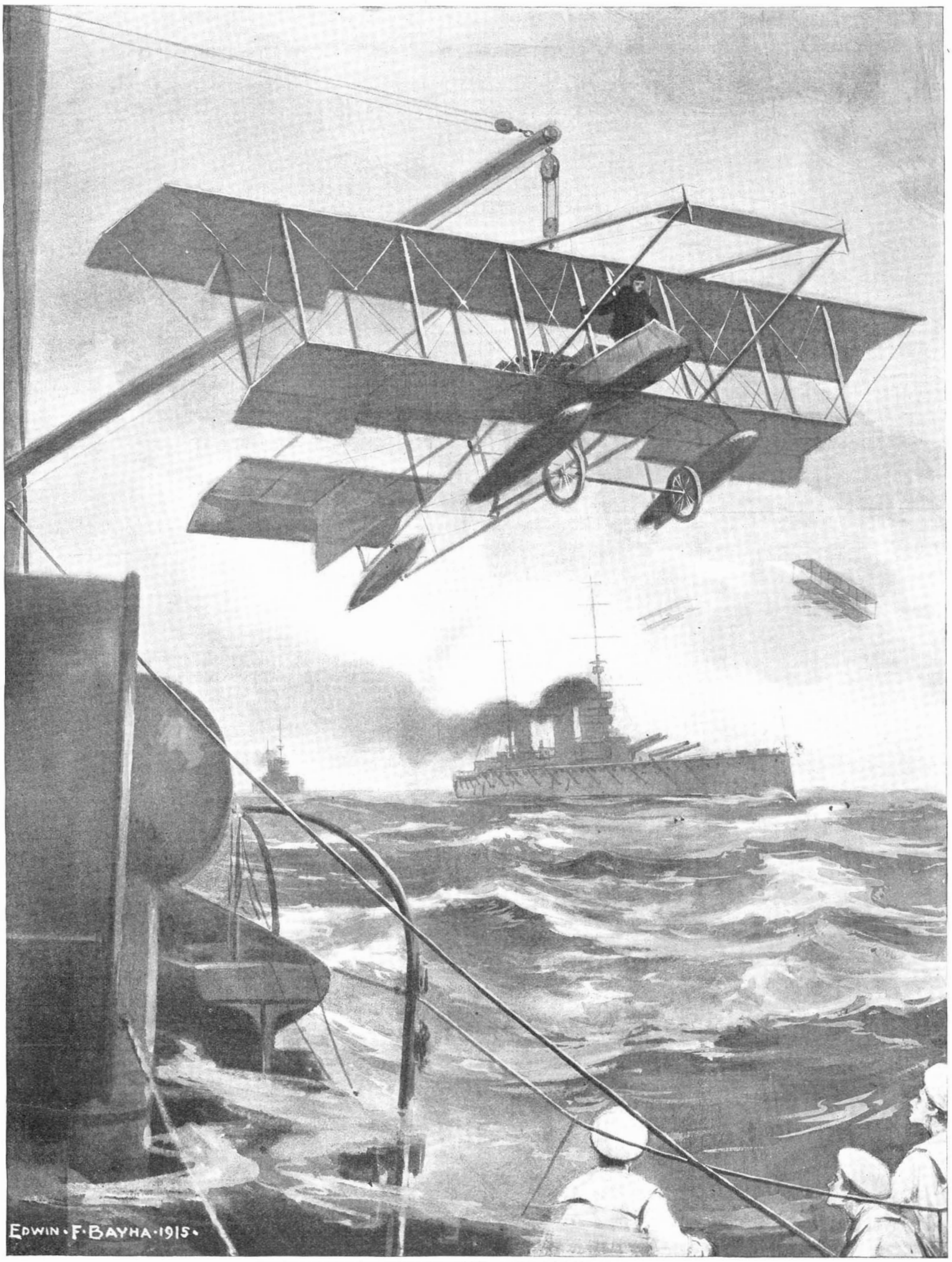
SCIENTIFIC AMERICAN



"THE EYES OF THE FLEET"—LAUNCHING A SEAPLANE

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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.

Industrial Preparedness for Peace

THE wealth of the United States in natural resources has not by any means proved to be an unmixed blessing in its effect upon the industrial and commercial situation. Like every other pioneer people in a land of great fruitfulness, we have gathered that fruit which was the richest, the most plentiful, and afforded the easiest plucking. Hence, Nature's prodigality has begotten in us certain habits of extravagance and improvidence, of which there are only too many and too eloquent evidences on every hand. We have exhausted the virgin fertility of our soil without effort at recompense—we have cut down our forests without any attempt at replanting—we have dug out the richest of our minerals, and, for want of a little care and patience, have allowed millions of wealth to run to waste in the tail heap—and in our methods of manufacturing we have thrown away waste material which the more patient and thrifty European manufacturer has fabricated into a useful product, with profit to himself and useful conservation for the world at large. Not only have we been content to send our natural products abroad, there to be worked up into finished articles and, as such, to be brought back for sale in our markets, but we have been content to let the double shipment be made in foreign bottoms with an annual loss to us in freights of over $300,000,000.

It took the upheaval of the European war to reveal to us the extent of our neglect and the wide range of profitable industries which, due to our neglect, have become the monopoly of our foreign competitors. To-day we are confronted with an opportunity to enlarge our industrial undertakings and render ourselves independent of foreign markets, the like of which may never again be presented in the history of the United States.

In the belief that if once the country awakes to the facts it will make haste to seize the golden opportunity, the SCIENTIFIC AMERICAN has decided to open an Industrial Department, in which the conditions in the various industries affected will be clearly laid down, and a plan of campaign outlined by which the country may take the fullest advantage of the opportunities developed by the present war. This Department will be edited by a well-known expert in the science of industrial efficiency, who is now engaged, and has been for some time past, in making a close study of the industrial conditions and the opportunities which present themselves as the result of the present upheaval of trade conditions.

We wish to make it clear that this Department will not deal merely with the question of scientific management, and that the articles will not be merely a theoretical or academic study of the various problems. On the contrary, it will be our aim to treat the whole subject in a thoroughly practical manner, and present a series of facts and figures and their lessons, which can be put to immediate practical use in the development of existing industries, and in the foundation and development of new industries for the products of which we have been dependent hitherto upon foreign countries.

There is a great demand for cold facts and clear thinking on this subject of industrial efficiency, and industrial preparedness for after-the-war conditions. In proof of this it is enough to remind our readers that a recent Congress was guilty of the amazing stupidity of passing a bill prohibiting the practice of scientific management and efficiency engineering in Government manufacturing plants. This piece of abysmal legislative folly had its roots in the lobbying of the labor unions, which, emboldened, as they might well be, by their amazing success, are now introducing a bill to prohibit the use by the Government of materials manufactured in plants which employ efficiency methods.

No small part of the space given up to our new Industrial Department must be devoted to ferreting out and exposing any future attempts to throttle American industries by iniquitous legislation of this character.

The Navy We Need

THEORETICALLY, the United States, being the richest country in the world, should have the strongest navy in the world—practically, the United States should have a navy a little stronger than that of the nation whose policies are most likely to render that nation an enemy. The strongest navy is possessed by Great Britain; but her language, her laws, her code of private, public and international morality, and, above all, her great international policies, are so similar to those of the United States that it is quite unnecessary for this country to possess a navy equal to that of Great Britain. On the other hand, Germany, which possesses the second strongest navy, believes that it has cause for a deep-seated grievance against the United States, because this country has turned itself into an arsenal for the supply of ammunition to the foes of Germany; moreover, the United States believes that it has an even graver cause for grievance against Germany, because she has deliberately murdered over one hundred United States citizens upon the high seas, and, by failing to disavow the act of her accredited executioner, gives to that deed the solemn sanction of the Imperial German Government.

It is for the above reasons that the SCIENTIFIC AMERICAN wishes to go on record, once more, as stating that, although there is no practical reason why we should endeavor to make our navy equal in strength to that of Great Britain, there is every practical reason why there is an immediate and most solemn obligation upon Congress at once to bend all the resources, political, financial and industrial, of the nation to an urgent effort to bring our navy, at the earliest possible moment, up to that rightful position of second in strength which it held at the opening of the dreadnought era.

If there is one great lesson more than another, taught to us by the European war, it is that we should avoid that pitfall of procrastination and futile effort which hitherto, in all the operations of the war on land, has caused the words "Too late" to be written upon the operations of the British armies. Furthermore, had it not been that the British navy long ago learned the great lesson of preparedness and lived up to it, the war in Europe would have been over by to-day, and the British Isles would have been overrun and held fast by the Prussian military machine.

Last summer, when the present Administration realized that it had made a grand political mistake in sealing the lips of its naval and military experts and preventing due naval and military preparation, it called for a confidential report from the General Board of the Navy, stating what kind of a navy this country should possess to render it absolutely secure. The General Board knew perfectly well that the naval policy which Great Britain followed in protecting its own interests incidentally served to protect the interests of the United States. It was well aware that the existence of the vast Dominion of Canada in the Western Hemisphere rendered the upholding of the Monroe Doctrine just as vital to the interests of the British Empire as it is to the interests of the United States. It was mindful of the fact that in 1903, when it drew up a programme of construction which would serve adequately to protect the interests of this country, the navy by which it measured the strength of that programme was the German navy. Last July, when it made its report in response to the request of the Administration, it was well aware that the conditions in 1915 were the same as they had been in 1903; and when it stated that the American Navy should be made equal to the most powerful maintained by any other nation in the world not later than 1925, it was giving an academic answer to an academic question, and nothing more. Theoretically, it would be advisable to have a navy equal to that of Great Britain—practically, the General Board of the Navy believes that we should employ the whole shipbuilding resources of the country in bringing up our navy as quickly as possible to that position of second in strength which it recommended in 1903, and which it believes would be sufficient to-day, as then, to preserve this country in absolute peace and security.

Not only is it unnecessary, but it would be impossible, to lay down any programme which would assure our overtaking the British Navy at any predicted date, and certainly not by the year 1925. To do this it would be necessary to know beforehand what will be the year-by-year programme of construction of the British Navy; and, judging from the fact that since the war started she has added a dozen dreadnoughts, five new battle-cruisers and over seventy 35-knot destroyers to her fleet, it will be realized that if we started in a race to overtake her (something that we shall never do), she would add to her fleet at a rate which would maintain her big lead unchallanged.

But is it possible for us speedily to repair the shameful neglect of the past decade, in several successive years of which we have authorized the construction of only a single battleship? The thing can be done only if this matter of naval construction be lifted out of the field of politics and considered and handled upon a high plane of disinterested regard for the safety and well being of the country. And in bringing this about, one of the most necessary steps is for the nation to put a stop to the suicidal policy of distrust and active animus against the shipbuilding interests, which has characterized the policy of the present Secretary of the Navy from the very day on which he took up the responsible duties of his office. It has been the constant aim of the Secretary to prejudice Congress and the country at large not only against the great shipbuilding firms of the country, but against all those firms which are engaged in manufacturing the material and supplies which are necessary for the upbuilding and maintenance of the Navy. The result of this policy has been that naval contracts are unpopular, and that there are some firms which definitely refuse to enter bids for naval work.

Shortsighted, indeed, has been the attitude of the Secretary of the Navy in this matter. If Mr. Daniels had been possessed of that breadth of view and catholicity of spirit which are the essential qualifications of a competent Secretary, he would have realized that it should be the aim of the Secretary to enlist the whole of the shipbuilding strength of this country in the work of naval construction. Great Britain has done this so successfully that naval contracts are eagerly sought after by the big shipbuilding firms, which, assured of generous governmental support, have not hesitated to erect building ways and extend their manufacturing facilities in order to take care of profitable government contracts, which they knew would come in due course.

It would be good business policy to replace the present unsatisfactory method of competitive bidding by a policy under which the shipbuilders would be paid for the cost of construction plus an agreed-upon percentage of profit. Under this system the private yards would be perfectly willing to lay down new building ways and extend their shipbuilding facilities, particularly if the present Congress should authorize a programme which would include all those battleships and other types of vessels which Congress has cut out of the General Board programmes during the past ten years.

To show what could be done, the SCIENTIFIC AMERICAN recently made an investigation, with the assistance of one of the leading officers of our Navy, and found that with the enlargement of existing building ways and by the construction of additional ways, both at the governmental and private yards, it would be possible to take care of the nine dreadnoughts which are at present under construction or authorized and, by January 1st, 1917, to have twelve additional dreadnoughts under construction.

Official Endorsement and Patent Advertising

ONE of the first bills to be introduced into the Senate, when it convened last month, was a measure prohibiting the use of the name of any Member of either House of Congress, or of any officer of the Government by any person, firm, or corporation practicing before the Patent Office, for advertising purposes.

Those of the public who read this bill, no doubt, were surprised to learn that any such legislation is necessary. Surely any Government official who realizes the dignity of his position would not lend his name for advertising exploitation; but evidently there are many public servants who have not been restrained by such a sense of good taste. We have before us the literature of patent attorneys filled with letters of endorsement from United States Senators and Congressmen, as well as minor Government officials, which not only commend the reliability of the attorneys in question, but also their competency and their efficiency. Are these officials ready to endorse every practice of the attorneys they commend? Have they investigated them thoroughly? Do they realize the uses to which their letters are being put?

To the man who knows, such endorsements mean nothing; commendatory letters are very easily obtained. But the obscure inventor, who has been made timid by accounts of patent trickery and knows not in whom he can place confidence, looks upon such a letter as an official endorsement by the Government of the United States. He feels that he can rely absolutely upon a man or firm so highly recommended. It may never occur to him that the attorney in question was not carefully investigated before the letter was written.

It is more than a matter of bad taste—it is more than undignified to use official names in such a way. A serious responsibility lies upon the writer of any letter of endorsement. A "good word" to help a man along, if not given advisedly, may turn out to be the subtlest of evils.

Astronomy

The Harvard Observatory in Jamaica.—Now that Mars is attracting the special attention of astronomers, interest attaches to the question of the climatic conditions most favorable for observing the elusive and much-debated markings on that planet. Prof. W. H. Pickering, in his Twelfth Report on Mars, comments on the relative advantages of his own station, near Mandeville, Jamaica, Prof. Lowell's observatory at Flagstaff, Ariz., where Pickering spent six months when the observatory was established, and the observatory at Arequipa, Peru, where he spent two years. He declares that there is no choice between the best seeing at Mandeville, Flagstaff and Arequipa; but that good seeing is considerably more common at the Jamaican station than at either of the others. Flagstaff has a long winter, when the seeing is inferior, and Arequipa a long cloudy season, which comes at the same time with our northern winter.

A Lost Star Recovered.—The SCIENTIFIC AMERICAN of September 25, page 267, recorded the unsuccessful attempts of M. Raymond, of Antibes, to find the companion of Alpha Cancri, and the fact that the invisibility of the star had been confirmed at the Observatory of Marseilles. A reassuring note on this subject has, however, been published by Prof. Eric Doolittle in *Popular Astronomy*. In spite of unfavorable conditions Prof. Doolittle had no difficulty in seeing the companion on three nights in October, and he declares that he finds no change in its brightness. He thinks the trouble with the French observers is that they expected the star to be of about the 11th magnitude, as estimated by Dembowski and Otto Struve, whereas it is actually much fainter; viz., about 12.2. Prof. Barnard also writes that he observed the star October 6th, but he calls it of the 11th magnitude. There have been many reports of variable double stars, but none of them has thus far been confirmed.

The Nomenclature of Variable Stars was discussed at the last meeting of the American Astronomical Society, and a committee was appointed on this subject, with S. D. Townley as chairman. Various methods of designating variable stars have been in use, and there is still much confusion in the matter. Mr. Townley has thus defined the three fundamental requirements of a system suitable for universal adoption: (1) It must be simple, (2) it must be capable of indefinite extension, and (3) it must not depend upon any particular epoch of time. The Argelander nomenclature does not fulfill the first two requirements, and has, moreover, never been made all-inclusive, as it has not been applied to such variables as Algol, Mira, Polaris, etc. Mr. Townley recommends the adoption, in place of the Argelander system, of the plan proposed by Chambers, André and Nijland, according to which the variables of each constellation are numbered in order of discovery, each number being preceded by the letter *v*, and followed by the name of the constellation; for example, *v*21 Persei.

A Meteor Star Atlas.—Under this title the Dominion Observatory, at Ottawa, has just published a collection of twenty star maps, with introductory text, prepared by Dr. Reynold K. Young for use in observing meteors and plotting their paths. The track of a meteor is nearly an arc of a great circle. It is therefore conveniently plotted on a map where great circles are represented by straight lines, and accordingly the maps in Dr. Young's atlas are constructed on the gnomonic or central projection, which gives this desired property. The amount of error introduced by using maps on other projections depends upon several factors, such as the fraction of the sky covered by one chart, the distance of the meteor track from the radiant, and the particular projection used. In some cases the error may amount to more than five deg.; *i. e.*, a path correctly observed, if produced backward on a map with unsuitable projection, may not pass within five deg. of the radiant. The Meteor Star Atlas shows all stars down to the fifth magnitude.

The Variability of Betelgeuse.—Mr. Frederick C. Leonard has recently published a series of naked-eye estimates of the brightness of Betelgeuse (Alpha Orionis) made between July, 1914, and April, 1915, in continuation of earlier series which he has published from time to time. These show a decline in brightness during the nine months of about 0.30 magnitude, and an appreciably lower average magnitude than in the previous two years. In discussing the past history of this star and especially Sir John Herschel's observations, Mr. Leonard states that he has seen Betelgeuse several times when it was unequivocally equal in brightness to Capella, and therefore the fifth brightest stellar object in the entire heavens, and he has never seen it as faint as Aldebaran, while Herschel found it, at maximum, but slightly superior to Rigel, and at minimum inferior to Aldebaran. He, therefore, raises the question whether the star has actually increased in average brightness during the last three quarters of a century. Mr. Leonard finds the fluctuations in this star's brightness to be irregular and non-periodic.

Science

New Paper-making Materials.—The U. S. Bureau of Plant Industry has published a bulletin describing what appears to be a valuable new source of paper; viz., zacaton (*Epicampes macroura* Benth.), a grass growing wild in abundance in Mexico and Central America. This is but one of several possible paper-making plants that the Bureau has under investigation. Year by year the demand for materials other than wood and rags capable of yielding paper on a commercial scale becomes more urgent. Wood is now used in this country for pulp manufacture to the amount of about 4,500,000 cords a year, and the cost of pulp-wood is steadily rising.

The Distance at Which Heavy Gun-firing Has Been Heard during the present war forms the subject of some investigations by Mr. M. Christy, preliminary results of which are reported in *Nature*. Mr. Christy's house is at Chignal St. James, near Chelmsford, Sussex, about 125 miles from Ypres (taking the latter town, for convenience, as a known center of the region from which the sounds come). Mr. Christy states that he has heard the firing quite unmistakably since the beginning of the war, often all day and for many days in succession. He has collected records of the firing being heard at places throughout the southeast of England, the maximum distance from Ypres at which it was unmistakably heard being 140 miles, though there is a doubtful record of 150 miles. Apparently the direction of the wind has less to do with the transmission of the sound than certain other atmospheric conditions.

Parasites and Diseases Carried by Dogs.—Dr. M. C. Hall, of the U. S. Bureau of Animal Industry, has just published a bulletin on this subject, in which he points out that the domestic status of the dog has not yet been adapted to the hygienic requirements of modern life, and declares that the destruction of all superfluous dogs, including those that are ownerless or whose owners do not keep them at home and in a sanitary condition, would mean an annual saving of hundreds of human lives and an increase of millions of dollars in the wealth of the nation. He points out especially the danger of letting dogs take too great liberties with human beings; as, for example, licking the baby's face or the children's candy. Important diseases conveyed by dogs to man and the domestic animals include rabies, hydatid, gid, muscular cysticercosis, or so-called "measles," in sheep, tapeworm in man and especially in children, roundworm in man, tongueworm in man and stock, etc.

Standard Instruments for Measuring Evaporation.—The U. S. Weather Bureau has just published a pamphlet describing the standard equipment to be used at the evaporation stations it is about to establish in various parts of the country; a first step toward securing a large body of comparable data in regard to this elusive element of climate. The apparatus will include a circular evaporation pan of galvanized iron 10 inches deep and 48 inches in diameter, barely raised above the ground on a wooden support. In the pan stands a still-well, which provides an unruffled water surface wherein hook-gage readings can be made with accuracy. The hook-gage is provided with a micrometer screw head, and gives readings to thousandths of an inch. Near the evaporation pan is a standard rain-gage, the measurements of which must be used in conjunction with those of the evaporation apparatus in order to determine the actual amount of evaporation. Maximum and minimum thermometers, in a screen, and an anemometer complete the equipment. Observations are to be made daily about 7 A.M., local standard time.

Fox Farming in the United States.—Much has been written during the last three or four years regarding the remarkable development of fox farming in Canada, especially in Prince Edward Island, where this industry originated. Less publicity has, however, been given to the spread of the industry in the United States. In a bulletin on "Silver Fox Farming," just issued by the U. S. Department of Agriculture, it is stated that fox ranches are now established in Maine, New Hampshire, Massachusetts, New York, Pennsylvania, Ohio, Wisconsin, Michigan, Minnesota, Missouri, Oregon, Washington and Alaska. The natural habitat of the red, cross and silver foxes (color phases of the same species) includes the greater part of North America, from central United States northward to and including the treeless tundras. The silver phase, the pelts of which are most valuable, is in general more common as one goes northward, but is very irregular in its distribution. The bulletin above mentioned gives complete directions for raising these animals. The great value of the silver fox has led to extraordinary precautions against their loss. "On the more pretentious ranches the animals are regularly examined by a doctor and guarded by watchmen, bulldogs and burglar alarms. Cats are kept to act as foster mothers to orphan cubs. Foxhounds are trained to overtake and hold without injury foxes that have escaped, and bloodhounds are employed to track thieves."

