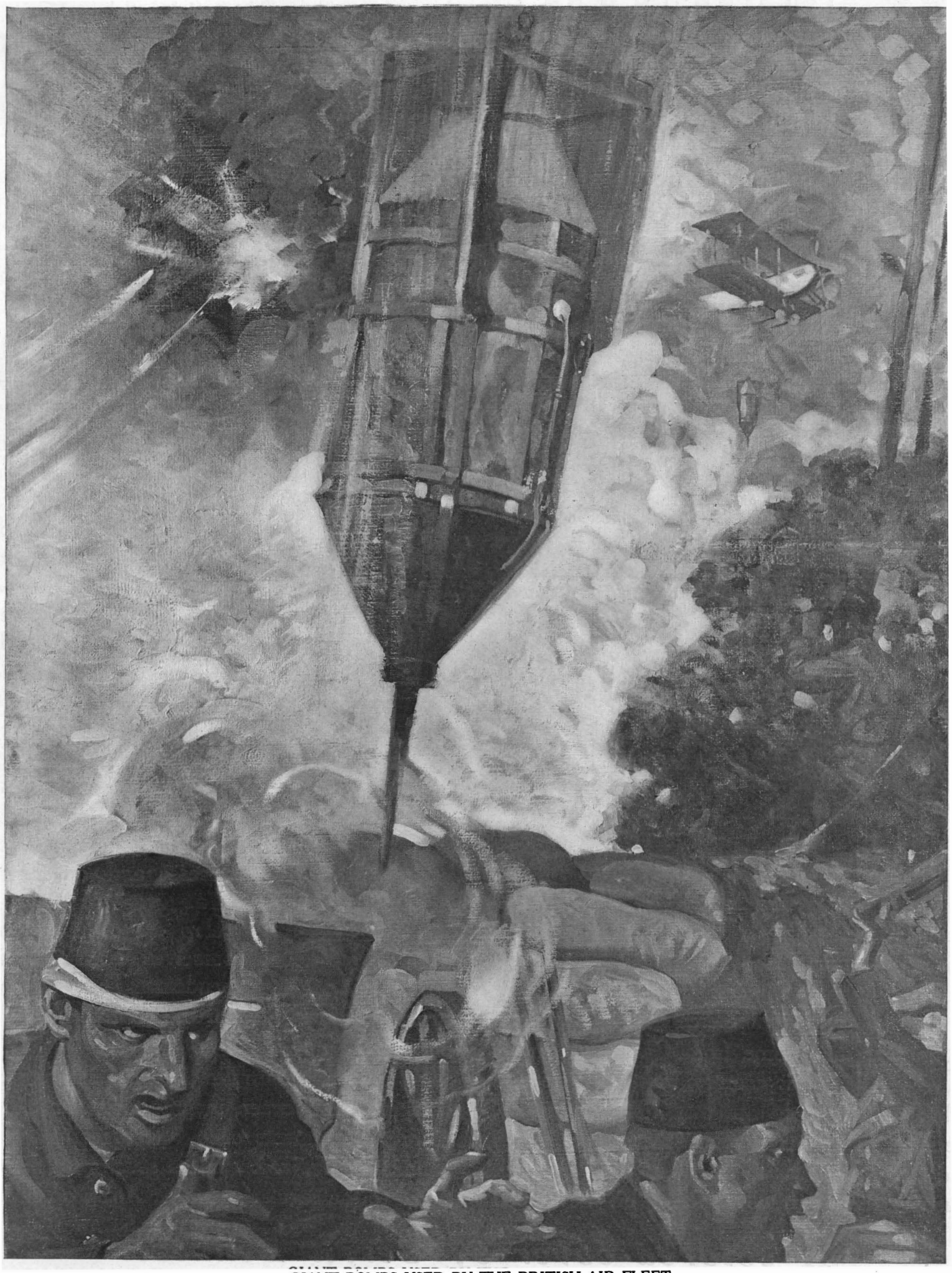
# SCIENTIFIC AMERICAN



GIANT BOMBS USED BY THE BRITISH AIR FLEET

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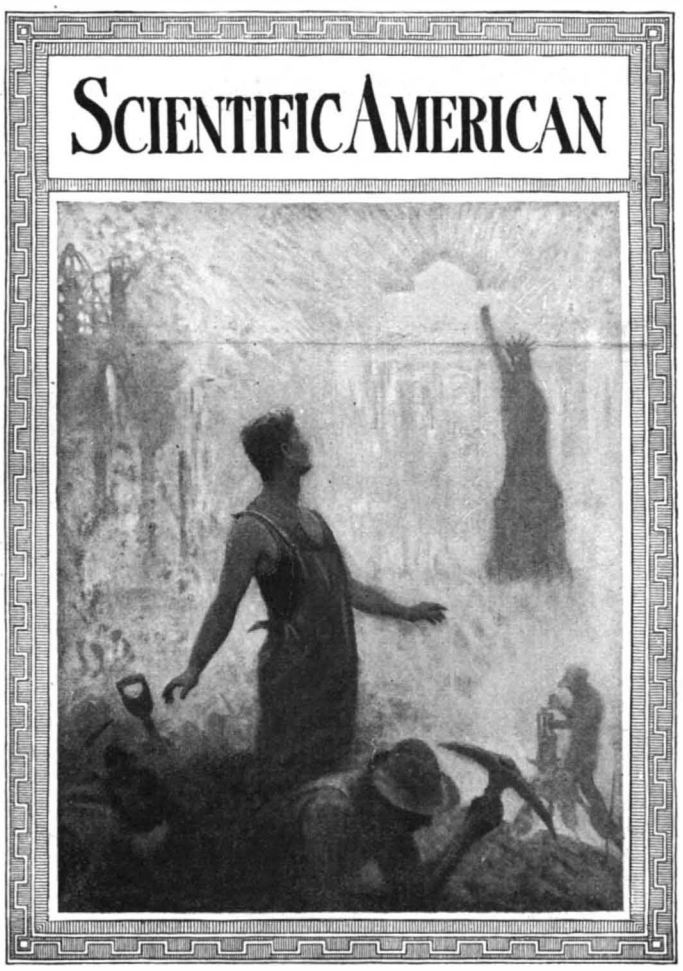
# INDUSTRIAL NUMBER

## SCIENTIFIC AMERICAN

**MARCH 4th, 1916**

NEVER have the people of the United States faced a more critical period in their industrial and commercial development. Never have we beheld a more glittering prospect of untold prosperity. But it is not to be ours for the asking. We must exert ourselves to the utmost or we shall lose it.

We must exercise all the ingenuity and resourcefulness, for which we are famed. This is a time for action. We must wake from our lethargy and seize the opportunity that lies before us. We dare not procrastinate. The peoples of Europe are not so blinded by the fury of war that they have forgotten to prepare for the commercial developments that will take place immediately after the declaration of peace. German ships are ready, on the instant of release, to carry into our markets and all over the world, the products that have been accumulating during their present state of siege. England is awaking to this situation and is considering measures that will assure to herself a giant share of the world's commerce despite any competition that may come from Germany. In the meantime, we, in this country, must take steps to establish ourselves in our own home industries, especially in the new ones that have arisen since the outbreak of the war, and in other industries that rightfully should be developed in this country and that may be developed if we seize our opportunity in time.




In order to bring this clearly to the attention of everyone in the United States, the *Scientific American* will publish a special *Industrial Number* on March 4th. Articles are being prepared by specialists which will tell how we may develop our national efficiency to a higher plane. They will tell of the enormous natural wealth of this country. No country is endowed with greater resources. In no country is the efficiency of labor higher. There will be articles on our new industries and on industries that we should develop in order to make ourselves industrially independent. There will be instructive information on the enormous wealth in our waste heaps.

By concrete examples the vital importance of co-operation between manufacturers and the research departments of our technical institutions will be emphasized. These articles will be additional to the regular *Scientific American* material.

***A colored cover by Gerrit Benneker***

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SEVENTY-SECOND YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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## Taking Salt from the Sea with Modern Methods

**By Paul H. Dowling**

IT seems a long way and a great transformation from the ocean water of San Francisco Bay to the contents of the salt shaker on your dining-room table; yet the process is not so remarkable when you consider that it all takes place right at the shore of the ocean, beginning with the filling of the ponds, at the edge of a bay, with water and ending half a mile away with the shipment of minute crystals of shaker salt from the refinery.

During the past ten years the progress made in the American salt industry has been great. In April, 1905, salt making on San Francisco Bay was described in an article by Enos Brown in the SCIENTIFIC AMERICAN. At that time, water was brought from the bay into the ponds at the rise of the tide by grotesque-looking Chinese windmills, and the crystallized salt was wheeled into the refinery in wheelbarrows. To-day, in marked contrast, gasoline engines pump the sea water into the ponds and gasoline locomotives draw long trains of specially constructed cars out over the hard beds, along the dikes and up to huge piles of the product lying beside the refinery.

The gasoline locomotives employed in the salt works to haul the salt trains from the beds to the heaps are interesting in themselves. Hardly larger than the toy trains that haul small cars around a summer resort track, their gasoline motors possess considerable power; in fact, the locomotives can readily draw a dozen or more heavy cars to the dump. Here a bucket lift takes the crystallized deposit to the top of the heap where a horizontal screw passes it on out to the proper place on the piles. About 25,000 tons of salt is represented in the large heaps appearing in one of the accompanying illustrations.

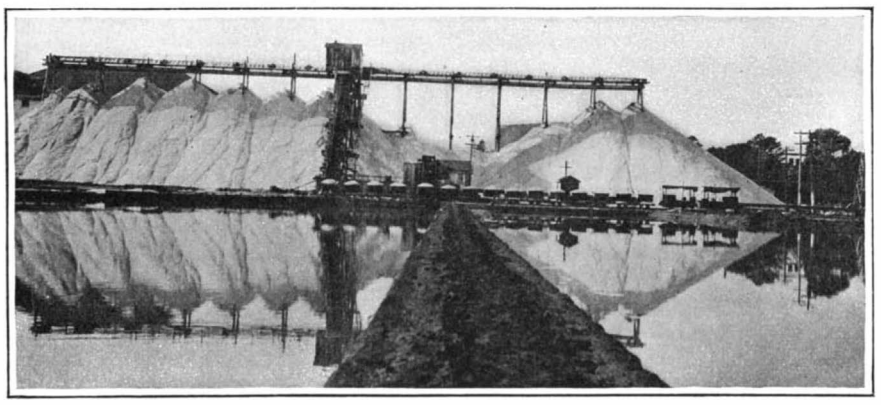
The plant at Leslie, just south of San Francisco on the peninsula, while a representative one from the standpoint of methods employed, is only one of a great many on the Pacific coast. There are a dozen or more across the bay and several farther south, at San Diego. Conditions seem to be almost ideal, however, near San Francisco, for humidity and temperature at that location are highly favorable to evaporation.

The sea water is usually brought into the ponds nearest the bay in the spring and winter and then allowed to saturate gradually until the following season. As the brine reaches a certain density, it is transferred through canals and trenches into the next basin up the line toward the refinery. When it reaches 75 to 80 deg., the brine is transferred to the settling basins and becomes a saturated solution. It then goes to the salting ponds where the salt is deposited and the water remaining allowed to run off into the ditches. Thus a continual process is going on; the water running through the various ponds until it finally reaches the salting pond. The water starts to make salt only after it has reached a percentage of 105 or 106. While water is being taken in at the first ponds, the water which was taken in some months before is going through the final stages of super-saturation.

In the ponds where the salt has finally become crystallized, there is a soft, black ooze beneath, and one's feet sink into the mass much in the same manner as they would sink into slush covering a pond of ice. The crust which has formed on top is somewhat like a hard crust of snow formed by rain and freezing, and in some places is as hard as ice itself. The salting ponds which have become solidified in this way have an appearance comparable to a skating rink which has become covered with snow or a rough layer of ice.

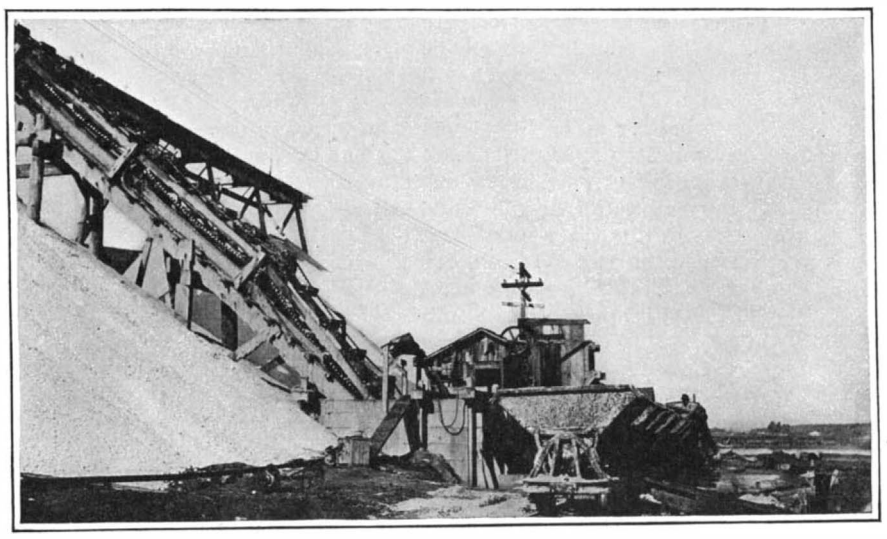
The tracks for the small trains are merely laid down on long boards which can be moved from place to place over the salt beds as the workmen shovel the salt from the ponds. While one train of cars is being loaded at one side of the pond, the two small engines are hauling another train from a second track down to the heaps.

The transformation from pure ocean water to the heavier solutions is shown in the color of various ponds. In the outer basins, the water is as clear as that of the bay, and sea gulls and ducks swim around as if on the bay itself. Farther in, in the settling ponds, the water takes on a yellow color, which becomes still deeper in the super-saturated solutions. In the salting ponds the water appears almost coal black under the white crystals which have formed above it.



Heaps of salt aggregating 25,000 tons, lying beside the refinery at one of the California salt works

Loading salt into cars for transportation from the salting ponds to the heaps beside the refinery



Removing the salt from the cars and transporting it to the top of the heap by a bucket hoist

## Apparent Death in the Realm of Microbes

**By Our Berlin Correspondent**

IF the conditions of life of a given organism are impaired to the extent of interfering with the most necessary vital processes, the organism, in most cases, will die. Some few organisms, however, are capable of passing into a condition of apparent death or *anabiosis*, in which no sign of life can be recognized even with the most refined means of observation.

In an article recently published in a German daily (see *Vossische Zeitung*, September 19th), Adolf Koelisch discusses some remarkable experiments made by E. Schultz and A. Singol, of Petrograd, which would seem to solve, in part at least, the much-debated question as to whether the mechanism of life, in the state of anabiosis, is actually arrested or if there are traces left of certain vital functions.

The experimenters dried roundworms out so thoroughly as to make them flat as paper strips, and after soaking them in water, allowed them to wither once more. The dried-out worms, in order to ascertain the condition of their inner organs, were then cut into thin slices. Though all the liquid had been evaporated, the tissues were found to be capable of swelling again, all parts immediately assuming a quite normal condition, as though the animalcule "had been snatched out of the midst of life, being capable of continuing its existence at a minute's notice."

The water thus had actually disappeared from the organs. In order to ascertain how matters stood with respiration, the exchange of oxygen between the dried-out mass and its surroundings, the experimenters locked some dried-out threadworms, rotifiers and other microbes, which for eight months had been kept in the state of anabiosis, in an air-tight box, in which all traces of atmospheric oxygen were replaced continually by an uninterrupted flow of purified hydrogen allowed to pass over the animalcules during a fortnight. Everything was thus done to isolate the microbes from any contact with oxygen. After a fortnight, the would-be corpses, on being moistened with water, were found not only to resuscitate, but to resuscitate more readily and more rapidly than those not treated with hydrogen. Hydrogen mummies would be restored to life after fifteen minutes, whereas others took forty minutes. All, however, were quite healthy, and all experiments invariably led to the same results.

How is this puzzle to be interpreted? Details of the process will have to be ascertained by chemists; suffice it to say that, as proved by these experiments, it is by no means immaterial for the dried-out living substance, whether it is kept in an atmosphere of oxygen or hydrogen, nor is it immaterial whether it is kept in the state of anabiosis for some length of time or only temporarily. Both facts, however, are hardly compatible with the supposition that every trace of vital functions is actually extinct in the state of rest; on the contrary, the variation in the time of resuscitation shows that in the dried-out cellular system, during the period of apparently complete rest, there are ceaseless changes going on.

This shows that animals in a state of anabiosis cannot well be likened to engines temporarily stopped by cutting off the supply of fuel, and life thus asserts its superiority over any purely mechanical systems. While an engine requires the same amount of energy to be set working, irrespective of the length of its period of standstill—provided it has remained unaltered—those animals are revived with the more difficulty as they have been longer at rest.

The experiments referred to are of great interest not only for their immediate value but also for the additional knowledge they furnish on the subject of death, of which so little is known even at the present day.

# SCIENTIFIC AMERICAN

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

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

## Preparedness and Our Merchant Marine

NO matter how the problem of our merchant marine is viewed, no matter from what angle it is approached, only one solution can be reached. It must be built up now, as it was built up in the beginning, with substantial government aid. Washington, Adams, Jefferson, Madison, all fostered the infant shipping industry of this country by preferential duty. Then, later, when Great Britain came to the rescue of its shipping with a subsidy, this move was promptly met, and under a Democratic President, too, with the payment of an equal and even greater subsidy to American vessels, and our ships continued to maintain their enviable premier position in the handling of the world's commerce.

Not until the intersectional political strife between the North and South cut down these subsidies did our merchant marine begin to decline, and British shipping to gain the ascendancy. This was in 1855, six years before the outbreak of the Civil War. It was not the war, but our desertion of American shipping interests, while it was struggling in competition with foreign subsidized vessels, that swept the Stars and Stripes off the seas. This is a point in history which does not seem to be appreciated by the public at large. It is brought out very clearly in a paper on "The American Merchant Marine, What It has Been, What It Is, What It Ought to Be," that has just been published by the Boston Chamber of Commerce. This paper is republished in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT because it is one of the most lucid expositions we have seen of the cause of the rise and fall of our merchant marine. The paper shows very clearly that some form of well-regulated subsidy is absolutely essential to the upbuilding of American shipping.

Unfortunately, the idea of a subsidy is particularly repugnant to certain sections of the country. We can tolerate a tariff which is just as truly a subsidy, although it may not be so readily apparent that the revenues are collected out of the pockets of the general public; but whenever the word "subsidy" is mentioned we picture our Government officials reaching into the pockets of the public for money to pay a few privileged individuals. Why should the public be concerned with the nationality of the boats that carry our commerce? Why should we draw large sums from the national funds merely to have our flag wave over the seas? These are questions that are asked by individuals who are not broad-minded enough to realize that every flourishing industry and every prosperous commercial development is bound to react upon the general prosperity of the nation.

However, laying aside this argument, it should be sufficiently clear to every one in these trying days, that the merchant marine is a *national necessity*. This is a lesson that has been rudely and painfully administered us by the present war. The Spanish War should have taught us the need of a large auxiliary fleet. The recent expedition to Vera Cruz pointed out that necessity. Now, however, we learn that not only in war, but even in time of peace, we are sadly in need of ships, which cannot be bought at any price, while the principal European nations are at war. A subsidy, therefore, is not to be viewed merely in the light of protection to our shipbuilding plants and shipping companies; it is rather the price that must be paid by our people for a most important adjunct to our navy, for service in time of war and for the security and independence of our trade while other nations are at war.

In order to build up our merchant marine we need a campaign of education. In the case of an invalid the physician must have a complete record of the history of the case before he can prescribe intelligently to the needs of the patient. Our people must have a better comprehension of the needs of our merchant marine before Congress will be likely to pass laws that will lighten the burden of the past and change the condition of sea service so that this trade will become sufficiently profitable to induce capital to invest in an industry which our continental position and immense littoral and our great foreign commerce entitle us to.

The paper, which will be published in the SUPPLEMENT of January 29th and February 5th, is recommended to every one who would be informed on this problem of vital national interest. Indeed, it is the duty of every American citizen to acquaint himself with the situation before us and how it has come about.

## The Peril of the Submarine

IN the submarine, modern warfare has reached a climax of frightfulness. Not only is the submarine frightful in the destruction it metes out to the enemy, but in the horrible death it is ever ready to hurl at its own crew if, for a moment, they should relax their vigilance. It has increased the difficulties of navigation tenfold by the addition of a third dimension to its direction of travel. Stone blind, in pitch black darkness, it must be guided through the depths of the sea, liable at any moment to be crushed against an uncharted rock or to bury its nose in a bank of mud from which it cannot be worked free.

But as if these perils were not enough, the submarine carries within its tight little hold stores of pent-up energy, ready to be discharged at the slightest provocation. Death lurks in the warheads of the torpedoes, any one of which is powerful enough to shatter a dreadnought and send it plunging to the bottom. Danger lies in the reservoirs of highly compressed air that are indispensable to the navigation of the boat; in the liquid fuel used to drive the engines when the vessel is on the surface; in the electric batteries that turn the motors when the boat is submerged. These last may seem the safest of the lot, but it is impossible to store energy without danger. Hydrogen is generated when the batteries are charging and discharging. The charging is done when the boat is on the surface, and it is comparatively easy to get rid of the gases, but when the battery is giving out its energy to the motors and driving the vessel under the sea, all the hatches must be closed, and it is impracticable to discharge the gases out of the boat. A ventilating system must be used to carry them away from the batteries and dissipate them throughout the hold of the vessel. A still further danger of the battery is the possibility of letting salt water come into contact with the electrolyte, which would result in the generation of chlorine gas and the poisoning of the crew.

