upon her military and naval forces. The nations now forming the Grand Alliance seemed chiefly concerned with the development of the aeroplane, convinced as they were that a fleet of such mosquito craft would quickly be able to put out of action any "gasbag," as airships were contemptuously referred to by their detractors.

Still, for some time it looked as if France, and, to some extent, Italy too, were determined to meet Germany's steadily growing airship fleet in the only way that might have put them on equal footing with the aerial forces flying the black-crossed ensign: by matching airship with airship. But if such was their object, both Latin countries were badly handicapped in this realization by a policy of misplaced patriotism, which favored the building of non-rigid and semi-rigid airships exclusively, these types being national products, while it barred vessels of the rigid type for the sole reason that the latter had been originated in Germany.

The Germans had no such scruples. While Count Zeppelin was exerting every effort to improve his airships, the German army authorities tried to purchase in France one airship each of the semi-rigid Lebaudy and the non-rigid Astra types. Having failed to achieve their object the Germans resolved to copy the vessels they could not buy: this is how the Gross-Basenach and Parseval airships came into being. It is but fair to add that, since this "inspired" inception, vessels of the above named types have largely developed upon original lines.

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GERMANY (Built and building: 31 airships of 742.7 gross tons.)
- Commissioned: 13 airships (312 gross tons.)
- Building 4 airships (110.8 gross tons.)
- Previously built, scrapped or lost 14 airships (319.9 g.t.)

GREAT BRITAIN (Built and building: 3 airships of 76.6 gross tons)
- None commissioned Building 2 airships (54 gross tons.)
- Previously built, lost: 1 airship (22.6 gross tons)

FRANCE (Built and building: 2 airships of 63.5 gross tons.)
- Commissioned 1 airship (18.5 gross tons)
- Building: 1 airship (45 gross tons) Unofficially reported.

NOTE—For sake of convenience all rigid airships are listed above as Zeppelins; Tonnage expressed gross or total lift, which furnishes a better basis of comparison than volume.

Table showing comparative strength of the Zeppelin fleets of Germany, Great Britain and France on August 1st, 1914

* Throughout this article the term *Zeppelin* is used in a generic sense, *i. e.*, meaning a rigid airship, just as the term *dreadnaught* is employed for describing an all-big-gun ship.

Strategic Moves of the War, June 9th, 1916

By Our Military Expert

FOR almost the first time in the course of the European war, the inauguration of a Russian offensive movement in force, attended by some measure of success, has been accompanied by a closely veiled censorship. The bare news is vouchsafed, at the moment these lines are written, that the fortress of Lutsk, the western apex of the Volhynia triangle of fortress towns, has fallen to the Russian advance which previous reports indicate as extending from the marshes of Pripet to the Bessarabian frontier, over a distance exceeding 250 miles.

Petrograd claims the capture of about 55,000 Austrian troops so far in the movement; as the Austrian strength which is currently reported to be holding the section of the line under assault seems to be about 600,000, this capture represents about one eleventh of the entire strength, no inconsiderable proportion, when the casualty probabilities are also taken into consideration.

The reported fall of Lutsk seems strange when its position is compared with that of the Dubno fortress. According to information which has remained unchanged for months, the Russian line was between 25 and 30 miles east of Lutsk, while at Dubno it inclosed the city on two, almost three sides—yet there is no mention of the evacuation of Dubno. This city is on the direct line from the key fortress of Rovno, which has remained in Russian hands, to Lemberg. If a general advance has been attended with success as claimed, it would be important and interesting to know the situation with regard to Dubno. Perhaps strategy indicated an easier way to secure its evacuation than at a great blood-cost, for the occupation of Lutsk establishes a very real threat to the communications of the more southern fortress, and further Russian success will undoubtedly force an Austrian retirement.

The line of advance upon Lutsk is a most logical one, bearing rich promise of gain if successful. Lutsk lies at the head of a short branch line of railway which springs to the southward from the main line extending from Rovno to the important junction of Kovel, which is a point of necessary gain before the junction of greater railway control at Brest-Litovski can be attacked. The latter, as a junction, is most necessary to Russian success on account of the radiation of roads on the west, of which there are three, one leading northward to Grodno and Vilna, one west to the next junction at Lukov and a third and shorter line, highly valuable in a restricted advance, to Kholm, directly to the south. It is clear then that the primary objective is Kovel, as a step toward Brest-Litovski.

The topography of the land practically divides the Russian line from Riga to Roumania into two almost equal sections. (For map of region between Riga and the Roumanian border see SCIENTIFIC AMERICAN of April 8th, 1916, page 380.) In a general western direction from the district south of Pinsk, marsh-lands, lakes and streams form a broken chain to the Bug River, which is paralleled in the section by the north-and-south railway from Brest-Litovski to Kholm, as mentioned above. This chain of water barriers forms a comfortable rest for the right flank of the advancing Russian line, one much more easily held than if it consisted of practicable terrain throughout its extent. And while an advance in strength is reasonably secured by this natural feature, it becomes more of a menace to its Teutonic defenders the farther westward the line extends; for full possession of the country to the southward as far as the Bug would automatically require evacuation of the northern position held by the Germans unless the advance was repulsed. There has been more consistent activity in the neighborhood of the Styr and Tchartorysk on the part of the Russians for months than in any other sector; the reason is obvious—to secure the right flank against the day of general advance.

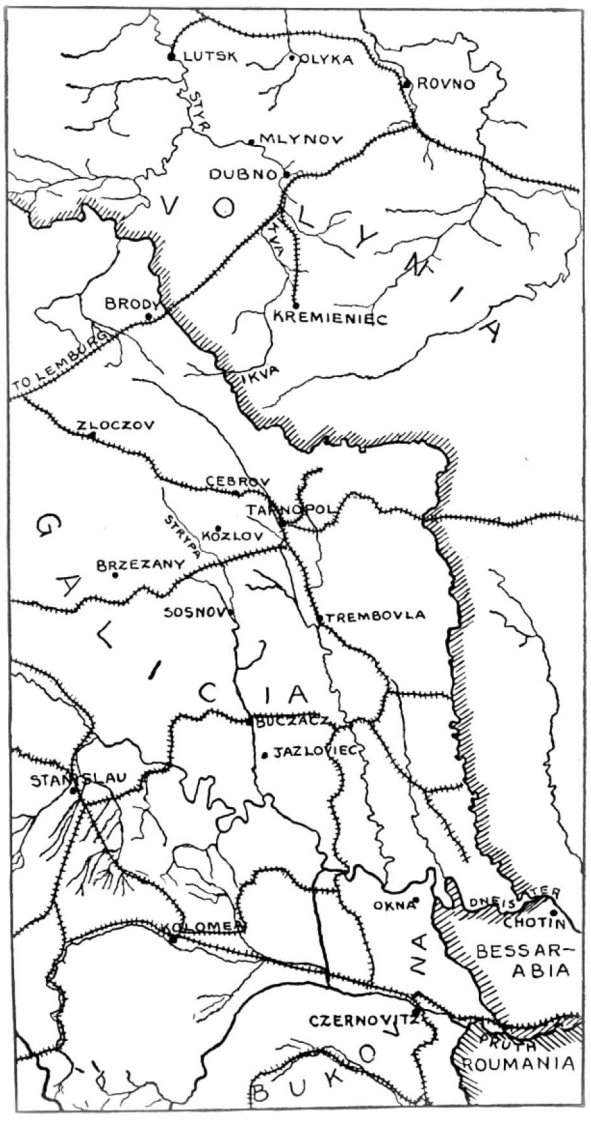
If this be the long expected Russian assumption of the offensive instead of a local activity—and it seems to be the former, for the strength of the attack combined with the length of the line appear to indicate it—it may mean either one of two things:

An immediate response to the Austrian attack upon Italy and an attempt to weaken the assaults which have continued for so long upon Verdun, by forcing the detachment of troops to the eastward; in this case, the offensive is a forced one and the bodies of troops engaged in it may or may not be thoroughly prepared in man-power and munitions, or:

It is definite indication that Russia has again surprised the world by being ready for major movements before she was expected to be—Russian mobilization in the first days of the war was complete long before even the German staff expected it.

After the long experience the Entente has had in this war, it is almost inconceivable that the high commands could repeat demonstration of their lack of concerted action and permit the most numerically powerful of their Allies to undertake major operations all alone—that is, without the active coöperation of other forces in other theaters of war. The dead Kitchener's army is available at last, so it is reported; the powerful forces at Saloniki seem ready for use, augmented by the lately arrived remnant of Serbia's army, some 100,000 strong. Will these armies let Russia go it alone? Or will some part of the great line in Flanders and France witness the attack of massed forces to prevent detachment of their opponents and their shifting eastward? And will the Macedonian frontier feel the tread of advancing hosts—for the same purpose, while Russia hurls her rejuvenated might upon the lines of Volhynia, Galicia and Bukovina?

With 800,000 Austrians massed against Italy and 600,000 on the Russian line, a total of 1,400,000, Austria may possibly possess a reserve of from 400,000 to



Region between Lutsk and Czernovitz where the Russians have launched a drive

600,000 men, although the latter figure is considered improbable. Russia would scarcely undertake a general offensive of this magnitude with less than 5,000 men per mile of front, for the sector, a million and a quarter in all. To oppose this, unless Austria could detach strong forces from the Italian front, even with throwing in her last reserves she could not muster over a million men to meet the attack, and that, at a late moment.

It scarcely seems possible that Germany could now give much material aid to her ally. Verdun has cost a very bitter price and the menace of the new British army becoming more of a disquieting specter with each passing day prohibits the material weakening of the northern half of the western line. The moment seems a most propitious one for the attempt to wrest the general initiative from the Kaiser's hands, for since the Marne and the great sweep of Russia through Galicia the Allies have never made any attempt to take the offensive except locally; Russia has gained by her stand at the Dvina time to rebuild her battered forces and arm and munition them properly with the vast reserve stores so necessary to a bitterly contested campaign; England has at least 3,000,000 available for action and 600,000 are situated on a strategic flank at Saloniki, ready to essay the clipping of Turkey from touch with her more powerful confederates of Europe.

The most interesting development to watch will be that of the dispositions by the Teutonic general staff to meet the newly made situation. Judging by past performances, the response of this brilliant body of soldiers should be startling by the effective correctness of it, even should fortune so favor the Entente as to compel Teutonic retirement to actual defense of the Empire. Many months ago the writer ventured the opinion that the real war would not begin until the Central Empires were compelled to take their turn on strict defense when the full benefit of concentrated interior lines would be had. And as nothing has since occurred to change the opinion, it is still adhered to. Perhaps its correctness may soon be demonstrated; perhaps not.

The Current Supplement

THOSE interested in the study of the heavenly bodies will welcome the article on *The Siderial Center* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT No. 2111, for June 17th, which discusses some considerations tending to indicate that Canopus occupies this important position. In these days when so many amateur yachtsmen are building fast scout boats *A New System of Navigation and Nautical Astronomy* will be widely welcomed, as the method described is so simple as to relieve the abstruse science of navigation of many of its terrors to the uninitiated. The article is written by an acknowledged authority, and is fully illustrated by diagrams. While icy cold weather, accompanied by much snow, was experienced by the armies in France during the first year of the war, the past winter, although much milder in temperature, was marked by the almost continuous fall of rain that flooded the trenches and made living in them a matter of great discomfort. This condition is described in *Winter in the Trenches*, which is illustrated by several excellent pictures. *Electric Truck Troubles* tells of the experiences of the early truck builders, and how the difficulties were successfully overcome. *The Mechanism of a Dream* treats, in an interesting way, of the operations of the mind when volition is in a state of suspension. *Chemical Gardens* illustrates and describes methods by which beautiful crystalline formations of various mineral silicates may be produced. These simple chemical experiments may be successfully performed by the younger members of the family. *Synchronous Gearing* explains some of the ingenious apparatus required for the successful operation of the printing telegraph, accompanied by illustrations and explanatory diagrams. Other valuable articles in this issue include *Artificial Seasoning of Timber; A Method of Drop-Measuring Liquids and Suspensions* and *Energy of Transformation during Horizontal Walking.*

The Death of Charles Sooysmith

ON Friday, June 2nd, Charles Sooysmith died at his home on Riverside Drive, New York city, and the world lost one of its foremost civil engineers. He was in his sixty-first year.

Mr. Sooysmith was born in Buffalo, N. Y., and studied civil engineering both in the Rensselaer Polytechnic Institute and in the Polytechnicum of Dresden and other European technical colleges. During 1879 1880 he was Assistant Superintendent of the Maintenance of Way Department of the Atchison, Topeka & Santa Fe Railroad, following which he founded an engineering firm, which undertook many important works. In the course of these he introduced the freezing method of excavation in this country and secured a number of patents for its use in subaqueous tunnels. He also used the caisson system for the first time. Mr. Sooysmith was prominently identified in the construction of the New York subway, and for a time was a member of the Metropolitan Sewerage Commission. More recently he was connected with the building of the Belmont-McDonald rapid transit tunnel.

Nonslip Horseshoes Needed in Cuba

THERE should be a ready sale in Havana, Cuba, for a nonslip horseshoe. Most of the streets are paved with vitrified brick. They are as hard as iron, and the city's heavy traffic has worn them perfectly smooth, so that after a shower they are very slippery. Over 2,000 one-horse cabs are in use in Havana, and it is a common sight to see a horse fiat on the ground from having slipped. At other times a horse will "skate" with his own momentum. There are also thousands of draft animals owned in the city, and the slippery streets prevent their pulling a full load, for shoes soon wear smooth and afford no purchase on the bricks. A nonslip horseshoe would fill a real need.

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.*]

Rifle Sighting from an Engineer's Standpoint

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the subject, "How the rifle is sighted," and having read your able article of December 11, 1915, and the subsequent correspondence by crack shots, I desire to present the matter from an engineer's standpoint.

All engineer's sights used for exact work are based on the principle that they bisect the line of sight and the object sighted. Considering these sights in the order of their accuracy, the telescope stands first. In this instrument the line of sight passes through a focal point and is bisected vertically and horizontally by fine cross hairs, and when the instrument is trained on an object so that the cross hairs bisect the object vertically and horizontally then the telescope is in exact axial line.

The second class of sight is that of the surveyor's compass. In this instrument the first sight is a fine vertical slot in an upright bar on the near side of the compass; the second sight is a corresponding slot in an upright bar on the opposite side, and in the center of this latter slot is a fine vertical wire. The line of sight passes through these slots and is bisected by the wire in the second slot, and when this wire appears in the center of both slots and also cuts the object sighted the instrument is in accurate line.

The third class, peep hole sights, are used where only approximate accuracy is required and the distances sighted very short.

The fourth class, open sights, common to the rifle, are not used on any engineer's instruments to my knowledge.

Assuming that the telescopic sight is objectionable for general use, there is no good reason why the principle of bisecting sights in a modified form should not be applied to the rifle. It would give speed and accuracy, and while the cost would be somewhat greater, this would be offset by saving of ammunition, and in military use it would be a saving of men.

ROBERT YATES.

Passaic, N. J.

The Scientific American in South America

To the Editor of the SCIENTIFIC AMERICAN:

Perhaps you will be interested in an experience I had at the local library this afternoon. I entered to consult several books of reference, and was astonished to see the SCIENTIFIC AMERICAN on the table where only the daily papers are kept. There was a man just finishing his reading of it, and three others quite evidently awaiting their turn. I engaged them in conversation, and found that one was an official of the railway, two were machinists, and the fourth was a lawyer. The last told me that he looked forward anxiously to each arrival of the SCIENTIFIC AMERICAN because your articles on the strategy of the European war gave him more and clearer real news than all the daily papers.

On inquiring at the desk why the SCIENTIFIC AMERICAN is kept on the daily paper table, I was informed that it is in such constant demand that it must be kept where it can be quickly reached. I have also found it on the tables of the most exclusive clubs of South America, and much sought after by the members. It may seem a paradox, but it certainly is a better export medium than many that are so-called.

E. C. DE VILLAVERDE.

Georgetown, Demerara, British Guiana.

The Giant Kew Pine

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in reading Mr. John Beach's letter in your issue of January 15, 1916, identifying the Giant Kew pine with the variety known in Florida as the Smooth Cayenne. I doubt the latter could ever reach the proportions of a Giant Kew, given suitable climatic conditions, and although the two may be allied, they may not be synonyms of the same variety. Still, I may be wrong.

The Giant Kew was first introduced from the Kew Gardens to Ceylon, where, I believe, it was grown at the Botanical Gardens, Peradeniya. The variety did not appeal to the people especially, as the plant required some amount of cultivation and attention, and, if grown at all, it was only in small patches. Later, when the plant was distributed farther East, the innate industry of the Chinese quickly brought it to the fore, and large quantities are annually grown (especially in Sarawak) both for local and outside consumption.

The natives here call the variety "Nanas Pound," but otherwise the recognized name is "Giant Kew," and even the R. B. Gardens of Peradeniya, to which I had the pleasure of supplying a few thousand suckers while in Ceylon, knew it by that name, and it is the only name under which Messrs. William Bros., of Heneratgoda, Ceylon, trade in.