Industrial Efficiency

Working Capacity of a Single Gallon of Gasoline.—According to the *Wall Street Journal*, a single gallon of gasoline will do wonders almost anywhere, but nowhere has it been applied to better purpose than on the farm. It will milk 300 cows, bale 4 tons of hay, mix 35 cubic yards of cement, move a ton truck 14 miles, plow three fifths of an acre of land or generate sufficient electricity to illuminate the farm house for 30 hours.

To Recover the Iron in Discarded Wooden Cars, an Eastern railroad burns them. Before setting the cars on fire, however, they are carefully inspected and all sills and other wooden parts fit for further use are removed. The value of what remains is said to be so little that it does not justify the expense of tearing it down and accordingly it is cheaper to burn the wood, leaving the iron which is sold as scrap.

Panama Canal Slides and Transcontinental Transportation.—The use to which the great waterway has already been put in transporting merchandise from coast to coast has been strikingly revealed by the closing of the canal due to the land slides. As an example of the inconvenience caused, a large oil company of California has found it necessary to ship huge quantities of oil to the Atlantic coast via the transcontinental railways, using trains of 25 tank cars carrying approximately 250,000 gallons, whereas in the recent past it has made all its shipments via the Panama Canal.

Revenue from a Railroad Junk Heap.—A leading Eastern railroad prides itself on the fact that it does not throw away a single article that has any value to man or beast. Everything that has been relegated to the scrap heap is afterwards sold if there is a market for it. In 1914 the scrap metal sold brought in to the company's treasury $2,157,241.24, which sum was $1,000,000 less than in 1913. Waste paper alone sold for $19,211, oil barrels for $22,439, and old rubber for $15,222. Locomotives and wooden passenger cars sold for $114,326. Old wheels, metals and wrought iron yielded more than $780,000. Other odds and ends brought in $121,997.

A Method of Preventing Oil Conflagrations has been tested out with no little success by a leading American oil producer. Briefly, if an oil tank catches fire the heat immediately melts a fusible connection closing an electric circuit, which in turn releases controlling valves of a tank containing a certain solution which then flows into lines running to the mixers installed in the tanks. Each mixer is fitted with fusible plug valves which melt out and the solution runs into the mixers, producing a foam that spreads over the surface of the burning oil and prevents access to air necessary to combustion. In a recent test in Hawaii a fire was extinguished in 46 seconds after it had started, 42 seconds having elapsed before the fuse plug melted.

American Steel the Equal of the German Product.—It is announced that American steel manufacturers have finally succeeded in producing a product that equals that of the famous Krupp works at Essen, Germany. For years the Krupp works have been supreme in the manufacture of certain steels, particularly the alloys used in the manufacture of crankshafts and other parts of gasoline motors, where greatest strength coupled with the least weight is desired. For the first year of the European war American motor builders were seriously handicapped by the German government's embargo on Krupp steel, but in response to the urgent demand of the motor builders, the domestic steel mills set to work and at last have succeeded in equalling the German steels.

Improvements in Sand-Blasting.—A constant effort has been evinced on the part of foundrymen towards the improvement of sand-blasting operations and the reduction of the dust hazard. The earlier manual cleaning of castings with wire brushes has long since been supplanted by the tumbling mill which entirely eliminates manual labor, although it has many disadvantages. Fragile castings and those with delicate surfaces can not be treated in a tumbling mill, and hence some other methods have been developed for such work. Among them are sand-blast machines equipped with revolving or reciprocating tables. A most recent method of sand-blasting and one which is applicable to the largest castings is that making use of a hose through which sand is driven by compressed air with great force. The hose is provided with a nozzle so that the sand-blast can be directed on the castings. In order to prevent injury to workmen from not only the dust but the sharp particles of sand as well, the work is usually done in a room especially intended for the purpose. The room is usually equipped with a ventilating system, and the worker is provided with a substantial hood or helmet to protect his head and neck from the sharp sand that rebounds from the castings. The workman must wear a respirator in which the sponge is constantly moistened, in order to breath the air without danger. Only men in perfect physical condition should be selected for the work, since it is most trying on the lungs.

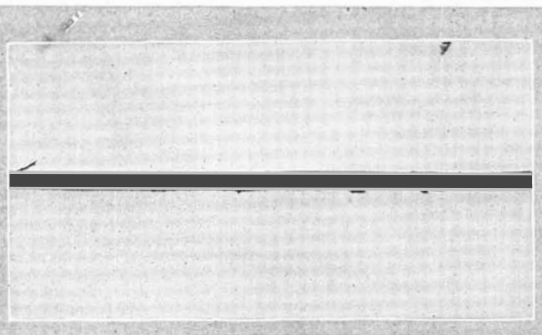


Fig. 1.-Single cocoon thread spun by the silk worm, as it appears with a magnification of about 100 diameters.

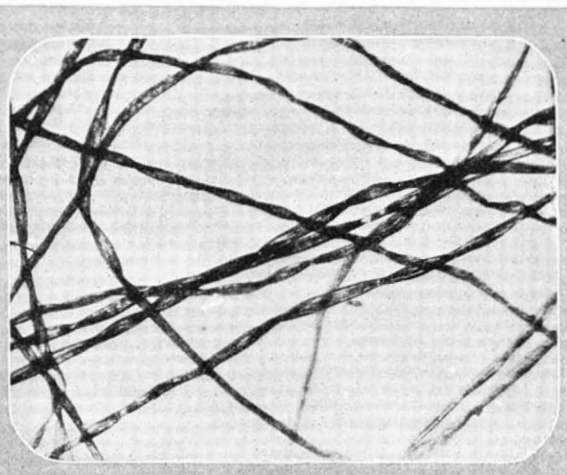


Fig. 3.-Mass of cotton fibres, showing their characteristic twist which causes them to interlock. Magnification, about 100 diameters.

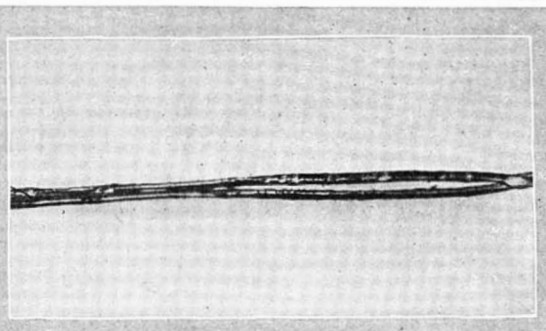


Fig. 2.-Single silk fibre with the two fibres split apart where the silk gum failed to hold them together. Magnification, about 100 diameters.

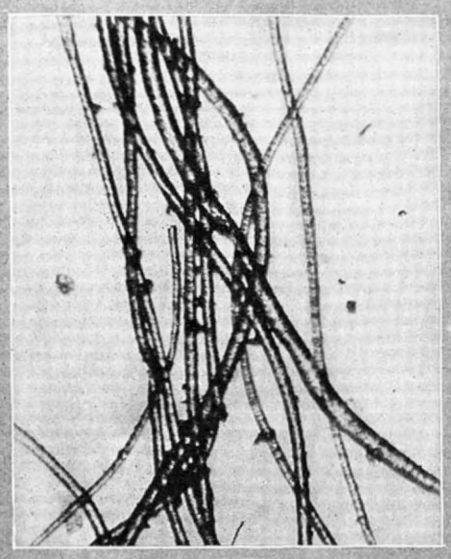


Fig. 4.-Mass of Merino wool fibres, showing the tiny scales that are characteristic of these fibres. Magnification, about 100 diam.

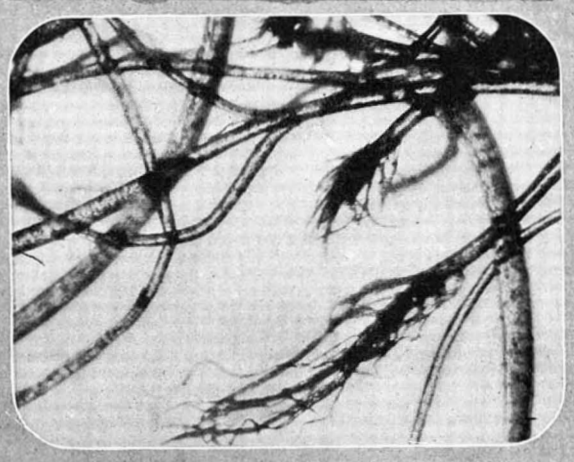


Fig. 5.-Appearance of shoddy under the microscope, showing the macerated and torn ends of the fibres. Magnification, about 100 diameters.

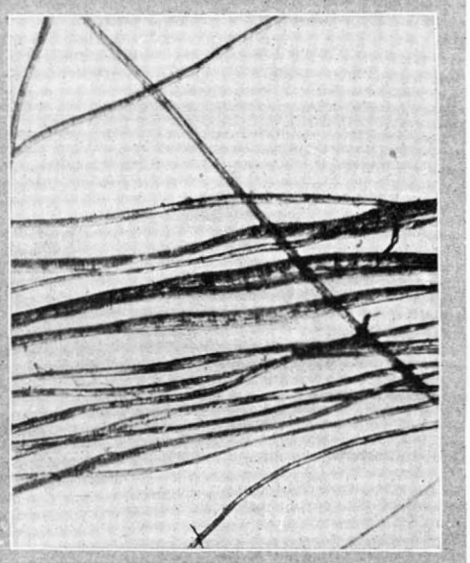


Fig. 6.-Mass of linen threads which are secured from the inner bark of the flax plant. Magnification, about 100 diameters.

Highly magnified views of the fibres most common in the manufacturing of fabrics for wearing apparel

Textile Fibres and Their Characteristics

Microscopic Studies of Common Textile Fibres and What They Disclose

By Karl B. Lamb, Ch.E.

FEW persons indeed know the actual appearance of the individual fibres from which a piece of cloth they may be examining is woven, or anything about the methods employed in preparing and using these fibres. While experience has taught them to distinguish between wool, cotton and silk, still these terms mean very little to them except as concerns the finished product.

How many realize that a single thread of No. G sewing silk may contain as many as 1,000 cocoon threads side by side, or that each silk cocoon contains from 2,400 feet to 1 mile of one continuous thread? It requires about 2,000 cocoons to provide one pound of silk; therefore, there is represented in a pound of silk approximately 5,000,000 to 10,000,000 feet, or in round numbers 900 to 1,800 miles of fibre. Considering the higher figure, this is enough to stretch nearly two thirds the distance across the United States!

Equally startling is the fact that each wool fibre as it comes from the back of the sheep is covered with tiny scales and that it is the interlocking of these scales which enables wool to be "felted." It is likewise interesting to learn that wool is reclaimed from old clothes and rags and rewoven into cloth, and that the reason why cotton can be spun into very fine, strong yarns is because the cotton fibres are of a very fine diameter and are flat, twisted ribbons in structure, which fact enables them to "kink" together and interlock.

The accompanying enlarged views of a few of the common textile fibres disclose certain characteristics of these fibres which are unknown to the naked eye. The first illustration, Fig. 1, shows a single cocoon thread as it is spun by the silk worm, greatly magnified. This raw silk is composed of about 80 per cent pure silk and 20 per cent silk gum. The silk itself is formed by two glands in the body of the worm, and during the spinning of the cocoon it flows through two channels in the head of the worm into one exit tube. The silk is, therefore, composed primarily of two single threads or filaments. At the same time as the silk filaments are being formed, the silk gum is being prepared by two other glands and flows out with the filaments, cementing them together. This gum is of the consistency of fairly thin fluid when it emerges from the glands, but it quickly coagulates upon coming in contact with the air. In Fig. 1 the twin structure of silk fibre can be readily seen.

In Fig. 2 appears a photomicrograph of a silk fibre, showing a defective spot where the gum has failed to hold the two silk filaments together, allowing them to split apart. This view, as well as that appearing in Fig. 1, depicts the characteristic glasslike smoothness of the silk fibre, which property gives it the beautiful lustre that distinguishes silk fabrics.

The next photomicrograph, Fig. 3, shows a mass of cotton fibres that, as can be seen, are in the nature of flat, twisted ribbons. This peculiar structure of the fibre is characteristic and is the cause of cotton's most important trait, namely, the facility with which it may be spun into very fine and strong yarns. As will be seen from the photomicrograph, it is evident that when the fibres are twisted together the kinks interlock, thus forming a strong, compact thread.

"Mercerized" cotton is formed by treating ordinary cotton with caustic soda, causing the fibres to swell and to a greater or less extent lose their twisted structure. They become smoother and thus give a much higher lustre to the fabric made from them.

A mass of Merino wool fibres appears in Fig 4. Merino is the finest of the wools, and a close examination of the photomicrograph reveals the fact that the hairs are covered with tiny scales. When the wool fibres are worked and massed closely together, the scales open up and interlock with one another. This feature results in "felting," which enables wool to be used for felt hats and other purposes.

In Fig. 5 appears an excellent example of the appearance of shoddy under the microscope. New wool fibres in cloth have clearly cut ends the same as when they were cut from the back of the sheep. Shoddy, on the other hand, is obtained from old woolen cloth by a process of tearing, hackling and combing, which leaves the ends of the fibres macerated and torn, as shown.

Magnified a great number of times, there appears in Fig. 6 a mass of linen fibres. These come from the inner bark of the flax plant and are long and of great strength. Accordingly, the fibres are fairly smooth and as a result good linen possesses considerable lustre.

Solidified Naphtha

THE hydro-carbon oils have been solidified in the laboratory many times by many experimenters, but, heretofore, the process has not been exploited commercially. Now, however, a New England chemist has succeeded in solidifying naphtha on a commercial scale, and is putting it on the market in compression-top cans, as a household commodity. The naphtha, which is solidified by a process analogous to saponification, has much the same appearance as vaseline, and is of about the same consistency. It is claimed that it has many virtues which are foreign to the liquid hydro-carbon, chief among them being its solubility in water, which, combined with the fact that it has all of the grease-removing qualities of liquid naphtha, renders it a highly efficacious article when used in the laundry. Used undiluted, it is said to be ideal for taking spots out of clothes, cleaning and polishing furniture, automobile bodies, etc. It burns readily, but, not being highly volatile, will not explode under ordinary conditions.

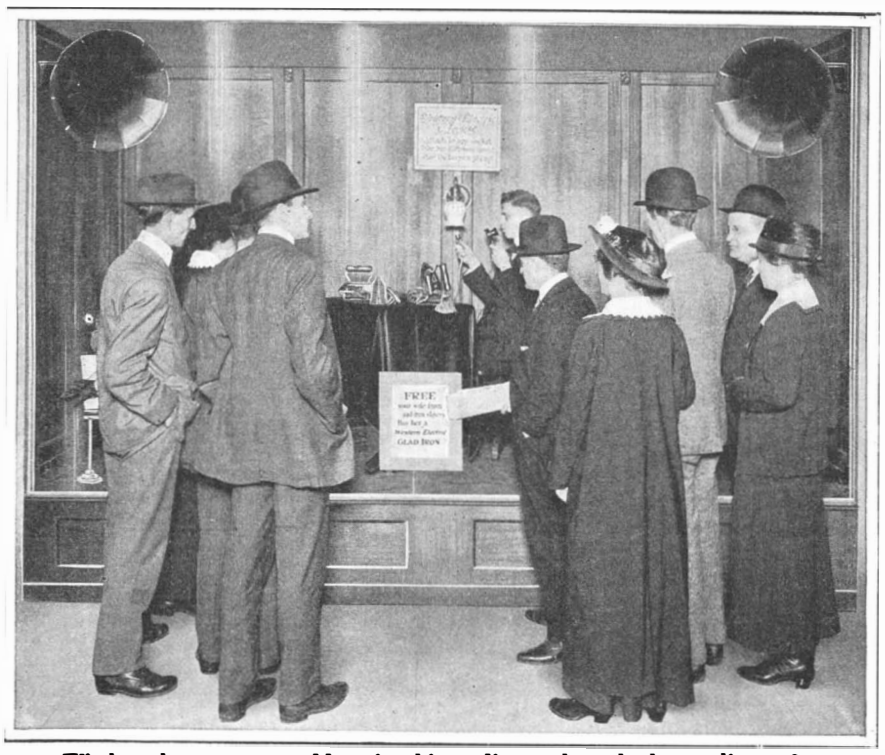
Potato Peeler

A NEW form of potato peeler, which appears very practical as well as simple, is the object of a French patent of recent date. It consists of a large frame of wood or metal about 8 inches square, this being filled up by a honeycomb make-up of steel blades. The whole has a somewhat concave shape, and the blades are placed in the frame so as to make up small cells of ⅛ to 1 inch square, by the use of sets of longitudinal and transverse blades suitably inserted. It is claimed that this affords a very rapid potato peeler by rubbing over the sharp edges, and above all it can be easily cleaned.

Loud-Speaking Telephones as an Aid to Window Demonstrators

THE handicaps under which window demonstrators have labored in the past are too well known to require an elaborate explanation of them. Suffice it to state, however, that heretofore window demonstrators have had to possess not a little ability in pantomime acting, and such points as could not be conveyed to the audience by visual means have had to use the crude vehicle of lettered cards, a means at once time-consuming and unconvincing.

In an endeavor to give window demonstrators a better opportunity of exercising their salesmanship, an electrical manufacturer has recently introduced a loud-speaking telephone equipment especially designed for this purpose. As will be noticed in the accompanying illustration, the loud-speaking telephones, fitted with amplifying horns, are fastened outside the store window, while the demonstrator within uses a conventional type of telephone transmitter into which he speaks. If he desires to have both hands free, he can wear a transmitter fitted with straps which hold it in position, similar to the equipment used by telephone operators. Thus can the demonstrator go about his work without a pause, speaking all the while to his interested audience standing outside.



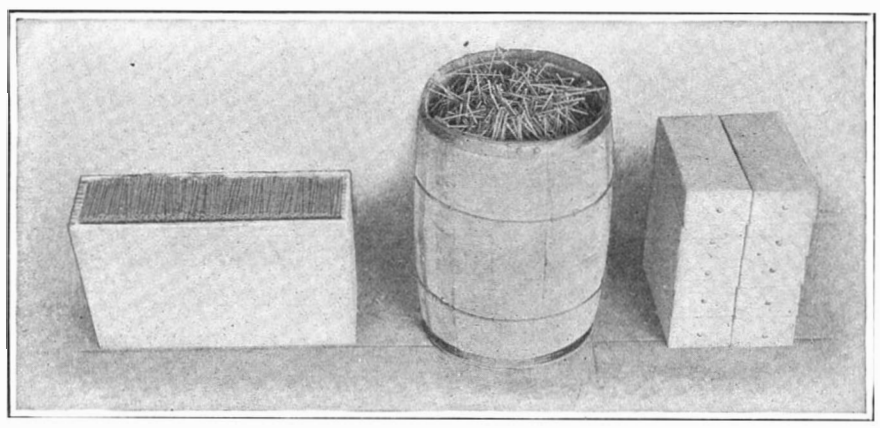
Window demonstrator addressing his audience through the medium of a telephone transmitter and loud-speaking telephones

Parallel Packing of Nails by Electricity

WHEN next you go to the hardware store to buy some nails, you may notice a rather startling innovation which has been made in the packing and handling of nails in bulk. Heretofore they have been dropped loosely into a keg, and the pieces locking and interlocking as they do from a mass which is almost impenetrable to the scoop generally provided in the hardware store for the purpose of removing them from the keg. The scoop is almost superfluous, for the clerk is invariably compelled to remove the nails by hand and place them in the scoop in which they are conveyed to the scales. But now things are different. You will find the nails nicely and accurately arranged in a box, parallel to each other, so that their removal by hand is a simple matter.

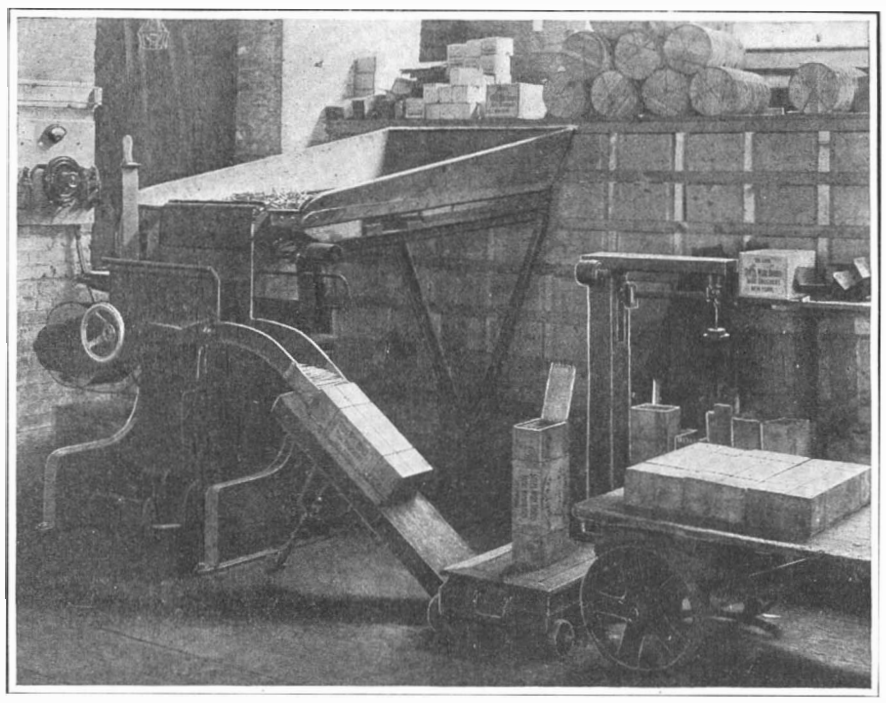
The greatest advantage of the new method, however, is that the nails systematically laid in a box will occupy a little more than half the space required when they are dropped in the keg. In one of the accompanying illustrations the boxes being filled by the machine have a capacity of fifty pounds each although no larger than a five-pound confectionery box.

