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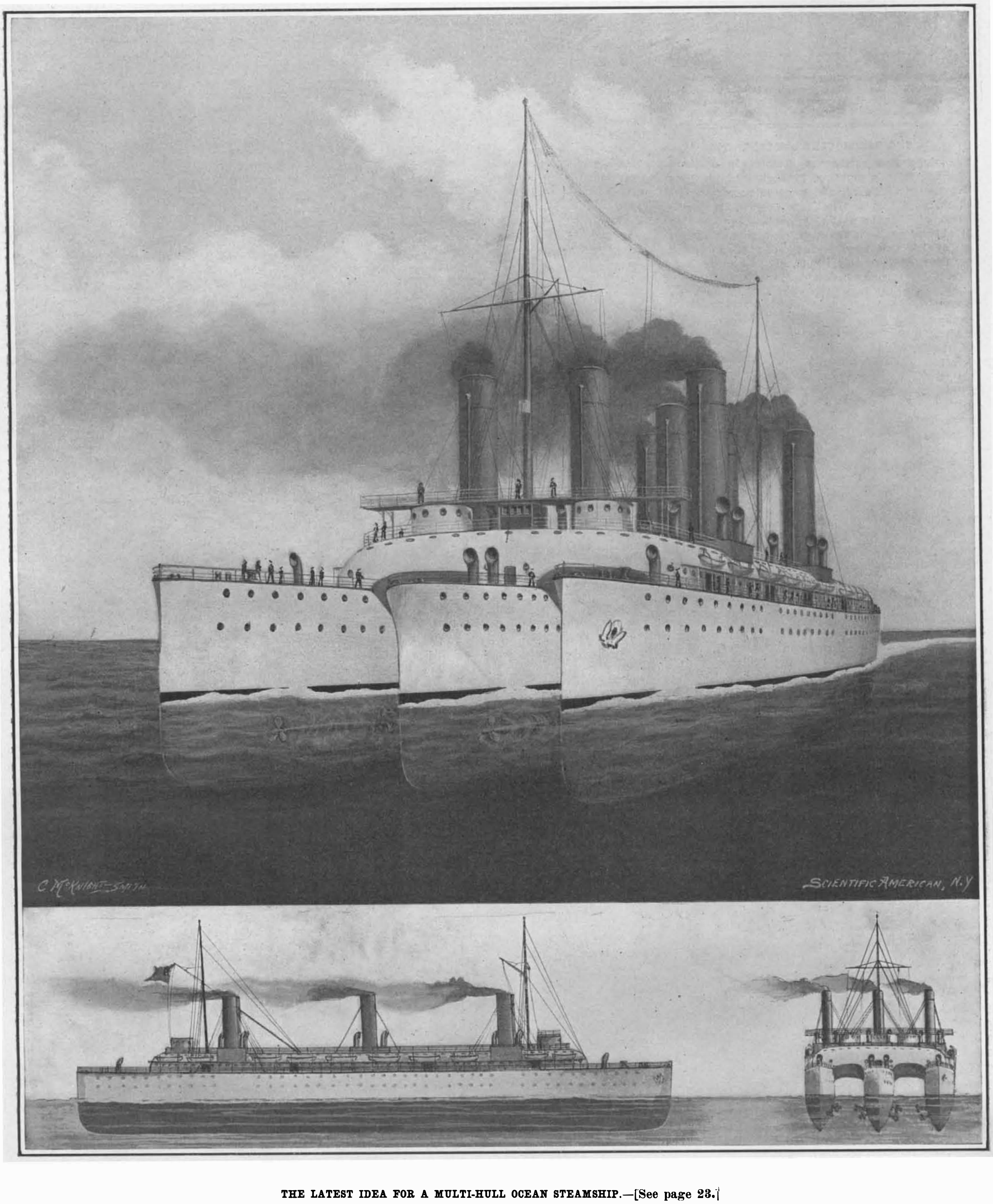

THE LATEST IDEA FOR A MULTI-HULL OCEAN STEAMSHIP.—[See page 23.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JANUARY 9, 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 EARTHQUAKE DISASTER.

The stupendous earthquake disaster in southern Italy and Sicily is probably, in respect of the lives and property destroyed, the greatest tragedy of its kind that has happened in the history of the world. So complete has been the destruction in the area affected, and so large the number of municipal and other officials that have been killed, that it will be many days, and probably weeks, before accurate statistics of the loss can be drawn up. At the present writing, it seems to be pretty certain that from 150,000 to 200,000 lives have been lost. That the larger rather than the smaller figure may be correct, is suggested by the fact that in this, unlike other disasters of the kind, the figures first published proved to be far below rather than above the actual figures. History records only two disasters of the kind in which the total number supposed to have been killed was greater than that at the Straits of Messina. Even the frightful upheaval at Krakatoa, in the year 1888, involved the death of but one-third or one-fourth of the number of people killed in the present disaster. Fifty thousand souls were lost at the great earthquake at Lisbon, to which reference is so frequently made; and we have to go back to the year 1703 to find the record of a tragedy alleged to have been equal to this. It was in that year that 200,000 people perished in the earthquake at Yeddo. The greatest loss of life which history records is supposed to have occurred when Antioch was destroyed in the year 526. The tendency to exaggeration, however, which characterizes the chronicles of early history casts some doubt upon the magnitude of the figures both for the Yeddo and the Antioch disasters; and hence we are driven to the mournful conclusion that by the time the tale of destruction is complete, the Messina horror will prove to be the greatest of which history possesses any record.

The scene of the disaster is the stretch of thickly-populated and highly-developed country bordering on the narrow Straits of Messina, which run between what is popularly known as the "toe of the boot" of southern Italy and the neighboring island of Sicily. Like the stretch of coast line in which the disastrous San Francisco earthquake occurred, this region is one that has always been subject to heavy seismic disturbance. Not far from the straits, on the island of Sicily, is Mount Ætna, and at the northern end of a string of islands that stretches to the north of the straits is Stromboli. On the western shore of the straits is, or rather was, located the prosperous city of Messina, of 200,000 inhabitants, and upon the opposite shore was the city of Reggio, with 45,000 inhabitants. Scattered along the coast line and in the contiguous country are half a dozen towns with a population of from 1,000 to 14,000 souls, to say nothing of numerous smaller towns and villages, in which the ruin appears to have been complete. At the present time it is estimated that the loss of life in Messina is 90,000, in Reggio 40,000, and that the fatalities in the other smaller towns and throughout the country will bring the total loss up to between 150,000 and 200,000.

That the loss of life should have been so enormous is due to the circumstances, first, that the earthquake occurred in the early morning when most of the population, being within doors, was caught in the wreck of the falling buildings; secondly, that the earthquake was accompanied by a huge tidal wave which swept over the ruins of the devastated city and rolled for many miles inland over the lowland portions of the country; and, thirdly, that the crippled and entombed survivors of this double disaster were caught in the series of conflagrations which broke out immediately after the earthquake.

The terrific violence of this convulsion of nature, as shown by the fact that the relief steamers which hurried to Messina and Reggio describe the shore line on both sides of the straits as being so completely disrupted as to be beyond recognition, would point to the earthquake as being due to volcanic agency—a belief which is strengthened by the fact that the disturbance occurred in a district which includes three of the best-known volcanoes, namely, Ætna, Stromboli, and Vesuvius. Compared with the magnitude and the deadly nature of these natural phenomena, our knowledge of their causes must be confessed to be very limited. By some they are believed to be due to the generation of steam caused by water finding its way, under the enormous pressures which exist at the bottom of the ocean, down to the heated portions of the earth's interior crust, where the pressures engendered are sufficient to lift the superincumbent mass, or cause those sudden rearrangements of position which manifest themselves in the complicated and terrific oscillations known to us by the name of earthquakes. Another theory, based upon the fact that the disturbances occur generally along the line of chains of mountains, ascribes the earthquake to the gradual shrinkage of the earth's crust, and the resulting tangential pressures, which have manifested themselves in the wrinkling or crumpling of the earth's surface into mountain ranges. According to this theory, there is a readjustment under pressure along certain "faults" or lines of fracture in the earth's crust, such as occurred in the recent San Francisco earthquake. Yet another theory, which has been advanced in connection with the present disaster, is that the millions of tons of matter which are continually being broken down by denudation, carried to the ocean, and deposited in the form of silt, cause, in the course of ages, a shifting of the earth's center of gravity, and that the resulting stresses, acting upon the relatively thin crust of the earth, result in sudden movements of readjustment. It must be confessed, however, that the last theory seems scarcely adequate to account for such a terrific disturbance as that at the Straits of Messina.

The indications are that the line of the main fault passed beneath the straits, and that the movement was accompanied by an extensive subsidence. This is strongly suggested by the accounts of eye-witnesses which have come to hand. They describe the phenomenon of the tidal wave as being preceded by a considerable receding of the water, which, in some cases, was so great as to leave vessels resting upon the bottom of the bay. This was succeeded by a tidal wave described as being 40 feet high, which, approaching from the straits, swept far inland. A subsidence of the bottom of the straits would have exactly this effect. The water would first recede to fill the void, and then, as the sea rushed in from either end of the straits to restore equilibrium, its momentum would naturally carry it shoreward in the manner described.

THE WRIGHT AND VOISIN (FARMAN) FLYING MACHINES COMPARED.

Prominent among the men whose names will always be associated with the first determination of the laws of flight is F. W. Lanchester, whose studies of the flight of birds, made over a quarter of a century ago, first attracted Prof. Langley's attention to the subject of mechanical flight. Hence, the paper read by Lanchester last month before the Aeronautical Society of Great Britain, in which he makes a careful comparison of the principles, properties, and relative efficiency of the aeroplanes used by the Wright brothers and that used by Farman and Delagrange, will be read with deep interest throughout the aeronautical world.

The Wright Machine.—The Wright machine, designed and built by the famous brothers of that name, weighs complete, with operator aboard, 1,100 pounds; has a total supporting surface of about 500 square feet; and its maximum velocity is 40 miles per hour. The aerofoil (sustaining surfaces) consists of two equal superposed members. The auxiliary surfaces include a double horizontal rudder and two vertical fins in front and a double vertical rudder astern, whose total area is about 150 square feet. The four-cylinder motor, weighing about 200 pounds, drives two propellers and develops 24.7 brake horse-power at 1,200 revolutions per minute.

The Voisin Machine.—The machine used by Farman, Delagrange, and others should be known by the name of MM. Voisin, who, with their engineer M. Colliex, are the designers and builders. It weighs, with operator aboard, 1,540 pounds; has 535 square feet of supporting surface in the aerofoil and tail; and its maximum velocity of flight is 45 miles per hour. Unlike the Wright machine, it is provided with a large number of vertical surfaces, for controlling flight and giving lateral stability, whose area is about 255 square feet. It is propelled by a single screw driven by an 8-cylinder, 265-pound motor, giving 49 brake horse-power at 1,100 revolutions per minute. Mr. Lanchester attributes the great difference in the weight of the machines, the Voisin being 40 per cent heavier than that of the Wrights, largely to the fact that the former is fitted with a four-wheeled chassis, as compared with the light pair of wooden runners used by their competitors.

Comparison of Horse-Power.—On the question of the great excess of horse-power of the Voisin over the Wright machine, 49.2 as against 24.7, Mr. Lanchester says that in addition to being considerably less efficient in its screw propeller—a tax paid for the constructional advantage of a direct drive—the Voisin aeroplane is also slightly less efficient, its gliding angle being not quite so good as that of the Wright machine. He considers that the explanation may be found in the fact that the gliding surfaces of the Voisin type are wider in proportion to their length; but we think he comes nearer the truth when he draws attention to the fact that the machine has relatively greater idle surface subject to skin friction. The following table gives the sum total of the resistances overcome by the pounds-thrust of the propellers, as estimated by Mr. Lanchester:

	Wright. Pounds.	Voisin. Pounds.
Skin friction	40	60
Struts and wires..............	30	20
Aeronauts, motor, etc..........	20	10
Radiator and tanks.............	5	25
Alighting gear	..	10
Sustentation (power-expended aerodynamically)	60	100
Pounds-thrust of propellers....	155	225
Efficiency of propulsion........	0.63	0.54
Gliding angle (calculated)....	7 deg.	7 deg. 40 m.

The statement of the author of the paper that Mr. Wilbur Wright has said in conversation that he makes "no allowance for skin friction, believing it to be negligible," is surprising, and we feel satisfied that, in this respect, Mr. Wright must have been either misunderstood or misquoted.