It was with the purpose of eliminating this last danger that experiments were made with the new type of battery. The nickel-iron Edison cell uses an electrolyte consisting of caustic potash, or lye. No dangerous reaction takes place when salt water comes into contact with this electrolyte. However, this danger is already practically non-existent even in lead batteries, because as they are now constructed there is absolutely no danger of leakage, and not until the hold of the vessel is filled with water to a level of several inches above the top of the big batteries is there any possibility of forcing salt water into them. When a submarine has reached as serious a condition as this the chances of the crew are decidedly hopeless, even though they be not exposed to the danger of poisonous gases.

While intending to eliminate one danger, however, the nickel-iron battery has intensified another danger. Fully twice as much hydrogen is given off by the Edison battery as by the standard lead battery, which is practically universally used. Furthermore, as the carbonic gas in the air has an injurious effect upon the caustic electrolyte, the individual cells of the battery are not properly ventilated. This results in the formation of an explosive mixture of hydrogen and oxygen gases which is always confined in the cells.

The explosion in the E-2 the other day was undoubtedly due to the large volumes of hydrogen given off by the Edison battery while it was being subjected to tests. Such was the finding of the Board of Investigation. At present writing the Board of Inquiry is still continuing its hearings and has not yet fixed the blame for the accident. However, it is readily apparent from the findings of the Board of Investigation that the nickel-iron battery, while adding practically nothing to the safety of the submarine, introduces an element of danger which does not exist in the lead-type of battery.

## The Libraries of Washington

IT is doubtful whether any other city in the world has so great a number or such a variety of public and quasi-public libraries as Washington, and especially so many large collections of books devoted to particular branches of knowledge.

The average visitor to the capital finds his way, as a matter of course, to the Library of Congress, and is duly impressed by such facts as that this institution, with its hundred miles of shelving, representing a capacity of 3,540,000 books and 84,000 volumes of newspapers, has at present a collection numbering about 2,250,000 volumes. From these figures he is apt to conclude that every class of literature is almost exhaustively covered by this institution, and that the national library is therefore the most likely place to find any particular work, or works, on any particular subject. The fact is, however, that the Library of Congress is a poor place to seek books on a great many subjects.

Washington is a city of special libraries. Thus it happens that the geologist does not go to the Library of Congress for the literature of his science, but to the library of the Geological Survey, which contains 90,000 books and 100,000 pamphlets, dealing almost exclusively with geology and closely germane subjects. The medical man finds only an insignificant collection of medical literature in the Library of Congress, compared with the half million medical books and pamphlets in the library of the Surgeon General of the Army—the leading medical library of the world. The most nearly complete collection of United States public documents extant is that contained in the library of the Superintendent of Documents, which is attached to the Government Printing Office. It numbers 147,855 books and pamphlets, and 16,289 maps. The library of the Department of Agriculture contains about 131,000 books and pamphlets on agriculture and other branches of science that enter into the work of the department. This does not include the library of the Weather Bureau, which has a collection of 33,000 works, dealing chiefly with meteorology and climatology. Military science is represented in Washington by two large libraries, which have just been merged into one, viz., the library of the War Department, with 60,000 volumes and 40,000 pamphlets, and the library of the Army War College, with 34,427 volumes. The Navy Department has a technical library of about 50,000 volumes. The Naval Observatory has the largest collection of astronomical literature in America, amounting to 27,296 books and 5,452 pamphlets. The State Department library contains about 7,000 volumes, devoted chiefly to international law, diplomacy, history, foreign laws, and descriptions of foreign countries. The Patent Office has a magnificent library of technological literature, numbering 94,648 books and pamphlets. The Bureau of Standards has 11,166 books and several thousand pamphlets, on physics, technology, and the like. The Coast and Geodetic Survey has 25,000 books and pamphlets, 35,000 maps, charts and blue-prints, and much manuscript material, all relating to the subjects embraced in the work of the Survey. The Smithsonian Institution deposits most of its books at the Library of Congress, but the National Museum, which is a branch of the institution, maintains an independent library of 43,692 books and 72,042 pamphlets pertaining chiefly to the natural sciences. The Bureau of Mines has a collection of about 12,000 volumes, relating especially to mines and mining, including a large number of mine accidents. The Bureau of Education has an unrivaled pedagogical library of 145,000 volumes and pamphlets. This library lends books by mail to educators and school officials throughout the United States. (Most of the Washington libraries lend to *libraries* throughout the United States, so that their splendid resources are available to students all over the country.)

The Columbus Memorial Library of the Pan-American Union has 28,399 books and pamphlets relating to Latin America. The literature of Freemasonry and kindred topics is represented by about 100,000 books and pamphlets in the library of the Supreme Council of the Thirty-third Degree. The Volta Bureau contains an immense but unnumbered collection of works pertaining to the education of the deaf and germane subjects. There are two large libraries of railway literature in Washington, viz., that of the Interstate Commerce Commission, with 16,000 volumes and 10,000 pamphlets, and that of the unofficial Bureau of Railway Economics, with about 25,000 books, pamphlets, and maps. The law library of the Department of Justice contains about 45,000 books and pamphlets, while there is still a larger law library attached to the Library of Congress, and one of about 16,000 volumes at the headquarters of the Bar Association of the District of Columbia. The Bureau of Labor Statistics has about 28,000 books and pamphlets on labor problems and similar subjects. The Bureau of Fisheries has 28,695 books on ichthyology and other topics in which the bureau is interested. The Engineer School at Washington Barracks has a library of about 50,000 books and 8,000 pamphlets, devoted to military and civil engineering, etc. The Census Bureau has a statistical library of 28,970 books and 39,418 pamphlets. The Bureau of American Ethnology has 31,709 books and pamphlets on appropriate subjects. Last, but not least, Washington has a great public (Carnegie) lending library, and large libraries attached to each of the local universities and colleges, besides small libraries connected with schools, clubs, etc. Altogether there are 137 public, semi-public, and society libraries at the capital.

Probably the greatest need in special libraries at Washington is one devoted to geography. Although the Library of Congress has a magnificent collection of maps, it is weak in other branches of geography, and the capital has no library analogous to those of the American Geographical Society in New York and the Royal Geographical Society in London.

## Automobile Notes

**A Jitney Problem.**— Jitney drivers have discovered that there is a considerable difference in the profit to be made from different passengers. For example, a fat man occupies 15 cents' worth of room, but pays only a nickel, and as a consequence the wise jitney usually fails to see a stout passenger seeking a ride.

**Adjusting Lamps.** — A large portion of the light from the average lamp is projected upward, and above the level of the lamp; and this portion of the light not only serves no useful purpose, but is largely the cause of the glare that is so objectionable to every other user of the road. It is a simple matter to so adjust the lamps that the light is thrown downward, and this not only obviates the glare, but concentrates more light on the road. A little judgment in adjusting lamps would result in benefits to everybody.

**Another Alcohol Fuel from Transvaal.**— About a year ago a new alcohol fuel mixture was introduced in South Africa, under the name "Natalite." The discoverer of this fuel now announces that he has been able to increase greatly the efficiency (in thermal units) of his fuel, by adding certain other ingredients. His new mixture is called "Ethol" and, according to the report of Prof. Orr, of the British School of Mines and Technology, gives 2½ per cent more in thermal efficiency than gasoline. The consumption is at the rate of .165 gallons per brake horse-power, as compared with .125 gallons where gasoline was used. The "Ethol" mixture, however, was used in the gasoline engine without the slightest change or adjustment to the carburetor.

**Powerful Tractor Made in America.**—Built according to specifications for a powerful tractor to move the heaviest mobile artillery, which were received by a Springfield (Mass.) concern from the French and British governments, a new tractor is now available for American building and contracting firms, which surpasses all previous vehicles of this type. The new tractor recently picked up, without much difficulty, a huge flat truck on which was loaded an immense boiler weighing more than 66,000 pounds, the truck itself weighing over eight tons. The total dead weight moved by the four-wheeled tractor was therefore 41 tons. The usual requirements for moving such a load by means of horses would have been a team of 28 strong animals, with 10 extra horses and a block and tackle for starting.

**Getting after Vibration.**— In the not very distant past many automobile manufacturers gave but casual attention to the balancing of their engines, trusting to the vibrations of the road to disguise those due to the engine or divert attention from the engine builder to the road builder or the tire maker. Great improvements have been made, however, for it has been realized that proper balancing means much to the efficiency and life of the entire machine, as well as increased comfort to the user, and the advent of the eights and twin sixes brought the subject still closer to the designer. There is still much that can be done in the way of balancing moving parts and eliminating vibrations, and our best engineers are giving the subject careful study, although the frequent changes of model delays the results.

**Circuit Tester Helps Repairs.**— The extraordinary increase in multiple-cylinder motors for automobiles has caused a great demand for experienced electricians in garages and repair shops, because of the difficulty in locating electric wiring troubles, and properly connecting the maze of wires in the modern motor car. An instrument which greatly lightens this task is an electric circuit tester which has just been brought out by an Illinois manufacturer. It is composed of a telephone receiver, a cord with plug which screws into any electric light socket, and a long flexible cord with the proper terminals for connection. When trying to find short circuits, broken circuits or proper connections in the wiring system, the circuit tester will indicate them in a few seconds. The manufacturer thinks so well of the instrument that he agrees to send it on 10 days free trial.

**Heat in Tires.**— It is well known that after a long and fast run the tires of an automobile are found to be very hot, and many have supposed this is the result of the friction of the tire on the road. Such is, however, not the case, at least as to the greater portion of the heat. The real cause of heating is the internal friction of the tire itself, for as the tire is being constantly deflected by contact with the road, the various plies, or layers, which compose the tire, do not act uniformly, and consequently there is more or less motion between them, that results in friction and heat. The greater the change in shape in the tire as it contacts with the road the greater will be the friction. Of course the harder the tire is pumped, the less will be the deflection; but it is evident that while a perfectly rigid tire would generate but little heat, it would fail in giving easy riding, so we must put up with some heating and consequent wear of the tire. The subject is one that is being successfully studied by the tire maker.

## Science

**A New Automatic Transpiration Scale,** for the study of the transpiration rate of plants, is described by Messrs. L. J. Briggs and H. L. Shantz, in the *Journal of Agricultural Research* for October 18th. It is so designed that the plants may be freely exposed to the weather, and is of large capacity. The same article reviews the various forms of transpiration balance that have been heretofore in use.

**The Crocker Land Expedition,** under Donald B. MacMillan, is spending another winter in the Arctic. The steamer "George B. Cluett," which went north last autumn to bring the explorers back, is ice-bound in North Star Bay, about 120 miles from the expedition's base at Etah, Greenland. Letters received by way of Copenhagen reported all hands well and preparing for a renewed campaign of explorations during the winter and spring.

**The Talgai Skull,** the relic of Pleistocene man in Australia which was exhibited at the Australasian meeting of the British Association, has been presented to the University of Sydney. The skull was found near Talgai, in the Darling Downs, Queensland, and is completely mineralized. According to Prof. Edgeworth David, it may be that of a member of the first human family to cross Wallace's line and introduce the dingo (a sort of Asiatic jackal) into Australia.

**A New Isogonic Chart of the United States,** showing the general distribution of magnetic declination over the country on January 1st, 1915, has been published by the Coast and Geodetic Survey, to supersede a similar chart published in 1910. It is based on about 6,000 values of declination, including about 800 in Canada and 300 in Mexico and the West Indies. The lines on the chart are generalized with respect to local irregularities, but the latter, so far as data are available, are indicated by entering on the chart isolated abnormal values differing by more than a degree from the normal for the locality. A disturbed area of some extent, indicated by observations at several places, is represented by a small closed curve. In consequence of this plan the isogons on the chart have a more regular appearance than those on the chart for 1910.

**Trench "Frost-bite."**—An article in the *Lancet* discusses the so-called "frost-bite" from which many soldiers suffered while fighting in the trenches in Flanders last winter. It is characterized by swelling, pain, and disturbance of sensation in the part affected, but not by the necrosis or death of the tissues which occurs in true frost-bite. The names "frigorism" and "frigidism" have been suggested for it. The conditions causing it are cold, wet, and interference with the circulation in the leg and foot by tight puttees and boots. A very thin layer of moderately dry air between the skin and the external cold water or ice enables the heat of the circulating blood to keep the parts free from "frigorism," and this can be secured by wearing bags of very soft, thin oil-skin on the lower limbs, in conjunction with woolen socks. Nothing tight must be worn around the leg.

**Storm Warning Lanterns.**— At the solicitation of marine interests, especially on the Great Lakes, and also in pursuance of a plan recommended recently by the commission on storm warnings of the International Meteorological Committee, the U. S. Weather Bureau is preparing to introduce a new system of night storm warnings, consisting of three lanterns in a vertical line, instead of the two lanterns heretofore employed. By this arrangement it will be possible to indicate the expected direction of the wind to the nearest quadrant, instead of to only two directions. Experiments recently conducted by the Bureau show that, in order to be seen separately by the naked eye, lanterns should be approximately four feet apart for each mile the observer is distant. To secure great brilliancy a standard electric lamp of the gas-filled tungsten type is being tried out. The new system of lanterns is being first installed on the Great Lakes.

**Human Characteristics in Apes.**— Mr. R. L. Garner, who has devoted the best years of his life to the study of the African anthropoid apes in their native haunts, recently delivered a notable address before the Biological Society of Washington on the habits and social conditions of these animals. In many respects they resemble closely the lower races of humanity. Their diet is mainly vegetable, but flesh is an essential part of it. They sleep on the back or side, like human beings, and often make their beds 18 to 25 feet off the ground. They have acute sight and especially hearing, but their sense of smell is not much better developed than that of man, while the sense of touch is less acute than in man. The period of gestation is probably seven months. Twin births are exceedingly rare. Females are sexually mature at from 7 to 9 years; males a year or two later. The usual duration of life is 20 to 21 years. Rights of ownership are well respected among them.

## Industrial Efficiency

**Electric Drive in Textile Mills.**— The total cost of electrical equipment for textile mills, according to J. R. Olnhousen in the *Electrical World*, is about 10 per cent of the complete cost of the mill. The annual cost of power is from 4.5 to 5 per cent of the total cost of the manufactured products. Experience with up-to-date motor drive shows an increased production over mechanical drive of from 5 to 7.5 per cent.

**Long-Handled Shovels for Forced Firing.**—As a result of feeding fires under boilers operating at 175 per cent rating, the firemen of a Middle West electric power plant suffered from blisters on the exposed parts of their bodies. The company solved the difficulty by providing the firemen with long-handled, square-ended coal shovels which, while not impairing the dexterity with which the toilers fed the fire, saved the men from the intense heat.

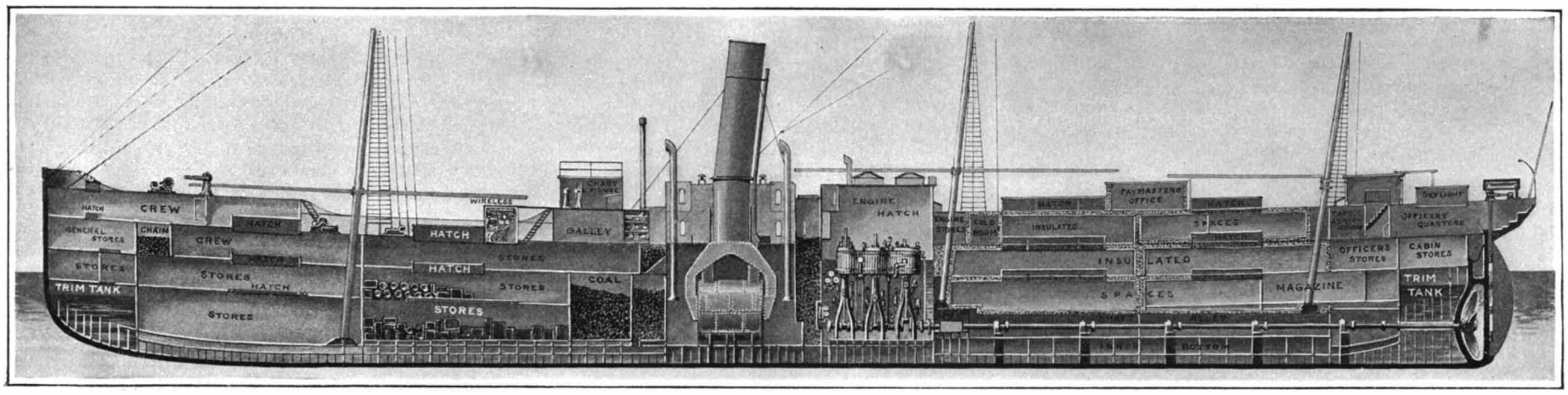
**Prompt Medical Attention and Its Rewards.**— Even the smallest scratch on the hand sends a Bethlehem Steel Plant employe to the dispensary. There is no debating whether this or that hurt is sufficient to make the laborer stop work—it is compulsory that the doctors do the deciding. More than 90 out of every 100 men can immediately return to their work after the necessary medical precaution has been exercised. When it is recalled that injuries at first no more serious than a slight scratch may lead to the amputation of a limb or even death, the reason why 1,300 or more toilers visit the dispensary of the Bethlehem Steel Plant every week is at once apparent.

**Paper Made from Grass.**—It is reported that the Department of Agriculture is experimenting with wire grass as a source of supply for pulp for making paper, in place of poplar or liriodendron. This variety of grass grows on the Pacific Coast and in western Mexico, and possesses the very desirable property of toughness and can be reduced by the soda process. It is stated that paper manufactured from the stock has proved as satisfactory, in physical tests, as a first-grade machine-finished printing paper. In appearance and in feeling, the paper produced is satisfactory. However, the experiments have indicated that more bleaching powder is required in the bleaching process than in the case of poplar stock.

**Rules for Abating Smoking Stacks on Vessels.**— The Department of Health of New York has recently issued a folder addressed "to owners of steamboats" and containing much valuable information in regard to the abatement of smoke. Not only does it instruct boat owners how to avoid smoking stacks, but it also deals at length with the advantages that accrue by so doing. The following rules for firemen are given: 1.—Fire one half of the furnace at a time and wait until the smoke stops before firing the other half. 2.—Keep the door open slightly for about two minutes after firing. 3.—Fire a small amount of coal at a time. 4.—Keep fires clean and ash-pan free of ashes. 5.—Carry a level fire. 6.—Break lumps of coal into small sizes before firing. 7.—Use steam jet. 8.—Maintain a steady water level.

**Winding Watches by Electricity.**—While the winding of one's watch would seem to call for but a small amount of energy, it assumes a most significant aspect when multiplied several hundred times, as in the instance of a watch repairing concern in New York City part of whose work it is to wind 700 watches or more each day. To facilitate the work the firm makes use of an electric motor which drives a small, felt-lined socket through friction drive. It is only necessary to start up the motor and hold the stem of a watch against the felt-lined socket to wind the time piece. When the watch is completely wound, the tightened spring overcomes the pressure between the motor pulley and the friction disk, with the result that slippage takes place. Simple as this electric watch winding equipment is, it has replaced several men formerly required for the work.

**Quartz Glass Now Made in America.**— As a result of the war, the United States has entered into a new industry, namely, the manufacture of quartz glass. Heretofore, this product has been manufactured in Germany and imported into this country in large quantities, despite the high tariff. Curiously enough, the glass has always been made from a peculiar kind of sand which is found only in Nebraska. Thousands of tons of this sand in the past have been shipped to German glass factories and returned to the United States in the form of finished glassware, such as crucibles, test tubes, retorts and other similar articles employed in chemical laboratories. So great was the demand for quartz glass or Silicium Dioxyde ($SiDiO$) in this country that previous to the war it was found advisable and even profitable to mine the sand in Nebraska, transport it in bulk to Atlantic seaports and across the ocean to Germany and, after the glassware had been manufactured, to return it in the finished form to American markets. The advantages accruing from the new industry are too obvious to be mentioned here.




Sectional view of the U. S. supply ship Culgoa

# Supply Ships of the Navy

## Importance of Auxiliary Vessels to Our Fleets

THE contention of the great Corsican that an army travels on its stomach finds an equal application to the great fleets which constitute naval armaments. The majesty and grim potential strength apparent when a huge warship's impressive bulk fills the delighted eye of the layman is apt to overshadow realization that no mere warship, nor even fleet of fighting units alone, can successfully undertake operations distant from the base or for a period of long duration unless auxiliary vessels maintain unfailing service of supply.

In the maintenance of a proper meat supply to the fleet, supply ships of the navy find their most important function. While many other elements of ration and equipment are transported by these ships, the great refrigeration holds of this class of naval auxiliary make it necessary that special ships be either built or altered for the handling of beef. The average battleship now in service is supposed to carry sufficient meat and ration supply to last about a month without renewal. When a ship of this class sails for foreign waters there are probably 40,000 pounds of meat aboard.

As there is never assurance that a ship will not be called upon in an emergency for a sudden departure, supplies aboard are rarely permitted to fall low. For this reason, though a battleship might stock up for a greater period of time, while away from its base each ship is supposed to be visited at least once a month by a supply ship.

About one fourth of the cargo space of a supply ship is given over to meat-storage. The "Culgoa," "Celtic" and "Glacier," supply ships of the United States Navy, when they leave on a visiting trip carry five or six hundred thousand pounds of beef, frozen hard and maintained at a proper temperature. This amount of beef is sufficient to supply the Atlantic fleet for about one month.