The machine for packing nails in the manner described is of German origin and just being introduced into this country. Its operation is based upon the principle that linear iron articles when brought into a magnetic field will automatically take a position parallel to the lines of force. The machine consists essentially of the electric paralleling mechanism, a feeding trough and a shaking device. By means of the latter, the nails glide gradually into the paralleling mechanism and while still falling are drawn in the direction of the lines of force. The nails are passed into a tray fixed between the two magnetic poles and at intervals the tray is pressed downward and the contents emptied into boxes. With but little adjustment the machine may be made to handle any size of nail. The paralleling mechanism uses direct current at 110 or 220 volts pressure.



Old and new methods of packing nails

At the left, 100 pounds of nails packed by electricity; in the center, 100 pounds of nails packed by the old method; at the right, ten 10-pound cartons of nails packed by electricity.



Electro-magnetic machine which packs wire nails in parallel, saving space and facilitating subsequent removal from the boxes

American All-Steel Battleplane with Turrets at Plane Tips

WHAT is claimed to be a noteworthy advance in heavier-than-air craft construction by the leading aeronautical experts of the United States was recently disclosed when an all-steel battleplane, designed by Grover C. Loening, received its initial test. The new aeroplane was flown at Readville, Mass., on December 12th, by Lt. Byron Q. Jones of the U. S. Army aviation corps, with eminent success.

Copyright International Film Service

Testing the engine of the new all-steel battleplane. The plane tip gun turrets are not as yet mounted in place

The new machine may be generally described as a biplane with a wing spread of 65 feet over-all. Vanadium steel replaces the usual wooden framework, resulting in a flying machine of unusual strength. A most commendable feature is that all the parts have been standardized and stamped out by machinery, insuring perfect interchangeability and ready repairing. In fact, the construction follows the unit system throughout; the planes being made up in sections the number of which can be altered to meet the requirements of the service for which the machine is intended. Then again, if a section of the planes has been damaged in use, it becomes a simple matter to remove the damaged portion and replace it with a new unit. Incidentally, this form of construction is inexpensive.

Equipped with a 140 horse-power engine and a propeller mounted in front of the nacelle, the new battleplane is capable of a speed of 90 to 95 miles per hour. Its fuel tanks have a capacity sufficient for a flight of 800 miles.

Perhaps the most novel feature of this unique aeroplane are the two gun turrets mounted at the tips of the planes. These, it is said, will be about 8 feet long by 2½ feet wide and will provide room for a rapid fire gun and gunner. The placing of the turrets at the plane tips permits of swinging the guns through a vertical arc of over 90 deg. and a horizontal arc of somewhat over 200 deg.

In times of peace the battleplane can be adapted to peaceful pursuits such as the carrying of mail and express packages by using the gun turrets as baggage compartments, in which instance it is said they can hold about 500 pounds with safety and without appreciably altering the speed of the craft.

Animated Drawings in the Moving Pictures

PATRONS of the moving-picture shows find much amusement in the animated cartoons wherein the moving parts of the picture originate in series of drawings of which each successive picture shows the object in a slightly advanced position from that which it occupied in the last preceding picture, and these when rapidly projected on a screen cause the persons, animals or other objects to appear to move in the same manner as they do in the ordinary moving picture. Patents have been granted illustrating efforts to facilitate the production of these cartoons on a commercially practical scale. One of these patents was issued in the summer of 1914 to John Randolph Bray of New York city. Realizing the labor of reproducing by drawing the background in each picture, this inventor prints on a series of sheets of thin transparent paper the same background or grouping of stationary objects. The artist then draws on each printed sheet the objects which it is desired to represent as moving, such moving object being drawn on the succeeding sheets in slightly advanced positions. After the series of sheets or pictures are completed, they are photographed in succession on a kinematographic film, which may then be projected upon a screen in the usual manner.

Since the Bray patent, a patent relating to the subject has been issued to Earl Hurd of Kansas City, Mo., in which a background containing the stationary parts of the scene is produced on a sheet and the movable objects are produced in successive positions or poses on separate sheets of transparent material and then photographed in succession on a kinematographic film, each picture of the series being formed by a separate sheet of the transparent material placed in front of the background sheet, the latter being visible through the transparent sheets on which the successive positions of the movable objects are produced.

Strategic Moves of the War, December 30th, 1915

By Our Military Expert

THE Turkish theater of war is now of particular interest, for the formation of a strong Teutonic army of invasion to be directed against Egypt and the Suez Canal is currently reported. Such invasion may be attempted coincident with the completion of the railway from Scutari to Medina, running through Palestine; but the consensus of opinion of those who have studied the situation holds that tremendous difficulties must be overcome before any local measure of Teutonic success can be reaped, while preponderant numerical strength is essential for such a serious undertaking, due to the great length of the line of communication and its vulnerability. From Scutari to Maan, where the railway bends to the east near Akaba, in Palestine, is twelve hundred miles, and the way is threatened in many places.

That any such attempt will be made at present is scarcely credited, unless, indeed, the invading force be composed almost exclusively of Turkish troops, numbers of which are engaged elsewhere. It presupposes a change in the existing general situation. If a movement in force is attempted, Saloniki may be abandoned by the Entente and the forces now held there be shunted, via the Mediterranean, to the el Arish-Akaba line, which guards the northern approach to the Gulf of Suez and the canal proper. And, whereas the Mediterranean will be available to the Entente for supply lines, the railway is apt to prove inadequate for Teutonia's similar needs.

The much mooted question as to whether the Central Empires are feeling the pinch of adversity through food-shortage and the lack of materials for the manufacture of munitions and other necessities, may well draw attention to the very interesting map accompanying this article, upon which is indicated the location of natural resources of the territory within a radius of about 600 miles, surrounding the Black Sea.

First and foremost, even beyond the necessity for war supplies, arises the food question. In no possible way can a war be more quickly concluded than by the cutting off of food supply to an opponent. In the Franco-German war Paris was only starved out after a desperate defense. The acquisition of Turkey as a Teutonic ally opened up the resources of that country as a food depot, rendering available, to a certain extent, an amount of foodstuff over and above that required for home consumption. Along the line of the Bagdad Railway—the portion beyond the northern border of Mesopotamia being as yet unfinished — are to be found certain cereals and other foodstuffs which may be utilized for export into Teutonia. But Turkey is neither a wheat nor yet a corn country—products much in demand at the present time.

That portion of Bulgaria to the north and northeast of Philippopolis, which might almost be called an agricultural oasis of arable land in a desert of Balkan mountain, produces a considerable quantity of wheat, which has become available through the alinement of Bulgaria with the Teutonic cause; other wheat lands are to be found in Roumania. In the light of the latter's position of armed and wavering neutrality, how much of the produce expediency has permitted to flow out of the state, living under the probability that within a short time it will be needed at home, is problematical.

Russia is in far better case. The lands skirting the northern shores of the Black Sea constitute a wheat belt to a depth of three or four hundred miles, amply tapped by railways. Figures are not available as to the extent to which the district has been drained of men for the forces in the field—probably largely—yet, taking into consideration the lifelong habit of field labor to which the peasant women have been accustomed, it is reasonable to believe that a sufficient human force is available to insure a plentiful harvest.

The beet sugar district of Russia lies close to a threatened locality, for it is barely behind the Russian line where it fronts the Austrian, north of Bessarabia. Science having demonstrated the value of sugar as a food, this cultivated resource is of some importance in the economic scheme.

The local and available minerals necessary to the manufacture of munitions are scattered. Iron deposits lie thickly in the Russian section north of Rostof, being surrounded by ample coal fields. The locale, controlled by four branches of a main railway line, provides far more raw material than the smelters of Russia can adequately handle under existing conditions. In the vicinity of Tiflis are other deposits of iron, for the transportation and utilization of which a railway runs from Tiflis to Poti, on the Black Sea. Adjoining the petroleum fields to the westward of the Caucasus are other iron-ore sections, though transportation facilities are not as good here as in the aforementioned localities.

Accruing to the advantage of Teutonia, iron is to be found in Turkey, just south of the Sea of Marmora. In addition, beginning about one hundred miles south by east of Smyrna, iron deposits range near the northeastern coast of the Mediterranean as far eastward as Alexandretta. According to the latest available information, the Bagdad Railway is not connected as yet across the fifty-mile gap extending from Adana toward Eregli, northeast of Alexandretta; until this discrepancy is remedied, the transportation of ore must be difficult; but in all probability the railway construction work is being pushed to the limits of endurance, not only for the sake of the minerals, but to establish direct railway connections with the Turkish interior and toward Egypt as speedily as possible.

By Courtesy of *Illustrated London News*

What Turkey and Bulgaria have to offer their Teutonic allies

bullets of modern warfare, is found in Turkey near Angora and southeast of Sokia, a railway terminus from Smyrna. Zinc, manganese, iron and coal are also in the vicinity, which is very rich in minerals. Lead is also available near Eregli, on the Bagdad line.

Coal, that necessity for the generation of steam for locomotives and various factories, is rather abundant. The Entente is served by enormous coal deposits in the Black Sea section north of Rostof; and there are ample railway facilities to expedite its employment. Two hundred miles to the southeast, on the main line, are other coal deposits, nestling in the foothills of the Caucasus Mountains, while still others lie to the northward of the Tiflis Railway.

There are small coal deposits in Bulgaria. The south shore of the Black Sea offers a certain amount of the mineral to Turkey, while others lie north and south of Smyrna.

The advent of the automobile as a principal means of field transportation, with the utilization of motor cars for countless purposes in warfare, has necessitated conservation of the natural resources from which gasoline is made. The Entente seems to have a little the better of the proposition, for in the map-section shown the Bagdad section appears to include the only petroleum fields at the service of Teutonia, and it is now threatened by the proximity of English forces in the vicinity of Bagdad. The Russian territory west of the Caucasus is rich in the product, transportation of which is easy by rail and water. Other large reservoirs of petroleum are found near Vladikavkaz, near the Caspian Sea.

The petroleum fields of Roumania are subject to the same question as affects the wheat of the section. In all probability much of this fluid finds its way into Teutonia through commercial transactions, for the supply is rather more extensive than would be needed for Roumania's possible future military operations.

In Turkey a certain amount of cotton is found available for Teutonic use. It is distributed as follows: east of Smyrna; in the vicinity of Aleppo and on the Kurdistan-Mesopotamia line; in the Mersina-Eregli section, just north of the Island of Cyprus. All these sections are touched by railways, actual or under construction. This cotton is used in the manufacture of explosives and for clothing.

Egypt, on the other hand, supplies for the Entente at least five times as much cotton as Turkey can offer to the Teutons, although there is at present some difficulty experienced in furnishing Russia a proportionate quota on account of the lack of ports of entry and the bulk of the commodity.

Upon analysis, therefore, it is not believed that the food and mineral resources of Turkey and the vicinity afford any great material benefit to the Teutonic cause. The section has never been noted for its exportation of foodstuffs, and there is no reason to suppose that matters are greatly bettered under present conditions for, where transportation is concerned, all the eggs are in one basket—the Scutari-Bagdad-Medina railway.

Copper, that most important element in the manufacture of certain war implements, is found in limited quantities in southern Bulgaria, while Turkish production of the metal is restricted to the vicinity of Tirebolu, almost at the southeastern bend of the Black Sea, and farther south along the Euphrates. But as there are no railway lines whatever in the section, benefit of the deposits cannot as yet be had by the Teutons except by laborious caravan convoy or on the Black Sea, subject to interruption by the Russian naval force.

Russia possesses copper mines about a hundred miles south of Tiflis, and within comparatively easy reach of Julfa, just to the northward of the Persian border. The railway from Tiflis to Julfa opens this region for use, although its secure possession may be somewhat threatened by the proximity of Turkish forces which the balance of war may sway into active menace.

Lead, of principal use as a filler for the steel-jacketed

Death of William Howard Doane

HAVING attained his eighty-third year, Doctor William Howard Doane, noted as a hymn writer and composer of music, passed away on December 23rd at his home in South Orange, N. J.

It was through the invention of woodworking machinery that Dr. Doane, who was born near Norwich, Conn., became wealthy. He was an ardent student of music and at one time toured the world making a study of the music of each nation and bringing back with him a rare collection of musical instruments, which he gave to the Cincinnati Art Museum. Dr. Doane wrote a number of church hymns, and it was due to him that Fanny Crosby reached her high position as a hymn writer. In cognizance of his work the Denison University of Granville, Ohio, conferred the degree of Doctor of Music upon him. Dr. Doane at the time of his death was a member of several historical societies.

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.*]

The National Guard

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue "Citizen" presumably from Texas takes exception to my article of October 23rd advocating strike duty be assigned to the regular Army only, thereby exempting the National Guard from such service. My only answer to this citizen is that, if Uncle Sam finds the regular Army the best policeman he has, it would be foolish to put any one else on the job.

That is not the only reason why the Guard should not have to do police duty. It is composed at present of a few business men and their clerks. I do not think it will be disputed when I say there is practically no brawn in the National Guard, and the strike duty requirement is the cause for the laboring man not being enrolled. My idea is to improve that which has merit as well as retain it. We need look no further than the National Guard for our citizen army. Membership in that body should be the natural vent for the patriotic feelings of every healthy man between the ages of 18 and 45. The Government pays all expenses, and enrollment does not mean that you will be taken from your labor; does not conflict with any religious principles. The only reasons there are not 10,000,000 men in training to defend their country instead of a little over one per cent of that number is, first, the false security from attack we have heretofore contented ourselves with, and, second, the prejudice held by the great masses of the American nation, the working people, occasioned by the use of the Militia in labor troubles.

My high minded "Citizen" casts a slur on the National Guard patriots on general principles apparently. Let me tell you "citizen," as you call yourself, the National Guardsman is the only patriot, not a regular soldier or a sailor in the United States to-day, who is preparing himself to defend his country.

It is always well to acquaint oneself with the subject before venturing criticism. The governors of the states no longer have supreme command of the Militia. That office is now held by the President of the United States; and he can order them for service anywhere within the borders of the nation. The present Congress will no doubt make that anywhere under the Flag.

Likewise the statement is wrong that the last Congress made provision for enlistment in the regular Army for a term of eight months. I earnestly hope some such legislation will be enacted this term. Eight months' training will not make a soldier, but re-enlistments and a changed sentiment towards the profession of arms—which means the soldier—will do wonders for the Army. But do not for a moment think it is going to obviate the necessity for the National Guardsman. We need every man trained to take his place in the ranks; it is the only sure protection for a peace loving land.

If allowed to do so, the National Guard could furnish many times 100,000 men for an appreciable length of time each year, who would always be found with no doubt as to their standing in time of war.

PATRIOT.

Colorado.

Stability of Ships

To the Editor of the SCIENTIFIC AMERICAN:

With reference to the letters of Mr. C. D. Irwin, regarding the "Statical Stability of Ships," permit me to say that it is by no means a simple matter, under varying conditions of load or trim and the effect of the human equation in arranging such elements, to assure perfect conditions of stable equilibrium in seagoing vessels.

When designing a "sister ship," if a little more cargo capacity is desired, or a slight increase of speed is demanded, the former can be easily attained by adding to the depth or length of the vessel, and the latter by adding to the boiler power, and by increasing the speed of revolutions. Should such desired increase be somewhat overdone, no harm will accrue. But, if greater statical stability is required, care must be exercised so that this element may not be overdone, as, short of being absolutely unstable, it is almost as objectionable to have too much stability of form, as too little. The great desiderata, since the proportionate dimensions of ships have been more scientifically defined, are that the masters and officers of vessels should possess at least a quasi-scientific knowledge of the principles governing the statical stability of floating bodies, and that all vessels should be supplied with curves of stability, or, at least, with metacentric diagrams. Vessels possessing absolute surface stability may readily be capsized by injudicious loading, just as the vessel having no stability of form may be rendered perfectly safe by judicious loading. No vessels ever capsized while possessed of a metacentric height. On the other hand, I have seen many large vessels which had no metacentric height, in the upright position, which were perfectly safe in any seaway, so long as the cargo or ballast was so secured that it could not shift. The "Austral," "Hammonia," and the "Canopus" were frequently afflicted with a minus metacentric *height*, and yet they rendered efficient sea service for twenty or thirty years. The most extreme case of disproportionate dimensions, however, I ever investigated during an experience of fifty years, was that of the "missing" steamer "City of Limerick;" her extreme breadth was 34.4 feet, and molded depth 31.9 feet, which gave the extraordinary ratio of depth to breadth of 0.92, whereas this ratio should never largely exceed seven tenths, and in freight boats .6 should be the limit.

Regarding the deformity of the "Limerick" let me quote an extract from my paper read at the International Engineering Congress: "A few years since a deep and narrow steamer, the 'City of Limerick,' had been made still deeper by the addition of a third deck. The government authorities being advised by some of the best experts of the danger attendant on a sea voyage with that craft, she was stopped, after being fully laden, by my good friend Mr. Guiggin, the detaining officer.

"It would seem that that gentleman, though an excellent shipbuilder, was ignorant regarding the cargo on board, or was unaware of the effect of the weights carried, and the distribution of same, indeed, so much so that all the powers of the Imperial government were insufficient to stop the departure of that vessel, for, as it happened at the time, she had stability, due to weight, by virtue of some six hundred tons of railroad iron, stowed low down in the bottom. This lowered the center of gravity about two feet, and secured a temporary metacentric height of nearly eight tenths of a foot. This, though small, gave the same result as would four feet added to the breadth.

"With no iron in the bottom, and the holds filled with homogeneous cargo, such as coal, there would have been no metacentric height, the center of gravity being then fully three tenths of a foot above the metacenter. Indeed, the *height* of the *metacenter** was not more than three and one half feet. The 600 tons of iron stowed in the lowest position in that steamer was essential to obtain statical stability, but such a distribution of weight in a vessel having stability due to proportionate dimensions, or form, would have caused excessive stiffness and rolling, because of the combination of low position of the center of gravity—due to weight, and the high position of the metacenter—due to the great breadth of the water plane. Let me predicate from this that the board of trade surveyors or inspectors of hulls, are not generally competent to rule on such points as these, especially as they have no rules to guide them."

JOSEPH R. OLDHAM.

Red Fire

To the Editor of the SCIENTIFIC AMERICAN:

The best red fire, but not the cheapest, is an old formula used by the Boston Comedy Company, about 1860. It keeps well and with but little danger of spontaneous combustion. Sold then at $3 a pound. Strantium nitrate powder, four parts; potassium chlorate powder, two parts; gum shellac orange, ground fine, one part. Mix well on paper! To be burned in a long narrow train.

GEO. H. HARTWELL.

Southbridge, Mass.

Light from Broken Crystals

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of November 20th there is an article on "Light from Broken Crystals."

In connection with this subject, I would add that the luminescence described is very nicely shown when breaking, in a darkened room, the ordinary thin peppermint and wintergreen wafers, as purchased from any candy dealer.

CHAS. O. RHODES.

Groton, N. Y.

Opening for American Manufactures in India

To the Editor of the SCIENTIFIC AMERICAN:

One of the first results in India of the present war was the complete stoppage of all the supplies from Germany, Austria and Belgium of the hardware, glass and china wares, furniture, toys, chemicals, tissues, paper, drugs, tools, liquors and other goods that for many years have arrived from these countries. Much public interest is being shown in projects for the extension of local industries in order to render India self sufficing, but a reference to the current issue of the *Indian Textile Journal* will show how much preparatory work this country has still to accomplish in order to furnish her own requirements. Japan seems to be the only country that is trying to benefit by the present situation, but there seems to be a very good opening for many branches of American manufacture that at present are little known in our markets.

Our review of the industries of India is the result of nearly 30 years' personal experience of the country and its people.

JOHN WALLACE, C. E.,
Editor *Indian Textile Journal.*

Bombay, India.

The Question of National Defence

To the Editor of the SCIENTIFIC AMERICAN:

In dealing with the question of national defence we should recognize that our position is peculiar to ourselves. Unlike England, loss of sea control does not mean certain national extinction, although it does mean certain defeat. In order to insure victory we should have a navy, *i. e.*, battle fleet, which would be second to none, including England's at the point of contact. This does not mean a navy greater than England's, but one second only in size. It should be large enough to make the dispatch of a battle fleet strong enough to cope with it dangerous to England's safety through attack by another power.

The only successful defence is attack. The present programme of the administration calls for 85 coast defence submarines as against 15 sea-going, or fleet, submarines. For two reasons we may consider coast defence vessels as worthless.

First.—They cannot lie in line with the battle fleet in general engagement, and that is what decides sea control.

Second.—They are worthless, practically, for defence. If the enemy, through the weakness of our battle fleet, secures control of the sea, he will, as at the Dardanelles, take measures to neutralize them. Their cost put into the battle fleet would accomplish something towards securing sea control, which, after all, is what a navy is for; not to maintain navy yards for the political influence of their workmen. We may safely say that the submarine bubble has burst. From such reports as are published, the only submarines accomplishing anything are of the sea-going type. Therefore it seems the part of wisdom to construct such submarines as we build of this type.

Summing up the naval situation, we should develop and maintain a battle fleet able to meet and destroy the enemy on the sea. The money now wasted in the maintenance of unnecessary navy yards, for political reasons; keeping in repair ships worthless in a general engagement, for economical reasons; and building small, cheap coast defence vessels, for sentimental reasons, put into the battle fleet would accomplish much.

For coast defence we should rely primarily upon sea control, secondarily on coast defence fortifications manned by a well trained personnel, with sufficient mobile forces to repel landing parties.

Our military development should follow the lines of attack. The Lord forbid that we should be compelled to wage war, but if we must fight let us do the enemy all possible damage. It is better that his cities be laid waste than ours. The following suggestions are made to accomplish this end.