Longitudinal and Lateral Stability.—It is when we come to questions of stability that the widest differences are found between the two types of machine. Wilbur Wright has stated that, as far as the Wright machine was concerned, stability depends entirely on the skill of the aeronaut; and, if he is correctly reported, he does not believe in the possibility, under ordinary weather conditions, of safety being achieved by the inherent properties of the machine. "Sooner or later the fatal puff must come that will end a flight." Pro. Lanchester says that his own observations of the flight of the Wright machine fully confirm the above statement. Voisin, on the contrary, in designing his aeroplane intended that it should be automatically and inherently stable, and Lanchester considers that by the provision of a tail he has succeeded in this. He believes that the disposition of the parts of the Voisin machine are such as to give stability; since it complies with the following conditions: First, the pressure is less per foot on the tail than on the main aerofoil, so that the attitude of the aerodrome to its line of flight is one of stable equilibrium; second, the areas and disposition of the surfaces, the amount of inertia, the velocity of flight, and the natural gliding angle are related to comply with the equation of stability, so that any oscillation in the vertical plane of flight does not tend to an increase of amplitude. Observations of the two machines under flight indicate that the Voisin requires less manipulation of the horizontal rudder than does the Wright brothers' machine.

Any advantages that the Voisin may have over the Wright in the matter of inherent longitudinal stability, we are inclined to think, are fully compensated by the greater lateral control secured in the Wright machine; for by twisting the wings Wright has the lateral stability under direct control. This provision is employed to neutralize the influence of sudden wind gusts, and to prevent the machine from canting over too much when turning; but no special mechanism is provided on the Voisin machine to prevent excessive canting. Consequently, Farman and Delagrange, as Lanchester observes, commonly turn in a leisurely manner under an easy rudder, whereas "Wright frequently performs sensational evolutions, turning with his machine canted 30 degrees on a radius of perhaps not more than 60 or 70 yards." In view of these facts, we cannot understand how Lanchester should be of the opinion that in the Voisin machine "the lateral stability leaves little to be desired." Summing up the comparison, the author of the paper is inclined to think that "the Voisin machine has the advantage, as containing more of the features that will be embodied in the flying machine of the future." He believes that the secret of stability is contained in the one word *velocity*, and that until it is possible to obtain higher speeds of flight, we cannot hope to see the flying machine in everyday use. The Scientific American is of the opinion, however, that the machine of the future will be of the Wright type; but provided with automatic means for the control of both longitudinal and lateral stability.

ENGINEERING.

On the last day of 1908 Wilbur Wright made a continuous flight at Auvours of 76.5 miles in 2 hours 9 minutes 33 seconds, at a speed of 35.5 miles per hour. By this flight, which was made over a closed circuit, he broke all previous records, and thus won the Michelin prize of $4,000 cash and a $2,500 trophy.

In the suit of the government against the anthracite coal-carrying railroads, Prof. Ritter, a mining expert and geologist, in testifying for the government, estimated that the supply of coal underground in the Pennsylvania fields was 2,230,000,000 tons. He gave it as his opinion that this supply, great as it was, would be exhausted in about eighty-four years' time.

Plans which have been received at Portsmouth, England, for the construction of the eighth "Dreadnought" of the British navy, to be known as the "Neptune," show that she will be 3,000 tons larger than the type ship. She is credited with a battery of ten 12-inch guns, and a numerous anti-torpedo armament of 4.7-inch guns. The "Neptune" will be 510 feet long, 86 feet wide, and of 20,250 tons displacement.

The Great Western Railway, England, is famous for its express trains. During the season of American travel, there are three expresses which run daily from London to Exeter, a distance of 173 2/3 miles, without a stop, in three hours, at an average speed of just under 58 miles an hour. A fourth express makes the same run at an average speed of 56 1/3 miles an hour. It is not unusual for the total load back of the tender and expresses to reach 400 tons.

Of interest to transatlantic travelers is the announcement that the construction of a large harbor and docks near Plymouth is to be commenced as soon as government permission is obtained. The site selected is near the entrance to Plymouth Sound. An area of 1,000 acres, having a depth of from 48 to 35 feet at low water, is to be inclosed by breakwaters, and drydocks and piers will be built for the accommodation of eight or ten liners of the largest size. The scheme includes the construction of two drydocks, 1,000 and 1,100 feet in length.

The United States revenue cutter service has recently added to its fleet the new life-saving tug "Snohomish," which has been built for service in the rough seas of the Pacific coast in the vicinity of Neah Bay. She is equipped with the Miller marine breeches buoy for life saving, and her sphere of operations will be confined to such stretches of the coast line as are not provided with any life service stations on shore. She will approach ships which are stranded in positions which are beyond the reach of the shot line, or in seas so heavy that no lifeboat could live.

The urgent need for naval colliers is shown by Rear Admiral W. S. Cowles in his annual report as Chief of the Bureau of Equipment. He says: "When it was decided to send the battleship fleet on its present cruise around the world, the question of supplying it with coal was a serious problem. The few colliers possessed by the navy were utterly inadequate, and the Bureau was unable to obtain American ships at any reasonable price. . . . Had foreign complications arisen, or had a combination been effected between foreign shipowners, our fleet might have had to remain helpless in some foreign port."

A launching device for ships' boats, which showed the requisite qualities of speed and safety of operation, was recently tested in this city. Although it was built from the design of a medical man, Dr. Charles Hunt, the device meets the special requirements of this difficult problem in a thoroughly "shipshape" manner. The gear, briefly described, consists of a hand wheel and drum, geared to a longitudinal shaft beneath the boat, at the ends of which is gearing, which serves to turn the davits and swing the boat outward. One man, by operating the hand wheel, releases the boat from the chocks, turns the davits, and lowers the boat on an even keel, the three operations being performed in sequence. When the boat reaches the water, it is released from the blocks and tackle by pulling a cord attached to a special releasing device.

An early instance of the use of the Walschaert valve gear in this country is recorded in the obituary of Mr. Alexander Mitchell, as contained in one of our contemporaries, devoted to the interests of the locomotive. In the year 1864 the Lehigh Valley, in taking over the plant of a smaller road which it had absorbed, secured two locomotives, built by the Niles Locomotive Works, of Cincinnati, which were equipped with the Walschaert valve gear; and Mitchell seems to have been the only employee of the road who understood the mechanism. It is well known that the Walschaert gear is of long standing, having been extensively used for many years in Europe. Its recent adoption in this country is due chiefly to the great increase in the power of our locomotives, and the unwieldy size to which the eccentrics and gear of the old Stephenson link motion has grown.

ELECTRICITY.

When a telephone line is electrostatically charged, the telephone acts as a condenser. The winding serves as one plate of the condenser, the frame of the receiver as the dielectric, and the person who is holding the receiver to his ear as the other plate of the condenser. In order to prevent this condenser from discharging through the person, a German inventor provides a grounded metallic cover for the receiver, the capacity of which is somewhat greater than that of the body.

As it has been aptly put by W. R. Cooper before the British Institute of Electrical Engineers, cooking in the ordinary kitchen range might almost be said to be "a by-product of wasted heat." It seems odd that the coal so wastefully used in the kitchen range cannot be converted into electricity in the power station, and be transmitted to an electrical stove in the kitchen with a saving of cost to the householder. The only thing that can be said in favor of the coal range seems to be that it provides a constant supply of hot water.

A large power station is being built in Japan to furnish current for Tokyo, Yokohama, and adjacent cities and towns. The capacity of this station will be 60,000 horse-power. The power will be derived from a 600-foot head of water on the Oi River. Six generators directly coupled to vertical waterwheels will be installed. The generators will be of the three-phase, 25-cycle type. The waterwheels will develop 13,500 horse-power. The 6,600-volt transmission line will be carried on steel towers 50 feet high and spaced 450 feet apart, over a distance of 105 miles.

Bare aluminium wire may safely be used in coils without any insulation except between successive layers, owing to the existence of a film of oxide on the surface of the aluminium. The film in its natural state will resist 0.5 volt; but by exposing it to the air at a temperature about 100 deg. C. it is possible to get rid of the hydrates contained in the film, and thus increase its resistance so that it will withstand a high voltage. The insulation between the layers of the coil should be non-hydroscopic, and the coils should be covered with insulating paint to prevent moisture from entering.

The effect of electric current on concrete has recently been studied by U. James Nicholas. The conclusions at which he arrived, as recently published in the Engineering News, are as follows: 1. That electrolytic corrosion of structural and reinforcing steel, imbedded in concrete, takes place at the anode. 2. That even neat cement is no protection against this corrosion. 3. That the cathode is not affected by oxidation. 4. That cement and concrete in brine will crack when carrying an electric current to or from imbedded steel and cannot, therefore, under these conditions, be regarded as an insulator in any sense. 5. That the concrete undergoes electrolytic, and not metallic conduction. 6. That as small a current as 0.1 ampere continuously flowing will accomplish the results indicated above. 7. That the resistance of concrete is an inverse function of the percentage of sand.

The use of windmills to develop electric power is receiving considerable attention abroad. Prof. La Cour, working under the auspices of the Danish government, is the pioneer in this work. He finds that the best windmill for the purpose is one which has four wings, arranged at right angles to each other, and with adjustable sheets having an inclination of from 10 to 35 degrees. A storage battery is used in connection with the dynamo driven by the windmill, and between the battery and the dynamo is an automatic device, which prevents discharge of a battery through the dynamo when the speed of the windmill falls. W. O. Horsnail, in England, uses a dynamo provided with a few turns of series windings in a direction opposite to that of the shunt winding, so as to retard the rise of potential under sudden spurts of speed due to puffs of wind.

A danger to which many hydro-electric plants are subject is described in the current issue of the General Electric Review. A power house in Gaffney, S. C., was flooded with water, which completely submerged two 125-kilowatt exciters, and largely covered the generators and transformers. As soon as the water subsided, the bearings of the generators were cleaned and the machines were started. After the water had been fanned from the coils the armatures of the generators were short-circuited, and the fields were excited with low voltage from the exciters, so as to raise the temperature of the coils and thoroughly dry them. With the exciters some difficulty was experienced, and it was found necessary to disconnect the shunt winding and short-circuit the armature through the compound winding. By regulating the speed of the machine, the temperature of the field coils was controlled. The transformer coils were dried by short-circuiting the secondaries, and permitting a sufficient current to flow through the primaries to give the proper temperature.

SCIENCE.

News comes from Pasadena that the great 100-inch glass for the Mount Wilson Solar Observatory is defective. After the first grinding began, a large flaw was found, so that a new casting will have to be made. This will delay for many months the construction of the great eight-foot reflecting mirror on the peak. The casting of the great glass disk was done in Goblain, France, and the cost was $50,000.

By a German patented process, starch is made insoluble in hot water by treating it, in the cold, with formaldehyde and a moderately strong acid. The product is distinguished from that obtained from starch and formaldehyde at a high temperature by the fact that the starch grains remain unaltered and quite permanent. It is not only insoluble in boiling water, but it is not attacked by soda lye or other strong alkalies. It may be employed as a filler in plastic compositions, as a dressing for fabrics and in the manufacture of paper.

By Neufeld's process (patented in Germany) solid and compact objects are built up of successive thin layers of chrome-gelatine, each layer being exposed to light before the next layer is applied. Each layer is coated with a reflecting substance and the next layer is then attached to it with the aid of chrome-gelatine solution. In this way the entire mass is thoroughly exposed to the action of light, so that it is uniformly strong and elastic throughout. When a large mass of chrome-gelatine is cast in one piece the light cannot penetrate sufficiently to harden the mass uniformly.

The ancient Tyrian purple was obtained from mollusks of the genera Murex and Purpura. The art of dyeing with this color was completely lost in the Middle Ages and the subject was not investigated until the eighteenth century. It has been proved that the color is produced by the action of light on a colorless secretion of special glands possessed by the mollusks. It is probable that the action of the enzyme also contributes to the result. Chemical investigations have indicated the presence of indigo blue in the dye. Friedlander has made a new study of the famous dye and concludes that it is closely related to indigo but is not identical with either indigo blue or thio-indigo. Only qualitative tests could be made, because only a small quantity of the color could be obtained—2 1/3 grains from 750 mollusks!

