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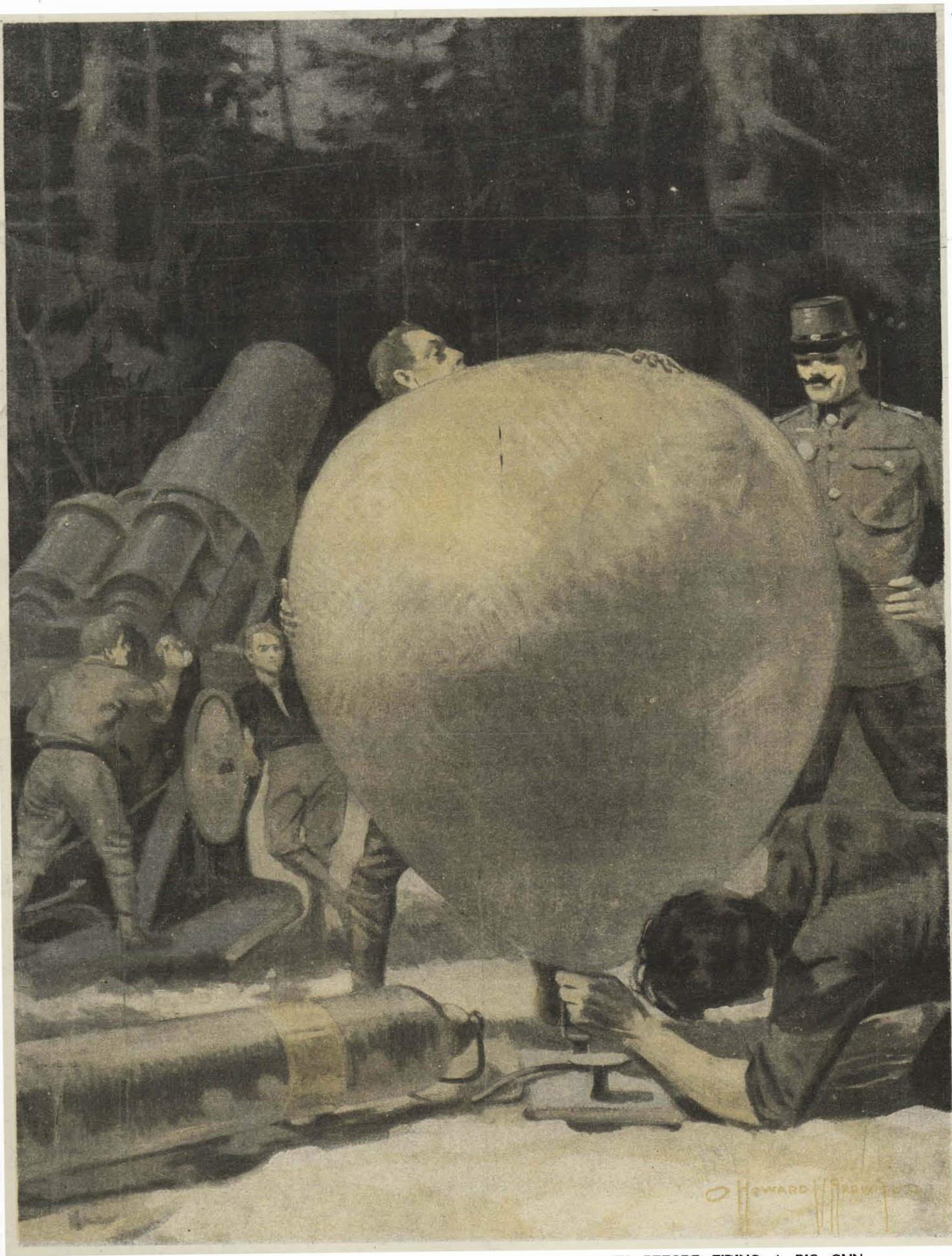

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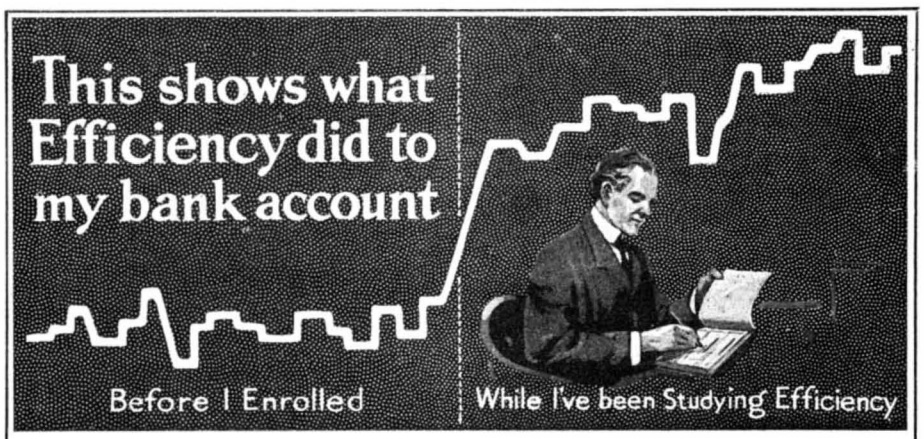

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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NUMBER 13

NEW YORK, SEPTEMBER 23, 1916

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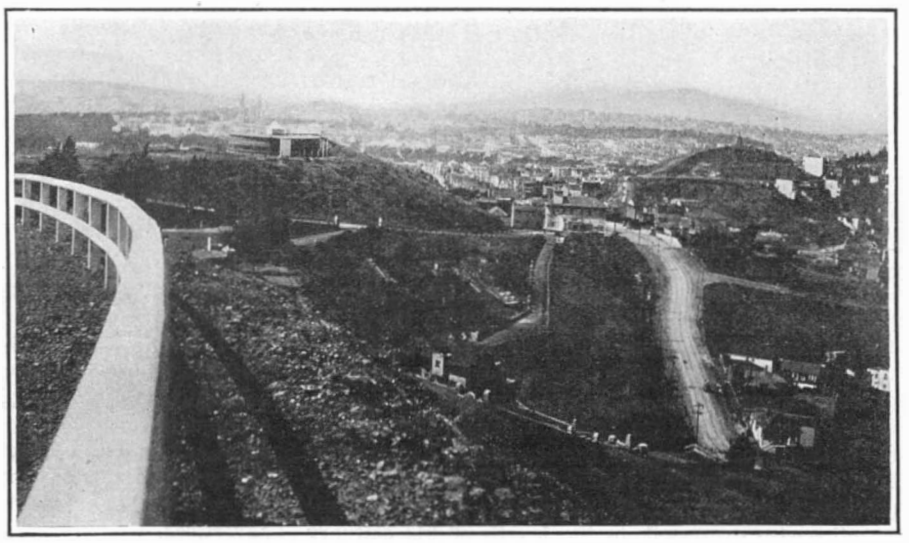
A piece of the auto road up Twin Peaks



A bend in the road showing view over the city

Converting a Municipal Liability into an Asset

By Monroe Woolley

ONE of the significant features of the twentieth century civilization is its command over the earth's topography. In former times, if a community did not take kindly to the acclivities and declivities surrounding it, if it found a watercourse or a swamp or a mountain in its way, it had just two alternatives; it could move the town bodily to some other location, or it could put up with the inconvenience.

Modern cities are in no such subjugation to the whims of nature. Hills are levelled or tunnelled, swamps are filled in, rivers are diverted, good roads are built to hitherto inaccessible places, and in general the physical aspects of nature are forced to conform to the wishes of man. An excellent illustration of all this is found to-day in San Francisco. Cramped on a narrow peninsula, the city has been seriously inconvenienced by Twin Peaks, a great double mountain 600 feet high, which has cut off convenient travel between the city and the regions directly south of it, and forced residential expansion to take an eastward turn to the towns and villages across the bay on the mainland.

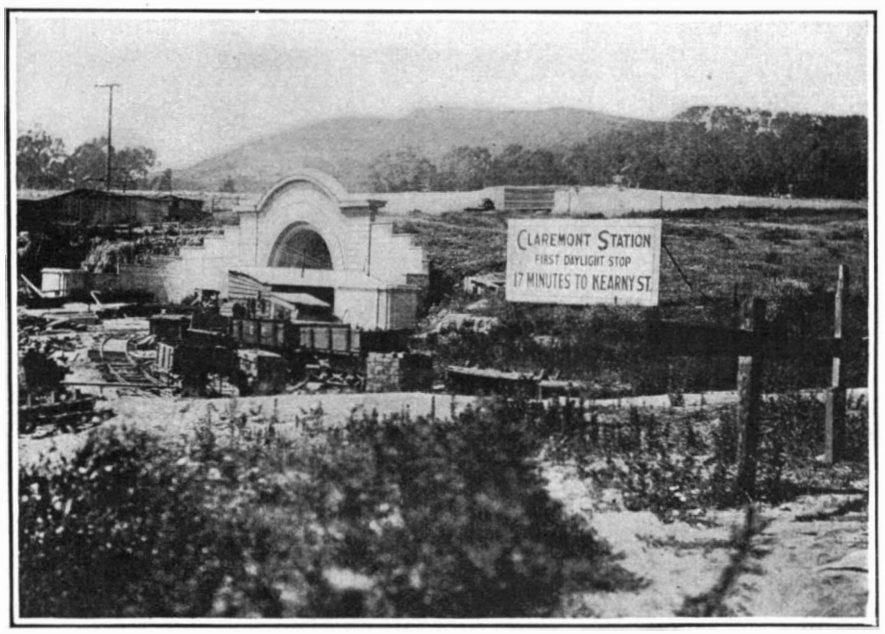
This state of affairs is being remedied by the driving of a tunnel 12,000 feet long right through the heart of the mountain. The Twin Peaks Tunnel will open up hundreds of acres of home sites which are now inaccessible to city workers. Through electric trains will be operated, and where it once took the better part of a day to reach the new residence districts by a tedious process of climbing over the mountain or circumnavigating it, the running time between the "first daylight stop" and the heart of the city will now be only 17 minutes.

But San Francisco is not stopping here. She is not content with demonstrating that if a mountain is too big to be moved away bodily with profit, it is never too big to have a hole shot through it. She is not going to stop with abolishing Twin Peaks as a nuisance; she is going ahead to make an ornament out of them.

From the summit of Twin Peaks there is a magnificent view of city and harbor and ocean stretching out below. But heretofore the only way in which one could negotiate San Francisco's miniature Matterhorn was afoot or behind a plodding horse. Either means of reaching the summit required all day. But even in what we might now term mediaeval times it paid to trudge up Twin Peaks and scramble down again.

All this is now changed. The city has constructed a modern concrete boulevard leading from the busy paved streets right up to the summit, winding around the miniature mountains in broad sweeping curves, with such low grades that the motorist can get to the top without resorting to low speed gear or to switchback tactics.

Much circling must be done to reach the summit. In places the roadway is cut through solid rock, in others thousands of cubic yards of earth had to be removed to get down to the roadbed. But the material excavated was all used in filling for crossing gulches and gulleys. The road in places follows well defined precipices, and these dangerous spots are protected by heavy wooden barriers skirting the outer edges of the way. Gutters have been laid along the inner side for the entire distance, so that drainage is excellent and the water can never undermine the cement surface of the road.



South portal of the Twin Peaks Tunnel

With a tunnel cut through it from end to end, and a road of this character built to its summit, it may certainly be said that this mountain has been thoroughly remodelled to serve the ends of the residents of San Francisco.

Remarkable Increase in the Manufacture of Electrochemical Products

ELECTROCHEMICAL and electrometallurgical products enter into almost every phase of our industrial life and their manufacture has been increasing by leaps and bounds. The chief products made by the aid of electric current are aluminum, phosphorous, silicon, sodium, graphite, chlorine, oxygen, hydrogen, ferro-alloys, copper, titanium, vanadium and other alloys, calcium carbide, carborundum and other abrasives, caustic soda, caustic potash, sodium peroxide, chloride of lime or bleaching powder, carbon bisulphide, and muriatic acid.

According to a report issued by the United States Bureau of Census, the value of electrochemical products has increased from $18,450,000 in 1909 to $29,600,000 in 1914, an increase of over $11,000,000. This does not include iron and steel made in the electric furnace, which also falls under this class. The extent to which we are dependent on electrochemical products is little realized. The manufacture of these products has been steadily increasing, but today the supply is far short of the demand, due in many instances to the inability to obtain permission from the Government to use more power at Niagara Falls, the great electrochemical center. Of 36 establishments reporting in 1914 manufacturing electrochemical products, 18 were located in New York, 4 in Michigan, 3 in California, 2 each in Pennsylvania and West Virginia, and several other states having each one. Most of the plants in New York State are at or near Niagara Falls.

The 30th semi-annual convention of the American Electrochemical Society, whose membership includes the very foremost electrochemists of the world, will be held at New York, September 27th to 30th, 1916, at the time of the Exposition of Chemical Industries.

Manganese Mining in Panama

TO those engaged in the study or use of minerals, it will be interesting to know that mines, rich in manganese ore, have been located on the Atlantic Coast of Panama, north of Colon toward Colombia. Traces of manganese are to be found in most rocks, but to be commercially valuable there should be at least 40 per cent of metallic manganese and the ore must be low in percentages of phosphorus and silica. The mines in question are producing 60 per cent manganese ore and the steel companies offer a ready market for all that is shipped. The ore is chiefly used in the form of alloys, those with iron being most important.

The mines recently visited are at an elevation of from 300 to 500 feet, the hill tops being covered with clean black ore, in appearance like a bed of hard coal. The miners ply the ore loose with drills, when it is loaded into small "Decaville" cars and shot down a steep grade to the wharf. Here it is sorted, weighed and packed in burlap bags for shipping. The harbor at this point is excellent, permitting a steamer of considerable size to come directly to the dock—a marked contrast to the shallow open roadstead of most Latin-American ports.

SCIENTIFIC AMERICAN

Founded 1845

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

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

Posthumous Laurels

EUROPE'S mad carnage has cut short an appalling number of brilliant careers—many of them still in the embryonic stage—and the scientific world has borne its full share of such losses. Scientific men of mature laurels are, for the most part, beyond the age of eligibility for service on the firing-line. Hence those who have already completed a great part of their work for humanity have been spared, at the expense of those whose beneficent work lay before them. Thus we arrive at the paradox that the ultimate loss which the world sustains in the death of a *savant* in warfare is likely to be in inverse proportion to the amount of interest the event arouses; or, otherwise expressed, to the length of his obituary notice.

Recently, however, we have been struck by numerous attempts to correct the anomaly in the distribution of honors to which this situation gives rise, and to insure that at least some of the young men of promise who have gone from their laboratories and their universities to share the fate of their uneducated or ungifted brothers-in-arms shall not "die without their fame." Current numbers of *Nature*, the great English scientific weekly, contain many tributes to fallen men of science whose actual scientific achievements were scarcely noteworthy, but who, before an untimely death intervened, were believed by their friends and colleagues to be marked out for distinguished careers. Some of these were mere striplings, not yet graduated from the universities.

A similar desire to make death's victory less complete has impelled the French Academy of Sciences to bestow a large number of its recent prizes, posthumously, upon young patriots who, had they lived, might have had to wait some years for such honors; though in all these cases the men to whom the prizes were awarded had given at least a substantial earnest of their prospective work in the shape of tangible contributions to science.

It is a pious sentiment that inspires this rendering of honors for deeds that have not been, and never will be, done. The same sentiment, beyond the mere sense of personal loss, doubtless moved Milton to immortalize the brilliant Edward King—"dead ere his prime"—in that most exquisite English imitation of a Latin imitation of a Greek pastoral, "Lycidas." It is no longer the fashion to write such elegies, but it is fitting that, in our unmelodious modern way, we pay kindred tribute to those whom death, alone, has prevented from enriching the world.

Price Maintenance

WE are in receipt of an open letter prepared by Mr. Eldredge Reeves Johnson, in which he discusses the proposed legislation aimed to permit manufacturers to control the price at which their goods may be sold at retail, and to prevent price cutting.

Mr. Johnson expresses the opinion that the name "Price Maintenance" is bad, and that it "has done the cause of 'Fair Trading' a little more harm, to date, than the total of all effort has accomplished in the matter of educating the public to the fact that the standardization of prices in any one line of articles bearing the same maker's name, is a sound, honest, worthy business policy and not an insidious method of raising and maintaining prices unduly high," and he suggests that "The Standardization of Fair Prices" would be a much better title.

It seems to us to matter little what name this effort to prevent ruinous cutting of prices shall be known by; for if the purchasing public can be made to look at the matter thoughtfully and to forget for the moment the apparent saving to them by the unfair tactics of the price cutter who lures them into his store by offering a standard and advertised article at cost or less on the chance of selling them other and unknown merchandise for more than it is worth, they will see that it is but fair that the manufacturer of such standard goods, who makes and creates the demand therefor through large expenditures for national advertising, shall have the right to say that his merchandise shall not be sold for less than a fixed price by all retailers—a price which will insure a fair profit to the retailer. It seems to us eminently fair and just that such a manufacturer who creates the demand for his merchandise and sends the purchasing public to the retail stores asking for that merchandise, should have the legal right to see that the price cutter shall not exclusively benefit thereby.

The opponents of this legislation advance the argument that this is an effort on the part of heavy advertisers to get back the cost of their advertising by fixing the price at more than the article is worth; but in making such an argument they lose sight of the fact that by such advertising the manufacturer creates a large demand and a resulting increase of production, and it should be apparent to everyone that increase of production is a material element in the reduction of price, as witness the material reduction in the price of a well-known and popular automobile which, during the coming year, is to be sold for fifty dollars less than it brought last year.

It must be further borne in mind that the cost of advertising is in the nature of a permanent investment in goodwill, the effect of which is expected to show in the future, so that while such expenditures are relatively large, they are always carefully determined with relation to the anticipated increase in demand and the consequent increase in production, and as a result, instead of having the effect of increasing the retail price, the usual effect is to enable the manufacturer to reduce materially the price of articles that are extensively advertised.

The price cutter may not care whether he makes a profit on a particular article or not, for he makes a large profit on other articles which he may sell to the person who goes to him for the advertised article; but he gets most of the trade on that article, with the result that other retailers who have stocked up on this nationally advertised standard article, and who must make a fair profit on all of the merchandise they sell, may find these goods a fixture on their shelves. Naturally they will not re-order, and thus the price cutter in time will become the only retailer of such standard advertised goods, and may continue to sell them or not just as he sees fit. Thus he can utterly kill the demand for such goods and destroy all the costly efforts that the manufacturer has made to create a market for them.

We heartily indorse every effort to secure to the manufacturer of standard goods and who spends his own money to build up the demand therefor the legal right to protect himself from the price cutter; but we recommend caution and care in the drafting of proposed legislation, in order that it shall not go too far and so that it shall not be construed as an effort to suppress competition in the retailing of merchandise generally; for it is true to-day, as always, that "competition is the life of trade."

If the proposed law shall be restricted to apply to the resale of standard merchandise for which the manufacturer and not the retailer has created the demand, we believe it will be favorably entertained by Congress and indorsed by all fair-thinking persons.

It will be difficult in our judgment to draft such a law that shall not transgress the provisions of the Constitution, but no doubt it can be done, and we believe that it should be done.

Some of the Fruits of Necessity

GERMANY'S present isolation is likely to benefit the wide world when peace is declared, by reason of industrial and technical achievements inspired by necessity. The Teutons have left no stone unturned to make well-nigh everything of service, and in this way they are disclosing possible uses for waste products and applications of a variety of raw materials that heretofore have been generally neglected.

As is well-known, the Germans have made tremendous strides in the fixation of atmospheric nitrogen, and in the production of nitric acid and ammonia they have relied principally upon the cyanide process in which calcium carbide is the basic material. Calcium carbide has likewise found a widespread field of service as an illuminant in the household and elsewhere in place of kerosene. Oil lamps have been converted into acetylene lamps by a cheap and simple burner. In consequence of this tremendous increase in the employment of calcium carbide, the technical experts have striven to find some profitable ways to utilize the residual carbide sludge which was commonly thrown away. This sludge is a slimy stuff left in the water after the acetylene gas has been released from the carbide. Chemists have experimented, and have found that when this sludge is mixed with 40 per cent of building sand it makes an excellent mortar. It hardens quickly and effectually binds stonework.