First.—"A citizenry trained and accustomed to bear arms." The Swiss military system would be ideal for this purpose.

Second.—A regular army of sufficient size to man the coast defences, hold our colonial possessions and provide an expeditionary force sufficient to make and hold a landing on the enemy's territory until reinforcements arrive. For this purpose we should call for volunteers from those who had finished their first year's training in the national militia. Failing to secure enough men in any one year to fill the ranks, conscription should be resorted to. These men to serve from three to five years with the colors and then go into the army reserve, as distinguished from the militia reserve.

Third.—Abolish the state militia and have all military forces in the hands of the Federal Government.

Fourth.—The establishment of a council of national defence, made up of the combined army and navy general staffs. This council to have entire charge of the making up and administration of the budget for national defence, absolutely without regard to the political aspirations of budding congressmen.

Fifth.—The accumulation of sufficient stores and munitions to enable us to take, and keep, the offensive.

The Philippines should be held at all costs. From a sentimental viewpoint, that of passive resistance, they are a source of weakness; but this viewpoint is unworthy of any consideration. From the point of view of strategy in over-seas operations in the East, they are a base of operations for attack.

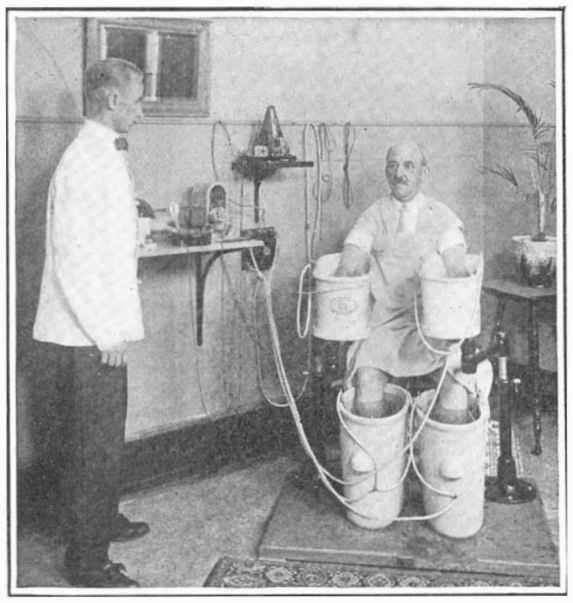
I believe this development will actually defend us. The certain knowledge that we were prepared to carry the war immediately into the enemy's territory would act as a deterrent to the necessity of going to war.

"It is better to make the country an armed camp—if necessary—for our own soldiers than to have the enemy make it such for his."

ROGER L. GORDON.

Somerville, Mass.

* This is not the metacentric *height*.



Electro-therapeutic device used in conjunction with hydriatric treatment

Weight-reducing machine making use of sinusoidal current

Device for stimulating the activity of the liver

Curing by Machinery

Growing Importance of Electrical and Mechanical Devices in Medical Practice

By Hinton Gilmore

MECHANICS has come to be the handmaid of medicine. The modern physician requires an elaborate equipment of machines in the practice of his profession. The physician of the old school got along very nicely with a thermometer and a saddle bag filled with a varied assortment of drugs. Even the more advanced physicians of 50 years ago contented themselves with very meagre equipment. It was not considered necessary for the ordinary practitioner to turn his office into a machine shop.

With the advance of both mechanics and medicine, however, it has been found that there are many devices which materially aid the progress of the patient towards recovery. It is estimated that where the old time physician could equip himself for his profession at a cost of $15 to $20, it now devolves upon the young physician to spend even as high as $1,000 for a very inauspicious opening of his practice.

The use of the X-ray, both in diagnosis and for purposes of relief, involves extensive apparatus. The comparatively recent science of automatic exercise calls for more machines. The use of heat, called technically diathermy or thermothermy, requires specially perfected devices, in fact, every phase of modern advance in medicine includes in its operation some machine which has been created to meet the emergency.

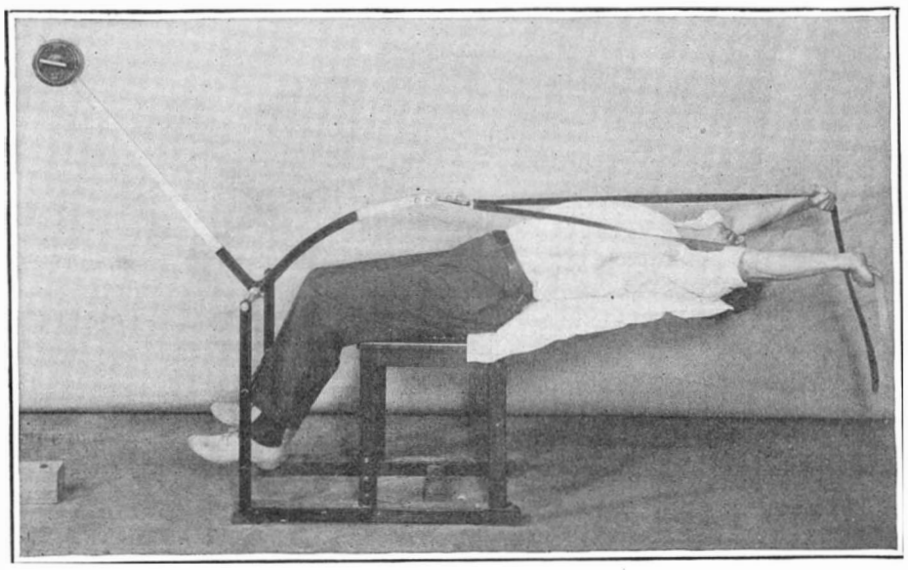
While the ordinary practitioner has found it necessary to stock his office with many mechanical devices, the greatest development in mechanical therapeutics has been reached in sanitariums. In these institutions, all properly approved curative measures are gathered under a single management and more attention is given to the use of machines than to the use of drugs. Whole departments are devoted to electrotherapy, diathermy, mechanical Swedish and other phases of mechanical therapeutics.

Electrotherapy involves the use of many special devices. The automatic exerciser in which the sinusoidal electric current is used is extremely beneficial in the treatment of rheumatism and similar disorders where there is a likelihood of muscular atrophy through enforced inactivity. The sinusoidal current while painless and shockless induces violent muscular contraction. By the means of electrodes it may be applied to the body in such a way as to exercise any set of muscles. The current is especially valuable in treating cases of obesity. Fat folks lose weight readily because of the violent exercise which it makes possible.

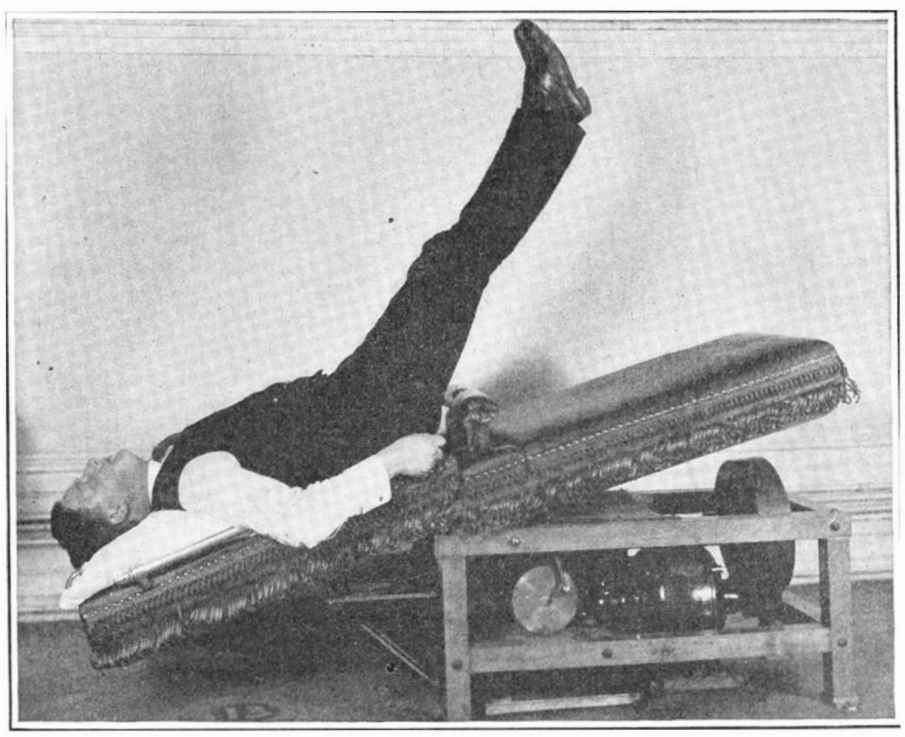
Electrical devices also assist materially in certain hydriatic or "water cure" treatments. Electrical baths are helpful in cases of rheumatism as well as in severe nervous disorders.

The electric light bath is a part of the equipment of practically every sanitarium. The simplicity and effectiveness of the electric light bath as compared with the turkish bath gives it a place, also, in the mechanical equipment of the ordinary practitioner.

Mechanical methods are almost exclusively used in the administration of the curative system known as mechanical Swedish. Vibratory machines, percussion devices, tumbling sofas, "camels" and "horses" and other odd machines are found useful in the restoration of health. Vibrating chairs, operated by motors and so arranged as to set every muscle a-quiver have been found restful and wonderfully helpful in quieting angry nerves.



Exercising device that has proved wonderfully helpful for relieving the disorders incident to a sedentary life



Tilting sofa—device used in correcting prolapsed organs and in overcoming effects of sedentary existence

Abdominal kneading machines are also included nowadays in the equipment of sanitariums. The machines are readily beneficial in cases of intestinal sluggishness, prolapsed vital organs, inactive livers and other disorders often associated with sedentary existence. The mechanical "horse," a jog-trotting machine that gives the rider all the benefits of an early morning gallop, is often used to set sluggish organs to doing their work more effectively.

Aside from the immediate curative advantages of man's machines, mechanical pursuits of mild vigor are often valuable in restoring nervous patients to mental and physical stability. Wood carving, basketry, carpet weaving and clay modeling are some of the occupations most helpful in such cases. The secret of the work cure lies in the fact that a gentle occupation prevents the patient from brooding over his ill-health. The introspective tendency is thus removed and the patient is then amenable to other therapeutic processes.

The value of mechanics in medicine has been amply demonstrated and the science of healing is coming to regard with increasing favor the aid offered by mechanical devices. The physician, in private practice, finds it incumbent to meet the advance made by institutions and the result is that the office of the modern physician is coming more and more to resemble a machine shop, just as the hospitals and sanitariums are being gradually converted into health factories.

The Current Supplement

AN important paper in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2088, January 15th, 1916, is on the *Physiological Importance of Phase Boundaries*, which is a consideration of the physical and chemical systems concerned in living cells. The explanation of the principles and operation of *Steam Turbines*, with a number of excellent illustrations, will be generally welcomed, as this class of prime movers has become so important for many purposes. *Nature Study in Agriculture* considers an important subject in its relation to educational motives and purposes. *The Nitrogen Problem in Arid Soils* discnsses the causes and remedies for deficient crops. *Oil Films on Water and on Mercury* is a valuable study that throws light on the discontinuity of matter and the size of molecules. *Waste Pine Wood Utilization* gives an interesting review of the products that can be obtained from this material, and of the processes employed. *How Guncotton is Made* describes, with illustrations, the process for the manufacture of this high explosive. *The Electric Arc in Vapors and Gases at Reduced Pressures* discusses the possibilities of a lamp with unconsumed electrodes, and is accompanied by illustrations and diagrams. *Electric Activity in Ore Deposits* is concluded.

Exploring the Earth's Interior With Electric Waves

THE application of electric waves to the exploration of the earth's interior was first suggested by Truestedt, in 1901, and was subsequently and independently patented by Mueller. Recently the subject has been treated, both experimentally and theoretically, by Heinrich Loewy, who at first was interested in a purely scientific problem, the demonstration of the nucleus of liquid iron which Prof. Wiechert conjectures to exist at a depth of more than 1,000 kilometers. Some preliminary experiments, however, showed that facts of great importance to miners can be learned from the application of electric waves to much smaller depths.

This possibility is a result of the varying physical character of the constituents of the earth's crust, in which insulators, which transmit electric waves, alternate with conductors, which impede their passage.

The experiments of Loewy and his collaborator Leimbach have led to the development of a number of methods of exploring the earth's interior. The methods first employed are based on the reflection, refraction and interference of electric waves, and require both sending and receiving apparatus. The presence and, in favorable conditions, the location of conductors (water or metallic ores) are deduced from variations in the strength of the received waves. The depth of the deposit is deduced from the inclinations of the sending and receiving wires for the maximum strength of the received waves. Newer and apparently more valuable methods are based on the variation in the emitted waves which is caused by the electric properties of the immediate environment.

In April, 1913, a company was formed in Goettingen for the development and exploitation of the various processes. The first practical work undertaken was the examination of a boring with regard to the danger of flooding. The boring was tubed and the tube, as it could not be removed, was necessarily employed as the conductor of the current producing the electric waves. The tube traversed a stratum of water, but the disturbing effect of this direct current was eliminated by a special electrical device, and the soil surrounding the tube was examined with complete success.

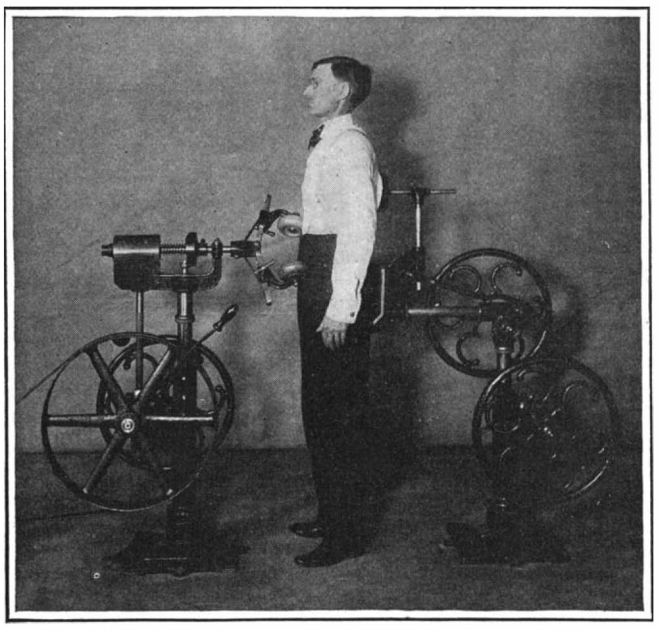
In another test the antenna was placed in a boring which was known to traverse a bed of clay, 20 feet thick, resting upon and overlaid by massive rock salt. The graphical records of the apparatus not only showed this source of disturbance in its known position, but also indicated the existence of a thinner stratum of clay lying below the known thick layer. The boring crew testified that they had, in fact, encountered this second clay stratum.

From the position of the disturbance in the recorded curve the distance of the source of disturbance from the apparatus can be directly deduced. For a time the principal field of application of the electrical methods was found in salt mines, in which, usually, the danger of flooding can be determined from a great distance.

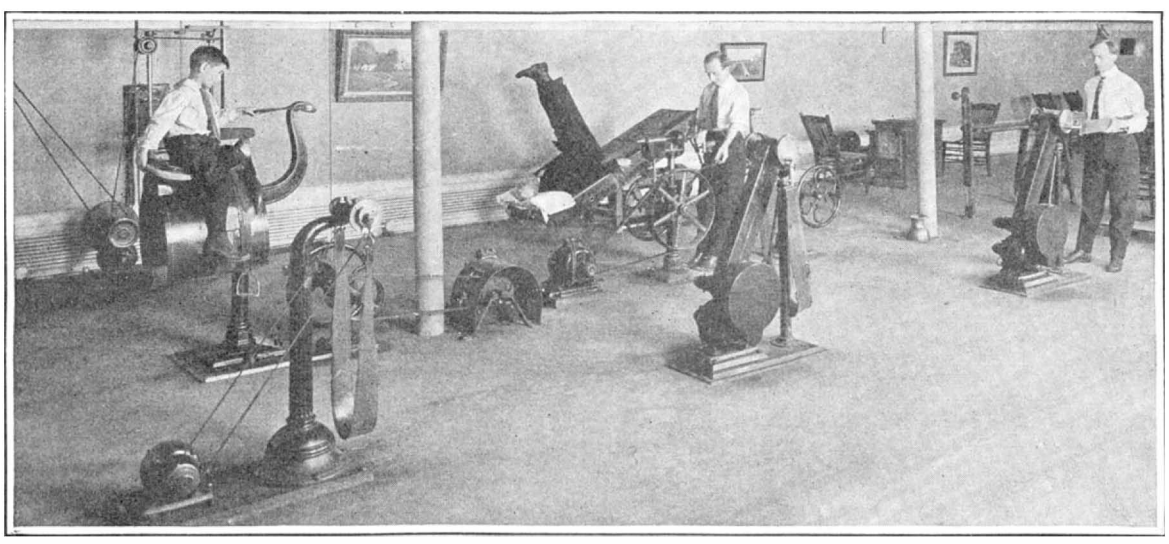
The success obtained in this field led to the employment of the electrical methods of exploration in tunnel building. Hitherto the flooding of tunnels in process of construction has been combatted by two principal methods. In one of these the mountain mass through which the tunnel was to be bored was frozen by means of pipes, often hundreds of yards long, filled with a freezing mixture, and the tunnel was then bored through the frozen mass. In the other method water-bearing crevices were filled with cement, an operation often requiring months of labor. Both processes are very expensive and neither is absolutely certain. In many cases the expense can be greatly reduced and the uncertainty eliminated by locating the dangerous spots by means of electric waves, thus insuring the application of the processes only where they are needed.

The electrical methods are especially valuable in cases in which they can be employed successfully to locate water and ore without boring. The dryness of the soil, the abundance of ores and the scarcity of water in German Southwest Africa induced the Goettingen company to send an exploring expedition to that colony in April, 1914. After three weeks of experiment the leader of the expedition reported the possibility of determining the presence, depth, and extent of deposits of ore and water, without boring, by means of easily portable electric apparatus.

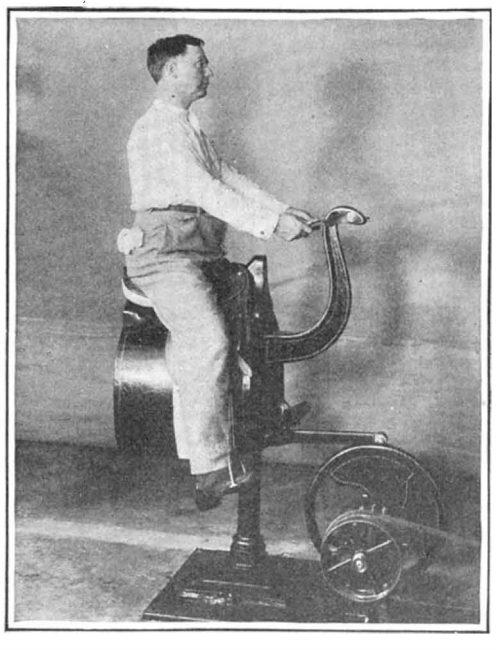
Meanwhile the company has found water and determined its depth, by the same method, in various places in Germany, and the indications thus found have been confirmed by boring.—*Umschau.*



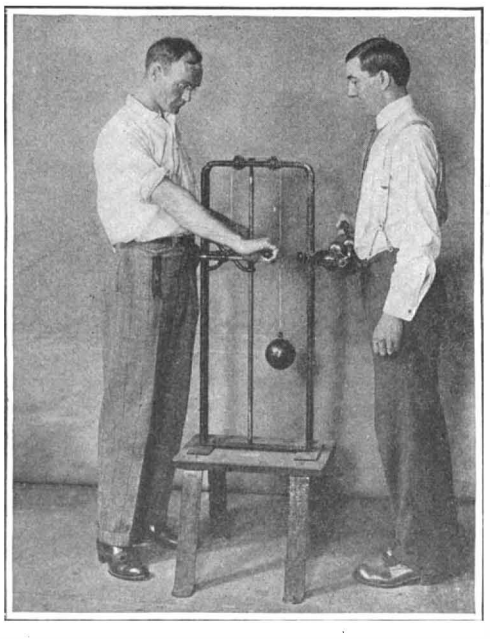
Mechanical equipment for securing greater intestinal activity through a kneading process



Scene in a department of a sanitarium devoted to mechanical Swedish treatments



Mechanical "horse" which emulates the exercise derived from horseback riding



Percussion machine which is used in promoting organic activity

Prevention of Fog by a Blanket of Oil

THE use of oil as a preventive of fog holds forth much promise, although it would appear that its possibilities have not yet been fully determined in the absence of a series of exhaustive experiments. It is learned from the *Hydrographic Bulletin* that experiments to prevent the fogs in river valleys have been made in France with variable success, the best results being obtained by employing vegetable oils. The procedure is to cover the surface of the water with a thin film of oil which keeps the air from coming in contact with the warmer water, thus hindering the condensation of the water vapor. It is believed to be possible for a ship which has to stop or anchor off a fog-bound coast to create a clear zone around her by distributing storm oil for a time.

Captain E. K. Roden, in charge of the nautical department of a well-known correspondence school, in writing on the subject of fog prevention by the use of oil cites two instances which are in no little degree convincing. The first occurred when two demijohns of olive oil were broken and spilled on the deck of a steamer anchored off a small South American town, near the mouth of the River Parana. At the time dense fog prevailed, but as the oil found its way to the water it was noted that the fog cleared over those portions of the surface covered with oil. The second instance was observed on board a steamer at anchor outside of Magdalena, a resort southeast of Buenos Aires, in the mouth of Rio de la Plata. The fog was very dense and a boat was sent toward Magdalena with a dripping oil tank attached to its stern. A clearing was noticed in the wake of the boat, but a strong wind blowing the fog across the course of the boat soon made the clearing less distinct.