The name Neanderthaloid has been used to denote an extremely ancient race of men, of which remains were first found in 1856 in the Neander valley (Germany). Since then an entire skeleton of an adult woman of the same type was found in Dordogne (France) in 1905, and only a few months ago, near the same place, Mr. O. Hauser unearthed the skeleton of a youth showing the typical characters of the race—strongly developed supraorbital ridges, powerful maxilla, large teeth, etc. The wisdom teeth were still in their alveoli. The lower jaw was prognathous to an extent almost calling to mind the muzzle of an animal. The canine teeth were not very highly developed, as in anthropoid apes. The bones of the limbs were entirely in accord with the type known to us in paleolithic man, the femur massive and stubby, the radius curved. Near the human remains were found those of *Bos primigenius:* The attitude in which the body was placed seemed to indicate that it had been placed there for burial. This is of special interest, as it has hitherto been somewhat generally held that primitive man did not bury the dead, and that this was an indication of his entire lack of all religion.

The excavations which were undertaken in the island of Delos by the French Archæological School of Athens under the direction of M. Homolle and pursued by M. Holleaux, uncovered a portion of alluvial ground. The alluvium had been deposited in the northern part of the island by the Inopos, an ancient torrent, now reduced to a rivulet. At the quaternary epoch and at the beginning of historic times the stream brought down sand which contains fragments of pottery coming from historic epochs. While the archæologists were making excavations here, Homolle sank some shafts on his own account and found a molar tooth of a fossil elephant. Prof. Boule, of the Paris Natural History Museum, considers that it is a tooth of the *Elephas antiquus.* The discovery of a tooth of this species is for the present the only point which we possess as to the last phases of the history of the Ægean continent. The smallness of the island, which measures at most 3 miles in length and often less than 0.16 mile in width, proves that a mammal of the size of the *Elephas antiquus* could not live upon such a limited space. Consequently, the island of Delos, that is, the central part of the Cyclades, must have been still connected with the continent at that epoch. The separation of the Ægean continent into islands thus appears as a relatively recent event in the history of the eastern Mediterranean region, a deduction borne out by the observation of the volcanic phenomena of the region.

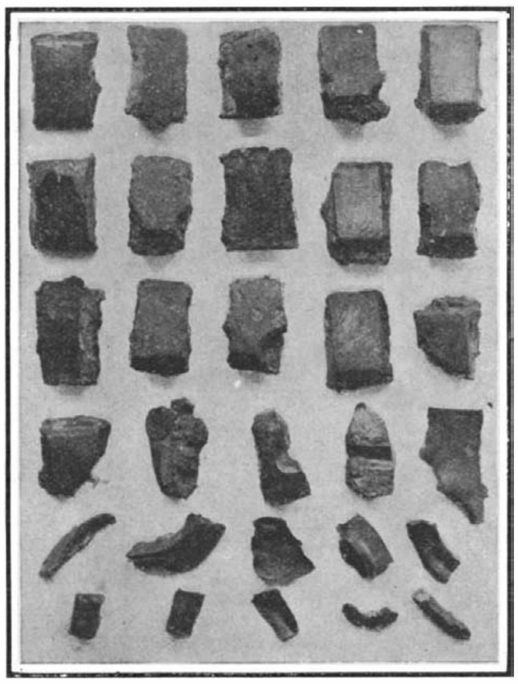
A NEW RIFLE-PROPELLED GRENADE.

Some interesting tests and experiments have been carried out in England with a new type of rifle grenade that has been recently invented by Mr. F. Marten Hale. This new missile was suggested to the inventor by the success that attended the use of hand-thrown grenades by the Japanese outside Port Arthur and in Manchuria for trench storming. In order to render such an arm of even greater utility and efficiency, he embarked upon a series of experiments toward the projection of the missile by means of the ordinary rifle. The scheme is similar to that embodied in Lieut.-Com. Davis's torpedo, recently described in these columns. It is possible by such weapon to discharge a shell from a protected position several hundred feet from the assaulted point, without any attendant exposure.

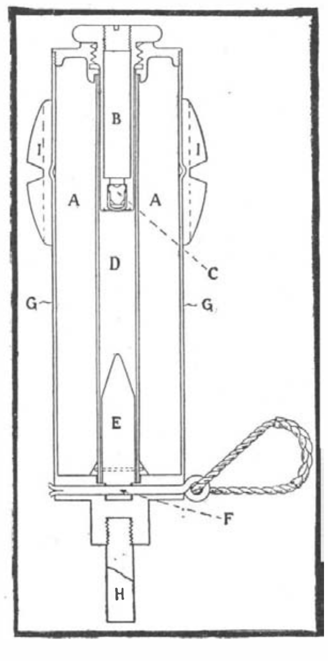
Mr. Hale has succeeded in evolving a design of such character that no injury whatever is inflicted upon the rifle, or its use interfered with when bayoneted.

The accompanying illustrations will convey an idea of this new arm in use. In general appearance it resembles the ordinary pyrotechnic rocket with the head and tailpiece. The head or body is about 5 1/3 inches in length by approximately 1⅝ inches in diameter, made of stout brass tube. Into the bottom of the tube is screwed the tailpiece, which is about 9 inches long and which slides into the barrel of the rifle. The total weight of the grenade is approximately 22 ounces.

The central space of the casing *G* is hollow, and carries a tube *D*. Into the upper end of this tube is inserted the detonator *B*, secured in position by a milled head-nut. To the lower end of the detonator is attached the cap and anvil *C*, by means of which it is fired. The detonator itself is carried apart from the grenade in transport for safety, so that inadvertent explosion is impossible. The lower part of the hollow tube *D* carries the brass striker *E*, which, though sliding within the tube, is held in its position and prevented from creeping toward the detonator *B* during flight by the copper shearing wire shown. When the head of the grenade strikes the target this striker is released under the force of the impact, falls on the cap of the anvil *C*, and fires the detonator and the explosive charge *A*, carried in the annular space between the central hollow tube and the outer casing *G*. Passing through the base of the striker *E* is a copper safety pin with a cord loop attached. After the grenade has been fixed in the rifle barrel ready for discharge, the soldier gives the cord loop a pull, thus drawing out the safety pin, so that the striker is held in position by the copper shearing wire, as already described. The steel rod *H* fits closely in the barrel of the rifle, and also acts as tailpiece and balance to the grenade during its flight; moreover, it plays an important part in its propulsion. Around the external surface of the grenade casing, near the head, the steel shrapnel ring or weight *I*, serrated into 24 parts, is carried, which when the charge explodes, bursts into fragments flying in all directions. The explosive used is "tonite," equal to No. 1 dynamite. It embodies most of the high-explosive properties of compressed guncotton with the advantage that it can be exploded by an ordinary detonator without the use of dry primers. The explosive charge of the grenade weighs about 4 ounces.



FRAGMENTATION OF GRENADE AFTER EXPLOSION.



SECTION THROUGH THE RIFLE-PROPELLED GRENADE.

A GRENADE WHICH IS HURLED BY A RIFLE AND EXPLODED AT THE TARGET.

With the elevation of the rifle at an angle of 30 degrees and using the British government blank cordite cartridge, the grenade can be thrown 450 feet. When a cartridge having a cordite charge of 45 grains instead of the regulation weight of 31.5 grains was used, the grenade was thrown 900 feet. The augmentation of the powder charge by approximately 50 per cent was found to inflict no ill effects upon the rifle, and ball cartridge could subsequently be used therewith with perfect success.

In carrying out experiments with the weapon, a hillock or mound was selected about 40 feet square and 10 feet in height, affording just such cover as that which an attacking party would use in a strategical forward movement upon a position. From the rear of this ridge a number of grenades were fired over the hillock, the range being such that they fell on low ground under the shelter of the opposite side of the ridge. The grenades fell and exploded with terrible effect, a large hole being torn in the ground where each grenade had struck the earth and exploded, while the fragments of the serrated weight ring were found scattered in all directions over a wide area.

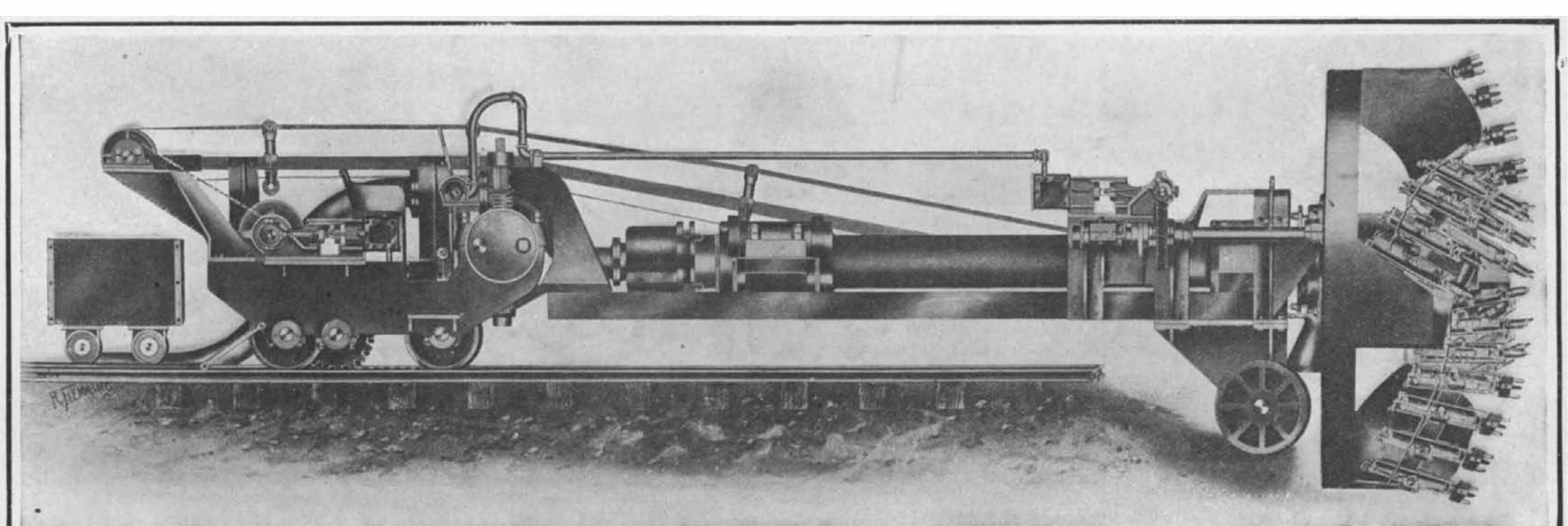
For the purpose of demonstrating the havoc that would be wrought in this manner, a number of screens of brown paper measuring 6 feet in height by 8 feet in length were erected in the vicinity of the spot where the missiles fell. These were either blown down by the force of the concussion or torn to shreds and riddled by the flying fragments. In another test a pit was prepared, 6½ feet deep by 8 feet long and 3½ feet wide. It was lined with 12 inches of concrete covered by 1-inch planking. The top of the pit was closed with nine heavy timber balks measuring 4½ feet long by 10 inches wide and 5 inches thick. A grenade was then dropped into this pit by suitable means. The resultant explosion hurled the top timber balks bodily into the air for several feet, and threw them on one side. Subsequent examination of the walls of the pit showed them to have been easily penetrated and the concrete backing extensively damaged and pitted. Altogether, 19 out of the 24 fragments of the ring encircling the grenade were recovered, the average weight of each of which was 9 grammes, while other pieces numbering 31 in all were picked up from behind the planking which they had pierced, the total weight of the fragments secured being 157 grammes, the largest piece of which weighed 10.3 grammes and the smallest 0.22 gramme. The extent of the fragmentation together with the ease with which the 1-inch planking had been pierced, even by small pieces only weighing 0.22 gramme, combined with the violence with which the timber balks covering the pit were thrown into the air, testifies to the death-dealing potency of this new invention.

Though so widely and terribly destructive in itself, the grenade is perfectly harmless unless detonated. In the course of an action, should a grenade be pierced by a bullet, the result would be quite negative. Convincing proof of this was shown by firing ball point blank at the grenade. The bullet simply pierced the casing and smashed the explosive charge, not the slightest detonation or explosion of the charge resulting.

A TUNNEL-BORING MACHINE.

The accompanying illustration shows a machine which has been designed to bore a rock tunnel by chipping away the face of the rock with a number of pneumatic chisel-headed hammers, the hammers being so placed on the machine that when the holding mechanism upon which they are mounted is rotated, every part of the opposing face of the rock is covered by the chisel. The design is the joint work of Mr. E. F. Terry of the Terry & Tench Company, in this city, and Mr. O. S. Proctor, of Denver. The whole machine is mounted upon a two-wheel truck at the front and a four-wheel main truck at the rear, the rear truck running on a 22-inch gage track laid along the center line of the tunnel. Centrally between the track rails is a duplex rack rail, which is engaged by a spur gear mounted on the truck, by which the whole machine is carried forward against the work. The front truck is provided with conical wheels suited to running on the invert portion of the circular tunnel as excavated by the machine. The main frame consists of a 20-inch I-beam laid on its side, at the rear end of which is

(*Continued on page* 22.)



