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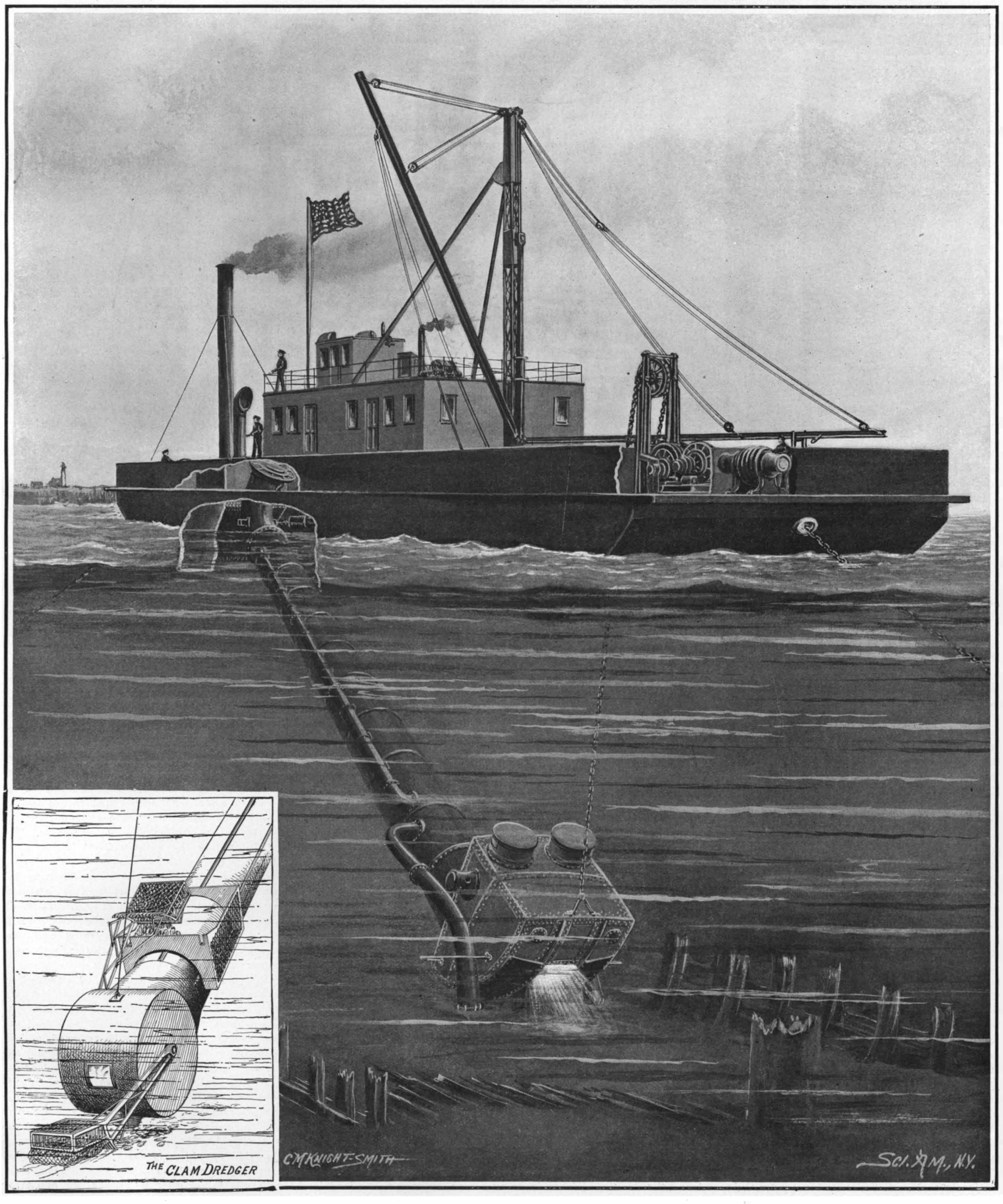

On the night of October 9th, 1799, the British man-of-war "Lutine" with $5,872,000 in bullion and specie on board, was sunk off the entrance to the Zuyder Zee. Over $5,000,000 is known to be still in the wreck.

ATTEMPT TO RECOVER SUNKEN TREASURE FROM BRITISH MAN-OF-WAR "LUTINE."—[See page 334.]

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ESTABLISHED 1845

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NEW YORK, SATURDAY, MAY 1st, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TRUTH ABOUT THE GERMAN "DREADNOUGHTS."

To anyone who makes a dispassionate study of recent German naval developments, there is nothing to indicate that her present activity in the construction of battleships of the "Dreadnought" type is aimed at any particular power, or has anything in the nature of an intended challenge. The true motive is to be found in the lessons which were taught by the Japanese war, when it was demonstrated to the minds of most, though not by any means of all, naval experts, that the battleship of the future would be armed entirely with 12-inch guns. Now, although this fact was of vital importance as affecting the rating of all existing navies, there was none that was so seriously affected as the German navy, and this for the following reasons:

At the time of the Japanese war, the effective battleship fleet of the Germans, built and building, included twenty vessels. Ten of these, due to be completed between the years 1904 and 1908, were ships of the first class, carrying four heavy armor-piercing guns in the main battery, and a large number of rapid-fire guns in the secondary battery. Except in point of size and steaming radius, they were comparable with the best battleships of other nations. The ten earlier ships, completed between 1900 and 1903, were of a decidedly inferior type, carrying in their main batteries a light gun of only 9.4-inch caliber. These earlier ships were somewhat discredited, even before the Japanese conflict; and it can readily be seen that the enhanced value given to the big gun by the results of the battle of Tshushima, placed these ten vessels outside of the battleship class, and actually relegated them to the second line of defense, leaving the German navy with only ten first-class line-of-battle ships.

Long before the "Dreadnought" was launched, the German naval authorities realized that, if their fleet was to maintain its relative standing among the world's navies, there must be a very large increase in the number and power of ships of the first class; and there can be little doubt that this increase was contemplated before the first "Dreadnought" had taken the water. It is the German policy to build always according to a definite programme, extending over a period of years, and the authorities have determined that, in order to replace the ten battleships above referred to, and, in addition to this, make the annual appropriations for new ships which are necessary to maintain the relative position of the German navy among the powers, a programme calling for the laying down of four vessels of the "Dreadnought" type every year would be necessary. The programme was adopted; the necessary building slips were prepared; large additions were made to the German plants for the manufacture of guns and armor; and the construction of the ships has progressed strictly according to schedule.

There is nothing in these facts to warrant the statement that Germany is attempting to outbuild either Great Britain, the leading naval power, or the United States, which at present holds the second position. It was Germany's weakness in battleships, and not, we believe, any sudden desire for aggrandizement or conquest, that instigated her present ambitious programme. Had she not built at the rate she is now building, she would in a few years' time have ranked as a poor third among the naval powers, and her navy would not have been commensurate with her vast and rapidly increasing merchant marine.

That she is not challenging, and probably has no disposition to challenge, the British navy for the premier position is shown by a dispassionate review of the facts of the case.

By the year 1912 there will be available thirteen German "Dreadnoughts." On the same date, including the ships recently authorized by Parliament, Great Britain will have in commission twenty "Dreadnoughts." If the colonies should build the six ships that have been suggested, she will, at that date, have twenty-six. But in estimating the strength of the two navies, it is altogether absurd to omit consideration of the ships of the pre-"Dreadnought" period. Of these, Great Britain in 1912 will possess forty and Germany twenty, but if we omit the ten ships that are armed with 9.4-inch guns, Germany will have only ten pre-"Dreadnought" battleships of the first class. At that date Great Britain will possess of armored cruisers thirty-five, and Germany but eight. The British battleships of the older fleet carry 152 12-inch guns. The German battleships mount only 40 11-inch guns. The British cruisers carry 68 9.2-inch guns, as compared with 6 9.4-inch guns carried by the German cruisers.

In conclusion, we would utter a word of protest against the sensational and inflammatory methods which of late years have been adopted by the press, the various navy leagues, and the legislative representatives of the people, in the endeavor to secure the necessary appropriations for naval expansion. We ourselves believe that there is a legitimate naval expansion, whose extent should be sufficient to insure the integrity of the people concerned, the security of their sea-borne commerce, and the replacement of the older warships as they become worn out or obsolete. We believe, also, that a powerful navy, if it be commensurate with the needs of the nation, is one of the best guarantees of peace, just as a weak navy inadequate to the protection of a wealthy people is an invitation to aggression. But these legitimate considerations are a very different matter from the motives of aggrandizement, jealousy, fear, and even active hatred, which much of the recent discussion of naval armaments has tended so greatly to provoke.

"HOUSE FLY" SHOULD BE CALLED "TYPHOID FLY."

The house fly, which we have hitherto in our ignorance considered as a harmless creature, or, at the worst, simply a nuisance, has been shown, as the result of scientific researches, to be in reality, judged from the standpoint of disease, a most dangerous insect. Dr. L. O. Howard, in his recent investigation of the economic loss through insects that carry disease, to which reference was made last week, devotes a chapter to the house fly as a carrier of typhoid bacteria. The facts brought out are so startling, and so vitally affect the health of the community, that we are publishing this chapter in the current issue of the SUPPLEMENT. Limitations of space prevent anything more in the present notice than a brief summary of the salient features of the report.

At the outset emphasis is laid upon the fact that the term "typhoid fly" is open to some objection as conveying the erroneous idea that this fly is responsible for the spread of typhoid only. As a matter of fact, the insect is dangerous from every point of view, and is liable to spread the bacteria of all the known intestinal diseases. The true connection of the so-called house fly with typhoid fever and the true scientific evidence regarding its rôle as a carrier of that disease, have only recently been worked out. Celli in 1888 fed flies with pure cultures of the typhoid bacillus, and inoculations of animals were also made, proving that the bacilli which pass through flies are virulent. Dr. George M. Koeber, in his report on the prevalence of typhoid fever in the District of Columbia, has drawn attention to the danger of the contamination of food supplies by flies that have been in touch with typhoid patients. The prevalence of typhoid fever in the camps of the United States army during the Spanish war brought about the appointment of an Army Typhoid Commission, which found: First, that the flies swarmed around the sanitary quarters of the hospital, and then visited and fed upon the food prepared for the soldiers in the mess tents. Secondly, that officers whose mess tents were protected by screens suffered proportionately less from typhoid than those whose tents were not so protected. Thirdly, that typhoid fever gradually disappeared with the approach of cold weather and the consequent disabling of the fly in the fall of the year. The final conclusion was that the fly carries the typhoid bacillus either by the adherence of infected matter to its feet, or within its own digestive organs.

In 1899 Dr. Howard made a study of the typhoid or house fly, in its relation to country and city sewage, and he made a further investigation of the species of insects that are attracted by food supplies in houses. In this investigation he found that the typhoid or house fly constituted 98.8 per cent of the whole number of insects captured in houses throughout the whole country, under the conditions indicated above. The importance of this insect as a carrier of the dreaded disease in army camps, as shown in the Spanish war and in the Boer war and in the camps of great armies of laborers engaged in gigantic enterprises, like the digging of the Panama Canal, is obvious. But it is certain that, even under city conditions, the influence of this fly in the spread of disease has been greatly underestimated.

In a report to the Merchants' Association of New York, based upon numerous observations of the relation of flies to intestinal diseases, which was published in December, 1907, it was shown that the greatest number of flies occurred in the weeks ending July 27th and August 3rd; and that the deaths from intestinal diseases rose above the normal at the same time at which flies became prevalent; culminated at the same high point; and fell off with slight lag at the time of the gradual falling-off of the prevalence of the insects.

A certain species of mosquito has been demonstrated to be the cause of the spread of malaria. Yellow fever is caused by another kind of mosquito; and now we know that the supposedly harmless house fly is an active agent in the distribution of intestinal diseases. In view of these facts, Dr. Howard's contention that this familiar household insect should henceforth be known as the "typhoid fly" would seem to be well made.

REDUCING THE NOISE OF ELEVATED ROADS.

It is surprising that during the recent agitation in this city against unnecessary noises, more attention was not given to the greatest of all noise producers, the elevated railways; for it is certain that if the roar of elevated trains could be abolished, the most distressing source of the city's clamor would be removed. The din of the elevated roads is not due to faulty track. So heavy is the traffic, that it is imperative upon the company to keep the rails, joints, and ties in good condition; and we believe the maintenance of these tracks is comparable with that of our best steam railroad systems. The excessive noise is due largely to the fact that the track is laid upon cross ties, and that the concussions of the wheels, especially when passing over the joints, is imparted to the steel framework of the trusses and columns, which acts as a huge sounding board to intensify the din.

The present Chief Engineer of the Manhattan Elevated Railroad, Mr. George H. Pegram, some years ago planned an elevated road structure for Kansas City, based entirely on the use of longitudinal ties placed in steel troughs for a roadbed; and speaking of the undesirability of cross ties on an elevated structure, Mr. Pegram says that he has always believed that cross ties are out of place on an elevated structure. On the ground, where they are necessary to distribute the weight over the surface, they have proved the best construction; but they are not needed for this purpose on an elevated road, and their effect there is to darken the street below, to intensify the noise, increase the labor of cleaning the structure, and lead to unpleasant drippings after a fall of snow or rain.

The question of noise from the operation of trains on the elevated roads in Chicago is causing much agitation in that city at the present time. In the outlying districts of the city this is not so important a matter; but in the heart of the business district, where the different elevated lines terminate, they go around a "loop" some two miles in extent. On account of its location here between the high office buildings and in some of the principal thoroughfares, the noise from the elevated trains has proved to be a very disagreeable feature.

Many plans for lessening this noise have been submitted, but it has been found most difficult to devise any plan which would subdue the noise to the desired extent and at the same time leave enough light for the street below not to make it objectionable. The problem is to reduce the noise without taking away the light, while the matter of expense is also important. Among the plans submitted to the Traction Expert of Chicago is one by Mr. Carl R. Klok, which is based on the fact that the roadbed of cross ties on an elevated structure tends to increase and intensify the noise caused from the operation of trains, and that trains running over rails resting on a level, continuous, uninterrupted surface or support will cause much of the vibrating noise to "sink into" or be absorbed by it, even though the support be composed of ties. In order to bring about such a continuous support to the rails, the plan under consideration provides that two out of every three cross ties be removed, and in their place smaller ties be placed lengthwise under the rails and between the remaining ties. Under this arrangement the rails rest on a continuous and uninterrupted support, thus insuring a great reduction of the noise from running trains and a more firm support to the rails at the joints, where most of the noise is produced. The gage of the track is maintained by the remaining cross ties. In the steel trough system, as used on the Forth Bridge, Scotland, each rail is laid directly upon a bed of timber placed in the bottom of a continuous trough of steel. This has the advantage of providing a continuous guard rail for each wheel in case of derailment. For city use it would have the further advantage of shutting out the least possible amount of light from the streets below.

ENGINEERING.

Every day in New York city about twice as many passengers travel vertically by elevator as travel horizontally by elevated, subway, and trolley car. Figures given in a paper recently read before the Electrical Engineering Society of Columbia University show that the 8,000 passenger elevators in the Borough of Manhattan carry approximately 6,500,000 per day; whereas the last report of the Public Service Commission states that the number carried daily by the surface, elevated, and subway cars in the entire city of New York is 3,500,000.

Health conditions at Panama continue to show steady improvement. The death rate among employees during the month of February, 1909, was 10.98 per thousand, as compared with 12.72 for the same month in 1908, 25.62 in 1907, and 43.00 per thousand in 1906. The death rate per thousand for the whole population of the canal zone was 40.20 in 1905; 38.09 in 1906; 36.07 in 1907; 21.40 in 1908; and 18.59 in 1909. These are the smallest death rates, both among employees and among the whole population, in February since the United States took possession of the work.