On the Atlantic station there are two supply ships—just two less, according to the opinion of duly qualified naval officers, than desirable for an ample war service. There is one supply ship on the Pacific station, while the only ship of this class expressly designed for the purpose is now under construction at the Philadelphia Navy Yard. The other supply ships of the Navy are converted freighters.

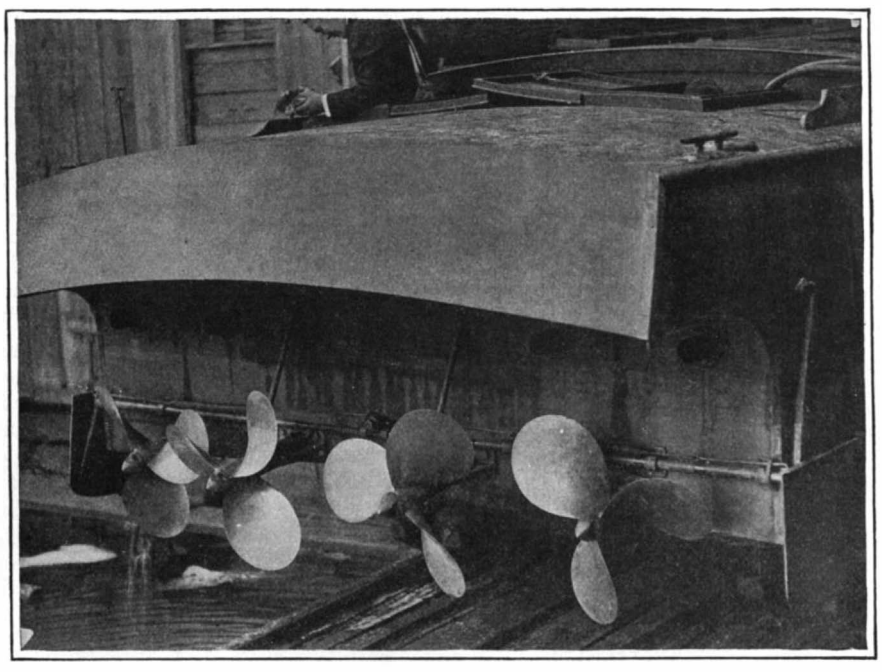
During days of peace, as, for instance, when the fleet is engaged in maneuvers near Guantanamo, the "Culgoa" and the "Celtic" alternate each month in sailing with supplies from some port of departure to the fleet rendezvous. After replenishing the larders of the main fleet, the supply ship proceeds to pick up the various vessels scattered on the station.

The refrigeration holds of supply ships are heavily insulated by casings of wood and zinc packed with charcoal. These insulations have been built in after a remodeling of the interior structure of the ship to meet requirements. The compartments are kept at a temperature of about fifteen deg. below zero.

There are, in addition to the below-zero sections, others for the stowing of supplies which must not be allowed to freeze. There is one compartment, with a capacity of about 4,000 cubic feet, entirely given over to the storage of hundreds of thousands of eggs, side by side with quantities of butter.

Other holds are devoted to vegetables and "dry stores," onions, potatoes, beans, &c., and rows of flour barrels flanked by boxes of prepared provisions. Canteen stores, such as candy, jam, cakes and small articles for personal use, are delivered to ships which have previously purchased them. It is surprising how much candy is sold aboard a ship.

In addition to carrying articles of food, these ships form a sort of express service to the fleet, delivering requisitioned articles of equipment, even to guns, for which there is space. They frequently carry ammunition supplies, a large magazine being provided in each ship for the purpose.



Stern view of a sea-sled, showing the arrangement of the surface propellers, and the peculiar rudders

### Speedy Patrol Boats for the U. S. Navy

THE novel motor boats known as "sea-sleds," originated by a designer in Nova Scotia, have been found so speedy, and also so dry and steady in rough water, that they have been adopted by the United States Navy for various purposes, and recently a specimen of this type has been tried out for duty as a fast patrol or picket boat, for which work it is expected that it will be particularly efficient. Armed with a couple of light rapid-fire guns a boat of this kind could easily run down the most powerful submarine, and its great speed should enable it to avoid the shots fired by craft of any kind.

As will be seen from the illustrations the sea-sled is not a handsome craft, but greatly resembles a scow, with flat, vertical sides and square bow and stern. Its special feature is the underside arrangement, for the member that answers as a keel starts at the middle of the deck, at the bow, and extends, by quite a flat curve, to a point near the stern, where the bottom of the boat is flat. This construction forms a gradually diminishing V-shaped trough extending longitudinally through the hull, and the outline of the boat in the side view shows the chine at the lower edge of the vertical side, and not the keel line.

As the sides are flat and vertical, and as the width of the boat is somewhat greater at the bow than the stern, there is no tendency to throw water above the deck line, but on the contrary all spray is collected in the V-shaped opening at the bow and carried under the bottom, thus making a very dry boat in rough water. It is claimed that considerable quantities of air are also collected by the V-bow, and forced under the boat, so that it rides on a cushion of mixed air and water. It might be expected that a boat of this

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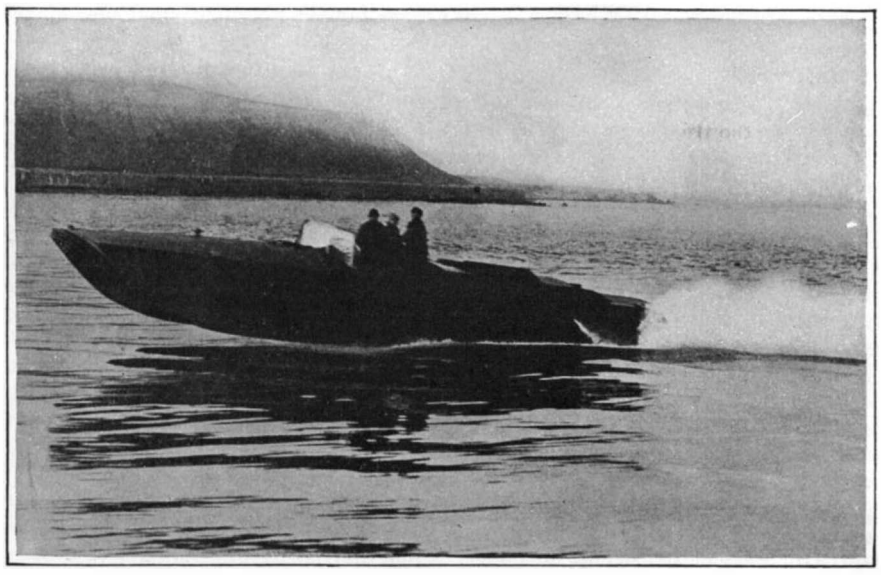
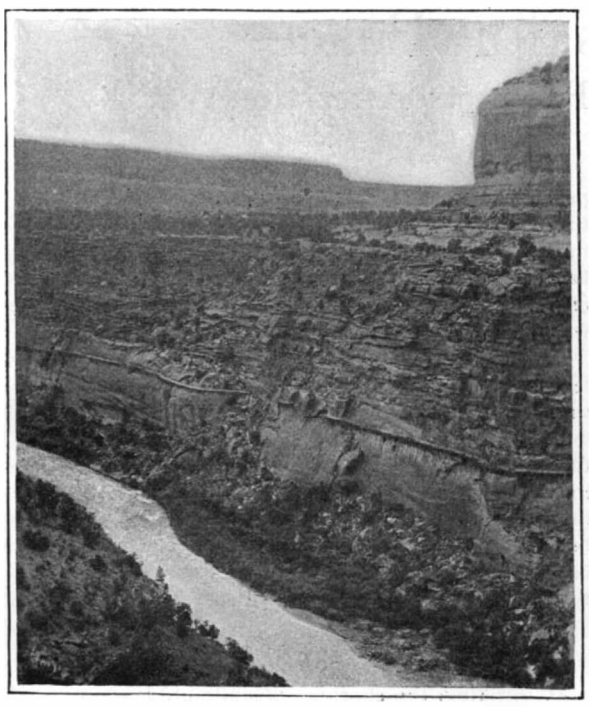
When it starts, the sea-sled churns up a great cloud of spray behind



The sea-sled running at high speed. Note how smoothly it glides over the water



San Miguel River Canyon, showing the flume along the right-hand wall

## San Miguel River Canyon Flume—A Monument of Gold Mining Failure

By W. F. Wilcox

IN the rugged region of western Montrose county, Colorado, there are the relics of a dreamer's scheme to get gold. Along the precipitous sandstone cliffs of the San Miguel river, which winds its tortuous way towards the Rio Dolores, cutting in two the magnificent carnotite field, is a flume which is at once a mechanical wonder and a reminder of a colossal failure.

There is pay dirt at Hydraulic, near the Colorado-Utah line, where the placer outfit was located. It assays from 75 cents to $1.25 a yard. It was back in 1890 that a St. Louis concern dreamed of a placer mining proposition to save these values and make a mint of money.

Water was to be taken out of the San Miguel river somewhere near the Club ranch and diverted, by means of a flume, out of the depths of the canyon until the location of the property was reached. In order to secure the required fall to the flume and bring the water out of the deep cut, some 12 miles of flume were required and all of it had to be hung on the rocky sides of the canyon, as depicted in the accompanying views.

A contract for 3,000,000 feet of No. 1 pine lumber was let to two men of Montrose. The lumber was sawed at Pine Flats on the Colorado-Utah line in the La Sal mountains. It was a most difficult country to get into. Entrance was secured at White river, where the railroad was left behind. Seventy miles of wagon road had to be built to the timber lands in order to get the machinery through, especially the big five-ton boiler.

From the lumber mill there was a gigantic road proposition to the site of the flume. As an illustration of the extreme gradients encountered, in one section of five miles a drop is made from 9,000 feet elevation to 4,000 feet. Many an accident happened to the eight-mule team outfits that freighted the lumber over this rugged land. The two lumber contractors agreed to deliver the lumber at $22 per thousand feet; and in view of the conditions just mentioned it is needless to state that they became bankrupt. It was the long haul of 22 miles that contributed most towards their failure.

But the lumber contractors were not the only losers and by no means the largest.

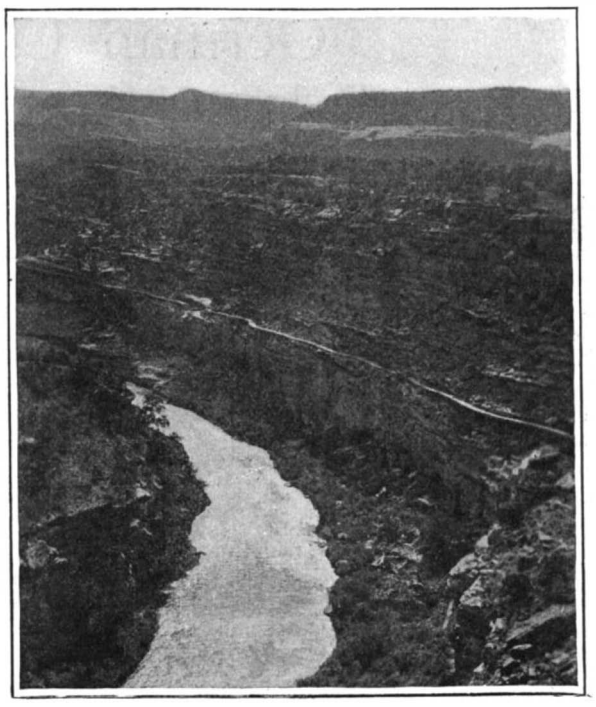
The making of the flume was a wonderful undertaking. Men were hung over the rimrocks and lowered by ropes into the canyon. Here they worked in the boiling hot sun. They were suspended anywhere from 150 to 500 feet down from the top of the canyon, with a yawning chasm below them. Their work was tedious under the circumstances: first, a hole had to be drilled into the rock; next, a specially made iron piece was inserted in the hole; then a board was lowered and fitted over the end of the iron and a tap screwed on. A brace was then fitted into the rock below and set up snug against the timber. Following this, planks were lowered and a 16-foot section of flume finished. On the average, five or six men laboring for 10 hours finished a stretch of 128 feet of flume. Frequently the men lowered over the ledge had to pull themselves under overhanging and projecting rocks. In one instance, for a hundred odd yards the flume is really over on the opposite side: the walls project to such an extent that anything dropped from the flume will fall on the opposite bank. The flume, which is 6 feet wide and 18 inches high, required about two years to construct. The lumber contractors were a year and a half delivering the lumber.

While the ground assays good gold values, the company was unable to save any. The gold is in the form of "flour" gold, which is too fine for hydraulic or placer working. It is said that the company took out $5 worth of gold and then abandoned the project. At any rate, the company never paid out, and in a few years the property was sold for taxes by Montrose County. A Chicago company secured title by paying a thousand dollars for the tax receipt, thus coming into possession of a property that cost over a million dollars.

Under the control of the new company, more improvements were made and new machinery and processes installed; but even the infusion of fresh capital could not make the undertaking pay out, for the gold refused to be reclaimed. The manager went back to Chicago to report, and later committed suicide because of some misunderstanding with the promoters, which arose over the property.

To-day the flume hangs along the side of the San Miguel River, a relic, a monument to the failure of two big gold mining concerns, and a lumber contracting company, and the suicide of a man. Although it must have cost upward of a million dollars, it lies without an owner, disintegrating in the terrific sun that is reflected along the mighty cliffs of a desert land.

People attracted to the western Montrose region at the present time by the carnotite-radium activity marvel and wonder at the temerity of any man who would propose such an undertaking. A more successful mining scheme is now being worked to a successful issue in that very region, which is the world's greatest radium deposit, furnishing, as it does, about 95 per cent of the total supply. The country surrounding the San Miguel is rich in radium, and the properties, camps, mines and concentrating mill of one of the leading mining concerns is located beside the flume.



Another view of the San Miguel River Canyon and the remarkable flume

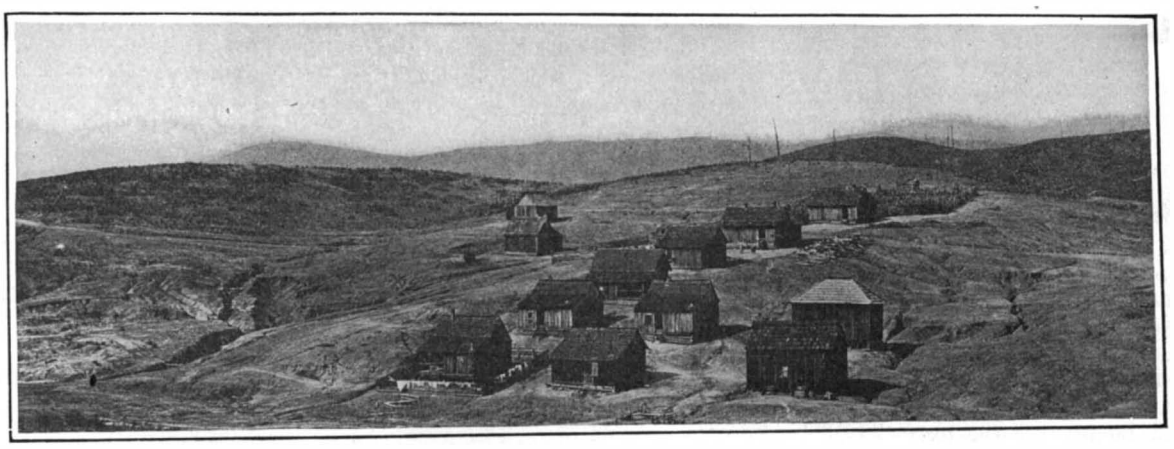
A scenic highway is being projected along the river canyon on the opposite side of the flume, which when completed, winding along the depths of the canyon down to the Dolores and out through the famous Gate Way in Utah, will be without exception one of the most wonderful scenic automobile routes in the world.

## Destruction of Vegetation by Fumes from Smelters

SERIOUS trouble is being experienced in Tennessee and Georgia on account of the sulfur fumes from plants of the Ducktown Sulphur, Copper & Iron Company, and the Tennessee Copper Company. In 1905 the State of Georgia took action against these companies, alleging that they permitted a discharge of gases which destroyed vegetation, including forest trees, in that state. Both companies were forced to install plants to utilize a considerable percentage of the sulfuric acid gas. These plants, however, have been unable to utilize a sufficient quantity of the gas, and last Spring the Supreme Court decided to have a special expert ascertain the amount of gas released and the amount which ought to be utilized in order to make the fumes harmless. The report is expected to be made soon.

Officials of the Forestry Service think the time is close when the Government will have to take up this question of fume damage, since large sections of the Cherokee Area are subject to such damage and it is reported that the injury has extended to the Georgia Area.

A study may be made of the sulfuric acid industry in the Eastern states to find out whether, if the sulfuric acid from such places as the Ducktown plants were fully utilized, it would make possible a reduction in the cost to farmers of acid phosphate, which has become an important fertilizer throughout the East.



View of a portion of Ducktown, Tenn., depicting how all the vegetation has been killed by the sulfur fumes from nearby smelters

Striking example of erosion caused by deforestation of great areas due to the sulfur fumes from the Ducktown smelters

## The Northeast Passage Again Achieved

PRESS reports quoted in the *Scottish Geographical Magazine* announce that the Sverdrup and Vilkitskii arctic expeditions, in their three ships, arrived safely at Archangel in the middle of September. As the Vilkitskii party started last year from Vladivostok, this report means that the feat of sailing around the arctic coast of Eurasia—the Northeast Passage—so often attempted in vain, has been achieved by the same Russian naval officer who discovered Nicholas II Land in 1913. The only previous expedition to make this passage was that of Nordenskjöld, in the "Vega," which traveled in the opposite direction (eastward) in 1878-79. Why has not Vilkitskii's latest feat been reported conspicuously in our newspapers?

# German Commercial Preparedness for Peace

## An Englishman's View of Germany's Industrial Activity and Prospects After the War

By James Armstrong

*THOSE who have supposed that Germany's commerce and industries have been so seriously crippled by the existing war will find much food for thought in the present article which we have reproduced in full from the British World's Work. Mr. Armstrong describes the situation from the English point of view with much apprehension and strikes a note of warning which should be heeded in this country as well. It emphasizes the importance of our own Industrial Preparedness for Peace.*—EDITOR.

SO absorbing and vital, especially in this country, is the necessity to produce munitions for the maintenance of destruction that the more critical requirements of commerce are in danger of being overlooked. The period of maximum pressure has passed. Our industries have been so effectively mobilized, the handicap in raising the provender of destruction has been overcome, with the result that now we are able to take brief breathing spells. The fact that the crisis has been passed is officially revealed by the abolition of Sunday labor.

The organization of our facilities for the prosecution of the war having enabled a certain output to be achieved and maintained, it is now possible to look round and to estimate the general state of affairs, not only in regard to pressing needs, but of the future when cannon and shells will have to make way for plows and pens. The moment when the latter will be required may spring upon us with dramatic suddenness: indeed there is every indication that the change will be as cataclysmic as was the declaration of hostilities.

Under these circumstances the question arises: "Are we ready for peace?" According to the outward and visible signs the reply is an emphatic negative. If the transition of our factories from war to peace is likely to occupy anything approaching the time required to convert them from peace to war, then we are confronted with a situation as dark and dreary as the first six months following the invasion of Belgium and France.

We are somewhat lethargic in our movements and apathetic in matters regarding the future. We differ from the German in that we think only of one thing at the time.

Now the methodical Teuton maintains that peace and war must run in single harness. He and his newspapers are now full of talk of "preparedness for peace." Even as its industries were organized to secure the commercial position of Germany in the sun, so will the hundreds of factories which have been raised and equipped during the spasm of war be subsequently devoted to the exigencies of trade.

The world-wide catastrophe has taught Germany many severe lessons apart from her military miscalculations. They are lessons which have not been brought home to the Allies because our circumstances have been so vastly dissimilar.

Germany has been blockaded and has been forced to realize that many articles for which she was formerly dependent upon others outside, either had to be made within the country or gone without.

Evidences of this condition of affairs are revealed on every hand. In pre-war days she was the largest customer for Chilian nitrates with which to fertilize her hard-worked ground. Before many weeks of war had elapsed she was faced with a critical situation.

Foodstuffs would have to be raised within the country. In order to secure the maximum yield per acre there was a heavy call for fertilizer. But the stocks of Chilian nitrates were so slender that they would be speedily exhausted. To maintain the food-supply, a substitute would have to be found.

Some years ago a commercial factory for the extraction of nitrogen from the air was established in Norway, and it has proved a remarkable commercial success. Germany purchased extensively from the factory, but the manufactured article was forced into competition with the natural product from the slopes of the Andes, to the disadvantage of the former.

If Norway could render the process remunerative and successful, Germany certainly could do likewise. That was the Teuton argument, and without any further delay the process was taken in hand.

### Food from the Air

Another motive governed this development. Nitric acid was in acute demand for the manufacture of high explosives. It could be derived in vast quantities if the extraction of nitrogen from the air were taken up. The leading German company devoted to this process placed orders for the speedy erection and equipment of several extensive installations.

The contracts for two nitric acid producing establishments were placed with the Allgemeine Electricitäts Gesellschaft of Berlin, while another concern placed a further contract with the same organization for the equipment of an electrical station which ranks far and away as the largest single order of its character ever carried out in Germany.

Another plant which is far more ambitious and comprehensive is also under way. Some years ago a company was established to provide the city of Berlin with electricity for lighting, heating, and power. The concern anticipated that, upon the expiry of the initial term, it would receive a renewal of the concession for a further number of years, and to this end it acquired extensive lignite fields near Bitterfield in order to be in close proximity to an abundance of cheap fuel for generating the requisite current. But the civic authorities decided to exercise their option and to buy out the private company.