A TUNNEL-BORING MACHINE WHICH CAN DRIVE AN 8-FOOT TUNNEL IN ROCK WITHOUT BLASTING.

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH.

BY HERBERT T. WADE.

Physicians are now forced in large part to look to various scientific institutions and laboratories, where medical research can be carried on most effectively, for new methods of curing and preventing disease. In Europe there are a number of such institutions, but in the United States the Rockefeller Institute for Medical Research in New York city stands as the most important example of the few organizations of this kind which private munificence has made possible. It is a home for medical research of the most special character, and differs from other American medical laboratories in that it is independent of any medical faculty or general hospital, so that from beginning to end there is nothing to interfere with purely scientific investigation.

Provided with an adequate endowment, the Rockefeller Institute is housed in a commodious building on a bluff overlooking the East River. There is in course of erection a small hospital, where the staff may apply and test under careful observation such new methods or discoveries as have proved worthy of a thorough trial on human beings afflicted with diseases not yielding to present modes of treatment. Such a hospital promises to be of the greatest value to the medical profession, for the treatment will be entirely at first hand. With the highest medical and nursing skill used in caring for patients suffering from such specific diseases as are accepted for treatment, there will be the most intimate knowledge of the remedial agents employed. In this way the establishment will be made more effective than existing hospitals for the successful demonstration of any new form of treatment, though otherwise its methods will be the same.

General laboratory for physiological and pathological chemistry.

The Rockefeller Institute for Medical Research.

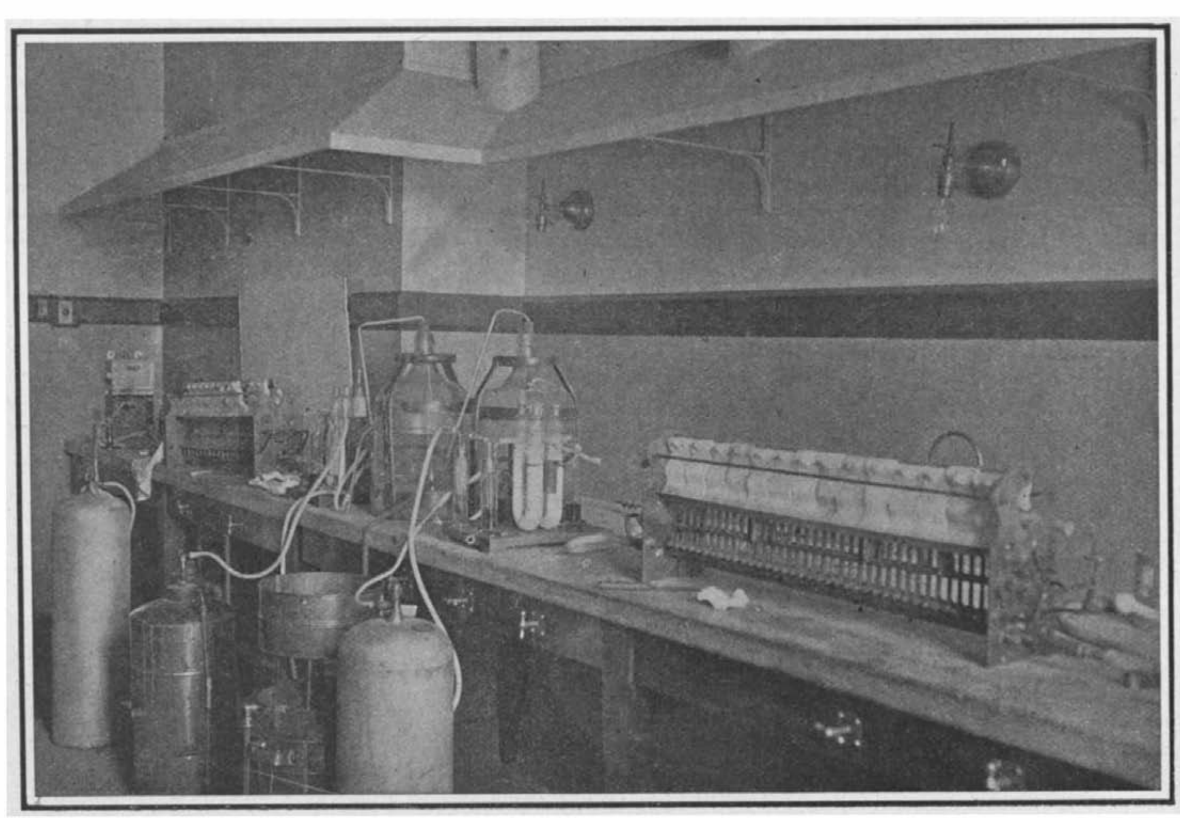
The laboratory building shown above overlooks the East River. The new hospital of the Institute is now being erected to the right of the laboratory.

There are diseases that confessedly are not understood by physicians, and will not yield readily to any treatment, and therefore must continue indefinitely or terminate fatally. On such diseases the inventive and investigating genius of many scientific medical men in every part of the world is centered. When any new method of treatment is discovered, haste is made to test it in numerous hospitals, not only with the object of saving the lives of afflicted patients and curing the disease, but to prove the efficiency of the treatment or remedy for future and broader application. The attending physician or surgeon usually is more than willing to apply any new treatment suggested by workers in European or American laboratories and hospitals. It is evident, however, that a method can be much more successfully developed and tested by the close co-operation of the investigator and the physician in charge, who may be one and the same individual.

The Rockefeller Institute stands for the development of experimental medicine, so that new and original studies and researches can be prosecuted, and their results tested on a systematic and effective basis through careful experimentation on animals, and finally by application to human patients. In medicine, as in other branches of modern science, discoveries and improved methods are not the result of a sudden inspiration, but of systematic and patient experimentation and research, in which negative results are only too frequent.

As it is as impossible as unjustifiable to test on a human patient any treatment or remedy until its effect on animals is understood thoroughly, animal experimentation necessarily form a large part of all progressive medical research. The animals used are supplied essentially with the same organs as human beings, the functions of which in many cases are identical, and can be studied thoroughly in health and disease. Especially is this advantageous in the case of diseases which are communicable to animals, for then their progress and cures can be studied directly in the laboratory. The animal under such conditions receives the best of food and care; for it is necessary that there be no complications of any kind to obscure the effects of a treatment that may involve the administration of some drug, inoculation, antitoxin obtained from another animal, or surgical treatment requiring the removal of an organ or some portion of it, or possibly the substitution or transplanting of bone, nerve, blood vessel, or tissue. From the animal is learned in the first place the normal action of the various organs, their precise functions, and their connection and interdependence, or in short what is termed physiology. Therefore a constant and ever more special study of the nature of the healthy organism is an important part of the work of the Rockefeller Institute, and the results of such investigations are of inestimable value to students and teachers of physiology as well as to the intelligent practitioner.

But it is naturally to morbid or diseased conditions that active medical attention is directed, and in this field of pathology there is an almost infinite range of conditions, to whose study the methods of physiology



Combustion apparatus in special combustion room of the chemical department.

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH.

and biological chemistry and microscopy are applied. By the use of colored stains micro-organisms can be rendered visible under the microscope. Many forms of bacteria not otherwise to be observed will respond to different dyes with different effects. By various culture processes the bacteria themselves can be propagated for further study and experiment. After the bacterium of a disease is discovered and isolated, it can be propagated as desired, often in an attenuated form, so that a culture can be prepared and used for inoculation in order to render a person or an animal immune from the disease. Or from the blood of an animal thus inoculated a serum can be obtained, containing antitoxin or substances capable of neutralizing the toxins or poisonous substances produced in the blood by the bacteria. In this way the important science of serum therapy has developed. The antitoxin thus produced for diphtheria, for example, has greatly diminished the mortality from a disease once dreaded. A serum treatment for cerebro-spinal meningitis developed at the Rockefeller Institute promises likewise to be of the greatest usefulness in the cure of that malady.

The starting points in these researches are specimens from diseased patients. A culture of the bacteria is made, and then by inoculation the disease is communicated to some animal such as a mouse, guinea pig, or rabbit. The disease is then studied, it being possible of course to kill the animal at any stage and subject it to post-mortem examination and study, so that the exact progress of the disease may be learned and material obtained for further culture. A horse may be inoculated, and from its blood a serum rich in antitoxin obtained. The serum thus obtained is then tried on diseased animals. If a number of experiments are consistently successful through their entire range, the serum may be tried with human beings. Not every animal is suitable for every investigation. While certain are immune to some diseases, to others they will respond readily, so that an extensive number and variety must be maintained by the Institute. While under observation the animals receive as watchful care as human patients, and their weight, temperature, and other indications of their symptoms are duly observed and recorded.

Without taking up a specific investigation, it is of course impossible to refer in detail to methods or technique. From a large number of researches covering a wide field, it is somewhat difficult to select those whose importance would appear at once to the non-medical person. One of the earliest efforts of the Institute made in co-operation with the New York city Board of Health and various infant hospitals was a report on the results of milk feeding, in which the most wholesome condition of milk, and especially its freedom from injurious organisms, was determined. In fact, this was an important part of a general study which has put the New York Board of Health in a position thoroughly to safeguard the milk supply of the city, and the medical profession at large to understand most fully the proper condition of milk used in infant feeding, so that the infant mortality of the city is diminishing in a most gratifying manner. Another early study of the Institute dealt with dysentery and the conditions under which the disease is spread. Again, there has been the serum for meningitis, with which encouraging results already have been obtained, and the progress made on the study of the growth of cancer, a disease which has baffled efforts for its cure and relief.

An important work in biological chemistry has been undertaken with reference to the essential composition of albumen as a foundation for our knowledge of the physical basis of life. The production of spinal anæsthesia by magnesium sulphate injections has received practical application at the hands of surgeons for certain classes of operations, and has also been used to mitigate the spasms of lockjaw, and of contributing to the recovery of the patient. More recently, success has attended experiments dealing with the transplanting of various organs in different animals, which already has suggested the possibility of its wide human application.

For carrying on the work of the Institute, an efficient organization under the direction of Dr. Simon Flexner, formerly professor of pathology in the University of Pennsylvania, has been assembled. There are specially organized departments of pathology, bacteriology, physiological and pathological chemistry, physiology, pharmacology, comparative zoology, and experimental therapeutics each in charge of responsible heads aided by a number of assistants.

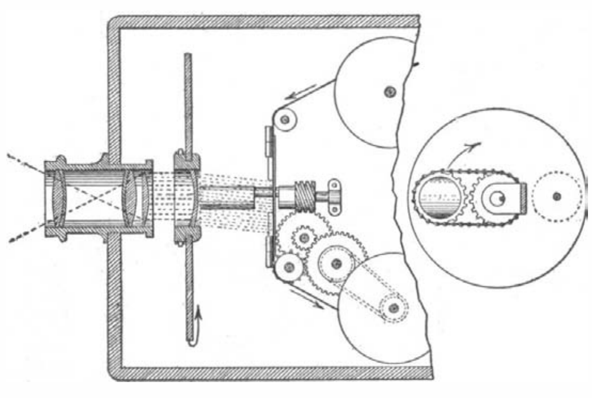
Taken all in all, the Rockefeller Institute, with its thorough organization and equipment, is a striking illustration of what an adequate endowment judiciously administered can accomplish for scientific research and the benefit of man.

Scientific investigation to-day must be productive of results which a discriminating but utilitarian public can appreciate. From medical laboratories have come such means for combating such diseases as diphtheria, cholera, yellow fever, and bubonic plague, to mention but a few whose consequences have been most appalling, so that it is not unreasonable to look for a career of constantly increasing usefulness for the Rockefeller Institute, whose work has been inaugurated so auspiciously.

A NOVEL CAMERA FOR MAKING MOVING PICTURES.

Numerous cameras have been invented for producing photographs of objects in motion upon an intermittent moving sensitized film, but none so far, we believe, have come into public notice wherein the film has a continuous movement from one spool to another behind a lens. The camera in the accompanying illustration has this latter feature, which renders it much more easy to operate and more simple in construction than is usual, and the basis of the exposure of the image on the moving film in an optical manner is quite novel and interesting. A single crank on one side of the box operates through suitable gears and belting the lower winding spool, which in turn draws the sensitized film from the upper roll over a guide roll downward through a feed tube in a constant continuous movement, while another gear meshing in a spiral spur rotates a longitudinal shaft, on the extreme left end of which is supported a revolving exposure disk.