The United States army will make tests this summer of a new 3-inch shell of novel design, which combines in itself the qualities of a solid shot and a shrapnel. In tests which have been already made excellent results were obtained, masonry being thrown to the ground and targets representing artillery completely destroyed. The solid steel head of the shell contains a charge of high explosive, which is detonated on impact. Back of this is the shrapnel chamber, containing 120 bullets and a charge of high explosive. The shrapnel portion can be timed to explode above a body of troops, leaving the solid head of the shell to pass on and strike an independent blow.

It has been definitely decided to install on the new battleships of 26,000 tons batteries of twelve 12-inch guns, instead of ten 14-inch guns. The latter was an alternative proposal that came before the Navy General Board, which has decided that there would be no material gain in the adoption of the 14-inch gun for the main batteries. The army ordnance officers, however, are building five sea-coast rifles of 14-inch caliber, but of the low velocity of 2,150 feet per second. One of these is of the wire-wound type, and the other four are of jacketed construction. Preparations are now being made for the manufacture of four additional wire-wound 14-inch rifles. The destination of these guns will be the new coast defenses of the Philippines.

The latest available figures regarding the two huge ships projected or building for the White Star Company indicate that they will not be quite so large as was commonly supposed, although they will yet be considerably larger than the "Mauretania" and "Lusitania." They will measure 860 feet between perpendiculars and 890 feet over all. The beam will be 92 feet, and they will have a molded depth of 64 feet, which is four feet more than the depth of the "Mauretania." The motive power will consist of two reciprocating engines of 15,000 horse-power driving the wing propellers, and a 10,000-horse-power turbine driving the central propeller. This combination will be sufficient to drive the ships at a sea speed of 19.5 knots.

Before the electrical equipment of the Sinclair tunnel was accepted by the railway company, a thorough test of the electrical apparatus under operating conditions was made, during a period of several months, by the contractors. It was found that the electric locomotives were capable of hauling 1,000-ton trains, as against 700-ton trains hauled by the steam locomotives. The 27.3-car trains, which was the average size of the trains hauled by the electric motors, required ten minutes to pass through the electric zone. The average size of the steam trains was 19.7 cars, and it took the steam locomotives fifteen minutes to haul them over the same distance. The steam locomotives burned per month, $5,000 worth of coal, costing $6 per ton; the electric service, burning soft coal costing $2 per ton, required only $1,150 for fuel for the same period.

In the construction of the new Catskill aqueduct it has been planned to cross the water courses and rivers which intercept the route of the aqueduct by siphons rather than by bridges, or pipe lines laid in the bed of the rivers. One of these siphons will be carried beneath the Hudson River at Storm King, and the present indications are that it will have to lie at least 700 or 800 feet below the surface of the river. Another important siphon, not so deep, but of much greater length, will be constructed below Rondout Creek. Because of the disturbed condition of the strata underlying the Rondout Valley, the siphon will have to be carried down to depths of between 400 and 500 feet before a sufficiently solid rock is found for the construction of the tunnel. The total length of the siphon between the end shafts will be approximately four and a half miles, and it will have a diameter throughout of 14½ feet.

ELECTRICITY.

While 60,000 volts was considered a maximum tension for transmission lines a few years ago, we are now using 72,000. An 80,000-volt line 13½ miles long is now building, and a line has been built designed for 100,000 volts.

With a view to supplanting the horse cars of crosstown lines in New York, the receiver of the Third Avenue Railroad is experimenting with two cars, one an electric storage battery car using the new Edison storage battery, and the other a gasoline-electric car in which a gasoline engine is employed to operate a dynamo that furnishes current to motors on the car axles.

A novel type of trolley car has been built for the South Manchurian Railroad. The car is divided into first and second class compartments by a vestibule and steps at the center of the car. As these steps must not project outside the car body, they cut into the side sills and necessitate a special construction of framework. The first-class compartment is fitted with upholstered seats, while slat seats are provided in the second-class compartment.

A simple method of improving the efficiency of a moving coil galvanometer has recently been discovered. It consists in the use of a piece of soft iron wire which is attached to the coil outside the strongest part of the magnetic field and at right angles to the lines of the field. In the experiments tried by the inventor the wire was about 6 centimeters (2.36 inches) long and 0.33 millimeter (0.013 inch) in diameter. Another method is to fasten a magnetized steel wire parallel with the field, but with its poles reversed. In this way it is possible to increase the sensitiveness of an instrument many fold.

A new type prepayment car is being tested by the Pittsburg Railway Company. The car is adapted to single-end operation, the passengers entering at one end of the car and leaving at the center except in case of a crowd, when the door at the forward end of the car may be thrown open to provide an additional exit. The conductor is stationed near the center of the car at the head of an aisle, formed by a partition running to the entrance platform. This virtually divides the car into two compartments. Passengers entering the car must pass up the aisle and after paying their fare may enter the main body of the car, or the compartment formed by the partition.

It would be quite an advantage to the automobilist if he could communicate by wireless telephone with his garage or the nearest automobile station in case of accident. A. Frederick Collins, who is developing a system of wireless telephony, recently made experiments with portable apparatus to determine the range of service of the instrument. He was able to communicate over a short distance with a garage in Newark, but at a distance of 8 miles the apparatus failed. Apparently wireless telephony will have to be developed far beyond its present efficiency before it can be of service to the automobilist. The chief difficulty is that only a short transmitting antenna can be used requiring an enormous expenditure of energy to reach a city garage because of obstacles in the way such as steel buildings, trees, wires, etc.

An interesting electric railroad is being operated between Stockton and Lodi, Cal., in which direct current is used at 1,200 volts. The present length of the road is 15 miles, but it is planned to build several extensions. For two miles out of Stockton the current is collected from a trolley wire at 550 volts, and beyond this point the higher tension is collected from a third rail. The dynamotors used on the cars are provided with a commutator at one end of the armature, for receiving the high-tension current, and the other for delivering current at 600 volts for operating the auxiliary apparatus. When the car passes from the 1,200-volt rail to the trolley circuit, the dynamotor ceases to operate automatically and the auxiliary apparatus receives its current direct from the trolley when the motorman closes the circuit of the 550-volt contactor. When passing from the 550-volt section to the 1,200-volt section, the 550-volt contactor drops out automatically.

With the purpose of studying enormously high voltages a short experimental transmission line has been built in Sweden which is adapted to operate at 500,000 volts. A special form of transformer is used to furnish this high electro-motive force. Circulating oil is used for insulation between the high and low tension windings. The line is supported on the suspended type of insulators which are hung at a distance of 11 feet apart. Tests of the surface discharge showed that a wire of 10 square millimeters (0.0155 square inch) cross section would discharge at 35,000 volts, of 20 square millimeters at 50,000 volts, of 100 square millimeters at 200,000 volts, and of 250 square millimeters at 390,000 volts. As the tension was raised to 480,000 volts, the noise grew very loud and sparks leaped from the insulators. At night the glow of the discharge could be seen two and a half miles away.

SCIENCE.

Lassa, the mysterious capital city of Tibet, which so long remained closed to European influence, appears to be in the way of civilization. A Calcutta newspaper states that a commission from that city has received from a large convent in Lassa an order for numerous objects of European manufacture, including one hundred brass musical instruments. Apparently occidental culture will make its entrance with a brass band.

P. A. MacMahon proposes the determination of the diameter of a star by measuring the time taken for its occultation by the dark limb of the moon. With a star of parallax 0.10 sec., and of same actual diameter as the sun, this occultation time would be about 1/500 sec. From other photographs Dyson has found that a star of magnitude 1.0 might possibly be photographed in about 1/780 sec. If this can be secured by means of a rapidly-moving film the problem might be solved.

One of the most surprising results of the cross motion of the fixed stars, as projected on the background of the sky, is the gradual falling to pieces of the familiar constellations. The stars are moving in all sorts of directions, some faster and some slower, and the inevitable consequence must be that in a few centuries the whole face of the heavens will be so changed that if we could come back again to our earthly life we should not recognize them. Of course, a very long period of time will be required to produce a very great transformation.

A German patent has been granted for a process of making fertilizers by the combination of lime with materials containing silica and alumina. Either natural materials (clay, loam, marl, etc.) or artificial materials (household refuse, rubbish, soft coal ashes, etc.), kiln-dried if necessary, are mixed with slaked or unslaked lime and, in some cases, treated with superheated steam. Compounds of potash, phosphorus, and nitrogen are also added, according to the character of the other materials and the kind of fertilizer desired. The advantage claimed for the process is the cheap production of certain compound silicates which greatly increase the fertility of the soil.

Prof. W. H. Pickering, of Harvard University, has devised a scheme which he hopes will settle once and for all whether or not Mars is really inhabited. If $10,000,000 were placed at his disposal, he would construct a system of mirrors arranged to present a single reflecting surface toward that planet. The mirrors would be so turned as to make a complete revolution every twenty-four hours. They would occupy an area of more than one-quarter mile, in order that sufficient light would reach the Martians. Even this huge reflecting surface would be invisible to the Martian observer unless he were equipped with a powerful telescope.

Flemming has recently made a number of ascensions, in a free balloon, for the purpose of studying the radio-activity of the upper strata of the atmosphere. As no earth connection was possible, the ordinary method of experiment was modified, the electric field being established between two wires, suspended from the balloon and connected with the poles of a dry battery of about 2,000 volts. The radio-active matter accumulated on the negative wire. The loss of charge was measured during the flight, immediately after the wires were hauled up. The difficulties of observation due to the oscillations of the balloon were minimized by a special suspension of the apparatus. Radio-active emanations were detected at all elevations attained by the balloon, which ascended more than 10,000 feet above the earth. The strongest radio-activity was found in the fourth ascension, which was made in a storm, but further observations will be required in order to determine the existence or non-existence of a causal connection between the atmospheric conditions and the degree of radio-activity.

Gilpin and Cram have published in the American Chemical Journal an account of their experiments in the separation of the constituents of petroleum by capillary action. This phenomenon was first discovered by Day, who observed that some separation occurred in the filtration of petroleum through fuller's earth. Subsequently, Engler showed that the separation was due to mechanical causes and that no oxidation of the oil took place. From a long series of experiments Gilpin and Cram deduce the following conclusions: When petroleum rises in a tube filled with fuller's earth a separation of its constituents takes place, so that the oil at the bottom of the tube is heavier than that at the top. The hydrocarbons of the paraffin series rise to the top of the tube, while the unsaturated hydrocarbons remain at the bottom. Only about two-thirds of the oil absorbed by fuller's earth is expelled by the application of water, and the portions successively expelled differ in constitution. Many clays possess a separating power similar to that of fuller's earth, but less intense. This power is not possessed by pulverized bricks made of the clay.

THE AMPHIBICYCLE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

We hear from time to time of machines which are designed to float on the water and are propelled by the use of pedals. Such craft, however, are intended only for use upon the water. Inventors have also had the idea of craft which will run not only on water but also on land. Some time ago we illustrated such a craft—a combination automobile boat and road machine.

In order to obtain the same result but in a much simpler and inexpensive way a young inventor of Lyons, France, had the very practical idea of adapting a bicycle for use in this manner. To enable it to run on water he attached to it a pair of cylindrical floats, a propeller and a rudder. On leaving the water the cylinders and nautical gear are lifted so as to allow the wheels to run on the ground. The cyclist can then pedal his machine in the usual way. As the cylinders can be made of very thin sheet metal they need not be heavy.

The inventor was able to run his machine on the Saone in the neighborhood of Lyons and also on roads apparently with no difficulty. When in the water the machine is able to make 5 or 6 miles an hour quite easily.

THE AMPHIBICYCLE TRAVELING ON LAND.

THE AMPHIBICYCLE TRAVELING ON WATER.

The two cylindrical floats, which end in a conical point, are attached to the bicycle frame by jointed supports so that they can be raised and lowered as desired and can be fastened in place when the cycle is on the road. For operating the propeller a rubber-covered friction wheel is employed, which is mounted behind the tire of the rear cycle wheel, the small wheel's motion being transmitted by a bevel gearing to the propeller shaft. By using the proper combination of gearing the propeller can be reversed. In general, this reversing mechanism will not be needed. A small rudder is mounted at the front, and is controlled by a rod passing from the front cycle fork into the water.

The two cylinders are braced across by a rod which passes between the wheels and also by another like rod in the rear of the machine. The whole machine weighs about 270 pounds. As built at present it is about 8 feet long and 3 feet 6 inches in outside width. The cylinders are about one foot in diameter.

A NEW CLASS OF SUBMARINES FOR THE UNITED STATES NAVY.

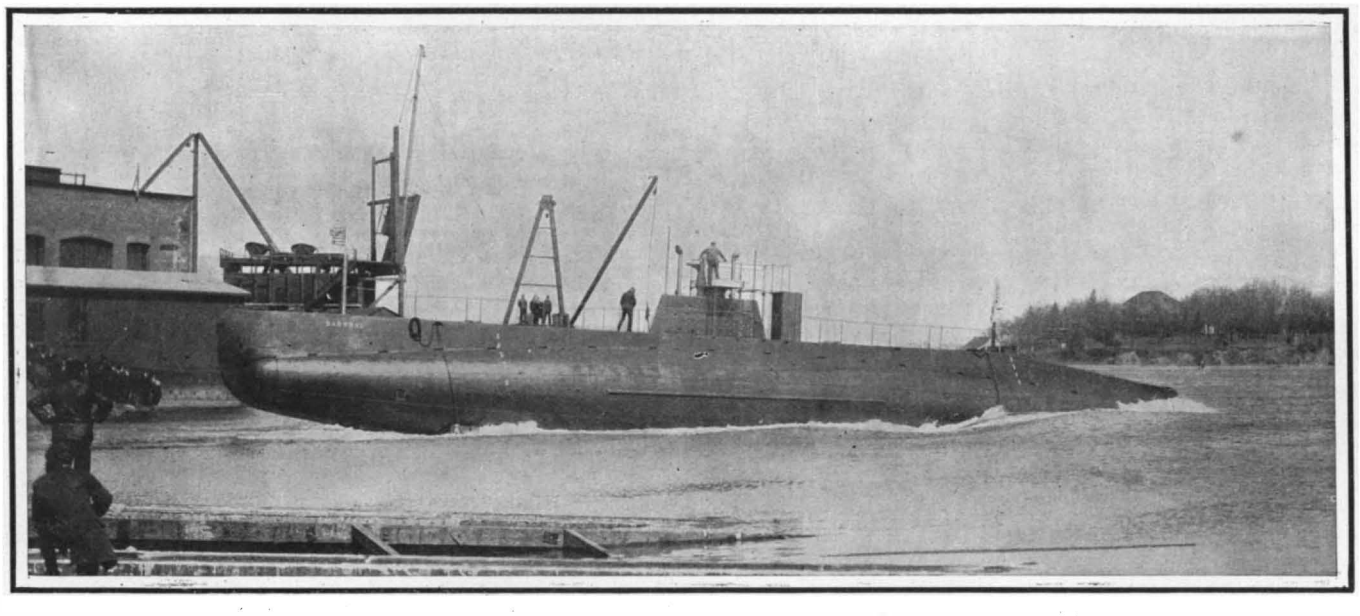
The launching of the submarine boats "Narwhal," "Tarpon," and "Stingray," which occurred at the works of the Fore River Shipbuilding Company on Thursday, April 8th, was notable, not merely for the number of boats that entered the water on the same day, but for the fact that one of these, the "Narwhal," represents a new class, of greater size, power, and speed than the earlier vessels of our submarine fleet.

The "Tarpon" and "Stingray" are each 105 feet long, with 13 feet 10 inches beam. They are driven when at the surface by internal-combustion engines at a speed of 11 knots. In the submerged condition, the internal-combustion engines are shut off, and the boats are driven by electric motors served by storage batteries of large capacity. The submerged speed is 10 knots. Steering in a horizontal plane is controlled by vertical rudders, and the degree of submersion is controlled by horizontal rudders acting in conjunction with submergence tanks, which are filled and emptied at will.