According to Captain Roden, in calm weather good vegetable oil can be used with advantage in clearing a pathway or zone through a fog bank, provided the fog is caused by the evaporation of surface water. With a strong wind the effect is lost, except possibly in the direction in which the wind is blowing. The effect of wind, however, may be overcome, it seems, by distributing oil over a considerable portion of the sea. Inclosed waters, such as New York Bay, might be cleared of fog by having several distributing stations for oil and taking advantage of tides in spreading the oil, thus minimizing the effect of wind.

A Process of Cold Enameling

THERE are many small objects whose beauty is much enhanced by the application of a coat of enamel, but which are not capable of being fired. A process of enameling these in the cold, so simple as to be quite practicable for amateurs, is described in *La Nature* as follows: To a solution of sodium silicate, boiled in a closed vessel, there is added about five per cent of sulphate of lime. This causes a precipitation to take place, the ulterior effect of which is to prevent efflorescences which would injure the looks of the enamel. The solution, after being once decanted, assumes the consistency of a paste which is heated to about 75 deg. Cent. to apply to the objects to be enameled. A second decantation takes place in the vitreous layer, and this then takes on an unalterable translucence. It may be tinted any desired shade, either in the mass or superficially, the colors being fixed by tannates of gelatine and alum.

Bureau of Standards Studies Specimens of Bronze

THE quality of metal castings is usually determined by measuring the properties of a test specimen cast from the same metal. The United States Bureau of Standards has completed an investigation of the various foundry operations that influence the properties of the test specimen, for one of the most generally used alloys, known as Government bronze, having the composition 88 copper, 10 tin, and 2 zinc. The Bureau studied the effects of temperature on castings, methods of gating, casting, molding, kind of sand, heat treatment, and the effect of similar factors upon the resulting mechanical properties.

A microscopic examination of the fractured test specimens showed that the most common source of weakness was the occurrence of oxides within the metal. Such oxides appear frequently as thin films throughout otherwise sound metal, producing a condition of brittleness and low ductility. The results of such tests are of great importance to all users of alloys.

Morning and Evening Stars for 1916

By Frederic R. Honey, Trinity College

THE publication each year of the article Morning and Evening Stars affords the writer an opportunity to call attention to what may be called current events in the solar system. To this end tables are given which include the principal elements of the orbits of the planets; their conjunctions and oppositions; conjunctions of the planets; and their elongations, which give the dates when the planets' positions, on account of their greater distance from the sun, are most favorable for observation. These positions may be verified by reference to the plots. The scale of the orbits of the major planets is very much reduced, which is apparent on comparing the orbit of Mars in the two plots.

The permanent members of the solar system include besides the periodic comets, the asteroids, many of whose orbits are very eccentric, and are inclined at large angles to the ecliptic. But a description of these orbits which fill the gap between those of Mars and Jupiter would require separate treatment, and would exceed the limits of this article.

The Sun, the Earth, and the Moon

The sun and moon are apparently about the same size, *i. e.*, they subtend nearly equal angles. This is proved at the time of a total or annular eclipse, the variations in their apparent diameter being due to the varying distance between the earth, the sun and the moon. Some idea of the great magnitude of the sun may be obtained by comparing the dimensions of these bodies. The earth's diameter is $3^2/_3$ times the moon's diameter; and it is therefore about 49 times its volume. The sun's diameter (= 864,392 miles) is a little over 109 times the earth's diameter, and over 1,300,000 times its volume. The diameter of the sun is 400 times that of the moon, and 64,000,000 times its volume. Hence it appears that at the date when the earth's distance from the sun is 400 times its distance from the moon, the sun and moon subtend equal angles, *i. e.*, their apparent diameters are equal.

The sun's axis is directed to a point midway between Vega and Polaris; and its rotation in 25¼ days is in the same direction as the revolution of the planets—indicated by the arrows A. On account of the earth's movement in its orbit, the sun's apparent rotation (the synodic period) is accomplished in 27¼ days.

The earth's equatorial diameter is 7,926.7 miles, and its polar diameter is very nearly 7,900 miles. Its axis is inclined at an angle of 66.55° to the ecliptic, and is directed to a point in the heavens about 1¼° from Polaris. The direction of the earth's rotation on its axis is indicated by the arrow shown at the date January 1st.

There will be a total eclipse of the sun February 3rd; an annular eclipse July 29th; and a partial eclipse December 24th.

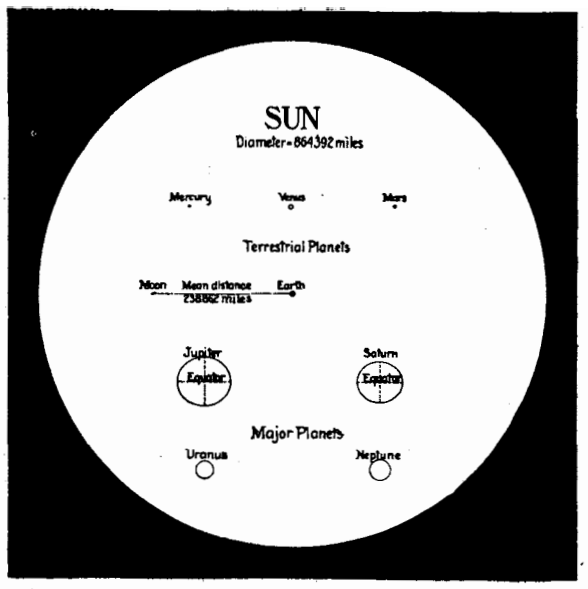
A partial eclipse of the moon will occur January 19th and July 14th.

The Terrestrial Planets

The mean distance between the sun and the earth is 92,897,416 miles; and the linear eccentricity of the earth's orbit, or distance between its center C and the sun (= e) is $^1/_{60}$ of the mean distance. Moving with a velocity of 18½ miles per second, the earth completes its revolutions around the sun in 365¼ days, the average length of the year for four years, including the present one (leap year) of 366 days. The earth's place in its orbit is shown for every fourth day. Intermediate positions and dates are easily interpolated. If the plot be placed so that the earth's position at any assigned date is between the reader and the sun, the dates attached to the terrestrial planets will be read without turning the head.

Table 1 gives the diameter of each planet; its mean distance from the sun in terms of the earth's mean distance; its velocity in miles per second; its period in years; and the eccentricity and inclination of its orbit.

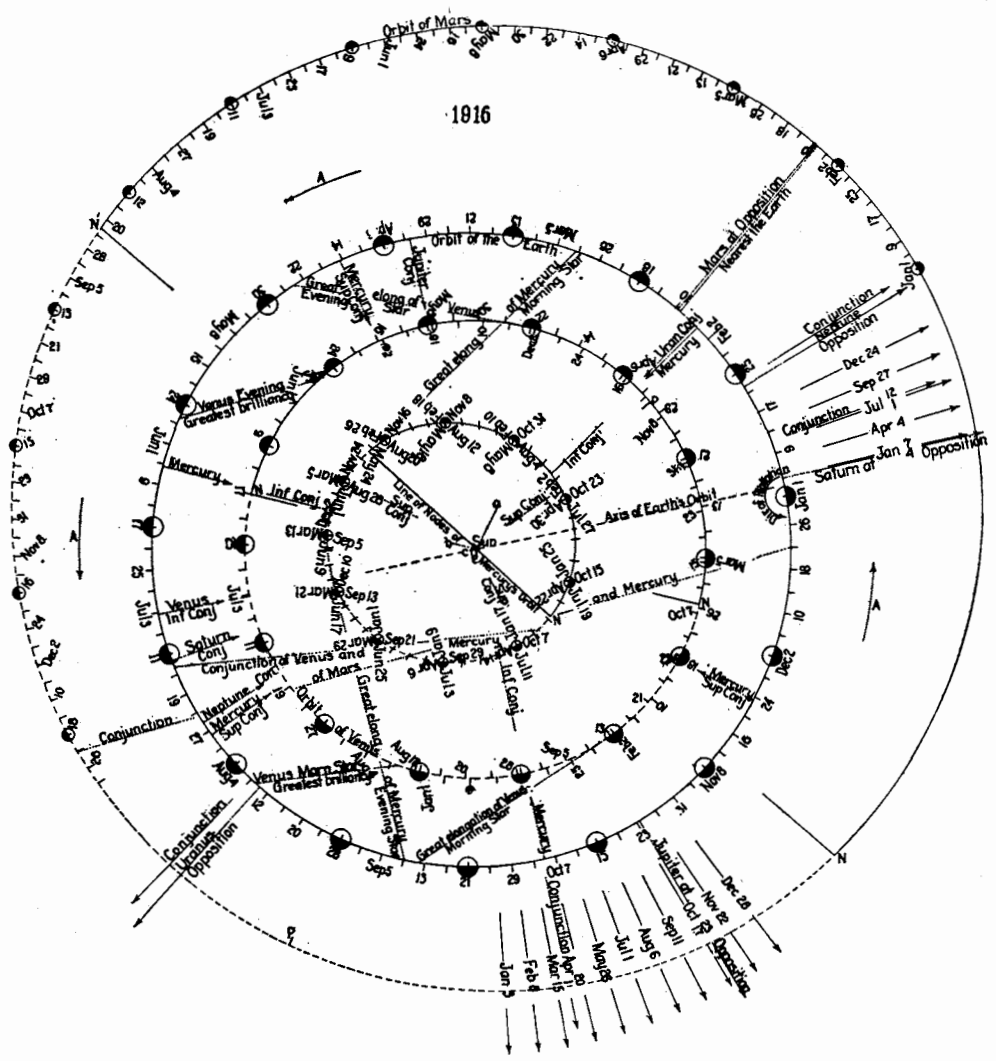
Since Mercury's velocity, on account of the great eccentricity of the orbit, changes very rapidly between 35 miles per second at perihelion and 23 miles per second at aphelion the planet's position is shown at intervals of two days. The period is 88 days; and as Mercury makes over four revolutions during the year, four dates are attached to each position. The linear eccentricity is the distance between the sun and *b* the center of the orbit.



Size of the sun compared with those of the planets

TABLE I

Planet.	Diameter, Miles.	Mean Distance.	Period, Years.	Velocity, Miles per Sec.	Eccentricity of Orbit.	Inclination to Ecliptic.
Mercury	3008.54	0.387	0.241	23 to 35	0.206	7.00
Venus	7701.48	0.723	0.615	21.9	0.007	3.39
Mars	4548.84	1.524	1.881	15.0	0.093	1.85
Jupiter. Equatorial	90256.02	5.203	11.862	8.1	0.048	1.31
Jupiter. Polar	84779.42					
Saturn. Equatorial	76456.40	9.539	29.458	6.0	0.056	2.49
Saturn. Polar	69781.78					
Uranus	30193.44	19.191	84.015	4.2	0.047	0.77
Neptune	34823.34	30.071	164.788	3.4	0.008	1.78



Relative movements of the terrestrial planets

Relative movements of the major planets

The eccentricity of the orbit of Venus is so small that it is indistinguishable in the plot. As a consequence the planet moves with a nearly uniform velocity. It completes its revolution in 224.7 days. The dates for the first revolution are attached without the orbit, and those of the second revolution within the orbit.

The linear eccentricity, or actual distance from *a* the center of the orbit of Mars to the sun is greater than the corresponding element in the orbit of any of the terrestrial planets.

The position of perihelion or point of each planet's nearest approach to the sun is marked *P; N* is the ascending node where the planet passes from the space below the ecliptic to that above, and *N'* is the descending node.

The Major Planets

The directions of the planets Jupiter and Saturn as seen from the sun are shown by arrows at intervals of 36 and 88 days respectively; and those of Uranus and Neptune at the dates of opposition and conjunction. A separate plot of the orbits of these planets gives their positions at the beginning and the end of the year. These positions should be compared with those indicated in the plot of the terrestrial planets.

The earth will be at perihelion January 2nd and aphelion July 2nd. Mars will be nearest the earth February 9th; at aphelion March 13th; and at the descending node August 22nd. Jupiter will make the perihelion passage April 17th; and Saturn will reach the ascending node September 27th.

Conjunctions and Oppositions

Oppositions and conjunctions with the sun are fully illustrated in the plot of the orbit of the terrestrial planets. In order to avoid confusion only two conjunctions of the planets are illustrated, viz., those of Mercury and Venus, July 13th, and of Mercury and Mars, December 21st. The other conjunctions may be easily verified by the application of a straightedge which will pass through the earth and the planets at the dates given in the table. The dates of great elongations of Mercury and Venus, and those of Venus' greatest brilliancy may also be verified.

TABLE 2. GREENWICH TIME

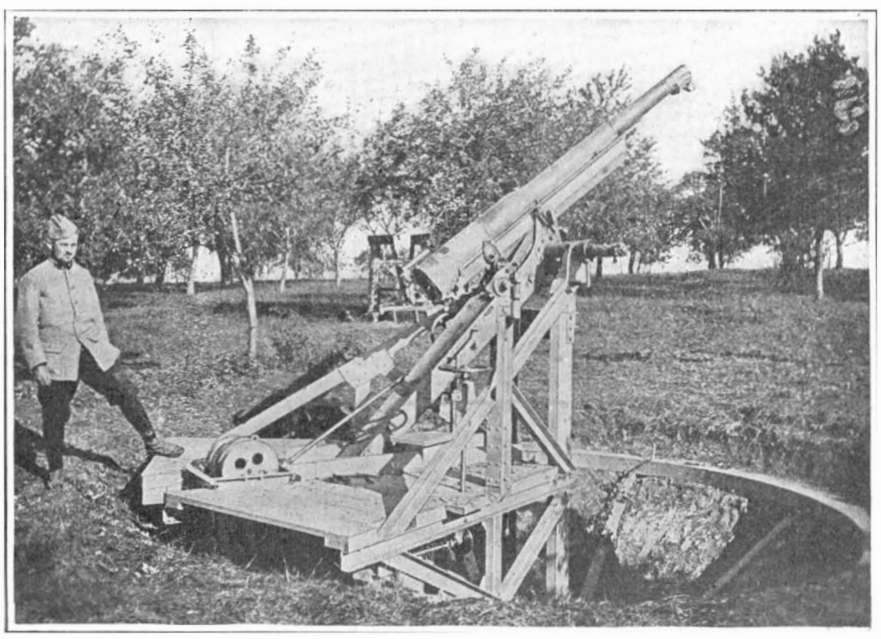
Planet.	*Conjunction.*	*Opposition.*
Saturn		Jan. 4
Neptune		" 22
Mercury (Inf.)	Feb. 4	
Uranus	" 5	
Mars		Feb. 9
Jupiter	April 1	
Mercury (Sup.)	" 14	
Mercury (Inf.)	June 5	
Venus (Inf.)	July 3	
Saturn	" 12	
Neptune	" 25	
Mercury (Sup.)	" 27	
Uranus		Aug. 10
Mercury (Inf.)	Oct. 4	
Jupiter		Oct. 23
Mercury (Sup.)	Nov. 23	

Morning and Evening Stars

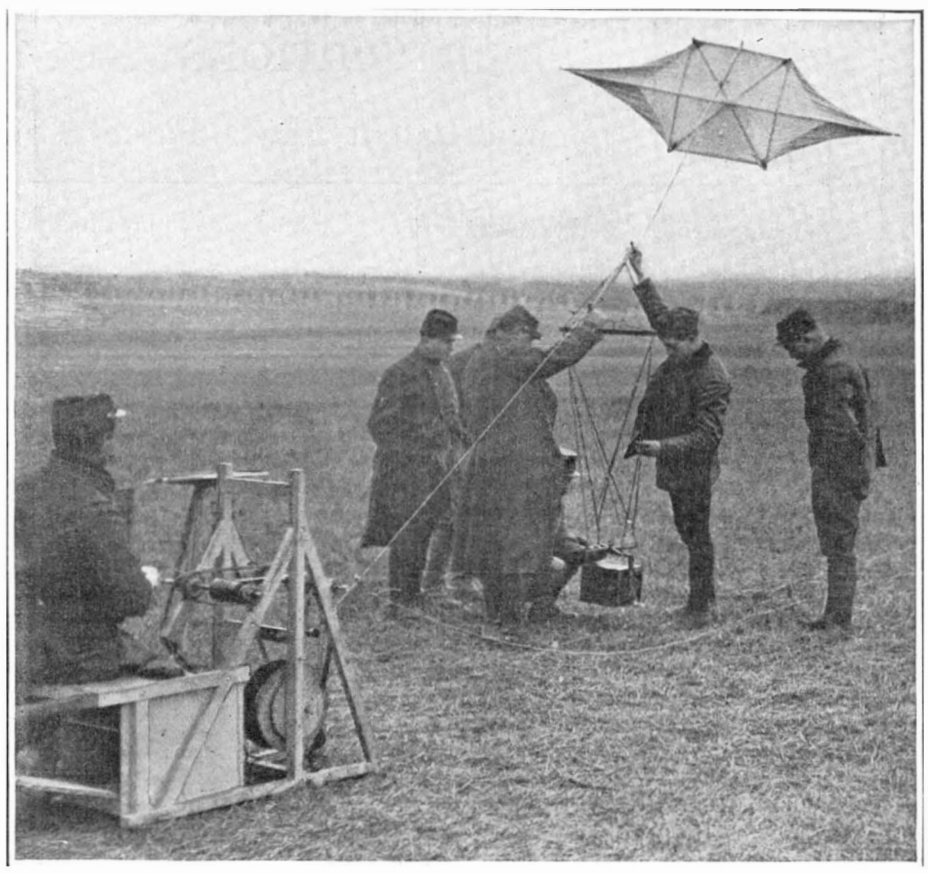
The morning and evening stars for any day in the year may be ascertained by inspection of the plot of the terrestrial planets.

(*Concluded on page* 68)

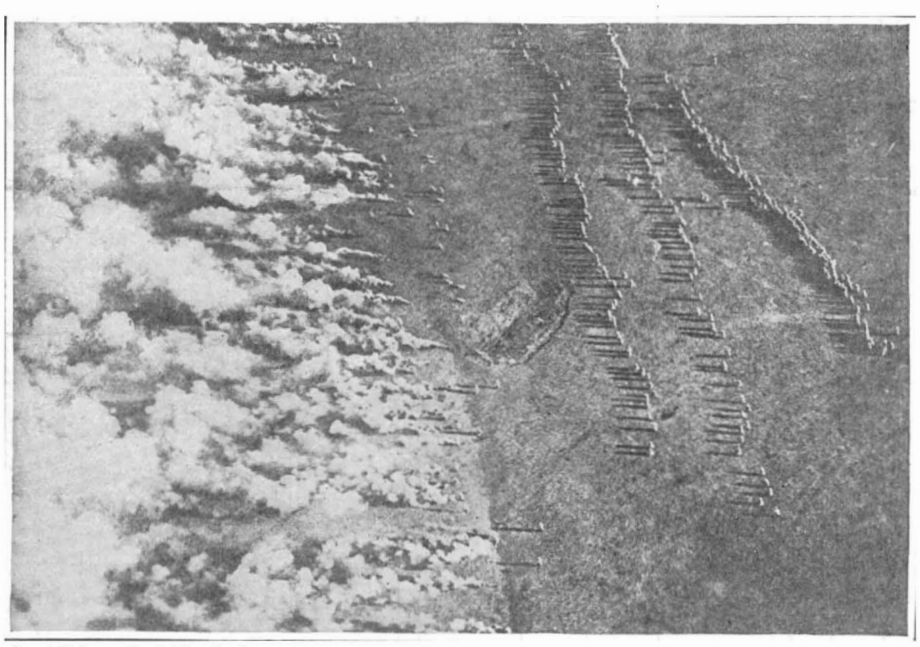
French officer verifying the identity of a carrier pigeon



French 75 mm. field piece mounted for use against aeroplanes



Preparing to photograph the German trenches with a kite camera



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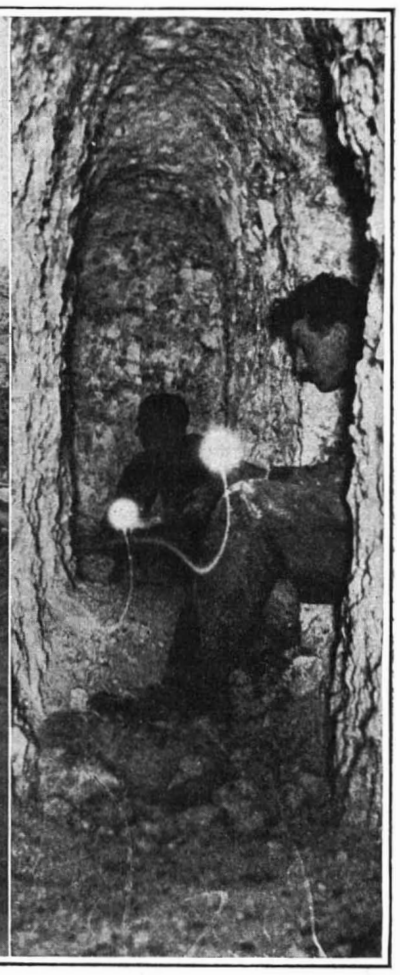
German gas attack photographed by a Russian airman

Bringing the 100-lb. bombs into the trenches

One of the bomb throwers

Target practice on a toy aeroplane



In the underground galleries

Photographs by Medem Photo Service

ALONG THE BATTLE-FRONT IN FRANCE

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Device for Improving Steering Gear of Light Automobiles

PROMPTED by the difficulty of steering a light automobile, especially on rough roads, an American manufacturer has recently introduced a simple device which is claimed to make the cheapest motor car steer like a high-priced car equipped with an irreversible steering gear.