If the variety is an exotic, it is more so out East than West, and as far as I am aware, this variety has no disease out here, but not a little damage is done to mature and ripe fruits by nocturnal rodents when grown in the vicinity of jungles and forests.

It is quite possible that Giant Kew fruits do not travel well, owing to the pericarp being softer and the fruit itself more juicy and luscious than any other variety, but for canning and dessert purposes there are few fruits that beat it.

W. L. VANDER SLOTT.

Department of Public Works and Surveys,
Kuching, Sarawak.

Is there Not Some Use for Chlorophyl?

To the Editor of the SCIENTIFIC AMERICAN:

It is noticed that everything that is of wide distribution, or that is very abundant in nature, is of great importance to the daily well-being of mankind. It might be more conservative to say that almost everything, etc. As examples, iron, salt, oxygen, etc., may be mentioned. The use of all these antedates history.

I have often wondered why a substance so widely distributed as chlorophyl should not have been adapted to the uses of mankind. It would almost seem that Nature intended man to find a use for it, and was simply waiting until he "tumbled to it," to use an expression foreign to the dignified columns in which it will appear.

I have never heard of any extended use of chlorophyl nor of any investigations as to its adaptability. Has anything ever been done along this line?

ROBT. G. PILKINGTON.

Overhead Sprinkling for Truck Gardens

To the Editor of the SCIENTIFIC AMERICAN:

Your article on "Overhead Sprinkling for Truck Gardens" seems to imply that this form of applying water is quite novel in the East. Around St. Louis this has been in quite general use for the last three years, and possibly in an experimental way was tried out a year or two previously.

The truck farmers here usually utilize a wind mill to fill a tank from which they then distribute the water through galvanized iron pipes raised to the requisite distance from the ground on wood or galvanized iron supports. The orifices are usually simple holes drilled at proper angle into the pipes thus avoiding the expense of applying the small brass nozzles which your article speaks of.

The continued extension of the systems seems to imply that it has proved successful and economical, but of course it cannot compete with Texas, Louisiana and Florida for vegetables which are shipped-in, during January, February and at least a portion of March.

A. BLAIR RIDINGTON.

Feeding the Prisoners of War

By Our Berlin Correspondent

THE providing of adequate food to the prisoners of war raises a number of difficult problems, not only on account of the abnormal economical conditions created by the war, but of the unprecedented numbers of prisoners interned in the concentration camps. The well-being of these enormous masses belonging to all the enemy nations depends to a high degree on a continuance of a diet more or less in keeping with national customs, and, in the case of Orientals, on the observance of a stringent code of ritual laws.

In order to give due consideration to all these problems, the German War Department, some time ago, arranged for a course of lectures where the commissariat officers of German prisoner camps were initiated into the secrets of alimentary physiology and the art of cooking. Officers from 129 concentration camps attended these lectures, in connection with which an exposition was held.

Prof. Backhaus discussed the scientific principles of the feeding of prisoners, the various articles of food and the most suitable bills of fare; Dr. Rubens explained the rudiments of alimentary physiology, and Dr. Neumann dealt at some length with the question of bread supply. This problem is the more difficult as prisoners have to submit to the same limitations as the civil population, though some classes, the French and Russians in the first place, are used to a more abundant consumption of bread. In order to arrive, at least, at a partial solution of this problem, the War Department purchased large quantities of second-rate rye and wheat meal, which in itself would not be suitable for baking, but which could be mixed with other kinds of meal, not subject to government control. From this mixture, there was made, at the camp bakeries as well as by private firms, an additional bread which is kept for sale at the prisoners' canteens. By medical prescription, it is, however, supplied free to underfed prisoners, as well as to those doing hard work or who are otherwise difficult to feed.

The normal daily amounts of nutritive substances allowed for each prisoner are: 85 grammes of albumen, 40 grammes of fat, 475 grammes of carbohydrates, with a total of 2,700 calories (heat units). In the case of hard bodily work, a surplus of 10 per cent is allowed.

The following sample of a bill of fare prepared by the War Department may be of interest: Coffee with 30 grammes of sugar, or preferably soup containing 100 grammes of solid substance is given in the morning. A soup consisting of 30 grammes of soya meal, 60 grammes of fecula, and 10 grammes of fat has given especially satisfactory results. For the midday meal, there should be provided 750 grammes of potatoes and 300 grammes of vegetables, fresh or canned (or else, 40 grammes of dried vegetables). On three days in the week, this should be supplemented with meat (preferably twice fresh meat, and once salt meat), the prescribed amounts being 120 grammes with bones, or 100 grammes without bones. Another addition recommended by the War Department is 200 grammes of fish on two other days, and 150 grammes of pulse with at least 30 grammes of bacon, fat or meat preserves on each of the remaining days. Salt, spices and fat should be supplied in abundance. A supper which has proved itself highly suitable is 600 to 750 grammes of potatoes in their skins, with 150 grammes of herring or 100 grammes of sausage or 100 grammes of cheese; the potatoes in their skins can be replaced by a "potato salad," dressed with oil, vinegar and sugar, and mixed with green salad. Thick soups, made from 100 to 150 grammes of beans or meal, are likewise excellent suppers. Rice with dried or stewed fruit is also quite suitable. Russian prisoners are, of course, afforded an opportunity to indulge in the drinking of tea, their national beverage. Wherever available, skimmed milk should be used freely. In choosing and preparing the food, the special taste of each nation should be accounted for, as far as possible. This is not only humanitarian, but the wisest course to follow, since a given amount of food is utilized to the best advantage and with the best results for the well-being of prisoners, if prepared in accordance with the men's own cooking methods. This is why native cooks are employed in many camps.

In the case of Orientals, there is the additional difficulty of accounting for religious customs. Mohammedans, like Jews, eat no pork, the pig being considered unclean, while Hindoos would not touch beef, oxen being to them holy animals. Moreover, both Mohammedans and Hindoos make a point of only eating meat prepared by their own coreligionists, from cattle slaughtered according to a special ritual.

The director of a German Commissariat Office, Mr. Schiel, lectured on the subject of food storage, dealing with the several methods of storing meat, and of storeroom ventilation. Löffler's mouse-typhus bacillus was recommended against the mouse nuisance. The different criteria on which the condition of preserves should be judged—rusting tins, gas production, etc.—were discussed at length.

Captain Storp spoke on the employment of war prisoners in the performance of productive work. He laid stress on the economical bearing of the problem, mainly from the point of view that enemy consumers should supply some equivalent for their maintenance. Work allowing of rapid results should be given the preference, harvest work and moor culture in the first place.

Other lectures dealt with the rôle of sugar, the food value of the soya bean, the meat and fish supply, adulteration and testing of food, canteen operation, etc. A specimen dinner was cooked every day, at noon, and the afternoons were spent in discussing the lectures and visiting model plants.

An interesting adjunct to this course of lectures was an exposition where, beside a collection of plans of prisoners' encampments, speciments of prisoners' work were shown. A point has long been made in German military hospitals, of diverting the attention of patients from their ailments and the care for their future, by ordering them to do all sorts of manual work, which has been found to exert a most beneficial effect on the healing process. A similar course has been followed at the concentration camps, and the results, as evidenced by the specimens shown at the exposition, are gratifying as well as instructive. These exhibits, in fact, allow not only the variable cleverness of the men, but the widely different mental disposition and abilities of the various nations, their customs and habits to be gaged. Wood paintings, carved work, and water color paintings by French and Belgian prisoners, and drawings by Russians—mainly on war subjects—were on show. Interesting exhibits comprised carved wooden covers for prayer-books, toys, tankards and vases made from clay, and forks and knives forged from nails. An artist had even constructed a violin.

The Great North Sea Battle

Tactics of the Engagement as Described by British Naval Officers

"**First phase, 3:45 P.M.,** May 31.—Beatty's battle cruisers, consisting of the 'Lion,' 'Princess Royal,' 'Queen Mary,' 'Tiger,' 'Inflexible,' 'Indomitable,' 'Invincible,' 'Indefatigable,' and 'New Zealand,' were on a southeasterly course, followed at about two miles distance by the four 'Queen Elizabeths.'

"Enemy light cruisers were sighted and shortly afterwards the head of the German battle cruiser squadron, consisting of the new cruiser 'Hindenburg,' the 'Seydlitz.' 'Derfflinger,' 'Lutzow,' 'Moltke,' and possibly the 'Salamis.'

"Beatty at once began firing at a range of about 20,000 yards (12 miles), which shortened to 16,000 yards (9 miles) as the fleets closed. The Germans could see the British distinctly outlined against the light yellow sky. The Germans, covered by a haze, could be very indistinctly made out by our gunners.

"The 'Queen Elizabeths' opened fire one after another, as they came within range. The German battle cruisers turned to port and drew away to about 20,000 yards.

"**Second Stage, 4:40 P.M.**—A destroyer screen then appeared beyond the German battle cruisers. The whole German High Seas Fleet could be seen approaching on the northeastern horizon in three divisions, coming to the support of their battle cruisers.

"The German battle cruisers now turned right round 16 points and took station in front of the battleships of the High Fleet.

Beatty's Quick Maneuver

"Beatty with his battle cruisers and supporting battleships, therefore, had before him the whole of the German battle fleet, and Jellicoe was still some distance away.

"The opposing fleets were now moving parallel to one another in opposite directions, and but for a master maneuver on the part of Beatty the British advance ships would have been cut off from Jellicoe's grand fleet. In order to avoid this and at the same time prepare the way so that Jellicoe might envelop his adversary, Beatty immediately also turned right round 16 points so as to bring his ships parallel to the German battle cruisers and facing in the same direction.

"As soon as he was round he increased to full speed to get ahead of the Germans and take up a tactical position in advance of their line. He was able to do this, owing to the superior speed of our battle cruisers.

"Just before the turning point was reached, the 'Indefatigable' sank, probably from striking a mine, and the 'Queen Mary' and the 'Invincible' also were lost at the turning point, where, of course the high seas fleet concentrated their fire.

"A little earlier as the German battle cruisers were turning the 'Queen Elizabeths' had in similar manner concentrated their fire on the turning point and destroyed a new German battle cruiser, believed to be the Hindenburg.

"Beatty had now got round and headed away with the loss of three ships, racing parallel to the German battle cruisers. The 'Queen Elizabeths' followed behind, engaging the main High Seas Fleet.

Six Ships Attacked the Warspite

"**Third phase, 5 P.M.**—The 'Queen Elizabeths' now turned short to port 16 points in order to follow Beatty. The 'Warspite' jammed her steering gear, failed to get around, and drew the fire of six of the enemy, who closed in upon her.

"I am not surprised that the Germans claim her as a loss, since on paper she ought to have been lost, but as a matter of fact, though repeatedly straddled by shellfire with the water boiling up all around her, she was not seriously hit and was able to sink one of her opponents. Her captain recovered control of the vessel, brought her around, and followed her consorts.

"In the meantime the 'Barham,' 'Valiant' and 'Malaya' turned short so as to avoid the danger spot where the 'Queen Mary' and the 'Invincible' had been lost, and for an hour until Jellicoe arrived fought a delaying action against the High Seas Fleet.

"The 'Warspite' joined them at about 5:15 o'clock, and all four ships were so successfully maneuvered in order to upset the spotting corrections of their opponents that no hits of a seriously disabling character were suffered. They had the speed over their opponents by fully four knots, and were able to draw away from part of the long line of German battleships, which almost filled up the horizon.

"At this time the 'Queen Elizabeths' were steadily firing at the flashes of German guns at a range which varied between 12,000 and 15,000 yards, especially against those ships which were nearest them. The Germans were enveloped in a mist and only smoke and flashes were visible.

"By 5:45 half of the High Seas Fleet had been left out of range, and the 'Queen Elizabeths' were steaming fast to join hands with Jellicoe.

"I must now return to Beatty's battle cruisers. They had succeeded in outflanking the German battle cruisers, which were, therefore, obliged to turn a full right angle to starboard to avoid being headed.

"Heavy fighting was renewed between the opposing battle cruiser squadrons, during which the 'Derfflinger' was sunk; but toward 6 o'clock the German fire slackened very considerably, showing that Beatty's battle cruisers and the 'Queen Elizabeths' had inflicted serious damage on their immediate opponents.

Jellicoe's Fleet Arrived

"**Fourth phase, 6 P.M.**—The Grand Fleet was now in sight and coming up fast in three directions (divisions?). The 'Queen Elizabeths' altered their course four points to the starboard and drew in toward the enemy to allow Jellicoe room to deploy into line.

"The Grand Fleet was perfectly maneuvered and the very difficult operation of deploying between the battle cruisers and the 'Queen Elizabeths' was perfectly timed.

"Jellicoe came up, fell in behind Beatty's cruisers, and, followed by the damaged but still serviceable 'Queen Elizabeths,' steamed right across the head of the German fleet.

"The first of the ships to come into action were the 'Revenue' and the 'Royal Oak' with their 15-inch guns, and the Agincourt, which fired from her seven turrets with the speed almost of a Maxim gun.

"The whole British fleet had now became concentrated. They had been perfectly maneuvered, so as to 'cross the T' of the High Seas Fleet and, indeed, only decent light was necessary to complete their work of destroying the Germans in detail. The light did improve for a few minutes and the conditions were favorable to the British fleet, which was now in line approximately north and south across the head of the Germans.

"During the few minutes of good light Jellicoe smashed up the first three German ships, but the mist came down, visibility suddenly failed, and the defeated High Seas Fleet was able to draw off in ragged divisions.

"**Fifth phase, night.**—The Germans were followed by the British, who still had them enveloped between Jellicoe on the west, Beatty on the north, and Evan Thomas with his three 'Queen Elizabeths' on the south. The 'Warspite' had been sent back to her base.

"During the night our torpedo boat destroyers heavily attacked the German ships, and, although they lost seriously themselves, succeeded in sinking two of the enemy.

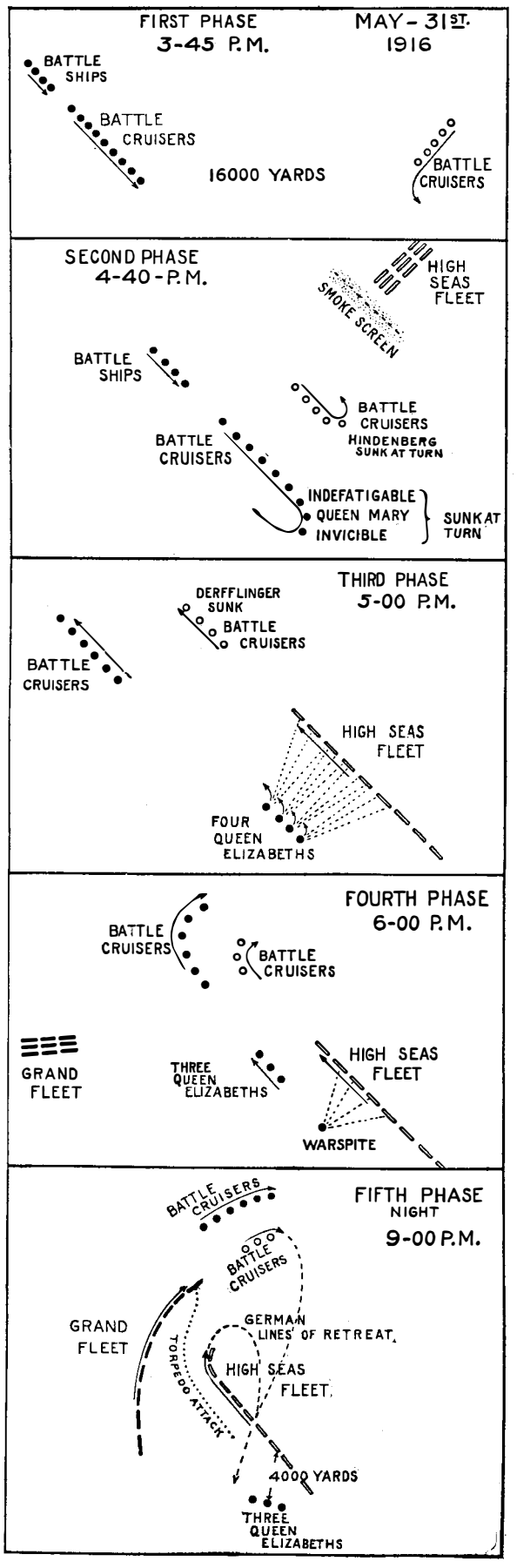
"Co-ordination of the units of the fleet was practically impossible to keep up, and the Germans discovered by the rays of their searchlights the three 'Queen Elizabeths' not more than 4,000 yards away. Unfortunately they were then able to escape between these battleships and Jellicoe, since we were not able to fire as our own destroyers were in the way.

"So ended the Jutland battle, which was fought as had been planned and was very nearly a great success. It was spoiled by the unfavorable weather conditions, especially at the critical moment, when the whole British fleet was concentrated and engaged in crushing the head of the German line.

"It was an action on our part of big guns, except, of course, for the destroyer work, since at a very early stage our big ships ceased to feel any anxiety from the German destroyers. The German small craft were rounded up by their British opponents and soon ceased to count as an organized body."