In the distillation of tar there remains a by-product in the form of a hard pitch which has commonly lent itself to but very few uses. Since the beginning of the war, the Germans have discovered that this stuff makes an excellent fuel for industrial purposes. To utilize it, the pitch is pulverized, and because of its friable nature but little power is required for this purpose. Indeed, much less energy is needed than would be the case in powdering coal. This fuel is fed into the furnace by means of compressed air, and owing to its lightness a moderate pressure suffices for the work. The heating power of this pitch dust is a good deal higher than that of coal, and, in fact, is more nearly like that of crude oil. As the stuff burns without producing slag or ashes, it is a labor saver, and therefore distinctly economical.

This tar by-product has lately been found by the Teutons to be available for domestic use in combination with coke waste in the form of small pieces or powder. In the past this pulverized or granular coke waste has been used as a filler in the laying of pavements and as a substitute for sand in mixing concrete. Now, this coke and hard pitch can be combined and pressed into briquettes by means of machinery already existing. The cost of this briquetting is very low, and the fuel so formed is admirably adapted to the requirements of the household. The one essential desideratum is a good draught, and this is generally to be found in all up-to-date buildings. By this means the Germans have made it possible to utilize every particle of the coal consumed in gas plants and other places manufacturing coke, either directly or indirectly. As a means toward conservation of the mine output, this adaptation of waste products is of well-nigh universal interest.

The Cockerill Works at Seraing, Belgium, have had their blast furnaces converted into tar burners owing to the scarcity of coal, since the Germans took possession of them. Tests were first made with a furnace having a capacity of twelve tons. The tar burners were installed in pairs, and the fuel was injected under a pressure of 1½ atmospheres and atomized at the burners by compressed air of 3 atmospheres. In this furnace 2,000 tons of steel, in 215 heats, was handled in less than three months. The tar consumption was at the rate of 292.5 pounds per ton of molten metal, including the fuel required to heat up the furnace and to maintain the blast. Later, a 25-ton furnace was arranged to burn tar. Under peace-time conditions the tar can be utilized to greater advantage in many other ways, but as a war measure its employment is advisable, and even economical, when coal is scarce.

Rope is a daily necessity for power transmission in many forms and for a variety of other purposes. A nation without enough rope at hand is like a small boy with a kite and no string. German cordage has been made in the past mainly from jute imported from the tropics. The war blockade substantially cut off this source of supply The Teutons then turned their attention to finding a vegetable fiber within the Fatherland capable of playing the part of a more or less perfect substitute. This they have now discovered in abundance in a native plant, and with characteristic foresight the Germans are intent upon laying the foundation for a new and valuable industry. They claim for the new fiber qualities quite as desirable as those of jute.

The fabric problem has been a serious one in Germany, since cotton and wool have been either requisitioned for military purposes or the supplies from without substantially stopped. Necessity again drew attention to former experiments having to do with the employment of the fibrous parts of the common nettle or thistle. The technical difficulty lay in separating the fibrous matter from the vegetable matter. To this end muriatic acid was tried, and also a process of desiccation, but the fiber became brittle and quite unfit for fabrication. Since the outbreak of war, however, a German chemist has overcome these difficulties, and has succeeded in weaving materials from nettle fiber that are both thin and strong. Not only that, the cloth is lustrous and soft.

A process has recently been discovered in Germany by which leather scrap can be converted into a very valuable nitrogenous fertilizer, and, at the same time, it is possible to recover from the leather waste 20 per cent of the tannin. Before the extraction of the tannin the scrap leather has comparatively little value as a fertilizer. The waste material is chopped fine, freed of grease, and given an alkaline bath at a temperature of from 50 to 60 deg. Centigrade. In this manner most of the tannin is withdrawn, and by further heating and the addition of a suitable alkali the stuff becomes an excellent plant food, which is readily disintegrated in the soil The tannin solution obtained by the process is evaporated, and in this way the dilute bath is made to yield up 20 per cent of tannin. Inasmuch as tannin is expensive, the Germans find the two-fold process well worth their while.

Aeronautical Notes

Inventions by Swedish Officer.—According to the Swedish *National Tidende*, naval authorities have allowed Lieut. Hasselberg to experiment at the Naval Flying School at Karlskrona with two of his inventions. The first is stated to render possible electric communication—presumably some form of wireless transmission and reception—between an aviator in flight and the earth, while the second is a contrivance to direct the course of torpedoes from aeroplanes.

Proposed Air Line from Berlin to Constantinople.—According to a report from Vienna, plans are on foot for the establishment of an airship line between Berlin, Vienna, Budapest, Sofia and Constantinople. Banks and private financiers are said to be behind the project. The report does not state what use will be made of the line, although it suggests that the countries interested will be asked to assist the airship line to the extent of having it carry mail. Nor does the report state whether Zeppelins or aeroplanes will be employed, although it is more than likely that the former are planned.

Destroying Crops With Fire Bombs.—Rather fictitious sound the reports emanating from Germany to the effect that Allied airmen are dropping fire bombs to destroy Teuton crops. In the formation of a proclamation to farmers, the headquarters of the Seventh Army Corps at Maintz states: "We learn from reliable source that an Anglo-French flying corps is being formed for the purpose of dropping a special kind of fire bomb on our fields as soon as our harvest is ripe and dry weather has prevailed for some time, in order to destroy our crops." Following the same trend, the *Frankischer Kurier* says that the British and French flying men have already attempted to destroy the Bulgarian crops in the same way.

Holland's Aerial Forces.—Surrounded by warring nations, Holland has not been standing still in the matter of aeronautical equipment for her fighting forces. Quite a number of aeroplanes are in use in Holland, the majority of these closely following the lines of the H. Farman, but built by the Spijker Works under the direction of the well-known Dutch aviator, Henry Wijnmalen. Eight of the machines built in Holland were recently piloted in a circuit race from Soesterberg to Gilze, Rijen, Scheveningen, and back to the starting point. It is reported that military machines are constantly engaged in cross-country flights, flying in escadrille formation. Whereas a single machine would have been seen in the air a few months ago in the rural districts, fleets of machines are now common.

U. S. Army Aerial Bombs.—According to an announcement recently made by Colonel George Montgomery, gas bombs, incendiary bombs, aerial bombs and hand grenades are being made and experimented on at the Frankford Arsenal, Philadelphia, for use of the United States army. A new gas bomb containing a combination of sulfur dioxide and several other poisonous gases is now being tried out in a series of experiments. A new aerial bomb which has been developed at the Arsenal utilizes a fuse that depends solely on a clockwork arrangement, instead of atmospheric pressure, as is usually the case. "This is considered advantageous," states Colonel Montgomery, "because when the bomb has been timed for such a height the rarefied atmosphere at high altitudes causes a too rapid burning of the fuse. But with clockwork arrangement the bomb will explode exactly when desired."

Allied Methods of Downing German Observation Balloons are somewhat vaguely described in notes taken from the diary of a British airman and recently published in the *Daily Mail*. In part, these notes read: "In the afternoon we are all excitement to see the 'sausages' strafed, but they are obscured by mist. One after another the Nieuports leave the ground and hustle off to their goals. Each has his complement of rockets on board, ready to be shot forth at the touch of the button. We wait for their return, and are delighted to see a flaming red mass fall to the ground far away. Soon the first machine returns and is surrounded by eagerly questioning groups. His answer is 'Yes,' and we greet it with a cheer. High above we see number two. It is obvious that he has succeeded, for he is throwing loops and doing stunts all over the place. It is very simple. The hostile sausage is seen, and our pilot dives from 8,000 feet. Soon the unwieldy bulk of the machine is on his sights, but it sways from side to side as the winch exerts full power to bring it down. It is of no avail. The moment has arrived, and the pilot presses his button. Simultaneously he does a vertical 'bank' to avoid crashing into the billowy mass in front. Eight fiery rockets leap forward. Six find their billet. A ribbon of flame springs into being along the length of the bag, and it slowly descends. But not for long. The flames spread into one terrific flash, and the blazing remnants crash headlong to earth, 5,000 feet below."

Science

The Internal Structure of Saturn.—Some interesting results have been obtained by Dr. Lowell in calculations based on the positions of the minor divisions in Saturn's rings. These indicate a greater oblateness in the planet than is actually seen to exist. Dr. Lowell therefore suggests that there is a sort of internal oblateness. According to this view the planet consists of different layers, of which the inner rotate faster than the outer; in consequence of which the inner would become more oblate. Dr. Lowell gives a characteristic personal touch to his findings by ingeniously and illuminatingly comparing Saturn to "an onion in partitive motion."

Monochromatic Photographs of Jupiter and Saturn, taken by Prof. R. W. Wood, with the 60-inch reflector of the Mount Wilson Observatory, are described by him in the *Astrophysical Journal*. The ultra-violet filter transmitted the region between wave-lengths 3500 and 2900; the infra-red, the region above 7000; the yellow, all rays above 5000; and the violet from 4000 to 4500. Saturn, by infra-red light, shows only a faint trace of the belts ordinarily seen; while with violet light a very broad, dark equatorial belt is seen, and a dark cap about the pole. Jupiter's dark belts are hardly visible on the infra-red plates, while they are shown in greatest contrast with violet light.

Low-power Eyepieces.—A statement commonly met with in the textbooks is that the lowest power that can be usefully employed on any telescope is one of five to each inch of aperture; e. g., a magnifying power of 15 with a three-inch telescope, etc. With a lower power part of the light gathered by the object-glass is supposed to be wasted. This statement is based on the assumption that the average diameter of the human pupil is one fifth of an inch. Recently it has been pointed out by the English astronomer, Mr. W. H. Steavenson, that while this is about the average diameter of the pupil in daylight, its diameter is quite different under ordinary observing conditions; i. e., in semi-darkness. With the aid of flashlight photographs he has found the aperture of the pupils in darkness to be nearer one third than one fifth of an inch, and the above figures for the minimum power of the eyepiece should be corrected accordingly.

The International Institute of Agriculture offers a shining example of an international scientific and humanitarian agency which has not permitted its activities to be interrupted by the European war. Not one of the 55 governments which support the institute has yet manifested any intention of withdrawing from membership, even temporarily. Until Italy entered the war, the delegates of the various countries resident in Rome held harmonious meetings at the building of the institute in the Villa Borghese. After Italy declared war and the delegates of Germany, Austria, Hungary, Turkey and Bulgaria were obliged to leave the country, the institute opened an office at Brugg, Switzerland, and this now serves as a connecting link between the belligerent countries. The contents of German and other "enemy" publications are still abstracted as usual in the French, English and Italian editions of the monthly bulletins, and the German edition of these bulletins continues to appear. Thus at least one bulwark of civilization in Europe—besides the Red Cross—remains unshaken by the unbelievable events of the past two years.

Observations of Lightning Discharges.—Mr. C. T. R. Wilson, of the Solar Physics Observatory, Cambridge University, has developed special apparatus with the aid of which he measured, during the summer of 1915, the sign and magnitude of the changes produced in the earth's electrical field by the passage of about 100 lightning discharges. In two storms it was found possible to get at the same time measurements of the distances of about 50 of these discharges, by timing the arrival of the sound of the thunder. The changes of field resulting from the discharges, as measured by the apparatus, varied between 15,000 volts per meter and 1 volt per meter. The change produced by a discharge 10 kilometers distant generally exceeded 1,000 volts per meter. Apparently the apparatus can be used to measure the effects of discharges at distances exceeding 100 kilometers (62 miles). In the case of a sufficiently distant discharge it is possible to calculate from Mr. Wilson's data the electric moment of the discharge; *i. e.*, the product of the quantity of electricity discharged and the mean height from which it has been derived. The moment is proportional to the product of the change of field and the cube of the distance of the discharge producing it, if the latter is great enough compared with the height from which the discharge has come. The quantity of electricity passing in a single discharge is found to range between 30 and 300 coulombs. Mr. Wilson has lately added to his apparatus an attachment which makes it possible to secure a convenient automatic registration of the electrical effects in question.

Radio Communications

The United States Naval Station at Chollas Heights, seven miles from San Diego, Cal., has been completed at a cost of $300,000. It is reported that 72,000 feet of phosphor-bronze wire have gone into the aerial system, which is suspended from three 600-foot steel towers. The sending apparatus is rated at 150 kilowatts.

Wireless and Gun Spotting.—Although no facts are available concerning the wireless apparatus used on board British and French aircraft on the western front, it is understood from the reports of correspondents that a great part of the accurate work of the big 15-inch guns mounted on special railroad carriages is due to the spotting of aerial observers, who communicate with the artillerists by radio.

Static and Germany's Transatlantic Wireless.—It appears that the German operators of the Sayville and Tuckerton wireless station are having their own troubles in handling the telegraphic traffic in the face of severe static. Recently the Western Union Telegraph Company announced that static conditions in Berlin had interfered with the reception of American dispatches, and in consequence the service would have to be suspended for awhile to allow the operators to catch up with their work.

A High-Frequency Buzzer for wireless work has recently been developed by an American manufacturer. Operating on but one cell of dry battery, the buzzer is said to emit oscillations that closely approach the pitch or tone of high frequency radio transmitters. The manufacturer claims that the buzzer will operate continuously for hours at a time at constant amplitude without change of period, and that it is easily adjustable over a wide range. By connecting a condenser and inductance across the contact point of the buzzer, a source of oscillations of constant amplitude and constant wavelength is obtained for laboratory and testing purposes.

Amendment to Radio Laws and Regulations.—Paragraph 126, page 64, of The Radio Laws and Regulations of the United States, edition of July 27th, 1914, was amended July 1st, 1916, to read: "The code test shall continue for 5 minutes at a speed of 20 words, 12 words, and 5 words a minute, respectively, for the commercial first, second, and lower grades, 5 letters, numerals, or other characters to the word, and to qualify the applicant must receive 20, 12, or 5 words in consecutive order accurately and legibly written. Operators will not be permitted to break or interrupt while receiving or to correct or alter the transcription after it has been submitted to the examining officer."

Blind French Soldiers for Operators.—It is an established fact that the blind far excel in acuteness of hearing and sensitiveness of touch their fellow men who have unimpaired sight. The French, with their usual foresight, have taken this into consideration in planning occupations for French soldiers after the war, according to the *Wireless Age*. French scientists, after careful investigation, have decided that blind soldiers will make good wireless operators. The qualities most needed by a wireless operator are highly developed faculties of touch and hearing. In most cases people who have been rendered blind not only retain those two faculties intact, but develop them to a remarkable degree of acuteness and sensitiveness.

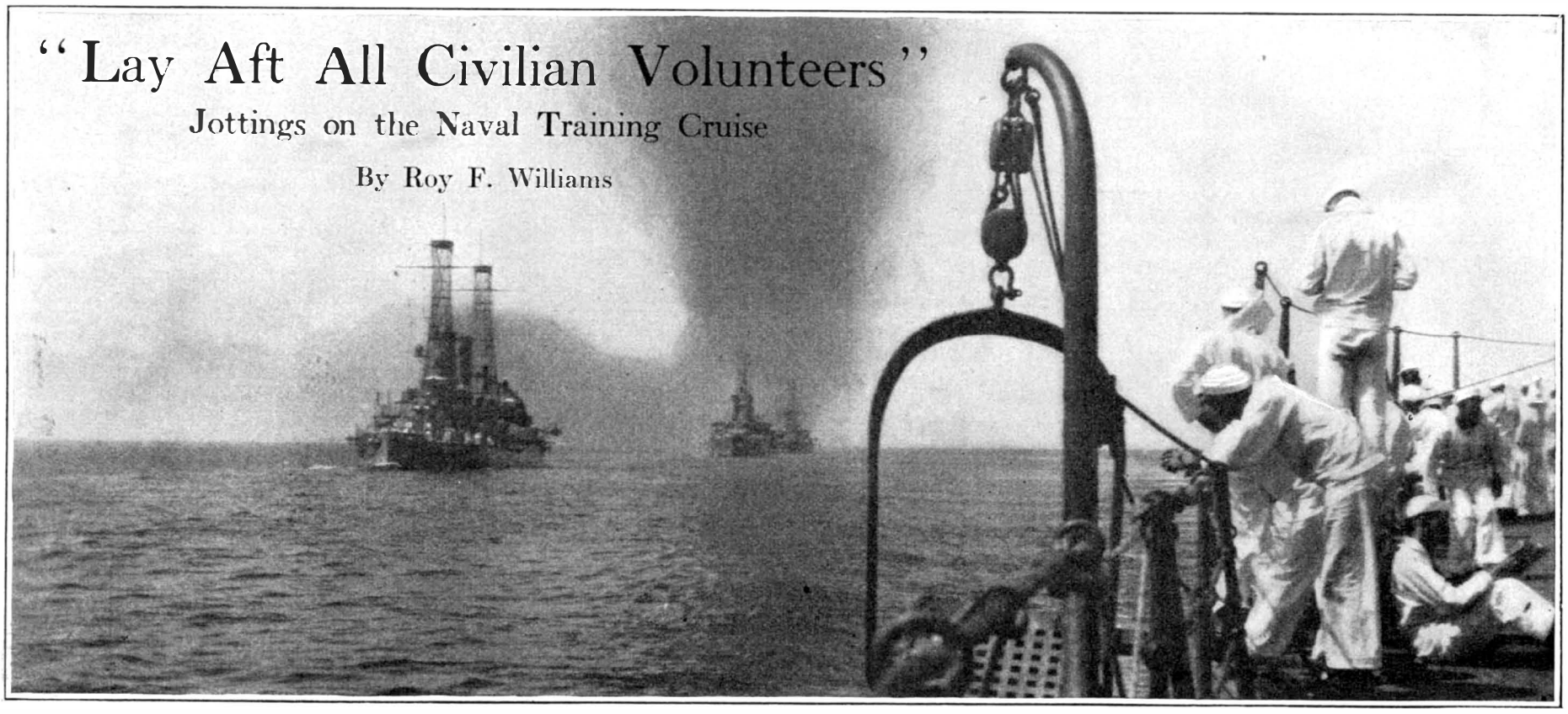
Forest Fires to be Prevented by Wireless.—Philip E. Edelman of St. Paul, Minn., a recognized writer and authority on wireless subjects, has been engaged as electrical engineer to prepare plans for a chain of radio stations to protect the vast Dominion of Canada Parks from forest fires and depradations. The Canadian government has extensive areas in Western Canada where communication is extremely difficult, and will use equipment of a new and special design. This will be the first installation of its kind, and opens up a new field for the application of radio telephony and telegraphy, both of which forms of communication are embraced in the plans of Mr. Edelman. The stations will be used to report fires and poachers as soon as discovered, so that aid can be immediately sent to the vicinity concerned.

Radio Aerials on Zeppelins.—The installation of wireless apparatus on board the German Zeppelins makes use of the metal framework of the airship for the capacity ground, and a trailing wire for the aerial. The latter is normally held on a large reel of light construction, fitted with wire spokes, which give it the appearance of a modified bicycle wheel. The aerial wire is ordinarily lowered after the oscillating circuit of the transmitter has been adjusted to the desired wave length. By watching the deflection of a hot-wire ammeter, the operator can determine when sufficient wire has been paid out to obtain a radiating system of a natural wave length the same as the oscillating circuit, or at least one that gives a high efficiency for the wave length chosen. The best results are secured when the maximum deflection is noted on the hot-wire ammeter.