On the flat side of this disk near its periphery is a transparent circular window, the axis of which coincides with the axis of the camera lens, the latter being rigidly secured to the front wall of the camera, and also is in line with the moving film behind. Within the circular aperture of the disk is a rotatable ring having sprocket teeth on the portion of its circumference extending laterally beyond the flat surface of the disk. Within this rotatable ring is secured a concavo-convex or negative cylindrical lens termed a refractor. At the rear of the camera lens combination is fixed a plano-convex or positive lens. Referring to the small illustration on the right, it will be noticed a stationary sprocket is fixed to the shaft bearing. A sprocket chain connects



A SHUTTERLESS MOVING PICTURE CAMERA.

this sprocket with the movable ring sprocket on the rotating disk. The effect of this arrangement is to keep the transverse horizontal axis of the cylindrical lens in a horizontal position as the disk revolves. In the larger illustration the course of the rays of light from the object through the lens is shown. From the camera lens they are directed in a parallel direction by the single plano-convex lens and upon impinging on the movable cylindrical lens in the disk, while its direction is upward, are refracted downward with the same rapidity that the constantly moving film moves also downward, thereby impressing the image upon the film perfectly sharp and clear and always in register and line. The arrows show the lens in the disk moving upward while the film passes downward. At the same time by means of an eccentric pin on the main shaft a reciprocating frame adjacent to and in front of the film moves downward with the refractor rays as they strike the film and makes a distinct division line between each picture. Another device is provided at the top of the camera for indicating the number of feet of film that are used. The inventor, Mr. Joseph Bianchi, of Toronto, Canada, in explaining the operations of the camera, stated that he was able to secure good motion effects with eight impressions to the second on the moving film in place of sixteen, as usually required on cameras of the intermittent character. Positive strips made from the negative films are passed through any usual moving picture lantern with the stop interval between the pictures, and are more steady with less lateral displacement than is generally noticeable in films of the ordinary type. The camera is also very light to carry and is convenient to operate. It is a distinct advance in avoiding the usual delicate intermittent mechanism of cameras of this type.

The Current Supplement.

Prof. Reginald A. Fessenden opens the current SUPPLEMENT, No. 1723, with a brief history of wireless telegraphy. Each year there are millions of cords of wood wasted in the forest and on the farm. F. B. Veitch explains how this waste wood may be practically utilized by destructive distillation, and by recovering the turpentine and other products with which it is charged. Sir William Ramsay places himself on record as having observed a phenomenon that indicates how radium's decay may be stopped. Dugald Clerk, the well-known authority on gas engines, discusses the problems of the motor car. The Brusio-Campocologna hydro-electric power plant is one of the largest and most up-to-date electric power generating and transmission systems of the world, a pressure of 50,000 volts being utilized to send the current to its destination. This electric installation is described by F. C. Perkins, and its chief features are illustrated. L. Delaunay contributes an article on "Matter and Ether," which explains the meaning of the terms. Dr. C. W. Michaelis writes on hardening hydraulic cements.

A TUNNEL-BORING MACHINE.

(*Concluded from page 20.*)

attached a yoke casting mounted adjustably on the rear truck. By means of two screws, one horizontal and the other vertical, this yoke is moved vertically or laterally, for the purpose of varying the adjustment of the frame in any direction of alignment or gradient. Above the frame, mounted in bearings at the front and rear ends of the I-beam, is a hollow, longitudinal driving shaft, which carries at its forward end the large circular head in which the drills are mounted. This drill head consists of a central hub, a casing, four connecting arms, and four bars to which the pneumatic hammers are fastened. The hammers are seated in a plane parallel to the axis. Upon three of the bars six hammers are mounted, and upon the fourth seven hammers, and they are so composed that as the head rotates, they cut along different overlapping circles and cover the face of the excavation. Steel plates fixed between the four groups of hammers are arranged to form pockets to catch and carry away the fragments of the rock as they are broken from the face of the wall. They discharge into a hopper at the rear of the rotating head, from which they are carried away by a conveyer leading to the rear end of the machine.

Air is led to the drills through the hollow driving shaft. At its rear end the shaft rotates in a stuffing box fitted in an air chamber carried on the rear truck of the machine.

The head is rotated by a compressed-air engine, carried on the forward part of the frame, the motion being communicated by a worm-wheel drive, which rotates a longitudinal shaft provided at its front end with a pinion. The pinion engages a gear, which is bolted to the rear case of the rotating head. The forward motion of the machine is secured by an air engine on the rear truck which, by means of a friction wheel and gear train, turns the feed gear, before mentioned as meshing with the rack laid between the rails on which the machine travels.

The machine which we illustrate is designed with a drill head 8 feet in diameter. If a full-sized tunnel of say 15 or 20 feet diameter were being driven to rock, the method adopted would be to drive an 8-foot heading with the boring machine, and then break down the rock, until the full sections were secured, by the usual process of drilling and blasting.

As to the capacity of the machine and the cost of operation, the designers estimate that it will be capable of removing 5,000 cubic feet of rock per day, and that $300 per day will be sufficient to meet all the expenses incident to the operation of an 8-foot machine. While testing the cutting elements in the shops, one of them cut a strip across the face of a granite rock 4 inches wide, 4 feet 4 inches long, and 1 inch deep, in one minute. This is equivalent to driving an 8-foot tunnel 72 linear feet in 20 hours, by the use of twenty-five of the pneumatic cutting hammers, which is the number mounted in the machine which we illustrate.

A rock tunneling machine has been the dream of many inventors for a long time, and many and various have been the mechanisms devised. When it is considered that the ordinary compressed-air drill, which represents a survival of the fittest in rock-drilling methods, at least as regards endurance, requires 5 to 10 horse-power and an average of six changes of the drill bit in cutting a hole six feet long of an average diameter of two inches, not to mention rapid wear and frequent breakage in the machine itself, and that in many kinds of rock one such hole per hour is considered good work, the nature of the problem of building a machine to cut away roughly a thousand times as much rock nearly half as fast (which is what the manufacturers claim for their machine) will be appreciated.

Taking into consideration the time lost in adjusting an air drill for each hole drilled and in making a new "set up" of column, tripod, or stretcher bar for every few holes, all of which the tunneling machine will eliminate, the work done by this machine will be something like two hundred times that of an ordinary air drill; and if it will really "stand up" in practice and do that work with about one-tenth of the proportionate power of the air drill and no greater delay due to wear and breakage, the economies effected will be obviously immense, and the achievement is indeed a great one.

Correspondence.

Manly Drive for Heavy Gun Mounts.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of December 12, 1908, page 429, is a description of a hydraulic drive applied to automobiles. On reading the article it occurred to me that the same principle might advantageously be applied to the mechanism used in traversing heavy seacoast guns and in retracting guns or disappearing carriages from the firing position, when for any reason they have not been fired and returned to the loading position by their own recoil.

JOHN W. C. ABBOTT,
Capt. Coast Artillery Corps, U. S. A.
Fort Barry, Cal., December 23, 1908.

GOOD ROADS AND THE PRICE OF FOOD.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 19 there is an article on "The Political Economy of Good Roads," in which there are several statements which it seems to me, from my viewpoint as a farmer, are misleading.

There is no doubt that country roads are not as good as they might be, and that life in the country would be pleasanter if roads were always good. But it is also true that country roads are reasonably good most of the year; and where the residents of any locality want good roads, they may have very good traveling on dirt roads by proper grading, using the King road smoother to preserve the grade and the wide-tired wagon to prevent rut making.

But the point I wish to make is that the condition of the country road affects mostly the farmer or producer, and only to a very slight extent the consumer.

The price the farmer gets for his product is for it delivered at the railroad, and he gets no more nor less, whether he trots in on a good road or wades through mud.

The cost of the lamb chop, the breakfast roll, or the egg is immensely more affected by the speculator in food products than by the country roads.

The visible supply and the probable demand fix the price both to the producer (at the railway station) and to the consumer.

If, by having good roads the farmer could haul larger loads in less time, he would gain by having more time for other work and save wear on teams and wagons, but the price to the consumer would remain the same, because the price the farmer gets is f. o. b. at the railroad.

It may cost 25 cents a ton per mile to haul produce on country roads when the farmer hires someone to do his hauling, and this multiplied by all the tons hauled may give the frightful sum of $305,000,000 as the cost of getting the produce of the country to the railroad; but as most of the heavy hauling is done at a time of the year when the farmer is not rushed with work, and has horses that would otherwise be idle, he does not feel the burden; and as 50 bushels of wheat or corn and 100 bushels of oats are considered a fair load for two horses, it does not seem that roads are so very bad as the statisticians make out.

The good road is coming, but for many years yet it will have to be made out of plain dirt, and the only benefit the city consumer will get out of it will be the pleasure of riding on it when he comes to visit his country cousins.

ARTHUR PICKFORD.
Nora Springs, Ia.

A NOVEL FILTRATION PLANT.

To the Editor of the SCIENTIFIC AMERICAN:

The problem of supplying pure water to municipalities is receiving so much attention at present, that the idea of a Buffalo man for building a filtration plant is perhaps of sufficient interest to you to warrant its publication in the SCIENTIFIC AMERICAN.

To describe briefly, the plant consists of a cement platform or table built on the bed of the body of water from which the supply is drawn. The table, which is perforated to allow the water to flow through, is of varying thickness according to the weight of the filtering material, which is distributed over its surface, and may be any combination of sand or gravel or other material suitable to local requirements, such as the chemical properties of the water to be filtered or the amount of water to be filtered through a given surface in a given time. This table is supported at intervals by cement columns or legs resting on the bed of the lake or stream.

The sides and ends of the table are separated from the surrounding water by a curtain of the same material as the table, built at an incline, the lower end resting on the bed of the stream, and the upper end on the edge of the table.

After passing through the filter bed, the water is collected in a piping system underneath, and pumped to the consumer.

To supplement the sand and gravel filter, mineral wool may be used if desired in the perforations in the platform, and also in the receivers of the piping system.

This plan is particularly commendable on account of its cheapness, as the item of maintenance is practically nothing, and it can be built on the bed of the supplying body of water, even low enough to prevent its interference with navigation.

If there is a current flowing over the bed, it will be cleansed of sediment by the passing water, and will require no attention except at very rare intervals.

OTTO F. ALARIE.
Tonawanda, N. Y., December 22, 1908.

CLEANING STONE.

To the Editor of the SCIENTIFIC AMERICAN:

The writer hesitates about making the following communication, owing to the simplicity of the process; but the results have been so surprisingly satisfactory, that perhaps your readers may be interested in and benefited by some further description.

The writer had often noticed that the tombstone of a parent at the cemetery, that had been exposed to the weather for some twenty-four years, had become considerably blackened, and had been tempted to have some cleaning done on it, but had seen the comparative futility of such attempts, and let the matter go from time to time.

A short time ago, while at the cemetery on some other business, he happened to have some pieces of sand or flint paper in his pocket, and it occurred to him to try the effect of its application on the stone in question. The effect was so encouraging that he returned later with more sandpaper of various sizes, and working on the flat surfaces with a bold sweep, and on the sunken lettered matter with a piece of the paper wound over the end of a stick, using first a medium coarse grade, and finishing with finer grades, Nos. 0 and 00, he in the course of two hours had transformed the stone into a condition closely resembling its original appearance, and comparing very favorably with one standing beside it, that had been erected within the past three years; the effect was very remarkable, and the work went on with great rapidity.

A cemetery employee who had been observing the process said: "I have been here twenty years, and have seen women come here with scrubbing brushes and various cleaning compounds and sand soaps; have seen professional marble cleaners at work here for days, with blocks of stone and sand and water, and have seen chemical processes, but I have never seen a better result than you have produced in two hours, and that usually in as many days, with sand and a stone and water." He seemed to think that there was some mystery about the flint paper, and wanted to examine it.

There was no mystery; the facts are as follows: Besides the growth of a black fungus, there is a microscopic pitting of the surface of the stone, little granules of marble standing up, and surrounded around their base by dirt of various sorts. The only way to remedy things is to remove a film from the marble and establish a new surface, and this the flint paper does, rapidly and satisfactorily, and at the same time leaves it with a finished surface. It is in fact, in a way, similar in its action to the sand blast, so much used nowadays in the cleaning of marble fronts, only in a smaller and inexpensive way; and in fact might replace the sand blast on smooth marble work for many purposes.

It is a decided success. Ten cents' worth of sandpaper and a little muscle (mixed with a little brains) will transform a tombstone or small monument into the appearance of having been recently erected.

CLAUDE L. WOOLLEY.
Baltimore, December 17, 1908.

International Tuberculosis Exhibit.