[The only connected and understandable description of the Battle of the North Sea is that given by the Glasgow Herald and cabled in full to the New York Times of June 6th. It has all the earmarks of being written by one or more naval officers, and it contains many intimate touches, which at once suggest an eyewitness possessed of thorough experience in the handling of ships and fleets. The fact that, if the maneuvers of the various phases of the battle are plotted out they piece together and form a logical sequence of events from the first gun to the escape of the German fleet by night through a gap in the British line, and that the story agrees closely with the Admiralty reports, is strong evidence that, in its main features, the description is substantially correct. We give the account verbatum. The diagrams, which have been drawn in this office, are based strictly upon the facts given in the article.

It should be understood that, in these diagrams, which illustrate the various phases of the engagement, the British ships are shown in full black and the German in outline. EDITOR.]



Diagrams of phases of the fight

Anti-Aircraft Guns

MR. LANCHESTER, the well-known English aeronautical expert, has examined the conditions under which aircraft can be successfully fired at from the ground. He states, and practice in the European war confirms his statement, that rifle and machine gun fire is out of the question for this purpose; for at a height of 7,000 feet the aeroplane can navigate in perfect safety and it would be difficult to hit it even a thousand feet lower.

"Not only would the velocity become so reduced as to render a hit capable of little mischief, but the time of flight of the bullet rising vertically to this altitude would be about eight or nine seconds, and the distance moved by the aeroplane 1,000 feet, more or less. Therefore it would be necessary to fire into quite a different part of the heavens from that in which the aero-

aeroplane was observed."

In order to overcome the deficiencies of the rifle bullet as far as aircraft are concerned (small range, low velocity and insufficient destructive power), several gun factories have produced so-called high-angle or anti-aircraft guns, which are now extensively used by the European belligerents. These guns can fire almost vertically an explosive projectile weighing from 8 to 40 lbs. to a height of over 20,000 feet; they are usually mounted on armored motor cars so as to possess great mobility.

In spite of this great mobility, it is nevertheless a case of mere luck if a single anti-aircraft gun succeeds in winging an aeroplane. It is therefore generally deemed necessary to have whole batteries of such guns fire at the same time if good results want to be attained.

Here are some data on foreign anti-aircraft guns, such as are now in use in the European war:

The German Army is chiefly provided with a 71 millimeters (30 caliber) Krupp motor gun which carries six men and sixty-two shells. The car weighs, complete, 7,100 kg., the weight of the gun alone being 1,230 kg.; the projectile weighs 5 kg. and has a muzzle velocity of 650 meters. This gun can fire up to an elevation of 75 degrees, the range being then 6,300 meters; the firing speed amounts to from 20 to 25 rounds per minute.

This L-gun [so-called on account of the uncomfortable length of its official name (Luftfahrzeugabwehrkanone)] has a maximum speed of 60 kilometers per hour; it can climb a grade of 1 in 5 (20 per cent), and carries a 12 mm. armor.

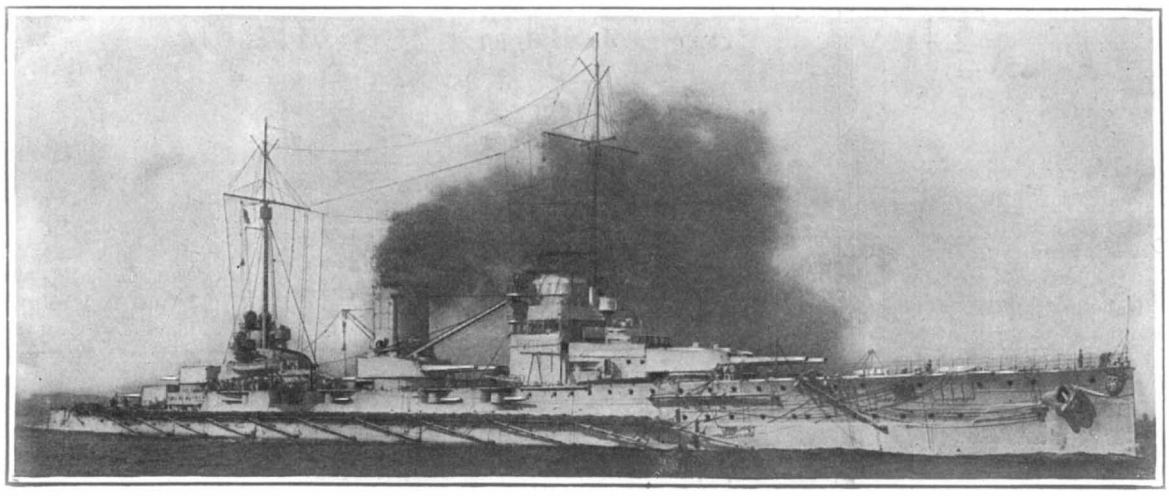
The anti-aircraft gun with which modern German submarines are equipped, being also a product of the Krupp factory, is very similar to the one just described. Its bore is 88 mm. and its barrel is 35 calibers long; it can fire from 20 to 25 projectiles per minute up to an elevation of 80 degrees, each projectile weighing 9.5 kg. The muzzle velocity is 800 meters.

Krupp has produced a still more powerful anti-aircraft gun, which has a caliber of 105 mm. and fires a shell weighing 15.5 kg. with a muzzle velocity of 800 meters up to an elevation of 60 degrees. This shell discharges a smoke trail to facilitate aiming. The 105 mm. L-gun is chiefly used for naval purposes and coast defense works; it is assumed on good authority that the new German dreadnoughts of the "Kronprinz" class and the scout cruisers of the "Wiesbaden" class each mount a number of these guns.

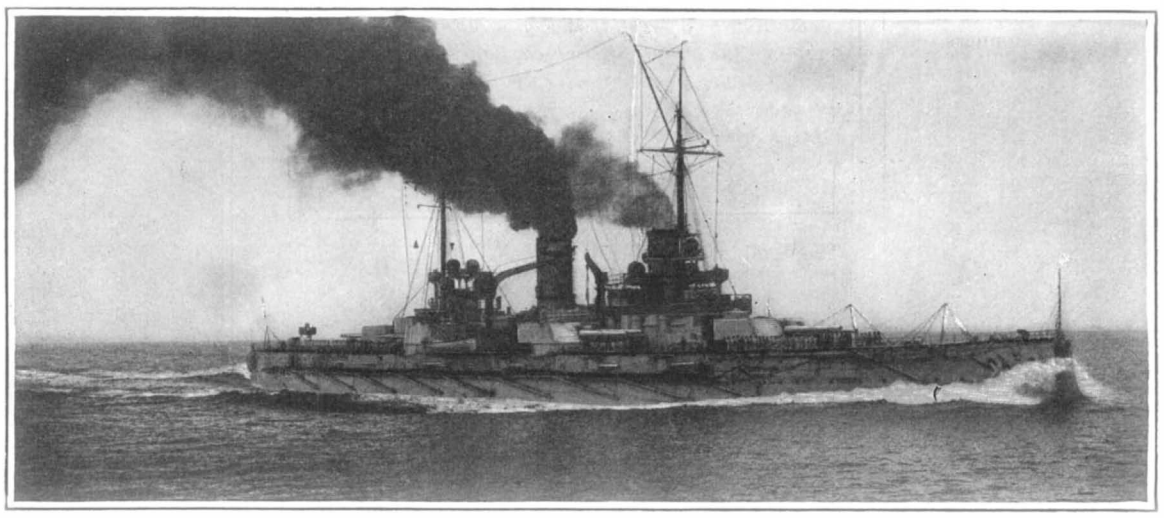
The Ehrhardt gun factory of Duesseldorf has also built a number of various anti-aircraft guns, all mounted on motor trucks whose caliber varies from 50 to 105 mm. The most remarkable of these is the 35 caliber 65 mm. anti-aircraft gun, which fires a 4.1 kg. projectile with an arc of elevation of 75 degrees and a muzzle velocity of 670 meters per second to a maximum height of 5,800 meters. At an arc of elevation of 43 degrees the range attains 10,000 meters. This gun can fire three sorts of projectiles: (1) an ordinary shrapnel containing 150 steel balls of 9 grams each; (2) a smoke shrapnel of 170 steel balls of the same weight; and (3) a "balloon grenade," which is particularly adapted for use against airships.

This gun is mounted on an armored motor car, which is protected by a 10 mm. steel plating on the top and the front part and by a 5 mm. belt on the sides; it weighs, complete, 6,650 kg.

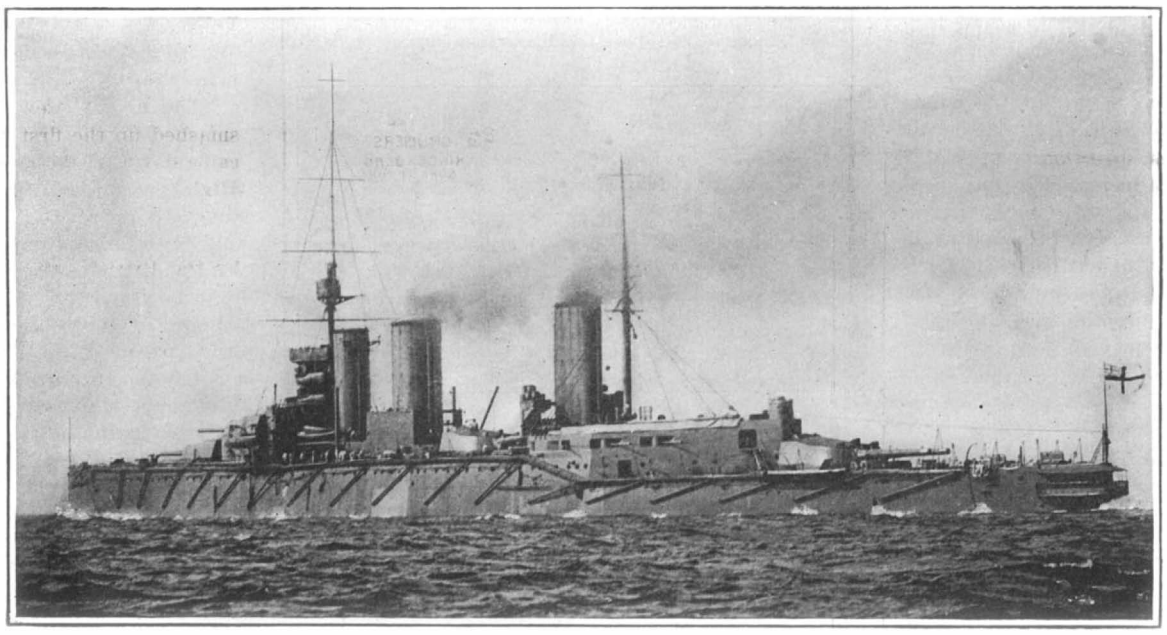
The Skoda Gun Works of Pilzen (Austria) also supply an anti-aircraft gun, which has a bore of 37 mm. (1.5 in.) and is 70 calibers long. This gun has a muzzle velocity of 1,000 meters per second and fires a projectile weighing 0.8 kg. at an arc up to 80 degrees. It weighs complete 615 kg. and can be conveniently placed on any high-powered motor car.



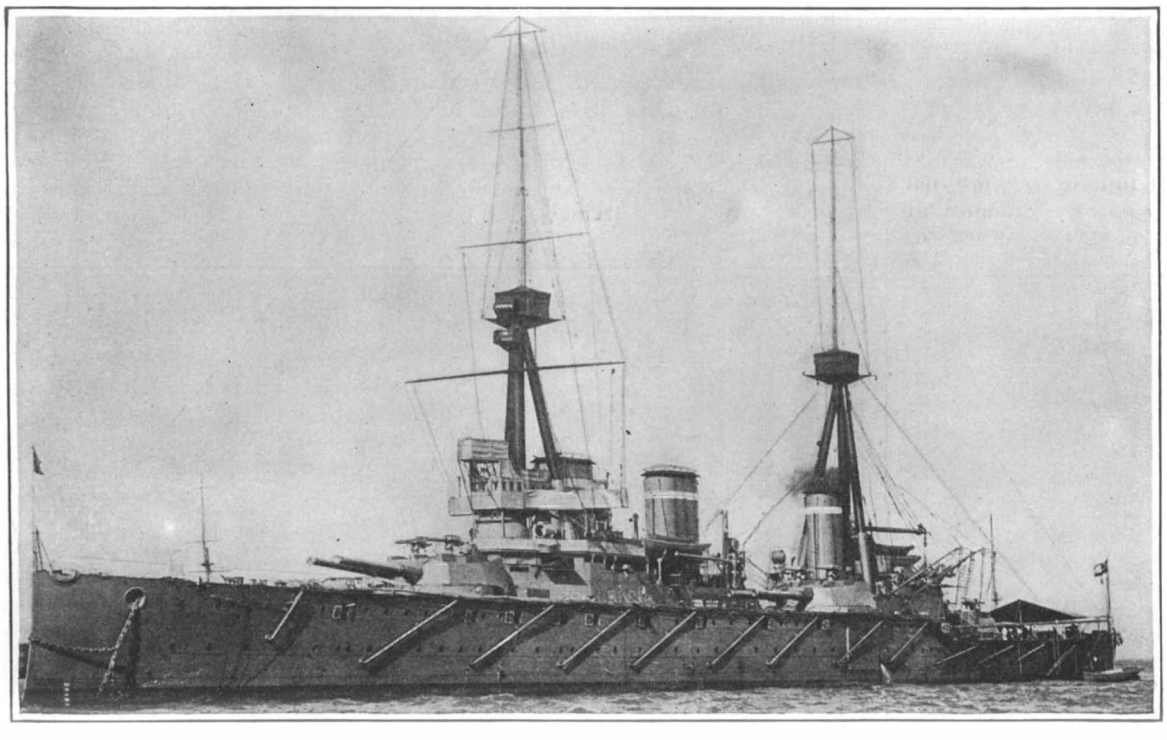
Typical German battle-cruiser. Two of the latest of this type, the Hindenburg and Derfflinger, sunk



German dreadnought battleship Westfalen, twelve 11-inch guns, sunk. Also the predreadnought Pommern, four 11-inch guns



British battle-cruiser Queen Mary; eight 13.5-inch guns; sunk



British battle-cruiser Invincible, eight 12-inch guns, sunk; also the sister ship Indefatigable

CAPITAL SHIPS LOST ACCORDING TO ACCOMPANYING ACCOUNT OF THE BATTLE

Substitute for Gelatin Found in the Philippines

ACCORDING to a recent issue of the *Commerce Reports*, a substitute for imported gelatin is made in the Philippines from a kind of seaweed brought in by the fishermen and sold in the markets. The native women use it to produce desserts similar to those made elsewhere from gelatin. Foreigners also find it a good substitute for gelatin. It is similar to the dried substances brought into the islands from Japan and China, after being extracted from various kinds of seaweed by the Japanese and Chinese, dried and marketed in the form of bundles.

The preparation of gulaman, as it is known, is not carried on in the Philippines on a commercial scale, but the dried article is imported from Japan and China and is currently on sale at the small shops. This commercial product is prepared by extracting the substance with boiling water, congealing the product, and then partially drying it before cutting into strips an eighth of an inch wide. The strips are then thoroughly dried for shipment. The yield is sometimes as much as 60 per cent. One part of the substance to 300 parts of water yields a jelly on cooling.

The amount of raw seaweed brought in now from the sea is not enough to meet the local demand for gelatin. The cheapness of the imported article prevents a greater demand for the local substitute.

A Novel Device for Making Deviation Tests or Surveys in Deep Drill Holes

IN diamond drill borings the drill deviates considerably from its starting direction, and because of this it is sometimes important to obtain a survey of the hole. There are several methods in use at the present time for making deviation tests. The one most generally employed consists in lowering into the boring a glass tube partly filled with a solution of hydro-fluoric acid, and then measuring the angle between the axis of the tube and the plane of the etch line produced by the surface of the acid. Owing to capillarity, refraction, and the shortness of the etch line, however, accurate location and measurement of this angle is impossible; there is an error of from one to three degrees of arc. Moreover, the etch line method gives no definite information concerning the lateral deviation or strike.

Drill hole surveying apparatus in position

In dry rock free from seams, so that a hydrostatic condition can be maintained in the hole when it is filled with water, a pressure gage arranged to record its maximum reading may be used to determine the water pressure in the hole at various intervals. These readings indicate the level at which they are taken, and the dip is then determined by considering this depth as one leg of a right triangle, and the depth along the hole as the hypothenuse. This method again does not indicate the strike.