"Lay Aft All Civilian Volunteers"

Jottings on the Naval Training Cruise

By Roy F. Williams



The United States reserve fleet in line-ahead formation

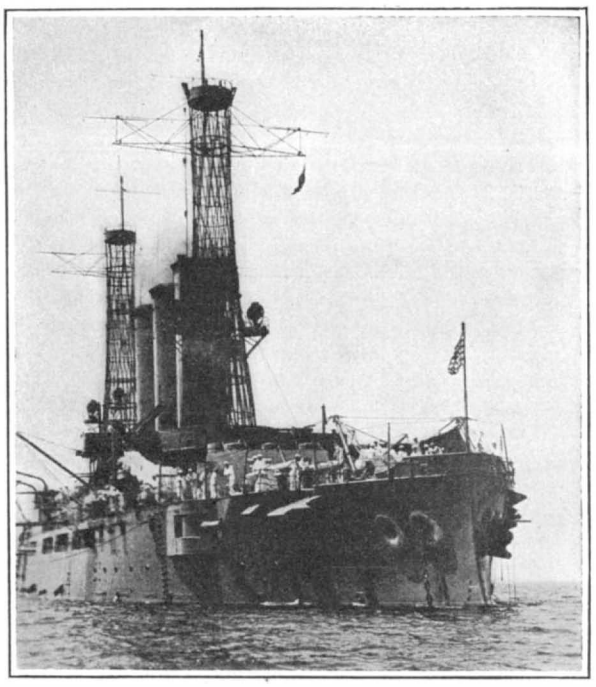
Mr. Williams and Mr. Marshall, the authors of this and the following article, are members of the staff of Munn and Company who volunteered for the Naval Training Cruise. At the editor's request, they have written these accounts of their experiences, to give the readers of the SCIENTIFIC AMERICAN *a first hand idea of the meaning of this individual contribution to national preparedness.*—THE EDITOR.

TO the average sport-loving American a four-weeks' cruise on the Atlantic needs no other inducement than an invitation; there is recommendation enough in the blues of water and sky, the salt air and the unusual clarity, solar by day and stellar by night. But, add to this an invitation to cruise with full freedom on one of our gray battleship monsters, and to participate in interesting war-games, and then you have the ideal solution of the vacation problem.

Such an invitation the United States Navy extended to Civilian Volunteers this year with the express purpose of training them for future emergency. There were 2,500 who volunteered to give their vacations to their country—with a reservation on a highly pleasurable vacation for themselves. On August 15th nine battleships of the Reserve Fleet steamed out of the designated points of disembarkation, Philadelphia, New York, Newport and Boston; and four weeks later these sea-defenders returned with these 2,500 men, all in better health and with ruddier complexions, with yarns of sea life which will fill clubs, offices and college rooms for many days to come. Some returned complaining that the cruise had not transformed their hazy idea of our naval strength—these also complained of the high premium on lounging space on the quarter-decks. However, a large majority brought home concrete results of an interesting education on battle formations, semaphore signals, six-inch guns, Whitehead torpedoes and bayonet drills.

The month's work had been roughly divided into four sections; a week each of deck duty, war maneuvers, target practice and engine-room duties and inspection.

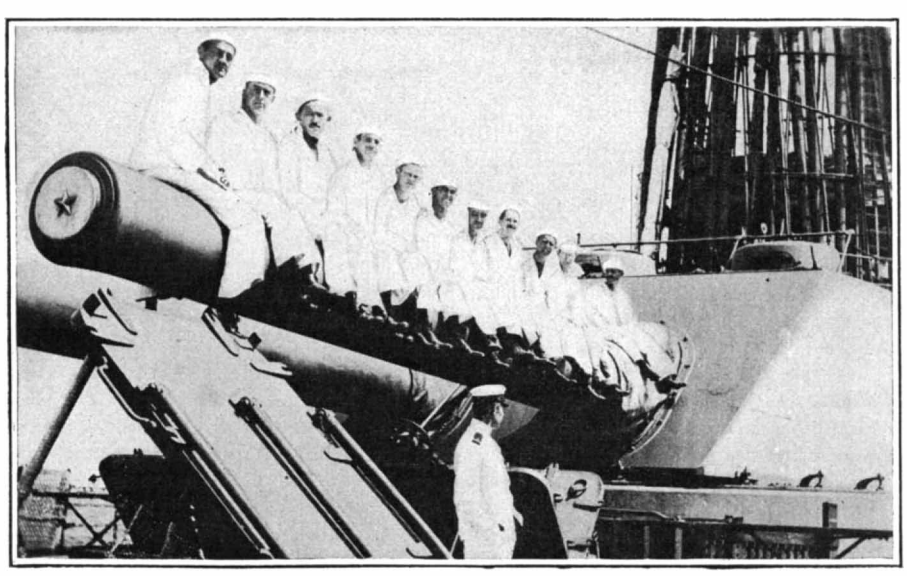
With this vague outline of work to perform, the U. S. S. "Maine," "Kentucky" and "New Jersey" pulled anchor at the Brooklyn Navy Yard with the New York contingent aboard. The crow's nests, packed to capacity houses, passed beneath Brooklyn Bridge near enough to allow enthusiastic farewells between volunteers and bridge pedestrians. That same evening we arrived at Block Island, the novelty of the cruise being augmented by the arrival of five more battleships and the flagship "Rhode Island." Still later the torpedo destroyers, which were to help us against the "enemy," arrived in time to participate in the cruise.



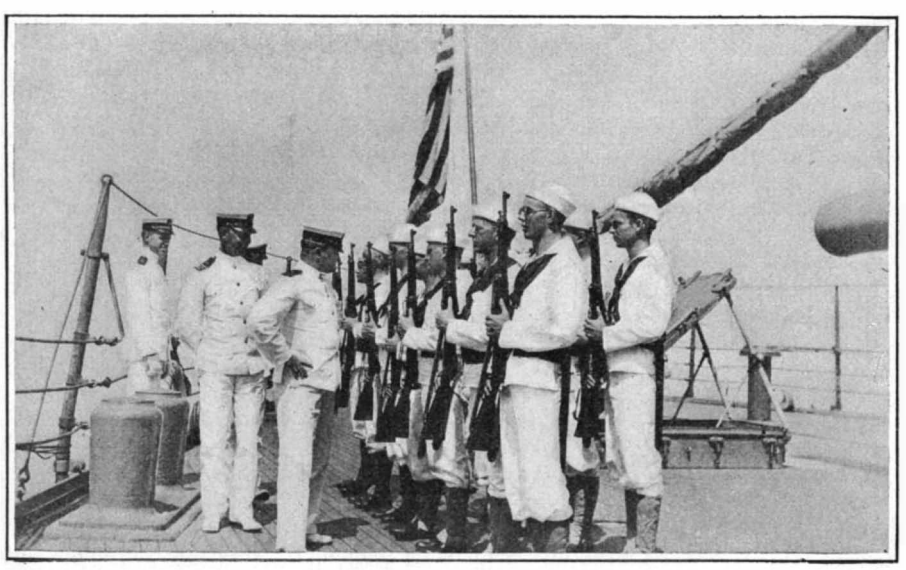
The U. S. battleship "Maine"

That night we were introduced to the Bo's'n and his famous bo's'n pipe. This individual, the circus barker of the Navy, was soon to be an important part of the cruise. At first it was amusing to hear his jargon of "Lay aft all the anchor watch to muster, the speed-cones, break-downs, annunciators, lookouts and life-buoys" and "All hands to man the lifeboat falls lay aft on the quarter-deck," but soon we were made to realize that his amusing jargon was none other than a call to work. Not strange to relate, his most welcome sound was the simple summons to mess—as regular as the clock itself.

Deck duty was mildly disciplinary, highly instructive. Throughout the day and night, two- and four-hour watches were maintained, probably the most interesting of which were those on the bridge with the captain and other officers. The annunciator watch by leverage announced to the engine-room what speed was desired, one third speed fore or full speed reverse. Speedcones, similar in apearance to phonograph horns, were hoisted on starboard and port halyards at varying heights according to the speed. In this way deck officers and other ships in the fleet can determine the speed of the ship. Lifebuoy watch calls for a man of keen eyesight; in case of man overboard it is his one duty to loosen the cords of the lifebuoy which drops automatically to the water. At the same time it becomes illuminated, the buoy lamp being supplied with acetylene gas generated by the contact of sea water with the calcium carbide. This gives the man in the water a definite haven until the lifeboats are lowered. Lookout duty is obviously to keep the officers on the bridge informed of all on-coming lights or ships. On this watch lack of training and ignorance of nautical terms afforded no little amusement. The normal answer to an officer's query of "Where away" would be "three points off the starboard beam, sir" according to the location; whereas a volunteer seaman would content himself with answers "Far away, sir," or "Out there about a mile." Another laugh provoker was the frequent experience of a look-out man using several minutes to chart the nautical location of a distant light and then return with his report, satisfactory enough except for the fact that the light had disappeared in the meantime. Many volunteers displayed eagerness in learning naval communications; on the bridge there were many voluntary



Yale representatives on one of the 12-inch guns



Inspecting the guard of the day

classes in flag signaling and semaphoring; in the radio room several showed real efficiency with the Dit-Dit-Dot of the wireless code; and of course there were divisions on the quarterdeck almost every hour of the day, going through the manual of arms and the bayonet drills. All this fundamental work, together with five lectures aboard the "Rhode Island," comprised the first week as we lay at anchor off Block Island.

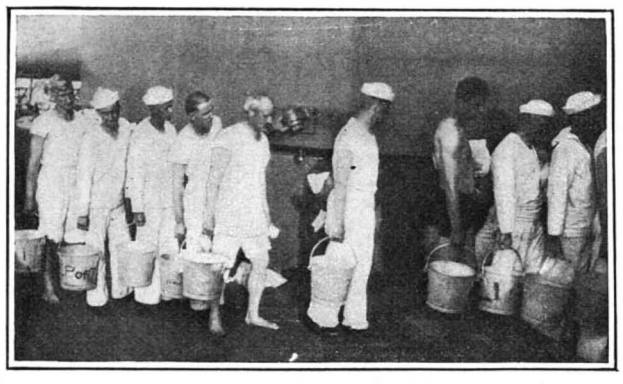
With the start of the second week we sailed out of sight of land, in the bloodheat of excitement, in an effort to defend the Atlantic coast against the invading "Red Fleet" of pre-dreadnoughts, battle-cruisers and submarines. The gun strength was 114 to 64 in favor of the "Reds," due to their larger 14-inch guns. The maneuvers were to have lasted a week, the "Blues" defending the Atlantic coast from Portsmouth to Hampton Roads, while the "Reds" were to storm any vulnerable port, and, after capture, to land imaginary transports of 60,000 troops. The first half of the week of the maneuvers resembled very closely crossing the Atlantic under normal conditions. But on the fourth day a radio dispatch announced that one of our torpedo destroyers had theoretically sunk the transports with their 60,000 men off the Jersey coast. That exciting news found us steaming 12 knots south. At the same time that Barnegat was reached the booming of the "enemy's" guns was heard; fully twenty minutes later the keenest eyes discerned the smoke of one, two, three, and finally ten ships. It was only a matter of minutes then before the huge battle-gray monsters of the "Nevada" class steamed within eight miles of our single column—an easy range for their 14-inch guns. With at least a fair hope of victory, we were soon outmaneuvered at an elbow turn that we were forced to take. Here the "Reds" steamed across the elbow, easily picking off each individual "Blue" as she turned. Thus sank the Reserve Fleet of the U. S. Navy with 2,500 volunteer sailors aboard, most of whom knew nothing of the theoretical disaster until they read of the same in the papers three days later.

Our second Sunday at sea resulted in shore leave at Old Point Comfort. It was a truly sincere cry of joy that went up all over the ship as land was sighted that afternoon, the first vision of land in eight days. Another treat awaited us the following day, when there was arranged a two-hour parade drill within the walls of old Fortress Monroe. Here again enthusiasm and inspiration more than offset an obvious lack of training. It was there, within the confines of that history bedecked fortress, we found out that even if we were well trained as regards pairs and squads of fours, that did not, *ipso facto*, make a column straight or a "right about" anything but a scramble. Then started the target practice at Tangier Sound. Sixteen crews of thirteen men each were picked on each battleship and the three-inch guns were used throughout the practice. In this branch many civilian volunteers showed skill apt enough to surprise the officers in charge. Many creditable records were made, owing to thorough instruction received on sight-setting, range-finding and shelling.

Nor was the cruise by any means a floating technical school; there were regattas of swimming, diving and punting to determine the aquatic ability of each contingent; early on the cruise we formed lifeboat crews, with races between picked eights from the various battleships; and we were fortunate enough to have had lectures by a half-dozen naval authorities on paramount questions, such as coast defense, relative value of submarines, cruisers and aeroplanes in scout duty, etc. Coupled with these lectures were daily inspections by small voluntary groups, entrance never being denied from the mastheads above to the magazine chambers below.

It would be a grave omission not to mention "Scrub-and-Wash-Clothes." This song of the bos'n was heard regularly at 4 P.M., at which time all operations of the day were suspended in favor of deck laundering. A wild scramble with pails for the limited fresh water aboard ship, another rush for deck space large enough for a jumper, and soon every volunteer, regardless of his social or business calling, was on hands and knees applying the brush to his uniforms. Two hours later there was a sore back, a pair of stiff knees, but a confident feeling that to-morrow's captain's inspection would find him in "clean whites."

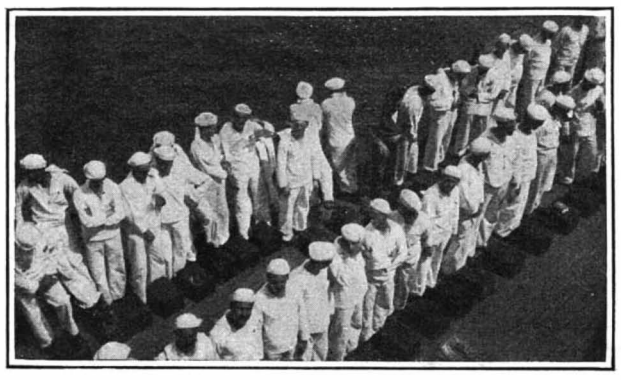
When the four weeks were ended and the white uniforms were set aside for tailored outfits, there was sincere regret that the end was at hand. Many descended the gang plank wishing that they were ascending it for another four weeks, but there were few indeed who did not possess some new training which would be of real value to the United States in time of need; in view of this the experiment of the Navy can well be said to have been highly successful.



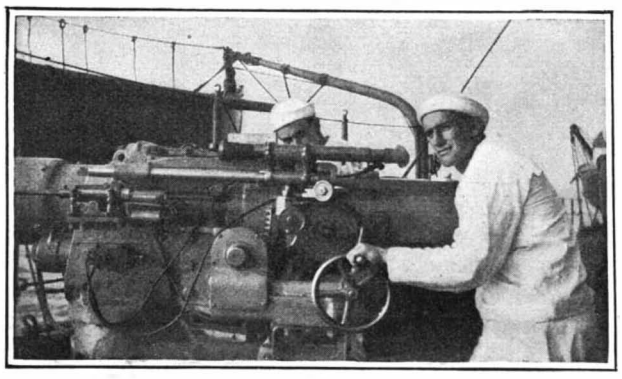
Waiting in line for fresh water

"Scrub and wash clothes"

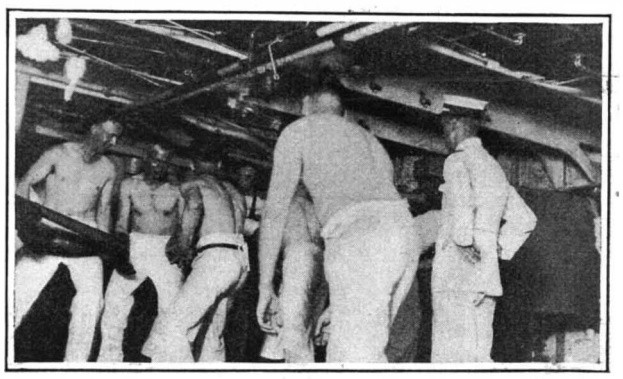
On the whale boat falls



Line up at ditty-box inspection



Pointer at the 3-inch gun



Six-inch gun crew at battle stations

The Life of a Naval Volunteer

By Everard B. Marshall

WHEN the volunteers on the U. S. S. "Maine" had sent away their civilian clothes and found themselves in uniform, in mysterious surroundings, on August 12, 1916, they realized that the training cruise was a reality, and that the occasion required that the life and customs of the ship be learned. Some with very long trousers, and at least one of the volunteers with the largest size uniform manufactured by the Navy Department refusing to meet around his middle, learned after inquiries that the tailor for whom they were looking was called "Sails," and that his workshop was located away aft and below, adjacent to the double bottom. With this information, if one was not "out of luck," he could find the place; but the strange doors and passages below decks were certainly confusing, and much time was consumed and strange places were visited in order to make what appeared to be a very simple mission.

The volunteers, after being mustered in and before mess, found their thoughts reduced to the simplest terms, for they realized that conditions on board ship were very different from those on land, and that it was necessary for them to learn how and when they would get their meals, and the gossip about hammocks was not altogether reassuring.

The mysteries of the mess were soon disclosed to certain volunteers, for two from each mess were detailed as mess cooks, to serve for three days. A mess cook has nothing to do with the cooking of the food, but nevertheless his duties are of some importance, and on well regulated ships he must work fast in order to be ready for his mess between the bugler's call for mess gear and the call for assembly, which follows in fifteen minutes. As the volunteers were inexperienced, they were given additional time in which to do their work. In preparing for mess the mess cooks first take the tables down from the fastenings overhead, after which the benches which are on top of the tables are set up in place. The mess gear is then "broken out," the mess gear consisting of a knife, a fork and a spoon for each man in the mess, and the "breaking out" consisting of the distribution of the pieces around the table—on land they call it "setting the table." The plates and cups are then obtained from the scullery; and, if the mess cook is experienced, he stands at the end of the table with a pile of five plates, and with one movement throws the plates along the table so that they will be spaced equal distances apart. In this way the plates and the gear are arranged around the tables in the mess, five men sitting on each side of each table. The mess cook must then go "up top sides" to "Doughhead" (the baker) for bread and pie (which is supplied some three times a week), and a visit must be made to "Jack of the Dust" for butter. "Jack of the Dust" also furnishes the mess with pepper, salt, fruit, catsup and other supplies, the wrappers of which are dusty when stored. Visits are then made to the galley with platters and tureens for food, and with a huge pot for coffee. The food is at once served, and in order that the mess cook may "stand by" ready to go for "seconds," it is customary for him to commence to eat before his mess march down.

The mess having finished eating, the dishes are stacked in metal trays and are carried to the scullery, where they are washed by dipping the trays containing the dishes into boiling suds, the knives, forks, spoons, platters and plates being washed by the mess cook, and the tables being secured overhead after the benches are folded up thereon. In this way the dining saloon is again turned into a living-room, which, however, is without any furniture other than a six-inch gun and several horizontal bars, on which are the long bags which contain the volunteers' clothing.

Each garment is rolled up separately and tied before being placed in the bag, which serves to keep the uniforms from becoming wrinkled, and assists in finding what is wanted at the bottom of the bag. The compartment referred to is on the gundeck, and is not only transformed at will from a living to a dining saloon, but it has still other uses, for when the bugler sounds "Hammocks" the volunteers take their hammocks from the nettings and swing their hammocks from beams which support the deck overhead. Contrary to the usual stories which circulate, it is a simple matter to swing into a hammock five or six feet high. The difficulty is in staying in the hammock until the master-at-arms sings out "Rise and Shine" at five o'clock in the morning. There is much science in adjusting the clews so the sides of the hammock will be far enough apart to prevent suffocation and still be inclined sufficiently to provide lateral support, which is necessary where a slight roll means a five-foot fall. A messmate of the writer, before learning the science of hammock clews, rolled out of his hammock and into the

(*Concluded on page* 288)

The Spiral of Archimedes

Its Practical Value to the Modern Craftsman

By Henry G. Schaefer

THE mechanical engineer, the draftsman and the machine designer are, at times in their professional work, confronted by the problem of correctly dividing the circumference of a circle, or a given arc of such circumference, or the angle or sector subtended by such arc, into a greater or less number of divisions either equal to each other or in certain ratios. This is the case, for instance, in laying out cams of continuous rotary or reciprocating arc movement, or other mechanism for imparting irregular or intermittent motion to or from shafts or other parts of machinery. In such cases the designer resorts to the best means at his disposal, generally using a protractor, but every practical draftsman is well aware of the limitations of this instrument and of the difficulties attending the use of it in any but the simplest operations. The calculations necessary to find in degrees and minutes the sizes of angles of the desired proportions or ratios, are tedious and involve vexatious delays, so it would seem that a strictly graphical method to solve such problems expeditiously would be a desideratum.