Under these circumstances it appeared as if the lignite field investment would prove a white elephant. But the war invested the situation with a totally different aspect. The government demanded vast quantities of fertilizer for the satisfaction of the farmers and truck garden produce raisers, as well as nitric acid for explosives. The private company was approached and urged to assist in meeting the national necessity by embarking upon the "fixation of nitrogen" process.

### Nitrogen at 1½d. a Pound

With the money received from the Berlin City Fathers as the price of the electrical undertaking the original concessionaires laid down a huge plant upon the lignite fields, the whole of which, extending over 2,500 acres, has been purchased. Here are sufficient supplies of cheap fuel to keep the works going for some thirty years at full pressure.

A subsidiary company has been inaugurated to carry out the actual work of "fixing the nitrogen" withdrawn from the atmosphere, and this concern has contracted with the electric generating company to buy sufficient current to enable 66,000,000 pounds of nitrogen to be extracted in this manner per annum at an average cost 1½*d.* per pound, for fifteen years, with the option to extend the agreement a further ten years.

The initial section of the scheme has been completed and has been attended with such conspicuous success that the plant is to be extended in order to ensure double the yearly output of fertilizer.

In view of the enormous developments of the many extensive plants which have been laid down to exploit this process of producing fertilizer, it is obvious that Germany will depend less than formerly upon Chile for supplies when peace is declared. The capital invested in these enterprises is too huge to risk competition. If the nitrogen-food factories were forced into inactivity by the natural product, then the electric generating stations would have to close down also, inasmuch as they would be deprived of the markets for their current.

There is another feature which must not be overlooked. Under normal conditions the establishment of such works entailing a heavy expenditure of money would demand the preservation of the initial outlay or depreciation allowances in the annual balance sheets until such time as the capital outlay has been extinguished. But when peace is declared and these factories settle down to their usual routine the item of capital expenditure, representing the cost of erecting and equipping the buildings, will not appear. These charges will have been extinguished by the government in the form of payment for nitric acid.

In other words, the war in Germany is financing the industries which at a later date will plunge the world into a commercial conflict, which is certain to be waged as bitterly as that now running its course.

### Dependence upon Coal

Similar conditions prevail in the coal industry. Since the outbreak of war the German coal-gas production has advanced by leaps and bounds at the instigation of the government. The latter has been loud and insistent in its demands for these products of coal-gas distillation which are indispensable for war.

Shut off from the great oilfields of the world, Germany has been compelled to rely upon its home products for running the Diesel engines of its submarines, the light engines of its aircraft, and the heavier motors of its automobiles. The gas is wrung to the last drop to extract the benzol for the foregoing purposes, toluol for T.N.T., carbolic acid for disinfectants, cyanogen, the deadly gas which is employed in the poison-gas war and the preparation of asphyxiating shells, and ammonia, which, in the form of sulphate of ammonia, serves as a substitute for saltpeter, which can no longer be imported.

But in the practice of the arts of war those essential to peace, which have no military significance, are neither ignored nor wasted. The tars arising from the manufacture of the coal-gas are rich in the elements for the production of aniline dyes. At the moment these may be regarded as by-products, merely because there is no, or only an extremely limited, home market for them. Consequently the dyes are being stored up in huge accumulations awaiting the arrival of the opportune moment for flooding the whole world with them.

### The Aniline Dye Crisis

At this time the shortage of aniline dye-stuffs is affecting the whole world to a very serious degree. Only recently a keg of a certain color happened to come upon the market through a forced auction sale. Normally a keg of this particular dye can be purchased for some sixty shillings, but so pronounced is the dearth of this color, that this solitary keg called a bid of some £312 before the hammer fell. There are other dyes for which not only this but other countries are in urgent need, and these colors have risen to prohibitive prices.

Efforts to ease the situation are being made in this country and the United States, but they are of almost negligible significance. An elaborate and well-equipped aniline dye manufactory, capable of competing with the German organizations upon level terms, cannot be brought into operation in a day. It has taken Germany many years to establish this industry, which is now virtually a world-wide monopoly.

The result is that Germany does not view British, French, or American activity in this field with the slightest apprehension. She could flood the market to-morrow so effectually that every competitor, coming into existence during the war, would not merely be snowed under but wiped out of existence.

No firm will be able to sell aniline dyes at the prices which the German trust will unload them. It must be remembered that the cost of producing these enormous stocks have been defrayed. The Teuton government has not only paid a high price for its essentials from coal-gas distillation, but also for the waste as well, and the dyes could almost be given away at a profit.

A similar story may be traced through every ramification of German industry. Every factory which has been impressed into the service of war is at liberty to carry on as usual to a certain degree. There is no immediate demand for its specialties owing to the export market being closed, but Germany recognizes the imperative necessity to possess fully charged commercial magazines against the critical moment which must dawn.

### Huge Profits

Those who labor under the apprehension that Germany's industrial companies are passing through a critical period and are faced with bankruptcy will receive a sudden awakening. Take, for instance, the Allegemeine Electricitäts Gesellschaft, the mammoth electrical trust. During the year 1915 it earned a gross profit of £11,544,000 and paid a dividend of 11 per cent upon its share capital of £7,750,000.

The dividend was 1 per cent in excess of the previous year, and this notwithstanding that taxes were up £40,000, and that bonuses to staff and pensions were increased by £15,000 and £25,000, respectively, while there was a further expenditure of £230,000 on war allowances. The gross receipts were £412,000 above those for the previous year.

"Oh, the increased profits are due to payments for munitions!" So explains the ordinary person. But are they?

In common with all other industrial concerns in the Fatherland the Allegemeine Electricitäts Gesellschaft has been called upon to supply shells, grenades, cartridges, and so forth to meet the desires of the military, but at the same time it has been exceedingly busy on its normal work of building electrical equipment. True, this has been absorbed by the factories which have come into existence for supplying other government necesities, but if the statements of the officials of the trust are to be credited stocks have been maintained at a high level to meet all and any emergency.

(*Concluded on page* 132)

# 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.]*

## Student Military Training

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading your fine articles and editorials on "National Preparedness," and thought that you might be interested in a plan that has suggested itself to me since attending the Fort Sheridan U. S. Business Men's Training Camp. As I am a graduate of the engineering department of the University of Illinois, where military training is required for two years, I believe that this plan would appeal to students at colleges generally, and it would be a source of great value for the United States Government. Its chief advantages are that it would cost the Government practically nothing and would produce citizenship far superior to what we are able to graduate from our colleges at present.

The plan is as follows: A student regiment would be formed at a government post, officered by regular army officers, such as the type detailed now to teach at West Point. The course would continue for one half year, beginning at a semester period and lapping over the summer vacations; students returning to college when finished. Such subjects as Civics, Military History, Strategy, Military Engineering, Sanitation (mechanical engineers might take a month in a government arsenal shop), etc., would be given under these instructors, as well as thorough discipline and personal hygiene, and also an extended military maneuver under full equipment; in other words, six months of intensive West Point training at Government expense. The best graduates of this course would qualify as officers in a volunteer army. The regiment would be entirely separate from the regular army and composed entirely of students from various colleges.

The college would give one half year's school credit to those completing the course, which would be entirely elective, and each college would select such subjects to be omitted from graduation requirements in each department as would leave a required course of study which, in addition to the army course, would produce citizens with equal if not better attainments than those remaining four years in college. I would prefer to have the student return to college for an uninterrupted senior year under the collegiate influence, making the usual four years from matriculation to graduation.

I would be very much pleased to have comments on this plan from citizens in all walks of life.

WHARTON CLAY.

226 S. LaSalle St., Chicago, Ill.

## The Steam Automobile

To the Editor of the SCIENTIFIC AMERICAN:

An apology is due all drivers of steam cars by you after publishing the "Winton" article in the automobile number of the SCIENTIFIC AMERICAN. All the merits attributed to the steamer it possesses, and a few more, and it has not gone on the "scrap heap" with the two-cylinder gas car, but has been improved and perfected to such a degree that it now makes 300 miles on a single tank of water and develops 15 miles per gallon of coal oil at 9 cents per gallon, instead of using gasoline at 20 cents. It has such flexibility and reserve power that it can pass anything on the road, and in ordinary traveling, when a gas car appears bobbing up and down hills two or three miles ahead, without any extra effort on the part of the steamer, in a very short time the gas car is a thing of the past.

I have driven steamers for more than nine years and know what they are, therefore must take exception to the article in question, which is either malicious or ignorance.

W. DOUDEN.

Millersburg, Pa.

## How a Rifle Is Sighted

To the Editor of the SCIENTIFIC AMERICAN:

I have just read with interest the very good article in your issue of the 11th ult. on "How a Rifle Is Sighted," and would like to add a few words thereto with reference to the use of the sight on the Ross rifle, one or two facts in connection with which seem to have been overlooked.

The "U" shaped notch on the battle sight is not of the ordinary "U" shape, but has rather the appearance of a peep sight with a piece scooped out of the top, and was so made with the idea of being used in the same way as the peep sight, *i. e.*, by looking through instead of alining—while giving the minimum amount of obstruction of view. And I have found, in my experience as musketry instructor, that the recruit will very readily adopt this form of sighting after having had a little practice with the peep. Therefore, the Ross battle sight, when used at close range in a very great hurry, should be quite as accurate as the peep sight would be under similar circumstances.

The peep sight aperture on the Canadian service rifle is no longer of about 6-100 inch diameter, the hole having been enlarged to about 1-10 inch over six months ago; and since this change was made it has proved to be as serviceable as an open sight in the worst kind of light, in addition to its other manifest advantages. I have used the tenth-inch peep sight on several occasions a considerable time after sunset, when the light was poor, and found the sighting quite as clear as over the bar—which would be no small advatage to a man with poor accommodation of sight.

A. O. ANDERSON.

Quebec, Canada.

## Volunteer Motor Boat Squadron

To the Editor of the SCIENTIFIC AMERICAN:

You state in your January 1st number, under the article headed "The Motor Boats of the Volunteer Patrol Squadron," that this "is the first real substantial move of private individuals to train themselves for a naval reserve in this country."

This is contrary to fact, as in May, 1912, the Power Squadron of the Boston Yacht Club was formed, and a fleet of from ten to twenty-five power boats held regular maneuvers and drills through the season.

This movement spread, and in February, 1914, under the guidance of Chief Commander Roger Upton, the United States Power Squadrons was formed at a meeting in New York, at which there were representatives from the Navy Department and the Department of Commerce.

Since then the squadrons have been formed in Portland, Boston, New Bedford, Narragansett Bay, New Haven, New York, Philadelphia, the Potomac River, and several on the Great Lakes.

The requirement for membership in the squadrons is a high degree of skill in navigation.

Frequent drills in the summer are compulsory.

This movement antedated all others in the way of preparedness.

Although the conditions of service are not as exacting as in the article referred to, the number of men participating and its possibilities of usefulness in time of war are at least as great.

A squadron may be formed within any recognized yacht club and admitted to the United States Power Squadrons upon its members passing the required examination.

FRANK P. HUCKINS.

Boston, Mass.

## Concerning Leprosy

To the Editor of the SCIENTIFIC AMERICAN:

I have read the article appearing under the above heading in your issue of September 4th, 1915. Will you allow me, as a layman, to make a few remarks regarding same, as it seems to me somewhat inconsistent concerning both the contagiousness and the cure. You say that leprosy has met its Waterloo; would to God it had! But we in South Africa cannot agree with you in that.

Chaulmoogra Oil has been used here for very many years, but we cannot claim that it has definitely cured a single case of leprosy, although many who have used it for a number of years have been discharged from our asylums, still we cannot attribute the cures to Chaulmoogra Oil, as most of those discharged were of the anaesthetic type, which generally dies out after fifteen or twenty years without any treatment whatever. Many other drugs and methods of treatment have been tried here, but we have yet to find the cure. Chaulmoogra Oil has been used both internally and externally, *i. e.*, drinking, injecting, and rubbing the skin. So we would very much like to know how it is used in America to produce such happy results.

*Contagiousness.*—In several parts of your article you state that the disease is non-contagious, and in others you infer that it is highly so. For instance, you say: "Once possibly contagious, it is no longer so." Again: "Children may nurse from the breasts of leper mothers for a year or more, and still be taken away clean and unharmed." And again: "Hence those cities which are now and then thrown into a panic through the report that a leper is at large in their midst need not worry for fear of getting it. Better worry over the case of measles next door." Surely this says plainly that the disease is non-contagious.

In other parts you say: "But when military conquests took us into distant lands where the dread disease exists, our medical men at once took up the seemingly hopeless task of finding a cure for it." Which means that you were afraid of the soldiers bringing it home with them. Again, you say that, "In almost all large colonies the lepers are attended by Sisters of Charity, and these saintly women, once their lot is cast, never again return to the outside world." Why not, if the disease is non-contagious? "A Chinaman first introduced leprosy in Hawaii," and again, "A few of our soldiers, returning from service abroad, have brought the disease home with them." Surely these last would plainly say that leprosy is highly contagious. Which is it—contagious or not?

Pretoria, Transvaal. UNO.

To the Editor of the SCIENTIFIC AMERICAN:

Replying to "Uno's" criticism of my editorial covering leprosy cures as made in American colonies where this disease is prevalent, I wish to say that scientists in the Philippines who are industriously studying this disease have asserted many times that it is not ordinarily communicable by contact. There is a distinction between infectious diseases and contagious diseases.

That cures have not been made in South Africa is no logical argument why cures have not been made in the Philippines. On the other hand, the Manila press has recorded *additional* cures *since* my article was written, and I have no reason to believe now, as I had not before, that the papers there are subsidized by an unscrupulous coterie of designing medical men.

My critic states that he would very much like to know how Chaulmoogra Oil has been used to produce the happy results recorded. If he will take the trouble to address the Bureau of Health, Manila, he may be able to get this information from *official sources*.

If this is done it will doubtless be discovered that it is a *matter of record* that children are reared from leprous parents and are afterward permitted to leave the colonies to live among the people.

The writer asks whether the disease is contagious or not. I wish I could say to him that our medical experts who are devoting their time to such work think it is not. Furthermore, the writer, in company with Mr. Henry Savage Landor, at one time spent many hours in a leper hospital in the Philippines, conversing with scores of lepers and photographing their sores and abrasions. We did not contract leprosy, as we surely would have had the disease been contagious; therefore, I might say that I *personally know* the disease *not* to be *contagious*, "as are measles."

I understand that Dr. Wayson, in Hawaii, has effected cures with a new treatment altogether, but I am not fully informed on his work, and could, therefore, not discuss it with any degree of intelligence.

MONROE WOOLLEY.

Fort Casey, Washington.

## Why Not a Lincoln Ironway?

To the Editor of the SCIENTIFIC AMERICAN:

The very interesting article in your issue of January 1st by the president of the Lincoln Highway Association prompts the above question.

In describing his overland automobile trip, the writer refers to the almost impassable state of the celebrated highway in many places between Chicago and Nevada during the rainy weather.

At such times could not the nearest parallel railroad be induced to run a daily auto special with much profit to itself, the autoist and the large towns along its line? Freight rates on a single car, added to passenger rates for the autoists, are a big item of expense. But a train of ordinary flat cars carrying 30 or 40 autos and their owners should make the cost per auto relatively very small. So should the attaching or detaching of two or three such cars to schedule freight trains at different points along the line.

And, owing to the great saving of time and daily living expense, the trip's cost to the ironway traveler must be far less than to the highway traveler. The former would make 20 miles an hour, while, according to your correspondent, the latter could cover only 35 miles a day over the soft surface roads of the middle West.

By avoiding night travel, if preferred, and keeping to the speed just mentioned, the autoists would see every mile of the country. They would be no more exposed to wind and weather on the train than on the road; less so, in fact, than while ploughing through "gumbo" mud or jolting and plunging into the chuck holes or "Thanky Marms" farther west—and frequently alighting to extricate their cars.

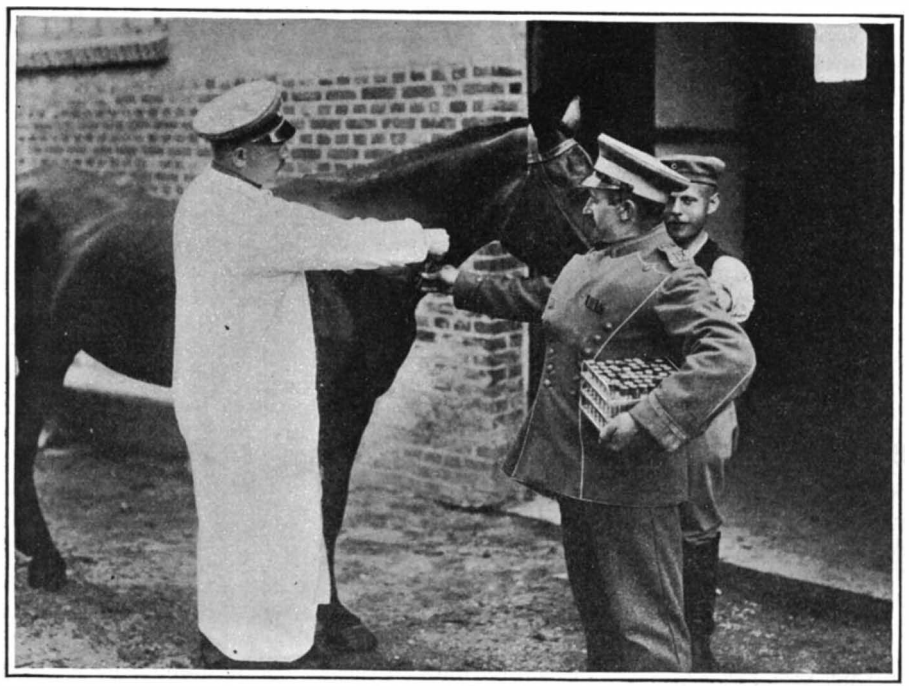
The president of the Highway Association, owing to his name or nature, had something of a joy ride. Yet he confesses to a very long and a very strenuous one. Five thousand others, he thinks, essayed the trip in whole or part, but he cannot be sure that any of them got through. Probably the proportion was decidedly small.

How many of the 5,000 might have made it, however, could they have had a lift of from 50 to 250 miles or more whenever the weather became too execrable?

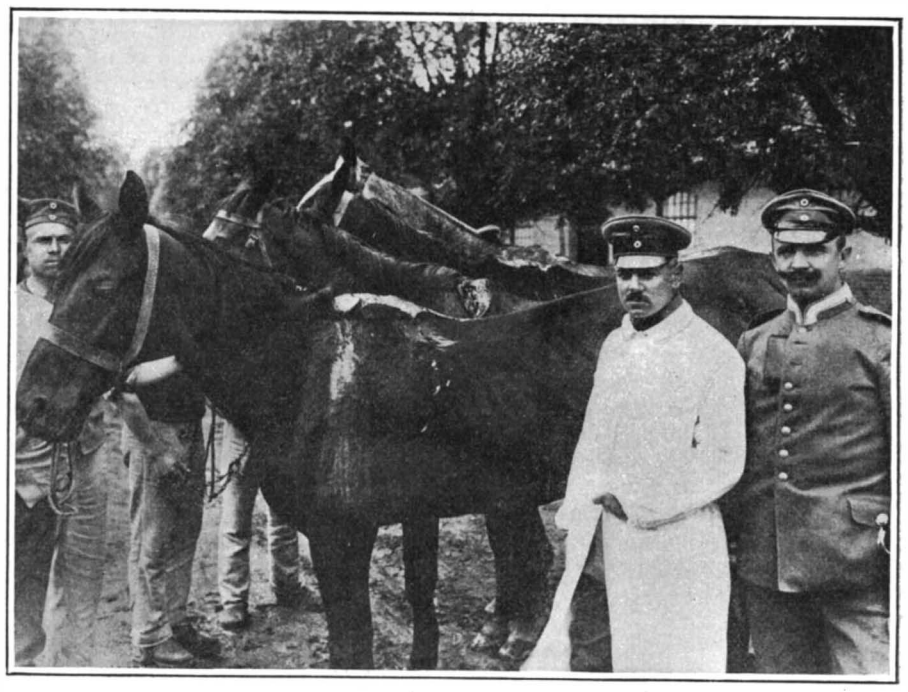
For auto tours Europe is out of the question next summer, and will be a sorry place for some years to come. Meanwhile the West needs the autos and the autos need the West. Must they await the hard-surfacing of many hundred miles before they can get together?

JOHN CHETWOOD.

San Francisco, Cal.



Taking a blood test of a horse



Horses operated on at the withers

# A Horses' Hospital

## Work of the German Army Veterinary Surgeons

By Dr. Alfred Gradenwitz

IN spite of the growing importance of motor cars and the prominent part incumbent on railways, ours is by no means a horseless age. In fact, the present war, while evidencing the wonderful mechanical progress of our era, throws the horse into unexpected prominence. When it is considered that each army corps, on a war footing, comprises tens of thousands of horses, it will be readily understood that the total number of those used by all belligerents should amount to some millions. The veterinary service for these quadruped armies therefore raises a number of problems and assumes an unprecedented importance, second only to sanitation in wartime.

How are the horses wounded on the battlefield or affected with illness restored to health and made fit to resume their posts? Little has so far been heard of the way this important task is organized, and it is thought that the following account will be all the more welcome:

In order, first, to sum up the main tasks performed by the veterinary surgeon, behind the battle front, it may be said that by staying the bleeding of recent wounds, he is able to save the life of a great many horses. Again, in the case of epidemics, he will have to diagnose the complaint and to take such measures as are required in order to remove the infected animals. The discovery of glanders may even be called a vital question for the army, this terrible disease being transferable to man, even though the epidermis be intact. Any horses responding to the Malleine test are, therefore, killed and dissected immediately, thus controlling the disease and insuring the maintenance of sufficient numbers of these animals.