The inventor of the device here illustrated, Charles B. Galvin, was employed on the test borings in connection with the Hudson River Tunnel of the new Catskill Aqueduct, and it was this experience that led him to devise an improved method for making drill hole surveys. In his device, an optical line of collimation, tangent to the curving axis of the hole, is formed by the projection of the image of a cross-hair member, and the vertical and horizontal lines which intersect in the axis of the hole at the point for which the reading is taken are established by a gravity member—a plumb-line or a rolling ball. The horizontal and vertical deviations are thereby indicated graphically and simultaneously, and recorded photographically on a disk of sensitized paper. The cross-hairs consist of lines etched on clear glass, and are so designed that their center point may be plotted even if it falls off the disk. A source of light, which may be a one- or two-candle power battery lamp, current supplied from the surface via the cable, is situated in the focus of the condenser in the manner shown. An efficient illumination of the cross-hair glass is thus obtained, and a

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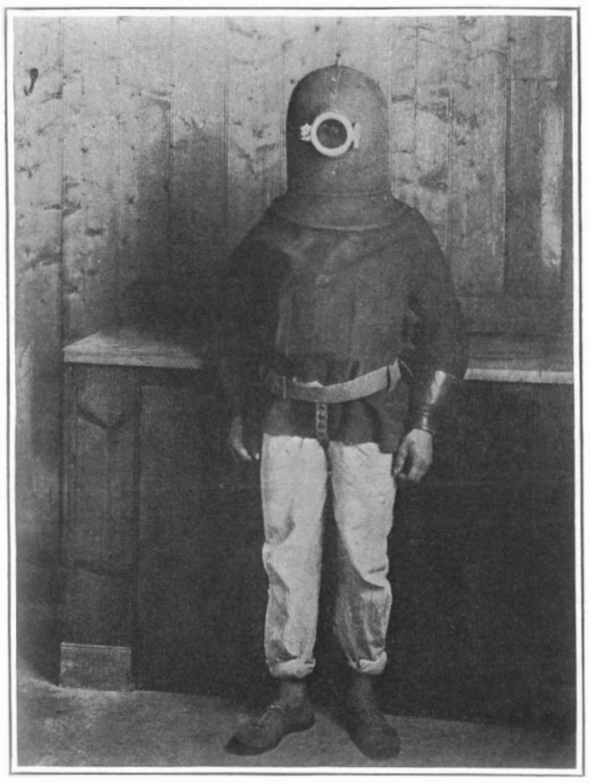
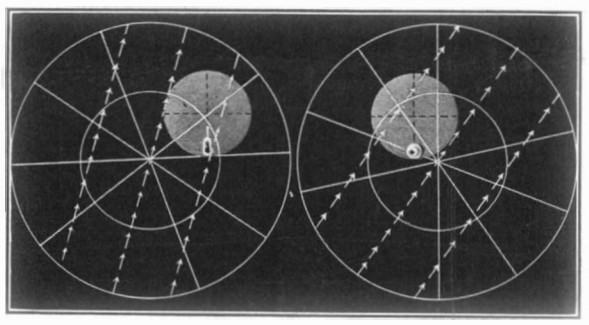


The combination helmet and suit used in escaping from a disabled submarine



Typical prints, one with plumb bob, one with ball, showing construction for locating center of cross-hairs by means of tangents to circular photographic image

Combination Helmet and Suit Used in Escaping from Disabled Submarines

TO enable the crew of a submarine to escape from a disabled craft and reach the surface in safety has long been one of the problems confronting the leading naval powers of the world. Toward this end the British and German naval authorities are the only ones, so far as is known, who have developed a combination helmet and suit, a type of which appears in the accompanying illustrations.

The submarine escape apparatus consists of a light canvas helmet supported on a metal frame, and a waterproof suit which contains the air supply. The equipment is independent of any external source of air, working on the principle of the self-contained diving suit. Chemicals are used to regenerate the air for breathing, and it is reported that in some types of suits the supply is sufficient for a period up to 30 minutes.

Member of a submarine's crew emerging from a hatch, wearing the escape apparatus

In the event of an accident to a submarine which precludes its rising to the surface again, each member of the crew is supposed to don one of the helmets and escape, either by way of the conning tower hatch or an ordinary hatch.

Eliminating Railroad Accidents Arising from Faulty Switches

BECAUSE of the numerous accidents each year that may be directly traced to faulty switches, for some time past railroad executives have been watching with varying interest the patient efforts of Ira A. Call, the young Denver engineer who intently has been developing a new type of switch.

Being of substantial design in that it uses regular rails instead of the usual form which tapers down to a point, the new switch possesses far greater strength throughout and can not be split. The design of the switch is such that it is impossible for debris, gravel, snow or ice to become lodged between its parts and interfere with its operation; it is practically self-cleaning. It provides a guard rail during passage of the switch and creates no inequality in the track that can cause breakage of flanges, axles or draft rigging. The switch can be operated from the switch-stand by hand, from the tower by any one of the standard interlocking control systems, or it can be operated by the engineer from his seat in the engine cab without stopping or lessening the speed of the train, and this at any predetermined distance from one hundred yards to a mile or more. It supplements without alteration of method or plant any one of the standard block-signal systems. When the last wheels of a train have passed the switch a sufficient distance to insure that cars on siding and main line will clear, the switch closes without further attention of the human element.

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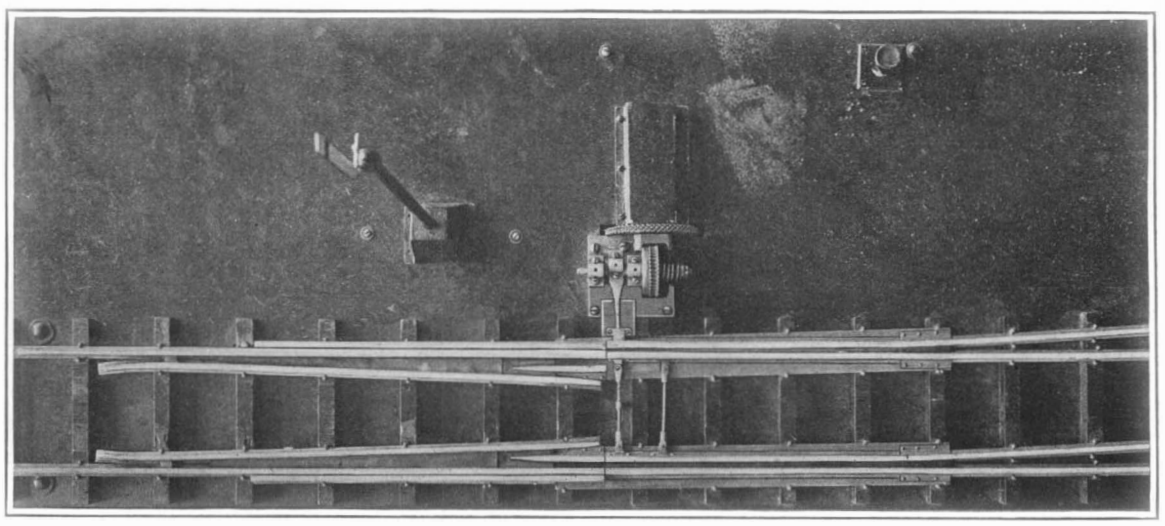


Layout of the electrically-operated main line and siding switch developed by a Denver inventor

Charcoal on the Hoof

THE stumps left on a cut-over tract of timber land have always been a good deal of a liability to those engaged in the lumber industry, since it has been possible to remove them and put the land to any use only at a prohibitive cost. An entirely new departure in the technique of stump removal, which has recently had successful trials on the lands of a large Mississippi lumbering company, promises not merely to render the removal of the stumps feasible, but actually to make the stump itself an asset.

Turning stumps into charcoal with a portable oven

The "stump-burner," shown in the accompanying illustration, is really a portable charcoal oven and still. It is set up over a stump, and a burning process initiated, which continues till the stump is entirely reduced to charcoal and heavy oils, both these products being recovered. When one stump has been thus treated, the apparatus is moved to the next one.

The biggest obstacle in the way of settlement of the vast tracts of cut-over pine lands in the South has been the cost of clearing the land. This burner destroys the stump to a sufficient depth beneath the surface to permit plowing without further cutting out of roots or preparation of the land in any way. The by-products from the destruction of the stump are expected to prove valuable enough to offset the entire cost of the process of removal, if indeed the process when applied to green stumps does not prove to be commercially profitable. One ordinary pine stump has yielded as much as 17 gallons of heavy oil (after boiling off the water), in addition to the charcoal, which is of an excellent grade.

Fighting Locusts with Chlorine Gas

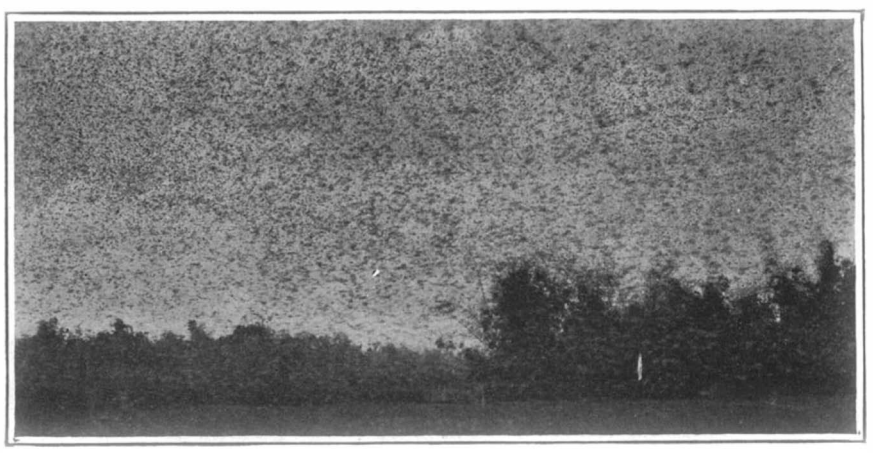
By Monroe Woolley

THERE is good in everything if we but look for it. The Filipinos have found some good in the present European war. They have learned, from the Germans, to fight an enemy with chlorine gas.

Locusts fly in the Philippines in swarms so dense that it often takes hours for them to pass a given point. The sun is obscured and the hum of their wings in flight may be heard for miles. Never a year passes but what damage to the extent of millions of pesos is done by droves of these insects throughout the scattered archipelago. Where the distance is not too great, the bugs actually cross from island to island on their riotous rampages.

It was Dr. Vivencio Rosario, of the faculty of the Philippine University, who first hit upon the use of chlorine gas to combat the locusts, and he obtained his idea from the war in Europe. Experiments thus far conducted with the gas have been very satisfactory. All the locusts reached by the fumes were quickly killed, and it only remains to perfect equipment for spreading the gas economically and thoroughly, without detriment to other life. Already, where locusts have not passed beyond the "hopper" stage, they may be readily exterminated with the gas—just mowed down, as it were.

But another Filipino, Senor Hernandez, director of Philippine agriculture, has an entirely different method of ridding the islands of the locust pest. He does not believe in permitting the insects to reach the hopper stage, much less to acquire wings for their missions of destruction. He would annihilate them at the cradle.



Swarm of locusts in Cavite province

As locusts destroy the crops by eating them, Senor Hernandez says they, too, must be eaten. Of course the Filipinos have been eating them as a means of getting rid of them. Roasted grass-hoppers are a delicacy in all Filipino markets, and have been for years. It is said they taste much like peanuts.

But a better way to eat locusts is to devour them before they hatch. Where locusts are now eaten by the thousands the clever director of agriculture would have them eaten by the millions. Senor Hernandez believes in taking his own medicine and he himself has partaken of locust eggs as a diet. He likens the dish to Russian caviar, which is made from the eggs or roe of the sturgeon.

Other people have been induced to try the eggs, and they liked them so well that the egg-eating idea is spreading. Entire provinces are learning of the fine delicacy, and the demand for the eggs is steadily growing. Already many people are earning money gathering the eggs for market, just as men fish for sea food or gather mushrooms for the table. The eggs are taken from the ground, are washed in warm water, and are then salted.

Clam digging in this country is said to be not half the sport egg-digging is in the Philippines.

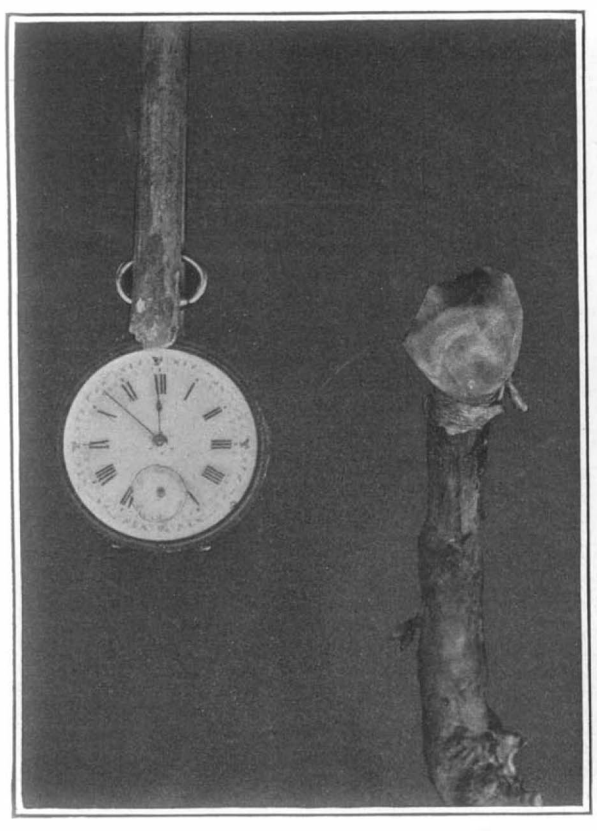
Testing the Uprush of Sap

By S. Leonard Bastin

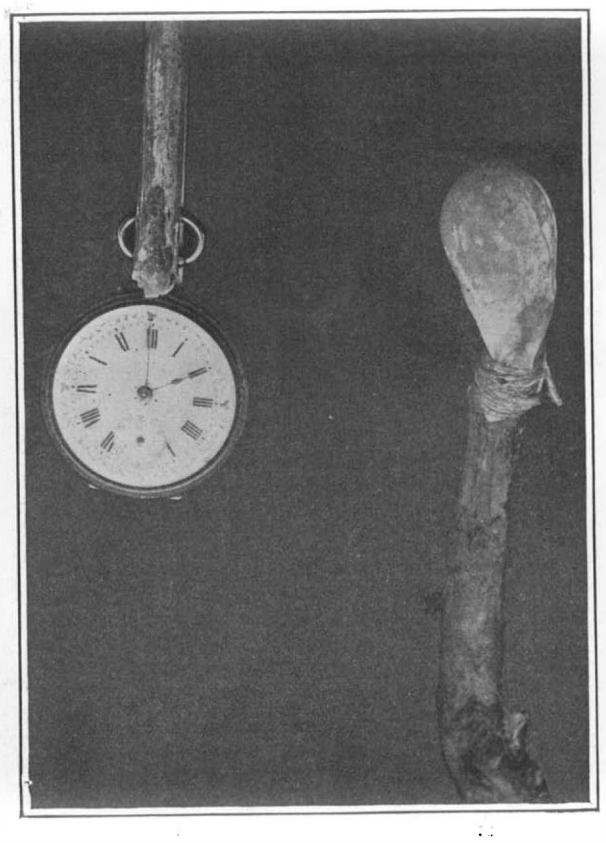
EVEN now the causes which underlie the great upward flow of sap in the spring are not completely understood. That the movement is accompanied by considerable force has been demonstrated in a remarkable manner.

In the spring season, when the sap is rising with great vigor, the stem of a grape vine was cut right across. With as little loss of time as possible a piece of bladder was tied over the surface of the wounded part. As fixed, the bladder was in a state of collapse but it did not remain in this condition long. Within half an hour it was obvious that it contained a good deal of liquid. As time went on the amount of fluid matter increased, so much that the bladder was quite full. Two hours after fixing the bladder was so distended that it was lifted right up. An hour later the pressure had increased to such a degree that the bladder burst, being unable to stand the strain any longer.

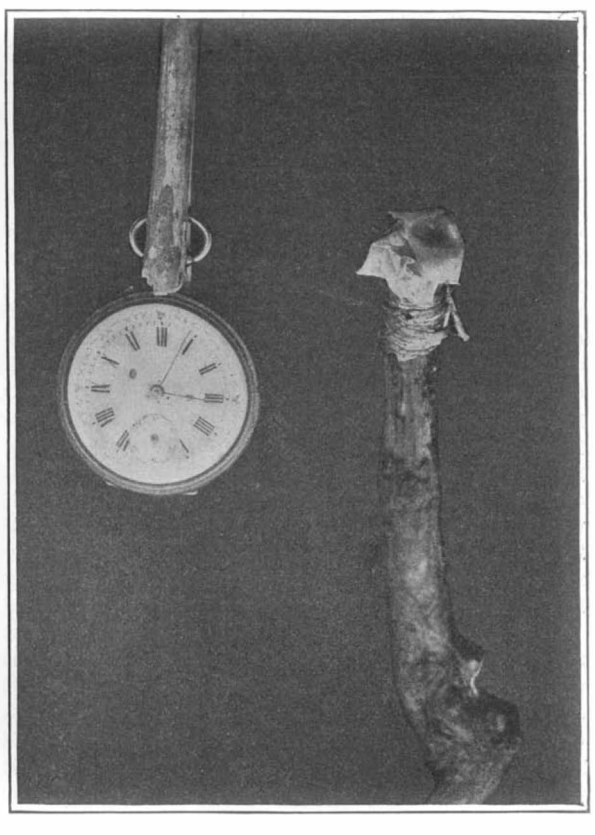
In this connection it is interesting to recall the experiment of Dutrochet, also with a grape vine stem. In this case a bent tube, containing mercury, was affixed to the cut stem in such a manner that any fluid coming from the plant would have to lift the column of quicksilver. In one of his experiments it was shown that the sap raised the column of mercury to the height of 30 inches. Dutrochet calculated that, in such a case, the force exercised by the sap was five times greater than that of the blood in the crural artery of the horse. It requires no student of anatomy to appreciate the force of this statement.