An attendance of 350,000 in three weeks at the International Tuberculosis Exhibition is the record-breaking figure reached by the International Tuberculosis Exhibit of the Charity Organization Society.

When, in October, 1908, the Committee on Tuberculosis urged the New York Board of Aldermen to make a $13,000 appropriation toward bringing the Tuberculosis Exhibit from Washington, and maintaining it for six weeks in New York, their hopes led them to name 100,000 visitors as a possibility. With three weeks still to count up, an attendance of a half million is practically assured.

The exhibition itself has been quite fully described, both at Washington and New York. The advertising campaign in New York, drawing into co-operation the most varied and heterogeneous elements of the city's population and progress, has resulted in a definite manifestation of a "people aroused." Tuberculosis can be diminished or stamped out only in proportion as great masses of people rise to fight it, both by guarding themselves against it and by preventing its spread in their families and among their friends. Therefore the city is stimulated to real hope by such a record-breaking attendance.

For the first time in the history of the campaign against consumption, social workers and physicians feel that there is evidence that consumption can be cured, because the masses are arising to learn about tuberculosis.

When the exhibit closes in New York, January 15, it is to be taken almost in its entirety to Philadelphia, where great preparations are being made to house it and to display it properly.

A MULTI-HULL OCEAN STEAMSHIP.

Although the idea of building steam-propelled vessels with multiple hulls is an old one, it does not seem to lose attractiveness to the inventor as the years go by. The illustrations on the front page of this issue show one of the latest proposals of this character. Our artist has made his drawing from the plans contained in a pamphlet entitled "The Ocean Express of the Future," in which the author asserts that in getting out the plans for modern ocean ships our designers are "on the wrong tack for high speed." The prototype of the modern multiple-hull vessel is, of course, the well-known catamaran, in which two long and narrow hulls, or buoyant bodies, are held in a position parallel to, but distant from, one another by a light platform, or even, in the simpler forms, by two transverse poles or spars; the object of the arrangement in this case being to secure stability for carrying a relatively large amount of sail. The most ambitious attempt to produce a successful vessel of this type on a large scale was made nearly half a century ago by Bessemer, the author of the Bessemer steel process. The ship was built with two hulls connected by heavy transverse bracing, and she was driven by paddle wheels running in the channel-way between the hulls. The "Bessemer" was designed for the Channel passage from Dover to Calais. The principal object aimed at was to secure a vessel of sufficiently wide beam to eliminate the heavy rolling, which is one of the chief discomforts of the Channel passage. Incidentally it may be mentioned that the vessel was provided with a large central passenger saloon, swinging upon trunnions, whose axis was parallel with the ship. Manually operated hydraulic plungers were provided for controlling the swinging of the saloon and maintaining it always in the level position. The "Bessemer," however, was found to be impracticable and was ultimately withdrawn from service.

Returning, however, to the triple-hull ship shown in our engraving, it is evident from the prospectus before us that the designer is of the opinion that the principal defect of the present type of single-hull ship is that it presents too great a head resistance to the sea, and that there is a considerable loss of power, due to "eddy-making at the stern." These defects are attributed to the concentrating of the whole of the energy of the engines upon propellers placed at the stern of the ship. He would overcome these defects by dividing his displacement between three hulls which, in the present case, are each 25 feet wide, 500 feet long, and separated by two water channels each 25 feet in width, making the total beam of the vessel 125 feet for a total length of 500 feet. The propellers would be "carried by torpedo-shaped protuberances, which project from the sides of the hulls into the water channel between the hulls. These propeller carriers are arranged in line from stem to stern, and are parallel with the sides of the hull."

The designer of this vessel is of the opinion that if the displacement of, say, a 30,000-ton ship, instead of being contained in a single hull of wide beam, were divided between three hulls of narrow beam, they would cut through the water with a minimum of resistance due to their finer form; and so the objections referred to above would be overcome.

Unfortunately for the success of this proposition, the promoters seem to have lost sight entirely of the important question of skin friction, which results in towing tank experiments and in full-sized ships of finely-modeled form have shown to account for fully one-half of the total resistance. Now, resistance due to skin friction depends, among other things, upon the total area of the immersed surface; and since the triple-hull vessel must, because of its narrow beam, draw at least as much water to secure the same displacement as the single-hull ship, the immersed area will be represented by the six immersed sides of the three hulls instead of the two sides and flat bottom of the single hull of ordinary design. It is safe to say that the resistance due to skin friction would, in the triple-hull vessel, be at least 100 per cent greater than that of a ship of equal displacement of the ordinary type. To this also must be added the increased skin friction and eddy-making due to the series of "torpedo-shaped protuberances" projecting from the sides of the hulls for carrying the many propellers.

It is from the structural point of view, however, that the impracticable character of the proposed ship becomes most evident. Anyone who has crossed the Atlantic Ocean on a large high-speed liner and watched the starting of rivets and springing of plates and beams, when she is being driven hard into a head sea, will understand that it would be a structural impossibility to tie three separate hulls together with sufficient rigidity, except by loading the structure down with a mass of stiffening transverse girders, etc., which would be so heavy as to sink the vessel pretty nearly to her load line, and leave but little of the ship's total displacement for engines, boilers, coal and accommodations. It is easy to imagine what would happen when a 30-foot sea, running diagonally, began to lift the bow which is nearest in the picture, before it exerted its lifting effect upon the other two hulls. The transverse racking strains on the connecting platform at its point of attachment to the hulls would be such, that we question if any system of riveted connections could withstand it. Moreover, in running at high speed into a head sea, the long and narrow hulls would bury in green water up to the superstructure, whose broad, flat surfaces would be subjected to a bombardment that would ultimately start all the riveting, besides flooding the whole after part of the structure with solid masses of water.

The present form of single-hull vessel of the type of the "Lusitania," "Kaiser Wilhelm," and the "Adriatic" is not, as the prospectus before us would have us believe, the outcome of a slow-moving conservatism; it is rather the product of seventy-five years' experience gained in all kinds of weather throughout the Seven Seas.

Death of Andrew Burgess.

On December 18 last, Andrew Burgess died at the age of seventy-one. He was well known as an inventor of firearms of the magazine and automatic type.

THE KRUPP STEEL WORKS OF TO-DAY.

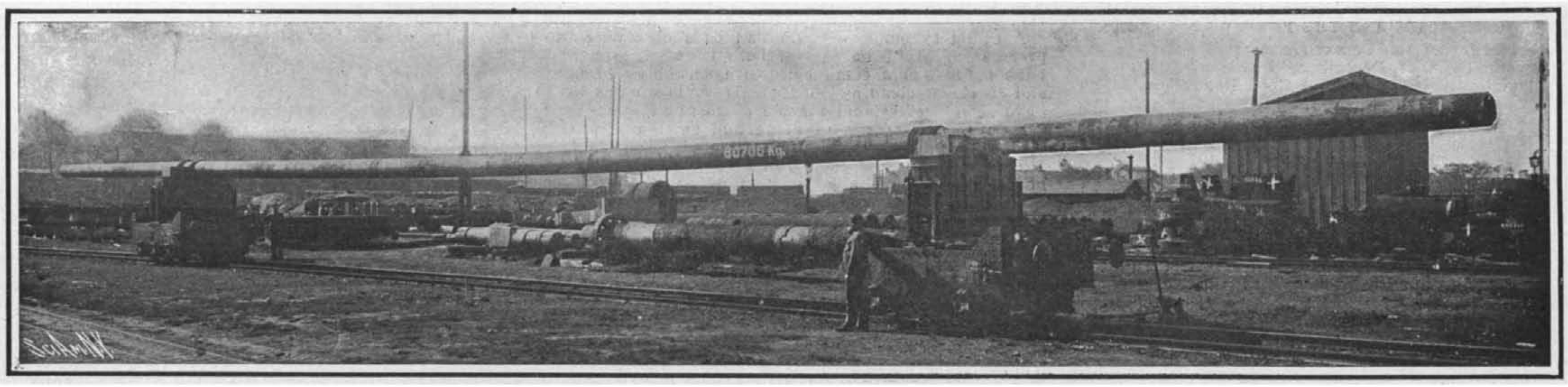
Among the great industrial establishments of the present day, the Krupp Works are undoubtedly the largest and most important, as may be judged from the fact that at the beginning of the present year, in the Essen Works, and in the other large concerns which are identified with the name of Krupp and operated under a common control, there were employed, counting officials and workmen, 65,000 men; while 35,000 men were employed in the Essen Works alone.

The town of Essen lies within a few miles of the Rhine in fertile undulating country, and surrounded by the most important coal mines in Germany. Conspicuous among the buildings of the town is a stately modern building, the Town Hall, which by its imposing size and elaborate architecture affords the first suggestion that the city which it graces has a population of nearly 100,000 souls. In the square before the Town Hall is a noble bronze monument, representing a man clad in a simple citizen's coat, whose right hand rests on an anvil, and whose penetrating eyes are overhung by the heavy brow of a thinker. The inscription records that the monument has been raised to Alfred Krupp, a man who within the time of half a generation raised a small and comparatively unknown country town to a position of importance and celebrity. It is impossible within the limits of such an article as this to give any adequate description of the marvelous establishment which was built up by the genius and industry of this one man; and we must be content to offer the following summary of the vast properties associated with the name of Krupp, which has been furnished by one of the officials of the company.

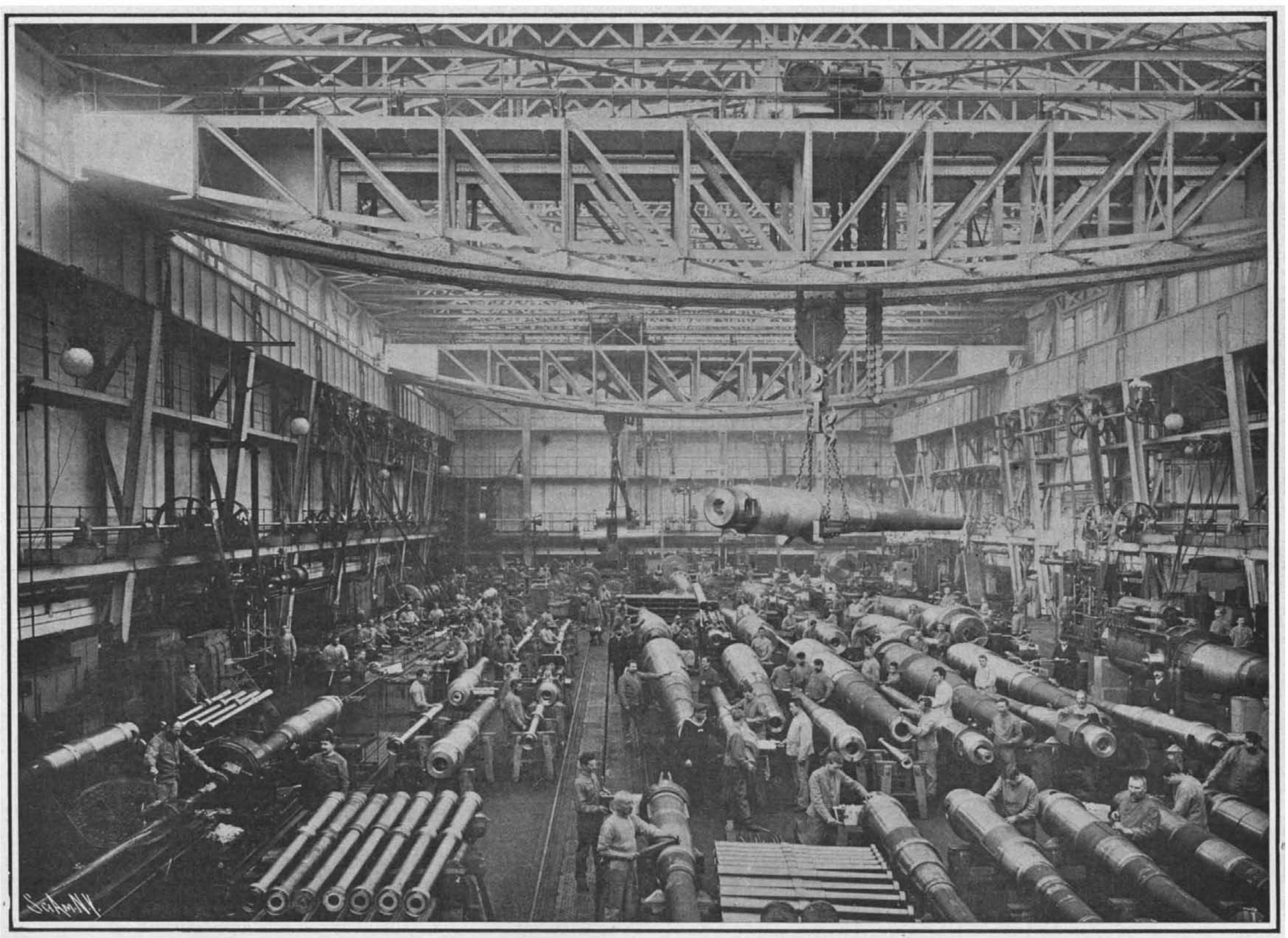
After the death of the late sole proprietor, Friedrich Alfred Krupp, who died November 22, 1902, the Krupp Works passed, undivided, into the possession of his eldest daughter Bertha; and in accordance with the last wishes of Krupp they were then, beginning from the 1st of July, 1903, formed into a joint stock company, the shares of which have entirely remained in the possession of Miss Krupp. On October 15, 1906, the heir to the Krupp property was married to Herr Krupp von Bohlen und Holboch, who has since joined the council of trustees as its vice-president. The company is controlled by a board of managing directors, comprising eleven members, ten of whom reside at Essen, and one at Magdeburg, the latter at the same time presiding over the board of directors of the Grusonwerk at Magdeburg-Buckau. That the works have continued to increase in spite of the severe loss sustained by the death of their founder is shown by the figures giving the number of people employed in all the Krupp Works, counting both officials and workmen. In 1902 there were employed in all the Krupp Works 45,000 men, and in the Essen Works alone 25,000 men. In October, 1905, only three years later, 62,000 men were employed in all the Works, and 33,000 at Essen, and these figures, as we have already shown, had risen by January, 1907, respectively to 65,000 and 35,000. The actual ratio of growth is larger than appears from these figures, because of the great increase in the use of labor-saving devices between the years 1902 and 1907. That is to say, the rate of growth of output must necessarily have been larger than the rate of growth of employees.