The boats are provided with a light superstructure, extending the full length of the hull, which is of an inverted V section at the forward and after portions and broadens out amidships, where it includes the conning tower. The latter extends about 6 feet above the superstructure deck, and through its roof project the air intake and the periscope. Two torpedo-launching tubes are provided at the bow, and each boat carries four torpedoes.

The "Narwhal" is a much larger vessel, and the increased displacement has made possible a considerable increase in both the speed and the armament. Though the beam remains the same as in the "Tarpon," viz., 13 feet 10 inches, the length has been increased by 30 feet, from 105 to 135 feet. This gives a finer form, and reduces the wave-making, when the boat is steaming at the surface; the speed being 13 knots as against 11 knots for the "Tarpon." The powers of attack have been practically doubled by the provision of four torpedo tubes, as against two in the "Tarpon."

All three vessels were launched in a practically complete condition, and will soon be given their trials.



THE "NARWHAL," ONE OF A NEW CLASS OF SUBMARINES FOR THE UNITED STATES NAVY.

Marking Patented Articles.

BY IRVING D. KIMBALL.

Many patentees do not realize the importance of marking their inventions as patented and affixing the date of their patent, in accordance with section 4,900 of the Revised Statutes, which reads:

"Sec. 4,900. It shall be the duty of all patentees, and their assigns and legal representatives, and of all persons making or vending any patented article for or under them, to give sufficient notice to the public that the same is patented; either by fixing thereon the word 'patented,' together with the day and year the patent was granted; or when, from the character of the article, this cannot be done, by fixing to it, or to the package wherein one or more of them is inclosed, a label containing the like notice; and in any suit for infringement, by the party failing so to mark, no damages shall be recovered by the plaintiff, except on proof that the defendant was duly notified of the infringement, and continued, after such notice, to make, use, or vend the article so patented."

To illustrate in a simple manner, let us suppose A has a valuable patent, but neglects to mark the article covered thereby. B may suppose in absence of such notice that it is not patented and may make and use or sell a large number of them. This may result in a serious loss to A's business; but as he has not notified the public that his article is patented, he is not protected by law and can collect no damages. If, however, upon finding that B is making his invention, A notifies him to stop such infringement, B can be held accountable for any which he manufactures after the receipt of such notice.

A patent is a public grant which is rightly subject to such restrictions as are necessary to protect the welfare of the public in general. If a man has a piece of land that he doesn't want people to walk upon, he surrounds it by a fence or puts up a sign, saying "No trespassing." If there is no fence or sign, one supposes that there is no objection to a person walking across it. If a man has a patented invention which other people must leave alone he should put a sign on it, in order that the public may know of his right.

The courts, in ruling upon questions arising under this statute, have as a rule held the contestants strictly to the wording of the statute.

In one case the patentee of wooden dishes stamped them "Oval Wooden Dish," and the crates in which they were shipped with the word "Patented," and the date of the patent. The court held that the stamping of the word "Patented" on a crate containing patented articles could not be construed to be either a marking of the word *upon* the articles or *affixing* it to them as required by the statute. The statute clearly states that the notice can only be affixed to the package when the nature of the patented article does not admit of its being marked. The assertion that to mark the notice on the dishes would so add to their cost that they could not be sold at a profit does not permit a deviation from the letter of the law.

From this it is clear that the inventor or manufacturer must carefully determine what method of marking will give him the protection of the law. On a machine it is a simple matter to have the notice cast on or fastened to the machine in the shape of a name plate. But on such an article as a hair-pin, for instance, it would be necessary to place the notice upon the box or wrapper containing them.

It is necessary that each article should be stamped with the day and year, but this is sufficient even if the word "patented" is abbreviated.

Marking an article "patented," not with the day and year of the patent which covers it, but with the date of a previous patent to the same inventor upon which the later patent is an improvement, is not a compliance with the statute and gives the patentee no right to recover damages.

Manufacturers and inventors should see to it that as soon as a patent issues, its date, with the word "Patented" or "Pat.," is put upon the article; or, if this is impossible owing to its nature, that a label is affixed either to the article or the package containing it, giving the information. Having paid out good money for a patent, it is a simple matter lawfully to notify the public of such right, thereby avoiding misunderstandings and expensive lawsuits.—American Machinist.

Quite a stir is being made in England by the opening of a large American department store in London. Not only is the system of conducting business thoroughly American, but the equipment as well. This applies particularly to the electrical equipment. There are 286 arc lamps and 6,000 incandescent lamps in the store, many of the latter being tantalum or tungsten lamps. The show windows have been very effectively illuminated, as well as the showcases along the aisles. Electricity is used for operating the fans, pumps, vacuum cleaner outfit, hair-drying machines, ice-breaking machines, etc. There are nine electric passenger elevators, each provided with an up-and-down signal light. The store is provided with a private telephone exchange, with 60 main lines, and 400 local stations. There is also a system of electric clocks, and controlled by these clocks is a system of electric bells which announce meal time and hour of opening and closing.

THE NEW CROTON FALLS RESERVOIR.

The latest and possibly the last addition to be made to the total storage capacity of the Croton watershed is that represented by the new 15-billion gallon reservoir, which is approaching completion near the town of Croton Falls on the river of that name. When the dam has been finally closed, there will be in all ten separate reservoirs in the Croton watershed, with an aggregate storage capacity of 104,530,000,000 gallons.

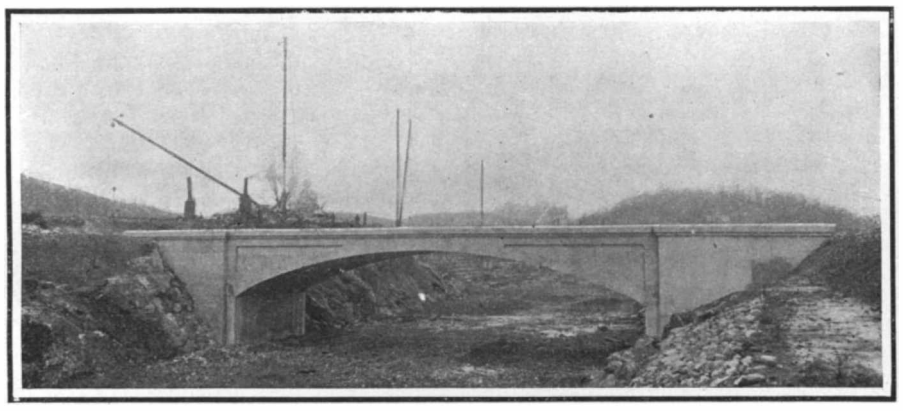
Although the main reservoir is located on the west branch of the Croton River, it serves to impound also the waters of the east branch of the same river, the flow of whose water is diverted to the west branch by means of a dam across the east branch and a canal 3,700 feet long leading from the dam to the west branch. The diverting dam is built of rolled earth, with a center core wall of masonry. The core wall, which extends along the axis of the dam, is carried down to a maximum depth of 85 feet below the crest and is everywhere founded upon solid rock. The dam itself has a maximum bottom width of 245 feet, a uniform width of 15 feet at the top, with a maximum height at the center of 50 feet, and a length on the crest of 1,185 feet. During the construction of the diverting dam, it was necessary to unwater the site by the construction across the valley, about 900 feet upstream, of a smaller temporary earth dam 18 feet in height and 700 feet in length. The water, during the construction of the main diverting dam, was led from the temporary dam through a wooden flume, 850 feet in length, to the permanent waste channel of the diverting dam, and was discharged into the bed of the river about 1,000 feet farther downstream.

The connecting channel, leading from the diverting dam to the west branch of the Croton River, has a bottom width of 30 feet, and its construction called for the excavation of 110,000 cubic yards of rock and 200,000 cubic yards of earth. The bottom is heavily paved to a depth of 3 feet, and the retaining walls are built of rubble masonry.

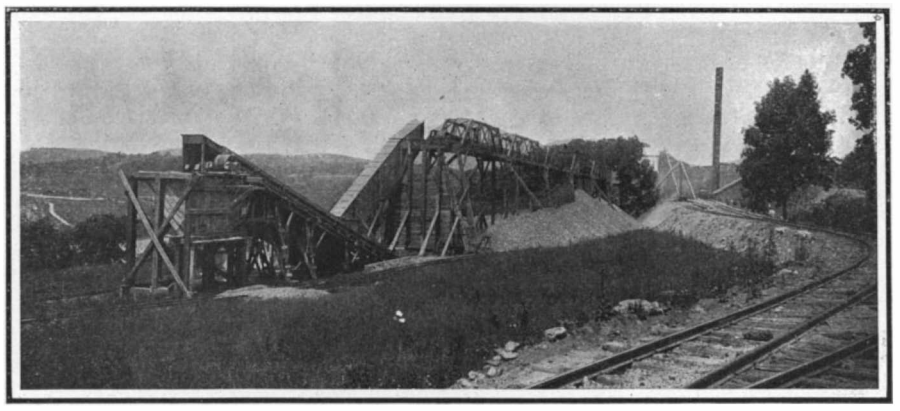
The main reservoir, which, as we have said, is of 15 billion gallons capacity, is being formed by the construction of a dam which is 125 feet wide on the foundations, 167 feet high, and 1,070 feet long on the crest.

This dam is being built of heavy cyclopean masonry, and it is faced with cast concrete blocks of large size. In the completed structure there will be 240,000 cubic yards of cyclopean masonry and 28,000 cubic yards of concrete. The foundations were prepared by removing the soil, gravel, and fissured rock over the whole area of the dam, until solid rock impervious to water was everywhere uncovered. Solid rock was found at a depth of about 55 feet below the original surface of the ground, and 155 feet below the flow line of level of discharge of the reservoir. A waste channel to carry off the surplus waters when the dam is full has been quarried out of the solid rock of the hillside adjacent to the wasteway, which has a length of about 700 feet.

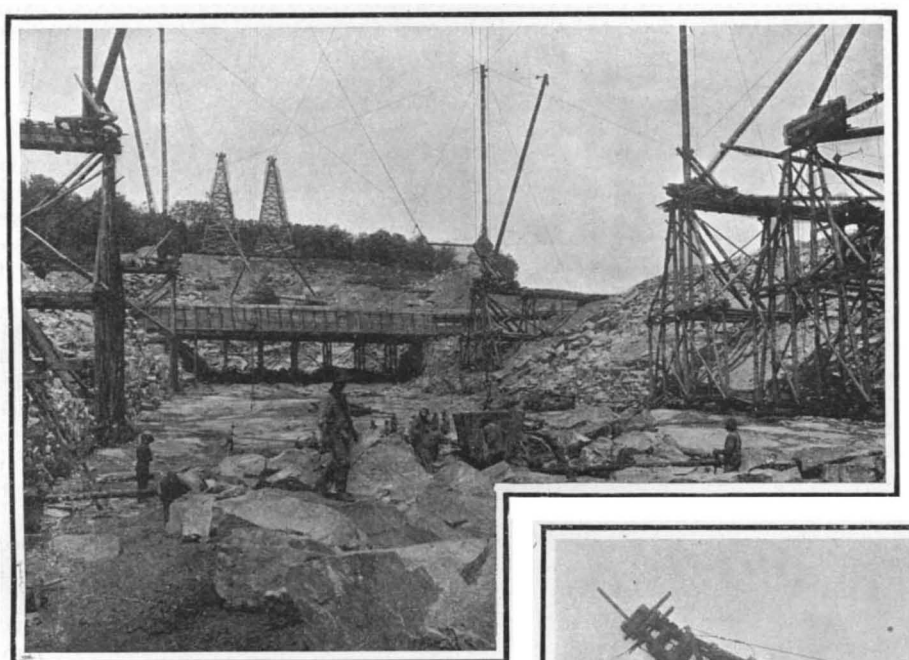
In constructing reservoirs of this character, an important problem is that of carrying the waters of the river through or across the dam during construction. In the present case the Croton River at this point has an ordinary flow of about 200 million gallons per day, at a speed of about four miles an hour. It is subject, however, to sudden freshets, during which



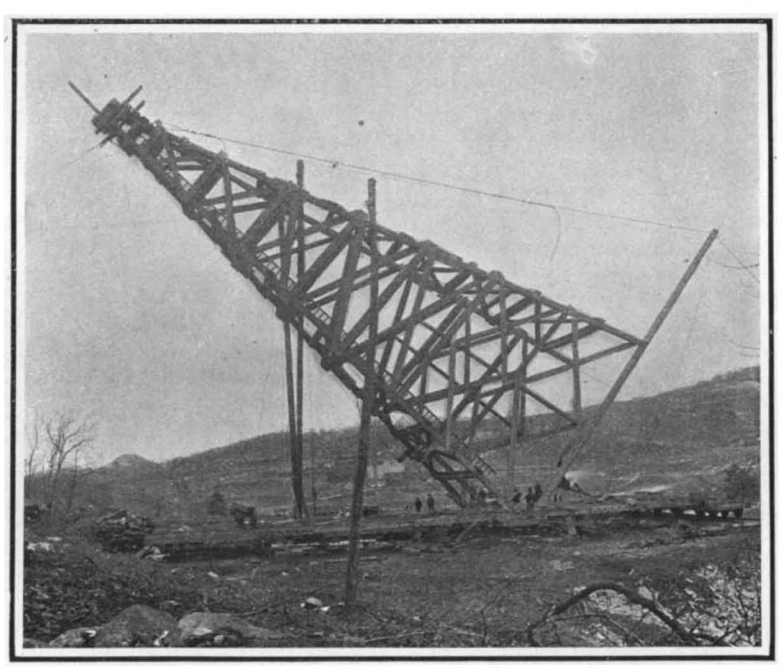
Reinforced concrete arch bridge at the diverting dam.



Crushing plant, conveyors, and stone piles.

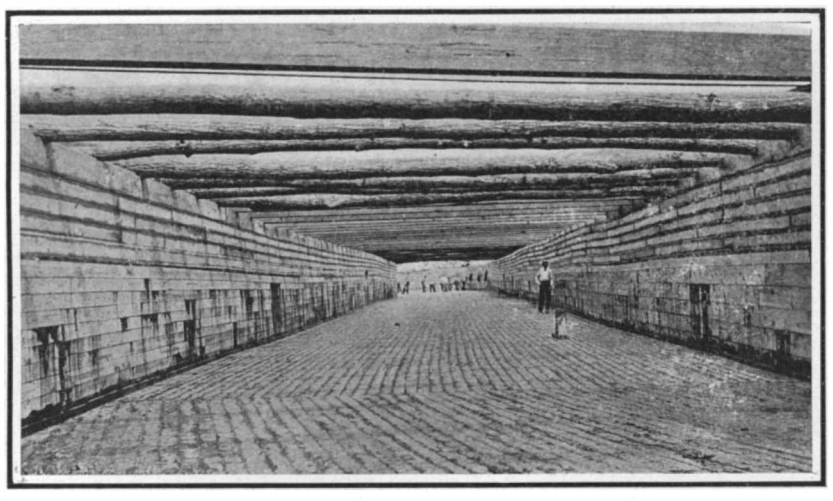


The main dam, showing the cyclopean masonry in place, and the flume for carrying the Croton River in the background.

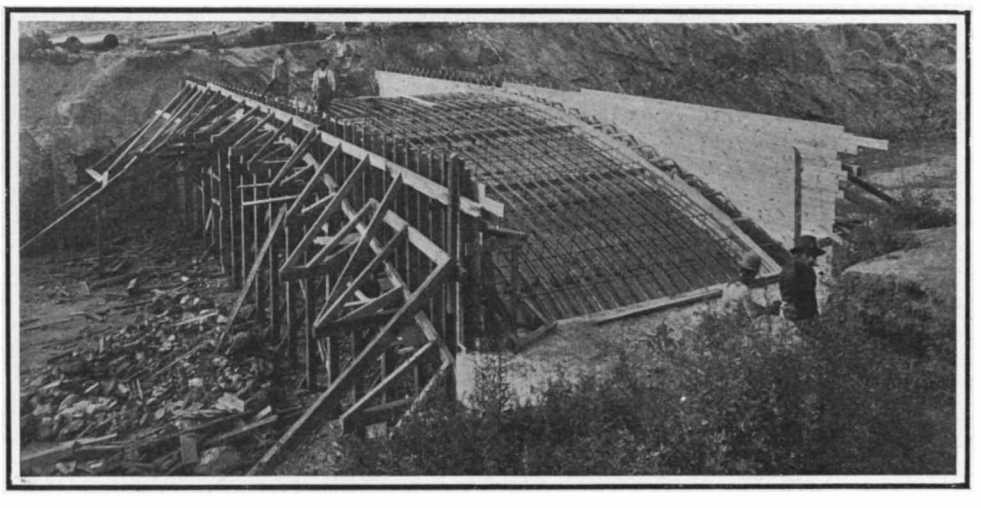


Erecting one of the timber towers for the cableways.