Briefly, the device may be described as two strong, reciprocating coil springs slipped over the tie rod and held in place by a clamp that fastens to the front axle. The springs absorb every jerk on the wheels, so that the driver can sit back in comfort and disregard the irregularities of the road. The device is applied in a few moments' time with a wrench. It does away with the necessity of tightly gripping the steering wheel of cheap cars when driving, and keeps the wheels in the road by righting them automatically the instant they strike uneven spots or obstructions of any kind. In a recent demonstration a car equipped with the device was driven at high speed around the corner of a city street and the driver released the steering wheel. Instead of running into the curb, the front wheels were automatically righted and the car continued down the side street in a straight course.

The Pallograph—An Instrument for Recording Vibrations of Vessels

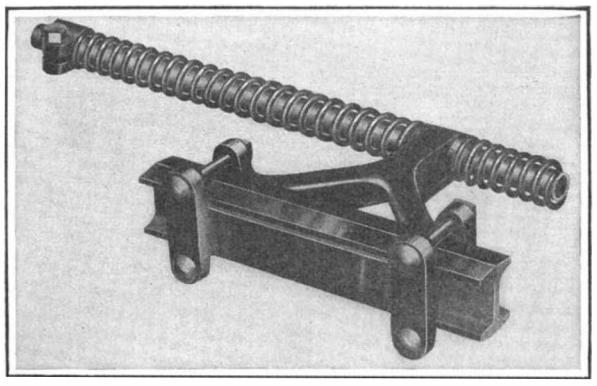
THE only pallograph in America, and, indeed, one of but two or three in existence, has just been completed by Elmer A. Sperry, of Brooklyn, N. Y., for the use of the U. S. Navy engineers at the model basin, Washington, D. C., in connection with their investigation of vibration of ships.

Briefly, the pallograph is an instrument which simultaneously records vertical and horizontal transverse vibrations; and while the instrument is primarily intended for use aboard ships, it may be used to trace vibrations or oscillations of any character to their primal source.

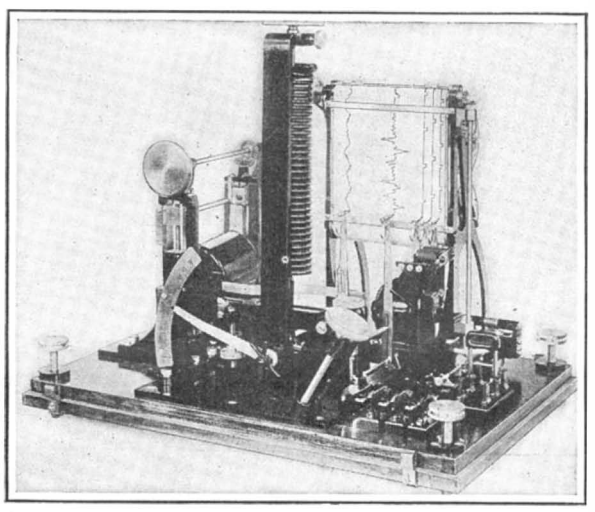
The Sperry pallograph embodies a number of substantial improvements over that developed by Dr. Schlick of Hamburg, Germany, possibly the most important being mechanism which so regulates its period that it will not come into synchronism with any harmonic of the ship's motion. Of equal importance is the introduction of pencils for indicating revolutions of the ship's shafts and a time marker indicating seconds. Records are made on a 5" paper strip, moved upwardly at constant speed by a small motor; the speed of travel being variable from 1½" down to ⅝" per second, as required. It will be readily understood that vibrations of high frequency or of considerable amplitude should be recorded on a rapidly moving strip, so that the wavy lines of the diagram will be widely separated for thorough analysis—indeed, it is even frequently necessary to enlarge certain sections so that conclusions as to the causes of the vibrations may be determined with absolute certainty.

When the pallograph is in operation the "pendulum" appears to oscillate and vibrate rapidly, whereas in reality it is standing absolutely still and the pallograph structure is moving in unison with the body on which it rests.

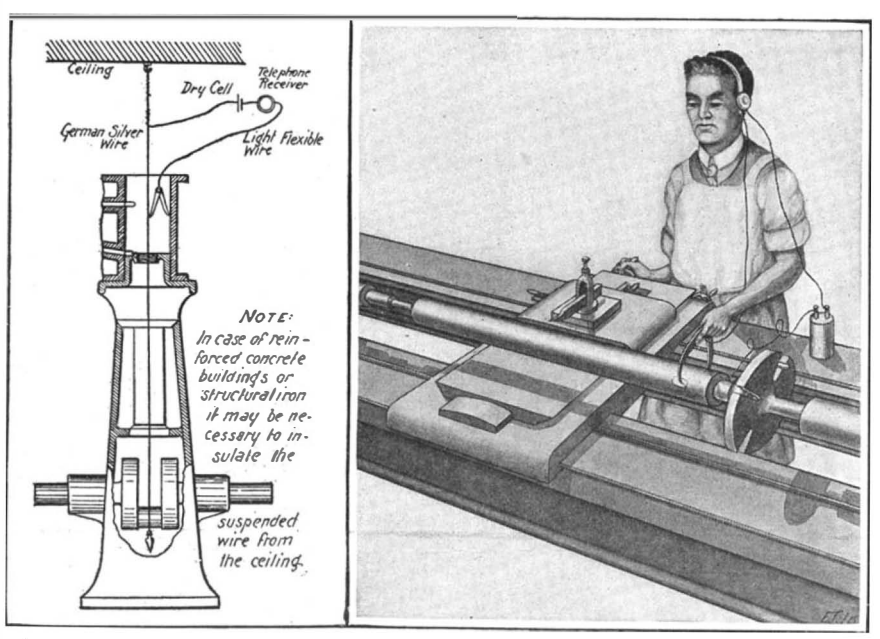
The general dimensions of the apparatus are 24" long, 14" wide and 20" high; the weight is approximately ninety pounds.



Steering device for low priced cars, showing method of application



An instrument for recording the vibrations of steamships



Two methods of using a telephone receiver and dry cell in connection with caliper gaging

Increasing Accuracy of Calipers by Using Telephone Receivers

BY the application of an ordinary telephone receiver and dry cell to a pair of calipers it is possible to gage machine work with an accuracy greatly exceeding that attained by using the ordinary calipers alone.

In the accompanying illustrations are shown two methods of employing electricity for gaging purposes. The first illustration represents a cross-sectional view of an upright engine, through the center of which passes a plumb line of German silver wire, hung from the ceiling. If the ceiling is of metal and is grounded, the wire must be insulated. The wire forms one side of the circuit, which includes an ordinary telephone receiver and a single cell of battery, while the other side of the circuit leads to the calipers. By passing the caliper down through the cylinder of the engine, touching either the cylinder wall or the wire with one of the legs of the calipers and attempting to bridge between the wall and the wire, it becomes possible to determine whether or not the cylinder is bored out to the required size and whether it is of an even diameter throughout.

The foregoing method is somewhat crude. A much better procedure is to insulate both legs of the calipers from each other, thus enabling the German silver wire to be dispensed with entirely. The calipers, thus insulated, can be lowered down into a cylinder more conveniently, in gaging the bore. When the diameter of the bore is of the same or greater size than the caliper adjustment, a click is heard in the telephone receiver, caused by the closing of the circuit through the part that is being gaged.

In the second illustration is depicted the method of using electricity for gaging machine work held in a lathe. If an ordinary pair of calipers is being used, a piece of cigarette paper is placed between one leg of the calipers and the metal work, as shown. The insulated leg is held tight against the work while the other leg is employed for gaging. While the work is of the same size or larger than the caliper adjustment, a click is heard in the telephone receiver.

It will be appreciated that these methods are inelaborate and that they offer much opportunity for improvement if the user wishes to go to the trouble of making a more practical gage.

New Rules of Practice

NEW rules of practice before the United States Patent Office became effective January 1st.

The new rules, while elaborate and technical, make for brevity, simplicity, speed and efficiency.

A year ago Commissioner Ewing, of the Patent Office, appointed a committee, of which R. F. Whitehead, assistant commissioner of patents, was the chairman, and Walter F. Rogers of Washington, former president of the Patent Bar Association, was a member, to make a thorough revision of the rules of practice. No general revision of the rules had been made for several years and, in the view of Commissioner Ewing, it was desirable, even necessary, that the work should be done in the interest of inventors and in the interest of the Government.

After ten months of work the results were submitted to patent experts and patent attorneys throughout the country, with the request that they give the Patent Office the benefit of their suggestions in respect of the proposed changes. Hundreds of suggestions were made and all have been carefully analyzed and many of them incorporated in the new rules. This was the first time in the history of the Patent Office that practitioners and the inventing public ever were consulted concerning the formation of the rules and practices.

"Safety First" Tea Kettle

A NEW tea kettle is supplied with an extra opening in the top through which it may be filled without the inconvenience and danger of being scalded by the steam generated when cold water is poured into the hot kettle. The second opening is a small one in front of the bail and is protected by a hinged swing cover, which may be operated by the thumb while the kettle is being held by the bail under the faucet.

"Time-Study Watch"

THE stop watch, which was first made as a race track accessory and was used for a long time exclusively for timing speed contests, has now entered into very extensive use in the industrial world for the purpose of arriving at the cost and time of various manufacturing operations. For this purpose the ordinary decimal dial watch seemed to answer the demand, but after the time of a specified task has been taken, a more or less difficult computation is required to reduce the observation to output per hour or day as may be desired. A new instrument, by which these results are arrived at instantly and shown in plain figures on the face of the timepiece, is now being introduced into such establishments where it is the custom to secure detailed data concerning production costs. The new "time-study watch" has a computed dial, being divided into tenths and hundredths of minutes, and in addition the dial contains distinctly legible figures spaced two hundredths of a minute apart that indicate, at any point of elapsed time, exactly what the corresponding output per hour is. Thus, if it requires .76 of a minute to perform one operation, as shown by the large hand, the reading 78.9 directly under it is the corresponding output per hour. An employee realizing that the watch is being held on him will prolong the operation at hand by some wasteful and unnecessary movements. By the aid of this instrument the net time required for the work may be easily arrived at. Having made an observation of the time consumed, a second checking is made and the watch is stopped during the fractions of the second which the employee "loafs." The reading on the dial will give the actual time consumed in useful energy, and the difference between the two readings is the time wasted in that particular cycle of work. The movement of the watch is controlled by a slide on the outside rim of the case convenient to the stem. "Industrial coaches" are finding the "time-study watch" a great factor in their work.

RECENTLY PATENTED INVENTIONS

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

Pertaining to Apparel

SHIRT.—G. H. NICHOLAS, 854 W. 181st St., New York, N. Y. This invention relates to men's shirts, especially adapted for use by laborers, machinists and the like, although, if desired, certain features may be embodied in negligée shirts of the better grade. The invention improves the design of the shirts so as to be more durable, attractive in appearance and comparatively simple and inexpensive to make.

BUTTON.—R. C. BRADLEY. Address Victor C. Barringer, Monroe, La. An object here is to provide a button which can be readily covered by a piece of cloth without the necessity of using a special machine for covering the same. A further object is to provide a button in which the assembling of the parts stretches the cloth covering tightly into place.

Electrical Devices

ELECTRIC CLOCK.—F. HARDISTY, Buck Creek, Ind. An object of this invention is to provide a clock which is run by a small amount of current and which therefore consumes very little energy. A further object is to provide a novel form of striking mechanism which is also actuated electrically.

AUTOMATIC MALLET OR PLUGGER.—G. CROSTON, Hoquiam, Wash. The invention has for an object the provision of an electro-magnetically operated hammer or plugger having an improved form of switch whereby the circuit of the coils can be locked open or closed or whereby the operator can control the circuit manually.

Of Interest to Farmers

COTTON COMPRESS.—W. HILL, Alexandria, La. The inventor provides a machine with means for employing relatively quick-acting and slow-acting power, and with means for taking up the lost motion of the said slow-acting power; provides means for shortening the time required for the complete operation of the compress; and simplifies the mechanical construction of the compress.

SELF DUMPING FRESNO SCRAPER.—J. F. BOONE, Long Lake, N. Y. The invention relates more particularly to Fresno scrapers or scrapers for handling loose dirt, such as in leveling ground previously plowed when the land is about to be irrigated, as distinguished from slip scrapers, such as used on reclamation projects to cut into the solid earth and carry it off.

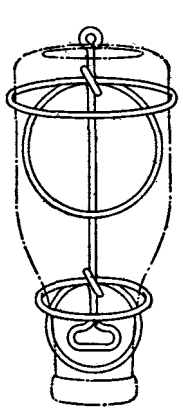
PEANUT THRESHING MACHINE.—C. R. LIVERMON, Roxobel, N. C. This invention provides a device by means of which the peanuts may be stripped from the vines and delivered in a perfect condition. It provides a device which will not tend to clog up, but in which the vines are so treated as to be kept from clogging up the machine and thereby delaying the operation of the device.

DISK CULTIVATOR.—J. Herdlein, De Soto, Mo. This improvement provides a cultivator capable of adjustment as to the depth of the cut of the disks, and as to the quantity of soil thrown by the disks, and as to the lateral position of the disks, and the width of the rows, and wherein the cultivator is especially designed for hard ground, and for destroying weeds, and for leaving a fine mulch on the surface.

COW'S TAIL HOLDER.—R. MCGAHEY, Walla Walla, Wash. The invention relates to means for preventing a cow from switching her tail while being milked, and one of the main objects thereof is to provide a device which may be instantly placed into and removed from operative position by the person milking the cow, and without the necessity of soiling his or her hands in so doing.

Of General Interest

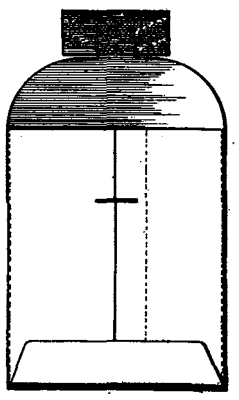
BOTTLE DRAINER.—C. H. TAYLOR, 80 Beacon St., Newburgh, N. Y. This invention provides a cheap, strong and reliable device



BOTTLE DRAINER.

adapted to support a milk bottle or the like in such position that it may thoroughly drain with the mouth portion open or free, and whereby the bottle may be filled in position to be collected by the milkman if desired. While especially designed for use in connection with milk bottles, the device is not so limited in use.

ENVELOP.—F. L. TOUPAL, ; 1410 Lowe Ave., Chicago Heights, Ill. This invention relates to envelops and more particularly to closures therefor. It provides a novel form of flap closure for retaining the envelop sealed against accidental opening thereof, which may be



ENVELOP.

opened without mutilating the same. It provides an envelop of this character which is simple in construction, thus reducing the cost of manufacture to a minimum, and which is effective in carrying out the purpose for which it is designed.

PROCESS OF OIL EXTRACTION FROM SEED KERNELS.—W. MCC. NEALE, 479 W. Washington St., Greenville, S. C. The objects of this invention are attained by testing the crushed seed kernels for moisture and then subjecting the so-crushed seed kernels to a hot current of predetermined moisture and temperature, the said seeds being prevented from agglomeration when subjected to the current so as to expose a maximum surface of contact to said current.

NON-GLARE DEVICE FOR THE EYES.—J. C. F. ME VAY, 707 Pacific Ave., Atlantic City, N. J. This invention relates to a non-glare device designed to be worn by persons to prevent the sunlight glare from buildings, sidewalks, snow, and the like, from injuriously affecting the eyes. The device is comparatively simple and inexpensive to manufacture.

UTILIZATION OF PEAT.—N. TESTRUP, 6 Broad Street Place, London, E. C., England; T. RIGBY, Station Hotel, Dumfries, Scotland, and O. SÖDERLUND, "Fairlawn," Clapham Park, London, S. W., England. According to this invention, the peat, after wet carbonization and removal of the bulk of its liquid matter by internally transmitted pressure, as on a filter press, has a further quantity of water removed from it, either by treatment in a band or like press, or by exposing it to hot products of combustion from apparatus employed on the process, part of the partially dried material being supplied to ammonia recovery gas producers, and the remainder converted into gaseous fuel product.

CHECK-UP HOOK.—W. J. FRICKE, 2011 Yolo Ave., Berkeley, Cal. This invention has reference to devices known largely as check-up hooks, in the use of which a load, either suspended, or connected to be towed or hauled, is adapted to be released by the release or casting off of a pivoted hook by which the load is connected to the draft power or suspension means.

BAG SPLITTER.—W. J. CULLEN, Room 1406, 30 Church St., New York, N. Y. This invention relates to devices for separating the contents of a bag into two or more parts and particularly to what is known as a bag splitter, and has for an object the provision of an improved construction which accurately splits the bag into the desired number of parts with a minimum effort.

BOTTLE CAP.—P. D. BELLES, 339 E. 124th St., New York, N. Y. This invention has reference to bottles and jars and has particular reference to closures for such devices. Among the objects of the invention is the provision of a temporary closure for a milk bottle or other container from which the liquid contents are to be dispensed periodically.

PENCILING GUIDE.—W. E. AYCOCK, Aycock, Fla. This guide is for use in painting or penciling the bases of the grooves between the outstanding faces of scratch joint brick work, and particularly grooved wood surfaces in imitation of such brick work, the object being to provide a guide for a paint brush of any suitable character by which the faces of the grooves may be well and quickly painted without danger of painting or smearing with paint the sides of the grooves which are the edges of the outstanding faces in imitation of brick.

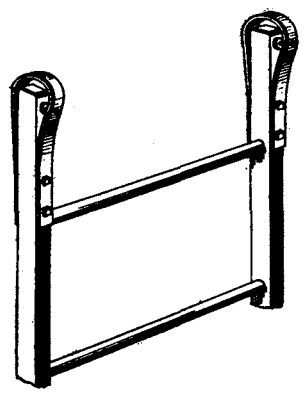
PENCIL HOLDER.—M. F. SEXTON, Stuart, Iowa. This invention has reference to means for holding a pencil, and has reference more particularly to a pencil holder adapted to be received on a person's finger, which comprises a ring having means adapted to receive and hold a pencil or a penholder.

SHELVING.—A. T. WINDQUIST, 1617 Morgan St., Aberdeen, Wash. This invention provides shelving of sheet metal, suitable for use in stores and shops, or for holding books or the like, and of sectional character, capable of being set up or knocked down, and adjustable for varying needs, and wherein the mechanism is such that the shelving may be quickly set up or taken down, may be packed in compact form when knocked down, and which will be of handsome appearance when set up.

Hardware and Tools

WRENCH.—T. HAND, P. O. Box 663, New Haven, Conn. The present invention has reference generally to wrenches and more particularly to a wrench having something of the nature of a combination tool, in that it is particularly adaptable to round surfaces such as pipes and also to polygonal shaped work.

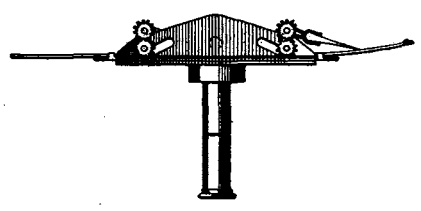
LADDER ATTACHMENT.—F. L. TOUPAL, 1410 Lowe Ave., Chicago Heights, Ill. This invention is an improvement in ladders and has particular reference to a device carried thereby and adapted to engage a wall or other support to retain the ladder in position. The device will not materially damage the support



LADDER ATTACHMENT.

against which the ladder is leaning and at the same time, will effectively prevent slipping of the ladder while in use. The fastening device has shields or guards which prevent engagement of said devices with a support when only the weight of the ladder is bearing there against.

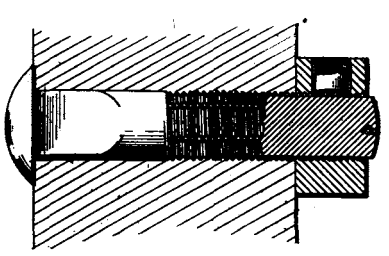
SELF STROPPING SAFETY RAZOR.—ETHEL C. GALLUP, 291 Broadway, New York, N. Y. This invention relates to a form of safety razor including a head and a handle therefor; one or more razor blade holding devices being permanently connected with the



SELF STROPPING RAZOR.

head and adjustable thereon so as to position a blade or blades for either shaving or stropping purposes. It improves safety razors so as to make them more readily adaptable for either shaving or stropping purposes, without material interchange of parts, than has been heretofore possible.

NUT LOCK.—A. C. GRIFFING, Baskin, La. The invention has for its object to provide a simple, inexpensive and easily operated lock for preventing accidental dislodgment of the nut from the bolt, wherein the locking mechan-



NUT LOCK.

ism is supported by the nut, and coöperates with the bolt to prevent accidental reverse rotation of the nut on the bolt, but arranged to permit the lock to be released to permit reverse movement of the nut.

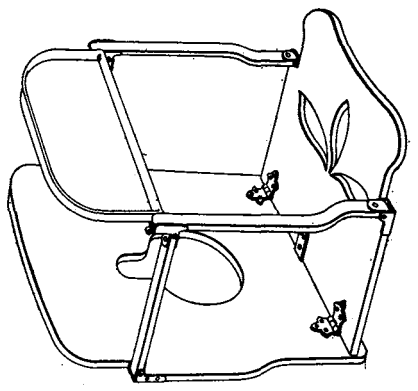
Heating and Lighting

LAMP AND LAMP SUPPORT.—C. KAUFMANN, care of Kaufmann, Williams Lamp Co., Santa Ana, Cal. The invention relates more particularly to lamps and supports thereof especially adapted for use in connection with automobiles, motorcycles, canoes, launches, and the like, the object being to provide an arrangement wherein the lamp proper may be removed from its support and utilized as a spot light in case of trouble.

AUTOMATIC SAFETY VALVE.—G. F. WEHMANN, 830 Manhattan Ave., Brooklyn, N. Y., N. Y., and L. G. WULBERN, Charleston, S. C. In the present patent, the invention has reference to safety valves, particularly for gas pipes, and the main object thereof is the provision of such safety valves which automatically close when the surrounding atmosphere reaches a predetermined point.