Considering, then, the want of some better means of accomplishing the desired results, attention is centered on one of the transcendental plane curves, which by its peculiar properties, lends itself to the solution of such problems. This curve is known as the Spiral of Archimedes, and its equation, referred to a system of polar coördinates is $\rho = a\ \theta$. ρ represents the radius vector, or the distance of any point (ρ) on the spiral from the centre; while θ is the angle between the radius vector at any given point and the initial line where $\rho = o$ since θ also equals o. [Fig. 1.] a is a constant which controls the spire or amplitude of the curve.

In words the curve may be defined as the locus of a point moving along a straight line with a constant velocity, while the line rotates about some fixed point on it, also with a constant velocity.

Referring again to Fig. 1, the angles A O B, B O C and C O D are constructed equal. By swinging the arcs A A′, B B′, etc., we find that A′ B′, B′ C′ and C′ D are equal. By examining the equation we find that *any* angular increment *must produce* a *proportional* increment in the length of the radius vector, and this law makes possible a strictly graphical and mathematically correct method for the division of angles and circumferences, arcs and sectors of circles into any number of equal or proportional parts. A reversal of the process brings us to the desired end.

Suppose it were necessary to trisect the angle A O D. By constructing the curve, laying off O A and O D at A′ and trisecting D A by the common method based on similar triangles, and the use of the auxiliary line A′ A″, then swinging the distances O B′ and O C′ to intersect the curve, B and C would determine the trisectors of the angle.

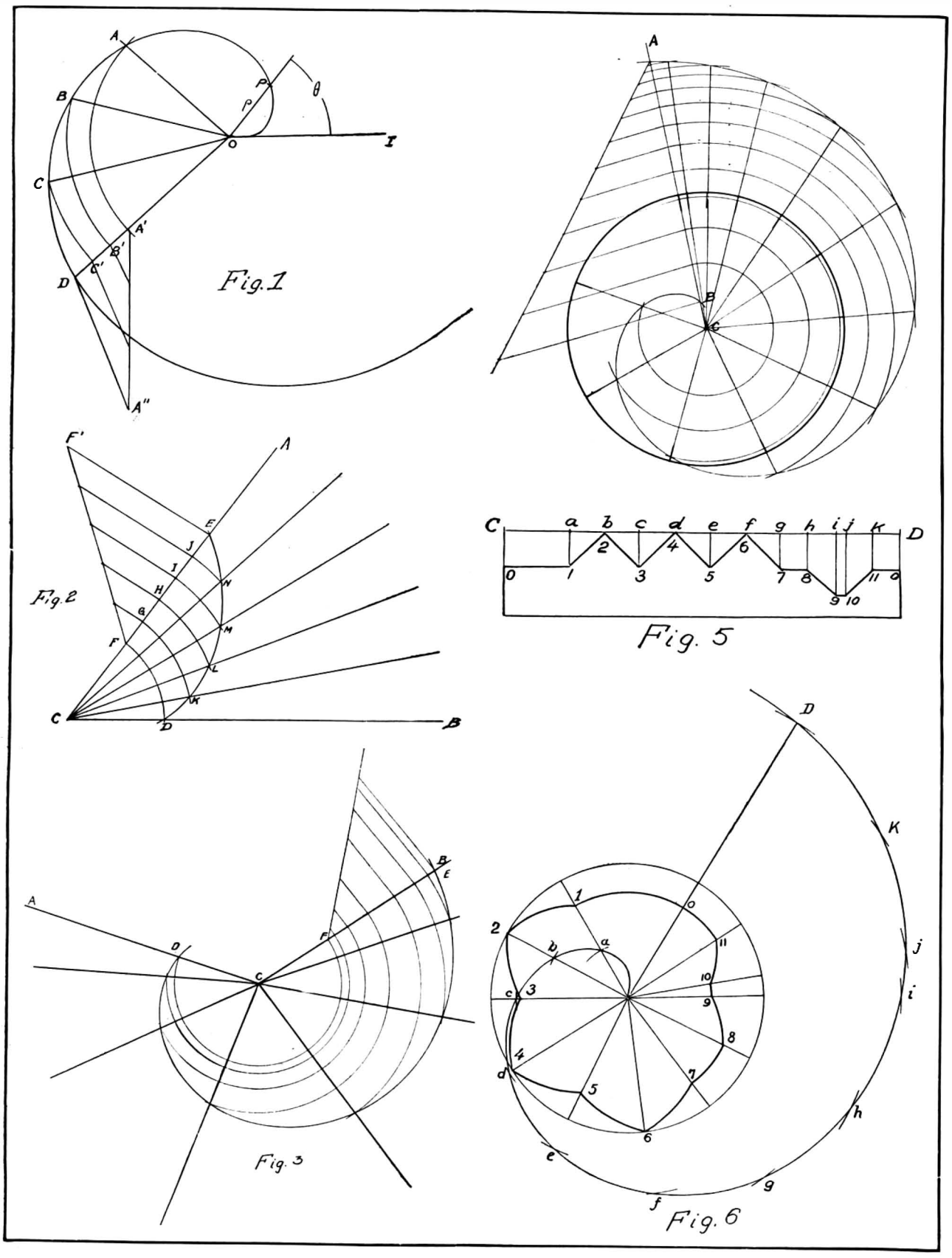
The further application of this method to the solution of some problems chosen at random from a large number which suggest themselves, is shown in the remaining diagrams. Figure 2 shows the division of the angle A C B into five equal parts. Again to divide an angle greater than 180° into, say, seven parts in the ratio of 1:2:3:4:3:2:1 (Fig. 3) Draw curve D E; bring D to F; divide F E into parts proportionate to 1:2:3:4:3:2:1 and proceed as above.

Fig. 4 shows the division of the circumference of a wheel, such as is used in the striking mechanism of a clock, into twelve parts increasing in size in regular arithmetic ratio. After drawing spiral and radius A C, divide A B into twelve parts of the proper proportions and proceed as above.

For such simple constructions as angle division, the amplitude of the spiral is a matter of indifference. Any spiral may be used for any such problem; a single Archimedian template enables one to divide any angle in any desired way. For more complicated mechanical applications we must enforce a condition upon the spiral, and this is most conveniently done by making its amplitude equal to some given length. Thus, in designing a cam, the movement it is desired to impart is first laid out in a diagram as in Fig. 5. The various distances *c a*, *c b*, etc., can be directly transferred to an Archimedean Spiral whose amplitude C D (Fig. 6) is equal to C D (Fig. 5), and the radial lines drawn as in Fig. 6. Then the desired circumscribing circle of the cam may be drawn and the points 1, 2, 3, 4, etc., plotted. These will give the contour of the cam as shown.

In like manner ratchet wheels of irregular circumferential spacing may be laid out; also eccentric pins or cams for blank holding and ejecting devices on cutting and drawing presses and on feed mechanisms therefor, or to actuate special movements in all kinds of automatic machinery.

The practicability of this method having been thus demonstrated, I wish, in conclusion to call attention to its value to the student in solving theoretical problems. The distance corresponding to any angle, as F E (Fig. 2), gives a graphical representation of the value of that angle. Hence any problem dealing with the corelations of straight lines, and capable of graphical solution may be applied to angles, by using their representative straight-line values.



Details of angle division by use of the Archimedean spiral

Radium Production in Bohemia

IN the mining of uranium ore in Bohemia, 25,720 pounds of uraninite prepared by smelting, having an average value of $471.50 per hundred pounds, were produced in 1915. Of the different uranium compounds, there were produced in the government mine in Joachimsthal 2,325 pounds of an average value of $252.50 per 100 pounds.

The government factory for radium compounds produced compounds containing 1.754 grams (27.07 grains) of radium elements having a total value of $209,364.50. The radium production in 1915 represented an increase of 0.879 gram (13.57 grains) as compared with the production in 1914, the value of which shows an increase of $100,000 in round figures.

Offices on Wheels for the German Business Men

GREAT business is expected in Germany after the war, and the question is being discussed in the Brunswick press as to the advantages of having special compartments in the cars of express trains for business men. It is suggested that these compartments be fitted up with a table covered with green cloth, suitable chairs, writing materials, and other appropriate articles. this special service being analogous to sleeping and dining car service. It is believed that there will be a demand for such cars, and that business men will gladly pay an extra fee for the conveniences furnished.

The chambers of commerce of two cities have already sent the Minister of Public Works petitions for the introduction of this improvement.

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.]

England's Mistake a Lesson to Us

To the Editor of the SCIENTIFIC AMERICAN:

A few days ago the Aviation Section of our Army issued the outline of its plans in connection with the establishing of an aeronautic testing station, for which Congress allowed an appropriation of $300,000. On the date that this announcement was made, those closely connected with the aeronautic movement were reading, with tremendous interest, the reports of the committee which the British Government appointed to investigate the management of the Royal Aircraft Factory, the national organization which is most generally blamed for the delays which have taken place in the developing of the Royal Flying Corps.

Those who have been connected with aeronautics since its infancy know that in the period 1909-1913 aviation in England did not advance, because the British army authorities were obsessed with the idea that they could develop a "perfect" aeroplane and a "perfect" motor at the Royal Aircraft Factory. While waiting, no one encouraged private aeroplane and motor manufacturers, and as a result, when the international situation began to grow serious, England had to lose much valuable time building a civilian aeronautic industry.

Since the war started the Royal Aircraft Factory has, according to the report of Lord Curzon, Chairman of the Air Board, manufactured only 2 per cent of the aeroplanes used by the British Government, and the representatives of the Government in Parliament are always careful to emphasize that the Royal Aircraft Factory is not, and will not be, used to manufacture aeroplanes or motors.

Another charge which brought about the investigation of the Royal Aircraft Factory was that partiality toward designs made by the Royal Aircraft Factory prevented the military authorities from giving due consideration to better types of aeroplanes and motors developed by private manufacturers.

It was most unfortunate that the Under-Secretaries for War, Colonel Seely first, then Mr. Tennant, assumed an indifferent attitude towards these criticisms, as towards the general subject of aeronautics. They chose to consider criticisms of inactivity "political" criticisms, and did not act. As Mr. C. G. Grey, the British aeronautic authority, points out, the removal of Colonel Seely and Mr. Tennant from the War Office was assisted by the state of aeronautical affairs as disclosed by "mere agitators."

The derogatory statements about American aeroplanes and American motors made to the press by an officer of the Aviation Section of the U. S. Army shows an attitude of mind which, if shared by the other too-few members of Colonel Squiers staff, may lead to disaster.

The natural tendency of the heads of an experimental station is to attempt to turn out "the perfect aeroplane." This would be fine were it not for the fact that while the experimentations are taking place the tendency is to let the work of training aviators and equipping them with aeroplanes come to a standstill; and after the "perfect" machine is finally out, those in charge are apt to feel that it is an acknowledgment of inferiority to order better types developed by private manufacturers. And then follows the tug of war which causes strife and prevents progress.

Better a hundred times not to have a government "testing plant" than to go through what England has gone through.

The report of the Royal Aircraft Factory investigating committee divides the Royal Aircraft Factory into 41 departments; the report of Lord Curzon gives 39 departments.

Some of these departments, like the Supplies Department, are large, this department alone employing as high as 365 people!

The estimate for experimentations alone to be conducted by the Royal Aircraft Factory this year is one million sterling! This does not, of course, include materials used for spare parts, etc., being turned out at the factory.

Congress has allowed $300,000 for our testing plant, and we encouraged this action—but not to develop a white elephant like the Royal Aircraft Factory.

In a public statement an officer of the U. S. Army Aviation Section spoke derogatorily of American manufacturers for what he considers inability to make deliveries. The facts in the case are that he did not want what was available and did not allow sufficient time to develop something new.

The report of the committee which investigated the Royal Aircraft Factory states that it takes between 6 and 9 months to develop a new type aeroplane, and Lord Curzon, the Chairman of the British Air Board, states that it takes ten months to prepare to turn out engines in quantities.

Some absurd talk has been heard about the American aeroplanes which went to England. It is stated that they are "only used for training and for coast defense." The fact is that these machines were ordered to be used for training and for coast defense on designs approved by the British authorities, and the machines were inspected by the British inspectors before shipping. The investigation of the Factory brings out the fact that 2,500 aeroplanes of a "training and coast defense type" were also ordered from British constructors. Why should they order something else when they need a given type? Why buy a 3-ton truck when you need the 1½-ton type?

Half a dozen other countries have between 2,000 and 9,000 aviators. We have about fifty in the Army and Navy, and fifty more, including National Guard officers, under training.

England alone has not less than 100 aviation stations. The United States Army and Navy have exactly four aviation stations between them.

So we need to concentrate efforts on training aviators and establishing stations. These things are vital. Congress has shown willingness to allow the means to carry into effect the plan to train 2,000 aviators approved by the country, and there are at least 2,000 National Guardsmen and civilians anxious to join the air service.

HENRY WOODHOUSE,
Member Board of Governors, Aero Club of America; Director American Society Aeronautic Engineers; Education and Industrial Delegate, Pan-American Aeronautic Federation.

Aero Club of America, New York, N. Y.

Canada and the International Patent Convention

To the Editor of the SCIENTIFIC AMERICAN:

While most of the great countries of the world have become members of the International Convention, Canada is conspicuous as a country whose subjects are deprived of the benefits granted by the Convention provisions. This is true, although British subjects domiciled in Canada have indicated a desire that Canada join the Convention. The Canadian Government has also made overtures with reference to Canada joining the Convention, but under a reservation permitting Canada to restrict importation.

In the Canadian Patent Act there is a provision which invalidates a Canadian patent if the patentee imports the patented article into Canada after a predetermined period, and this is the stumbling block which has prevented Canadian inventors and merchants from taking advantage of the beneficial provisions of the International Convention which pertain to the protection of inventions and trade marks throughout the world. While it may be possible to advance very good arguments to show the importance of requiring Canadian patentees to carry on the manufacture in Canada under their patents, to supply the Canadian public with the patented articles manufactured in Canada, it is difficult to see why it will not be possible to obtain the same result without making invalid a Canadian patent if by chance the Canadian patentee imports into Canada a few of the patented articles. The Canadian Patent Act also provides that the manufacture of the patented article be carried on in Canada, and this provision if slightly modified will alone serve the desired purpose and be in harmony with the principles of the Convention provisions.

Canada is by no means the only country which requires that the manufacture under a patent be carried on in the country in which the patent is secured; and as it has not been found necessary in other countries to provide drastic measures prohibiting importation in order to make the home manufacture certain, it is not understood why Canada cannot obtain the desired Convention benefits by repealing the importation provision in the Canadian Patent Act, and at the same time care for her home industries. In some countries the law requires not only that the manufacture be carried on in the country granting the patent, but that the manufacture be substantial. In such a case the nominal manufacture in the country is not considered to comply with the requirements if the patented goods are imported in large quantities. This suggests how the manufacturing section of the Canadian Patent Act may be amended to provide for the manufacture in Canada of substantially all the patented articles sold in that country, while the importing provision may be repealed, and with it the bar removed which has prevented Canada from joining the International Convention.

In addition, the Canadian tariff laws will in every case encourage the Canadian manufacture to supply Canadian demands.

EVERARD B. MARSHALL.

Tenafly, N. J.

The Future of Wireless Telephony

To the Editor of the SCIENTIFIC AMERICAN:

Wireless telegraphy and its later development, wireless telephony have so far been mainly useful in places where the old methods are impracticable, as between ships at sea, etc.

The outlook for wireless telephony superseding the ordinary telephone within city limits seems dark by reason of the difficulty of preventing interference of messages. But that it is not hopeless is suggested by the fact that on a clear night thousands of stars are visible to the naked eye (millions can be reached with a great telescope), each maintaining its own individuality though their light waves have interlaced in an almost infinitely complex manner before reaching the earth. The principle involved may be easily illustrated by throwing two stones simultaneously into the water. It will be seen that when the circular waves from each cross their own form (identity) is not changed. The same principle would of course apply to the electric waves used in wireless telegraphy and telephony.

No attempt is here made to work out this very general suggestion in detail. But may we not find in this aspect of the starry heavens something prophetic of the day when the one omnipresent ether will be an all sufficient medium for the most complicated interchanges of intelligence in a great city?

WALTER J. TURNEY.

New York City.

A Serious Objection to Benzol as a Motor Fuel

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed from time to time in the SCIENTIFIC AMERICAN, references to the use of benzol for motor-driven vehicles and to the fact that it is largely used for that purpose in foreign countries whereas we in America seemed to limit ourselves to gasoline. Such statements have also been made in articles in other scientific journals and in the motor journals.

I take no exception to the fact but wish to point out that I have never yet seen a statement of the real trouble with benzol and of the reason why it probably will never be largely used, at least in our northern sections, and that is its high freezing point. It freezes solid or solidifies at 32 to 34 deg. Fahr., and consequently would be useless during about half the year in more than half of this country.

Perhaps this can easily be overcome by admixture with alcohol or gasoline, but that adds a complication not likely to be popular. I am constantly surprised that this matter has apparently never been mentioned by any of our prominent motor people. Can it be possible that they do not know it?

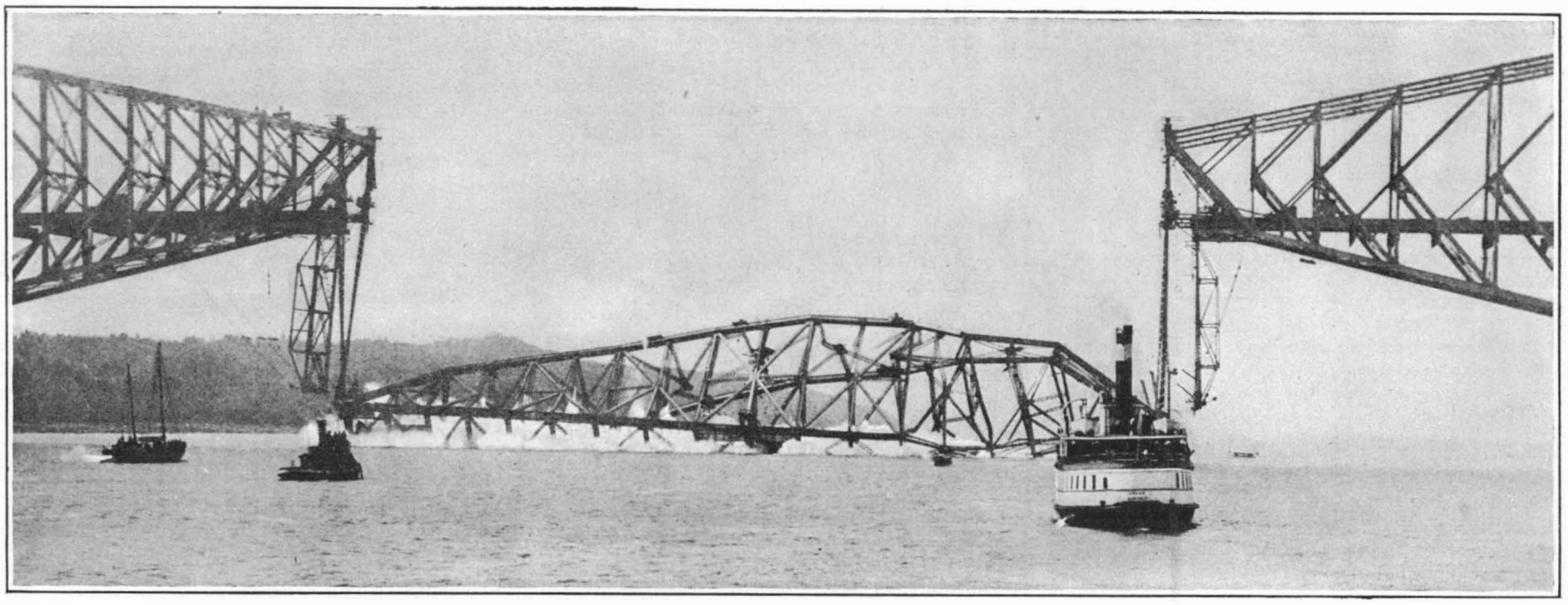
Benzol, unlike water, does not expand on freezing—it contracts, so it will not burst tanks or pipes.