Present condition of main dam, showing the facing of concrete blocks.



Interior view of the wooden flume though which the Croton River was carried past the dam during construction.



Forms and steel reinforcement—construction of concrete arch bridge at diverting dam.

the flow has increased to a maximum of 900,000,000 gallons per day. To divert this water from the site of the dam during construction, it was necessary to build two temporary earth dams above and below the permanent main dam, and to connect them by a temporary channel. Above the dam this channel is rock paved, and where it crosses the dam it is built as a wooden flume, and carried upon permanent steel trestle bents laid in the masonry of the dam. This steel work is left in place as the masonry is built up around it, and is thoroughly grouted into the structure. Two 48-inch discharge pipes are installed, which will take care of the flow of the river when the masonry of the dam has been carried up above the level of the flume. The normal cross section of the flume shows a width of 24 feet and an inside depth of 8 feet 2 inches, and its capacity is 1,000,000,000 gallons per day.

The main quarry for cyclopean stone is about 2,500 feet north of the dam, and an excellent quality of stone in abundant quantities was found to be available. The power for the operation of the whole works is developed in a plant about 1,200 feet south of the principal quarry, and adjoining it is the crushing plant and sand and stone storage elevating plant, an excellent view of which is given in one of our engravings. The power house contains a battery of five 333-horse-power vertical water-tube boilers, which supply steam for driving a 100-kilowatt Westinghouse dynamo, and a 300-horse-power Corliss engine which operates the stone crushers and elevator plant, and two Vulcan air compressors, each with a capacity of 2,000 cubic feet of free air per minute. The crusher house contains three McCully stone crushers, from which the material is handled by elevators and conveyors and delivered to the desired localities. Sand is excavated by a steam shovel from sand pits located up the valley, about a mile from the storage bin, and is hauled in dump cars to the elevator at the crusher house.

The concrete blocks for the facing of the dam are cast in a large yard by means of a specially-designed traveling bridge, carrying the hoppers from which the mixture is dropped directly into the molds below. The molds, which are built of timber, are metal-lined, and, before the casting of the blocks, the surface of the metal is smeared with crude vaseline, to insure an easy release of the forms and a smooth finish to the face of the blocks.

The handling of the materials of construction at the main dam is partly done by means of two 1,400-foot Lidgerwood cableways, with head and tail towers on opposite sides of the valley, which are respectively 75 feet and 105 feet in height. The stone for the cyclopean masonry is delivered to the dam by means of surface tracks, from which it is picked up and lowered into place by two rows of low level derricks, one on each side of the dam. In building the lower part of the dam these derricks place the stone directly in position, and in constructing the upper part of the dam they deliver it to the cableways, which also serve to distribute the concrete throughout the full length of the dam.

In addition to the important work above enumerated, the construction of this reservoir calls for the clearing of the 1,600 acres included in the reservoir site; the building of about 15 miles of highways, and of about 10,000 lineal feet of stone wall for the inclosure of the reservoir property. The estimated cost of the work is $3,028,000.

At the present writing the masonry has been built to a height of 60 feet above the foundation. The placing of the cyclopean masonry was begun June 15th, 1908, and work was shut down for the season on January 2d, 1909. During the intervening 160 days, 109,802 cubic yards of masonry and 7,330 cubic yards of concrete facing blocks were built in place, making a total for the season of 117,132 cubic yards. The total masonry and concrete in the finished dam will be 267,000 cubic yards.

All records for work of this character were broken in the month of October, 1908, when 25,941 cubic yards were laid in 28 eight-hour working days, the best previous records, as far as can be ascertained, being 21,000 cubic yards. Judging from the present outlook, water will be stored in the new reservoir by the end of the present season. Our thanks are due to Mr. F. S. Cook, division engineer in charge of the work, for assistance in the preparation of the present article.

The comet of 1556 was expected to return in 1848, but did not do so. On examining the elements of the comet, Prof. G. Forbes found certain peculiarities which caused him to believe that the body had been perturbed by some unknown planet, causing it to break up into three portions, which became visible successively as the comets of 1843 I., 1880 I., and 1882 II. These three comets have long been regarded as associated, in that their orbits are similar, although not identical; they all have retrograde motion, and all approach very close to the sun's surface at perihelion; the points of aphelia are also very close together.

SUBMARINE WRECKING VESSEL.

The illustration on the front page of this issue represents a new type of wrecking vessel, which has been built at Wyvenhoe, England, from the plans of Mr. Simon Lake, for the recovery of certain sunken bullion and specie, whose value is over $5,000,000.

On the night of October 9th, 1799, the British man-of-war "Lutine" sank off the entrance to the Zuyder Zee, while she was transporting some $5,872,000 worth of bullion and specie to Hamburg for the purpose of relieving the financial panic which existed there at that time. John Mavors Still, Lloyds Amsterdam agent, found the insurance effected to be £900,000 sterling at Lloyds and £160,000 sterling at Hamburg. England was at war with France; and Holland, under French influence, claimed the wreck as spoils of war. The ship became sanded, however, as she lay at the entrance to the Zuyder Zee, and the wreckers were forced to abandon her.

Peace being declared, the King of Holland, in 1823, ceded to the King of England his rights to the treasure, and the King of England ceded the right back to Lloyds. The sand being cut away from over the vessel by storms from time to time, diving operations were commenced under the supervision of Lloyds to recover the treasure. With the crude apparatus at hand, the company have succeeded in recovering in five attempts, during over a century, a total of 198 gold and silver bars and some 12,000 coins, in all to the value of about $541,228. The sand, however, continually drifted in on the wreck, and ultimately forced them to suspend operations. The engineer for the company having the contract with Lloyds requested Mr. Lake to design a submarine recovery apparatus for the salving of this treasure. The engineering problem is to remove about 40,000 tons of sand that has accumulated above and around the wreck, and to clear out the sand from the interior of the vessel, first removing her decks if they still remain. For this purpose a plant has been designed consisting of a large light-draft surface vessel, provided with a well running partially through the center of the vessel, for the purpose of housing the submarine bottom working apparatus. The dimensions of the surface vessel are: Length, 130 feet; breadth of beam, 43 feet; depth, 7 feet 6 inches. Two 16-inch centrifugal sand pumps and powerful derricks are carried by the surface vessel. Two 12-inch sand pumps work in connection with the submarine tube. Their suction ends are controlled from within the working compartment, and are to be used in the final cleaning out of the vessel, and to keep the sand away from the operators when they are working on the bottom.

The front-page illustration shows the proposed method of salving this treasure. The capacity of the sand-pumping plant is over 40,000 tons per day of twenty-four hours. Owing to the exposed nature of the location, and the fact that the sand drifts in so rapidly during the time of storm, the plant is made powerful enough to complete the whole job in a few days' time during the comparative calm of the summer.

The most interesting part of the plant is the submarine tube and working chamber. The former, built of steel plating, is hinged within the hull of the surface vessel. It is 5 feet in diameter and 95 feet long. Water ballast compartments are provided on either side; and there is a passageway down which the operators may walk when the working compartment is on the bottom.

The working compartment, also built of steel plating, is constructed on the same principle as the diving compartment in the Lake type of submarine boats, which principle has been successfully tested in numerous submarine boats constructed here and abroad. It is about eight feet across, with large doors opening out from its bottom, and with provision for the admission of compressed air. The bottom door may be opened, and the compartment may be hauled to any desired position by the use of anchor lines.

The working chamber is fitted with observation ports, for investigation of the bottom of the sea, which latter is lighted up by searchlights carried within the chamber. In working on a stationary wreck the chamber and tube would be moved, preferably by anchor lines; but when a search for a wreck or other object is being made, the chamber will either be suspended clear of the bottom, and the surface hull with its submarine tube and chamber towed by a tug; or the chamber will be lowered to the bottom, and the whole plant, surface and submerged, moved by means of a heavy mechanically-driven tractor wheel, projecting through the chamber and resting upon the bottom. To achieve this, sufficient water ballast is admitted to cause the working chamber to rest on the bottom, embed the teeth of the tractor wheel, and so afford sufficient tractive adhesion. The traction wheel is driven by a motor within the compartment, and may be turned in any direction, like a unicycle. The compartment may thus be navigated in the most devious course, around rocks or other kinds of obstructions.

This last will be the method of progression adopted when the system is used in the pearl fisheries, for which the plant is particularly well adapted. The small sketch on the front page shows the compartment fitted with two large, mechanically-operated rakes, hinged, one on each side, at the axis of the chamber. This type of machine would be used on bottoms that are fairly clear of rocks, and the method of cleaning up oyster ground may be likened to that of a reaper cleaning up a wheat field. The working compartment is wheeled back and forth over the oyster beds in parallel lines. When the rakes become filled, the submarine compartment is stopped, the rakes are rotated and elevated by machinery within the submarine working chamber, and the oysters are dumped into a car which runs on rails on the top of and sides of the tube, as shown in the sketch. The car being filled, it is hauled to the surface and dumped of its load. On prolific oyster bottom free from rock and in the clear waters of Ceylon, such an apparatus would probably catch more oysters per day than several hundred native divers operating in the usual manner.

The Current Supplement.

The opening article of the current Supplement, No. 1739, deals with another of those caterpillar traction engines which have aroused so much interest in our readers. In this particular instance, a steam caterpillar tractor is described, which serves the novel purpose of hauling logs over snow. Mr. A. D. Little contributes a *résumé* of his experiments on the effect of sulphur in illuminating gas on leather. Mr. Julius Bernstein writes on Fault Location. He treats this geological subject in a general way, so that those who are not familiar with the principles upon which are based some of the ordinary measurements for the location of faults will recognize that these fundamental principles are quite simple and are easily understood. George F. Stratton writes of "A Medieval Edison," who is none other than Edward Somerset, Marquis of Worcester. Under the title "The Ravaud Aero Hydroplane" a new type of aeroplane is described, which is adapted to rise from water. F. Savorgnan di Brazza writes on "The Human Eye—What May Be Seen at the Back of It." The distinguished physicist Prof. E. Rutherford contributes an excellent paper entitled "Some Cosmical Aspects of Radio Activity." Prof. Jacob Reighard's paper on "Subaqueous Photography" is concluded.

Burning Sewage Sludge.

For a considerable period the Metropolitan Water and Sewerage Commission of Massachusetts has followed the practice of compressing into blocks the material screened out from the sewage before it enters the pumps and utilizing it for fuel beneath their boilers. They early learned, however, that the brick work was burned out very rapidly whenever this fuel was used in connection with the externally-fired boilers. On the other hand, it was found to have no effect upon the steel plates. As a result internally-fired boilers have been adopted.

In the recent installation made at Deer Island, in accordance with plans by F. W. Dean, of Boston, a number of horizontal return tubular boilers were replaced by those of the internally-fired type. Scotch boilers were adopted, the combustion chambers being made of steel plate with water spaces, and without brickwork except in the bridge walls and around the fire doors. All objectionable effect of the gases from the sludge was thereby avoided. The compactness and convenience of this type of boilers are shown by the fact that they met the requirements where there was insufficient room for vertical boilers, and where the locomotive type could not be used because of lack of space to remove and replace the tubes; while with the Scotch type the tubes could be drawn within the firing space of the boiler house.—Municipal Journal and Engineer.

Thermal Effects of the Singing Arc.

La Rosa, after proving that the singing arc, when the self-induction and the resistance of the derived circuit are very small, consumes more energy and emits more light than the ordinary electric arc, was led to suspect that the increase of luminous power might be accompanied by a rise of temperature and by thermal effects unattainable with the ordinary arc. He tested this theory by attempting to fuse carbon in the singing arc. A series of experiments conducted with the greatest care and attention convinced him that the particles of carbon were actually fused and, consequently, that the temperature of a singing arc producing the spark spectrum is higher than that of the ordinary electric arc.

It is announced that Dr. Karl Bovallius has discovered in British Guiana, near the Brazilian frontier, 5 degrees north of the equator, a cataract as great as Niagara. The cataract is on a tributary of the Ireng River and has been named Chamberlain Fall. Another great cataract was discovered a few months ago on the Hamilton River in Canada.

Correspondence.

AN ERROR CORRECTED.

To the Editor of the SCIENTIFIC AMERICAN:

Please allow me to call attention to an error which occurred in the article of D. M. Morris in the number of April 10th. In the paragraph beginning "Assume 1 as a base with 1¼ as the sum of the other two sides," 1½ evidently is meant for 1¼, for 2/3 is not the reciprocal of 1¼, but of 1½, and 13/12 and 5/12 are not parts of 1¼ but of 1½.

But using 1¼ or 50/40 as the sum of the two sides, the difference would be 32/40, and twice the greater side would be 82/40 or the greater side 41/40, leaving the other side 9/40. JAMES LYNCH.

Georgetown College, Washington, D. C.

STEERING OF SHIPS.

To the Editor of the SCIENTIFIC AMERICAN:

In reading the article on the superiority of lock to sea-level canal, in the issue of March 27th of your valuable paper, I find a statement which may or may not have any bearing on the point in question, viz., the easiness of navigating along long tangents, but which conveys an idea as popular as it is erroneous. The statement referred to is the following: "The ship proceeds on a given course, until the lights or buoys show her to be in range for the next course, when the helm is put over and the ship's head swung sharply around."

Now the fact is that in making a turn the ship's head is never swung around. It is the ship's "tail," or stern, which swings. The rudder when put at an angle to the longitudinal axis of the ship will force the *stern* of the ship to one side or another, thus effecting a turn. That lack of understanding of this fact may have disastrous consequences, and that a correct idea will be of value in narrow channels or in danger of collision, is evident, and I remember two events in which this fact played a most important part.

The one happened to two English battleships leaving harbor and running parallel to each other with but a narrow space between them. Outside of the harbor lights order was given to separate at a sharp angle. The captains turned their rudders in opposite directions, naturally thinking that in so doing the distance between the ships would increase. But what followed was a collision; the sterns of the ships being forced against each other. The case went to court martial, and the cause was fully explained.

The other event happened to a sailing vessel, steering say N. W. on a foggy day. Suddenly the captain saw a steamer coming out of the fog a little aft of the middle of his ship on the larboard side. Now this captain, instead of turning west or, as one should think, *away* from the steamer, turned north. Calculating that in so doing the *stern* of his ship would move away from or at least in the same direction as the steamer. A collision followed, but not a very serious one; still, the captain was accused of poor seamanship, but was acquitted on explaining the principle on which he had acted. ALEXANDER KIELLAND.

Cashmere, Wash.

Radio-active Properties of Uranium and Its Salts.

BY A. J. JARMAN.

Radium and uranium are obtained from the same source, viz., uranite or pitchblende, the name uranium being given to it by its discoverer, Klaproth, in 1789. Both of these elements possess the property of radio-activity, and both of them emit similar rays. Six years have passed since the writer first made some important tests relating to the effects of the rays emitted by the metal uranium and some of its salts upon the human body. These tests, which are being continued at the present time, have proved to be of considerable value from a therapeutic standpoint.

The rays that are emitted from uranium, and its oxides in particular, have proved to be of such an extraordinary character, that the following record cannot fail to prove of interest in the line of scientific research.