The treatment of wounded and sick horses, then, takes place at special veterinary hospitals which have, for the first time, been installed during the present war. The writer is indebted to Veterinary Surgeon-Major Ohm and Major von Papen, the medical and military directors respectively of the Insterburg Veterinary Hospital, for the pictures accompanying this article and for much of the information it is based upon.

Horse undergoing Salvarsan treatment

This hospital, at the end of November last, was created, as it were, out of nothing, and had to fulfill a most difficult task, about 140 diseased horses, many of whom were affected with glanders, being transferred to it at the very beginning. The barracks occupied by the hospital, after being vacated by their regiment, had been taken up, in succession, by fugitives from Eastern Prussia, mounted Russian troops (during an invasion lasting but a few days, but leaving its traces of reckless devastation), and, finally, again by fugitives. On being taken over by the cavalry division, the barracks were found in an almost incredible state of neglect, and had to be cleared and disinfected most thoroughly with the assistance of Russian prisoners, before the hospital could commence operation. Rooms for accommodating patients of widely different kinds were made ready, and the hospital now comprises the following departments:

1. The reception stable, accommodating 60 horses, where all the horses coming from the front are kept until received in the proper ward. Here they are submitted to the Malleine test, as well as to blood tests, the result of which is waited before any horse is allowed to leave this stable.

2. A stable for patients suffering from infectious lung diseases, which affords room for 80 horses. This, at the present moment, is used for surgical patients, there being no cases of lung disease.

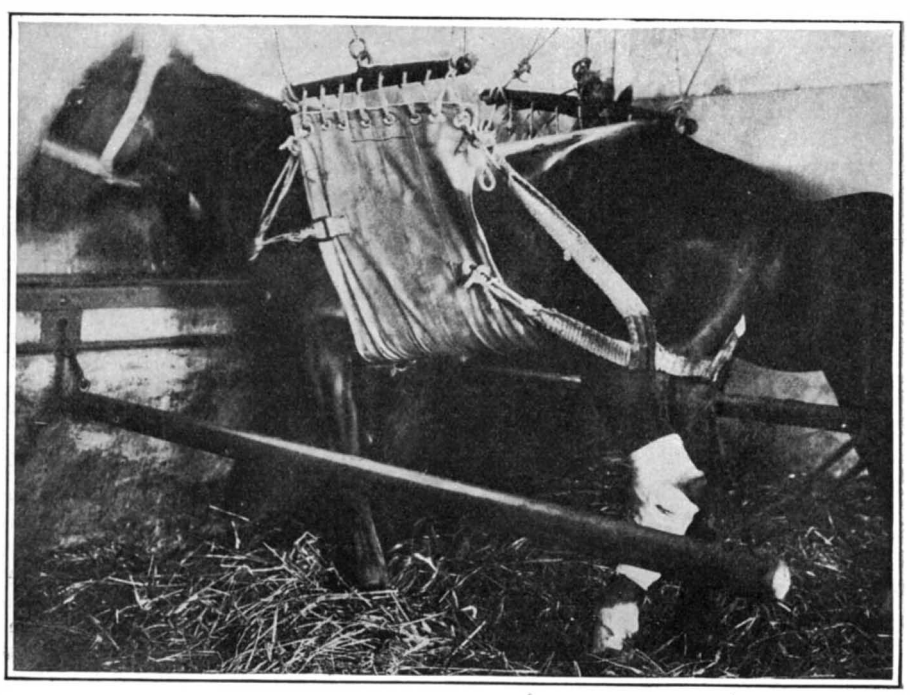
3. A shed comprising several sections, respectively, for horses suffering from glanders, suspected of infection with glanders, and afflicted with mange.

4. Three stables for surgical patients, accommodating 140, 140 and 80 horses, respectively.

5. A stable for officers' horses, mares in foal, and mares and foals, as well as for cured horses, ready to be released.

(*Concluded on page* 132)

Removing the shoes from a horse



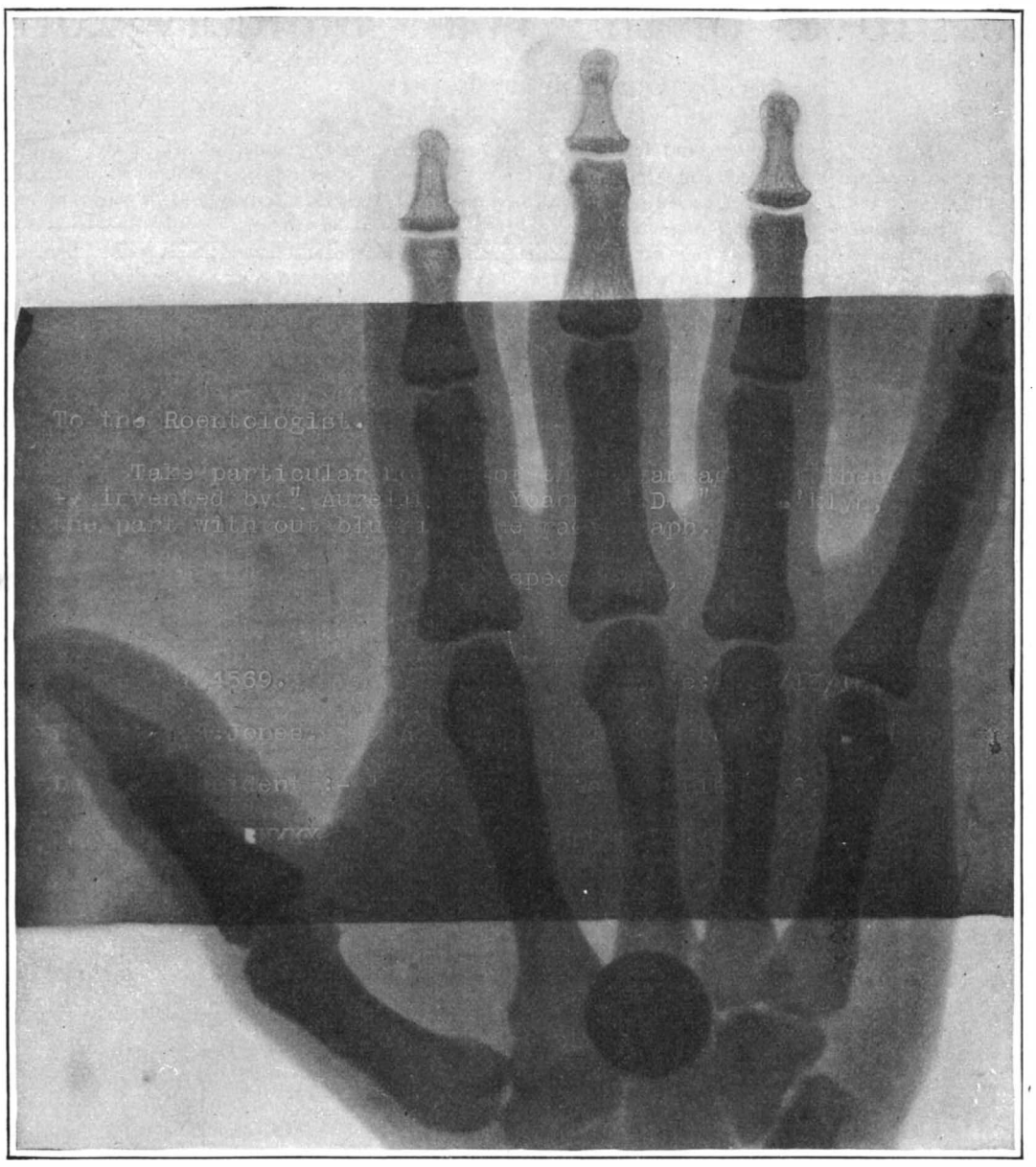
Horse in a sling to relieve weight on an injured leg

## An Improvement in X-Ray Photography for Legal Purposes

IN fifteen states of the Union to-day, X-ray photographs or radiographs are not admitted as legal evidence in court, unless the plates or prints include a label on which is written the name, address, date, remarks and other information relative to the case, over which appears plainly the part presented for damages. Obviously, the label or card must be partially transparent, leaving a more or less distinct view of the injured member showing through.

The method heretofore employed for attaining the transparent data sheet in radiographs consists of a celluloid container, sometimes lettered with the operators' names, into which lead letters and figures mounted on celluloid plates can be inserted. By altering the letters and figures it is possible to secure any desired combination in the legend appearing in the radiograph. While this method serves the purpose intended, still, it presents two objections: first, the lead letters have to be placed adjacent to the object being photographed, with the result that the letters often are displaced or moved out of alinement, resulting in an unsatisfactory—from a legal standpoint—radiograph; second, the very nature of the letters used limits the amount of information that can be registered on the negative.

There recently has appeared a new method of identifying radiographs, which, although of utmost simplicity, appears to have solved the existing objections. Invented by Dr. Aurelius de Yoanna, of Brooklyn, N. Y., it consists essentially of taking advantage of the variation in thickness of a piece of very thin sheet lead, or so-called "tinfoil," which results when writing on it with either a lead pencil or other stylus. As shown in the accompanying illustration, all the desired information may be written by hand or even typewritten on a sheet of tinfoil which is then applied to the hand or other injured member, by any suitable means such as glue or adhesive tape. Due to the fact that the thinned or compressed portions of the tinfoil offer less resistance to the passage of the X-rays than the remainder of the sheet, it is obvious that such portions will be lighter and stand out prominently in the radiograph. On the other hand, the uniform thinness of the tinfoil sheet permits of showing the superimposed member through it. Thus are the legal requirements met with in a simple manner and without necessitating any special apparatus other than a tinfoil radiograph label and an ordinary pencil or similar stylus.

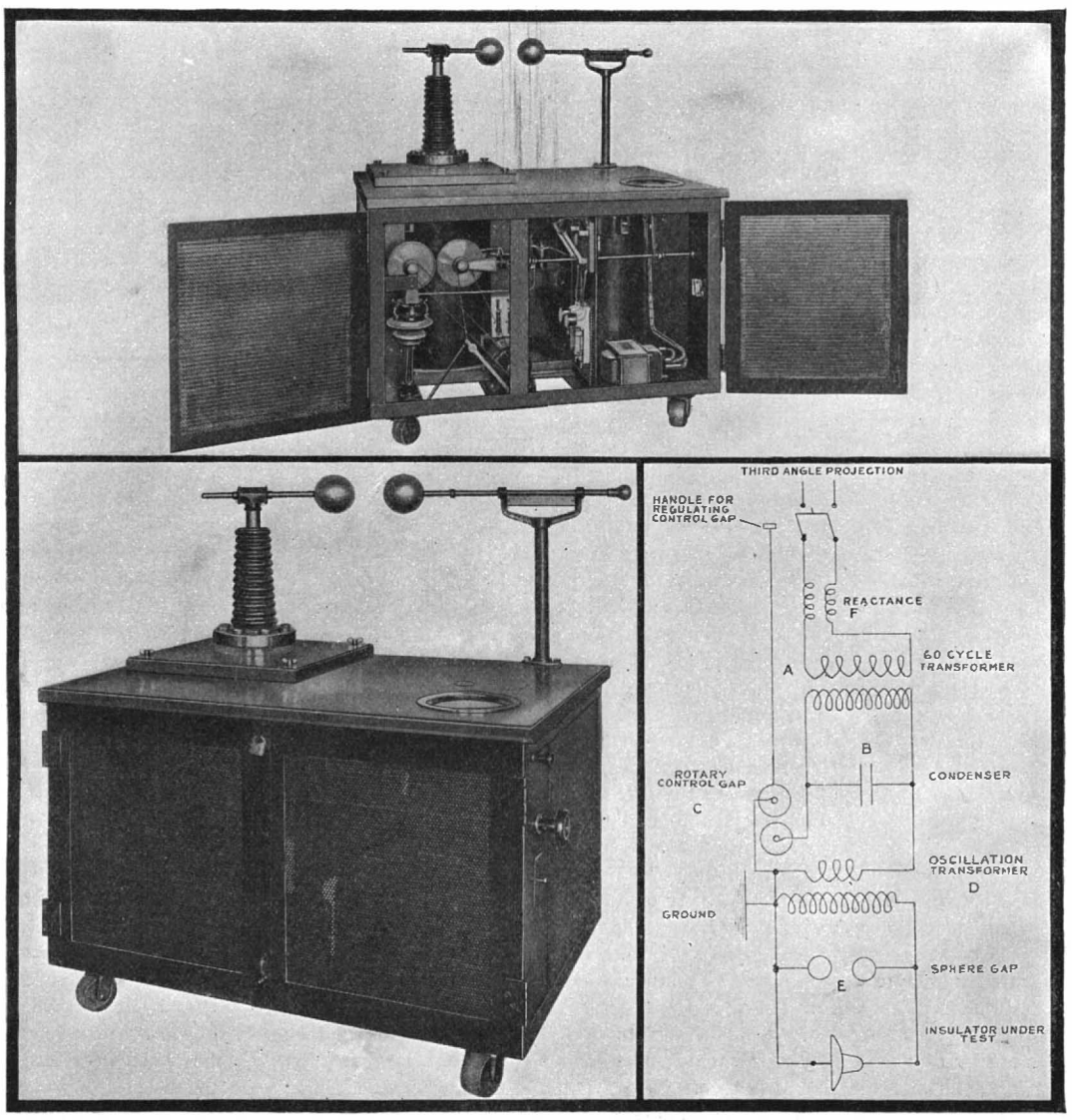



**Typical radiograph intended as legal evidence, showing the use of the newly invented tinfoil radiograph label on which the necessary information has been typewritten**

## Portable High Frequency Oscillator for Testing Purposes

AMONG the more recent electrical testing apparatus is a portable, high frequency oscillator designed especially for the testing of porcelain, high tension line insulators and bushings. It is made in different types and voltages, among the latter being 100,000, 125,000, 250,000 and 500,000 volts. The 125,000-volt type of equipment will deliver current having frequencies of approximately 300,000 cycles at voltages up to about 165,000.

The function of the high frequency oscillator is to approximate the conditions under which insulators fail in service, prime among which being lightning surges, switching surges and arcing grounds. It is designed for testing porcelain insulators only and is best adapted to testing at the factory, laboratory or at some point on a transmission system where insulators are delivered or tested. The essential elements of the high frequency oscillator are, briefly: A step-up transformer which raises 110 or 220 volt primary current to 13,000 volts in the secondary; a condenser placed across the terminals of the high voltage coils of this transformer; an adjustable control gap; an oscillation transformer, oil immersed, with an iron core, consisting of a few turns on the primary and many turns on the secondary; a properly proportioned sphere gap; and a suitable reactance to protect the step-up transformer against the damaging effect of short circuit when a spark takes place at the control gap.




**Collection of views of the new 125,000-volt high frequency oscillator for the testing of porcelain high tension line insulators and bushings**

**Above:** Interior view of the apparatus. At the left: General view of the high frequency oscillator. At the right: Diagram of connections of the apparatus, showing the electrical relationship of the various members

The oscillating current transformer of the testing equipment consists of two concentric windings arranged vertically in a stoneware jar and immersed in oil. This, as well as the other apparatus comprising the equipment, is supported in an angle iron frame mounted on casters and enclosed on all sides with perforated iron. A wooden cover is placed on top and supports the sphere gap.

The voltage of the equipment is controlled by gradually opening the control gap, one electrode being grounded and connected to a rod extending through the side of the case, which permits manipulation while the arc is playing across the gap. The high potential across the sphere gap is read directly in volts.

Heretofore, the usual high potential test of an insulator has been to apply twice its rated voltage at 60 cycles for one minute. However, it has been found that insulators that have successfully passed such a test, while they never fail in practice when subjected to 60-cycle currents of voltages within the rating, are damaged electrically by lightning, by heavy surges from switching by heavy surges from arcing grounds and similar causes. In marked contrast, however, when high frequency current is applied in the tests, the whole insulator is bathed in a visible and audible corona, which clings closely to the surface and searches more thoroughly for flaws and can be extended almost to the edge of the skirts before the spark discharge takes place. This spark then extinguishes itself and relieves the stress in that particular location, whereupon a new spark is formed elsewhere on the insulator surface. One hundred and twenty sparks per second can thus be produced, which is equivalent to 120 separate tests with a 60-cycle outfit. The heating effect produced by the corona discharges is negligible; and while the heat generated from sparks is naturally greater, still it causes a rise of but a few degrees.

In conclusion, the thoroughness of the high frequency test of insulators is strikingly illustrated by the following results: Among 1,000 porcelain parts of different types tested by each method, no failure by the 60-cycle test was noted on any part that had undergone the high frequency test. On the contrary, there was an average of 8 per cent of failures as the result of the application of high frequency current after the insulators had successfully withstood the 60-cycle test, indicating that the former furnishes a more exacting trial.

# Strategic Moves of the War, January 20th, 1916

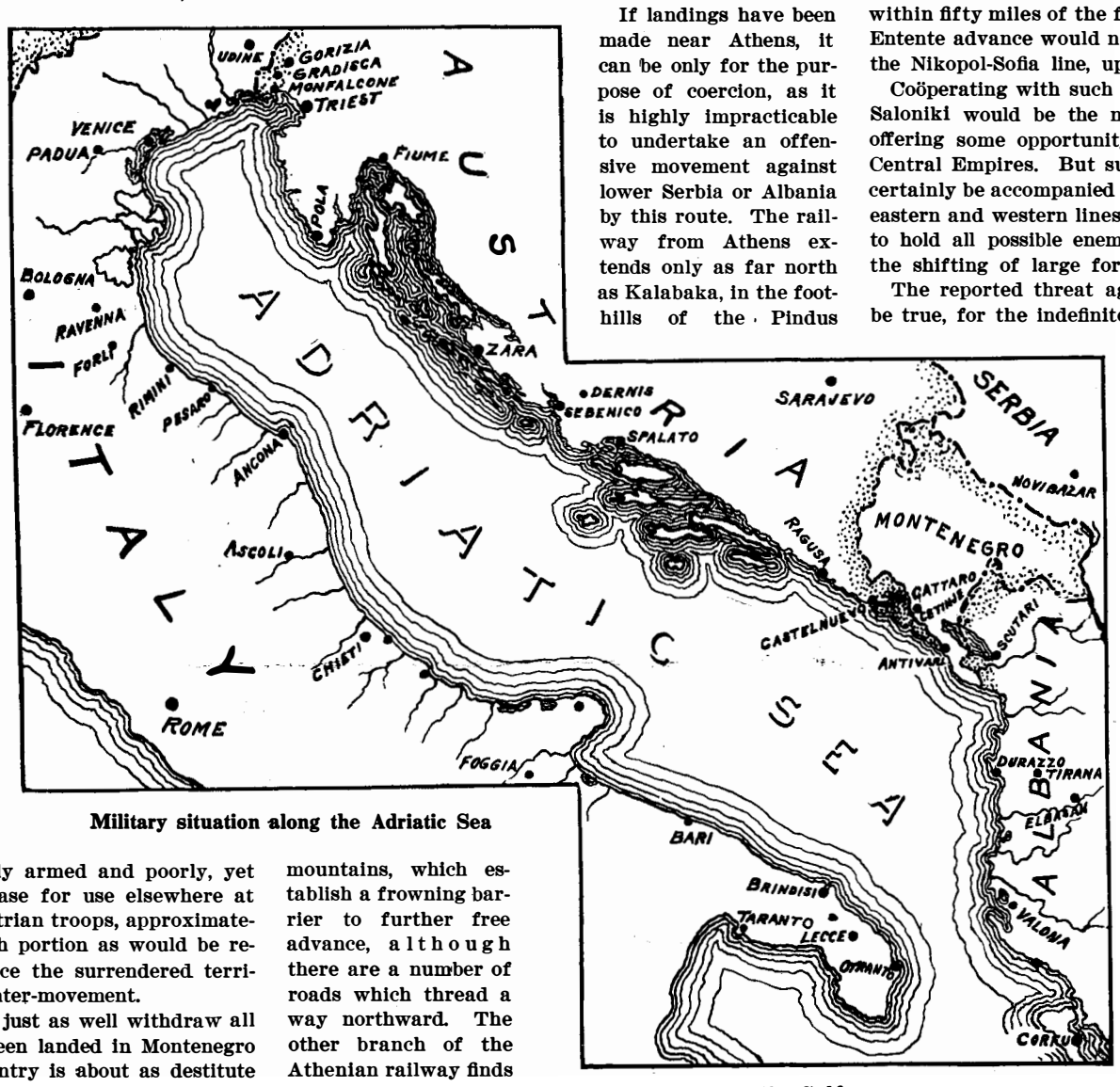
### By Our Military Expert

THE failure of the Entente Allies properly to fortify and defend Mt. Lovcen, the towering buttress of Montenegro which dominates not only the capital of that midget kingdom but the great Austrian naval base at Cattaro, seems, on the face of events, almost inexcusable. Winding a devious way between frowning crags and lofty mountains, the Bocche di Cattaro forms a quiet, secluded roadstead in which a gigantic fleet may rest secure from assault, provided the surrounding eminences are free from hostile, and adequate, occupation.

As a line for military operations, the Montenegrin-Austrian frontier in this section is practically useless, on account of the rugged character of the country and the almost total absence of roads over which an army may operate; but possession of the section, available for secure utilization of the Cattaro naval base, means that unless the Austrian fleet is foolhardy enough to venture forth to give battle to greatly superior forces, it may lie snugly in the mined roadstead at will, while otherwise it might have been shelled out with comparatively few guns of major calibre, and the place be rendered untenable.