A. WAYNE CLARK.

New Brunswick, N. J.

The Current Supplement

IT is surprising how many things there are that are constantly before our eyes of which we know little or nothing. An example of this is the moon, which must many a time have attracted the admiring, and even wondering attention of everyone, and yet not one person in a thousand has any idea of its characteristics. In a general way we know that the months are measured by the moon, but of the marvelous multiplicity and variations of its movements few people have any idea. *The Movements of the Moon*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2124, September 23rd, 1916, surveys this subject in a readable manner that will add measurably to the information of many readers. *The Royal Porcelain Factory at Berlin* tells of a class of artistic work that is being carried on in spite of the war, and it is accompanied by a number of excellent illustrations. The paper on *Metabolism of Insects* is concluded. *Modern Service Trucks* gives some facts in regard to the work performed by the special motor vehicles employed by electric light, power and railway companies, and for the maintenance of telephone lines and other public service organizations. It is accompanied by several typical pictures. *Diving Spectacles* illustrates and describes a novel protector that enables one to use his eyes freely under water. *Electrolytic Iron* reviews recent progress and processes in the production of this valuable material, together with estimates of its cost. *Machine Guns* is a timely survey of the history, evolution and construction of these indispensable weapons so extensively used in the great war. There are illustrations showing details of construction. *The Story of the Grinding Wheel* gives much interesting information in regard to a machine tool that has quite recently become a necessity in the modern machine works. This issue also contains an unusual variety of other valuable matter. *The Proper Use of Chemicals in the Laundry* tells of the processes employed in modern establishments, and gives much information of value to every housekeeper in relation to the treatment of fabrics.



Fall of the 5000-ton span. Note the backward swing of the further lifting chains at left of span, after breaking away

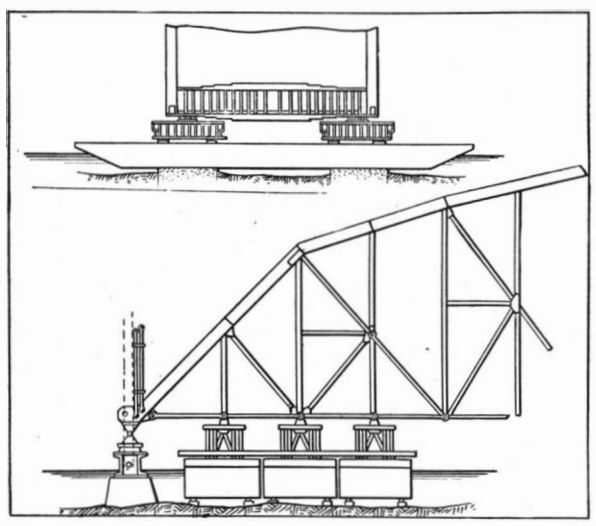
The Quebec Bridge Disaster

For the Second Time the World's Greatest Bridge is Wrecked During Erection

IF ever such conditions occur in mundane affairs as are implied in the term "hoodoo," they must surely be found in the two failures of the attempt to erect the world's largest span across the St. Lawrence River at Quebec. We know, of course, that the idea of a hoodoo is but one among the many superstitions which are gradually dying out in an age, in which science and calm reasoning are asserting their inevitable mastery over the mind of mankind.

It is too early as yet to make a definite pronouncement as to the cause of this second collapse of the Quebec bridge, but the following analysis of the methods by which it was attempted to raise the huge 5,000-ton center span into place will serve, we believe, to show that the disaster was due (as in the case of the fall of the first bridge) to the failure to apply to the design of the lifting gear a little of that engineering "horse sense" which was conspicuously lacking in the design of the great cantilever which failed so disastrously some ten years ago.

It will be remembered that the first bridge fell because a main compression member—the bottom chord—buckled under the weight of the unloaded structure and let the whole cantilever down into the St. Lawrence, with the tragic loss of eighty-two lives. This member (in the first panel of the shore arm, adjoining the tower) was composed of four vertical plate-steel diaphragms, five feet in depth, each of which consisted of several plates, stitch-riveted together. These diaphragms were spaced at equal distances from each other, and the width of the member as thus assembled was about five feet over all. Now, there was sufficient metal in these diaphragms to take care of the compressive load (about 9,000 tons) imposed upon them, provided they were held in their true longitudinal planes. Unfortunately, the all-important task of keeping the diaphragms in line was committed to a series of light lattice angles, measuring only 3½ by 4½ inches on the side. Theoretically, if the shopwork was exact and the member, as built up, was in perfect line, this latticing was sufficient for its purpose. But, as the event proved, these huge members lacked the proper stiffness and, as the cantilever was built out and the load increased they began to show indications of springing out of line. Ultimately, when the cantilever had been carried out to its full length and the work of building out the center span by overhang was begun, the lattice rivets connecting the angles with the diaphragms began to shear off under the stress, the action becoming cumulative, until the huge member crumpled up like a boy's tin whistle, and the whole cantilever collapsed into the river.



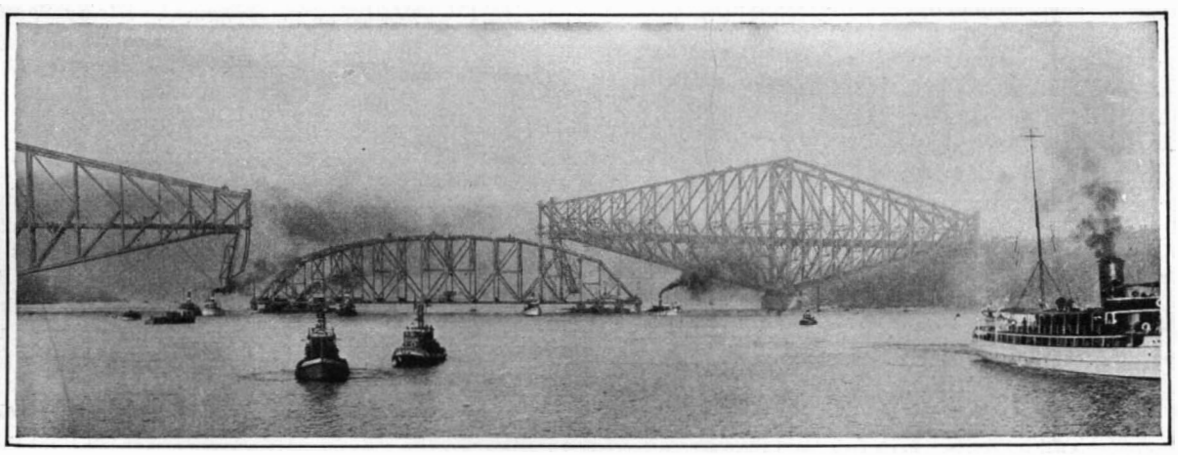
Cross-section and elevation of span during erection at Victoria Cove

In the design of the present bridge particular care was taken to guard against a similar failure. Stiff cover plates took the place of the flimsy latticing, and transverse diaphragms were introduced at stated intervals along the length of the various compression members. The present cantilevers are of enormous weight, strength, and stiffness; and these qualities stood the huge bridge in good stead under the great stresses engendered by the rebound, when the 5,000-ton load of the suspended span was suddenly removed, as it broke loose and dropped into the river.

The Quebec bridge is designed as a connecting link for several railroads between the United States and Canada. It carries two railroad tracks and two broad passenger footways. It will have the distinction, when completed, of containing the longest single span (1,800 feet) of any existing bridge, the next longest being the two spans, each 1,710 feet in length, of the Forth Bridge, Scotland. With these great bridges may be compared the three famous suspension bridges across the East River, New York: the old Brooklyn Bridge, of 1,595 feet span; the Manhattan Bridge, of 1,475 feet span, and the Williamsburgh Bridge, of 1,600 feet span.

In constructing the present bridge it was decided to build the cantilevers, only, by the overhang method, and construct the center span separately, lifting it into place when the cantilevers were completed. The center span, which was 88 feet wide, 110 feet deep and 640 feet in length, was built in the shallow water of Victoria Cove, which is situated on the Quebec side of the St. Lawrence, about four miles below the bridge. The total weight of the span, in the condition in which it was erected, was something over 5,000 tons.

The center span afloat on its six scows being towed to the bridge



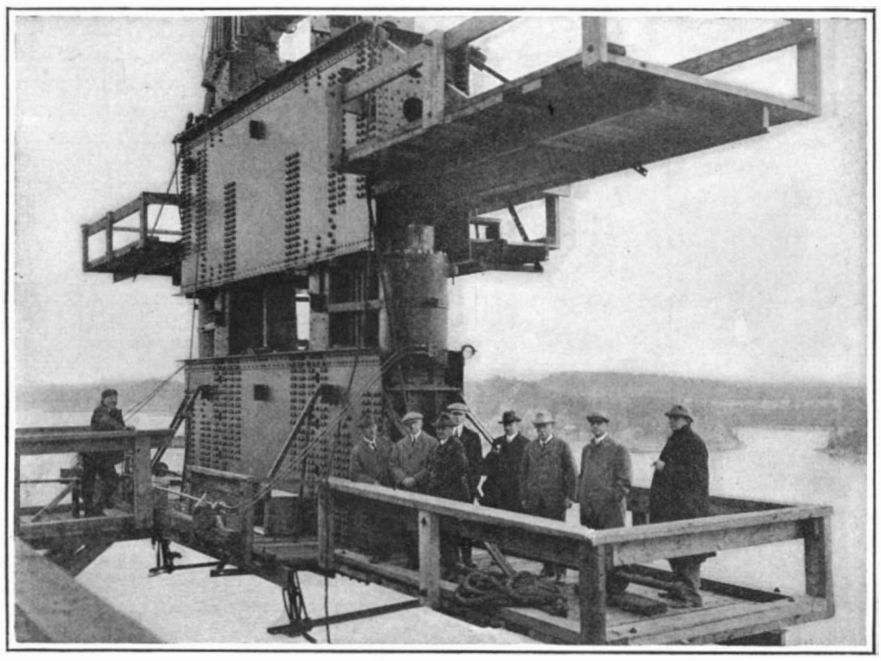
The span is being floated into position at the bridge under the control of tugs

Broadly speaking, the task consisted in towing the span on its supporting barges to position below the center gap between the ends of the cantilevers, lifting it 145 feet vertically, and pinning it into place as an integral part of the structure; but, although this method of erection has been frequently followed in previous cantilever bridges, the great size and weight of the central span and the height to which it had to be lifted involved the planning of special lifting gear, as described later in this article.

The span was erected upon six large scows, which were placed beneath three end panel-points at each end of the span, as shown in the illustrations. The scows were 165 feet long, 32½ feet wide, and their draft was 11½ feet. Dur-

ing erection the scows rested upon concrete foundations laid in the bottom of the cove. There is considerable rise and fall of the tide at this point, and to accommodate this, large valves were provided in the bottom of the scows, which were left open during erection to allow the water to enter. On Monday, September 11th, the day selected for closing the bridge, the valves were shut and the span was floated on its scows. It was towed out against a three- to four-mile current by several tugs, which had a combined pulling capacity of 100,000 pounds. The time of arrival of the span at the bridge was set for about half an hour after high tide, when the strength of the current would be at a minimum.

To hold the span in exact position while the lifting chains took hold of it, a "mooring truss" had been built at the end of each cantilever and was hung vertically from the bottom chords. Steel mooring cables, 1½ inches in size, which ran through powerful tackles, led from the bottom of the mooring trusses and were made fast to the ends of the central span. There were two of these at each corner of the span, making eight in all.



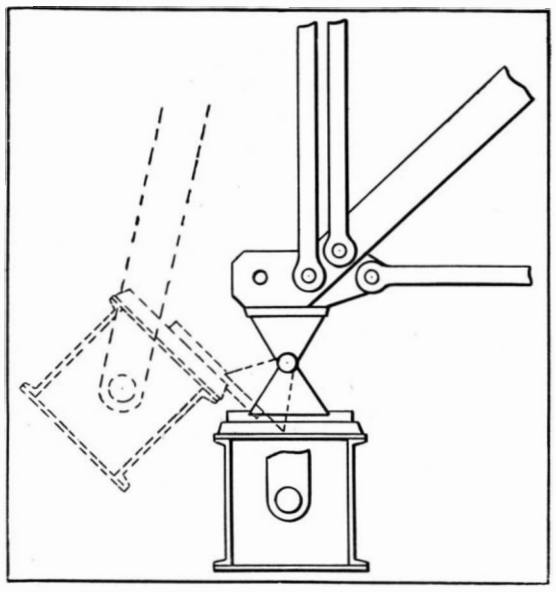
Courtesy of Engineering News

A pair of lifting girders with their two 1,000-ton jacks

The span was to have been lifted by means of hanger chains, which hung down from the cantilever, there being four strings of links or "slabs" to each chain. Each link was made up of two steel plates, 1⅛ inches thick by 30 inches deep. At their lower ends the hanger chains connected to supporting girders 7 feet deep and 25 feet long, and the load at each corner of the center span was transmitted to these girders by means of cast-steel rocker joints, which were designed to permit a certain amount of turning movement about the transverse and longitudinal axes of the bearings. At their upper ends the lifting or hanger chains were made fast to similar supporting girders arranged in pairs one above the other, with a pair of 1,000-ton hydraulic lifting jacks interposed between each pair. These upper girders were also provided with rocker-bearings, the object of which, as stated by the engineers, was "to allow the suspended span to move in any direction under the influence of whatever external forces from wind or current might act upon them during the hoisting of the span."

The lifting jacks were located at about the elevation of the floor of the cantilever. Follow-up screw jacks were provided in case of any failure of the hydraulic jacks. The operating pressure was about 4,500 pounds per square inch.

The method of lifting was as follows: Each operation of the jacks lifted the span two feet. During the lifting 12-inch pins engaged the lifting chain through diaphragms built in the upper jacking girders. At the end of the stroke, 12-inch pins were driven through the diaphragms in the lower jacking girders to engage the hanger chains. When this was done, the upper pins were removed, the jacks and upper girders lowered, the upper pins entered in place again, the lower pins removed, and the jacks operated through another 2-foot lift.

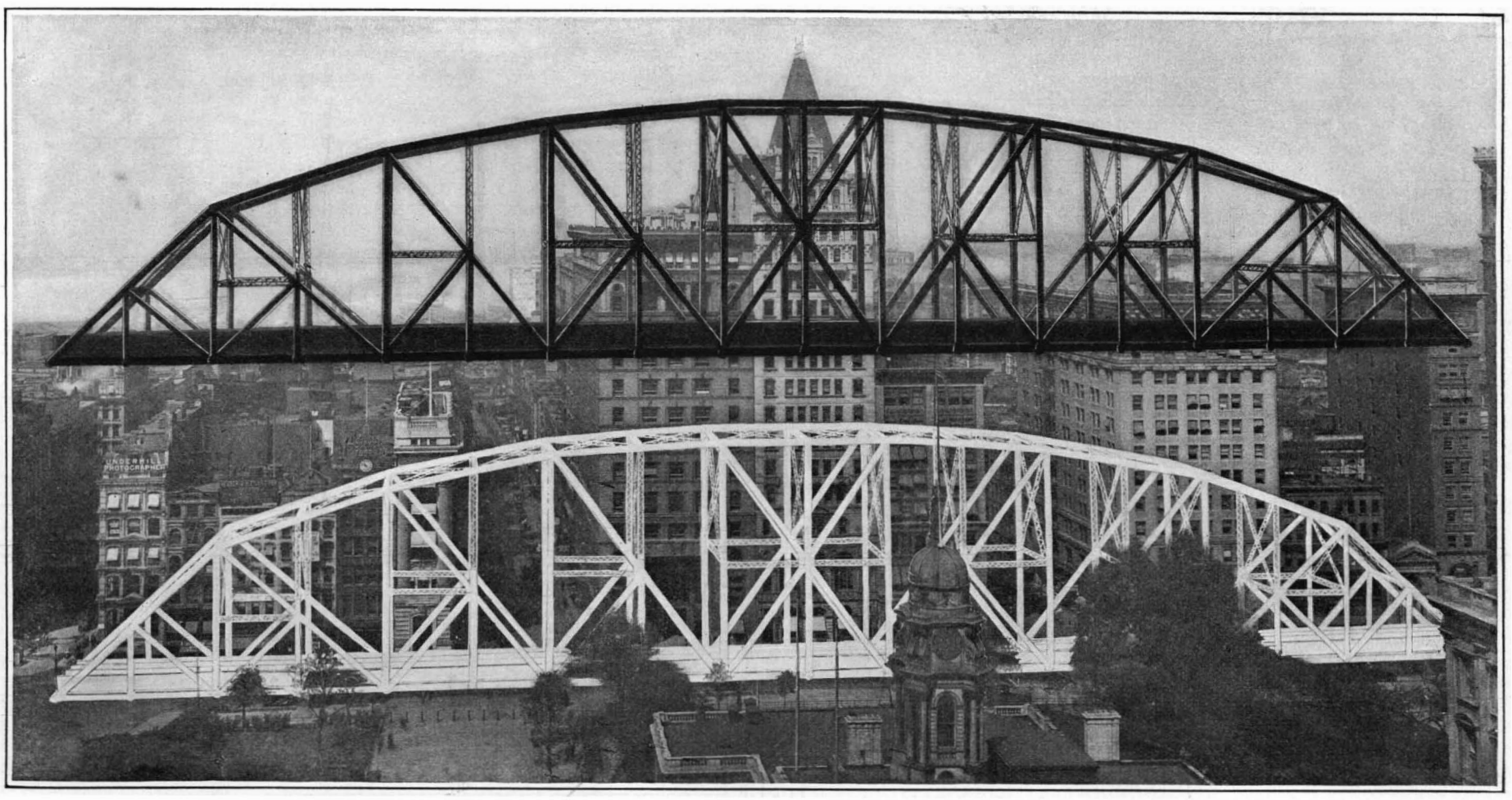


Approximate sketch showing how lower lifting girder may have slipped from beneath end of span

On the morning of September 11th, in the presence of a vast concourse of the populace of the surrounding country and distinguished invited guests, the span was successfully towed into place, and had commenced its slow ascent of 145 feet, the total time for the completion of which was estimated at about 20 hours. When the span had been lifted a few feet above the scows, the southwest corner of the suspended span slipped off its supporting girder at the bottom of the hanger chains, leaving the 5,000-ton girder which had been designed to rest upon four points resting upon three only. This, of course, threw a heavy torsional stress upon the cross-bracing between the stresses, which, if one may judge from the photographs, was none too heavy for its duty. Under the abnormal stresses now imposed upon this bracing, it commenced to buckle and break. This left the main top and bottom chords without their proper stiffening, and at once the inevitable happened,—the whole span buckled out of shape, fell into the river, and sank in 200 feet of water, where it will probably be allowed to stay.

And now as to the probable cause of the disaster. By reference to the approximate sketch showing the universal rocker-bearing between the lower chord of the span and the lower lifting girder, it will be seen that the point of attachment of the lower end of the lifting chain to the transverse lifting girder is several feet below the rocker-bearing interposed between the lifting girder and the bottom chord of the suspended span. Under these conditions the system was in unstable equilibrium; for if there was any movement due to change of length of the span as the result, let us say, of the change of bearing from the trusses to the lifting girders, or to change in temperature, or what not, there would be a tendency of the span to rotate the lifting girder about the pins connecting it to the lifting chains. In this case there would be sliding movement of the bridge chord and its rocker-bearing upon the lower pin, whose axis is parallel to the axis of the suspended span. These pins were probably greased, and it can be readily seen that once the sliding motion had set in it would be aggravated as it proceeded until the lifting girder was pushed back clear of the end of the central span, as indicated by dotted lines in the sketch. A little more engineering good sense and thoughtfulness would have led to the placing of the connecting pin between hanger chain and lifting girders several feet above instead of several feet below the rocker-bearing. Had this been done, it is our opinion that, since the system would have been in stable equilibrium, the accident could never have occurred.