The yellow oxide of uranium is very effective, as well as the cyanide and ferrocyanide. The cyanide of uranium is insoluble in a solution of potassium cyanide 99 per cent pure even at boiling point, while the ferrocyanide is soluble in such a solution in a cold state.

The molybdate of uranium is a pale lemon-colored plastic material, which turns green upon exposure to white light.

Pieces of tempered spring steel were taken and cut into lengths, varying from two and a half inches and half an inch wide to five and six inches, the ends being filed to a semicircular shape. These pieces of steel were then strongly magnetized, and cleaned; they were then submitted to the process of coating with the uranium oxide by means of electrolysis, the solution used being composed of equal parts by weight of uranium chloride and ammonium chloride in distilled water at a temperature of 60 deg. Fahr. The battery force employed consisted of two half-gallon Bunsen cells, using a saturated solution of bichromate of potassium in place of nitric acid. The outside containing vessels were charged with common sulphuric acid and water in the proportion of one part acid to eight of water, with an amalgamated zinc cylinder placed therein. The elements were then coupled in series. A strip of steel or carbon was used as an anode, and the steel strip as the cathode. In the course of a few seconds a brass-like deposit took place, due to the rapid formation of the yellow oxide of uranium upon the surface of the steel strip. The strip was then carefully removed, dipped in clean water, and dried by holding it with a pair of pliers over an ordinary gas jet. After a number of these strips are prepared, they are wrapped tightly in tissue paper, and pasted so as to retain the uranium oxide upon the surface. They can then be sewn into a belt to surround the body, made into any appliance to be worn upon the body, not necessarily in contact; they may be worn over the underclothing, because the radio-active rays are not impeded by woolen or cotton fabrics. In cases of lumbago, severe pain in the back, and affections of the knees, where the blood circulation is defective, the relief from pain, and the increase of vitality in the body generally, is astonishing.

The following test has been put into operation many times, to prove that there are active rays emitted from the coated strips of steel:

Several 5 x 7 Lumière Sigma sensitized photographic plates were placed in ordinary photographic printing frames, glass side down, previously fitting a double thickness of stout black paper in front of the plate; then upon the sensitive surface (all operations being performed under a double thickness of deep ruby glass) several coated metal strips were placed, some being crossed, and some in a straight line, then over these was placed a piece of clean glass plate, then the pad and back of the printing frame were adjusted, and the whole was wrapped in several folds of black velvet and placed in a well-made case, then locked, and placed in a dark closet also locked, and allowed to remain unmolested for a period of eighty to one hundred hours, and afterward submitted for development under deep ruby light, with the result that excellent radiographic negatives were obtained in the course of a minute or two. Upon fixing, washing, and drying, prints could be made from them by any photographic process.

The impression made upon the plates by these radio-active rays was clearly observed somewhat like a halo surrounding the steel strips, while within this halo a well-defined impression of the shape of the steel strips was plainly seen. The radio-active rays emitted from uranium and its salts are much lower in intensity than from radium, which makes them safer in their application. It was owing to this effect that the writer proposed about four years ago the name "radiopathic," because it appeared to express effectively a name for therapeutic use. Three years ago a physician requested the writer to prepare a knee cap for personal trial upon a stiff knee from which he was suffering. It was not typical rheumatism. His knee became so stiff at times that he could not bend it. The knee cap was made, the physician used it, with the result that the swelling decreased and the pain and stiffness disappeared. No other remedy was used but this simple radio-pathic appliance. Another case, in this instance what is known to medical men as neuritis, a severe twitching of the right arm at the lower part; an armlet and a body belt, prepared as above, were made by request. After wearing the appliances for about one month, the distressing nervous symptoms entirely disappeared, and at the end of one year's use of the appliance did not return.

In a case of abdominal tumor, the wearing of a body belt six inches wide, fitted specially with the radio-active strips, caused the stoppage of the growth in eight months, causing a reduction in the girth of the abdomen of *four and a half inches.* When such an appliance is worn around the body, it produces an extraordinary energizing or vitalizing effect. Pains in the back and loins are relieved by six hours' use. Quite unlike an electrical appliance, it is not necessary for the elements to touch the body, since there is no blistering effect liable to occur due to the intensity of radium or its bromide when that is used.

Other bodies placed near these radio-pathic strips are also affected by them. Photographic plates are quickly affected, and become irreparably fogged. Further experiments at present under way with the ferrocyanide of uranium bid fair to bring about some unlooked-for results in the researches of radio-activity.

Lunar Superstition and Potatoes.

After exhaustive experiments in potato planting, the United States Department of Agriculture has to say that, in season, one time is as good as another to put potatoes in the ground.

Almost everyone, even if he were not reared in the country, has heard of the idea about planting potatoes in the dark of the moon. The field workers of the Department of Agriculture have been investigating the matter, and have found that seventy-five per cent of the farmers of this alleged enlightened country put in their crops and do a good many other things about the farm governed solely by the moon's phases. Many farmers will tell you that if you plant potatoes in the dark of the moon they will run to tubers, and if in the light of the moon they will run to tops, and crops are planted accordingly.

There is usually a basis in fact for any superstition; and the moon superstition is so deeply rooted, that a number of experts from the Department of Agriculture, while going up and down and across the land, have made it their business to study the question, and see whether there might not be a germ of truth or, at least, some reason for the general belief that the moon's phases have an effect on animal and vegetable life. They have concluded after patient investigation that the moon myth is one of the comparatively few myths that date back to pure savagery, and has absolutely not an atom of scientific foundation on which to stand. The agricultural experiment stations all over the country have been defying this superstition for several years and raising just as good crops when the moon was one way as when it was the other. Therefore, once and for all, it is conclusively decided that there is nothing to the theory that potatoes should be planted in the dark of the moon.

All of this may not seem very serious investigation for a great government to undertake, but the work nevertheless has been interesting to the scientists, and if they have succeeded in weaning a few from the old superstitions about planting potatoes, they have been well paid for their work.

Sodium Nitrite.

Sodium nitrite is very extensively employed in the manufacture of "azo" dyes. The salt is produced by various methods. Sodium nitrate (Chili saltpeter) is converted into sodium nitrite by simple heating, but this process is made almost impracticable by the simultaneous conversion of much of the nitrite into oxide. The nitrate can also be reduced to the nitrite by the action of lead, or of various sulphides and sulphites. Sodium nitrite reduced by lead is a by-product of the manufacture of litharge, into which the metallic lead is oxidized in the process of reduction of the sodium salt. Sodium nitrite is also produced by passing nitrous acid vapor into a solution of soda. Finally, experiments have recently been made in the production of sodium nitrite by the action of calcium nitrate upon a mixture of sodium sulphide and sulphite. The reaction is as follow:

$$3Ca(NO_3)^2 + Na_2S + 2Na_2SO_3 = 6NaNO_2 + 3CaSO_4$$

Calcium nitrate. + Sodium sulphide. + Sodium sulphite. = Sodium nitrite. + Calcium sulphate.

Sulphur and caustic soda may be substituted for the sodium sulphide and sulphite. The equation then becomes:

$$3Ca(NO_3)^2 + 2S + 6NaOH =$$

Calcium nitrate. + Sulphur. + Soda. =

$$6NaNO_2 + 2CaSO_4 + Ca(OH)_2 + 2H_2O.$$

Sodium nitrite. + Calcium sulphate. + Lime. + Water.

The calcium sulphate precipitated spontaneously, and the lime formed in the second reaction may be precipitated by sulphuric or carbonic acid. On concentrating the liquid the sodium nitrite is obtained in crystals.

Benzoates in Butter.

Benzoate of soda or of potash is sometimes added to butter as a preservative. The benzoate can be detected by the following process: The butter is melted and stirred with a hot saturated solution of lime. The watery part of the mixture, after cooling, is drawn off, acidulated with phosphoric acid, and shaken with half its volume of ether, any tendency to emulsifying being corrected by adding a few drops of alcohol. The ether is poured off and evaporated, and the residue is allowed to dry in the air and is then gently heated with sulphuric acid to 212 deg. F. or a little higher for the purpose of dissolving the benzoic acid. The cooled solution is mixed with about one-tenth its volume of fuming nitric acid, heated for a few seconds, then cooled and mixed with two or three times its volume of water. Saturated solution of sodium sulphite is then added gradually, with constant agitation, until the evolution of yellow fumes ceases. Strong ammonia is then poured on the solution. The presence of benzoic acid is revealed by an orange-red coloration.

A Berlin journal states that an international understanding is to be set on foot for supplying all the leading cities of the Continent with automobile kitchens or open-air cooked food supplies. This will be a new use for the automobile, and the vans will circulate mainly in the lower quarters of the cities and in the outlying districts. At a very moderate price they will give a supply of cooked food. On the first trial of the new system, the vehicles will be fitted with two kinds of ranges or heaters, one of which will use a gas flame and the other will be an electric heater. Each automobile is mounted by two persons, one of which is the driver and the second the cook. The latter will also act to sell the food when the vehicle is stopped. In the front part of the car is mounted an ice-chamber of large size which will contain the raw meat principally, besides non-alcoholic drinks. The latter will be supplied as well as the food. It is stated that the first trial of this novel system will be carried out simultaneously at Berlin, Paris, and Moscow.

TRICKS WITH SOAP BUBBLES.

BY PERCY COLLINS.

Probably most people are of the opinion that bubble blowing is a purely childish pastime. But this is a mistake. Soap bubbles may be conveniently employed to demonstrate certain physical laws. Take, for example, the matter of surface tension. If we blow a bubble upon the bowl of a clay pipe, and remove the stem of the pipe from our mouth, the bubble slowly collapses. This is because the curved outer and inner layers of thin film, being at a tension, press upon the interior air and drive it back through the stem of the pipe. Again, if we blow two bubbles from two pipes, and connect the stems of the latter by means of a rubber tube, the smaller of the two bubbles will collapse, while the larger will increase in size. The explanation of this is that the bubble of smaller radius has its surface layers more sharply curved, and therefore exerts a greater pressure on the air within than does the larger bubble.

The writer, however, proposes to deal with soap bubbles mainly as a means of entertainment, leaving the reader (if he be so minded) to work out for himself their scientific possibilities. It may be said at once that upon the solution used success in bubble blowing entirely depends. The least elaborate formula, good yellow soap properly combined with pure water, is probably the best. Much depends, however, upon the manner of mixing. Take a bowl of slightly warm water, and rub in it a piece of good soap until a strong lather is formed. Skim off every particle of the lather, with a spoon, and proceed to test the solution. First blow a bubble about six inches in diameter from the bowl of a pipe. Then dip your finger into the soap solution, and attempt to thrust the former into the center of the bubble. If it does not collapse, the solution is ready for use. If it bursts in the ordeal, more soap must be added until satisfactory.

When once made, never disturb it. Many may think that occasional stirring will render it more uniform in strength, and better, but this is a great mistake; and the amateur will soon find that any disturbance of his solution will render tricks impossible that are otherwise quite easy to perform.

For artistic blowing, a little apparatus will be necessary. A straw or two, a clay pipe, one or two funnels of different sizes, and a ring made by twisting a wire round a bottle will be needed. Moisten thoroughly with the solution every article just before it is brought into use; and for this reason it is a good plan to keep one's straws standing in a half-filled jar or tumbler of soap solution.

In a pretty trick, attempt to form a string of bubbles —blowing one with the pipe, throwing it into the air, blowing a second, catching the first upon it, and so on until the chain collapses. With practice, a chain of five or six, or even more, bubbles may be formed. The trick has the advantage of demonstrating the quality of the solution if this be in question, and it is therefore a good one to commence with. Chain making is by no means as simple as certain other tricks which, at first sight, appear far more elaborate. For instance, it is quite an easy matter to blow a number of bubbles one inside the other. First pour a thin film of solution upon a sheet of glass, then dip your straw and blow upon the glass a good-sized hemispherical bubble. Now dip the straw again, thrust it boldly through the side of the big bubble, and proceed to blow a somewhat smaller bubble inside. Repeat the process as often as possible, and a very pretty series of iridescent hemispheres will be the result. An accomplished bubble blower will sometimes form a dozen before the inevitable dissolution ends his triumph. Much depends upon the steadiness of hand and eye.

A variation of this trick takes the form of a "poached egg." First, a large bubble is blown upon the sheet of glass in the ordinary way; then a "pull" is taken at one's pipe or cigarette, the while the straw is redipped, and the second bubble within the first is inflated with smoke instead of air. The result is a beautiful white, solid-looking hemisphere within another shining with rainbow colors.

A good deal of fun at a bubble party may be secured by asking a novice to place a bubble upon a flower. He will make attempts, but without success. Then the master of the ceremonies will do it with ease, as his flower is first secretly smeared with soap solution, which provides, so to speak, a "foothold" for the bubble. Both smoke-filled and clear bubbles may be used effectively; and a number of flowers of different kinds may be adorned. If the solution be strong and good, it is quite easy to make a dozen or more "bubble flowers" before the first one bursts.

The wire ring may now be brought into play with somewhat astonishing results. An ordinary hemispherical bubble may be blown upon the sheet of glass, and then drawn up with the ring to form a cylinder. Of course, the ring must be first dipped in solution, when it will be found to adhere tenaciously to the outer surface of the bubble.

By blowing a bubble with the pipe, throwing it into the air, and then catching it with two rings of soaped wire, the bubble may be pulled into a barrel shape.

An elliptical bubble is made by first dipping a wire ring into the solution, so that a film stretches across the opening; then, with a straw, blowing a bubble upon this film. Two bubbles are actually formed in close contact, the result resembling an old-fashioned lens, as shown in the accompanying engraving.

Another very effective trick may be described as the opening and closing flower. A five-pointed corolla should be cut out of rather thin white paper, mounted with a pin point upon the cork of a small bottle, and well smeared with soap solution. Upon this a good-sized bubble is to be mounted. If the bubble does not of itself pick up the rays of the corolla, they may be quite easily adjusted as pictured. When these preparations are complete, it is an easy matter to make the flower open or close by thrusting the straw into the bubble, and either sucking out air, or blowing it in.

We may wish to blow a bubble over a flower or any other object. Begin by placing the flower upon the sheet of soapy glass, or in a shallow saucer containing a little solution. Over the flower put a funnel of suitable size, and start to blow gently down the tube, the while you cautiously raise the funnel. Continue to blow until a sufficiently large bubble is formed. Then disengage it from the funnel by turning the latter carefully at right angles, the finger being applied to the opening of the tube. To accomplish this feat (shown in the illustration) calls for a little practice; but the novice will generally succeed after three or four attempts.

One may vary it by blowing a bubble over a small statuette or ornament, previously preparing the same by fixing a tiny circle of paper well damped with soap solution upon its summit by means of an atom of cobbler's wax. Then, upon this platform, a little smoke-filled bubble may be blown, as shown in the photograph.

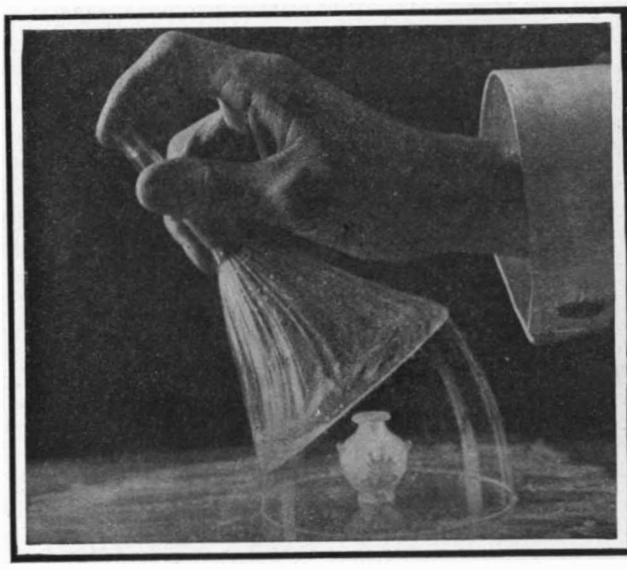
A bubble may be blown over a little pinwheel, made from paper, a small cork being used as a support. The wheel may be set in rapid motion within the bubble by a current of air blown through the ever-useful straw, the bubble increasing in size as long as the wheel is kept spinning.