It should have taken very few troops and a minimum of material to have secured the position, had effort been made in this direction while there was yet time. It simmers down, in public opinion generally, to another blunder of omission chargeable to the loose confederation of Entente alliance.

Should Montenegro conclude a separate peace with the Central Empires (at present writing reports are somewhat conflicting on this point), the country in question may do so on the ground of not having been signatory to the agreement to wage the war to a conclusion regardless of local conditions. It would include the surrender of all Montenegrin troops, thus vitiating the effectiveness, such as it is, of about thirty or forty thousand rough troops, poorly equipped, poorly armed and poorly, yet valiantly, led. It would release for use elsewhere at least twice the number of Austrian troops, approximately two army corps minus such portion as would be retained in the vicinity to police the surrendered territory and guard against a counter-movement.




**Military situation along the Adriatic Sea**

In such a case, Italy would just as well withdraw all her forces which may have been landed in Montenegro and Albania. This latter country is about as destitute of roads as the former and its terrain is equally forbidding. The attempt to administer a strong flank attack upon the Teutonic forces in Serbia through this section would be attended by such difficulty that much better results would accrue, even at greater loss in battle, through direct attack from Saloniki in ample force.

Italy may reasonably withdraw and concentrate her efforts along her Austrian battle-line, or add to the Entente strength at Saloniki. The ultimate effect upon these Adriatic principalities would amount to as much as would attend their occupation if, through the efforts of the Entente, victory eventually ensues to the cause. The negotiations would then certainly include restoration of Montenegro and Albania, and the Entente would have been the gainer by the lessening of the front to be occupied during the war. Sentimental reasons may have dictated the sending of troops to this section in the first place; they are certainly useless there now.

For months, Italy has been hammering at the Austrian line, apparently with little success. From the nature of the ground, it is a task Herculean which Italy has undertaken; yet it would seem that, with Austrian forces necessarily divided and with principal activity elsewhere so far as numbers go, Italy's resources should have forced a passage ere now. The anomalous situation wherein Italy is declaredly at war with Austria, while Austria's dominating ally, Germany, is not officially included, is peculiar, to say the least. Correspondents who have been in Italy recently report that things German are by no means taboo there, and that the internal situation has no likeness to that in other countries of the Entente with regard to people, customs and activities of their enemies.

This has led observers to deduce that Italy has only her own immediate ax to grind and would be content to wrest her personal gains from Austria without further concern with the war. The signing of Italy to the "Fight to the End" treaty, seems to disprove this; but certainly there is something strange in the matter.

The reported landing of Entente forces at various Grecian points other than Saloniki and Orphani, upon which latter place the Entente right is supposed to rest, leads to much speculation as to the truth of the report and the object of the move. Piraeus and Phaleron, Athenian seaports, it is stated, are now occupied by Entente forces of unknown strength, while the island of Corfu, separated from the Albanian-Grecian frontier by a guarding strait, has become a veritable island of regeneration for the war-worn Serbian forces which, it is alleged, will be reorganized and reëquipped for further service, by means of Entente resources.

If landings have been made near Athens, it can be only for the purpose of coercion, as it is highly impracticable to undertake an offensive movement against lower Serbia or Albania by this route. The railway from Athens extends only as far north as Kalabaka, in the foothills of the Pindus mountains, which establish a frowning barrier to further free advance, although there are a number of roads which thread a way northward. The other branch of the Athenian railway finds a terminus at Symora, on the western shore of the Gulf of Saloniki. As a railway from Saloniki extends westward by devious way, toward Monastir, the same ultimate ground is tapped by a shorter line.

Of course, it is not impossible that a military movement be undertaken through Thessaly but there seems to exist no necessity for it.

The condition of Montenegro and the practical clearing of Albania, or that portion of it which offers any threat to Teutonic communications or flank, seem to clear up the situation to a certain extent, to simplify it by the reduction of extent of the battle lines. Something must occur before long, for it is unreasonable to believe that the Central Empires are willing or able to retain a large force, even if it is principally composed of Bulgar and Turk, inactive. At the present moment, Saloniki is able to report "We are holding them off," while Teutonia is equally justified in saying "We are holding them in." It is a fair statement from either side, but no immediate advantage accrues to either Teuton or Entente as things now are.

The mere fact that the Entente persists in holding on at the Grecian seaport, is sufficient to demonstrate that there is a purpose behind it, which, in all probability resolves itself into the possession of an adequate base for an offensive when conditions become ripe, if they ever do. While the Russian offensive seems to have momentarily slackened, there is every reason why an attempt should be made to force home the clearing of Bukowina, that province which Roumania regards as her own and desires mightily. Without doubt, it is part of the price Russia has agreed to pay for active Roumanian support, even though it is purchasing with the property of another. With this Austrian province controlled to the Carpathians, with a general bracing of Russian strength, it is not inconceivable that Roumania would at once take heart and throw in her lot with the Entente cause.

Should that become an accomplished fact, the occupation of Saloniki would be fully vindicated. Russian and Roumanian troops would certainly strike southward against Bulgaria, along the five great railway lines of Roumania, while the western frontier of that country is well guarded by the Transylvanian Alps, which form its boundary, being touched at only six points by railways in a distance of some four hundred miles; and of the six railways, only four penetrate the frontier.

With Roumania in the game, the railway line which connects the Central Empires with Turkey and the East, the backbone of the entire Balkan theatre of war, is within fifty miles of the frontier, although any probable Entente advance would necessarily strike directly down the Nikopol-Sofia line, upon the latter city.

Coöperating with such a movement, an advance from Saloniki would be the natural sequence, even though offering some opportunity for defeat in detail by the Central Empires. But such a movement would almost certainly be accompanied by demonstrations on the main eastern and western lines, Russia, France and Flanders, to hold all possible enemy troops in place and prevent the shifting of large forces to meet the crisis.

The reported threat against Greece, then, may well be true, for the indefinite position of that monarchy is a sore trial to both contending parties. Force may have been utilized to supplement the diplomacy which has so signally failed in Balkan situations of the past when applied by the Entente. Perhaps there is a new diplomacy emerged from the crucible of failure. It is certain that the Entente would be in better case even if Greece should actively declare against the coalition than it is at present, where a policy of gloved handling handicaps decisive action.

It is believed by observers generally that the preponderance of the Greek population is inclined to favor the Entente cause. A Teutonic queen, a perplexed king, a populace fearing the wrath of Germany's mighty vengeance in case of failure, constitute a situation wherein the Gordian knot must be cut by no uncertain hand, and that, soon.

Should the present Grecian administration be overthrown and a republic under Venizelos be established, a possibility which is indicated in dispatches, the probability of Grecian forces taking the field with the Entente is considerable. Such additional strength should go far toward permitting an advance from the Saloniki lines and precipitate an action of the first magnitude, which might have a decisive bearing upon the conclusion of the war, if only by restricting the warring lines to the old east-and-west fronts in case local victory resulted for the Entente.

If the Teutonic attack upon Saloniki takes place within a short time, as is reported in contemplation, and if Bulgarian and Turkish troops participate actively, it may in itself bring Greece into the fight in defense of the integrity of the land.

## Microstructural Changes in Annealed Bronze

THE United States Bureau of Standards has just completed a study of the annealing of bronze, using the commercially important alloy zinc bronze (copper 88, tin 10, zinc 2) as a type. The results indicate that bronze is very different in its behavior from steel. It shows no recrystallization or grain refining unless it has been previously cold worked, as by rolling or hammering.

Heretofore, there has existed a general belief among metal workers that cast brasses and bronzes, not unlike cast steel, were greatly improved as a result of refining the grain by proper annealing.

# The Heavens in February, 1916

## Our Interesting Neighbor, Mars

By Prof. Henry Norris Russell, Ph. D.

NEXT to the solar eclipse of February 3rd—which was fully described in our last article—the most interesting event of the present month is the opposition of Mars, which occurs on the 9th.

The ruddy planet is at this time in the constellation Leo, about 18 deg. north of the celestial equator and, so far as his position in the heavens goes, very favorably placed for observation. As regards his distance from us, however, the present opposition is far from favorable—the closest approach of the two planets, on the day preceding the opposition, being 62,500,000 miles.

The orbit of Mars is decidedly elliptical, so that, though his mean distance from the sun is 141,000,000 miles, his greatest distance is 154,000,000, and his least only 128,000,000. The Earth's orbit is much more nearly circular, the greatest distance from the sun being 94,500,000 miles, and the least 91,500,000, and the two orbits are so disposed in space that the aphelion of the Earth—its remotest point from the sun and the perihelion of Mars—its nearest point to the sun—are nearly opposite to one another. If, therefore, the Earth passes between the sun and Mars at the time when Mars is in perihelion, the distance of the two planets is only 34,500,000 miles—the smallest possible value. Such a "favorable opposition" always occurs in the latter part of August, for it is at this time every year that the Earth reaches the appropriate point in her orbit.

At a February opposition, on the contrary, Mars is near his aphelion, and more than 60,000,000 miles outside the Earth's orbit—the present month furnishing an almost perfect example.

Since it takes the Earth a little more than two years to catch up with Mars, each successive opposition comes some 50 deg. farther east in longitude than the last, and the point of opposition works slowly round the sun, taking about 16 years to complete a circuit. Favorable oppositions therefore come at intervals of 15 or 17 years. The last one was in 1909, and the next—an unusually good one—will happen in 1924. After one of these dates the oppositions are successively less favorable for some eight years, and then gradually improve again.

At the present time Mars shows a telescopic disk a little less than 15 inches in diameter and appears to the eye like a star of magnitude—1.0—that is, three times as bright as Capella, and about 60 per cent as bright as Sirius. At a favorable opposition his diameter is fully 25 inches, and his magnitude is −2.7, making him nearly three times as bright as Sirius, and nearly five times his present brightness.

There are, however, certain observations for which the present opposition is valuable, for it is now summer in the northern hemisphere of Mars, and his northern temperate and polar regions are turned toward the sun, and are therefore visible, while the south pole is turned away and is invisible. At the favorable oppositions the reverse is the case. The south polar regions, and indeed the southern hemisphere generally can then be well studied; but the northern regions must wait for occasions like the present.

The possessor of a small telescope, though he may be disappointed in the small apparent size which Mars presents, can nevertheless see things of real interest, the darker areas which spot the generally ruddy surface, and the conspicuous white polar cap, shrinking as the Martian summer advances. The finer details, and notably the much discussed "canals," can, of course, only be seen with instruments of very high power.

The present Martian season is about half way from the vernal equinox toward the summer solstice, corresponding to the beginning of May on the earth. The polar cap is large, and shrinking rapidly, while, according to Dr. Lowell's latest bulletin, the northern canals are prominent, and the southern faint.

### The Heavens

As our map shows the finest region of the evening sky is now in the southwest. Right overhead are the twin stars of Gemini, Castor and Pollux—the former white, and a fine telescope pair, the latter yellow and single. South of them is the still brighter star Procyon, in Canis Minor, while nearer, and to the southwest is the planet Saturn, which is brighter than any of these three stars.

Lower down, in the south, is Sirius, brightest of all, with the remaining stars of Canis Major below and to the left. Southwest, and a little higher, is Orion, the finest group in the sky, and to the right of this, almost due west, is Taurus.

Northwest of the zenith is Auriga, with the brilliant Capella, second only to Sirius among the stars now in sight, while Perseus is lower down, and Cassiopeia still lower, and to the right.

Just north of east below the Pole are Draco and Ursa Major, rising toward the meridian. Below, a little north of east, Bootes has just risen and most of Virgo is also in sight a little farther south. Leo is high in the east, bearing Mars like a ball of fire in his forepaws, while Hydra, whose head is southeast of the zenith, trails downward to and below the horizon.


At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9½ o'clock: March 1.

At 9 o'clock: Mar. 8.
At 8½ o'clock: Mar. 16.
At 8 o'clock: Mar. 23.

NIGHT SKY: FEBRUARY AND MARCH

### The Planets

Mercury, which was an evening star last month, passes between us and the sun—though considerably north of the direct line—on the 5th, and becomes a morning star. He will be well visible at the end of the month, and reaches his greatest elongation on March 1st when he is 27 deg. east of the sun; and rises about 5:30 A.M.

Venus is an evening star, growing brighter as she approaches the Earth and more conspicuous as she gets farther north. Telescopically, she shows a gibbous phase, like the moon, four or five days from the full. To the naked eye, the most notable event will be the conjunction with Jupiter on the evening of the 13th. The two planets are then only four tenths of a degree apart, and will form a very striking spectacle, on account of their great brilliancy. Venus appears nearly two magnitudes brighter than Jupiter—that is, about six times as bright. Nevertheless, when viewed telescopically, Jupiter will be found to appear of more than twice the apparent diameter of Venus, and more than five times her "angular area," even if the whole disk of Venus were visible. As only a little more than three quarters of the illuminated surface of Venus is visible, the actual ratio of the angular areas of the two planets is seven to one in favor of Jupiter. It follows that, for equal apparent areas, the surface of Venus appears to be more than forty times as bright as that of Jupiter. The reason for this is obvious. Jupiter is 460,000,000 miles from the sun, and Venus only 67,000,000. The intensity of the sun's light varies inversely as the square of the distance, so that Jupiter, per square mile, gets only one forty-seventh as much light as Venus does, and, if the actual reflecting power of their surfaces were the same, the brightness of parts of the two planets of the same apparent size would be in this ratio.

When allowance is made for the fact that part of the visible surface of Venus is not fully illuminated by the sun, it is found that the reflecting power, or "albedo" of the surfaces of the two planets is very nearly the same;—59 per cent for Venus and 56 per cent for Jupiter.

Mars is in opposition, as already described, and moves from Leo into Cancer during the month. He is visible all night long, and is by far the most prominent object in the eastern sky. Jupiter is an evening star, setting at 8:20 P.M. on the 15th, and visible, even before sunset, if one knows just where to look. Saturn is in Gemini, coming to the meridian about 9 P.M., and very well placed for observation.

Uranus is in conjunction with the sun on the 5th, and is quite invisible.

Neptune is just past opposition—his position on February 2d being R. A. 8h. 12m. 31s. Reclination +19° 39′ 14″, and on March 1st 8h. 9m. 41s. +19° 48′ 32″. This places him about 1° 50′ north, and from 1° 15′ to 40′ east, of the triple star Zeta Cancri, which itself is at the apex of a right-angled isosceles triangle whose acute angles fall on β and δ Cancer (shown on our map). To identify the planet without a detailed star-map it will be necessary to make a sketch of the faint star in the region and watch for the planet's motion. He is of magnitude 7.7—quite invisible to the naked eye—but can be seen with a good field-glass.

The moon is new at 11 A.M. on February 3d, in her first quarter at 5 P.M. on the 10th, full at 9 P.M. on the 18th, and in her last quarter at 4 A.M. on the 26th. She is nearest the Earth on the 1st, remotest on the 13th, and reaches her nearest point (perigee) once more on the 29th. On the 3d, she eclipses the sun, the eclipse being partial for the eastern United States, and lasting from about 10 A.M. to noon. She is also in conjunction with Uranus and Mercury on this day—both being very near the sun—with Venus on the 6th, Jupiter on the 7th, Saturn on the 15th, Neptune on the 16th, and Mars on the 18th.

Princeton University Observatory,
January 18th, 1916.

## The Current Supplement

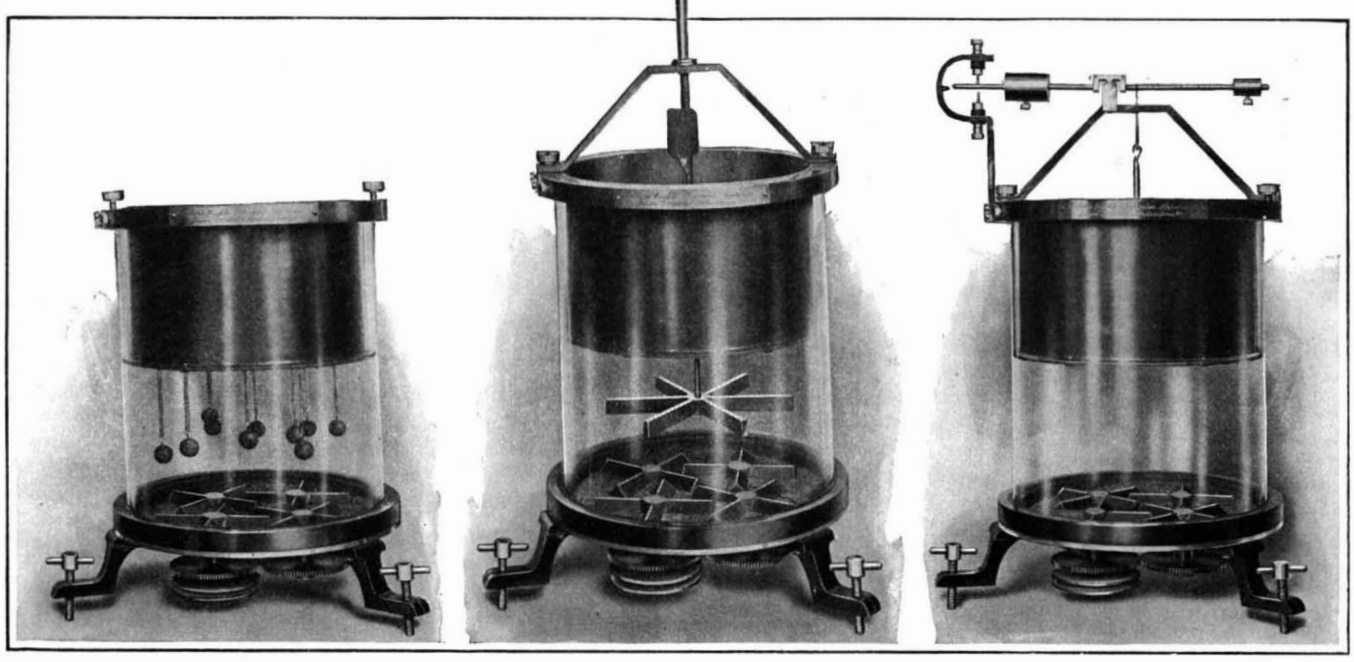
AN article on *The Construction of the Heavens*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, of January 29th, No. 2091, is an unusually readable survey of the progress of sidereal astronomy. *The Destruction of Historic Edifices in Europe* gives a few facts in regard to the irreparable injuries that have been inflicted on many famous public buildings. There are some pictures showing attempts at protecting the exterior decorations. *Searchlights in War* tells about some of the later and large electric outfits, and their various uses. The article is accompanied by excellent descriptive illustrations. An important paper at this time is the one on *Our Merchant Marine* that reviews its past history and future possibilities. In view of the proposals to establish government research laboratories the illustrated description of *The U. S. Naval Engineering Experiment Station at Annapolis* is timely, for comparatively few people are aware of what has already been done in this direction. *By-products of Gas Manufacture* gives notes on the recovery of hydrocyanic acid and its applications. *An Ingenious Electric Drive Gear* describes the operating mechanism of a gasoline motor car for use on branch line railways, a problem that is attracting attention in transportation circles. It is accompanied by several illustrations of the mechanism employed. *Zeppelin Airships* is a descriptive and historical address by the designer of these monsters of the air, together with some discussion of the subject. There are several appropriate illustrations. *Oil-Mixed Portland Cement Concrete* gives useful information in regard to the preparation and use of a valuable building material. The paper on *The Improvement of the High-Boiling Petroleum Oils* is concluded. There are also several shorter articles of general interest.

## Apparatus for Demonstrating the Motion of Gas Molecules

MUCH credit is due Dr. Edwin F. Northrup of the Palmer Physical Laboratory, Princeton University, Princeton, N. J., for developing what is believed to be the first mechanical apparatus ever designed for fully and successfully illustrating, in a visible way, the motion of gas molecules and the principles which govern these motions as laid down in the kinetic theory of gases, and for the verification of some of the theorems of this theory with quantitative measurements.

The apparatus consists essentially of a circular metal base, supported on three legs provided with leveling screws, on which rests a glass cylinder with open ends. The glass cylinder is approximately 25 cms. high and 22 cms. in diameter. A metal ring rests upon the top of the glass cylinder. Various attachments can be made to this ring. When the apparatus is used for illustrating the motions of gas molecules and the pressure produced on the walls of the container by molecular impact, there is suspended from a cross-piece attached to the metal ring a floating disk of glass. This glass disk is capable of free motion, in the manner of a piston-head, within the glass cylinder. The glass disk is ordinarily located a little above midway between the bottom and top of the glass cylinder. In the volume enclosed by the glass cylinder between the base piece and the floating glass disk, approximately 16,000 steel balls of 1-16-inch diameter are maintained in motion in the manner of gas molecules. The distribution of the balls throughout the volume in which they move is perfectly uniform. The motion of the balls is produced by means of four metal rotors which rest upon the metal base and rotate in the horizontal plane; two of them rotating in a clockwise and two in an anti-clockwise direction. The impact given the steel balls by the revolving rotors causes them to be in constant motion, simulating the action of gas molecules. Power for driving the rotors is derived from a small electric motor. Underneath the steel plate of the apparatus are four intermeshing gear wheels and a pulley for belt attachment to the motor.

The Northrup visible molecules apparatus, as it is termed, together with its accessories is designed to illustrate in a striking and convincing manner the following fundamental properties of a nearly perfect gas: First.—The change of pressure of a gas when the volume is maintained constant and the pressure changes. Second.—The change of volume of a gas at constant pressure with change of temperature. Third.—The property known as the viscosity of a gas—a property which is exhibited in all gases when the oscillations of an oscillating system suspended in a gas are damped out. Fourth.—The property possessed by a gas (and a liquid) of causing the irregular motion of small particles suspended in the fluid, known as Brownian movements. In the accompanying illustrations the accessories required for the different demonstrations, as well as the method of arranging the apparatus, are shown.