A bladder tied over the cut stem of a grape vine



Two hours later, the bladder distended by the sap



Three hours from the start, the bladder burst by sap pressure

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

Moving a Regiment by Motor

THE movement by automobile of the personnel of the National Guard regiments having armories in Greater New York, Sunday, May 21st, to a mobilization at Sheepshead Bay Speedway was carried out as planned initially only in the case of a few regiments. Owing to the insufficient number of trucks resulting from the lack of coöperation between the military authorities and the ruling motor truck interests, due entirely to not understanding the best way to get together, most of the men were moved by B. R. T. trains. The men of the 47th Regiment, with headquarters in Brooklyn, were fortunate in having a quartermaster-captain who was able to secure all the trucks he needed and who had sound ideas on how the movement should be carried on.

The trucks, furnished by local business men, included a wide range of types and arrived at the appointed rendezvous promptly. The movement was scheduled to start at 8:30 A.M., and all the trucks needed were reported before 8:15 A.M. These were 2- and 3-ton types principally though a small number of 5-ton trucks reported. All kinds and types of bodies were fitted, some had stake-platforms, some were closed furniture vans and some had screen side express bodies. All except one of the trucks were propelled by internal combustion motors, the exception utilized electric power. The maximum speed of the electric was about 10 miles per hour, that of some of the lighter gasoline trucks was three times as much. All drivers were volunteers and had never worked together.

Motor train on its way to the Atlantic Coast, showing the commanding officer in fast runabout

The movement degenerating into a free-for-all race

It will be apparent that it was somewhat of a feat to move a regiment of men with this miscellaneous collection of vehicles and hope to get them all at their destination at the same time. The officer in charge was faced with the identical practical condition that would arise at the present time in event of emergency and not the theoretical ideal of a well organized transport division utilizing trucks of the same make, speed and power, with trained drivers and commanding officers.

The train observed by the writer consisted of three touring cars, four runabouts and two busses for field and staff officers, three light delivery cars for the commissary department and 29 trucks for the non-commissioned officers and privates. No attempt was made to provide seats, the trucks were just as they would be if a sudden call came for their services and they had to be taken from their legitimate and every day tasks for emergency use. A non-commissioned officer was seated with each driver and put in command of the truck. This was a wise move on the part of the quartermaster captain as later events proved. This officer, in charge of the train, accompanied the writer in a high-speed runabout and was assisted by a lieutenant driving his own car in keeping the units of the column moving together and all trucks in their proper places. This required constant movement from one part of the column to the other, holding back the speedy trucks and hurrying up the laggards.

The pace was set initially by the colonel commanding the regiment who occupied the leading touring car and was entirely too fast for the trucks. The train was soon divided in two or three sections, some several blocks apart. A halt was called and all trucks allowed to get in proper position again. The pace of 12 miles per hour was then set by the pacemaker, but soon the column divided again and the fast trucks in the rear began to race in an effort to pass each other and the slower trucks of the line. At times there were three trucks abreast and the movement seemed doomed to degenerate into a free-for-all race. The cause of the split was found to be the electric truck which could not maintain the pace and one large 5-ton gasoline truck which was geared very low because its normal work was moving building stone.

The racing was stopped by catching the offending cars and ordering them back to their proper positions in the line. The officers accompanying the drivers were instructed to be sure that the trucks were not taken out of the column to pass others. The two trucks that held up the rest were sent to the rear of the line and by halting once more for a few minutes to allow them to catch up, the train was kept intact and all the men of the regiment arrived at the mobilization point at the same time. The writer was informed that this was the only regiment carried by motor trucks that arrived in this manner, as some of the Manhattan regiments arrived in sections, the touring cars and faster trucks arriving first, followed sometime later by the slower trucks.

A number of useful lessons were taught by this experience. The most important was that a large body of men could be moved more expeditiously by motor trucks to any given point not reached by railroads than by any other means. The regiment observed by the writer was transported nearly 10 miles in less than an hour, and had any opportunity been afforded to select trucks of nearly the same speed range, the distance could have been easily covered in half the time.

In future movements of this kind, it is the writer's opinion that the following points can be kept in mind advantageously. First, select the truck equipment carefully, trying to use trucks of the same kind as much as possible. If this is not practical, divide the train in divisions, grouping trucks of the same speed and power together.

Second, put each truck in charge of a responsible officer to prevent racing.

Third, electric trucks cannot be used with a gasoline truck train. They are too slow.

Fourth, the pace of 10 to 12 miles per hour is too slow for the majority of gasoline motor trucks as it necessitates driving in the lower gear ratios and heats the engine causing the water in the radiator to boil in a few miles.

Fifth, the officer in charge of the train must have a fast, easily handled small car of higher power, as he must be able to get from one point in the column to another very quickly. The under officer should also be provided with a car. Several messengers on motorcycles should be available to deliver messages from one part of the line to the other.

Sixth, a master-mechanic and assistants should have a reasonably fast truck equipped with the necessary tools for various roadside repairs and adjustments, carry spare parts, block and tackle, long planks, powerful jacks, lifting crane, winch, extra fuel and oil, etc., if the distance to be covered is of any moment.

Seventh, every truck should be numbered distinctly and should travel in its proper place. The numbers should be large enough to be read at a glance by the officers as they pass back and forth along the column to make sure that every truck is in place.

Eighth, an officer and messenger should be detailed to ride at the rear of the column and an experienced pacemaker and engineer officer at the head. The officers in charge must be free to go from one end to the other as the conditions demand.

Ninth, the trucks must be at least two lengths or about 30 feet apart and should maintain this pacing whenever it is practical.

Tenth, two-ton trucks are amply large for the purpose of moving men. The heavier trucks are too slow for this purpose and might tax the capacity of the ordinary country bridges too much. The engineer officer at the head of the column should examine all bridges and culverts to see if they need reinforcing before the trucks pass over.

It seems that a desirable point to work out in our preparedness plans is to determine the best organization for militia transport trains, keeping local conditions in mind. The various makes and types of trucks in every district should be card indexed as well as the good drivers and mechanics necessary for their operation, so the selection of suitable vehicles can be worked out in advance of the actual need. Closer coöperation between the military and motor truck or automobile ruling interests is essential to insure the successful use of civilian motor trucks in an emergency.

Motor Truck Queries

P. E. R. writes: I have recently secured possession of a 40-horse-power motor truck of early manufacture and of very substantial construction. I wish to change this into a tractor and I would like some idea about the amount of power necessary to do various kinds of farm work. For example, how much more power is needed for plowing than for hauling loaded wagons? How may one determine the drawbar pull available? A. You will find that the converted truck tractor will be much more suitable for hauling wheeled vehicles than it will be for plowing unless the general construction is changed materially. There is a great difference in draft required by wheeled vehicles and plows. The tractive effort for moving loaded vehicles on level roads ranges from 5.16 pounds per ton weight on steel rails or plates to 400 pounds per ton weight in deep sand. A vehicle may be moved on asphalt with a pull or push of 12 pounds per ton weight, and on macadam with a pull of about 31 pounds. Dirt or gravel road will require from 125 to 250 pounds pull per ton weight. A horsepower is equivalent to a draft of approximately 187 pounds at the rate of 2 miles per hour. Where the highway surface is good, a drawbar pull equivalent to that exerted by two horses would be sufficient to pull ten tons. On the other hand, in plowing or breaking, a tractor will have to be a powerful one and have the proper degree of adhesion to the ground, if it is to

(*Concluded on page* 650)

Shackleton's South Polar Expedition

(*Concluded from page* 636)

this reason the winds to be observed on the margin of this anticyclonic area will display a more or less cyclonic character, according to the year taken into consideration.

The Weddell Sea east of Graham Land, as well as the Belgica Sea west of Graham Land, belong precisely to this region of very accentuated variations. The Weddell Sea probably more so than the Belgica Sea, and that is why the ice conditions of the Weddell Sea may differ so greatly.

Shackleton's scientific observations will therefore be most valuable.

From another purely scientific point of view it is to be regretted that Shackleton did not succeed in accomplishing his programme. I have in mind the problem of the Antarctic Andes. It was my pleasure to discover, in 1898, that the rocks of Danco Land, of Palmer Archipelago and of Graham Land were Andean rocks. The great physiographic similarity of this Antarctic chain of mountains and the southern Andes of Terra del Fuego also led me to the supposition that the Andes really reappear in Antarctica south of Cape Horn. This view has since been adopted by all students of Antarctic geology.

But South Victoria Land, on the opposite side of Antarctica, is geologically and physiographically absolutely different: it is an old table-land.

In what direction do the Antarctic Andes extend? It may be that this relatively recent folding of the earth crust curves west towards King Edward VII Land, or it may be that it bifurcates, as has been presumed by Edgeworth David.

This important problem justified the attempt to cross the Antarctic Continent from sea to sea.

Mastery of the Air vs. Control of the Sea

(*Concluded from page* 637)

The German authorities seem to have been quite aware that in spite of their limitations the non-rigid and semi-rigid airships could fulfill some functions to the satisfaction of their owners—chiefly in conjunction with army operations and harbor defense, where their ease of transportation, low cost and general handiness were greatly appreciated. But the Germans were none the less convinced that for strategical reconnaissances and chiefly naval scouting high-speed airships, capable of long endurance, were required and that these requirements could not be attained by either one of the above mentioned types. This is why, undaunted by countless accidents, many of them tragic, Germany never lost her faith in the Zeppelin and, what is more, even encouraged the development of another type of rigid airship, the Schütte-Lanz. Thus, when the German navy lost her first two Zeppelins, four new vessels were laid down at once, three of them at the Zeppelin factory and one at the Schütte-Lanz works.

It is interesting to compare this progressive policy—which at the time was called adventurous—with the hesitating attitude of the British authorities towards airships in general and Zeppelins in particular.

After having tried and, generally speaking, failed to produce a serviceable lighter-than-air machine of original design, the War Office—which up to 1914 was alone in charge of the airships—purchased from foreign manufacturers a number of non-rigid and semi-rigid vessels, while the Royal Aircraft Factory furnished some small airships for instruction purposes.

The Admiralty seemed for a short time to be animated by a more progressive spirit. In 1909 an order was placed with the well-known shipbuilding firm of Messrs. Vickers, Sons and Maxim for a 21-ton airship of the Zeppelin type. This vessel, the "Mayfly" was launched two years later, but unfortunately broke up while she was being towed out of her shed. As it proved impossible to repair the

(*Continued on page* 647)

RECENTLY PATENTED INVENTIONS

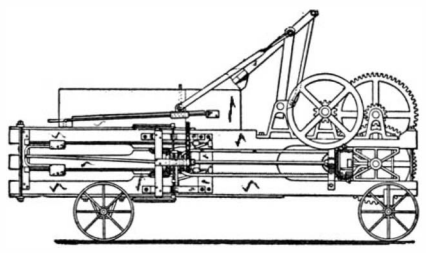
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices

REGISTERING DEVICE FOR TELEPHONE SYSTEMS.—E. M. NORTHUM, care of National Telephone Toll Register Co., Stephens, Ark. An object here is to provide an improved device over that shown in a prior Patent No. 1,018,981, these improvements consisting mainly in simplifying the construction of the device and the provision of means for registering the number of disks deposited in the registering device. It facilitates the posting of books and the checking up of telephone calls, especially those received on toll lines.

Of Interest to Farmers

SELF-FEEDING AND SELF-TYING MECHANISM FOR HAY PRESSES.—W. R. SMITH, Erie, Colo. The inventor provides a mechanism entirely automatic in operation; provides a tying mechanism that avoids the necessity for the use of head blocks for separating the bales from each other in the press; provides a construction whereby the friction between the



SELF-FEEDING AND SELF-TYING MECHANISM FOR HAY PRESSES

wire-tying mechanism and the wire is reduced to the minimum, thereby greatly reducing the wear on the parts of the tier, and provides a tying mechanism embodying the use of wire direct from spools or reels, thereby avoiding the necessity and expense of making up the wire into given lengths.

INCUBATOR.—J. W. SACHSE, R. R. 3, Shawnee, Okla. The invention improves the construction of an incubator with respect to the means for supplying moisture in a regular uniform manner to the bottom thereof, whereby the lower half of each egg is maintained suitably cool while the other half thereof is maintained warm, simulating in a high degree the natural method in incubation as when a hen steals her nest away and the eggs are subjected to more or less intimate contact with the cool ground.

Of General Interest

SAFE RECEPTACLE FOR VALUABLES.—H. W. WOODRUFF, SR., Slidell, La. The invention relates to locks for both portable and stationary safe receptacles for money, bonds, stock certificates, jewelry, etc. In its portable form the safe is preferably constructed in oblong rectangular shape, and is provided with a door, preferably hinged, to which the improvement is applied. This form is particularly adapted for use in making shipments by parcel post or express or similar agencies.

LIFE BOAT.—H. B. JOYCE, 1917 9th Ave., West Seattle, Wash. A purpose of the present invention is to provide a life boat with novel and removable thwarts allowing a plurality of similarly constructed boats to be nested one within the other to thus occupy little space which is such an important consideration on board a ship.

BOTTLE CAP.—H. V. CLAUSEN, 29 Broadway, New York, N. Y. This invention provides a substitute for the well-known "crown" stopper or cap whereby the waste of caps by being entirely removed from the bottle and thrown away, as in the said "crown" caps, is avoided, the device consisting of a body member in permanent connection with the bottle, the closure disks in separable connection with said body member, said disks being of different types and capable of repeated use.

NON-REFILLABLE BOTTLE.—F. H. LEITHEISER, 181 New St., New Brunswick, N. J. This inventor provides a means for the neck of a bottle providing for free outflow of the contents but preventing the introduction of other material to the bottle after it has been emptied, the means to prevent such introduction including a plurality of valve devices cooperating with the same holding means and also including a movable weight to effect the prompt seating of the principal valve.

SEAL.—T. F. COUGHLIN, 519½ Grove St., Jersey City, N. J. This invention has reference to improvements in seals used in sealing the locks of cars, safes, and in fact any other desired device, which it is desired to seal against opening by any one, and has for an object to provide an improved structure which must be broken before the same can be removed.

FOCUSING ROLL-FILM CAMERA.—E. U. WRIGHT, 147 Delcian Ave., Newark, N. J. The primary object here is to provide a roll film camera which can be used in an ordinary way for taking snap shots or time pictures but which can also be used as a focusing camera so that a high degree of accuracy is possible in obtaining a clear image and consequently for producing a clear picture without resorting to charts or guesswork in setting a camera at the proper focus, as by means of the usual finder.

FOUNTAIN-PEN FILLER CONTROL.—J. W. CROUSER, 114 Park Place, New York, N. Y. The object of this invention is to provide a simple, convenient and inexpensive fountain-pen filler control which, when accidentally displaced on the pen, will not cause a variation in the volume of the elastic reservoir and, consequently, eject a part of the ink thereof through the pen.

LIQUID MEASURING DEVICE.—HENRY ERNST, 4233 Hamilton St., New Orleans, La. This invention has particular reference to a beer measure. An object is the provision of novel means connected to a receptacle for automatically indicating, by the weight of the liquid therein, when a predetermined amount has been poured into the same.

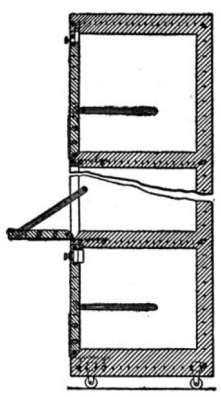
DEVICE TO FASTEN A CAMERA TO A TRIPOD.—W. C. WHINCUP, 224 Oriole St., Rochester, N. Y. Co-acting fastener elements are attachable respectively to the base of a camera and to the top of the tripod. The camera element is mounted to rock through an angle of 90 degrees to a position pendent below the camera base or a position within the camera base. The tripod element includes a cam lever which is sustained above the top of the tripod and means provided to exert a wedging and drawing action on a head on the camera element. This head extends through the bolt hole in the tripod top and held against lateral displacement in effecting engagement of the co-acting fastener elements.

CLOSURE FOR CONTAINERS.—A. G. CARLING, 119 W. 64th St., New York, N. Y. This invention provides a closure for bottles and other containers adapted to contain liquids for use as a mouth wash and other purposes; liquid soap for shampoos or other liquids, and arranged to permit of directing the liquid contents into a toothbrush or other implement or into a particular point without scattering or wasting the contents.

BACKING APPARATUS.—E. KEEFE, care of *Collier's Weekly*, 416 W. 13th St., New York, N. Y. This invention provides an apparatus which permits of conveniently melting the solder on the back of the copper shell and to then pour the molten backing metal into the solder and without danger of splashing of the molten backing metal and dispensing entirely with the use of ladles and overhead means for carrying the tray or pan containing the shell from one apparatus to the other.