On April 1, 1902, the shipbuilding yard "Germaniawerft" at Gaarden, near Kiel, and the engineering works at Tegel, near Berlin, passed into the possession of Fried. Krupp, who had already in 1896 taken over by contract the management of the Works, for a period of twenty-five years. In order to raise the Germaniawerft to the maximum of its productive capability, and to make it equal to modern requirements, the firm decided to recast the works from the very foundation, and also to transfer to Kiel the Tegel Works, which thus were amalgamated with the new establishments at the Germaniawerft. The grounds at the disposal of the Germaniawerft, at the time of the above-mentioned contract, covered an area of 138,716 square meters; this area was raised to 235,000 square meters, upon which the erection of the new and extensive buildings was carried out and completed during the years 1898-1902.

In 1903 the extension of the blast-furnace plant at



Hollow steel shaft, 17¾ inches diameter and 150 feet long, forged from 80-ton ingot.



Gun shop No. 5 where heavy naval and coast-defense guns are finished and their breech blocks assembled and fitted.

THE KRUPP STEEL WORKS OF TO-DAY.

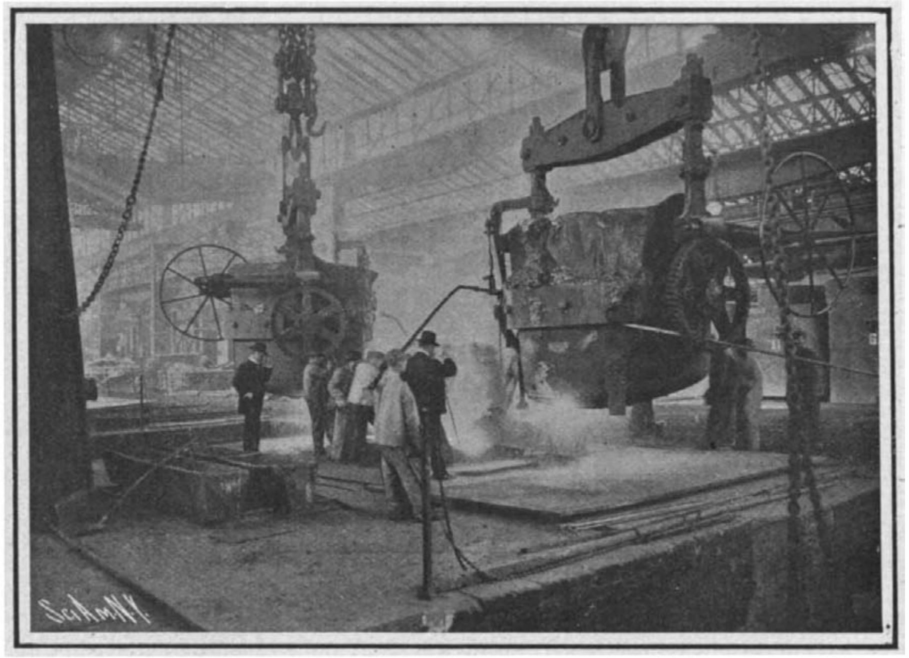
Rheinhausen, situated on the left bank of the Rhine opposite Duisburg-Hochfeld, was begun. These works were started 1896-7 with three blast furnaces, 23 meters in height and of 450 cubic meters capacity each. The extension of 1903 comprised three more blast furnaces, 26 meters high and of 600 cubic meters capacity each, and a steel works and rolling mill. In 1906 a seventh blast furnace was added. The whole establishment is laid out on entirely modern principles, and forms one of the most important iron works in Europe. The works have their own harbor communicating with the Rhine.

It is well known that the oldest specialty of the Essen works is the production of crucible steel, which is made in closed crucibles from raw materials, and poured by hand from these crucibles into ingots, which weigh up to as high as 85 tons each. These ingots, even in the largest sizes, are absolutely homogeneous and close-grained. Therefore, crucible steel is used for all purposes where reliability is the first consideration, where a sudden rupture would lead to the most serious consequences. Hence, it is an ideal material for the manufacture of guns, rifle barrels, armor-piercing shell, and for the more important structural parts of locomotives, stationary and marine engines, and hoisting machinery; it is also used for large rolls, for the manufacture of armor plate, and other milling purposes.

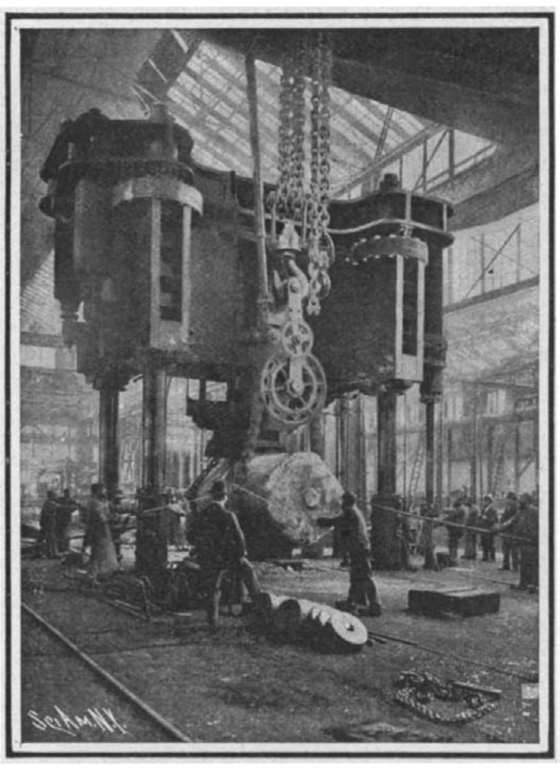
Next in importance is the production of open-hearth steel, the manufacture of which was first introduced in 1869. The growth of the open-hearth plant has been steady and on a vast scale, five different shops having been established in this department. The latest and largest of these contains ten furnaces of from 25 to 30 tons capacity; and in the whole of the five shops there is a total of thirty-five open-hearth furnaces with a total capacity of 625 tons. These five open-hearth buildings alone cover an area of over 32,000 square meters.

From the very beginning it has been a principle at the Krupp Works to put quality above quantity; and there is no doubt that the wonderful development of the concern and its worldwide fame have been largely the result of this fundamental principle, as expressed by Alfred Krupp's dictum: "In my factory second-rate material will not be used and shall not be made."

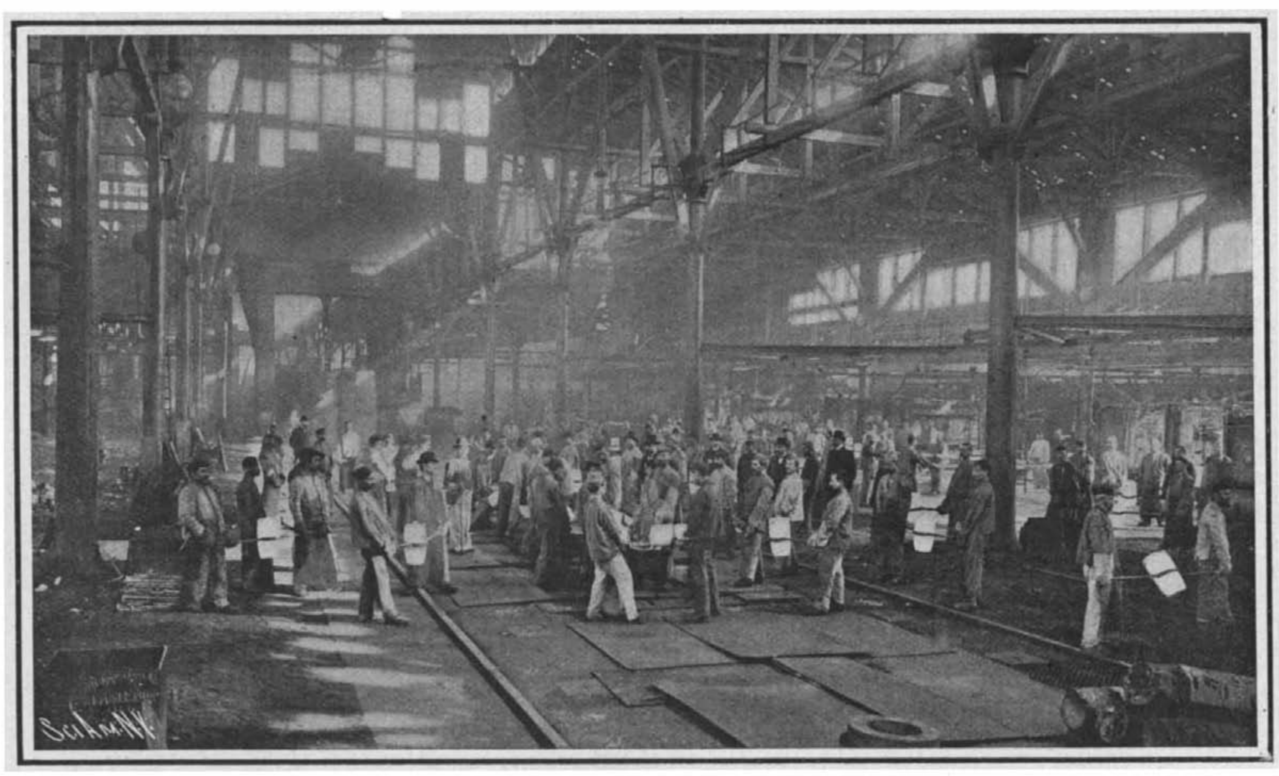
150-ton crane at the Krupp shipbuilding yards at Kiel. Capacity, 45 tons at 125 feet radius and 150 tons at 76 feet radius.



Two 40-ton ladles casting open-hearth ingot for a large armor plate.



80-ton ingot being forged under a 5,000-ton hydraulic press.



Casting an 80-ton ingot. This ingot called for 1,768 crucibles, operated by 490 men, and took 30 minutes to cast.

THE KRUPP STEEL WORKS OF TO-DAY.

In the accompanying illustrations are shown some characteristic views of the various parts of the Krupp establishments. One of these shows a 5,000-ton hydraulic forging press used in forging of heavy ingots down to the required shapes ready for machining. This press is shown at work on an 80-ton ingot. Its anvil block is movable, and its crosshead can be adjusted. It has a three-cylinder accumulator, capable of varying the pressure from 200 to 300 and 600 kilogrammes per square centimeter. In the Essen Works alone there are about seventy hydraulic presses, the largest being a 7,000-ton press for bending heavy armor.