The foregoing hints by no means exhaust the possibilities of the art.

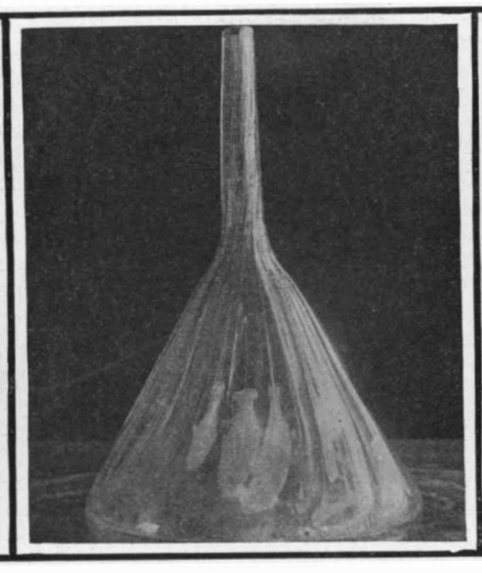
But pipes, funnels, straws—everything, in fine, that a bubble is to be blown from, or is to touch—must be thoroughly anointed. For if one tries to blow a bubble from a dry pipe or funnel, or to transfer a bubble when blown to a dry surface, that bubble will certainly burst. This fact need not be divulged at the outset to onlookers. Indeed, a vast deal of fun may be derived from the failures of novices to imitate the tricks which the accomplished blower performs with much ease.

Bubble parties have proved a great success. Their nature should be indicated upon the cards of invitation, and preparations made before the hour of meeting. A large table is necessary; and should it have a polished surface likely to be damaged by the soapy water, a mackintosh sheet should be spread. Each guest must be provided with a chair and the materials. Two or three glass funnels are sufficient and these should be carefully tested, as the rim of each must be quite true. A glass funnel enables one to get the object in the center over which the bubble is to be blown.

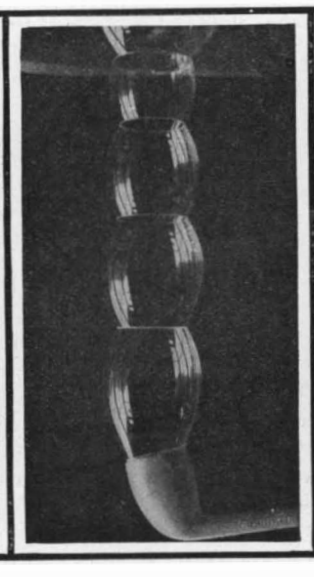
Pretty bowls and saucers, and dainty little ornaments, add greatly to the beauty of a bubble "set piece," such as some of those shown herewith. A bubble may just as readily be blown in a dainty saucer or other piece of china, by means of a funnel, as upon a flat sheet of glass, while the result will be infinitely superior.



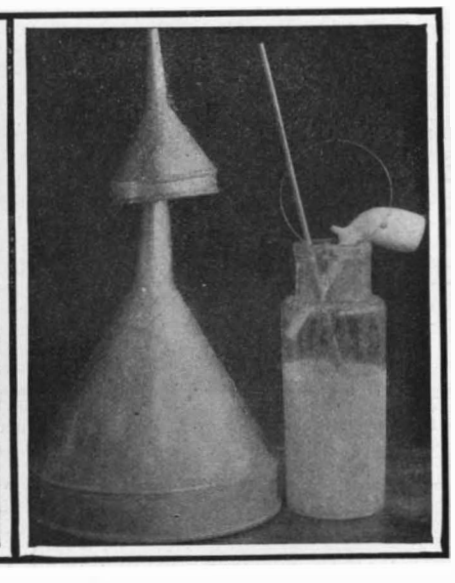
Raising funnel to complete bubble over object.



Blowing bubble over object by aid of funnel.



Blowing a chain of bubbles.



Apparatus for blowing bubbles.

TRICKS WITH SOAP BUBBLES.

The Tanbark Oak of California.

As the supply of oak in the Eastern States is being exhausted rapidly, the United States Forest Department has entered upon a careful examination of the tanbark oak of California, in which State it is estimated that there are a billion feet of tanbark oak standing and available for commercial uses. Hitherto the only use made of tanbark oak has been in tanning, the felled tree, after the bark had been stripped off, being cut into firewood. Experts believe that the wood can be used for flooring, construction, interior finish, and other purposes; and a systematic series of experiments is now being made to determine whether tanbark oak will be a satisfactory substitute for the oak lumber of the Eastern States. Tanbark oak is found from the southern part of Oregon to Monterey County, California, but reaches its maturity and highest condition in Mendocino County, California.

Why is the Sea Salt?

Sea water contains about 3½ per cent of sodium chloride and other salts. The evaporation of all the oceans would leave a mass of salt sufficient to cover the entire globe to the depth of 200 feet, and equal to the bulk, above sea level, of North and South America, or one-fourth that of the whole earth.

The theory that this enormous quantity of salt has been dissolved from continental rocks, and carried down to the sea by streams, is not tenable, because the salts found in solution in river water contain 80 per cent of carbonate of lime and only 7 per cent of chlorides, while common salt, or sodium chloride, constitutes 89 per cent of the salts of sea water. Moreover, the evaporation of inland seas which has taken place in central Asia has left saline deposits very different in composition from the salts of the ocean.

It appears, therefore, that salinity must be regarded as an original property of the ocean. Suess has advanced the theory that the salts now found in the sea have been ejected by volcanoes in early stages of the earth's formation. Even now every eruption increases the quantity of water vapor, carbonic acid, and com-

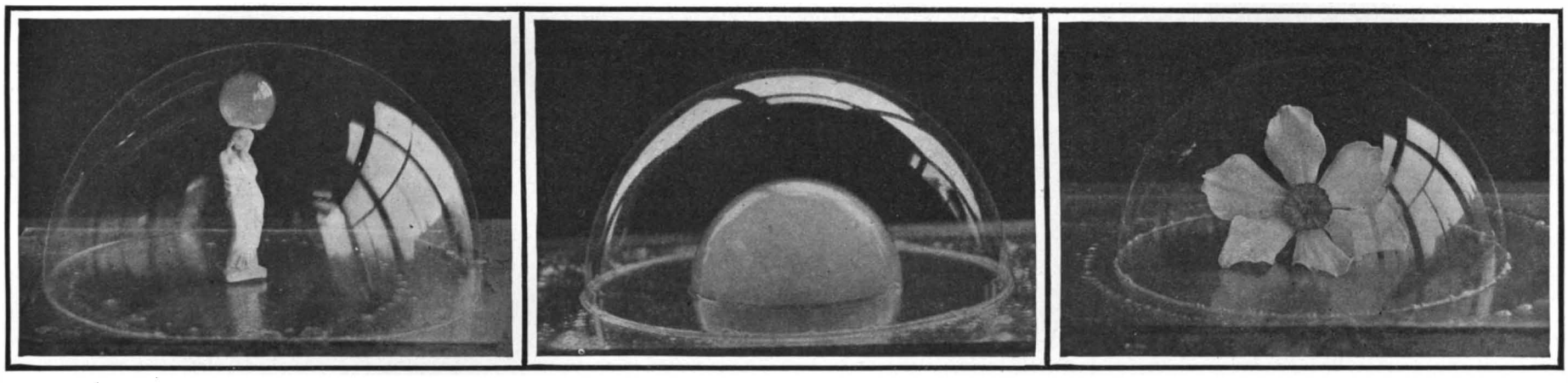
pounds of chlorine and sulphur in the atmosphere, and these substances ultimately find their way to the ocean. After every eruption of Vesuvius the crater is covered with a gleaming white layer of common salt, and the volcanoes of South America eject enormous quantities of hydrochloric acid—estimated as 30 tons daily for the volcano of Puracé, in Colombia.

This volcanic activity, now restricted to a few points of the earth's surface, must have been general in remote ages, before life appeared on the globe. The gases confined within the thin solid crust burst their bounds and found their way to the surface, bringing with them the millions of tons of chlorides which we find to-day in the oceans. Yet the transfer of these millions of tons is a relatively insignificant change, for on a terrestrial globe of a diameter equal to the average height of man (66½ inches), 1/16 inch would represent the greatest depth of the ocean, and the waters of the ocean contain only 3½ per cent of solids. —Cosmos.

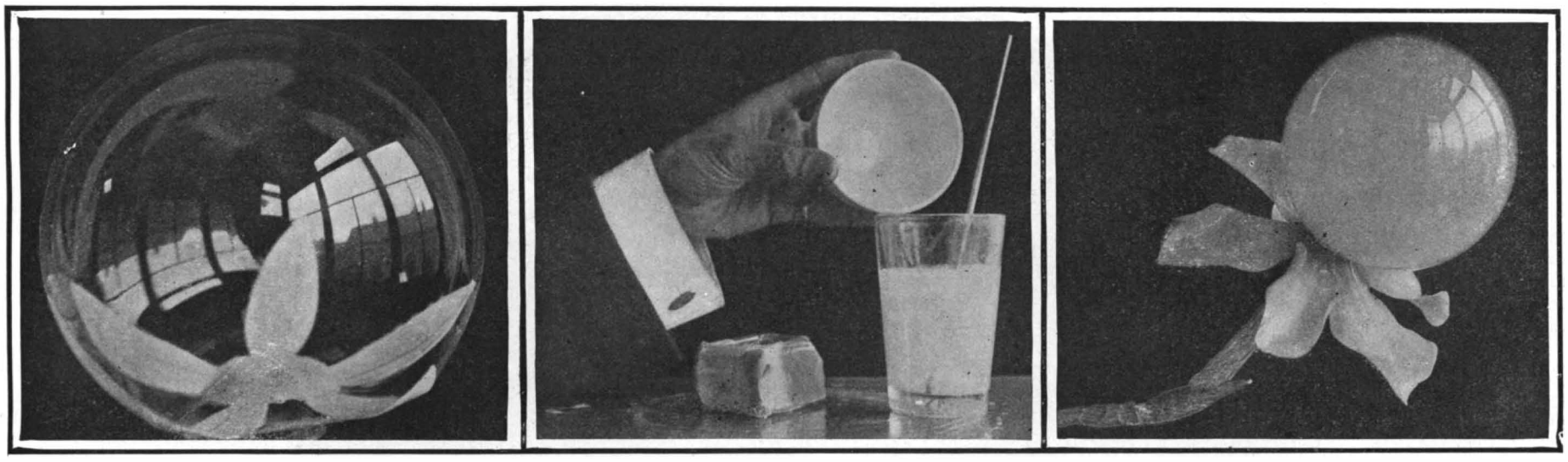
Japanese Petroleum.

The rational production of petroleum is a new thing in Japan. When the Japanese government recognized the wealth of the country in mineral oil it took the initiative in exploiting the deposits but regarded the aid of private capital as indispensable, so that to-day a large amount of American capital is invested in the Japanese petroleum industry.

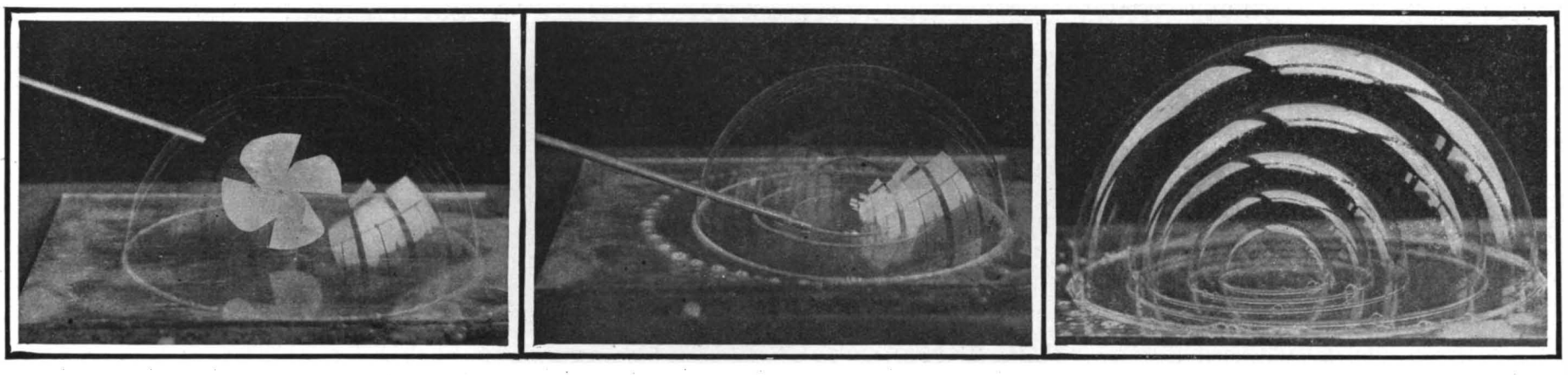
The oil is derived chiefly from the upper tertiary strata, though smaller quantities are found in diluvial and alluvial strata. The oil occurs in shale and sandstone, between impermeable strata and under pressures which cause many wells to spout with great violence. The wells now worked are from 300 to 2,000 feet deep. According to a Japanese authority the oil resembles Russian and Californian, rather than Pennsylvanian petroleum. It is composed chiefly of naphthalenes, with some hydrocarbons of the aromatic or benzol series. Of the paraffin or fatty series (C_nH_{2n+2}) it contains only 1 or 2 per cent of the higher members, or solid paraffins. It contains 0.06 to 0.83 per cent of sulphur, 0.3 to 1.8 per cent of oxygen, and 0.35 to 1.34 per cent of nitrogen. The composition of Japanese petroleum is very variable, but it is usually assumed to yield about 50 per cent of lamp and fuel oil. The heavy crude petroleum has a density of 0.922 and a very dark color. It yields about one-third per cent of crude benzine, 19 per cent of crude kerosene, 26 per cent of heavy fuel oil, and 54 per cent of lubricating oil. Under a law passed in 1905 the right to operate mines or oil wells can be acquired only by government officials, so that in future no foreigner can appear directly as an oil producer.



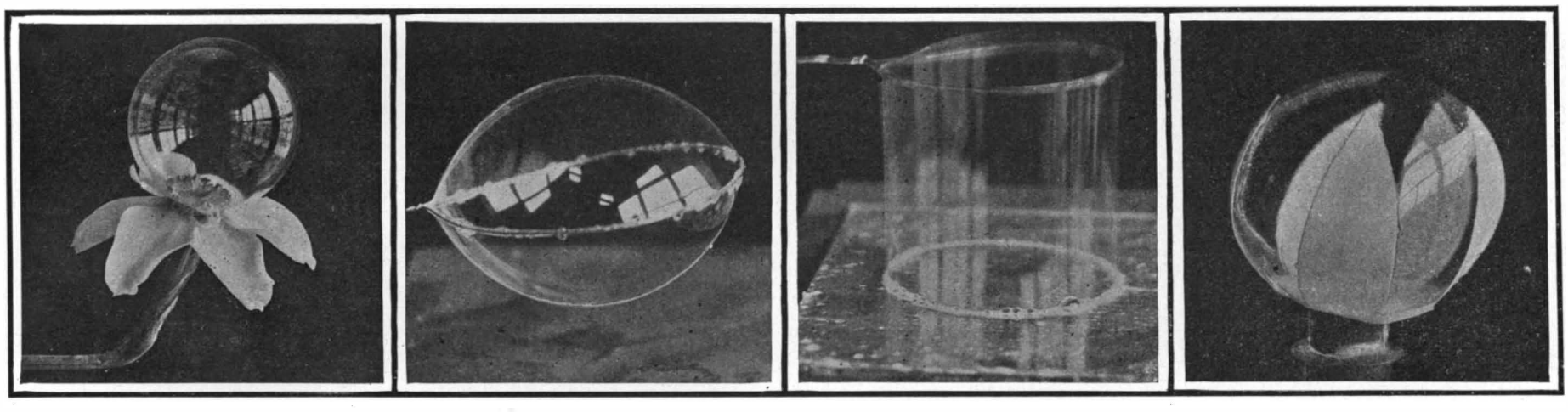
Small statuette inside a hemisphere. Smoke-inflated hemisphere inside rainbow-colored one. Flower shown after disengagement from funnel.