CIGAR OR CIGARETTE CASING WITH MATCH BOX INCLOSED.—A. S. MACKINTOSH, Buenos Aires, Argentina. This invention relates more particularly to combination cigarette and match cartons of a general type but of the variety in which the match receptacle is provided with a hinged closure over which the outer portion of the box slides. It provides a match carrying member with a lid or closure which has a bent over flap or lip which frictionally engages the wall of the match receptacle opposite to the hinge.

FIREPROOF CABINET.—D. CUOZZO, 21 Park Row, New York, N. Y. This invention relates to fireproof cabinets, and has reference more particularly to a reinforced concrete cabinet. It provides a strong, inexpensive and fireproof cabinet which is comparatively light and



FIREPROOF CABINET

in which the doors controlling the access to the cabinet constitute shelves for the cabinet when said doors are open and thus facilitate the inspection and manipulation of the subject matter carried by the cabinet.

CHAIR.—E. T. CARR, Mebane, N. C. Operators in knitting mills oftentimes are required to attend to two machines, which necessitates frequent turning around, and there has not been constructed, previously, any device in the form of a chair which could be effectively employed for the purpose of aiding the comfort and work of the operator attending the machines. This invention supplies this want by providing a swinging stool mounted between two machines.

MAIL POUCH.—P. J. LAWLER, Jackson Township, Iowa. The pouch is of a collapsible character and especially adapted for use in the collection and delivery of mail matter on rural free delivery routes, wherein each patron is provided with two pouches, one for containing mail matter to be left at the place of delivery by the carrier, the other for containing mail to be carried away by the carrier to be mailed from the local post office.

AREA GRATING.—J. F. STECKENREITER, Calyer and Jewell Sts., Brooklyn, N. Y., N. Y. The invention relates particularly to area or vault gratings made of wrought iron, steel or other rolled metals, such as are now commonly used for flooring over vaults, areas, steps, platforms and the like, the top surfaces of which become dangerous to the public and particularly in wet or frosty weather.

CLIP.—M. T. GOLDSMITH, 522 Mulberry St., Newark, N. J. This improvement provides a clip for use on fountain pens, clinical pocket thermometers and other articles intended to be carried in the pocket and arranged to permit a retailer or other person to conveniently and easily attach the clip to the article with a view to securely hold the article in position in the user's pocket.

CAN CLOSURE.—C. H. FOSS, Milaca, Minn. An object here is to provide a closure for opening the top of a can, box or the like arranged with an inner and outer plate and held in place by connecting members which hold the plates in alinement while allowing a movement toward and from the opening.

ELEVATOR.—H. C. HILKE. Address J. O. Bradney, 1 Broadway, New York, N. Y. This invention relates to improvements in elevators and is especially designed for use in hoisting lumber to be piled in stacks, although it may be advantageously employed for loading upon railway cars or boats other articles, such as long pieces of structural iron.

GRAVEL MACHINE.—H. T. SYKES, New London, Mo. This machine is for use in excavating gravel from gravel pits whether above or below water and of the class adapted to be operated by draft apparatus arranged at a distance as for instance an endless belt, wherein a scraper is provided supported by wheels, and movable with respect to the wheels into and out of loading position, and wherein mechanism is provided in connection with the scraper and the wheels for automatically lifting the scraper into inoperative position when loaded, and operated by the loading of the scraper.

ANIMAL TRAP.—E. S. CUNNINGHAM, Mansfield, Mo. The trap is arranged to permit of readily setting it without danger of injuring the fingers, to allow releasing the dead animal without touching it, and to prevent the animal from reaching the bait, thus allowing use of the bait for a considerable length of time without re-baiting after each capture.

PROPELLER.—C. A. HARTFIEL, 444 Jersey Ave., Jersey City, N. J. Among the objects of this invention, is to so improve the form or design of a screw propeller as to make it more efficient or to produce a more satisfactory result as to power and speed in proportion to the amount of power expended than propellers now in common use.

SCALE READING DEVICE.—H. G. CHALKLEY and DE WITT C. CONKLING. Address the latter, Room 1853, 50 Church St., New York, N. Y. This invention provides a means whereby the scale, vertical or horizontal of any surveying instrument, transit, theodolite, or level, may be read at sight to fractions of a second, without a vernier or the use of a microscope, which is an absolute necessity on all present style instruments reading as close as 30 seconds now known, the means also being applicable to protractors and all scientific and mathematical instruments where the degrees, minutes and seconds of the circle have to be read.

Hardware and Tools

NUT LOCK.—D. M. BARRINGER, Greensboro, N. C. This invention is an improvement in the type of nut locks in which the locking device is provided with a spring tongue adapted to engage a nut. The nut lock is formed of spring material, and has a flat body with a bolt hole at one end, and a flat side finger parallel to said body and whose free end is offset laterally in a plane parallel to that of the body.

STAY BOLT.—H. A. LACERDA, 303 Campbell Ave., Schenectady, N. Y. The invention provides a stay bolt for the fire boxes of boilers and like structures, and arranged to permit convenient and quick periodical inspection of the stay bolt without requiring removal of any of the parts, at the same time rendering the stay bolt steamtight and allowing movement of the boiler sheets in the direction of their plane without straining or otherwise injuring the stay bolt.

ANTI-RATTLING NUT LOCK.—H. B. PLOPPER, Litchfield, Ill. This invention provides a locking device which effectively prevents accidental displacement of the nut and rattling of the parts which is often incident to constructions of this character. The nut lock is composed of a minimum number of parts and is therefore easily and inexpensively manufactured.

PIVOT STRAIGHTENING TOOL.—J. F. DOLLES, Chester, Ill. The invention relates to means for straightening bent pivots on watch wheels, and provides a tool or attachment for a watchmaker's lathe which will accomplish this result without any danger of breaking the pivot or of injuring the wheel to which it is connected.

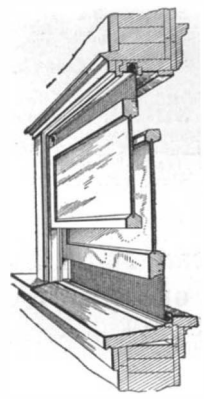
CALIPERS.—M. W. SEVERANCE and C. C. HERBERT, 37 Bellevue St., Lowell, Mass. In this instance the invention refers to outside calipers, and the main object is to provide such a tool which is adapted to receive and hold a rule in one of its legs whereby greater ease and accuracy of caliper adjustment is possible than with the conventional calipers.

Heating and Lighting

GAS FIRE.—H. J. YATES, Essex Works, Thimble Mill Lane, Aston, Birmingham, England. This invention relates to gas fires of the type comprising a number of radients or heating elements placed in conjunction with a firebrick back and the nozzles of a gas burner. The invention enables gas fires to be employed not only for heating purposes without contaminating the atmosphere of a room, but also to produce a more ample ventilation than has been possible with gas fires hitherto.

Household Utilities

SCREEN.—W. H. LOGAN, Denmark, Ore., care of Sixes Mining Co., Bandon, Ore. This invention has for its object the provision of a screen especially adapted for covering

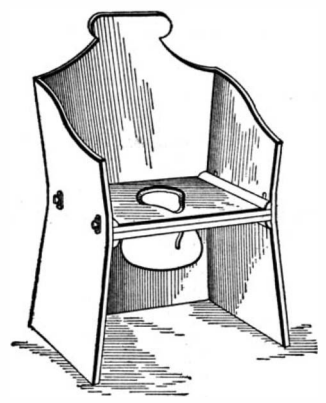


INSECT SCREEN

windows and other openings, to prevent the entrance of insects and the like, wherein the screens are supported on spring mounted rollers arranged in suitable openings in the window casing, and are connected to the sashes, to be moved into and out of position over the opening when the sashes are moved in the casing.

WINDOW.—M. M. BENSTER, Gettysburg, S. D. This invention provides means whereby window sashes may be quickly and easily removed from the frame to the inside of a room. The window structure will effectually prevent the entrance of dust and the elements and is one in which all danger to the person removing the sashes is overcome, as every part of the device is handled from the interior of the building.

CHAIR.—NELLIE FOUNTAIN, Route 1 Zillah, Wash. The invention relates more particularly to a nursery chair. The primary



NURSERY CHAIR

object is to provide auxiliary seats having different sized openings so as to accommodate both infants and small children. Another object is to provide means whereby a receptacle may be detachably secured to the seat so as to be readily removable whenever necessary.

SPOON HOLDER.—W. S. AVERY, 2200 Highland Ave. Knoxville, Tenn. This invention pertains to spoon or knife holders for use on the handles of cooking utensils, such as frying pans and the like, and the main object thereof is to provide such devices which are quickly and easily placed in position, which adapt themselves to handles of different shapes and sizes and which hold spoons or knives in either flat or edge positions.

STUFFING OR PACKING.—I. MARGOLIUS, care of Imperial Bagging Co., P. O. Box 1037 Norfolk, Va. An object here is to produce a cheap and efficient stuffing or packing to be used for stuffing mattresses, as packing material, as a heat insulating lining, etc. A further object is to provide a stuffing or packing which is free from objectionable odor and which is comparatively free from objectionable gum or other mucilaginous matter.

Machines and Mechanical Devices

ADVERTISING DEVICE.—H. A. ARMSTRONG, 96 Sterling Place, New York, N. Y. This invention relates to advertising devices known as Jacob's ladders, in which there are arranged a number of individual panels and so connect each to each that under certain conditions each upper parcel drops or turns downwardly around its lower edge as an axis, causing a similar action downwardly of the next lower panel, both sides of the panel being available as supports for signs or other advertising matter.

SAW MILL SHOCK ABSORBER.—G. H. HAMILTON, 474 E. Liberty St., Portland, Ore. An object here is to provide a shock absorber for saw mills which will prevent the cants from striking the delivery rollers and thereby causing injury to the rollers, the foundation of the mill and also to the part of the cant projecting beyond the end of the rollers.

WEIGHING APPARATUS.—P. VELTER, 44 Avenue du Maine, Paris, France. This invention relates to weighing apparatus in which

(*Concluded on page* 648)

"Mayfly" and no credit was available for a new construction, the British Navy stopped experimenting with Zeppelins until 1914, when Mr. Winston Churchill became First Lord of the Admiralty. At the instance of this far-seeing minister, twelve airships were laid down at once, two of which were Zeppelins; but before this building programme could be carried to completion, the great war broke out. By this time Germany had commissioned thirteen Zeppelins and half a dozen minor airships, while Great Britain possessed but three small non-rigid vessels.

It is rather astonishing that the British naval authorities should not have realized any sooner the value of airships and, particularly, of Zeppelins for naval scouting. In 1909 Sir Percy Scott—many of whose "revolutionary" predictions regarding naval constructions have been vindicated by the great war—wrote, in a preface to Jane's *All the World's Airships*, the following prophetic words: "In gaining information of the locality, strength and disposition of the enemy's fleet and so possibly unmask his strategy . . . an airship's services would be invaluable, for it might not be possible to obtain the information in any other way."

Twenty-two months of warfare have fully demonstrated the truth of Sir Percy's assertions. Germany has been able to use her Zeppelins with marked success in many diverse functions, about which little has come to light as yet. It is noteworthy, however, that one Zeppelin was decorated with the Iron Cross "for coöperation with submarines during a successful attack on three British armored cruisers." Several Zeppelins have also coöperated with German submarines, for enforcing the so-called "submarine blockade" by stopping and occasionally sinking such merchantmen as they could not bring into a German port. Other Zeppelins have been engaged in patrolling the German shores from Holland to Denmark and from Denmark to Russia; still others have played an all-important rôle as fast scouts for such portions of the German fleet as have ventured beyond the range of Heligoland's coast batteries. Their participation in the latest naval raid on Lowestoft even raises the question, whether the twofold slipping of the British blockade by the German commerce raider "Moewe" may not be attributed to intelligent coöperation between her skipper and one or more Zeppelins. The high speed of these airships, and their faculty to send, as well as to receive, wireless messages makes this assumption appear quite plausible.

German official reports seem to omit purposely all reference to this sort of work done by Zeppelins, while particular emphasis is laid on the destruction achieved by Zeppelin raids against the British Isles. These incursions on undefended shipping and manufacturing towns—however contrary to laws of civilized warfare they be—come well within the German definition of "commerce war," as practiced by German naval forces on several occasions. ("Vide" the raids on Scarborough and Lowestoft, the bombardment of Madras by the "Emden" and that of Papeëte (French Oceania) by Admiral von Spee's squadron; the latter instance is particularly enlightening, as all the shells were deliberately aimed at the business section of that port.)

From a military viewpoint the Zeppelin raids on England are of comparatively small importance, though some of them may have served the purpose of a "reconnaissance in force," either for ascertaining the whereabouts of Sir John Jellicoe's Grand Fleet or else for reconnoitering the location of English coast defense works. If such really was their purpose, then the dropping of bombs was successful from the German point of view, as it forced the British to disclose the location of their batteries by firing on the air raiders.

There still is another important function which Zeppelins may fulfill with a fleet: gun-spotting. During the Gallipoli campaign the "Queen Elizabeth" repeatedly fired across the peninsula, hitting targets invisible to her gunners, the cor-

(Concluded on page 649)

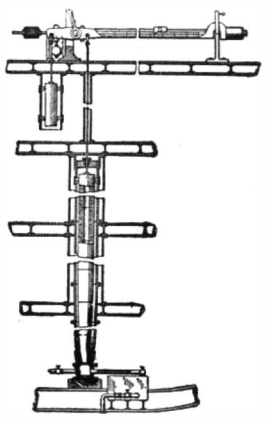
(*Concluded from page* 646)

the evaluation of the weights is obtained by measuring the tangents to the angles of inclination of the beam according to the principle set forth in United States Patent No. 950,528. The present invention makes it possible to read directly and at any moment both the gross weight and the net weight of the article without the necessity of knowing the weight of the tare or of making any calculations.

ENGRAVING MACHINE.—S. CLARK, 241 Virginia Ave., Jersey City, N. J. This inventor provides an engraving machine in which all lost motion is reduced to a minimum, whereby work of better quality is obtained, in which machine there is direct interaction between the stylus point and the needle point, and which machine can be easily and quickly adapted to various classes of work.

STUMP PULLING AND HANDLING MACHINE.—G. LEHNHERR, Pittsville, Wis. The invention relates particularly to a turntable construction forming part of a stump pulling and handling machine, the object being to provide an arrangement for directing the boom of a derrick in the machine, together with actuating means capable of imparting movement to the turntable at a plurality of points thereof.

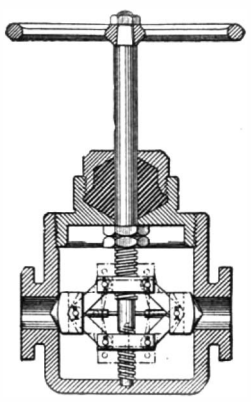
SHIP SCALE.—J. FRAME, Searsport, Maine. This invention relates particularly to a scale adapted for weighing a ship, and the cargo while in the ship. It provides an arrangement whereby a correct weight may be secured of the load as the same is placed in the ship



SHIP SCALE

regardless of the position of the load and of the scale. It provides a scale with means for compensating for the pitching of the ship during the loading so that a correct reading may be presented regardless of whether or not the ship is on an even keel. It also provides that a correct reading may be provided upon the beam connected with the weights according to the degree of submergence of the plunger.

VALVE.—W. A. BARTZ, 412 Congress St., Schenectady, N. Y. This invention provides a valve arranged to provide an effective closing of the valve, and easy opening of the same and convenient replacing of the packing while



VALVE

the valve is closed. To accomplish this use is made of a valve casing having an inlet and outlet valve arranged within said casing and adapted to open and close the inlets, a valve spindle mounted to turn in the casing and having threads, a nut screwing on said screw threads, and links pivotally connecting said nut with said links.

APPARATUS FOR TREATING ARTICLES OF GLASSWARE.—L. KAUFFELD. Address W. J. Wambaugh, care of Star Glass Co., Star City, W. Va. The invention relates more particularly to an apparatus for treating lamp chimneys and similar articles requiring the heating of the edges thereof, the apparatus being of that type in which provision is made for giving the glass articles a revolving movement on their own axes, whereby to prevent collapsing of the edges when heated.

SCHOOL LOOM.—ELIZABETH L. BOTTS, P. O. Box 617, Butte, Mont. The object of the invention is to provide a school loom more especially designed for use in schools to teach children the rudiments in the art of weaving, and to permit the weaving of tubular fabrics, single or double, with flat fabrics, two flat fabrics and the like in various colors and materials.

FABRIC CLAMP.—C. J. PRIESTER, care of Kretsch & Priester, 25 Bleecker St., New York, N. Y. This inventor provides an apparatus for holding fabric while the same is being piled or otherwise operated upon; provides an apparatus readily adjustable to piles of various thicknesses; and insures the operation of said apparatus on fabric, irrespective of the thickness of material or the number of piles forming the same.

MOTOR.—Z. A. BRUEGGER, P. O. Box 581 Williston, N. D. This invention is an improvement in motors, and the invention has for its object the provision of mechanism in connection with the puppet valves of motors,

MOTOR.

for eliminating the noise generally between the tappet and the valve during the operation of the valve. The improvement may be attached to existing engines without changing the engines themselves.