Household Utilities

CHILD'S SEAT.—W. H. GIBSON, 170 Rugby Ave., Rochester, N. Y. This invention pertains to a toilet seat for a child, and provides such a seat as is foldable, easily portable, and adapted for instant and positive connection



CHILD'S SEAT.

with a conventional toilet seat; and provides such seats as are rigid in use, light and compact, composed of but few parts not likely to get out of order to require repair, and comparatively inexpensive.

COOKING UTENSIL.—EMMA R. MEYER, 151 W. 145th St., New York, N. Y. This invention provides a utensil which has a lid substantially close-fitting and adapted to be held in position so that when in one position the steam will be practically held within the utensil and in another position openings are provided through which the water or juices may be drained off, the lid supporting and retaining means insuring that the operator cannot be scalded or burned, and, whereby the desire may be manipulated for draining off the water by the use of one hand only.

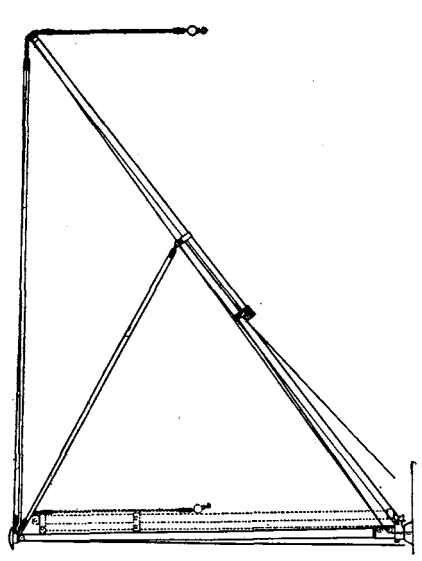
DOMESTIC UTENSIL.—J. N. JACKSON, Millersville, Ill. The main object here is to provide a frame or support for either of a plurality of attachments whereby the device may be used for various purposes. By means of such attachments the device is adapted for use as a press, for wine, fruit, or lard; as a meat or lard chopper; as a sausage stuffer, etc., without any alteration in the frame structure.

Machines and Mechanical Devices

VACUUM PUMP.—C. N. SNOWDEN, Santa Celilia, Guantanamo, Cuba. The invention refers to vacuum pumps of the reciprocating type, and has reference more particularly to pumps used in connection with sugar refining. The object is to provide an efficient pump whereby the said pump during its stroke can form a plurality of independent vacuums of predetermined pressure.

CLOTHES LINE HANDLING AND MEASURING MACHINE.—J. A. JOHNSON, 16 Dunham Place, Brooklyn, N. Y. This inventor provides means for mechanically controlling the delivery of rope from a supply coil to a cutting station; provides means for preventing the recession of the severed ends of the rope; provides means for registering the length of the rope delivered past the cutting station; provides means for delivering ropes of different characters from independent supplies without mutual interference; and avoids fraying or abraiding the material being handled.

EXTENSION BOOM.—N. E. ANDERSEN, Point View, Miami, Fla. In carrying out the invention, the extension boom is mounted on a main boom which is pivotally mounted on the foot casting of the mast, and an extension fall rigging is provided, controlled by an engine



EXTENSION BOOM.

drum, together with safety devices in the way of improved guiding means for the extension boom, locking devices to hold the extension boom in the adjusted position, and a support

for the extension boom when withdrawn entirely from the extended position.

PUMP.—F. FOLEY, Gillett, Ark. The invention provides a pump having a double piston or plunger together with mechanism for operating the pistons or plungers in opposite directions, and wherein a particular form of piston or plunger is provided, offering a minimum resistance to the upflow of the water on the downward stroke of the piston and a maximum of lifting power on the upstroke.

CLUTCH MECHANISM.—E. D. ROBERTS, care of The Puget Sound Iron and Steel Works, Tacoma, Wash. In this instance the improvement has for its object the provision of a clutch mechanism which will reduce to a minimum the end thrust and which, by the means provided will efficiently lubricate the wearing surfaces to present an undue generation of heat.

STRAP AND LINE REEL.—B. C. SKINNER, Dunedin, Fla. This invention relates to reels for holding box strapping, wire, rope and other stock, and has to deal more particularly with a brake or stop for abruptly stopping the rotation of the reel when the desired amount of stock is drawn off, so as to prevent the stock from unwinding and becoming tangled.

WORK FEEDING MECHANISM.—H. A. GRIFFITHS, 22 Francis road, Edgbaston, Birmingham, England. This invention comprises the combination with a slide, of a pair of racks, and a pawl and stop in conjunction with each rack, the arrangement being such that while the intermittent movements of the slide are being produced in one direction by the action of one of the pawls on one of the racks, the stop in conjunction with the other rack is operating to bring the slide to rest in the correct position at the end of each of such movements.

CLAM DIGGER AND FISHING MACHINE.—L. R. GAGE, Hoquiam, Wash. Among the objects of the invention is to provide a peculiar construction of dredging apparatus with means for adjusting the same vertically with respect to the supporting frame and having associated therewith an endless carrier or elevator for gathering and delivering the clams loosened from the sand by said dredging devices.

SAFETY GAGE GLASS.—G. ERNST, 176 Ferry St., Newark, N. J. The inventor provides socket pieces of peculiar construction into which the ends of the glass proper are fitted out of contact with the structure of the sockets, a tubular guard being provided surrounding the gage glass and connected rigidly to said socket pieces.

FIRE ESCAPE.—A. F. FORNELIUS, 12 Spring St., Athenia, N. J. This invention provides means for controlling the speed of descent of a person by means of the device, and provides means for accommodating the device to the weight of the person. It also provides means for re-winding the cable after use in order to allow of the use of the device by more than one person.

MACHINE FOR RENAPPING AND REFINISHING CLOTH.—E. J. DUNKLEE, 133 Elm St., Hackensack, N. J. In the present patent the invention has reference to a machine for renapping and refinishing worn cloth, and is especially adapted for use by tailors and cleaners whereby woolen garments can at the worn spots be so treated as to give the garment a new appearance.

CARBID HOLDER.—W. L. CASH AND I. B. CROWE, Graham, Ky. The invention provides a holder especially adapted for holding cans of calcium carbid, wherein mechanism is provided for supporting the can in a position such that it can be tilted to permit the removal of a portion of the contents without any great physical exertion, and wherein the mechanism may be quickly attached to or detached from the can.

SYRINGE.—R. B. THURMAN, Sparta, Tenn. This syringe is especially adapted for dentists' use, for flushing the oral cavity and for dislodging foreign matter in cavities of the teeth during the process of dental work, wherein the syringe is provided with automatic mechanism for draining the syringe.

Musical Devices

MUSIC HOLDER.—A. M. BROWNE. Address McVea Young, Pascagoula, Miss. The inventor provides a music holder adapted to be used as an envelope or portfolio for carrying sheets of music, and having means for supporting the sheets against accidental displacement, in view of the musician while he is reading them.

Prime Movers and Their Accessories

PRIMER.—C. KAUFMANN, care of Kaufmann, Williams Lamp Co., Santa Ana, Cal. This mechanism is for use in connection with explosion engines using distillate gasoline, alcohol or the like, and arranged between the carbureter and the engine, for assisting in the evaporation of the fuel when starting the engine, and wherein other mechanism is provided for permitting the use of fuel evaporation at a lower temperature than the ordinary fuel, for starting the engine.

CURRENT MOTOR.—B. T. SAMS AND W. H. HOUT, Warrensburg, Mo. In this case the invention relates to current motors, and has reference more particularly to a water wheel in the shape of a spiral formed by a cone surface and mounted to float in a water current at a suitable angle to the direction of the current with the cone surface of the spiral. The invention provides a current motor which is adapted to support itself on the fluid by which it is actuated.

Railways and Their Accessories

AUTOMATIC TRAIN STOP DEVICE.—T. T. CHALONER, 507 W. 169th St., New York, N. Y. The invention relates particularly to an automatic train stop adapted to be carried by the train and arranged to engage danger arms positioned along the track, whereby the stop mechanism will be operated for opening the air brake system of the train when the danger arms have been engaged.

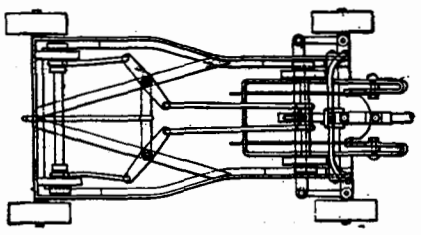
Pertaining to Vehicles

FLEXIBLE COUPLING.—A. N. CLASSON, Sheridan, Ill. The coupling is constructed with an arm secured to one of the shafts which is rotated by members with which it is engaged at its ends, the members being secured to the outer ends of levers fulcrumed to a disk secured to the driving shaft and with the inner ends of the levers connected by a link.

ROBE FOR AUTOMOBILES.—H. S. Z. ADLER, Box 466, Portchester, N. Y. This robe protects the lower portion of the person or persons seated on the front seat of the automobile against the inclemency of the weather, at the same time permitting the driver to freely utilize the feet for the manipulation of the pedals and to use the hands for manipulating the steering wheel or the hand lever or levers for controlling the emergency brake, reversing mechanism, or the like.

BOLT BEARING.—J. L. BEANE, Le Grand, Iowa. This improvement is in rodless end gates for wagons, and provides a mechanism for securing an end gate in place on a wagon, without the use of the usual rod, and wherein the gate may be locked or released without removing the locking means from the gate.

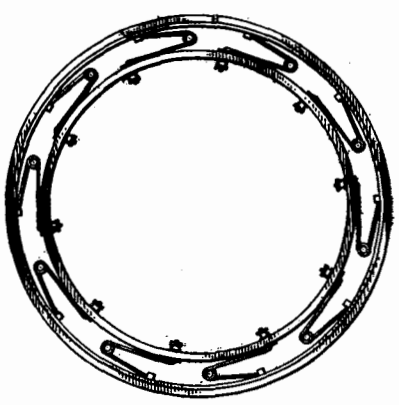
TRUCK.—I. MCCOON, Windsor Locks, Conn. This invention provides a manually operated truck, by means of which the time and expense involved to load the truck is reduced to a minimum. It also provides a simple, inex-



MANUALLY OPERATED TRUCK.

pensive, strong and convenient manually operated truck, in which the platform for loads is made to move bodily and in which the platform can be maintained in its extreme position without any effort.

VEHICLE WHEEL.—A. GIBEAULT, 411 Carpenter Ave., Iron Mountain, Mich. This invention relates more particularly to a novel tire construction, whereby the necessity for using pneumatic tires is obviated. It consists in providing an inner and outer rim with a

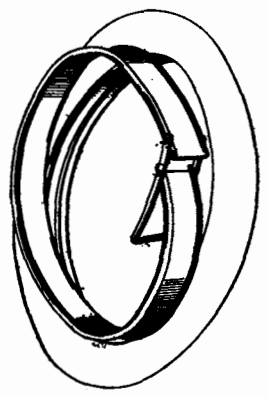


VEHICLE WHEEL.

plurality of spring members interposed therebetween and secured thereto in a novel manner. The primary object is the provision of a vehicle wheel which is light, durable, and calculated to effectively cushion the vehicle and eliminate shocks and jars thereto.

SUSPENSION WHEEL.—W. S. WATSON, care of Watson Suspension Wheel Co., 718-719 Hippodrome Bldg., Cleveland, O. An object in this case is the provision of a tension wheel having steel rims and spokes, the latter being provided with hub connections that may be used with the metal flanges or hub housing of any ordinary wooden spoke wheel used on automobiles.

OPERATING DEVICE FOR SPLIT WHEEL RIMS.—D. J. RAYMOND, Crandon, Wis. This invention relates generally to split wheel rims, and more particularly to an implement or means in connection therewith, and forming a permanent part thereof, for reducing the split rim when it is desired to release a tire there-

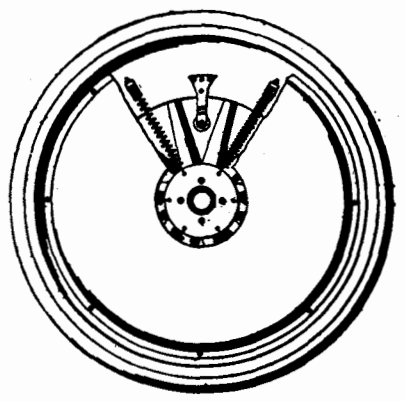


OPERATING DEVICE FOR SPLIT WHEEL RIMS.

from, said implement and means acting, when in closed position, as a brace for supporting the free ends of the rim on opposite sides of the gap in operative position.

MOUNTING FOR VELOCIPEDE PUMPS.—G. A. MAGIN, 53 Lancaster St., Albany, N. Y. The invention relates to mountings for velocipede pumps, that is, to means for supporting the pump within the tubular frame of the machine, in such a manner that the pump is carried safely and held firmly in position while the machine is in use, but is also readily accessible and easy to remove for the purpose of inflating the tires of the velocipede.

VEHICLE WHEEL.—E. H. SIPES, Tripp, S. D. This invention relates more particularly to that type commonly known as spring wheels, and adapted for use on automobiles and other vehicles. It provides an outer rim element having a frictional engagement with the inner hub element so that sudden starting of the



VEHICLE WHEEL.

latter will cause a slight relative movement therebetween and impart a more gradual rotation to said outer rim element, means being provided for limiting said relative movement whereby the springs and connections therefor will not be subjected to undue strain.

VEHICLE FRAME SUSPENSION AND SHOCK ABSORBER.—C. SIMON, 34 W. 13th St., New York, N. Y. This inventor provides a frame suspension which can be as easily applied to newly constructed motor vehicles as to motor vehicles already in use, as the attachment proper is applicable directly between one end of the spring and the frame of the vehicle without any alteration to any part of the vehicle.

WORM DRIVES FOR AUTOMOBILES.—E. S. SUTCH, 2128 Mt. Vernon St., Philadelphia, Pa. The present invention has reference to improvements in differential driving mechanism, and has for an object the provision of an improved construction wherein a worm will act as a power member without producing undesired end or side thrusts.

VEHICLE WHEEL.—N. CORNFIELD, 2 Columbus Circle, New York, N. Y. This invention has reference to vehicle wheels, the more particular purpose being to provide a wheel with springs suitably arranged for taking up the play of the axle, and performing generally the office of a pneumatic tire. Mr. Cornfield has invented another vehicle wheel, and the objects of the improvement are: to maintain the alinement of separately operating elements of the wheel; to minimize the friction between the relatively moving parts; and to strengthen and simplify the construction.

BUFFER.—R. C. ROGERS, 461 Park Ave., Brooklyn, N. Y. An object here is to provide a buffer which may be used upon a door at any point and a door of any kind with a minimum amount of work in applying the same tbe first time and practically no work in renewing the same.

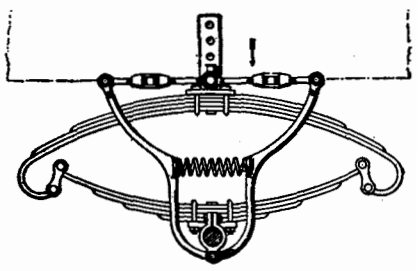
RESILIENT WHEEL.—J. F. NETTLE, P. O. Box 1057, Butte, Mont. This invention relates to improvements in resilient wheels, and has for an object to provide a wheel which retains the characteristics of a wheel provided with a pneumatic tire while presenting means to the earth or road-bed which cannot be punctured or readily injured.

PNEUMATIC CUSHION.—I. A. LAKE, 3342 Hill Ave., Bronx, New York, N. Y. In the present patent the invention has reference to cushioning devices and particularly to what are sometimes called shock absorbers for vehicles, and has for an object the provision of an improved construction that utilizes air as the cushion medium.

CHAIN TIGHTENING DEVICE.—E. J. BENSON, Blackfoot, Idaho. The invention provides means whereby a chain of the non-skid type may be tightened around a portion of the periphery of a wheel as in cases where the wheel is partially submerged in mud to such an extent as to render the placing of the chain entirely around the wheel impossible.

SPRING SUSPENSION GEAR FOR MOTOR CARS AND OTHER VEHICLES.—J. A. SHEARER, Prospect, South Australia, Australia. The invention relates to the suspension or mounting of the frame of a motor car or other vehicle upon its axles by means of links connected with each axle and pivoted to said frame and adapted to be moved against the action of the spring or springs, when said axle rises relatively to the frame, so as to absorb the shock or jar caused by the passage over rough roads or over irregularities or obstacles.

AUXILIARY SPRING FOR VEHICLES.—F. J. KITOWSKI, St. Cloud, Minn. This invention relates to auxiliary resilient suspension means for vehicles. The object thereof is to provide a simple, strong, efficient and inexpen-



AUXILIARY SPRING FOR VEHICLES.

sive auxiliary suspension means which forms a protector for the main spring used in connection with vehicles and which will also serve as a shock absorber.

ANTISKID DEVICE.—G. T. HECKMANN, 535 Merchants Laclede Bldg., 4th and Olive Sts., St. Louis, Mo. This invention refers more particularly to the type of anti-skid devices for tires involving the use of chains arranged to be secured transversely of a tire by clamp means engaging the spokes. It provides a clamp in which the clamp screw to tighten or loosen the jaws of the clamp is prevented from turning one clamp jaw relatively to another, whereby to facilitate the tightening and loosening of the clamp by the use of one hand only.

Pertaining to Warfare

SEMISUBMERSIBLE WAR SHIPS.—S. D. SIMMONS AND H. AMLING, 4228 Park Ave., Bronx, N. Y., N. Y. This invention relates to naval craft and in certain aspects is of the Monitor type, in that only the top of the hull and the gun turret are visible. The invention has for an object to improve the construction of the hull so as to be mine and shell-proof, due to its special shape and the thickness of the walls of the hull.

Designs

DESIGN FOR A LAMP SHADE.—G. C. LYNCH, 333 4th Ave., New York, N. Y. In this ornamental design for a lamp shade a side elevation shows the shade ornamented in a neat and attractive border and division arrangement of flowers and leaves.

DESIGN FOR A BOTTLE.—A. G. CARLING, 119 W. 64th St., New York, N. Y. In this ornamental design for a bottle the article is shown in three views, a front elevation showing a new design; an edge view; and a cross section of the same.

DESIGN FOR A BELL CROWN.—F. C. WHITE, 79 Delaware St., Woodbury, N. J. This ornamental design for a bell crown is shown by two figures; one representing a front elevation, and the other a side elevation.

DESIGN FOR A PHONOGRAPH BOX OR CABINET.—L. MABKELS, 160 William St., New York, N. Y. In this ornamental design for a phonograph box or cabinet, the article comprises a cabinet of low and almost square formation and of attractive lines.

DESIGN FOR A BODY FOR A PENDANT OR SIMILAR LAMP.—B. SCHWARTZMAN, 15 Laight St., New York, N. Y. This ornamental design for a pendant or similar lamp is No. 48,284. Mr. B. Schwartzman has also secured eleven other designs comprising two designs for a back plate for lighting fixtures, Nos. 48,286 and 48,291; two designs for a socket cover for lighting fixtures. Nos. 48,287 and 48,293; two designs for a canopy for lighting fixtures, Nos. 48,292 and 48,294; and five designs for a shower plate for lighting fixtures, Nos. 48,285, 48,288, 48,289, 48,290, and 48,295.

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

New York to Chicago—a Thousand Miles—on a Gallon of Oil—Another World's Record for the Franklin Car

IF YOU were an automobile manufacturer and expected to stay in business for the rest of your life, which would you rather do, play to the unthinking, imitative automobile public, or find out what *type* of car will do the *most* for the *motorist* and build it for the man who has to be *shown?*

One thing that separates the Franklin Car amongst all the fine cars in America is the Franklin system of Direct-Air-Cooling.

And let us say right here that *Air-cooling is making more people think* than any one principle in motor construction today.

Men have got to think about it because of what air-cooling is doing and will do.

The Franklin Direct-Air-Cooled Engine turns more of the fuel into useful power than any other engine.

The test of the Franklin Car by the Worcester Polytechnic Institute in April, 1914, proved that *84.4 per cent. of the power* developed is *delivered to the ground in driving force.*

The Franklin Direct-Air-Cooled Engine delivers the highest economy in gasoline.

The National Efficiency Test, on May 1, 1915, *proved the gasoline economy* of the Franklin—when 137 Franklin Cars, in all parts of the country, delivered an average of *32.1 miles on a gallon of gasoline.*

The Franklin Direct-Air-Cooling System does away with useless weights — the radiator, with its weight of water; the water-jackets, the piping, pump and pump accessories, pipe connections; the dead weight of castings and supports to carry these parts. It means less weight on the tires, a saving in drag, in wear, in grind.

The records of Franklin owners in every part of the United States, of *9630 miles to the set of tires,* proves that the saving of weight due to the Franklin System of Direct-Air-Cooling and flexible construction practically *doubles the life of tires.*

The Franklin Direct-Air-Cooled Engine does away with all troubles of freezing and over-heating—no water to freeze—no water to boil.

This Franklin Touring Sedan arrived in Chicago, at six minutes after six o'clock on the morning of November 20, 1915, after a no-stop run from New York City, establishing the world's record of 1046 miles on one gallon of oil. The lubricating system was officially sealed at the start. The Car carried two observers throughout the trip, and the test was conducted from start to finish under the supervision of the Automobile Club of America.

The Franklin Direct-Air-Cooled Engine delivers service twelve months in the year—regardless of climate, locality or weather conditions.

The Franklin Low Gear Run, August 1 to 4, 1915, proved the *perfect freedom of the Franklin Car from heating troubles*—a run of 860 miles from Walla Walla, Washington, to San Francisco, on Low Gear without once stopping the engine.