It will take another million dollars and another year's time to build another span and put it in place.



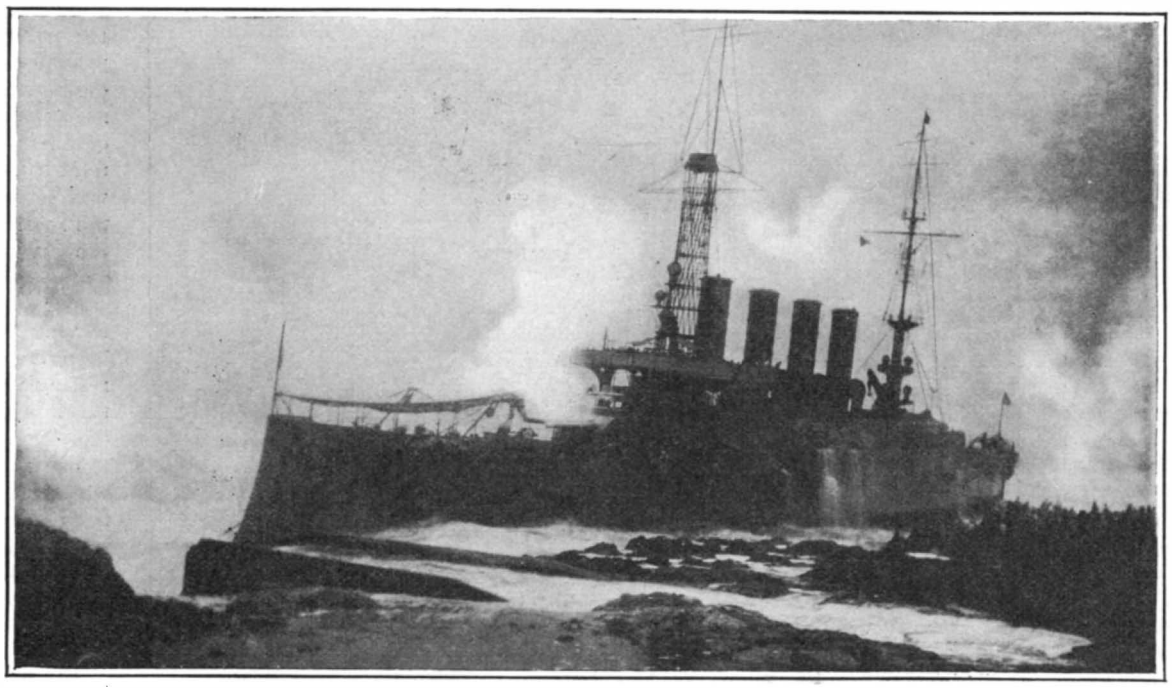
Placed on Broadway, Quebec's span would reach from Park Place, two and a half blocks. The height of span is 110 feet. Clearance 145 feet

American Warship Lost in West Indian Hurricane

WE present herewith a graphic picture of the wrecked United States Armored Cruiser "Memphis" as she now lies in San Domingo harbor. The "Memphis"—formerly the "Tennessee"—was doing police duty in connection with the latest Dominican revolution. On August 29th, during a severe hurricane, she was seized by a huge ground swell, carried across a broad expanse of shallow water, and driven solidly ashore. Our illustration shows the storm still raging about the stranded vessel.

First reports represented the "Memphis" as a total loss, but it is now planned to have representatives of several large wrecking companies inspect her with a view to seeing whether it will be possible to salve her. Fortunately she was left in such position that rescue of all on board was a simple matter. The wreck was not without loss of life, however, as some thirty odd members of the crew, who were returning from shore leave in a small boat, were swamped in the open harbor and lost when the hurricane struck.

The "Memphis" has had an eventful career. She came from the Cramps shipyard, in Philadelphia, in 1904. In 1908, while off Port Hueneme, Cal., she suffered a boiler explosion in which seven were killed. At the outbreak of the present war she was the vessel which carried nearly six million dollars of government money to relieve Americans stranded in Europe; and with the appropriation of all passenger vessels to the purposes of the British government she went into service for a while as a passenger ferry across the channel for Americans taking the first homeward step from the continent.



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Cruiser "Memphis" stranded in San Domingo harbor

A Gun That Shoots Both Ways at Once

THE principal factors that limit the power of armament for use on aircraft are the force of recoil and the weight of the gun. If the former is too severe the plane will suffer violent and highly dangerous perturbations at each discharge; if the latter is too great, mobility is seriously impaired.

To overcome these limitations, an American firm has finally brought to perfection an entirely novel and very ingenious type of gun. The original conception contemplated a gun so installed that on firing it was free to fly to the rear under the reaction developed when the projectile was discharged to the front. The gun was of course lost after each shot. A further development of the idea resulted in a double length gun containing two projectiles driven, the one toward the target and the other at random to the rear, by a single powder charge placed in the center of the gun. In effect the device was two guns, of equal bore and equal powder pressure, placed breech to breech so that the recoil of each was just sufficient to take up that of the other. In the absence of any surfaces upon which there could be an uncompensated working of the longitudinal drive from either gun, the result was complete balance of forces.

With the development of this invention the greatest obstacle to large size aeroplane guns has been overcome; but there remains a certain limitation in weight. This, too, though not entirely eliminated, is greatly reduced. The very absence of recoil cylinders effects a considerable saving in weight; and at the same time the gun itself can be made as light as is consistent with strength, without thought of resulting increase in the violence of recoil, or of weakening the gun's resistance to the longitudinal stresses arising from checking the recoil. This permits the use of an exceptionally light grade of special alloy steel, of such high quality and homogeneity that it may be subjected to much higher fibre stress than steel is ordinarily expected to withstand, with a much larger factor of safety than is usual in ordnance work.

We may supplement this general discussion of principles by a statement of some of the details of construction. The gun is cast as two separate tubes, which are joined by an interrupted screw thread. The front barrel, chambered at the rear to receive the projectile, is rifled; the rear barrel is of uniform bore throughout and unrifled. Its function is to provide the necessary travel for the rear projectile. When unlocked it rotates in its mounting, slides to the rear clear of the front barrel, and swings to the right and down. These movements, effected by continuous pressure on a single handle, constitute a simple and easily operated breech-opening mechanism comparing favorably with that of the latest type of quick firing guns.

The cartridge case is of brass, in outward appearance quite like that of an ordinary piece of ammunition. The projectile occupies one end, the powder charge the mid-section, the recoil charge of fine lead shot the rear end. This charge with its wads is approximately equal in weight to the front projectile, the difference being due to the difference in frictional resistance between a solid body in a rifled bore and a more or less dispersed one in a smooth bore. Upon discharge it quickly breaks up and loses its velocity a few yards from the rear muzzle, and so is not a menace to anyone behind or below.

These guns throughout are of extremely simple design and have proved very reliable under all conditions of service. Several hundred of them, with great quantities of ammunition, have been completed and dispatched to the allied nations. While those now under construction are two-, six-, and twelve-pounders, four- and five-inch guns have been built and tested with unqualified success, and the preponderance of small and medium calibre instruments is due entirely to the fact that they are more suitable to the current types of aeroplanes, and in no sense because they represent a limit of size beyond which it would be in any way disadvantageous or impossible to go.

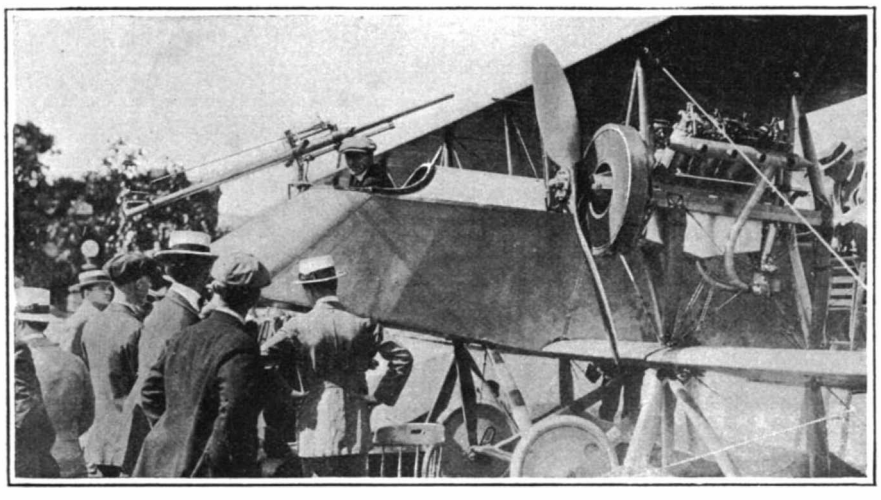
The two-pounder gun is 10 feet long and weighs 75 pounds. It shoots a 1.575 projectile with a muzzle velocity of 1,200 feet per second. It may actually be fired from the shoulder with less inconvenience than the ordinary high power rifle. The six-pounder weighs 130 pounds, the twelve-pounder 210. The latter is of three inch bore, and attains a muzzle velocity of 1,100 feet per second. These velocities, while apparently low, are in reality ample, because of the great increase in range due to the elevation. For example, the range of the twelve-pounder, when fired horizontally from a height of 5,000 feet, is 6,000 yards, three times its effective range at the earth's surface.

The practicability and effectiveness of this gun have been amply demonstrated in practice. Freed from the heavy pitching which the recoil of the ordinary gun produces, or from the excessive weight of the older types of recoil absorbers, an aeroplane equipped with it has a vastly increased freedom of action. It may fly higher and farther and faster, it may carry a greatly increased supply of ammunition, it may fire much more frequently and at the same time with equal or greater accuracy, than ever before. And it is to be remembered that the use of this novel gun is by no means limited to aircraft. It will now be possible to mount artillery of relatively large calibre upon torpedo vessels and upon motor boats and motor vehicles of every description. Indeed, so far as the science of making war has yet progressed, this gun represents the ideal type of ordnance for use on small units of any nature where extreme mobility and ease of transportation are the important considerations.

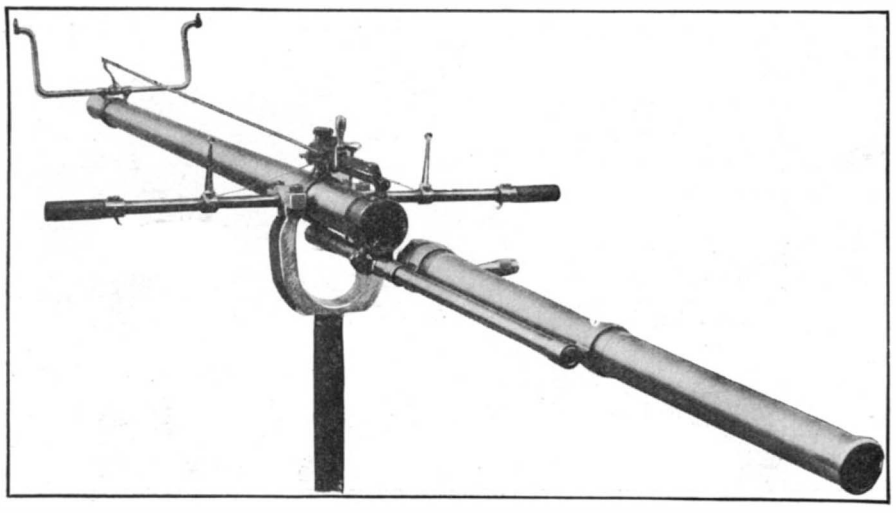
Novel Methods of Logging Employed by Lumbermen in British Columbia

A BRITISH COLUMBIA logging company has adopted what is known as the "high lead" system of logging, embracing the utilization of a combined yarding and loading engine mounted on a steel car, the steam for both engines being provided by one boiler. To accomplish the use of the "high lead" it is necessary to utilize a "spar tree" of a height of, say, 150 to 200 feet. To this tree is attached a 36-inch block through which the line is passed from the engine and carried out a distance of 600 to 1,100 feet where the logs are hooked on and brought to the railroad and loaded directly from the guy line onto the car. It is estimated that 25 cars of logs can be loaded daily with this system where conditions are favorable, giving a wide margin over ordinary logging methods.

Another system in use in British Columbia is the removal with dynamite of tops of trees selected for spars. The tree is ascended with climbing irons and the dynamite tied to the tree trunk at a point where the top is to be removed, and set off with a fuse of sufficient length to enable the workman to descend to the ground and get to a safe distance before the explosion of the charge. This method of removing the tops is said to be much safer and more economical than with the use of a saw or axe, in which case it is necessary for the workman to remain in the tree until the top has fallen.



Non- recoil gun mounted on aeroplane



Non-recoil gun with breech open for loading

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Letting the Clock Do the Cooking

IF the servant problem is to be solved in the modern American home, the solution will no doubt be in the extensive application of electricity. Just now a leading American electrical manufacturer offers a stove which is controlled by a clock, so that one can leave food in the oven and on the stove with full assurance that at the time desired the food will be cooked and when it is fully cooked will be kept warm without burning. Surely this stove must be a big step forward in eliminating the servant in the home.

What makes the present-day electric range so practical is the three-heat control for each heater, in the ovens as well as on the stove top. Where the cost of electricity is high, the fireless cooker principle used for the ovens in conjunction with the thermostat cut-off, makes the oven very economical to operate. Then again, the electric ranges are of metal and while they are so constructed that the parts cannot work loose, every part is quickly accessible for thorough cleaning, and repairs can be made quickly. But the main feature is to be found in the automatic time switch which turns on the current at any desired time, and the automatic thermostat that cuts it off.

Meals can be cooked automatically on the new electric range; that is to say, the housewife can put the food in the oven at any time of the day and set the clock for automatically turning on the current and hence the heat at the proper hour, at the same time setting the thermostat to maintain the proper temperature. Baking, roasting and boiling can be done in this way. When the proper temperature is reached, which requires ten minutes to half an hour, depending upon the temperature required, the current automatically cuts off and from then on cooking proceeds as in a fireless cooker. The heavy heat insulation about the walls of the oven—two inches of rock wool—causes the ovens to retain their heat for hours. No attention is required until the hour arrives at which it was determined the meal should be ready.

With the new electric range, breakfast can be prepared in the way just mentioned the night before with the assurance that it will be ready exactly on time. Not only does this feature make the range particularly convenient for the user, but it also makes the range an exceptionally desirable load for the central station, inasmuch as the peak of the range load comes an hour and a half to two hours before meal time.

Cooking processes that do not require much time and for which the food can be prepared in advance are performed on the stove top. For this purpose the electric range has two 8-inch and one 10-inch radiant heaters, each with a special three-heat indicating control switch. In the combination gas and electric ranges, the stove top is provided with four gas burners, one of which is of extra large size with a small, specially controlled simmering burner in the center. All the burners can be lighted instantly by means of an automatic gas lighter controlled by a valve at the front of the stove, which normally burns a very small pilot flame.

It is claimed that better cooking results can be obtained in the electric ovens than in a gas oven, owing to the fact that two heaters are provided, one at the top and the other at the bottom with baffle plates to provide a uniform distribution of heat. Pastry can be browned just as in any other kind of range. It is also claimed that food shrinks less in these electric ovens than in a gas oven, owing to the more flexible application of the heat and the fact that the oven is entirely enclosed except for a small ventilating pipe.

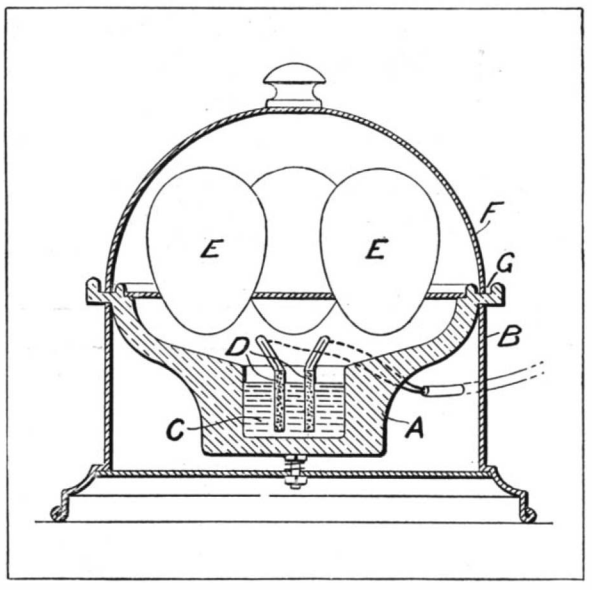
The load for the new electric range varies between 2,000 and 13,700 watts, depending upon the size and style; and the load factor is said to be less than 50 per cent. As for operating expense, a large number of tests have demonstrated that the consumption of current averages between 75 and 100 kilowatt hours a month for the straight electric range and naturally considerably less where gas is used for the stove top, as this is the most inefficient kind of electric cooking.

Using the Electrolysis Principle to Cook Eggs

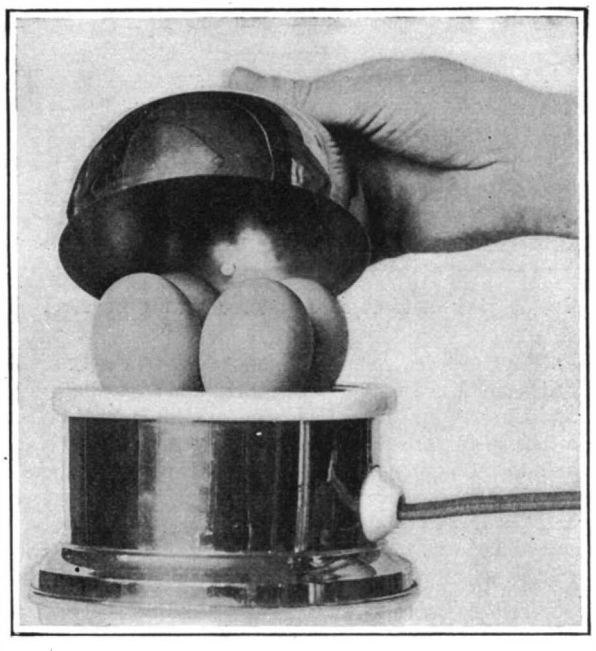
DEPENDING upon the heat developed by electrolysis of water rather than that produced by resistance wires, a newly-introduced cooking device commands the attention of those interested in electric heating devices.

Although primarily intended for cooking eggs, the new device may be employed for warming nursing bottles and other similar tasks, in which case the object is kept warm by the steam generated by the electrolysis of the water. The object to be heated is not placed in the water itself, as is usually the case. Instead, the object is placed above a small quantity of water through which an electric current is passed. The amount of water required is small; for instance, not more than 1½ teaspoonfuls need to be boiled to cook four eggs, whereas a kettle-full is necessary using other methods.

"Setting" the roast. When the clock reaches the time set on the indicator, the current is turned on



Cross-section of electric egg-cooker



Cooking eggs with heat developed by electrolysis of water

Not only does the small amount of water tend to reduce the current required to a minimum, but it also makes possible the automatic shutting off of the current when the eggs are sufficiently cooked. By measuring the amount of water placed in the heater, it is possible to determine the time when all of it shall have been converted into steam, shutting off the electric current and further heat.

The construction of the electrolysis heating device is shown in the accompanying sectional drawing. It will be noted that it consists of a nickel-plated base *B*, in which rests a porcelain dish *A* provided with a dome-shaped cover. For retaining the water that is to be converted into steam by electrolysis, a small well *C* is provided in the center of the porcelain dish. Carbon electrodes *D* are employed in order to prevent the formation of metallic salts. The top *F* fits into a groove *G*, which is sufficiently wide and deep to accommodate as much water as the well *C*. In this manner the water from the condensed steam is gathered in the groove, thus preventing the apparatus from operating indefinitely. The eggs are placed in the holes of a perforated metal plate which rests on top of the porcelain dish.

To operate the device, a definite quantity of water, based on the length of time it is desired to cook the eggs, is placed in a receptacle furnished with the cooker. The receptacle is graduated in the length of time the food is supposed to cook, and to simplify the work of measurement is perforated with a series of holes that are placed at different heights. The user's fingers cover the lower holes, leaving uncovered those at and above the level desired. In this manner the desired amount of water is readily measured.