Bubble mounted on rays of flower. Straw kept in solution ready for bubble blowing. Smoke bubble adorning a flower.



Hemisphere blown over pinwheel. Large bubble pierced for blowing a series of smaller ones. Many hemispheres may be formed before dissolution.



Bubble adorning flower. A dozen may be added. An elliptical bubble made by aid of wire ring. Hemisphere drawn up with a ring to form cylinder. Rays of flower closing in the bubble.

TRICKS WITH SOAP BUBBLES.

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

MOST of the finer constellations lie in or near the Milky Way; for example, Orion, Canis Major, Lyra, Cygnus, and Scorpio. But there are a few exceptions, and none of these is more conspicuous than Ursa Major.

Probably no group of stars is familiar to so many people as is the Great Dipper, though this name is apparently an Americanism, as it is almost unknown in England. It is at least really descriptive. The group looks like a dipper, with a badly bent handle, to be sure, but still quite serviceable. How the Dipper forms part of the Bear our initial letter shows. The Dipper handle is the Bear's tail; its bowl is in the creature's body, while a group of smaller stars about 20 deg. to the westward marks the Bear's head, and three pairs of nearly equal stars, farther south, represent three of its four paws.

Everyone knows that the "Pointers" at the front of the Dipper bowl are almost exactly in line with the Pole star; and many are familiar with the remarkable system of Mizar, the star at the bend of the handle. It has a distant companion, Alcor, visible with the naked eye; a much closer one, which requires telescopic aid to see it; and recent spectroscopic work shows that all three of these stars are really close pairs, with periods of but a few days or weeks. The stars β and ϵ are also spectroscopic binaries of much the same sort.

It is clear that in the Dipper we have a very remarkable group of stars; and their whole story is not yet told.

Five of the seven stars, those from β to ζ inclusive, are moving together in the sky, all very nearly parallel to the line joining the first to the last. The remaining two, at the ends of the series, are moving in almost the opposite direction, both receding at almost the same rate from a point in the sky not far from Vega.

At the rate at which either of these groups of stars is apparently moving, it would take it about 150,000 years to traverse the distance between the Pointers.

Referring to the map, with these data in mind, it is not hard to figure out what the Dipper looked like 100,000 years ago, or how it will appear as long hence. In neither case does the result bear much resemblance to the present form, though the five central stars are almost unchanged in relationship.

There is little doubt that these stars are really moving together, like the more numerous group in Taurus discussed by Prof. Boss, of which we spoke a few months ago.

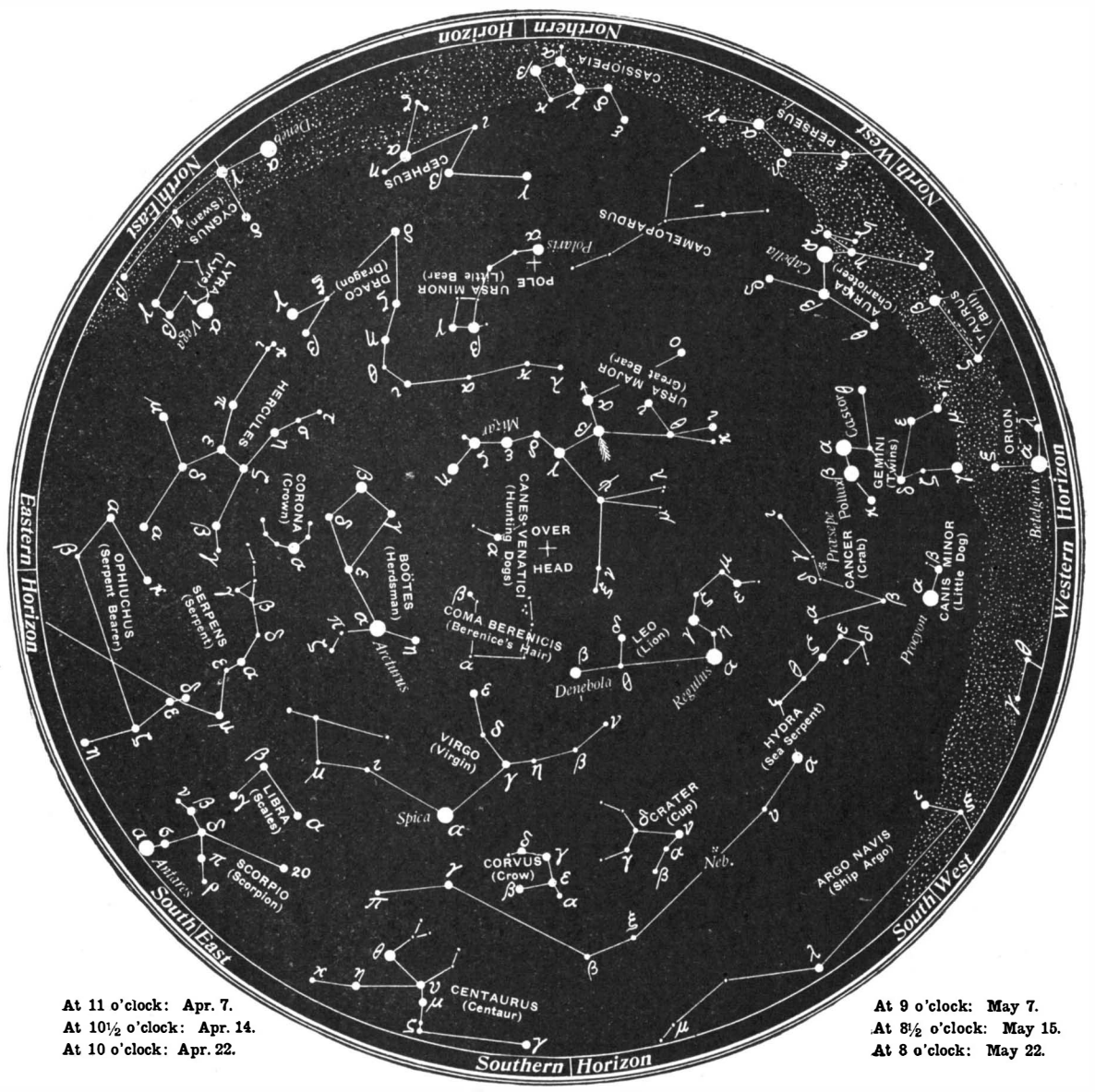
Dr. Ludendorff of Potsdam, in a very recent paper (from which many of the above data are taken) finds that these stars are all receding from a common "radiant point," which lies about half way between the stars $\varkappa$ Ursæ Majoris and Pollux. (See map.)

Since these stars are apparently opening up—getting farther apart—they must be approaching us. Spectroscopic observations show that this is really the case, the velocity of approach varying from 7 to 10 miles per second. From this rate, combined with the apparent motion of the stars in the sky, it is possible to find the distances of these stars, just as Boss did for the group in Taurus.

It appears that these five stars—or rather, seven for the two companions of Mizar belong to the group—are all at about the same distance from us—between 90 and 100 light years, or about six million times the sun's distance. The distance from one end of the group to the other is about four times the distance of Sirius from the sun, so that these stars, though evidently belonging together in some fashion, are not very near neighbors, even as the stars go.

The two other stars of the Dipper, though having no relation with the five, are not improbably connected with one another as the five are. Working on this hypothesis, Ludendorff finds that their distance is very nearly the same as that of the other group, so that all seven stars of the Dipper are really about as near one another as they seem to be. But, on account of their very different direction of motion, these two stars will in the lapse of ages separate from the five, so that they are only temporary neighbors—for a little matter of half a million years or so. All these stars are much brighter than the sun—from thirty to one hundred and twenty times as bright according to Ludendorff's data.

The most fascinating feature of such researches is the power they give us to forecast the remote future. One million years hence, the five stars of the Dipper will be nearer us than they are now, and brighter, if they keep on shining the same as ever. Two million years hence they will have begun to recede. By this time the following ones in their motion will have caught up with the leaders, so that all five will be bunched together in a small region, perhaps not larger than the present Dipper bowl. As they recede farther, they will grow fainter; and five million years hence they will, even if of the same real brightness as now, be hardly visible to unaided eyes like ours. It is almost too bold for speculation to follow them farther.



At 11 o'clock: Apr. 7.
At 10½ o'clock: Apr. 14.
At 10 o'clock: Apr. 22.

At 9 o'clock: May 7.
At 8½ o'clock: May 15.
At 8 o'clock: May 22.

At 9½ o'clock: April 30.

The other constellations need not detain us long. Below Ursa Major, in the north, are Ursa Minor and Draco, with Cassiopeia low on the horizon. In the northwest, also low, is Auriga. Orion has almost set, but Gemini hangs above his grave, and Procyon can be seen, a little farther to the left. Leo is high in the southwest. Below him, Hydra stretches its enormous length.

Due southward, almost on the horizon, the Southern Cross can be seen, but only from points as far south as Florida.

Virgo is near the meridian, well up in the sky. Scorpio is rising in the southeast.

Arcturus is high in the east. Corona and Hercules are below him on the left, in line toward Vega, which has just risen.

THE PLANETS.

Mercury is evening star all through May, and is well visible in the middle of the month—best about the 20th, when he is apparently farthest from the sun. At this time he is in Taurus, 25 deg. north of the celestial equator, and does not set till 9 P. M., so that the present elongation affords an exceptionally good opportunity to see this innermost planet of our system.

Venus is just past inferior conjunction, behind the sun, and is practically invisible all through the month, though theoretically an evening star, setting less than half an hour after sunset.

Mars is in quadrature, west of the sun, on the 13th, and at this time rises about 1 A. M., and is due south at six in the morning. He is in Aquarius, a long way from any bright star, and is the brightest object in the southeastern morning sky, though nearly three times as far away, and only one-tenth as bright, as he will be four months hence.

Jupiter is almost opposite Mars in the heavens, and is in quadrature on the 27th, at which time he is due south at 6 P. M., and sets half an hour after midnight.

Saturn is morning star in Pisces, rising about 3:15 A. M. in the middle of the month. Like Mars, he is far from any bright star, and so is easy to identify.

Uranus is in Sagittarius, and is observable in the early morning, best about 3 A. M., when he is near the meridian.

Neptune, which is in Gemini, is so low in the west at dark that he cannot be well observed.

THE MOON.

The moon is full at 7 A. M. on the 5th, in her last quarter at 5 P. M. on the 12th, new at 9 A. M. on the 19th, and in her first quarter at 8 P. M. on the 26th. She is nearest us on the 16th, and farthest away on the 28th; her distance, and therefore her apparent diameter, varying about ten per cent. She is in conjunction with Uranus on the 10th, Mars on the 12th, Saturn on the 16th, Venus on the 19th, Mercury on the 21st, Neptune on the 22d, and Jupiter on the 26th. On the evening of the 20th the young moon and Mercury will be quite close together. This will be a good time for the novice to make sure of the planet.

Princeton University Observatory.

Alloys of Manganese.

An alloy of manganese and copper, containing 30 per cent of manganese, is obtained by fusing the metals together in a graphite crucible. Alloys of manganese with zinc and with tin are made in the same manner, except that the manganese is not added until the other metals have melted. The manganese used in these processes is reduced by Goldschmidt's thermit process. It contains only 2 per cent of impurities and no iron or carbon. The addition of manganese to bronze and brass makes the alloy more homogeneous, softer and more malleable and ductile. The maximum effect is given by 6 or 7 per cent of manganese, which is added in the form of the rich alloys with copper and zinc mentioned above.

Manganese added to white metals in proportions of ¼ to ½ per cent gives them the color of silver increases their density and makes them easier to work. The grain of nickel castings is made finer and blow holes are eliminated by the addition of 2 per cent of manganese. The copper-manganese alloy containing 30 per cent of manganese and free from iron may be substituted with advantage for zinc and nickel in making aluminium alloys. From 4 to 6 per cent of pure manganese is often added to the copper crossbars of locomotive furnaces, where the presence of iron would diminish the resistance to fire.

Rapid Tanning with Formaldehyde.

Leather can be tanned very quickly with formaldehyde. A few hours' immersion in a 40 per cent solution produces a tough, well-tanned leather, which may be made more flexible by adding 5 or 6 per cent of soda to the bath. Trioxymethylene may be substituted for formaldehyde.

THE GREAT ICE JAM AT NIAGARA.

BY F. C. PERKINS.

The Niagara Falls and River, and the gorge through which the latter flows, have presented many strange and fantastic sights in the spring of the year, when the frosts of winter loosened their hold upon the waters, and the accumulated ice of the winter passed on its way down the river to Lake Ontario.

The present season has been no exception, and has indeed surpassed all previous records in the amount of ice that has accumulated below the Falls. The conditions combining to produce the present stupendous jam of ice in the Niagara Gorge were the high water in the upper river carrying large quantities of ice over the falls, and the heavy winds blowing up the Niagara Gorge and holding the ice back in the lower river. The vast quantities of ice which passed over the Falls and through the Rapids and Whirlpool became wedged against the banks and shoals at Lewiston, forming a dam which raised the level of the water 40 or 50 feet above the normal and 20 to 25 feet higher than ever before recorded, and piling the ice so high that a person standing on the ice could touch the under side of the Lewiston Bridge. The water rose so high as to enter the windows and doors of the hydro-electric power plant of the Ontario Power Company, completely shutting down the machinery for several days. The high-tension generators were partly submerged, and although the damage to the plant was not permanent, the electrical machinery was put out of commission, so that the power service on the transmission lines on the American as well as the Canadian side was for a time discontinued.

As soon as possible arrangements were made for a high-tension current supply from the other Canadian power plants above the Falls for temporarily supplying the Canadian power users; while on the American side the 10,000-horse-power gas engine power plant of the Lackawanna Steel Company was utilized for operating the Buffalo and Hamburg Electric Railway, as well as time that the Niagara River bridges would be carried away by the ice, which jammed into and far above the piers or abutments. The Great Gorge electric railway on the American side was buried 20 feet under the ice, its pole line and trolley wires wrecked, and the tracks badly damaged. The extent of the damage can hardly be estimated until the tracks are cleared and the ice passes out of the river.

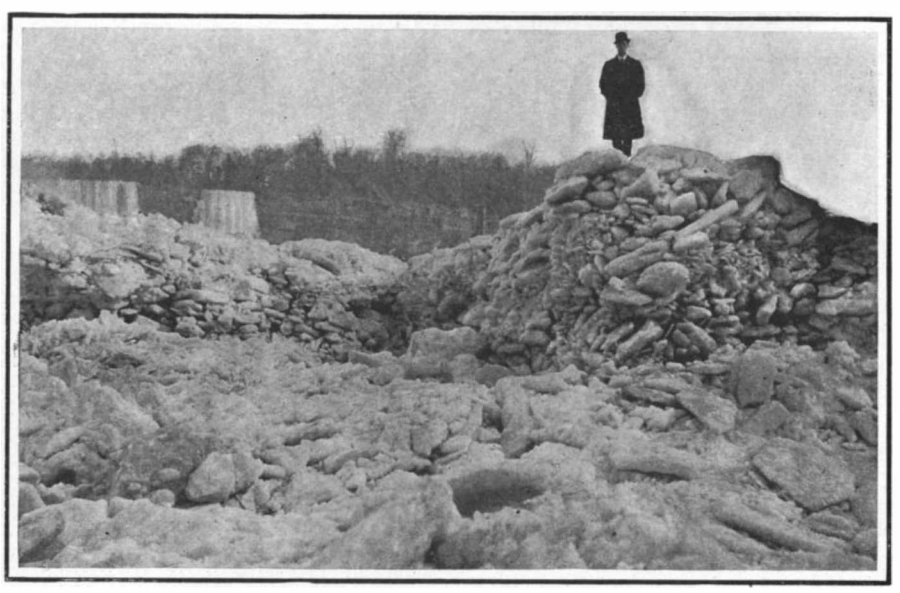
An ordinary ice bridge across the river, just below the Falls, is a wonderful attraction during those winters which are severe enough to cause the ice to form from the American side to the Canadian side. Never before, however, has it been possible to cross the river on the ice at the Rapids, as has been done during the present ice jam.