CARBURETER ATTACHMENT.—E. WALDMEIER, Cor. 27th Ave. and 14th St., Gulfport, Miss. An important object of the invention is the provision of a regulating device especially adapted for use in connection with engines having self-starters, and operated from the driver's seat of a vehicle to close the air inlet for the carbureter in order to supply the same with more gasoline whereby the mixture is made richer.

CARBURETER.—B. H. SCHMIDT, 17 E. 48th St., Minneapolis, Minn. This invention prevents the congelation of the gasoline, and the sluggishness consequent thereon; provides a regulator, automatic in character for increasing the fuel supply for an engine in proportion to the increased speed thereof; provides means for thoroughly mixing the fuel, the mixture being perfected in proportion to the supply thereof; and provides for quickly and readily dismantling the carbureter for repair or cleaning.

BUTTON FEEDING MECHANISM.—B. KOTKOVSKY, 299 Broadway, New York, N. Y. The invention relates to a feeding mechanism for feeding shoe buttons and the like to an attaching mechanism, such as a staple forming and driving device. It provides effective means for picking up buttons in a hopper, arranging them in a predetermined order, and supplying them in such order to a button-feeding chute.

SHUTTER OPERATING ATTACHMENT FOR PHOTOGRAPHIC CAMERAS.—H. C. ATWOOD, Box 362, Nocona, Tex. The attachment operates the shutter of the camera to which it is attached and giving the correct time of exposure. The operator sets the attachment to give the desired length of exposure at a desired length of time, thereby allowing him any specified length of time to place himself within the range of the camera and thus be a part of the object included within the range of the camera when the exposure is made. The shutter operating device may be attached to any camera whose shutter is operated by a thumb-lever, such camera not being already provided with such means of shutter operation.

POWER TRANSMISSION MECHANISM.—A. O. BOYLAND, Aurora, Neb. The mechanism is designed to connect a wheel or wheels to a shaft upon which the wheels are mounted for transmitting the rotation of the wheel or wheels to the shaft or that of the shaft to the wheel, and wherein the arrangement is such that the plane of the wheel or wheels may be inclined with respect to the axis of the shaft without interfering with the driving connection.

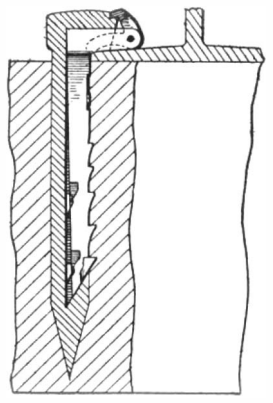
BUTTON ATTACHING MACHINE.—B. KOTKOVSKY. Address Rapid Button Attaching Machine Co., 299 Broadway, New York, N. Y. This invention has to deal more particularly with improvements in the mechanism for making the button-attaching staples and driving the same after a button is applied to the wire blank from which the staple is formed. The invention improves and simplifies button-attaching machine of the type disclosed in Letters Patent Number 1,134,078 formerly granted to Mr. Kotkovsky.

TENSION CONTROL.—M. C. HATTON, Upland, Cal. This improvement refers to tension devices for controlling the winding or unwinding of thread from reels or bobbins, whereby the thread on the reel will not become slack and will not tangle. The device is automatic in its action and starts the rotation of the reel carrier when the thread begins to wind or unwind from the reel.

BUTTON EDGE GRINDING MACHINE.—P. F. DUSHA and A. FEYK, address Holub Dusha Co., 1797 1st Ave., New York, N. Y. This invention relates to a machine for shaping and finishing the edges of pearl, shell and other buttons. It provides a machine of this character by which the edges of buttons can be ground or cut in various designs in a quick, simple and effective manner.

Railways and Their Accessories

RAILROAD SPIKE.—J. HEIKKILA, 711 Hammond Ave., Superior, Wis. The invention provides an anchoring device adapted to be automatically operated to embed itself in a railroad tie and to be locked to the spike

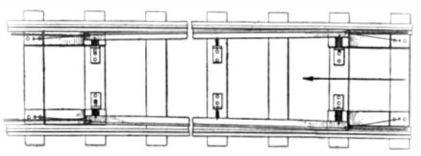


RAILROAD SPIKE.

when the latter is driven into the tie. It provides a latch pivoted to the anchoring device and operated, when said device is actuated, to engage the head of the spike to securely lock the parts together.

SEARCH-LIGHT ATTACHMENT FOR LOCOMOTIVES.—J. H. MCPARTLAND, Houlton, Maine. The searchlight is preferably placed on top of the locomotive or car, and provided with means whereby the light will be automatically tilted to direct the light rays upwardly at any angle corresponding with the direction of travel of the locomotive or car, and vertically when the locomotive or car is standing still, whereby, at night, accidents at crossings and collisions between trains or cars will be minimized.

RAILWAY GATE.—J. E. FIELDS, Bradleyville, Mo. This improvement provides a safety device for the crossing which may be so operated on the approach of a train that the crossing cannot be used. It provides a device



RAILWAY GATE.

in which a safety device is provided for obstructing the roadway so that the user of the crossing cannot cross the track, but which will permit him to pass the obstruction if by chance he should be on the track.

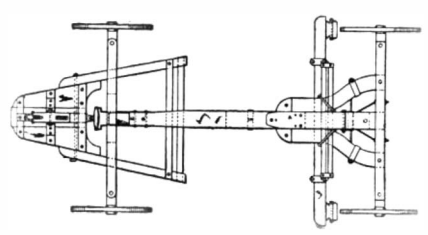
LIGHT SHIELD.—E. F. DEWITT, 9 1st St., Troy, N. Y. This invention relates to light shields of a kind suitable for general use and also for light shields especially adapted for use upon street cars and in various other kinds of railway vehicles. It may be used to advantage in carriages, boats, automobiles, and the like. The lamp is provided with a metallic shield which serves as a reflector for the light, and also for directing diffused light along a somewhat restricted path.

Pertaining to Recreation

AMUSEMENT APPARATUS.—B. HESS, care of Kerschner, 1717 Lexington Ave., New York, N. Y. In this instance use is made of an undulating track, a truck mounted thereon and supporting a circular box open at the top, and a passenger car body mounted to travel freely in the said circular box by its own weight and in a direction according to the inclination of the truck on the said undulating track.

Pertaining to Vehicles

WAGON BRAKE.—E. G. DOLAND, Starksboro, Vt. This invention relates to a wagon brake in which the brake is automatically applied by the backing of the draft animals, as shown in United States Letters Patent Numbers 944,080 and 980,076 formerly granted to Mr. Doland. The invention has for its object



WAGON BRAKE.

to improve, in various particulars, brakes of the class referred to whereby to increase the reliability of the brake devices and their operating means and to provide a wide range of adjustment to the various operative elements and provide for convenience of adjustment and increased strength.

VARIABLE LIGHTING DEVICE FOR VEHICLES.—A. R. COLGIN, 916 Napier Ave., Richmond Hill, L. I., New York, N. Y. The object here is to provide a lighting device for automobiles and other vehicles and arranged to permit the driver to use it as a strong headlight, a dimmed headlight or a side light for illuminating signs and other objects at the sides of the roadway.

TRACTOR WHEEL.—N. L. OLSON, 246 Mass Ave., Highland Park, Mich. The improvement refers to wheels and particularly to power or traction wheels and provides a simplified construction which may be variously coupled up so as to have a direct drive or a slow or fast drive. It provides a tractor wheel which may be adjusted for producing different speeds as may be desired.

STEERING DEVICE FOR AUTOMOBILES AND THE LIKE.—L. A. PETERSON, address R. Tjader, Darien, Conn. This improvement relates to steering devices for automobiles or the like, and has particular reference to means to prevent unnecessary and undesirable lost motion and freedom of movement of the steering post under the influence of natural roadway tendencies to cause vibration of the steering mechanism from the wheels.

SANDING DEVICE FOR AUTOMOBILES.—C. L. LINCOLN, 2823 Clarendon Road, Brooklyn, N. Y., N. Y. The improvement provides a sanding device for automobiles and similar vehicles and arranged to permit the driver of the automobile to control the discharge of the same or other dry, non-packing material, either in a large quantity at the peripheral face of the drive wheel and the roadway, or in gradually lesser quantities on the roadway in front of the drive wheel.

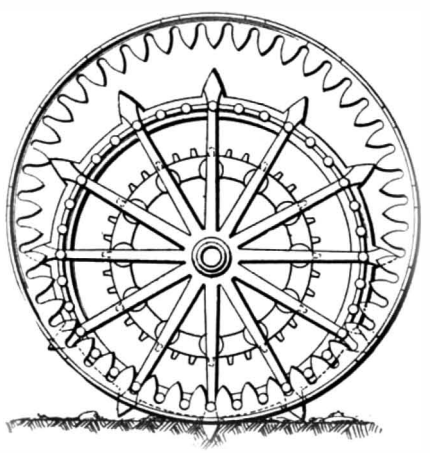
FAN ATTACHMENT.—C. E. GOSS, 1314 N. Chad, San Angelo, Tex. This invention provides auxiliary fan blades attachable to a fan having permanent blades whereby to increase the fan surface, by attaching the auxiliary blades, or reducing the fan surface to its normal area by detaching the auxiliary blades. It is more particularly intended for use in connection with the fan employed on the Ford car.

SHOCK ABSORBER.—G. W. COOPER, address H. S. JOHNSTON, Attorney, Perry, Okla. One of the principal objects of the invention is to provide a device adapted to take up and absorb shocks and rebounds imparted to the springs of a vehicle, and to subdue and control the side sway of the springs, thus easing and cushioning the motion of the vehicle and adding greatly to the comfort of its passengers.

SPRING WHEEL.—J. C. KOCH, Tower City, N. D. An object of this improvement is to provide a spring wheel, in which the felly is resiliently connected with the hub in such a manner that the springs of the wheel will yield to a partial turning of the felly relative to the hub, and thereby absorb the shock of a sudden stop or start.

SPRING WHEEL.—O. W. SMITH, Carrollton, Ky. This invention relates particularly to spring wheels, and provides a construction of spring wheel by which all lateral strains as well as the torque of movement may be taken up without danger of displacing the parts or creating undue friction in the operation thereof.

TRACTOR WHEEL.—M. S. EBY, Sorrento, La. The invention has for its object the provision of a wheel adapted for use with traction engines, mowing and reaping machines and vehicles of like character which operate on



TRACTOR WHEEL.

plowed ground, woods or other soft land where a maximum pull with a minimum weight is desired, and which applies power to or derives power from the point of engagement with the ground.

VALVE CONTROLLING DEVICE FOR TANKS.—J. P. GERAGHTY, care of P. R. R., 5th and Henderson Sts., Jersey City, N. J. This valve is more especially designed for use on automobiles and other power vehicles and is arranged to control the flow of gasoline from the tank to the carbureter so as to interrupt the supply of fuel to the internal combustion engine of the vehicle, with a view to prevent unauthorized persons from running away with the vehicle.

Designs

DESIGN FOR A CANOPY FOR GAS AND ELECTRIC FIXTURES.—B. SCHWARTZMAN, 15 Laight St., New York, N. Y. This ornamental design and the three other designs following, all by the same inventor, are distinguished by chaste, graceful and original lines of form and attractiveness. DESIGN FOR A SHOWER PLATE FOR GAS AND ELECTRIC FIXTURES.—DESIGN FOR A SOCKET COVER FOR GAS AND ELECTRIC FIXTURES.—DESIGN FOR AN OVAL BACK FOR GAS AND ELECTRIC FIXTURES.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

rect range being given by seaplanes through wireless.

But seaplanes cannot yet—on account of their short radius of action—cruise with a fleet out to sea; it is true that they might be carried on motherships, but in this case their movements will be dependant on their floating bases, whereas Zeppelins may cover 1,000 nautical miles independently. The advantage then lies obviously with the airship, the more so as the latter might spot the guns while remaining stationary and send, as well as receive, wireless messages—things a seaplane cannot do.

The British Admiralty seems to have at last awakened to the realization that Zeppelins constitute excellent naval scouts and that a lack of them places a fleet in an appreciable handicap against an enemy possessing such airships. This view was frankly voiced by Mr. Balfour, First Lord of the Admiralty, in the House of Commons.

"It is extremely desirable that we should have lighter-than-air machines in order to supplement the efforts of our fleet by machines which, in many respects and in favorable weather, are far more effective than the swiftest destroyer or the most powerful cruiser. Therefore we have done and are doing our best to de-develop lighter-than-air machines."

These words are particularly interesting in view of a report which reached here last November, stating that Great Britain contemplated building 50 Zeppelins and other airships within two years, whereafter sufficient vessels would be laid down each year to insure complete mastery of the air. Provided this report is true, it will be interesting to watch the development of Great Britain's bid for aerial supremacy—and Germany's answer.

A Novel Device for Making Deviation Tests or Surveys in Deep Drill Holes

(*Concluded from page* 642)

well defined image of the cross-hairs projected onto the disk of photographic paper at the other end of the tube by means of the objective lens, interposed at the proper focal distance between the cross-hairs and the paper. It is then merely a matter of analytic geometry to calculate the precise amount and direction of both dip and strike.

In plotting the points at which the readings are taken, it is assumed that the curvature of the hole is uniform between readings, and the coördinated distances as indicated on the paper disks from center of cross-hairs to vertical and horizontal diameters are considered as tangent offsets to the axis of the hole.

It is claimed that this instrument is well adapted for use in inclined holes as well as vertical ones, and as the general design is on the longitudinal plan, it is equally available for holes of small diameter. It is capable of a high degree of accuracy, because the methods by which the plottings are derived provides good geometrical leverage. It is independent of magnetic influences, and holds its adjustment very well, being quite rugged in all its parts. It is well adapted to being lowered into the hole on a cable, except when there is great pressure of water in the hole, or when the hole is nearly horizontal or actually pointing upward. For such cases the form is modified. The battery is placed within the tube, together with an automatic circuit maker and breaker which renders the apparatus entirely self-contained; and the instrument is then screwed to the drill rods.

Eliminating Railroad Accidents Arising from Faulty Switches

(*Concluded from page* 642)

The lines of construction of the new switch are simple. Four full rails from 12 to 20 feet in length, according to the length of lead required, are arranged in two pairs. A train approaching for the main line is received on one rail of each pair and guided on to the regular main line rails. A train approaching for the siding is received on the other rails of each pair and guided on to the regular siding rails. The heel of the switch is

fixed in alignment with the rails of main-line and siding. The toe of the switch moves right or left 4½ inches to align the main line approach rails with either the main line switch-rails or the siding switch-rails. A main line train travels directly forward on a full rail. A siding train merely takes a curve on a full rail without the slightest irregularity in the trackage.

In the electrically-operated switch invented by Mr. Call the movement of the switch is effected solely by the action of a motor of either 3- or 5-horse-power, according to the speed of movement required by traffic conditions. In instances where the electric current fails or in similar emergencies the switch can be thrown by hand. The control of the motor is vested in the regular track current, either direct or alternating, as in present use. The engine carries an insulated shoe connected with a push-button in the engine cab, the other terminal of the push-button being connected to the frame of the locomotive which in turn makes contact with the regular rails through the wheels. Approaching the switch at ordinary speed, the engineer, if under orders to take the siding, depresses the button just as he is passing over a short length of rail that is placed in the middle of the track and on which presses the insulated shoe. This auxiliary rail may be located at any suitable distance from the switch in the direction of approach. The depressing of the button causes the circuit between auxiliary rail and usual rails to be closed, which starts the motor and throws the switch. At the same time the signal is set automatically. If either the engineer, the contact, the current or the motor fails to operate, the signal bars the way. If the engineer disregards the signal he continues on the main line, in which case he must back up and operate the switch by hand in order to take the siding.

When the train has passed into the siding a distance sufficient to allow its cars to clear any train on the main line, the last wheels pass out of an electric block and the current, ceasing to pass through the wheels which offer a path of low resistance, must pass through its normal course of far higher resistance, which sets the motor in motion once more and returns the switch to its normal or main line position. While the train is passing from the contact rail to the end of the block in the siding the switch is rigidly fixed in its position.

As the train emerges from the siding to the main line, the first wheels enter the electric block again and the switch is operated to side line position once more, from which it returns when the last wheels have passed out of the other end of the electric block. Right here it is well to mention a remarkable feature of the switch: should the current fail so that the switch is not automatically set to side line position to allow the train to pass on to the main line, the train can still trail through the switch when it is set in the wrong position without damage to the switch or danger to subsequent traffic.

The fundamental feature of the new switch rests in the heavy steel bed plates on which the four rails of the switch are laid. Heavy steel studs as pivots fix each pair to the plates at the heel and the whole play of the switch is on these plates, attaining a certainty of operation and a resistance to traffic impact and torsion that is said to be superior to that of the regular rails. The creeping of the steel due to traffic or temperature, which hitherto has been an absolute barrier to any type of full rail switch, is claimed to be completely offset. The inventor estimates the saving effected by the switch over the conventional types at upward of 30 per cent. Old-type switches may be replaced singly without affecting in any way any other switch or frog on the track layout.