Other forms of electrolysis heaters are being developed, for the principle lends itself well to any form of steam cooking and heating. It is particularly applicable to the warming of liquids and the sterilizing of materials and instruments.

Milk from Beans—A New Industry of China

A FIRM composed of Chinese from the Province of Chekiang has recently opened a small factory at Changsha for the manufacture of milk from beans. This bean milk has long been known to the Chinese under the name of to fu chiang or bean-curd sauce. This is not to be confused with the product known as chiang yu, a fermented sauce made from beans which is well known both as the soy of the Japanese and as one of the constituents of the famous sauces of Europe.

Bean milk is made from the small yellow beans, the same variety from which the Chinese bean curd and chiang yu or soy are made. The process appears to be a very simple one. The beans are soaked and then crushed between two stones. The crushed mass is allowed to run off into a tub and is then strained through cheesecloth and diluted with water and boiled. After boiling, it is again strained and the white milk run off into bottles and sold to the factory's customers.

An analysis of the bean-curd milk shows that it has a specific gravity of 1.020 and a fat content of 3.125, contrasted with a specific gravity of 1.029 and a fat content of 3.9 for good average cow's milk in America.

The present bean-like milk factory is a small one. The proprietors report that they do all their work at night in order to have their milk fresh for delivery the following morning. They begin their work about 10 o'clock. The milk is ready and bottled by daylight, when it is sent out by coolies to the various customers. The room where the milk is made shows that no complicated machinery is necessary. At one end of the room were found two of the small stone mills in which the beans were ground. Large numbers of bottles were arranged on a rack near the wall, clean and ready to receive the morning's supply of milk. At the opposite end of the room there were three wooden vats built into a concrete foundation, which proved to be a furnace. The prepared product is poured into these vats and boiled, the furnace being supplied with fuel from a hole in the outside wall. On either side were two earthenware jars into which the boiled product is poured and from which it is allowed to run off through stop cocks into the bottles.

The manufacturers of the bean milk appear to be endeavoring to conduct their factory along hygienic lines. It is reported that they invited inspection of their factory and expressed a desire to carry out the suggestions made by the inspecting physician. These suggestions related principally to the sterilization of the bottles before allowing the milk to run into them.

The new product is very cheap as compared to cow's milk. The factory undertakes to supply one pint each morning for approximately 50 cents gold a month. If the industry proves a success, manufacturers of milk bottles and patent milk-bottle tops should find a market for their ware at Changsha. The milk-bottle manu-

facturer will, of course, have to compete with the enormous numbers of empty bottles discarded by families who use aerated water and wines. These bottles are sold by the servants and are purchased in just such factories.

Resistance Control for Sewing Machine Motors

AN ingenious device has been placed on the market for the more perfect control of an electrically operated sewing machine. In the circuit connecting the motor with the source of power is a coil of wire with about 120 tons, of such high resistance as to block the circuit completely. This coil is placed inside a neat metal treadle-box, with a slightly curled strip of phosphor bronze above it, and under the treadle. The coil is well insulated by a special cement, except directly beneath this strip.

As the operator presses her foot upon the treadle, the strip of phosphor bronze is pushed down upon the resistance coil. By virtue of its curled contour, it does not, under a moderate pressure, come in contact with all the coils. Those with which it does have contact, however, it short-circuits, thus reducing the resistance of the entire unit and permitting the passage of some current. The harder the operator presses upon the treadle, the more of the strip is flattened out and brought into contact with the coil, the more of the coil is short-circuited, and the more current allowed to pass. With increased current, the motor, and with it the machine, goes faster. So the operator has, theoretically at least, 120 different speeds at her disposal; and the thing works in a most natural manner, for the harder she presses the faster the machine runs.

In addition to its great convenience, this device possesses the advantage of great durability. The short circuiting is accomplished with no sparks and no burning—a fault of the ordinary type of circuit maker and breaker—and there is really nothing to deteriorate.

Suspension of Canadian Patent Working Requirements

A CANADIAN order in council of recent date, amends the previous war measure concerning patents by providing that in case the working of a patent in Canada is prevented by circumstances occasioned by the war, the validity of the patent will not be affected by a failure to manufacture or construct such patented invention in Canada until six months after the conclusion of the war.

Metric System Adopted by the U. S. Pharmacopaeia

THE revised edition of the United States Pharmacopaeia which is now in preparation will make use of the metric system exclusively in its weights and measurements. In order to aid in this transition from the customary system, the United States Bureau of Standards prepared a circular on weights and measurements for the pharmacist and physician.

The Bureau also furnished the committee on revision of the pharmacopaeia with a statement on the subject of the fineness of drug powders, giving definitions of the several degrees of fineness and the method to be used in their determination.

American Trade Marks in China

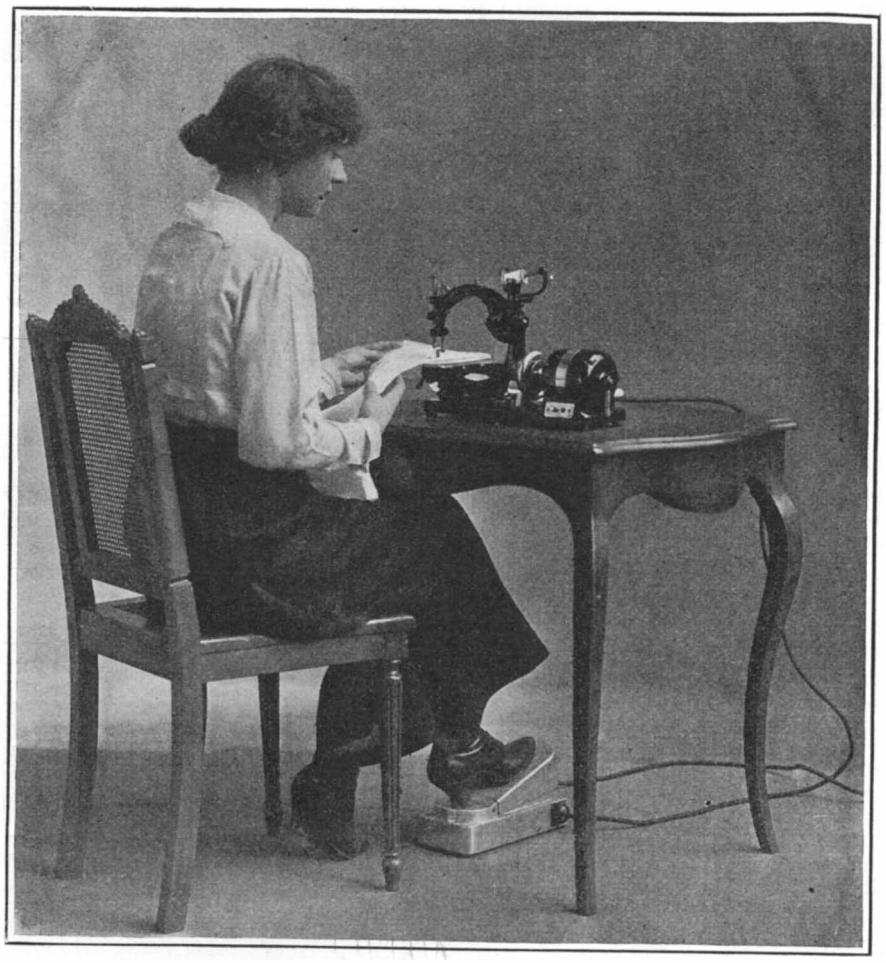
THE Chinese buyer lays great stress on the trade-mark or "chop," and once a certain "chop" has found favor with him he will give it special consideration. For this reason there is a great temptation on the part of others to imitate an established trade-mark for use in connection with the introduction of inferior goods, the result of which is the eventual disappearance from the market of the original articles. This information was received by the United States Bureau of Foreign and Domestic Commerce from its commercial attaché, Julean H. Arnold, stationed at Shanghai.

It is therefore extremely important, says the attaché's report, that the American manufacturer seeking a market in China should register the trade-mark covering his product in Shanghai through the American Consulate General and also in Tokyo, through the American Embassy, the latter action being necessary to guard against imitations by Japanese manufacturers for sale by Japanese dealers in China. As a further precaution against imitation the American manufacturer or dealer who contemplates entering the Chinese market should so embody the name of his firm or establishment in the Chinese trade-mark that the firm name and the product become inseparable. He should also always, without fail, embody the Chinese characters for "Made in America" in his trade-mark or "chop."

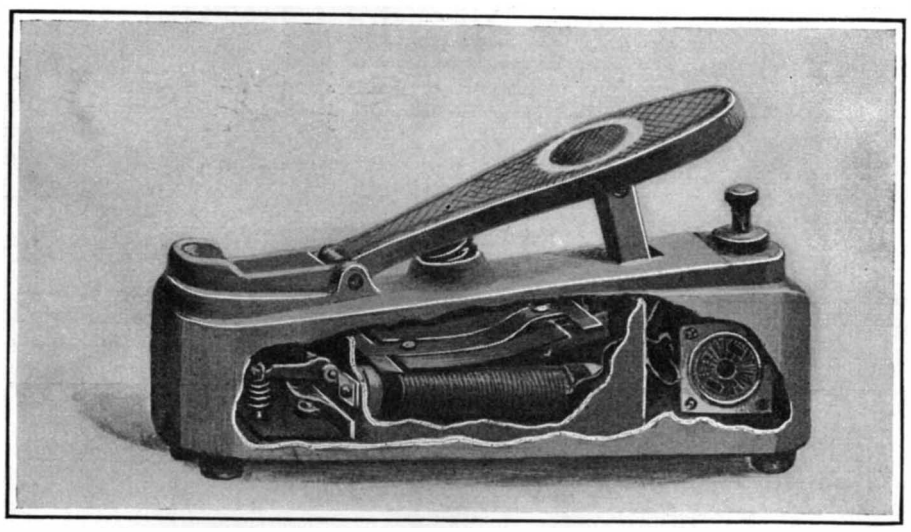
A Chinese Typewriter of Unique Design

MR. HOU CHOW, a graduate of the Massachusetts Institute of Technology, who was one of the original Chinese indemnity students to be educated in the United States, formerly aeronautical engineer for an American aeroplane company and now mechanical engineer for a printing press company of Shanghai, is the inventor of a typewriter which utilizes 4,000 Chinese characters.

The ordinary Chinese printing office uses about 6,000 characters while a complete Chinese dictionary may contain as many as 50,000. For all practical purposes, however, the 6,000 characters commonly used in a Chinese printing office are found to be quite sufficient.



Sewing with new type of treadle control. The harder she presses the faster it goes



Inside view of treadle control for sewing machine

Mr. Chow's invention has been exhibited by him at the American consulate general at Shanghai, and was found to be simple in design and portable. It should be comparatively inexpensive. Obviously, however, no great speed will be possible in operating the machine as now constructed. The 4,000 characters are distributed over an ordinary metal matrix drawn about a cylinder which is approximately 6 inches in diameter and has the appearance of being about 16 to 18 inches in length. The characters represented on the cylinder are printed on a flat table surface attached to the front of the machine, and by means of a rod attachment to the cylinder it is possible to locate any character by placing the pointer at the end of the rod above the character on the flat surface. When this is done the character on the cylinder is in exact position for securing an impression by the dropping of a hammer on a plunger. In this way several carbon copies may be secured readily.

Mr. Chow first thought of the practicability of a Chinese typewriter while inspecting American typewriters in the Mechanics Building, at Boston, as a student at the Institute of Technology. He has met with great obstacles in perfecting the mechanical part of his invention because of a lack of technical assistance at Shanghai.

Inasmuch as it would be utterly impossible to construct a typewriter having keys corresponding to the multitudinous Chinese characters, Mr. Chow resorted to the device having the revolving cylinder attachment. The first model of the machine, now exhibited, weighs about 40 pounds. By improvements which are under way the weight will probably be reduced to 30 pounds. The following statements are taken from Mr. Chow's description of his invention:

"My machine," states the Chinese inventor, "has an indicator upon which are written 4,000 characters, each occupying predetermined positions, or, in other words, each has coördinates. Now suppose we roll up the flat surface to the cylinder; the relative positions of the characters will not be changed. And if we connect this cylindrical surface and the flat surface by mechanical means, as I have done, we should be able to locate anything on the cylinders while we are locating its counterpart on the flat surfaces. This is the whole secret of the invention, so far as its mechanical development is concerned. This done, the rest is easy.

"The indicator, upon which are written or printed 4,000 characters, has an arrangement like the Kang Hsi Dictionary; *i. e.*, first according to radicals, and among the radicals according to number of strokes. Anyone who has had some experience with the dictionary or its equivalent should be able to find a desired character.

"The zinc types on the surface of the cylinder offer an exact reproduction of the characters on the indicator in reversed positions. The rotation of this cylinder gives one motion; the carriage, which carries a paper holder, and which is arranged to move transversely to that of the cylinder, gives the other coördinate motion. The long rack, which is the most essential part of the whole machine, turns the cylinder and at the same time moves the carriage. The track slides in a direction transverse to the motion of the carriage and engages a pinion with a square hole, which is rigidly attached to the carriage. The pulling in and out of the rack rotates the cylinder, while its pushing back and forth moves the carriage. The striking mechanism consists of a long square rod on the back of the rack and a hammer connected by a link and a plunger. As soon as a character is found a mere push with the thumb operates the hammer, which first presses down the plunger with a spring and then strikes. The spacing mechanism is operated by the same force that moves the hammer."

The inventor of the Chinese typewriter is of the opinion that his machine will be extensively required in Chinese offices where several copies of documents must be made. Moreover, he believes that it will be popular among the Chinese in foreign countries where it is difficult or impossible to secure the services of a skilled Chinese writer who is familiar with Chinese characters.

Sugar Mill Waste Products Converted Into Containers

TO provide containers in which to ship sugar from the Hawaiian Islands to refiners upon the American mainland, and to return potash in the same conductors to the islands, water- and fire-proof barrels are to be made from bagasse, one of the by-products of sugar mills in the islands.

Fiber board has already been made from cane from the Ewa plantation, on the island of Oahu, and is the basis of a plan which is now being evolved by a former resident of the islands, who is endeavoring to put his plan into operation.

One of the losses in sugar shipments is due to the bursting of the gunny bags. The bagasse barrel will eliminate this trouble and enable the planters to regulate their own supply of conductors by eliminating the long waits for bags that sometimes occur.

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

ADJUSTABLE SWEAT BAND FOR HEADWEAR.—L. KRONTHAL, 16 Waverly Place, New York, N. Y. This invention pertains to self-adjustable sweat bands for headwear, and provides a simple and inexpensive sweat band which coöperates with a self-adjusting band of headwear and which sweat band will automatically take up any increase in size of the headwear.

ICE CREEPER.—J. KIRKWOOD, Lenox, Mass. The invention provides an anti-slipping attachment or creeper adapted to be easily applied to a person's shoe, as, for instance, to the ball portion thereof, and whereby the person so shod will be free from danger of slipping, the device being light and neat in practical use and adapted to be easily applied or removed.

STRETCHER, — A. DOMBROWSKY, Balboa, Canal Zone. A frame is provided for engaging the opposite side edges of the superposed legs of trousers, together with means connected with the frame and movable with respect thereto for clamping the frame on the said edges, the frame being adjustable for varying sizes of trousers and arranged to permit the frame to be hung up to support the trousers.

Electrical Devices

INSULATOR.—H. H. COCHRANE, care of the Montana Power Co., Butte, Mont. The purpose here is to provide a simple, strong, efficient and durable insulator characterized by the provision of a central insulating core of fibrous nature sealed in replaceable, protective, insulating shells, so that the core therein is protected from atmospheric influence.

LIGHTNING ARRESTER. — G. W. VAN HORN. Address Curry & Spillers, Attorneys, Tusla, Okla. This inventor provides a device, especially designed to protect oil tanks and the like from the effects of lightning, wherein a series of elevated posts is provided, encircling the tank and supporting a network of conductors above the tank, the conductors being insulated from the posts and grounded to attract the charge and lead it harmlessly to the ground.

COMBINED REVERSING SWITCH AND BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES.—C. BERGMANN, JR., 511 W. 55th St., New York, N. Y. This invention relates more particularly to a switch for controlling the direction of rotation of the armature. It improves and simplifies the construction and operation of apparatus of this character, which is so designed that the circuit connections can be easily and quickly changed for reversing the direction of rotation of the armature.

Of Interest to Farmers

MEADOW TRENCHING MACHINE.—F. B. CURRIER, 248 E. Jersey St., Elizabeth, N. J. This apparatus is especially designed with the aim of causing the buckets to quickly and effectively discharge their contents, which is especially desirable in trenching machines, for the reason that the earth is heavy and soggy and is dumped with difficulty because of the vacuum or suction produced as the material attempts to drop out of the bucket when inverted, when the bucket is of that type having only one open face and compleely closed at all other points.

BOLL WEEVIL DESTROYER. — E. C. POELLNITZ, care of B. F. Gilder, Linden, Ala. The invention provides a machine wherein a supporting frame is provided, having depending pans placed apart from each other to permit the plants in the row to pass between the pans and adjustable vertically with respect to the frame, the pans being adapted to contain a poisonous solution, and wherein a particular form of dislodging means is provided for dislodging the weevil from the plants and knocking them into the solution in the pans.

FRUIT BRANDING MACHINE. — E. P. PORCHER, care of North American Fruit Exchange, Cocoa, Fla. This improvement relates more particularly to machines for stamping citrus fruit, especially grape fruit and oranges, the object being to provide a speedy, effective arrangement for this purpose, and with the attendance of a single operator, to stamp fruit of this nature without danger of injury to the fruit itself.

POTATO CUTTER.—W. S. SMALL, Charleston, Maine. An object of the invention is to provide means for holding the cups in position as they pass the knife, and for turning the cups relatively to the path of their forward movement, so that another knife will cut the potatoes at an angle to the cut made by the first-mentioned knife.

STUMP EXTRACTOR.—J. L. MORRIS and D. E. MORRIS, Gulfport, Miss. In this device fluid power is supplied to a stump lifting cylinder, the latter being supported in a portable frame so as to permit free movement thereof in any direction so as to maintain the same in a direct line with the stump being lifted, and eliminate all bending strain both upon the pressure cylinder and the connection thereof with the pump, including the rod of the piston working within the cylinder.

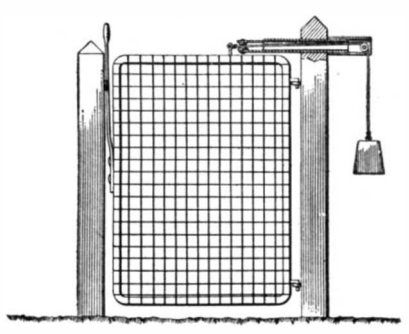
HAY LOADING MACHINE.—C. HILL, Merrillville, Cal. This improvement provides means for propelling the harvest upon a platform having a conveyor associated therewith which, when said platform is loaded, is adapted to be operated to convey the load upon a delivery incline whence it is deposited into a wagon or other vehicle.

Of General Interest

GATE.—C. WINTER, 1113 C Ave., East, Oskaloosa, Iowa. The more particular purpose here is to provide a device made entirely of standard metallic parts and so arranged that it may readily be assembled or taken apart. The gate is of a comparatively light weight and is easily operated and any part when broken or worn out may be readily replaced by a new part.

IRRIGATING DITCH.—D. H. BURTIS, 15 E. Washington St., Phoenix, Ariz. This invention provides a sectional ditch lining having the sections thereof formed so that the structure may be readily and quickly assembled and rendered watertight. It provides a check gate adapted to be placed in any desired position whereby the flow of water through the ditch may be checked and diverted through a suitable outlet pipe.

GATE CLOSER.—A. A. STILL, Annette, Cal. Mr. Still's invention is an improvement in the class of devices which are adapted to close a laterally swinging gate automatically when the gate is released by the person operating it.