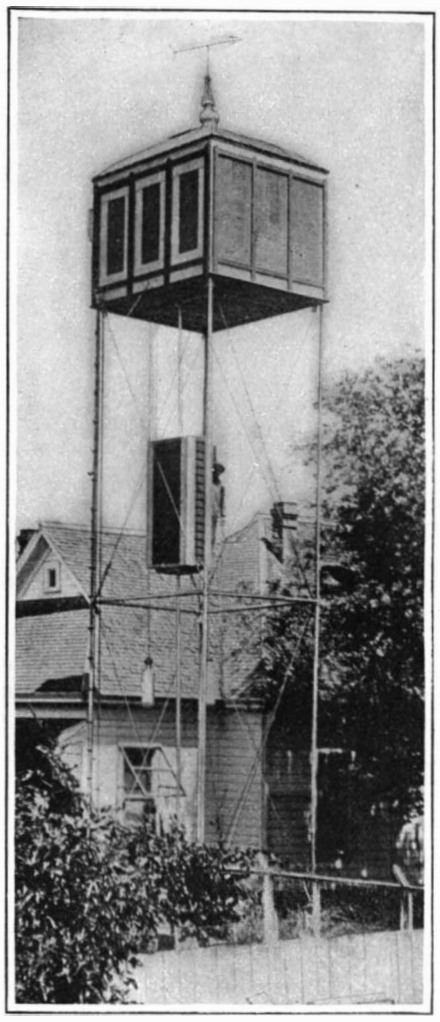
**Visible molecules apparatus developed by Dr. Northrup, arranged for different demonstrations of the principles of gas molecules**

At the left: Apparatus arranged with suspended wooden balls for illustrating the Brownian movements. Center: Set up of the apparatus with steel disk, rod and iron hub for illustrating viscosity of a gas. At the right: Apparatus assembled to illustrate and demonstrate changes in pressure, at constant volume, of a gas, when the temperature changes.

## Unique Sleeping Room Reached by One-Passenger Elevator

THE city engineer of a small town in California, who desired to spend his sleeping hours above the sultry air of his bed-room, hit upon the ingenious scheme of building an elevated sleeping apartment, far enough above the ground so that there would be a noticeable change in the temperature and the purity of the air. The net result of his efforts is veritably a nest in an iron tree, for he erected four stout iron pipes, braced them securely and built a comfortable sleeping room at the top. The distance between the floor is nearly 40 feet, and it is safe in all weather.

Its builder estimates that it will withstand a 200 mile-an-hour hurricane with ease. Aside from the principle of the idea itself, probably the most unique feature is the means for reaching the lofty sleeping room. A small, box-like elevator, guided by a two-inch galvanized iron pipe, is lifted by the strength of a one-sixth horse-power electric motor. Screens enclose two ends of the house, so that the ventilation nearly approaches that to be had by sleeping in the open on the hill-top.

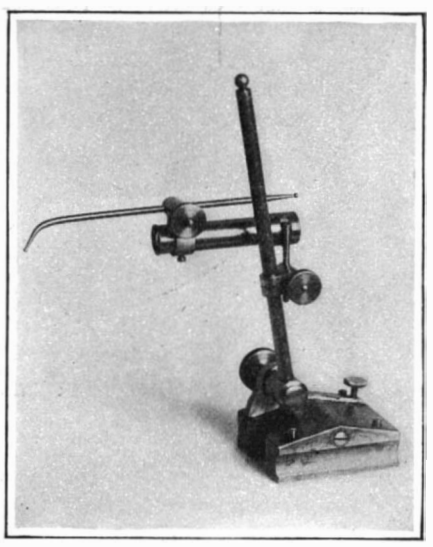


**Elevated sleeping apartment built by California engineer**

## Electric Test Indicator for Surface Gage

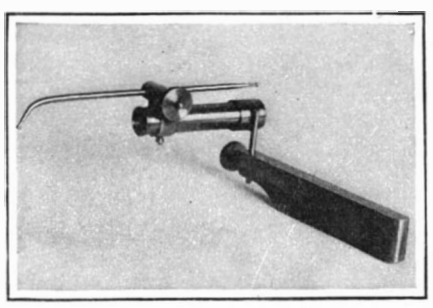
TO eliminate the strain on the eyes which accompanies the employment of an ordinary surface gage used by machinists and toolmakers, there has been devised an electric test indicator of simple design.

The device, which is shown in the accompanying illustrations, is the invention of J. G. Xander of Reading, Pa. It consists of a main body containing the battery and electric bulb, a gaging needle and the holding member. There are no connecting wires, and in every other respect the instrument is self-contained. The dry battery is renewable at small expense; its life being more or less problematical since it depends entirely on the service to which the indicator is put. The inventor states that he has used an indicator daily for over three months before renewal of the battery became necessary, and this may be considered a fair average.



**Electric test indicator mounted on usual surface gage**

It will be noticed that this device is entirely self-contained, and no connecting wires are necessary



**Electric test indicator mounted on a tool rest piece**

In use, the electric test indicator is applied in the same manner as the usual gages, but instead of watching the contact of the needle of the surface gage with the work being trued up in any machine tool, the workman is only obliged to watch for the flash of the electric lamp. The moment the ball point of the needle touches the highest point of the work in hand, either internal or external, the light in the end of the tube flashes. Thus there is indicated the direction in which the job must be moved, and after the work is perfectly true the light burns continuously. The indicator is claimed to be very sensitive and even the lightest touch of the needle causes the light to be flashed on. A special holder is provided for the indictator, permitting of its use in the tool-post of a lathe or other machine, where it may be inconvenient to use a surface gage.

## Paper and Charcoal from Hopvines

GERMAN scientists are certainly leaving no stone unturned in their efforts to assist the Fatherland to utilize every possible product which can be turned into a national asset. One of the latest announcements made is that hopvines may be made to yield an excellent quality of fiber for use in jute mills and paper mills, and likewise charcoal for powder. In the *Chemiker Zeitung* (Cöthen) August 7th, Otto Reinke states the result of his researches on the subject as follows:

"Willow-bark does not yield good fiber, the fiber being too closely surrounded. The broom-plant is not available, since if over treated with steam or soda-lye the fibers are too short and too weak, and like willow and hopvines it cannot easily be stripped except when treated with steam or a 0.5 per cent solution of hydrochloric or sulphuric acid, while in spite of this the fiber remains too much incrusted to be satisfactory to our manufacturers of jute. I, therefore, began to experiment with the hopvine, which is available in large quantities, since our breweries use 500,000 heads of hops yearly in making beer, and the yield is about 8,000 plants per hectar.

"The fiber is difficult to isolate by means of lye, but can be easily stripped after softening in a 0.5 per cent solution of inorganic acid, as also by steam at about 0.5 at. But since old vines, when allowed to lie long in the open yield fiber free of the incrusting substance and easily stripped, obviously this method is preferable, or better still, artificial layering in warm damp piles or layers."

By this method Mr. Reinke obtained a yield of 20 per cent of good fiber. The remaining wood, when treated with a 6 per cent solution of soda-lye at 3 at. gave exceptionally good paper fiber. From the roots also very beautiful long-fibered paper material was produced.

The wood of the vine, which is hollow, was dried and subjected to dry distillation and carburization. At 330 deg. Cent. beautiful red and brown charcoal was obtained, exhibiting the qualities demanded in good powder charcoal. Mr. Reinke therefore urges all patriotic hop-growers to pile their cut vines and allow them to be rained on and to ferment, and afterwards to dry for the sake of the fiber and charcoal obtainable.

## RECENTLY PATENTED INVENTIONS

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

### Pertaining to Apparel

SHIRT.—H. GERHARDT, 413 Diamond Ave., Hazleton, Pa. This invention relates to shirts, and has reference more particularly to a shirt which will not pull out of the trousers of the wearer. To obviate a number of objections, Mr. Gerhardt designed a shirt which will not pull out of the trousers, which will leave the legs free and therefore not interfere with the movements of the wearer, and which is convenient and simple in structure.

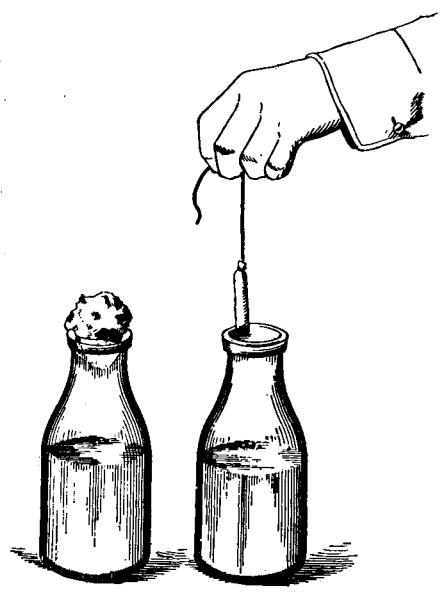
### Electrical Devices

CUT OUT AND SWITCH.—J. J. BUERO, 129 Calhoun St., Charleston, S. C. The invention is especially adapted for use between high tension conductors and buildings, wherein mechanism is provided in connection with the switch for preventing over charging of the wiring of the building in case of break downs or improper action of the transformers, the said mechanism being so arranged that an increase of voltage above a predetermined point will operate the said mechanism to disconnect the wiring of the building and to shunt the current to ground.

### Of Interest to Farmers

INSECT EXTERMINATOR.—W. G. ELKIN, French Camp, Miss. The invention provides an exterminator which may be readily driven by hand, its particular adaptation being for use in connection with cotton plants to trap and exterminate boll weevils, the device being in the nature of a hand-operated ground wheel supported framework, carrying an adjustable container wherein some suitable liquid may be contained for killing the insects.

CULTURE STARTER MAILING PACKET AND METHOD FOR MAKING THE SAME.—B. BARLOW, care of Albert Dickinson Co., Box 788, Chicago, Ill. This invention relates more particularly to a culture starter for making butter and cheese. The culture remains pure a long while in use, because the center of pure



CULTURE STARTING MAILING PACKET.

growth is carried over when the sack is lifted from one bottom of pasteurized milk to another. By other methods an average mixed sample is transferred. The culture is easy to handle and convenient in use. It has shown its advantage in transmission through the mail, as it goes in a sealed envelope as mail matter of first-class.

### Of General Interest

BOOK MARKER.—HELEN S. CARSON, 4717 Kimbark Ave., Chicago, Ill. This invention does away with the use of ribbons for holding the several marks in place within the book as arranged, and utilizes cover engaging strips, preferably of an adjustable nature adapting them for use in connection with books of different sizes, in place of such ribbons as illustrated in this inventors' former patent, No. 1,056,322.

PLASTER BOARD.—J. R. WALSH, Herkimer Bldg., Jacksonville, Fla. The improvement provides a plaster board formed of folding panels hingedly connected, for folding into compact form, for transportation, and arranged to be extended into the same plane to be applied flat, where no extra stiffness is required, thus eliminating joints between the panels, and eliminating the work of pointing joints, and preventing usual joint marks or cracks on the finish plaster.

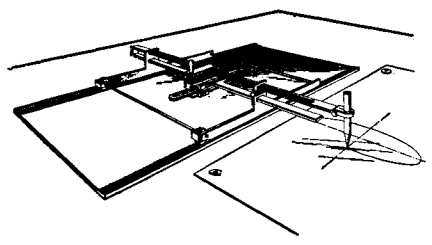
BOTTLE CAP AND OPENER.—N. ELLIS, 407 Townsend St., Syracuse, N. Y. The invention relates to bottle caps and more particularly to means associated therewith whereby the cap can be removed from the bottle without the aid of the customary cap remover or opener, and consequently dispensing with the necessity of looking for one when bottles are to be opened.

PHOTOGRAPHIC CAMERA.—S. ZACHARIA, 491 Broadway, Astoria, New York, N. Y. This invention relates to cameras using roll films, film packs, plates or other sensitized mediums, and an object is to provide a photographic camera arranged to permit convenient viewing of the image in correct position and in full size to facilitate accurate focusing.

EGG CARRIER.—I. V. BOWLEY, 25 Rollins St., Boston Mass. This invention relates to packing and shipping devices and has particular reference to fillers for egg crates or the like wherein provision is made for holding individual articles such as eggs, electric lamp bulbs, bottles or the like, in spaced relation to one another.

OPTHALMOSCOPE.—F. A. WELCH, 412 W. 115th St., New York, N. Y. The ophthalmoscope has a lamp and peep hole closely adjacent the lamp, and a rotary lens disk having a plurality of concentrically disposed series of lenses associated with the lamp and peep hole in such a manner as to shift the lens disk radially with relation to the lamp so as to bring any lens of either series within the line of sight.

ELLIPSOGRAPH.—F. KIRK and L. E. FRANCISCO, P. O. Box 10, Canon City, Colo. This invention provides a device designed for use by draftsmen and others, for drawing perfect ellipses, wherein a table is provided and a carriage having guided movement on the table,



ELLIPSOGRAPH.

together with an arm moving transversely of the table and provided with marking means, and connected to the table in such manner that the combined movement of the arm and the table will permit the drawing of a perfect ellipse.

DEVICE FOR AUTOMATICALLY ANCHORING SUBMARINE MINES AT A PREDETERMINED DEPTH INDEPENDENTLY OF THE BOTTOM OF THE SEA.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. The anchoring device forming the object of this invention permits of realizing the automatic transformation of anchored mines into floating mines when the depth of the sea exceeds the length of the mooring cable contained in the anchor so that soon after the launching the submarine mine places itself automatically at a predetermined depth whatever the depth of the sea may be.

APPARATUS FOR PROMOTING THE GROWTH OF HAIR.—L. J. WIDNESS, 208 Van Buren St., Brooklyn, New York, N. Y. The invention relates particularly with respect to the hair, and the main object thereof is to provide mechanical means for raising the scalp from the skull to permit the previously impeded circulation of blood due to a tight scalp to resume its normal flow and thus feed the hair follicles and hair roots and inducing the growth of the hair.

POST CARD RACK.—G. HONIG, Alice, Tex. This device comprises a rotary holder or rack mounted for rotation around a vertical axis and including a skirt-like outer wall of flexible material folded so as to form circumferentially arranged pockets into which the lower ends of a large quantity of post cards or the like may be inserted and supported in connection with certain other elements of the structure.

BOTTLE VALVE.—C. F. LENG, 42 Broadway, New York, N. Y. This invention provides a valve more especially designed to prevent refilling of the bottle by force or by the use of a vacuum, to allow easy and smooth decanting of the contents, and to prevent the valve from being forced down into the bottle or being removed therefrom after it is once inserted in the neck of the bottle.

NEWSPAPER EASEL.—J. MCCARTHY. Address McCarthy, Edge & Cleland, 909-911 Paulsen Bldg., Spokane, Wash. This invention has for one of its principal objects, the production of a device of convenient size and shape adapted to hold a newspaper or other reading matter while the reader is dining or is otherwise so situated that his hands are not free to hold the paper.

DINNER PAIL.—W. R. WRIGHT, 513 W. 4th St., Marion, Ind. Among the objects of this invention is the provision of a dinner-pail that shall, within the usual compass, not only provide suitable containers for both solid and liquid food, but also within that compass provide means for heating the said food.

### Hardware and Tools

DRAWING PEN REGULATOR.—M. P. STROCK, 1041 Grandview, Boulder Colo. This improvement relates to drawing pens and has reference more particularly to means for regulating the width of the line to be drawn and whereby any predetermined width of line can be easily obtained by setting the regulator of the pen at a predetermined position.

SWIVEL JOINT FOR HOSE REELS.—S. CLAY, address Harry E. Hoke, Hanover, Pa. This invention refers to swivel joint hose connections and more particularly to a swivel joint, especially adapted for use in connection with hose reels to form one of the notable supports thereof, the object being to enable a hose and reel to carry hose of varying lengths, thus permitting the sprinkling operation to be accomplished with the use of a given length of hose without unwinding all of the same from the reel.

LOCK.—G. A. WEHNER, 420 Habersham St., Savannah, Ga. The invention provides a lock of the permutation type, wherein a bolt is provided, and a casing having means for locking the bolt in locking position, the bolt and lock members being normally spring released, and wherein a series of push buttons is provided in connection with the casing, normally spring held in outward position and capable of being depressed, sundry of the buttons being positive and others negative in their action, so that when the positive buttons are simultaneously depressed the locking mechanism for the bolt will be released and when the negative button is depressed it will impede and prevent any release of the locking mechanism for the bolt.

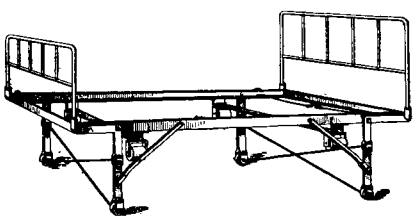
WRENCH.—F. X. FLECK, care of C. J. O'Brien, 227 William St., New York, N. Y. The wrench is arranged to provide a plurality of differently sized and shaped wrench heads and handles for taking hold of the wrench, one handle for each head, and so positioned relative thereto that the user can effectively turn the part engaged by the corresponding wrench head.

DETACHABLE COMBINATION LOCK.—G. T. OLDHAM. Address George S. Elliott, Fifth Avenue Bank, New York, N. Y. This improvement has for its object to provide a detachable combination lock having a shank with a lateral shaft for disposal in an opening in a key plate, a "combination" locking device being mounted on the shank for coöperating with teeth on the edge of the shaft.

### Household Utilities

WARDROBE FIXTURE.—B. BRAGER, 49 Crosby St., New York, N. Y. The improvement refers to wardrobe fixtures for supporting coat or other garment hangers, and has particular reference to devices adapted to be connected to or suspended beneath the horizontal shelves of wardrobes, clothes closets or the like, for supporting any suitable number, size or type of individual garment hangers.

BED FRAME.—N. SINCLAIR, 1405 Bannock St., Boise, Idaho. This invention provides a frame wherein collapsible, supporting legs are provided, together with a folding head and a folding foot capable of being folded over upon the body of the frame and connected with the



BED FRAME.

legs to collapse the same when the said head and foot are folded, and wherein the legs have casters, and the frame is provided with other casters brought into operative position by the folding of the frame, and arranged to permit the frame to be moved laterally, thus adapting the frame for insertion beneath another bed.

### Machines and Mechanical Devices

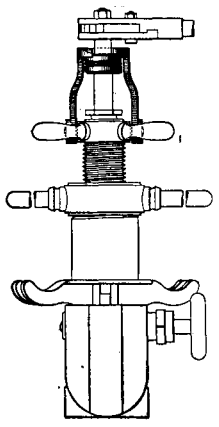
MOTION COUNTER.—W. R. AYARS and B. M. ANDERSON, Rome, N. Y. The inventor provides a motion counter for convenient application to a moving part of a machine, the motions of which are to be counted, and arranged to indicate the number of motions made by the moving member of a machine and at the same time registering the time during which the motions are counted.

SAFETY COUPLING.—G. O. FLOGLAND, 2929 Clinton Ave., Minneapolis, Minn. This coupling is of the class adapted for connecting the propeller wheel to its shaft, wherein mechanism is provided for preventing injury to the propeller or the shaft when the propeller strikes an obstruction, the said mechanism being arranged to permit relative movement of the propeller and the shaft when the propeller strikes an obstruction, and wherein the parts will automatically return to their normal position as soon as the wheel is released.

ATTACHMENT FOR PNEUMATIC MACHINE RIVETERS.—W. STARK, 1606 Lester Ave., Kansas City, Mo. This improvement provides an attachment for application to the front end of the riveter set and to be manually held thereto to constitute a forward extension of the riveter, whereby to perform general work now performed by separate and less efficient machines, such as the work of a backing out punch, a cold cutter, a gouge, or a diamond point generally used in cutting boiler plates or like sheet metal.

ATTACHMENT FOR PROPELLING, ELEVATING, AND SUPPORTING SHIPS, BOATS, SUBMARINES, AND THE LIKE VESSELS.—P. U. LOUBERY, No. 5 Quai de l'Industrie, Juvisy, Seine-et-Oise, France. This invention provides apparatus for propelling, elevating and supporting ships, boats, submarines, etc., and it consists substantially in an arrangement and construction of rotary propellers of the feathering vane type on driving shafts extending through the skin of the hull approximately at right angles to the length of the vessel.

TAPPING MACHINE.—H. W. ALCORN and F. R. GRAVATT, 523 6th Ave., Barberton, Ohio. The invention relates to pipe tapping machines, as in water, gas, oil, or other systems, and the main object thereof is to provide an attachment for conventional tapping machines which



TAPPING MACHINE.

renders the tapping operation much easier and quicker than is now possible. The attachment obviates the wear of a portion of the conventional machines, thereby avoiding the necessity for frequent and costly replacement of the worn portion.

### Musical Instruments

PLAYER PIANO.—H. A. CLAUSING, 406 Nye St., Lima, Ohio. This improvement provides a player piano arranged to permit variable accentuation of solo themes or other parts of the music in either treble or base, to provide an octave coupler for increase in the volume of the tone, especially when the instrument is used in large rooms or halls, and to permit the performers to throw off the dampers for sostenuto playing.

### Prime Movers and Their Accessories

VALVE LIFTER.—R. P. HENDERSON, 149 E. 54th St., New York, N. Y. The valve lifter is for use in connection with the valves of internal combustion engines. Devices for the purpose involve, as essentials, means to bear against the valve to clamp the same, and means to engage the washer of the valve stem, beneath the spring, in a manner to exert pressure on the spring and compress the same for the ready removal of the cotter pin, or equivalent expedient employed for retaining the washer.