Motor Truck Queries

(*Concluded from page* 644)

do an amount of work worth while. Soils differ greatly in their cohesive properties and the amount of work re-

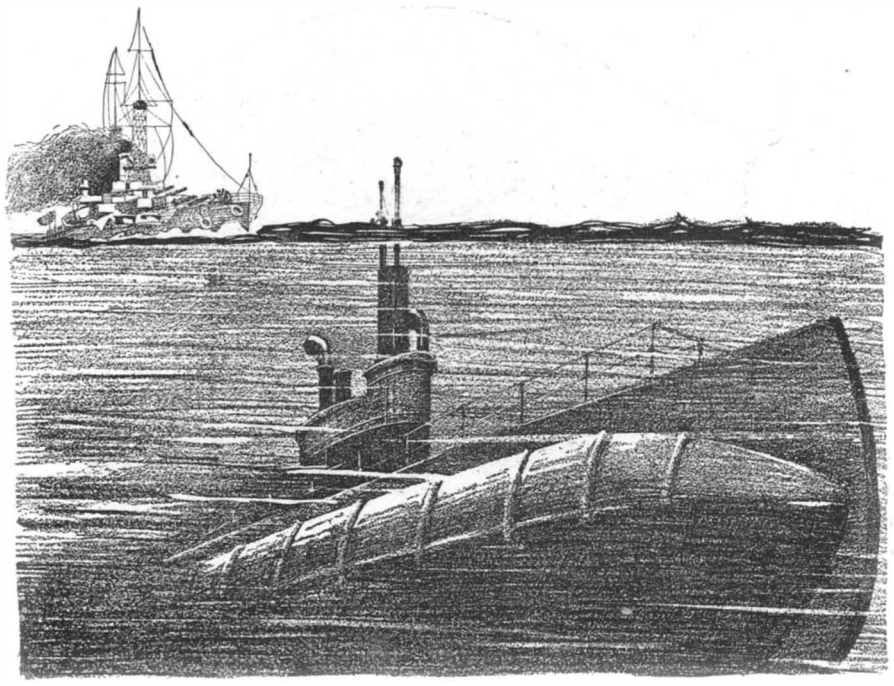
quired to operate a single plowshare will vary within wide limits. In an old English test made in five different soils with a share turning a furrow 5 inches deep by 9 inches wide, the average draft required was as follows: Loamy sand, 227 pounds; sandy loam, 250 pounds; moory soil, 280 pounds; strong loam, 440 pounds; blue clay, 661 pounds. The situation may be summed up by saying that for ordinary widths and depths of plowing the draft per square inch of cross section ranges from a minimum of three pounds in sandy soil to 10 or 15 pounds in turning the sod of the virgin prairie. The average tractor will not deliver more than 50 per cent of its brake-horse-power at the drawbar. In a remodeled truck, unless the driving system were carefully rebuilt and proportioned to obtain low speed and permit the engine to run at its most efficient speed, the proportion would not be as high as this. An engine that would deliver 40 horse-power under the belt might not deliver more than 10 horse-power in drawbar pull. The drawbar pull may be easily determined by a simple device known as a traction dynamometer, which is nothing more than a powerful spring balance which is attached to an immovable object at one end and to the truck to be tested at the other. The writer would not advise the owner of a motor truck to go to the expense of changing this to a traction engine unless the proper facilities for doing the work economically are at hand. On the other hand, the truck may be used for hauling all types of vehicles and farm appliances requiring but little draft without making any material changes. The amount of hauling the truck-tractor can do depends entirely upon the drawbar pull and the condition of the road surface over which the load is to be drawn. A drawbar pull of 10 horse-power would be equivalent to 1,870 pounds at a speed of 2 miles per hour.

P. E. R. writes: Can you give me any information relative to the process of making a rubber filling for tires in which gas is included under pressure? Is there any simple device for testing life, resiliency, etc., of solid rubber tires?

Answer. The substance you refer to is of German derivation and is offered as a substitute for air in tires. It is called "foam rubber" or "sponge rubber" and is very similar in structure to the sponge rubber erasers used by artists and draftsmen. It is produced by heating the raw rubber in a steel container and when the rubber is soft and sticky, nitrogen is admitted to the container under a pressure of about 6,000 pounds to the square inch. The gas is admitted at an intermediate temperature and at this high pressure a large percentage of it is absorbed by the rubber. The heating process is continued until the rubber is vulcanized and after vulcanization is accomplished the pressure is partially released and the nitrogen returns to its gaseous condition and when it reaches its free state it is capsuled and imprisoned in millions of minute rubber blisters, the pressure remaining from 125 to 150 pounds per square inch. The original amount of rubber is swelled to five times its former volume and the substance is pressed directly into the tire casing. Machines have been designed for testing the hardness of rubber, these indicating the various degrees of hardness in terms of resistance to depression of a plane rubber surface by a standard spring pressing on a blunt pin. The elasticity is shown in terms of resistance to permanent deformation or tearing. The "elastometer" is adapted for testing the elastic qualities of the rubber while the "durometer" serves to try the hardness.

F. A. H. writes: Is there any test on record of cars having been driven successfully for any length of time without differential gear or with a solid shaft passing through a live rear axle?

Answer. Four or five years ago a racing car won a 500-mile race on the speedway at Indianapolis and was without a differential. The Fifth Avenue Coach Company, of New York, has operated one of its busses without a differential gear for 30,000 miles and contrary to the expectations it was found that the rear tires had covered about 15,500 and 16,000 miles,



He Invented the Periscope—a Fortune was His—Then

MORGAN ROBERTSON proved that truth was far stranger than fiction when he wrote for the Saturday Evening Post the story of his own life. No story-teller, for instance, has ever written a romance of industry that compares with Robertson's experiences in inventing the periscope.

Robertson had gone to visit a naval officer, to secure material for a sea story. The officer took him on board a submarine.

Let the sailor-author continue the story:

"While in the lower part of the little boat the lieutenant in command showed me all its workings. It was a great day for me.

" 'The one thing we need,' he said as we came up, 'is an apparatus by which we can see what is going on above without having to rise.'

" 'In other words,' I added, 'if you could look into a glass down below, and, by a series of reflections, be able to view the surrounding surface of the water above, it would make the submarine the most powerful of warships.'

" 'Exactly.'

" 'Then I am going to invent it,' I declared, and I left him, knowing absolutely that it could be done.

"At that very moment, though I did not know it, a Frenchman, seated at his desk in Paris, was innocently devising a fantastic yarn that was destined to deal me a crushing blow—from which I never recovered.

"It was at the expiration of a year of experimenting I suddenly discoverd that in addition to other lenses, a cone-shaped glass placed in the end of the tube would do the trick of refracting the light rays as I wanted them. I was beside myself with joy. Working night and day I quickly rigged out a model, and—imagine my delight, it worked! I had solved the problem! I had invented the periscope!

"I sat across the desk from the lieutenant as he unrolled my blue-prints, and I shall never forget the expression in his eyes as he looked at the first one.

" 'You've got it!' he declared exultantly. 'The cone-shaped tip solves the problem.' I congratulate you.'

"I told him I had applied for a patent.

"The lieutenant suggested to me that if I could live on fifty dollars a week his company would put me on the payroll so that I might continue my experiments.

"It was in the midst of these happy moments that the blow fell. And this brings me back to the Frenchman and his yarn.

"The lawyers notified me that the United States Government had refused to grant me a patent on the periscope because a story had been published, prior to my application, in a French magazine, which had described fantastically the possibilities of an instrument similar to the one I had invented.

"My hopes were blasted. Understand, this Frenchman did not attempt an invention. He merely wrote that it was possible.

"My beloved periscope was now public property, and anybody had the right to proceed with its development. Though the submarine boat people had treated me generously, my devices were no longer needed. I was out of a job. Really, I believe it was the saddest momemt of my life when I went back to the typewriter and began to lay out a story. Ahead of me I saw the old grind, the weary rounds of the magazine offices, the butcher, the grocer, the landlord, and the wolf!"

MAKING A DREAM COME TRUE

You think this story tragic. Robertson's life was full of such tragedies. Though he wrote stories that magazines like Metropolitan, Saturday Evening Post, Harper's, etc., eagerly accepted, he died poor, and left his frail little wife without an income. It was these facts that led to the Metropolitan-McClure movement to gain him recognition and reward.

His desire, when dying, was that the sale of his books would permit his devoted wife to live without want. Will the American public grant him his last wish? That's what we propose to find out. YOU answer YES when you send in your order for this new four volume edition of Morgan Robertson's Works, together with your subscription to Metropolitan and McClure's Magazine. WE will pay for the books. WE will pay the carriage charges on them. WE will pay Mrs. Robertson a generous royalty—if you will pay for the magazines less than they would cost you at the newsstands, and you may pay for your subscriptions in easy monthly payments.

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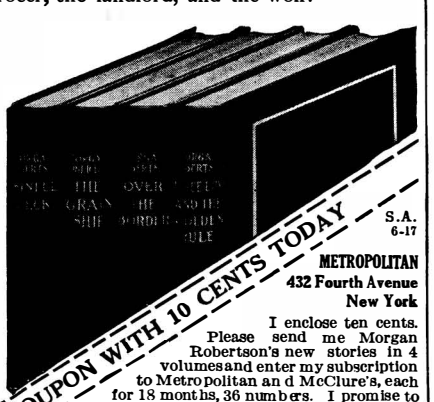

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respectively, which was greater than the tire life of approximately 11,000 miles which is the average on these busses. It is said that there is less skidding when braking on a solid axle than on the split type with differential gearing between the two wheels. A prominent axle maker has also been experimenting with its stock product from which the differential gears have been removed and satisfactory results were obtained after stronger axle drive-shafts were made to compensate for the increased stresses in that form of axle. While there is considerable discussion pro and con the writer does not believe that tests have been carried far enough to demonstrate that the differential can be entirely eliminated under all conditions of motor car operation with the same degree of success.

NOTES AND QUERIES

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

(14107) W. B. H. asks: Please tell me in the columns of your paper the normal temperature of small fish, such as gold fish. I have been told that a fish is as cold as the water they rest in. A. Fishes are classed in zoölogy with the cold-blooded animals, the temperature of whose blood is either that of the surrounding medium or very little above it.

(14108) F. B. A. asks: Can your paper explain a very curious experience I had in a hotel fire here recently? It was a three-story building; the rooms were all sheathed with North Carolina pine. The roof had fallen in, and the two upper stories were all ablaze. I entered the billiard room on the first floor, and the outside walls were all ablaze, the flames seemed to be sucked through the sheathing by a powerful draft, not a blaze or particle of smoke coming into the room. I unhung a picture 2 feet from the blazing wall. No heat, smell of heat, or smoke, was noticeable anywhere in the room. It seems to me to be a very unusual occurrence. There was not a particle of air stirring at the time of the fire, 7:30 A.M. A. The fact that the billiard room in the fire about which you write was free from fire and smoke was probably due to the outward draft of air caused by the burning of the walls of the building from the outside. Had the fire been on the inside, the draft of air would have been inward, and there would have been smoke in the room.

(14109) M. D. Catton asks: I have been informed that several telegraph messages could be sent over the same wire to the same place at the same time but from different stations, perhaps. Could you kindly give me information as to the old "*Quad*," as they called it, with two men at each end of the wire, one sending and the other one receiving, respectively; also inform me as to the truth of the first statement? A. You are correctly informed that several messages may be sent over one wire at the same time. In duplex systems one message is sent each way over one wire, and in the quadruplex system two messages can be sent in each direction at the same time. Then beyond quadruplex telegraphy is the Phantoplex, a system which permits an additional transmission of signals over a wire that is at the same time being operated as a single, duplexed, or quadruplexed circuit without interference between the two modes of signaling. You will find these systems described in McNichols' "American Telegraph Practice," price, $4. We shall be pleased to receive your order for a copy.

(14110) G. W. G. asks: To decide a controversy as to how fish absorb the oxygen from water through the gills: is this done and the element changed chemically in same manner as air is handled in the human or animal lungs? Is oxygen taken from the water in the process and is it returned by agitating the water in any manner whatsoever? As well known, water is practically incompressible, is it possible for the smallest quantity of air to remain in water, air to be forced in, or as contended, "all water has minute particles of air always present"? A. All natural water has air dissolved in it in sufficient quantity for the use of all aquatic animals and plants. These take the oxygen from the dissolved air and use it as we use oxygen from the air. This oxygen is not obtained by decomposing the water, as your remark seems to suggest. The oxygen is used by fish to oxidize carbon, forming carbon dioxide. Air is constantly being dissolved in water wherever air is in contact with water. It is more easily dissolved in running water since such water is continually being carried down from the surface and other water is continually brought up from below into contact with the air. The air dissolved in water is not present in bubbles and does not affect the compression of water to any considerable degree. You cannot see this air even with a powerful microscope.

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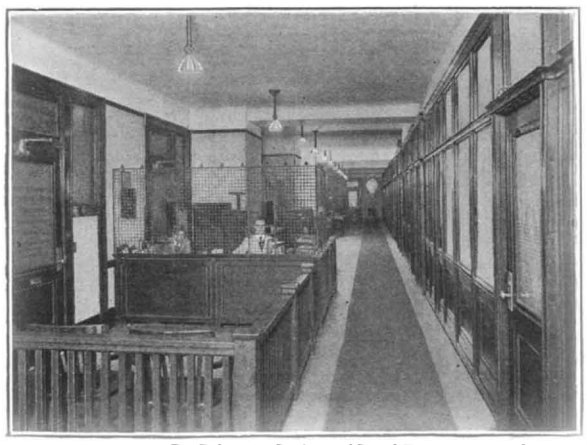

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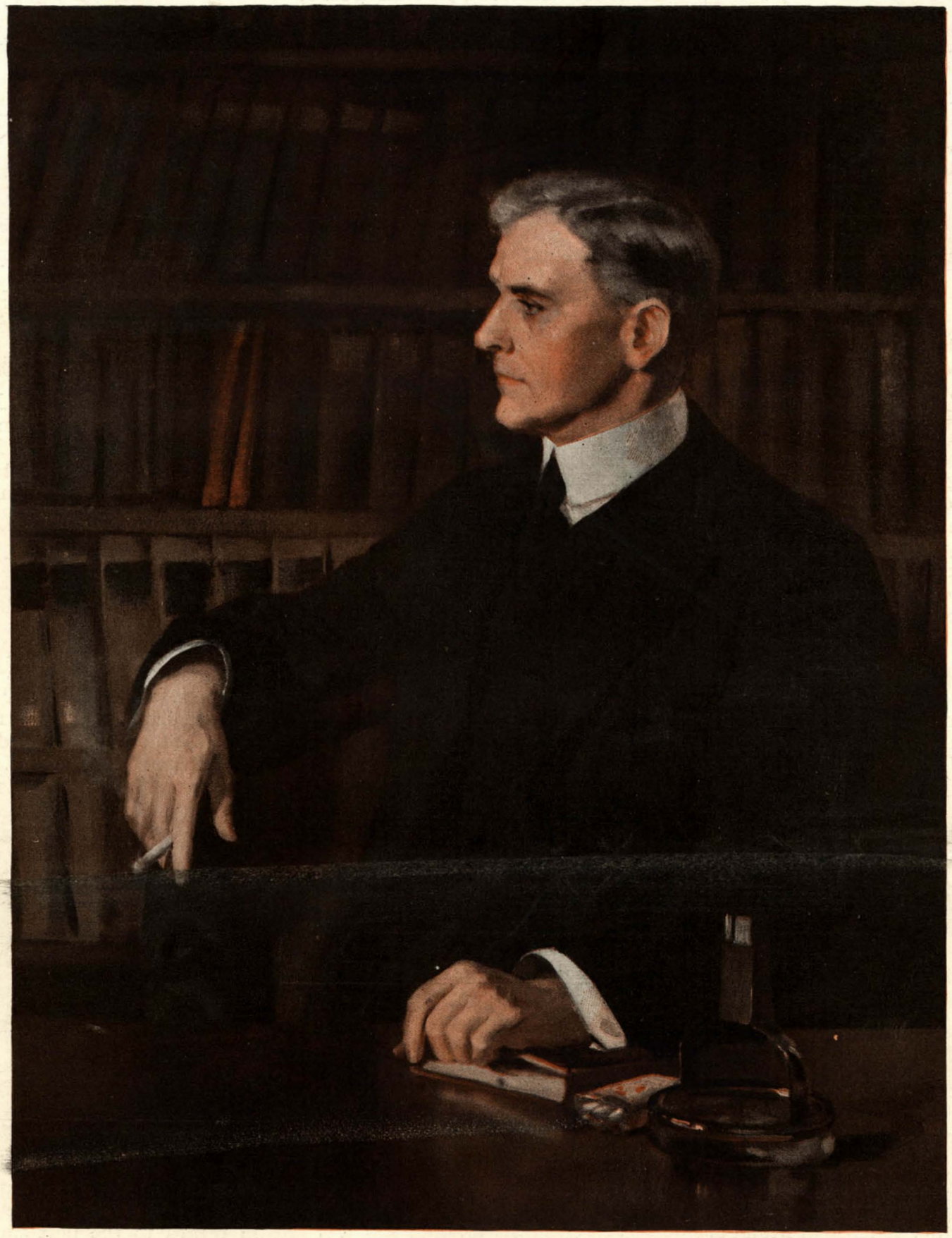

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