The new world's record for Oil Economy has just been established by the Franklin Direct-Air-Cooled Engine—*one thousand miles on one gallon of oil.*

The Franklin Direct-Air-Cooling System is *reducing the largest item of expense* in owning a car—the loss of value through wear and tear.

Every motorist can prove this for himself—find out the used-car value of any Franklin Car.

Remember once more, please, that these Franklin achievements have never been duplicated by any car, anywhere.

That the Franklin Direct-Air-Cooled Car is the one type that meets the rapidly growing demand of thoughtful motorists for comfort, economy and reliability, is proved by the fact that Franklin dealers throughout the country have had more orders than they could fill; that we have just closed the biggest year in our history, and that we are compelled to double our facilities for building the Franklin Direct-Air-Cooled Engines.

However much a man may know about motoring and motor cars in general, he never knows what the Franklin Direct-Air-Cooling System adds to the comfort, the pleasure and the safety of motoring *until he drives the Franklin Car himself.*

For the man who is looking for the car that will do the most for him, and wants to be shown—there are just two classes of men to talk to about the Franklin Car: Franklin owners and Franklin dealers.

They know the Franklin. Often they have owned and driven other cars as well. They can give you the facts about the Franklin Direct-Air-Cooled Car in comparison with other cars—a comparison that is growing more and more important to the motorists of this country every day.

FRANKLIN AUTOMOBILE COMPANY
SYRACUSE, N. Y.

Touring Car—$1950, F. O. B. Syracuse, N. Y.
Actual Scale Weight, 2680 Pounds

Morning and Evening Stars for 1916

(*Concluded from page 62*)

If a straightedge be passed through the earth and the sun at the assigned date, the planets will be divided into two groups, those on the right which rise before the sun and are morning stars; and those on the left which set after the sun and are evening stars. Before the dates of superior conjunction Mercury and Venus are morning stars; between superior and inferior conjunction they are evening stars. Before conjunction the other planets are evening stars; after conjunction they are morning stars.

TABLE 3. CONJUNCTIONS OF THE PLANETS.

Jan.	6,	Venus and Uranus
"	17,	Mercury and Uranus
Feb.	3,	Mercury and Uranus
"	13,	Venus and Jupiter
Mar.	4,	Mercury and Uranus
April	8,	Mercury and Jupiter
May	23,	Venus and Saturn
June	22,	Venus and Saturn
July	13,	Mercury and Venus
"	21,	Mercury and Saturn
"	26,	Mercury and Neptune
Sept.	5,	Venus and Saturn
"	13,	Venus and Neptune
Dec.	21,	Mercury and Mars

TABLE 4. GREAT ELONGATIONS OF MERCURY AND VENUS

Mercury	(E)	Jan. 20	May 12	Sept. 9
"	(W)	Mar. 1	June 29	Oct. 20
Venus	(E)	April 23	(W)	Sept. 12
Great brilliancy		May 27,		Aug. 9

Death of Thomas F. Richardson

THOMAS F. RICHARDSON, an engineer and bridge builder, died on December 26th at his home in Rutherford, N. J., in his sixty-first year.

Mr. Richardson, who was born in Woburn, Mass., was identified with a number of important engineering undertakings, prominent among which were the building of the cog-wheel railroad to the summit of Pike's Peak, Col., the Cañon Diablo bridge of the Santa Fé railroad, the largest bridge on the Mexican Central railroad at Encarnacion, and the Wachuset Dam and Aqueduct Metropolitan Water Works in Massachusetts. He was a member of several engineering societies and fraternal orders.

NEW BOOKS, ETC.

YOUR BABY. A Guide for Young Mothers. By Edith B. Lowry, M.D. Chicago: Forbes & Company, 1915. 12mo.; 254 pp. Price, $1 net.

Dr. Lowry's popular handbooks on hygiene are widely and favorably known. Her latest is addressed to the prospective mother and the young mother, and tells everything that is essential to the health and happiness of both mother and child. The most approved methods for the care of the baby are fully presented in the author's common sense way. Feeding, clothing, exercise, sleep and training are all covered, and if the knowledge of the book were universally applied we should no longer be faced with the appalling fact that nearly half the children born into the world die before they are twelve months old.

THE LOG OF THE ARK. By Noah. Excavated by I. L. Gordon and A. J. Frueh. New York: E. P. Dutton & Company, 1915. 12mo.; 150 pp.; illustrated. Price, $1 net.

A rollicking record of Captain Noah's historic voyage. Even the incessant rains could not dampen the spirits of the navigators, and the most reluctant reader cannot but smile at Noah's little difficulties with Mrs. Noah, the refrigerating machine, the lost flea, and the ichthyosaurus quadriscessus.

MACHINE DESIGN. By Albert W. Smith and Guido H. Marx. New York: John Wiley & Sons, Inc. 8vo.; 500 pp.; illustrated. Price, $3 net.

The demand for this standard work has made necessary a fourth edition, and the authors have availed themselves of the opportunity to revise the text thoroughly and to include the results of recent investigations of machine elements. "It is comparatively easy," said Prof. John E. Sweet, "to design a good new machine, but it is very hard to design a machine that will be good when it is old." To accomplish the latter calls for experience, imagination and foresight in the designer, and while no book may take the place of actual practice, the present work supplies in no small degree the necessary mental equipment and develops whatever natural aptitude the student may have to start with.

GAS ENGINE TROUBLES AND INSTALLATION. By J. B. Rathbun, B.S.C.E. Chicago: Charles C. Thompson Co., 1916. 8vo.; 440 pp.; illustrated. Price, $1.

Mr. Rathbun has provided a meritorious work of reference for all owners and operators of gas engines, which tells them in unmistakable language how to install, operate, make speedy repairs, and keep their engine running efficiently and economically. The construction

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INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.
MUNN & CO., *Inc.*

Inquiry No. 9432. Wanted the name and address of manufacturers of machines to make 2-color typewriter ribbons.

Inquiry No. 9434. Wanted the name and address of a manufacturer of special pins, 1/16 of an inch in diameter and ¾ of an inch long, the pins to be made of bone.

Inquiry No. 9435. Wanted the name and address of a manufacturer who can furnish grinding machines for the hollow grinding and finishing of razors. Up-to-date machines wanted.

Inquiry No. 9436. Wanted the name and address of a manufacturer of rat traps having a receptacle attached into which the rat drops and drowns.

Inquiry No. 9437. Wanted the name and address of a concern that can make an oil or grease gun. West preferred. Must be able to make in quantities of 10,000.

Inquiry No. 9438. Wanted the name and address of a manufacturer of light aluminum sheets, small tubing, rods and wire, also aluminum solder.

Inquiry No. 9439. Wanted the name and address of a manufacturer of a knitting machine which was on the market some years ago. The name of the machine was the Bickford Machine. It was a hand knitting machine, weighing about 15 pounds.

Inquiry No. 9440. Wanted the name and address of a concern selling Dr. Young's E-Z Sanitary Belt.

Inquiry No. 9442. Wanted the name and address of a manufacturer of a machine for cutting skeins of cotton and wrapping each bundle around the middle with wire. A machine of some such kind is used in the brush trade for wiring and cutting to length the bundles of bristles for paint brushes.

Inquiry No. 9443. Wanted the name and address of manufacturers of fuel oil burners and fire wall equipment, suitable for a maximum quantity of water evaporation in a locomotive firebox of the following dimensions: 2½' between door and flue sheet, 3' between grate level and crown sheet, 3' between side walls.

Inquiry No. 9444. Wanted the name and address of a manufacturer or patentee of a glass preserving jar made for use with air pumps for creating a vacuum.

Inquiry No. 9445. Wanted the name and address of a manufacturer who can make a combination pencil holder and point protector.

Inquiry No. 9446. Wanted the name and address of a manufacturer who can supply machinery for automatically wrapping cigars in thin imported tissue paper having the ends tightly wound and curled. Would consider purchase of machines or patent rights.

Inquiry No. 9447. Wanted to buy patented article which is needed in every home, with a possible view to manufacturing and distributing.

Inquiry No. 9448. Wanted to get in touch with manufacturers who can make small gasoline motors and parts thereof. Must be able to handle considerable orders with expedition.

Inquiry No. 9449. Wanted the name and address of a manufacturer who is prepared to build a new and very simple stationary engine with or without gas producer.

Inquiry No. 9450. Wanted the name and address of a manufacturer who can build a light simple motor for light automobiles and for portable farm work.

Inquiry No. 9451. Wanted the name and address of a manufacturer of machinery for making egg albumen.

Inquiry No. 9452. Wanted the name and address of a manufacturer making machinery for the production of Tannic Acid from the Mangrove plant.

Inquiry No. 9453. Wanted the name and address of a maker of a machine for washing and drying bristles; also machine for cutting, combing and assorting bristles.

Inquiry No. 9454. Wanted the name and address of a manufacturer of a machine for sewing the mouths of bags which will make a lug at each end in addition to sewing the mouth.

Inquiry No. 9455. Wanted the name and address of a manufacturer of equipment for making enamel cloth, rubber, and drill cloth

Inquiry No. 9456. Wanted the name and address of manufacturers of machinery for concentrating Thoria Nitrate from Monazite sand.

and adjustment of ignition systems and carbureters are given special attention, and all accompanying illustrations are of strictly modern engines and their accessories. A trouble chart serves to summarize much of the instruction in an easily accessible way, and this element of time economy is carried through the whole systematic arrangement of the reading matter.

THE TESTING OF MACHINE TOOLS. By George W. Burley, Wh. Ex., A.M.I.-Mech.E. London, England: Scott, Greenwood & Son, 1915. 12mo.; 240 pp.; 110 illustrations. Price, $1.50 net.

This is a book for engineers and students, in which testing for accuracy is emphasized as a subject of timely importance. There is a good discussion of methods and instruments, and the consideration of published results of tests is not slighted. Those having charge of classes in machine-tool testing will find the text an able and useful one.

THE BRITISH COAL TRADE. By H. Stanley Jevons, M.A., B.Sc., F.S.S., F.G.S. New York: E. P. Dutton & Company, 1915. 8vo.; 876 pp.; with maps and illustrations. Price, $2.25 net.

The most important industry of Great Britain is well worthy of study, and it would be hard to find a man better equipped for expounding the economic problems it involves than Prof. Jevons. His volume carries a large geological map of the British Isles and deals at length, though in popular style, with the industry and the trade, particularly in their economic and social aspects. His facts are for the most part first-hand; many of them will be new to the general public. He gives a clear account of mining methods, the market and by-products, mining law and the wage act, and the miners' life and their housing. He discusses foreign trade and the coal question in general. There are plans of mines, a graph showing freight variations, and a series of appendices dealing with important points of the subject.

A TREATISE ON HAND LETTERING. For Engineers, Architects, Surveyors and Students of Mechanical Drawing. By Wilfred J. Lineham. New York: E. P. Dutton & Company, 1915. 4to.; 282 pp.; illustrated. Price, $3.50 net.

Unquestionable merit distinguishes Mr. Lineham's treatise from the cheap handbooks on lettering that are so often seen. Its format is ample and dignified, setting off to the utmost advantage both letter-press and alphabets, and the quality of paper employed contributes in no small measure to the general appearance of the work. A dozen of the most commonly used alphabets are given and great attention is paid to the balancing of words about a vertical centre line. Various architectural styles are shown, and there is an architect's drawing, half-size, which gives all necessary lettering. Other inserts deal with surveyor's and machine designer's drawings. The instruction is sensible, full and clear, and the work is irreproachable in taste and in its conformity to the best canons of the art of lettering.

SHIP FORM, RESISTANCE AND SCREW PROPULSION. By G. S. Baker, Inst.N.A. New York: D. Van Nostrand Company, 1915. 8vo.; 247 pp.; illustrated. Price, $4.50 net.

Naval architects will appreciate the difficulties involved in dealing with so complicated, and in some aspects contradictory, a subject as ship form, resistance, and power results. As superintendent of the William Froude National Experiment Tank, the author has had the benefit of first-hand investigation leading to important results. He utilizes his powers and his experience to the full and, despite the difficulty of his subject, succeeds in intelligibly conveying accurate and valuable information. His book, largely based upon the work of experiment tanks, seeks rather to guide the designer as to what should be tested in this way—not to help him to dispense with such tests. The subject-matter naturally lends itself to treatment under two heads; the first division being given over to form and resistance, with discussions of stream line, skin friction, waves and wave-making, while the second division deals with the screw propeller in theory and practice. Naval architects, engineers and draftsmen will find their needs especially catered to, and the book will also prove its value to the student equipped with some elementary knowledge of the subject.

THE LETTER-WRITER'S HANDBOOK. By John Rexburn. Chicago: Browne & Howell Company, 1914. 12mo.; 230 pp. Price, 50 cents net.

WHAT AN ADVERTISER SHOULD KNOW. By Henry C. Taylor. Chicago: Browne & Howell Company, 1914. 12mo.; 95 pp. Price, 50 cents net.

WHAT A SALESMAN SHOULD KNOW. By Henry C. Taylor. Chicago: Browne & Howell Company, 1913. 12mo.; 86 pp. Price, 50 cents net.

"The Letter-Writer's Handbook" is a concise manual for the guidance of all letter writers, and covers both personal and business correspondence. The few specimen forms given are well selected, and all points are thoroughly discussed with a view to making of the reader a finished and efficient correspondent. Mr. Taylor's little works are well-known; his experience has been wide, and he has a knack of conveying salient truths in a readable manner. "What a Salesman Should

Know" is of course addressed particularly to the aspirant, although the older hand may find his time well employed in scanning the treatise. The hints on economical travel are money savers, and the suggestions as to approaching the buyer may serve to lay the groundwork of success. In "What An Advertiser Should Know" the small and the large advertiser alike will find a wealth of basic instruction and sound advice. They will find themselves guided toward a wise selection of mediums and a wide choice of advertising plans.

PRINGLE'S IDEAL SHORTHAND. By Harry Polk Pringle. Chicago: Pringle Publishing Company, 1915. 8vo.; 180 pp. Price, $2.

The "Ideal" shorthand is a light-line, non-position system developed by the author in the course of many years of experience. Indirectly based upon Malone's script method, it should present few difficulties to users of the Gregg and other systems which hark back to Malone for their fundamentals. The "invitation of accent" is made a concomitant of the work, and "reinforced vowel forms"—that is vowels followed in the same syllable by L or R—are responsible for much of the simplicity and wide adaptability of the new system.

NAVAL HANDBOOK FOR NATIONAL DEFENSE AND FOR THE EUROPEAN WAR. By Commander T. D. Parker, U. S. N. 80 pages, half tones and line cuts. Price, $1. net.

Commander Parker in this excellent little handbook answers the hundred and one questions which arise in the mind of the average layman, as he tries to follow intelligently the progress of the great war—the man who would like to know how far a big gun can shoot—what is a battle-cruiser—whether an aeroplane can sink a battleship—what are the means by which the British stopped the submarine war against merchant shipping. These and similar questions can be answered if the layman has time to ferret out the information from technical magazines or encyclopedias. But life is too short; he wants the answer at once; and Commander Parker has gathered together within the 80 pages of his handbook just the kind of information which so many people are seeking to-day. The chapters cover the following subjects: types of warships, the dreadnought, the cruiser, the submarine, guns and ammunition, torpedoes and mines, some points in international law, ships of the air, strength of our own and foreign navies.

EXAMPLES IN ALTERNATING CURRENTS. Vol. 1. By F. E. Austin. Published by the Author, 1915. 223 pp. Price, $2.40; in flexible leather.

Professor Austin is the head of the Department of Electrical Engineering in Dartmouth College, and several of his books have already been noticed in this column. This work takes up the solution of problems within its range and guides the student in their solution. The calculus is freely introduced, since the grade of the book is that of a college text book. Both discussion and illustration are employed to illuminate the problem at hand. It seems to be sufficient for the field it attempts to cover.

A TREATISE ON THE PIANO AND PLAYER PIANO. By Harrison Louis Van Atta. Published by the Author at Dayton, Ohio. 8vo.; 156 pp.; illustrated. Price, $1.50.

A piano is a collection of material from all parts of the world. America may furnish iron for the strings, etc., and the various woods used; but the wool for hammers and felts is likely to come from Australia or Africa, while Asia and Africa must supply the ivory and ebony of the keyboard. This treatise not only furnishes piano lovers and owners with an intimate knowledge of their instrument's construction; it also imparts information on the proper care and repair of the piano, including the tuning.

THE THINKING UNIVERSE. Reason as Applied to the Manifestations of the Infinite. By Edmund E. Sheppard. Los Angeles, Cal.: The Authors' Company, 1915. 12mo.; 347 pp. Price, $2.

"Finding the Infinite," like "finding God," means divers things to divers people. It is unfortunate that Mr. Sheppard makes the former claim in his dedication. The reader who allows this to deter him from reading the work will miss many a feast of reason. The author's message is something far better and more practical. He shows that right thinking—that is, sound reasoning—must not only characterize the philosophy of the happy man, but is absolutely essential both to material and spiritual progress. The work opens for us fresh vistas, imparts new vigor to the understanding, and teaches us to use the fine comprehension of our better and more rational moments to guide us through the difficulties of our darker hours.

SKUNK CULTURE FOR PROFIT. By F. M. Holbrook. Chicago: Skunk Development Bureau. 8vo.; 120 pp.; illustrated. Price, flexible binding, $1; cloth, $1.25.

The author's long personal experience and his original investigations combine to make this a handbook of exceptional merit and helpfulness. The breeding, handling and raising of our profitable little friend, the "sachet kitten," calls, as Mr. Holbrook says, for the three requisities of land, love, and labor; the land need not be extensive, and the man who loves animals and does not begrudge them a little attention need fear no insuperable difficulties. Aside from the steady business of killing for fur, he may sell foundation stock and new blood to the fur-farmer; there are many pet stock fanciers, too, all of whom may be prospective customers; to say nothing of the zoological gardens. The author has a happy way of imparting his own knowledge; his pages bubble over with laughable and instructive experiences such as only the veteran fur-farmer could recall. Every phase of the business, from the lay-out and stocking of the farm to disarming, feeding, judging and marketing, is carefully explained in the text, while the lessons are clinched and the enjoyment of the study increased by the wealth of illustration.

ELECTRICITY. By W. H. McCormick. New York: Frederick A. Stokes Company. 8vo.; 296 pp.; illustrated. Price, $1.50.

A fascinating subject loses none of its appeal by being as well presented as it is in Mr. McCormick's contribution to the "Romance of Reality" series. After a chapter on the birth of the science of electricity, and others on its elementary aspects and such basic devices as the induction coil, the dynamo and the motor, the reader is conducted through an electric power station, and its equipment is entertainingly explained. Subjects further dealt with are electricity in locomotion, electric lighting and heating, the telegraph and telephone in all their modern developments with, of course, ample space devoted to wireless, and the Röntgen rays. Even electro-culture is broached. Our English author here cites an American test upon sheep, in which the electrified animals produced twice as many lambs and a much greater weight of wool than did their unelectrified sisters.

TECNICA DELLA NAVIGAZIONE INTERNA. Canali Navigabili. Ing. Annibale Pallucchini. Milano: Ulrico Hoepli, 1915. 8vo.; 431 pp.; con 344 incisioni. L. 10.

In this monograph, canal construction and operation are very thoroughly set forth. There are descriptions and drawings of the boats commonly used, and some consideration is given to the resistance which the various types encounter as they are drawn through the water. The canal bed, locks, dams, the tow-path, elevators, and general maintenance are a few of the heads under which the subject is developed. The treatment is broad, and the illustrations are by no means confined to the works of Italian engineers.

THOMAS' REGISTER OF AMERICAN MANUFACTURERS. And First Hands in All Lines. New York: Thomas Publishing Company, 1915. 4to; 3,100 pp. Price, $15.

"Monumental" is a much-abused word; yet it seems fittingly used in connection with this mammoth testimonial to American progress in industry. The volume itself is a wonderful achievement of organization, of diligent effort, and of close accuracy; it is, in its final embodiment, a monument to our national vitality and our conquest of the world of invention and manufacture. The work has the distinction of being the largest classified reference book in the world, and it comprises a finding list and index; a list of manufacturers classified according to business, with rating; the manufacturers of the United States, arranged alphabetically by names, giving home offices, branches, officers, sales managers, and purchasing agents; leading trade names and brands; and an appendix dealing with architects, machinists and founders, banks, boards of trade and other commercial bodies, and leading trade papers. In short, these combined directories put into the hands of buyer and seller the addresses of practically all the "first hands" in all lines, together with just such concise information as to organization and standing as the purchaser or the seller must know before he can carry on his business in the most efficient and economical manner. The copies furnished American consulates in foreign cities are greatly in demand and, in view of the war and the consequent closure of many European sources of supply, this service must result in the stimulation of American trade with foreign countries.

A HISTORY OF ECONOMIC DOCTRINES. From the Time of the Physiocrats to the Present Day. By Charles Gide and Charles Rist. Authorized Translation, Under the Direction of the Late Professor William Smart, by R. Richards, B.A. New York: D. C. Heath & Co. 8vo.; 695 pp. Price, $3.

Prof. Gide's "Principles of Political Economy" has been widely read in several languages. In "A History of Economic Doctrines" he has collaborated with Charles Rist in an attempt to place modern theories in their true perspective by relating them to their historical forerunners. While much space has naturally been devoted to French thought, the authors have not failed to convey an adequate understanding of English theory, and have done almost equally well by Germany. When we consider the difficulty of compressing such a history as this into one manageable volume, our admiration is aroused at the measure of success which has been achieved. The work is addressed particularly to the student, and it brings home to him such facts as the antiquation of the Marxian doctrine, the recrudescence of Ricardian economics as Fabian Socialism, and the appearance of Violent Liberalism in the guise of Anarchism.