Many buildings on the banks of the river were overturned by the ice as it passed down the river; and the wreckage of the Niagara Gorge Electric Railway at the Whirlpool Rapids and the Devil's Hole not far from Lewiston was very severe. The worst damage occurred at Lewiston and Queenstown, where many buildings were destroyed, as well as the dock and electric railway tracks.

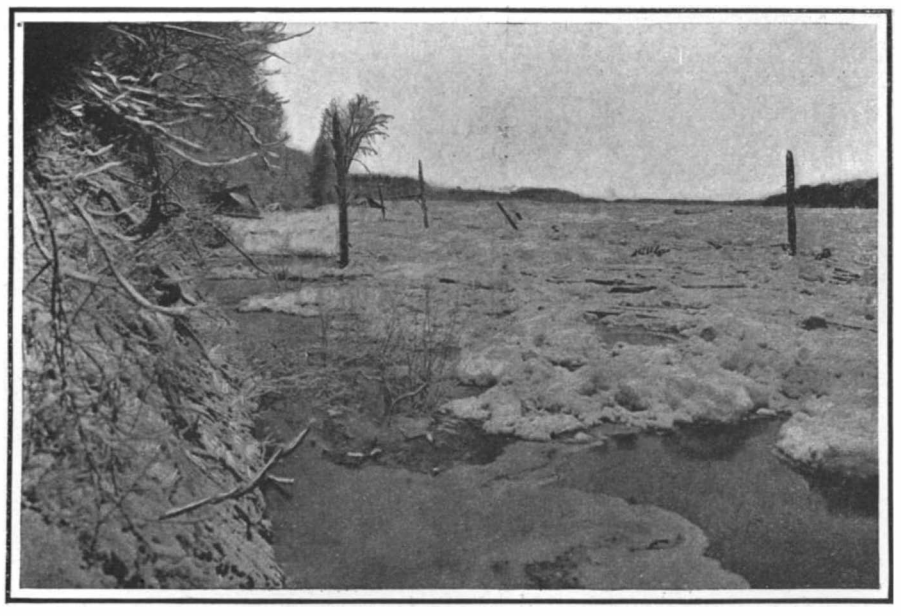
Not only were the railway lines buried under the ice and debris, but great havoc resulted along the shores of the lower Niagara River for the entire distance from the Falls to Niagara-on-the-Lake. The docks at the mouth of the river at Lake Ontario and Niagara-on-the-Lake were badly damaged, as were the fishing shacks on the river banks.

Conditions finally became so serious that Federal and State aid was requested, and after several attempts to blow up the mass at the mouth of the river with dynamite, the engineers succeeded in partially loosening the jam.

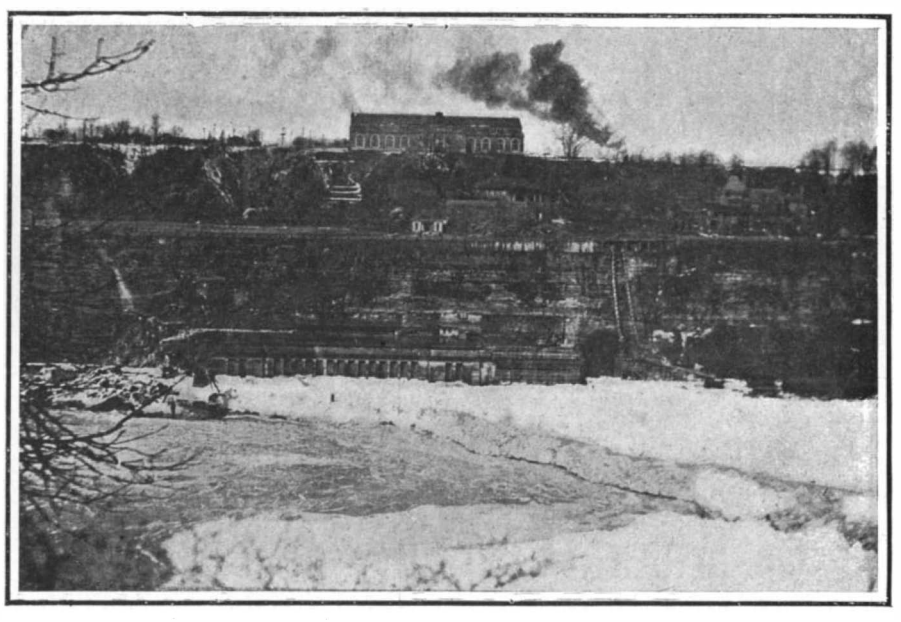
"Maid of the Mist" and dock wrecked by the ice.



Ice jam 50 feet high below the Falls.



Great Gorge railway buried 15 to 20 feet under the ice.



The ice jam at the plant of the Ontario Power Company.

THE GREAT ICE JAM AT NIAGARA.

The accompanying illustrations show the ice jam at the Falls, and the river filled with millions of tons of ice, which was piled 50 feet high on the Canadian side below the falls, wrecking the well-known electric inclined railway building.

The "Maid of the Mist" was carried high and dry, and its dock completely wrecked. It was feared for a

An Ancient Piece of Embroidery.

BY ARTHUR H. J. KEANE, M.J.I.

So far as is known, only one piece of embroidery, hailing from the old-time classic period of Grecian art, is now in existence; it is to be found in the "Eremitage" at St. Petersburg, where, so far, it has attracted very little attention, as it consisted merely of small pieces, from which it was difficult to form any idea of a complete ornamental design. These pieces were found in the Crimea near Kertsch, in the Kuban district. Although usually all textile materials molder away in the darkness and silence of the tomb, in this case the vault or tomb in which the material was found contained a quantity of saltpeter, and this caused the preservation of the material in question. As one of these pieces shows Greek inscriptions and designs in the style of vases dating from the time of Pericles, it may safely be assumed that it was brought into the Crimea by Grecian colonists.

The continental museums possess only old Egyptian and old Peruvian materials, as regards textiles dating from periods before the advent of Christ; these were also obtained, thanks to the preservative action of saltpeter and the dryness of the tombs in which they were found.

If it be remembered that so far we have had to depend upon literary descriptions, designs on vases, and faint paintings on statues, for an idea of the textile capabilities of the Greeks, the value of the present piece of genuine embroidery cannot be overestimated, as it shows us that the Greeks favored rhythmic lines, graceful spirals, and curves in pottery and metal work, and also in the textile industry. The background consists of a piece of fine claret-red material. The principal lines of the piece of embroidery, which is about five and three-quarter inches broad, are connected with the material by the chain stitch and overlap, and all the stitches show a yellowish tint. The design was graceful, artistic, and well conceived. Richly-designed woven work was first introduced from India into western lands by Alexander the Great, and the industry prospered in Alexandria to such an extent that, one hundred years after Christ, Martial wrote that Babylonian needlework (embroidery) had been conquered by the weaving shuttles on the Nile. Silk was not available to the Grecian embroiderers, so they embellished their work by means of gold dust, which was caused to adhere to the materials by means of varnish, and small gold spangles were also sewn on to bridal and other festive garments.

A novelty which has come into use in a number of British drafting-rooms is the employment of "cross-section" tracing cloth for detail drawings. The tracing cloth is ruled with vertical and horizontal lines one-eighth of an inch apart, in the same manner as ordinary cross-section sketching paper. It is claimed that the use of this kind of tracing cloth is the source of considerable saving in time, as it is easier to terminate lines at correct points and it makes it possible to draw simple details directly on the tracing cloth. —Machinery.

Legal Notices

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Inquiry No. 8965.—Wanted the address of the Dirt Mover Magazine.

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Typewriting machine, O. Woodward	918,938
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Typewriting machine, H. N. Josleyn	919,020
Typewriting machine, G. A. Seib	919,254
Types and type bars, making, F. H. Richards ..... 919,215 to 919,220, 919,223, 919,224, 919,226, 919, 230, 919,231, 919,232, 919,237,	919,241
Typographic machine, F. H. Richards	919,221
Typographic machine feed mechanism, F. H. Richards	919,225
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Valve, A. N. Rutan	918,918
Valve, P. Langer	919,036
Valve actuating mechanism for explosive engines, Winton & Anderson	919,104
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Valve closing spring, engine, R. W. Guilford	918,534
Valve for vacuum cleaning tools, self-closing, J. S. Thurman	918,930
Valve, gas cut off, O. A. Giffen	919,155
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Vault, burial, J. W. Chesrown	919,126
Vault or safe, Bowman & Damon 918,952,	918,953
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Vehicle wheel, L. W. Barnhart	918,644
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Ventilator, R. S. Coddiby	919,284
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Wagon, dumping, C. Heinley	919,011
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Washing machine, A. Gates	918,995
Washing machine gearing, W. H. Voss	918,934
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Watch, stem winding and setting, H. W. Matalene	918,759
Watchcase, C. V. Bates	919,117
Watchmaker's instrument, C. A. Braun, 918,821,	918,822
Water closet and soil pipe connection therefor, J. J. Cosgrove	919,283
Water heater, T. E. Durban	918,517
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Wave motor, D. K. Bryson	918,956
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Weather strip for metal frames and sash, Powers & Boyd	918,591
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Weed exterminator, E. E. Jackson	919,017
Weed exterminator and cultivator, A. I. Jones	918,677
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Weighing machine, automatic, F. Verplast	918,614
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Welding, clamping tool for holding and butting rail ends, beams, etc., during, Goldschmidt & Lange	918,745
Wheel attachment, current collector, L. R. Hecker	919,009
Wheel rim, vehicle, J. M. Alderfer	918,721
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Windlass, W. J. Vail	919,093
Window screen, A. E. Paddison	918,585
Window screen, metal, H. W. Johnson	918,676
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Wooden rim wheel, H. F. Ball	918,945
Woodworking machine, C. C. Chapman	918,655
Wool washing machine, F. G. & A. C. Sargent	918,771
Wrapper cutting mechanism, H. Y. Armstrong	918,813
Wrapping machine, H. Y. Armstrong. 918,641,	918,642
Wrench, W. E. Burnett	918,505
Wrench, J. C. Sparks	918,787
Wrench, E. D. Smith	919,260
Yoke, neck, B. J. Doran, et al	918,978

DESIGNS.

Bag, hand, I. J. Levy 39,937,	39,938
Bonnet, knitted, S. Burchard	39,940
Bottle, C. Boldt	39,921
Cabinet, sheet music, M. Shapiro	39,923
Cigar band, W. Weigang 39,926,	39,933
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Stove grate, vapor, C. Nelson 39,925
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Antipyretics, narcotics, and soporifics, Walker Pharmacal Co. 73,483
Beer, Piel Bros. 73,480
Bread, crackers, cakes, Middleton Baking Co. 73,451
Brooms and brushes, Amsterdam Broom Co... 73,403
Candy, Croft & Allen Co. 73,438
Canned and fresh oysters, H. F. Hemingway & Co. 73,444
Canned salmon, Teo. H. Davis & Co..73,459, 73,461
Canned salmon and catsup, Theo. H. Davis & Co. 73,460
Canned vegetables, L. M. Brackett & Co.... 73,434
Canned vegetables, fruits, berries, etc., Holbrook Grocery Co. 73,446
Caramel extract, Cam Caramel Co..... 73,435
Carpet sweepers, Bissell Carpet Sweeper Co.. 73,421
Chamotte ware, Stettiner Chamotte-Fabrik Actien-Gesellschaft Vormals Didier..... 73,485
China, French, Charles Abrenfeldt & Son... 73,422
Cigars, Chas. P. Stanley Cigar Co..... 73,423
Cigars, Theo. H. Davis & Co..... 73,425
Cigars and cigarettes, Samuel Saqui Co..... 73,429
Closet tanks and seats, Climax Sanitary Co. 73,436
Clothing, certain, Ohio Knitting Mills Co.... 73,477
Coats, vests, trousers, and overcoats, N. Morrison 73,413
Coffee, T. C. Jenkins 73,448
Coffee and spice mill machinery and coffee roasters, Jabez Burns & Sons 73,447
Coffee and tea, glazed, John Blaul's Sons Co. 73,449
Coffee, blended, Fort Smith Coffee Co..... 73,456
Cornmeal, American Hominy Co. 73,433
Cotton goods woven in colors, Amoskeag Manufacturing Co. 73,420
Cotton piece goods, Eddystone Manufacturing Co. 73,440
Dictionaries and grammars, Langenscheidtsche Verlagsbuchhandlung (Prof. G. Langenscheidt) 73,412
Disinfectant, Pearson's Antiseptic Co..... 73,478
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Feed for animals, ground, C. D. Milleson.... 73,452
Flour, wheat, Akin-Erskine Milling Co..... 73,432
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Fruits, dried, Griffin-Skelley Co..... 73,443
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Grape fruit and oranges, Terra-Cela Estates, Incorporated 73,458
Hose and machinery packing, B. F. Goodrich Co. 73,407
Hose made wholly or partly of rubber or having rubber incorporated therewith, B. F. Goodrich Co. 73,406
Hose supporters, T. P. Taylor 73,417
Ice breakers, Harrison Safety Boiler Works. 73,445
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Pills, liver, C. H. Keith 73,473
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Shoes, oxfords, and slippers, leather, F. O. Reed 73,415
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Soap holders, liquid, M. K. Mermod..... 73,450
Soda, starch, lye, bluing, etc., Western Grocer Co. 73,484
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Starch, laundry, pearl, and powdered, Corn Products Refining Co. 73,466
Starch, warp sizing, Corn Products Refining Co. 73,467
Stoves, cooking and heating, Bering-Cortes Hardware Co. 73,408, 73,409
Stoves, ranges, and furnaces, White-Warner Co. 73,431
Wagon and other vehicle dash curtains, National Curtain Co. 73,453
Whiskies, blended Scotch, Mitchell Brothers.. 73,476
Whiskey, blended bourbon and blended rye, J. Miller & Co. 73,475
Worsted piece dress goods, Jamestown Worsted Mills 73,427
Worsted, woolen, and cotton mixed piece goods, Griffon Co. 73,424

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"Billy 'Possum Puzzle," for a puzzle, J. W. Reynolds 14,775
"Blue Jay," for cigars, Schmidt & Co..... 14,762
"CO-ED." for nougat, Huyler's..... 14,766
"Colossus Socks," for socks, Taylor & Merikle 14,774
"Fairy," for a polish, Asher & Weir..... 14,770
"Heart," for chocolates, Huyler's 14,765
"Hed-Eze," for a medicine, W. J. Scherer.. 14,768
"Jacob Ruppert Sparkling Ale," for ale, J. Ruppert 14,764
"Neptune Brand Roofing," for roofing, S. H. Goldberg 14,776
"Parva," for refined cocoanut oil, S. Jacobson 14,767
"Rumatone," for medicinal capsules for the treatment of rheumatism and gout, H. C. Baer 14,769
"Sunburst," for furniture polish, J. B. Segbers 14,771
"Tairenda," for mending plaster, Peters Manufacturing Co. 14,772
"The Angelus," for cigars, Elmer E. Kirkland & Co. 14,763
"The Standard Handkerchiefs," for handkerchiefs, Robert Gair Co. 14,773

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"Acme Flour," for flour, E. V. Mendenball.. 2,463
"Fairy," for polish, Asher & Weir..... 2,467
"Golden Sheaf Flour," for flour, E. V. Mendenhall 2,462
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