INTERNAL COMBUSTION ENGINE.—J. KEISTER, Steubenville, O. Mr. Keister's invention has reference to internal combustion engines especially of the type designed for use on motor vehicles, and it includes improved valve mechanism and operating connections therefor by means of which ordinary valves of the puppet type are dispensed with.

### Railways and Their Accessories

RAIL JOINT.—J. C. PEPPERS, Y. M. C. A. Building, Beaumont, Tex. One of the principal objects here is to provide an improved joint employing means without the use of bolts for securely connecting adjacent rail ends together and holding them in place against longitudinal and spreading movement.

### Pertaining to Vehicles

REAR END SIGNAL FOR VEHICLES.—C. F. MARSTON, 825 Johnson St., Flatbush, Brooklyn, New York, N. Y. This inventor provides a signal having means readily operable by the foot of the driver, to selectively actuate signs to indicate his intent; provides a foot-pedal for controlling the driving mechanism of a vehicle, having mounted thereon a series of electrical contacts for completing operating electric circuits to dispose in view, and selectively, signs or implements the proposed movement of the vehicle having the signal.

AIR COMPRESSOR MOTOR.—D. E. CROUSE, T. DAVIS and CHARLES G. EIDSON. Address the last, care of The Auto Air Appliance Co., Industrial Bldg., Baltimore, Md. The improvement provides a device which may be run by any suitable power means, as for instance the shaft of an automobile engine and which will compress air into a tank or other suitable reservoir, and which may subsequently be used as a motor when the compressed air in the tank is admitted into the cylinders of the device.

RESILIENT WHEEL.—R. E. BRUNNOW, Edgehill, N. J. The purpose here is to provide a wheel for use on automobiles, auto trucks or other vehicles and arranged to dispense entirely with pneumatic tubes and similar devices now generally employed to obtain resiliency, and to provide a tire which can be cheaply manufactured and not liable to get out of order.

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

## A Horses' Hospital

(*Concluded from page* 126)

There are also available three racecourses, one of which is resorted to whenever the reception stable does not suffice to cope with actual requirements, while the two others are used to give healthy horses an airing, and, finally, there is a farrier's shop, the chief veterinary's office, a chemist's shop and a laboratory. The men and non-commissioned officers are housed in barracks of their own, where there is also the commander's office.

The staff at present comprises the chief veterinary surgeon, three veterinaries and two assistant veterinaries, each of whom is assisted by two men trained for the veterinary sanitation service, and a farrier. Each veterinary has under his charge at least 100 patients.

The general treatment and surgical operations are superintended by the chief veterinary. Horses affected with glanders are killed and dissected immediately; those suspected of this terrible malady are isolated and subjected to a renewed Malleine test. Horses suffering from incurable external disease, if free from fever, are handed over to the horse slaughterer; those with fever are killed and handed over to the flayer. A board installed near each horse's manger indicates its date of reception and sort of complaint. Much care is bestowed on keeping the horses' skin, hoofs and legs in proper condition, as well as on cleanliness, ventilation and disinfection of the stables. Each horse has a watering bucket of its own.

Service at the veterinary hospital lasts from 8 to 11:30 A.M. and from 2 to 5:30 P.M. The chief surgeon each day visits the patients of some stable with a view of ascertaining any infectious diseases, examining the condition of hoofs, etc., so that all the horses in the hospital are examined once a week. Those horses which are received at the delivery stable are treated with special care, fed on a special plan, given an airing every day and brought into such condition as to be immediately fit for heavy service with their detachment. Patients likely to remain at the hospital for some length of time are deprived of their horseshoes and, if required, are given a daily airing. Pregnant mares, mares with foals, and jaded horses are allowed a long rest every day on the grounds close to the hospital. Flaked oats are used extensively in feeding emaciated horses.

In order to protect patients against glanders, and to localize any outbreak of this disease, each horse, as above mentioned, is, on reception, submitted to the Malleine test. Moreover, a blood sample of each new arrival is sent to the laboratory, and all the horses are subjected to the Malleine test every three weeks, and to a blood test, once a month.

It has thus been possible to keep glanders out of the hospital, though 103 patients suffering from the disease had to be killed.

The following figures will give an idea of the useful work done at the hospital: A total of 1,995 horses were received at the hospital from its date of opening (November 23rd, 1914) until the end of May, the last date for which statistical data were available. Out of this total, 973 were discharged as cured to their respective detachments, 103 affected with glanders were killed, 128 were sold to the horse slaughterer, as suffering from incurable external disease, 92 died or were killed because suffering from feverish external disease, 49 were handed over to other depots or detachments, 12 mares in foal were handed over to the Chamber of Agriculture, and 84 were sold to farmers, because unfit for military service or being unworth the fodder. The total left at the hospital thus was 554 horses. Extensive operations had to be made on a number of patients.

Whenever unable to be operated on standing, patients are suspended from an attachment such as is used in equine obstetrics, no special operating table being as yet available. Most operations are performed in a chloral hydrate narcosis or local anesthesia (produced by injection of a cocaine-adrenaline solution).

Those horses which after operation are found to be unsuitable for war duty are sold at an acceptable price to farmers of Eastern Prussia who have returned to their devastated farms, thus in a measure remedying the prevailing scarceness.

One hundred and forty eight men of the German Landsturm, mostly with a long practice in the handling of horses, have been appointed to tend and care for the inmates of the hospital. Non-commissioned officers act as superintendents.

By employing all the available resources, a veterinary hospital such as this is able to cure a considerable number of invalid horses and, by surgical operations, to make a great many wounded ones fit again for war use, which otherwise would unavoidably be doomed to death at the slaughterer's hand or by a welcome bullet. Those cured are, by a proper treatment, made suitable again for heavy service, thus filling any gaps and restoring to each detachment their own horses, a practice bound to make for increased fighting fitness. Considerable values are in this way saved for the state, and veterinary surgeons are enabled to increase their stock of professional experience.

## German Commercial Preparedness for Peace

(*Concluded from page* 124)

This latter statement is somewhat cryptic. It reveals the Teutonic preparations for peace as practised by one of its most powerful and profitable industrial concerns. Notwithstanding the war the branches in Switzerland, Scandinavia, Spain and Holland have been able to carry on business satisfactorily, and incidentally it may be mentioned that the British branch in London is in a healthy and flourishing condition.

One item is not without its significance. Following the outbreak of war the trust was compelled to lay down extensions of buildings and to equip them with new and expensive machinery. During the year the latter has earned sufficient to enable the cost to be entirely written off, and they are nominally valued at one shilling per works!

If one company is able to achieve such an end during a single year of war, is it not logical to assume that a large proportion of the other industries of Germany are similarly placed? At all events, German industrial organizations are carrying on in such a manner that there is no danger of commercial posterity being bowed down with the weighty millstones incurred by the war.

### America Prepares

So far only one country has realized the fact that Germany is bent upon waging a bitter and prolonged commercial war when once the sword is sheathed. The commercial princes of the United States, from the fact that their country is neutral, and they are at liberty to wander hither and thither through Germany, have seen with their own eyes the vast organization which Germany is piling up to wage her industrial campaign.

They have convinced their government, and the authorities have taken all preliminaries to counter the step the moment it asserts itself. It is not so much a question of protection as the elaboration of precautionary measures to prevent unprincipled and unscrupulous dumping.

Australia has not been slow to emulate the American example, although in this instance there is a tendency more towards wholehogging. The land under the Southern Cross has pledged itself to have nothing more to do with German-made goods. Unfortunately there is a saving clause. The boycott will only apply provided that the articles can be obtained from within the Empire and at a fair figure.

The indefatigable efforts which are being made in German commercial circles against the day when she may resume her world-wide trading may serve to reveal which way the wind is blowing. This activity would not be so acute were peace very remote. Commerce is a fickle goddess. Whims and fancies vary so much that large stocks cannot be laid up indefinitely: they may be superseded or become considered obsolete.

### Germany's Advantage

Germany is in a superior position as compared with this country. She has only to satisfy her own military machine. Austria is quite capable of fulfilling all the needs of her own war department. True, Bulgaria and Turkey are making certain calls upon the armament-producing facilities of the two Empires, but they are negligible in comparison with what the Allies require. France, being deprived of her northern industrial centers, has had to depend to a great extent upon this country, while Russia has also been an insatiable customer for munitions.

But, as already mentioned, the critical moment in this special field of production has been reached and passed. In this country we now know exactly where we stand and what we can do. Owing to the complete mobilization of our resources we are in a position to meet any demand that may arise, and the strain has been alleviated somewhat by Japan and the United States.

The period of eased production has already commenced, and while it is not appreciable it affords us the opportunity to reflect. Without slackening in our efforts it should be possible to adjust the commercial machinery in such a manner, and to set the industrial wheels in such a direction as to enable the commercial vehicle to be restarted, and to enable speed in this direction to be gathered as the output of munitions slows down.

One should balance the other so as to keep our manufacturing resources at tip-top pressure whether it be for the needs of the moment or of those six months hence.

### Coming Transport War

So far as Britain is concerned no definite line of action to meet the threatened commercial invasion has been laid down. But evidently the skeleton of a precautionary scheme has been adumbrated, judging from the slender statements which have been dropped in the House of Commons. A "Zollverein" of the Allies has been suggested and will probably come into operation in some form or other. The Trade Federation of the Empire is more probable.

The fact remains that some cleverly contrived, effective, and adequate plan of commercial campaign will need to be drawn up, otherwise Germany will not only be in a position to make up for all she has lost by war, but will enable her to forge the weapons wherewith to ensure the commercial, if not the military and political, domination of the world.

Of one thing we may be certain. Germany's mercantile marine is hopelessly tied up through the vigilance and power of the British fleet. But when the mooring ropes can be cast off there will be a spirited and vigorous rate war. Conferences and rings will be impossible inasmuch as racial feelings will be too strained to enable community of interests to be arranged so far as the water traffic is concerned.

The vast stocks accumulated will have to be cleared out of the factories at all hazards, and we may confidently anticipate that they will be despatched to the markets of the world at very cut rates when overseas commerce once more becomes possible.

### Germany's Huge Purchases

Not only are the ships and their cargoes ready in Germany, but this wonderful foresight is going so far as to buy cargoes of much-needed products in countries where German ships are interned. According to the New York correspondent of the *Times:*

"Purchases aggregating in value £20,000,000 are reported to have been secretly completed by Germany in that country. They consist of copper, cotton, wool, lard, wheat, agricultural machinery, and other products.

"All these products have been bought subject to delivery in Germany 'sixty days after the war ends' or 'on order,' with the exception of wheat, all the purchases being stored in close proximity to

Atlantic ports, where many German merchantmen are interned. According to one report an order for small tractor engines built for farm work was actually delivered on shipboard at Newport News.

"Most of the products were bought on a margin which would involve large bank loans."

According to the *Chicago Herald* the operations of the German secret purchasing agents are as follows:

"Copper. Approximately 50,000,000 pounds, largely of electrolytic copper, bought on a 4 per cent margin, with an agreement to keep this margin under the market. The price paid ranges between 18½ and 19 cents.

"Cotton. 500,000 bales are said to have been bought. The buying operations have extended over several months.

"Wool. The estimates vary as to the amount stored, but it is agreed that the operations are not as large as in the cotton market.

"Lard. Purchases are now being made openly.

"Wheat. It is believed that millions of bushels have been bought, in addition to large quantities of maize.

"Farm machinery. In addition to tractor engines, every kind of machinery for use on farms and in factories, which have been stored on the eastern seaboard.

"German-American bankers describe these purchases as designed to establish 'preparedness for peace.'"

### Wanted—A Financing Syndicate

The fact must not be overlooked that these craft will be ready to steam out of German and neutral harbors when the moment arrives. On the other hand, several months must elapse before the British mercantile marine will settle down to its stride.

The tramps will be immediately available for duty, but the liners will have to go into dock for overhaul and extensive repair if not actual reconstruction, before they will be able to resume their sailings upon the seven seas. This work will occupy considerable time—sufficient to enable the Germans to reassert their strength.

The recent move which has been consummated in United States financial circles should stimulate us to prompt action. There a special syndicate has been formed with a capital of £10,000,000 to develop and to finance commercial expansion in neutral markets. It is to all intents and purposes an American reply to the German game, which in the past has proved so highly profitable.

To us such a syndicate is a friendly menace. Briton and American will be brought face to face upon common ground with the German striving to undercut both. Germany is convinced that within a few weeks of the declaration of peace she will have retrieved her Russian trade which attained huge proportions. The American syndicate proposes to devote special attention to this territory, relying upon Russian antagonism to Teutonic methods and trade to scoop the business.

Unless we are prepared to adopt similar methods there is but little doubt that America will succeed in her peaceful conquest. It should not be a difficult matter to establish a similar syndicate in London, and to provide it with similar weapons of war.

With such a backing we should be better able to enter foreign markets formerly held by Germany.

To capture this trade it will be incumbent upon us to offer to do business upon terms comparable with those of Germany of old. It was only by giving more advantageous terms and by meeting local requirements in a manner superior to that of conservative Britain that Germany was able to make such huge commercial strides overseas.

It is sheer waste of time to criticise and ridicule the Teuton methods, because they proved successful. No injury can result from taking a leaf out of the enemy's book, especially when it enables you to fight him squarely upon his own ground. Enterprise, initiative, and immediate action are absolutely imperative if we intend to oust the Teuton from his markets. To wait and see how things develop after the war will spell commercial suicide: the German will get there again as he did before.

[From the British *World's Work.*]

## Speedy Patrol Boats for the U. S. Navy

(*Concluded from page* 122)

description would pound badly in rough water, but it is claimed that this is overcome by the air cushion, above mentioned; and the great proportional beam makes a steady boat, as far as rolling is concerned.

Besides being unique in design the method of propelling these boats is unusual, as what is known as surface propulsion is employed. In this system the shaft of the wheel is set at about the water-line, at the stern, and the propeller wheel revolves half in the water and half out. Special advantages are claimed for the system, and it has been successful with the sea-sleds. Some of these advantages are the slight draught of water required, the absence of any strut or exposed shaft, and the rigid support that can be given the wheels, by well lubricated stuffing boxes located in the stern framing of the boat.

In the particular boat shown in the illustrations, which is the largest that has been built, four propellers are fitted, each driven by its own individual gasoline engine; and these screws work in pairs, one pair turning to the right, and the other pair to the left. This is distinctly shown in one of the illustrations.

The other two pictures show the boat running. In one of these the boat is just starting, and it will be noticed that the wheels are throwing up a great cloud of spray, high above the stern; but as the craft gathers speed the disturbance of the water at the stern is much less, and the boat begins to "plane," in the same manner as the ordinary hydroplane. This is shown in the second picture, and it will be noticed that when running at high speed practically no spray is thrown up forward, and the boat slides over the water very smoothly.

Owing to the light draught of the boat, and the arrangement of the wheels, the steering presented a problem. This was solved by hanging a rudder on each side of the boat at its stern, each one projecting slightly below and behind the hull. Only one of these rudders operates at a time, and they are hung on a hinge at their forward end which is set at an angle, so that they cut under when swung out, and this tends to pull the inward side of the craft down on the turn, thus counteracting the heeling effect.

Unusually high speeds are attained by these peculiar boats, and it is anticipated that they will prove useful in the Navy for a number of purposes.

## Patent Office Transactions for Fiscal Year Ending June 30, 1915

DURING the past fifty years the people of the United States have uttered two thirds of all the revolutionary epoch-making inventions of the world, ranging from the telephone and the incandescent lamp to Wright's aeroplane and high speed steel. Each day the United States Patent Office issues an average of 200 letters patent to American inventors, and the number of inventions is increasing with the years.

During the fiscal year ended June 30th, 1915, there were filed 66,497 applications for patents for inventions, 2,679 applications for design patents, 173 applications for reissues, 8,376 applications for registration of trade-marks, 947 applications for labels, and 444 applications for prints, the total number of such applications being 79,116. In addition, 1,938 appeals and 26 disclaimers were filed.

During the year there were granted 44,402 patents (including 1,489 designs and 179 reissues), 6,919 registrations for trade-marks, 762 registrations for labels, and 321 registrations for prints. The number of patents which expired during the year was 20,992. The number of allowed applications which were forfeited

for non-payment of final fees therein was 11,882.

The total receipts of the Patent Office were $2,270,937.68, and the total expenditures for all purposes were $2,087,581.26; the net surplus of earnings over expenditures being $183,356.42 for the year, with a grand net surplus of $7,714,316.62 since the establishment of the present system in 1836.

There are four points of special interest in the work of the Patent Office during the past year: FIRST: For the first time in years the office disposed of as many applications as were received, although the number of applications filed has not fallen off. During the years 1912 and 1913 there were filed 8,000 more applications per year than were disposed of.

SECOND: The total number of applications awaiting action June 30th, 1914, was 22,283. On June 30th, 1915, there were 18,270, a decrease of 4,013.

THIRD: The number of patents granted in 1914 was 38,225, and the number in 1915, 44,402, an increase of 6,177.

FOURTH: There was caused a reduction in the number of interferences declared from 1,129 in 1914 to 916 in 1915—a decrease of 213.

## NEW BOOKS, ETC.

CIVILIZATION AND CLIMATE. By Ellsworth Huntington. New Haven: Yale University Press, 1915. 8vo.; 333 pp.; illustrated. Price, $2.50 net.

Not so very long ago, geography used to confine itself to the physical features of the earth's surface; the newer geography interests itself in the distribution of plants, animals, and man. A step further in the relationship between geographic environment and vital phenomena is taken in the author's "Civilization and Climate," which seeks to map human character as expressed in civilization. He leans to the belief that the great countries of antiquity, no matter what their present climate may be, enjoyed during their rise to power "a climatic stimulus comparable with that existing to-day where the leading nations now dwell." From the study of thousands of factory hands and students, at all seasons, the author arrives at an approximate measurement of the climatic elements that influence efficiency. His "pulsatory hypothesis" holds that, while the past was moister than the present, the changes have taken place irregularly in great waves. Whether the reader be interested primarily in humidity or in humanity, the thoughtful vigor of this thesis will hold his respectful attention, even though he may be unable to agree with all its conclusions.

A HANDBOOK OF COLLOID-CHEMISTRY. The Recognition of Colloids, the Theory of Colloids, and Their General Physico-Chemical Properties. By Dr. Wolfgang Ostwald, Privatdozent in the University of Leipzig. Translated from the Third German Edition by Dr. Martin H. Fischer. Philadelphia: P. Blakiston's Son & Co., 1915. 8vo.; 278 pp.; illustrated. Price, $3 net.

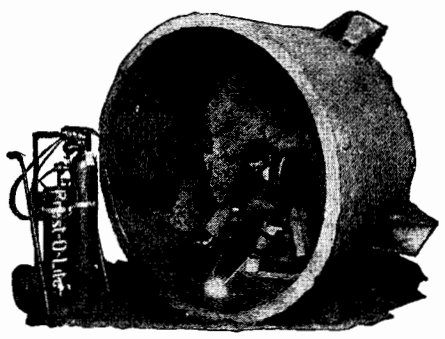
The translator's preface to Dr. Ostwald's authoritative text points out that, useful as crystalloid investigation has been, it is the colloid form in which Nature best reveals herself. This aspect is of the widest appeal not only to the abstract thinker, but also to the agriculturist, the metallurgist, the tanner, the manufacturers of paper and of paint, the dyer, the weaver, and numerous other followers of the practical occupations. The introduction treats of elementary, general and special analyses. Part I discusses general, and Part II special colloid-chemistry. The work sets forth the mechanical properties of colloid systems in considerable detail. We should be grateful to the translator and to the publishers for giving this classic to the English-speaking public, for seven years had passed, and the work was in its third German edition, before the opportunity was afforded us of reading this text in our own language.

INVENTIONS AND PATENTS. By Philip E. Edelman. New York: D. Van Nostrand Company, 1915. 8vo.; 288 pp.; illustrated. Price, $1.50 net.

That there is a most deplorable ignorance of the points involved in patent procedure cannot be denied. The waste in time and money directly due to this ignorance is incalculable, and such chapters of the work in hand as "Patent Attorneys," "Patentability and Practicability," and "Protecting an Invention," will prove of the highest usefulness to inventors. These and other chapters should find an interested following among investors and manufacturers. While we may not agree with the author in his contention that inventors form a class perhaps higher than any other to which human beings belong, we must admit that to the inventor is due the essential scheme of our modern civilization, and he is deserving of all the help that can be extended to him. The work should be read by all who are in any way interested in inventions and their protection. An appendix carries many useful forms of assignment, employes' agreements and options. As a whole the volume is to be heartily commended.

## Oxy-Acetylene Welding and Cutting

# Saved $10,000 a Year on Repairs Alone



*It would have cost* $120, *to recast this large kettle, to say nothing of the delay. The total welding cost by the Prest-O-Lite Process, covering time and materials, was* $4.60.

4,914 miscellaneous repairs—very few alike—were made in one railroad shop by oxy-acetylene welding at a cost of $8,865.29. The cost of repairs by other methods according to past records, would have been $19,640.32—a cleancut saving of $10,755.03 for the oxy-acetylene process in repairs alone—not counting the value of repaired parts, or cost of replacement.

In *your* shop there is a splendid opportunity for substantial savings.

Your junk pile can be made to pay you a profit. When heavy equipment breaks down, you can repair it on the spot, preventing costly replacements, delays and tie-ups in production.

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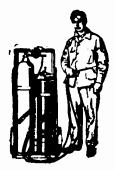

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