GATE CLOSER

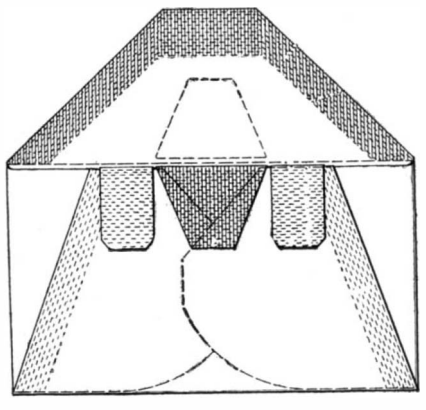
As shown in the accompanying engraving, the gate is hinged to a vertical post and is adapted to swing horizontally in either direction. The gate is provided with a spring catch which engages a catch on the opposite post.

METAL FENCE POST.—J. M. FELLOWS, care of P. S. Shayer, Agent, W. F. Express Co., Kokomo, Ind. Among the objects of this invention is the provision of a novel means for constructing a fence post of sheet metal or the like, and so bent or formed as to possess a maximum degree of strength and stiffness and with sufficient breadth to counteract the tendency of the fence to tilt laterally.

SHOPPER'S CATALOGUE. — H. B. ABEL, care of Hotel St. Louis, 34 E. 32nd St., New York, N. Y. This invention produces and supplies to the trade a catalogue having all the advantages of catalogues heretofore known with respect to detail of illustration, descriptive matter and price quotations, but in addition to have miniature designs of the main illustrations arranged at any convenient place preferably as a part of the same leaf as carries the main illustrations, such miniatures being adapted to be removed from the leaf and carried by the shopper.

REINFORCED CONCRETE TOMB AND MEMORIAL. — I. S. DAULEY, 61 Dietz St., Oneonta, N. Y. The purpose here is to provide a combined burial and memorial means which will be enduring, sanitary and give absolute protection to the human dead, which may be provided before death and which will be within the means of people who are financially unable to build a durable mausoleum and memorial above ground.

SAFETY ENVELOP.—J. BORRO, 60 Water St., New York, N. Y. This invention relates to stationery and has particular reference to envelops or other analogous wrappers for letters or the like. It provides an envelop of such a nature that it is practically impossible for it to be surreptitiously opened without detection. It provides an envelop which will automatically hold the contents of the letter spaced from the line along which an ordinary letter-operating machine operates, whereby it is practically impossible for said contents to be damaged while the envelop is being opened.



SAFETY ENVELOP

FENCE POST. — W. BRYSON, Fifield, Wis. This improvement has for its object to provide a fence post with recesses at its sides in which wires may be disposed, clamps being pivoted to the post for embracing the wires at the recesses, the clamps being normally held in position by pins which engage the clamps and which are disposed in orifices in the posts.

SURGICAL APPLIANCE. — J. L. SOWELL, Jasper, Ala. This invention has for its object the provision of an appliance for use during accouchement. The metal parts will be preferably of aluminum and the entire device is so arranged and constructed that it may be packed into a very small compass. The device is of metal with the exception of the pads, and hence is easily sterilized and the curved crossbar or yoke prevents infection during examination.

Hardware and Tools

OIL-CAN VALVE.—W. A. SCHMIDT, 903 Watson St., Lewistown, Mont. This can is adapted to carry kerosene, gasoline or some analogous oil, and from which the oil is to be dispensed into lamp bowls or other devices, an air vent being provided in the top of the can to facilitate the outflow of oil and the outlet being guarded nominally by an automatically closing valve having direct link connection with a closure for said vent.

PERMUTATION PADLOCK.—B. SNYDER, 326 E. 69th St., New York, N. Y. The purpose of the improvement in this invention is to provide a permutation padlock which is very simple and durable in construction, cheap to manufacture and arranged to provide a double safeguard against opening the padlock by unauthorized persons.

Heating and Lighting

WATER TUBE BOILER.—C. MCADIE, care of Mrs. Ida McAdie, 158 Mountain Way, Rutherford, N. J. The object of this invention is the provision of a new and improved water tube boiler arranged to utilize the heat arising from the burning fuel in the fire box to the fullest advantage, and to insure rapid circulation of the water and quick generation of steam.

SEMI-INDIRECT LIGHT ATTACHMENT. —P. SIMPSON, 138 W 116th St., New York, N. Y. This invention refers more particularly to an attachment whereby an ordinary light fixture can be easily and quickly transformed into a semi-indirect light fixture. It provides an attachment which is inexpensive and which will utilize a shade of the present ordinary fixture for obtaining the semi-indirect light effect.

GAS HEATER.—G. F. REZNOR, Mercer, Pa. This invention provides in a gas heater a fender and correlated body elements, whereby the fender will be firmly sustained, when adjusted in the normal position, at the front of the heater, the construction permitting the fender to be swung upwardly and afford convenient access to the reflector for cleaning, without wholly removing the fender, the fender, however, being readily removable when required for repair or otherwise.

Household Utilities

BEDSTEAD JACK.—O. D. FOSBURGH, 923 Pendleton St., St. Joseph, Mo. This invention has reference to beds for hospitals and sick rooms, in which provision is made for lifting the bed at the head to raise the patient from a horizontal to an inclined position. It more particularly relates to a bedstead the head of which is provided with extension legs.

EGG BEATER.—A. MOSES, 31 Jay St., New York, N. Y. This invention permits the operator to at will remove for repair or replacement any or all of the whip-loops of the beater; to roll the whipping structure in the hand during the employment of the beater in service; and provides a construction, the parts whereof may be separated in their structural elements.

EXTENSION TABLE.—C. P. CUNNINGHAM, care of Voss Table Co., Louisville, Ky. This inventor provides an extension device designed to facilitate the adjustment of the table to different sizes and prevent warping of the parts, which sometimes occurs in ordinary constructions. He also provides a device of this character comprising a bridge piece and slides movable relative thereto and so constructed as to be readily detached therefrom.

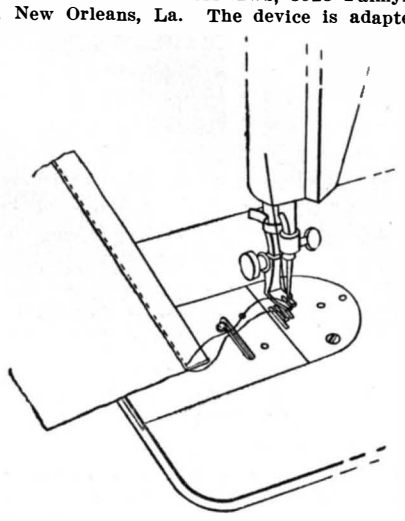
Machines and Mechanical Devices

FIRING APPARATUS FOR SUBMARINE MINES. — GIOVANNI E. ELIA, Rome, Italy. This invention relates to a firing gear for submarine mines and relies for its operation upon the fact that a spherical or circular mine rotates by contact with the hull of a vessel. It provides an apparatus which is thoroughly reliable and efficient in use, composed of comparatively few parts, which are easily constructed and assembled, and so designed that a high degree of safety is maintained in the launching or placing of the mine.

BLINDSTITCH TAPING ATTACHMENT FOR SEWING MACHINES.—J. F. HIGGINS, 226 Utica Ave., Brooklyn, N. Y. This invention provides an attachment whereby taping with invisible stitches can be easily, quickly and effectively accomplished, the feed of the tape being entirely automatic, so that the application of the tape to a fabric is as simple as making an ordinary seam or hem with a sewing machine.

CHANGE-MAKING MACHINE. — C. MCDERMOTT, Manalanan Ave., Freehold, N. J. This invention has reference more particularly to an electrically operated machine whereby the delivery mechanism and the controlling mechanism can be located at any different suitable places. Any change within one dollar can be easily and quickly delivered by the displacement of a proper button associated with a selector.

THREAD-CUTTING BLADE FOR SEWING MACHINES.—C. D. MATTHEWS, 3923 Palmyra St., New Orleans, La. The device is adapted to be applied to the foot or cloth plate of a sewing machine so as to enable the operator to quickly and conveniently cut the thread and to avoid undue waste of the latter, the cutting device being in the form of a blade which is set into and extends longitudinally of a slot in the plate and is secured to the under side of the latter in any desired manner, with the free end of the cutter disposed above the plate and shaped so that the threads can be engaged under the cutter, which has its lower edge sharpened and inclined, so that by drawing the thread longitudinally of the cutter the thread will be effectively cut.

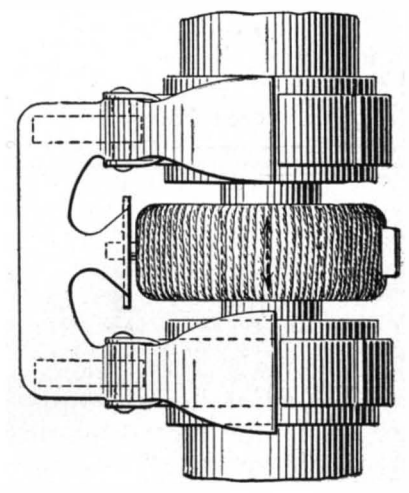


THREAD-CUTTING BLADE FOR SEWING MACHINES.

Prime Movers and Their Accessories

FEEDING APPARATUS FOR INTERNAL COMBUSTION MOTORS.—E. H. ARQUEMBOURG, 71 Rue du Moulin Vert, Paris, France. This invention has for its object a feeding device for internal combustion motors, constituted in such a way as to furnish to the motor a quantity of liquid fuel always strictly in proportion to the quantity of air sucked by the motor, whatever may be the speed and power of this motor, and thus remedy a number of inconveniences.

NUT LOCK AND SWAB.—J. D. VIRUETTE, care of A. L. Kellogg, Oneonta, N. Y. This invention relates to the piston rods of air compressors, and the main object thereof is to provide a lock for the nuts on such rods whereby the packings of the said air compressors are held against leakage. The invention also contemplates the provision of a swab on the piston rod and means on the nut for maintaining said swab in position.



NUT LOCK AND SWAB.

EXPLOSIVE GAS ENGINE.—O. DERR, 83 North River St., Wilkes-Barre, Pa. The main object here is to provide an engine which will develop relatively greater power than engines now known to this inventor because of the possibility of higher degrees of compression in his engine at all times during the operation thereof, of the maintenance of such high pressures, and the sizes and arrangement of the valves to insure great freedom of gas flow, comparative freedom from noise, and less liability for breakage of the valves by being hammered on their seats.

PACKING BOX.—W. T. SNELL, care of Snell Machine Works, El Paso, Texas. Mr. Snell's invention relates to packing boxes for outside packed plunger pumps, piston rods and valve stems, of the class shown and described in his Letters Patent of the United States, Nos. 1,018,938 and 1,057,363, and the main object of his invention is to provide an improved and simplified form of such devices.

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.

The Life of a Naval Volunteer

(*Concluded from page 279*)

hammock of another messmate who had cautiously swung his hammock lower down.

The first day was spent in learning where and how to eat and sleep, the location of the "scuttle butt," which in our navy is a modern drinking fountain, and the quarters of "Turps," the painter, "Chips," the carpenter, "Sparks," the radio man, and also in learning the gear about the ship.

The drills and lectures commenced the second day, and covered every department, each volunteer during his week in the engineering department being assigned to the ice machine, the evaporator, or some other piece of machinery, where he worked under the guidance of trained men. But, in addition to the work in the engineering department, the volunteer, when his division was assigned to deck duty, was detailed to serve in some particular capacity, the volunteer being permitted to perform the work alone when possible, and in other cases working under the supervision of a man from the ship's company who accompanied the volunteer, so that the volunteer might be instructed. In this way every volunteer obtained a general knowledge of the machinery of the ship and of the duties of the quartermaster, the steersman, and the other men on the bridge. Every volunteer also served at some period as a guard, a side boy who decorates the quarterdeck and stands at attention at the sides of the gangway when officers of rank come aboard; a time orderly, who strikes the ship's bell after first obtaining permission from the officer of the deck; the captain's orderly, who follows the captain about, ready to run errands,—the captain's orderly standing at the door when the captain goes into his cabin, to stop everybody and to carry to the captain any message which may be sent to him.

Every volunteer also had to practice at some gun, and all had practice as pointers and trainers during the subcaliber practice with the three-inch guns. In pointing a gun, the pointer looks through the telescope at the left of the gun, and elevates or depresses the gun to keep the wires where they are crossed in the telescope on the target; the trainer looking through the telescope at the right of the gun, and moves the gun horizontally until the wires in his telescope are crossed on the target. The captain of the gun handles the breech plug, and the sight setter stands with telephones at his ears ready to adjust the sight dials at the word of command from the plotting room; and in addition there are shell men and powder men, their number depending on the caliber of the gun and its location. Almost every volunteer had an opportunity to practice not only as a pointer and a liner, but in almost every other capacity.

The language of the ship cannot be learned in a moment, for while a good guesser will draw the inference that when he is pulling on a rope and the officer orders him to "avast," he should stop pulling, and when another officer tells him to "belay" something which he has previously told him, he should neglect the previous statement, it is much more difficult to interpret other orders. For many days the volunteers were running all over the ship every time the bugler or bos'n would sound a call, trying to find the right thing to do.

If one wants to purchase good stuff at low prices he should join the Navy, for at the ship's canteen you can purchase for six cents a cigar which on shore would cost fifteen cents, and everything else is sold at the same low rate, including grape juice. They also sell at low prices "tailor-made" cigarettes, but on the cruise these were sold out very shortly, which made it necessary for the volunteers to roll their own cigarettes for a considerable period.

While it would be foolish to say that in a month's experimental cruise a landsman could be transformed into a sailor, nevertheless the volunteers obtained a very good perspective of life in the Navy,

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CHIEF CHEMIST—EXPERIENCED in chemical research, mechanical design and scientific management, is open for engagement as chief chemist, superintendent, or in sales department. E. J. B., P. O. Box 2, Grand Central Station, New York City.

and much information which if added to by winter drills and lectures should make it possible for the volunteer to specialize in the cruise next year. Everything in the Navy is highly specialized, and if a man is an expert as a signal man, a gun pointer, or in some other capacity, and has a good general knowledge of the ship, he comes up to specifications. A yearly cruise should supply the volunteers with a good knowledge of life aboard a ship, but in order that good and substantial results may be obtained, the yearly cruise must be supplemented by considerable study and drill to train each volunteer for work in some special line.

It is to be hoped that the cruise this year will be repeated many times, and that, in addition, the Navy Department will find some means to give the volunteers special training during each winter.

[Next week's issue of the SCIENTIFIC AMERICAN will contain a description of the work of the motor boat squadron which coöperated with the ships of the naval training cruise.—ED.]

NEW BOOKS, ETC.

A TEXT-BOOK OF PHYSICS. Edited by A. Wilmer Duff. Philadelphia: Blakiston's Son & Co., 1916. 8vo.; 692 pp.; 609 illustrations. Price, $2.75 net.

The fourth edition of this standard work embodies many changes and additions, simplifying and bringing up to date such subjects as the dynamics of rotation, and introducing new material as in the case of the subject of sound. A somewhat novel feature of the work, it may be said for the benefit of those who are not familiar with it, lies in the fact that various experienced teachers are responsible for various sections, and the work as a whole had to satisfy all these contributors before being submitted to the publisher. Each writer has conscientiously endeavored to express himself tersely and clearly, and generally with an enviable measure of success. The text represents a rather long single course, but may readily be used for briefer courses by making certain omissions which the arrangement of the work, and the use of two sizes of type, greatly facilitates.

HOW TO BUILD UP FURNACE EFFICIENCY. By Jos. W. Hays, Combustion Engineer. Published by the Author, Rogers Park, Chicago, 1916. 12mo.; 158 pp.; illustrated. Price, $1.

"Your paper is too technical. Let us have something that the great mass of our readers can peruse with interest and profit." This was the editorial criticism on a manuscript of Mr. Hays, and in consequence his rather numerous booklets have a slangy cheerfulness that seems to have achieved its object, for the little work in hand is in its tenth edition. To do the author justice, his method would not have taken him far had it not been combined with solid good sense, exact knowledge, and sensible remedies. He urgently directs attention to the boiler room, tells you exactly how the fuel is wasted, and explains methods of finding and stopping these wastes, and of keeping them stopped. An appendix deals with oils, gas, wood refuse, and other fuels.

THE FARM MORTGAGE HANDBOOK. By Kingman Nott Robins. Garden City, New York: Doubleday, Page & Company, 1916. 12mo.; 241 pp. Price, $1.25 net.

There is a wide and increasing interest in the subject of rural credit, although comparatively few realize the essential differences between mortgages on farms and mortgages on urban real estate. The author, an expert in the subject, sets forth every phase of the question, imparting a thorough knowledge of facilities, needed legislation, the negotiation and marketing of the mortgages, and their quality as an investment. Investors who would familiarize themselves with this form of investment cannot do better than study this exceedingly well-written treatise. Forms for loan applications, mortgage deeds and assignments, and mortgage notes are given in the shape of inserts to the volume.

Freezing as an Aid in Poison Analysis

THE expert chemist is increasingly called upon in these days to assist the law in the determination of guilt in murder cases due to poison. Sometimes it is several weeks after a seemingly natural death before the finger of suspicion points to the possibility of murder by poison, with the result that the body of the supposed victim is ordered to be exhumed, so that its viscera may be subjected to qualitative and quantitative analysis.

Obviously the task of the analytical expert is not only gruesome, but highly unpleasant physically, because of the nau-

seating odors from the putrefying mortal remains which he must work with, and which often need a good deal of manipulation in the difficult and disagreeable process of reducing them to a state of sufficiently fine division. This process of homogenization, as it is called, can be greatly facilitated and also robbed of its offensiveness, according to a French scientist, Mr. G. A. Le Roy, by the simple device of previous congelation. As reported in the *Annales des falsifications* Mr. Le Roy states that after a sojourn of a few hours at a few degrees below the freezing point, such putrid animal matter can be cut, sawed, pounded, or ground up without discommoding the operator by nauseous odors. Thanks to this method the matter to be analyzed can be easily reduced to a snow-like pulp or a dry powder, having scarcely any odor, perfectly homogeneous, and readily acted upon by the usual solvents. He also recommends such congelation in laboratories and food experiment stations charged with analyzing alimentary, agricultural, or pharmaceutical products. It facilitates the mechanical division and homogenization of substances which are neither soluble nor liquefiable, but have a pasty, fibrous, or elastic consistency, such as meats, conserves, sausage, soft cheese, fruits, vegetables, etc.

Laurel Root as a Substitute for French Briar

OUR Government has consummated the sale of a large quantity of mountain laurel roots from one of the National Forests in the Southern Appalachians which are to be manufactured into pipes.

The mountain laurel root is similar in appearance to the French briar, which the majority of pipe smokers are said to prefer. The French briar is the root of the white heath or "bruyers." These roots are gathered in large quantities, and after being cleaned and sawed into blanks they are placed in hot water and simmered for 12 hours or more. This process gives them the rich hue for which the best pipes are noted. It is said that in 1915 the value of the blanks shipped to this country was almost $500,000, and in addition a large number of finished pipes were imported.

On account of the present scarcity and high price of French briar, a number of pipe manufacturers in this country have been on the lookout for substitutes, and the Forest Products Laboratory has conducted experiments to determine the availability of other woods. It is stated that the mountain laurel root burns out more readily than briar, but Forest Service experts are trying to find a method of hardening the wood, and have succeeded to an appreciable extent. They have also found that a number of the various kinds of chapparal which are abundant in the West give promise of yielding material which will be the equal of French briar in every way. Other woods now widely used for pipe making are apple wood, red gum, ebony, and birch, together with smaller amounts of olive wood, rosewood, and osage orange.

Considerable amounts of the laurel roots are being used, and officials expect to make further sales.

The First Dutch Annual World Fair

THE Utrecht fair—the first Dutch annual world fair—(after the model of that of Leipzig), is being postponed until next spring at the instance of the many intending exhibitors who consider the time for preparation too short if it were to be held this autumn.

It is, therefore, postponed from September-October until February 26th-March 10th, next spring. It promises to be a great success.

New Fly in Europe

THE red fly of Greenland has made its appearance in N. France. It has been seen in Holland. It is supposed it was brought over to Europe by the horses of the Canadian troops. Already it is causing quite as much inconvenience as its European cousin, the house fly.

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