Another view is taken in the open-hearth plant, and shows the casting of an open-hearth nickel-steel ingot for an armor plate. The metal is tapped from the furnace into two ladles of 40 tons capacity each, which are picked up by two 75-ton traveling cranes and brought over the mold, into which the metal is run direct through a vent in the bottom of the ladles. One of the most interesting of our illustrations is that taken in the crucible steel plant, which contains sixty-eight gas generators, eighteen heating and seventeen smelting furnaces. Here ingots have been cast weighing as much as 85 long tons, from crucibles holding 90 to 100 pounds of metal each. The great shaft shown in another illustration, which is 150 feet in length, was forged and turned from an ingot weighing 80 tons. To cast this ingot required the contents of 1,768 crucibles, handled by 490 men, the operation of casting taking, altogether, 30 minutes. This shop is served by four traveling cranes with an aggregate capacity of 173 tons. The crucible plant connected with the foundry has a capacity for making from 2,000 to 3,000 crucibles per day.

Perhaps the Krupp Works is best known for its production of high-class ordnance, which for several decades it has manufactured in large quantities and with uniform excellence. One of our illustrations shows Gun Shop No. 1, where the heavy naval and coast-defense guns are finished, and where breech locks are assembled and fitted. There are ten large workshops alone for machining and finishing guns and breech mechanisms. They have an aggregate floor space of 5½ acres, and they contain altogether about 700 machine tools.

The large quay crane shown in another illustration is located at Krupp's Germania Shipbuilding Yards at Kiel. The crane, which is built of steel, has been tested up to 200 tons capacity, and it is used for handling heavy machinery, boilers, guns, etc. It stands on three legs and carries a top platform, which, in turn, serves to support the horizontal swinging arm, which can be traversed in a complete circle. The arm carries two traveling trolleys, the smaller one for loads up to 45 tons at a radius of 125 feet, and the larger one capable of handling loads of 150 tons at a maximum radius of 76 feet. The track on which the trolleys run is 132 feet above mean water level. All traveling and hoisting operations are controlled electrically from the operator's cab, which is located inside the beam above the platform.

The vast scale on which the Krupp Works have been laid out is shown by the following statistics of the working plant, as installed in the sixty-odd departments: There are about 6,500 sundry machine tools and other workshop machines; 21 trains of rolls; 155 steam hammers; 21 transmission hammers; 74 hydraulic presses, including 2 bending presses of 7,000 tons pressure and 2 forging presses of 5,000 and 2,000 tons pressure respectively; 300 stationary steam boilers; 74 locomotive steam boilers; 539 steam engines of from 2 to 3,500 horse-power and aggregating 59,059 horse-power; 1,361 electro-motors, aggregating over 20,000 horse-power; and 725 cranes of from 400 to 150,000 kilogrammes lifting capacity.

THE PECULIAR BEHAVIOR OF MOREHOUSE'S COMET.

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

Celestial photography in the wonderfully skillful and capable hands of Prof. E. E. Barnard of the Yerkes Observatory has given to astronomy new wonders of the heavens and fresh problems to be solved in the portrayal of the Morehouse comet. This heavenly visitor, now known in astronomical lore as Comet C 1908, or by its discoverer's name, was found by Prof. Morehouse on a photographic plate taken September 1 at the Yerkes Observatory. Three nights' observations gave data enough to calculate the path of this object in its journey about the sun, and it was found that here was a body that was to be of great popular interest, for it was destined to become bright enough to be seen by the naked eye without the aid of a glass or telescope. Nor did it fail to live up to its reputation, and at the end of October and early in November it was easily visible in the early evening sky. Although the comet did not reach its position of being nearest the sun till Christmas day, it was closest to the earth (about 100,000,000 miles away), and consequently brightest about election day (November 3). After passing around the sun the comet will become visible again in February, March or April, but then can be seen only in the southern hemisphere.

Daniel's comet seen in the summer of 1907 was to the unaided eye much more interesting and picturesque than the Morehouse one, with longer tail and more easily visible, but photographically the 1908 comet far surpassed its predecessor in interest. Prof. Barnard regards it as the most startling comet since the application of the sensitive photographic plate. Daniel's comet was an "orderly, well-behaved body," but Morehouse's has been decidedly sensational ever since the day of its discovery. What has made it specially remarkable has been the wonderful outbursts and transformations in its tail, which has changed its appearance so suddenly and with such force that after twenty-four hours it would not be recognized from its appearance as the same body. The accompanying illustrations, reproductions of excellent photographs kindly furnished by Prof. Barnard, tell their own story. The comet was very favorably situated with a high northern altitude in October, so that the astronomer was permitted to take photographs practically throughout the whole night. The great interest attaching to it is evidenced when it is understood that between September 1 (its discovery) and November 3, Prof. Barnard obtained of it 239 plates.

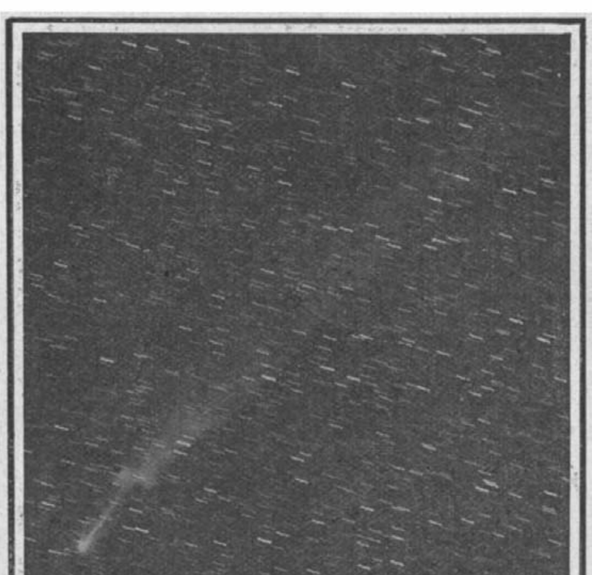
Remarkable transformations occurred on September 30 and October 1, violent changes taking place on the former date throughout the night. The first exposure on this night was not specially remarkable and gave no warning of the outburst seen on the photograph taken at 14 h. 22 m. central standard time (2:22 A. M., October 1) which is reproduced in Plate 1. In this the comet has become a very remarkable and beautiful object, utterly and entirely different from the first picture; the tail had tapered down to a very narrow connection with the head, and fluffy masses which had been seen on photographs taken a few hours earlier on the northern (lower) side of the tail became on this plate a large projection. The tail appeared cyclonic in form and structure, and doubtless an hour later the whole tail had become disconnected bodily from the head. What a transformation had taken place before the next evening! The same stars may be recognized on the photographs of the two nights, but the tails look not a whit alike. Plate 2 from a photograph taken October 1 at 13 h. 43 m. (1:43 A. M. October 2) shows half-way out on the tail a great mass of matter which formed the tail of the night before, and in successive pictures taken throughout the night of October 1, this mass of matter is seen getting farther and farther away from the comet. Several fine thread-like tails may be seen close to the head. Such changes caused the comet to become suddenly brighter to the eye, as was noted by Prof. Wilson at Northfield, Minn., on the night of September 30.

Another great disturbance occurred on October 15 which is represented in Plate 3 and which is remarkable for the most extraordinary secondary tail there shown. No trace of this was seen on photographs taken on October 14, while remnants of these cloudy masses much farther out are shown on plates taken October 16 and 17. Peculiar wavy appearances were seen in the tail about the middle of the month of November, and traces of this spiral motion can be seen in the beautiful photograph of November 18 reproduced on Plate 4.

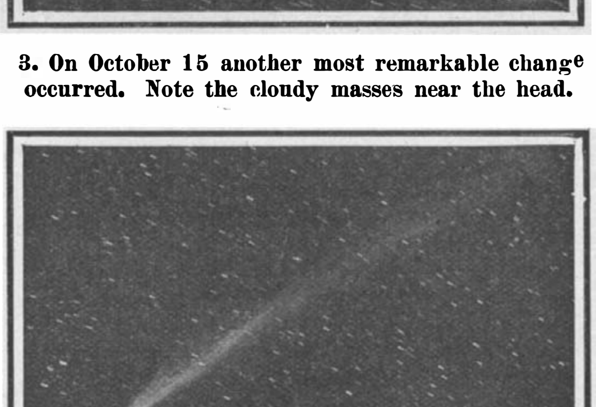
The cause of these peculiar outbursts is a little difficult to find. Early observers of comets noted that the tail was always directed away from the sun and explained this by some force seated in the sun which repelled the particles of the tail while gravity attracted the comet as a whole and made it move about the sun. Modern astronomy with its great advances has, within the last few years, given the nature of this repellant force, and has stated that it is due to a pressure excited by sunlight on the finely divided matter forming the comet's tail. What we call light consists of waves very small in size moving with great velocities. If six hundred millions of millions (600,000,000,000,000) of waves enter our eye in a second of time, we say that the light is green in color.

1. On September 30 the comet showed a well-marked fan-like tail.

2. On the next night the tail had almost disappeared, giving way to a few streamers.



3. On October 15 another most remarkable change occurred. Note the cloudy masses near the head.



4. On November 18 the tail showed a wave-like form with many diverging streamers.

THE PECULIAR BEHAVIOR OF MOREHOUSE'S COMET.

These waves, tiny though they are, exert a pressure on any object on which they fall just as the ocean waves exert a pressure when they pound in on the sands of the shore. The pressure of sunlight on ordinary objects is excessively small, but if the bodies become smaller and smaller so that the surface becomes relatively larger with respect to the mass (the mass decreases as the cube, and the area as the square of similar dimensions) a point will be reached in the subdivision of matter that particles will be repelled by the pressure of the sun's light rather than attracted by the force of gravity. This is the present accepted explanation of the cause why the comet's tails point always from the sun, nor is it an idle theory with no practical backing, for Professors Nichols and Hull have been able to make an artificial comet's tail in the laboratory by the pressure of light. But while this pressure theory explains the general behavior of comets' tails, it fails to give the cause of the sudden outbursts and changes in brightness and directions observed in the Morehouse comet. The sun, by its heat, undoubtedly starts activity in the comet nucleus, and this activity increases as the comet approaches closer and closer to the sun. Just how the head behaves and how it gives forth particles to form the tail, are problems which science at present cannot solve. The splendid photographs of this our latest comet taken by Prof. Barnard, will go a long way toward helping us explain the riddles of comets and their tails.

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the Scientific American, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best popular explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the following conditions:

1. No essay must be longer than 2,500 words.

2. The essays must be written as simply, lucidly, and non-technically as possible.

3. Each essay must be typewritten and identified with a pseudonym. The essay must be inclosed in a plain sealed envelope, bearing only the pseudonym. With the essay should be sent a second plain sealed envelope, also labeled with the pseudonym, and containing the name and address of the competitor. Both these envelopes should be sent to "Fourth Dimension Editor, Scientific American, 361 Broadway, New York, N. Y."

4. All essays must be in the office of the Scientific American by April 1, 1909.

5. The Editor of the Scientific American will retain the small sealed envelope containing the address of the competitor and forward the essays to the Judges, who will select the prize-winning essay.

6. As soon as the Judges have agreed upon the winning essay, they will notify the Editor, who will open the envelope bearing the proper pseudonym and containing the competitor's true name. The competitor will be notified by the Editor that he has won the prize, and his essay will be published in the Scientific American.

7. The Editor reserves the right to publish in the columns of the Scientific American or the Scientific American Supplement three or four of the more meritorious essays, which in the opinion of the judges are worthy of honorable mention.

Prof. Henry B. Manning, of Brown University, and Prof. S. A. Mitchell, of Columbia University, will be the judges.

If it is a fundamental axiom that an organism actively asserts or maintains a specific structure and specific activities, it is clear that nutrition itself is only a constant process of reproduction: for the material of the organism is constantly changing. In enunciating this principle before the recent meeting of the British Association for the Advancement of Science Dr. Haldane pointed out that not only is there constant molecular change, but the living cells are constantly being cast off and reproduced. It is only a step from this to the reproduction of lost parts which occurs so readily among lower organisms; and a not much greater step to the development of a complete organism from a single one of the constituent cells of an embryo in its early stages. In all these facts we have simply manifestations of the fundamental characters of the living organism. The reproduction of the parent organism from a single one of its constituent cells separated from the body seems to him only another such manifestation. Heredity, or, as it is sometimes metaphorically expressed, organic memory, is for biology an axiom and not a problem. The problem is why death occurs, what it really is, and why only certain parts of the body are capable of reproducing the whole.

The Editor of Handy Man's Workshop will be glad to receive any hints for this department and pay for them if available.

AN INEXPENSIVE ICE YACHT.

BY I. G. BAYLEY.

The following description of a junior ice yacht is not taken from a published article, or a design suggesting how to make a good boat, but is a description of one which has been already made, and proven a marked success. While there were many boats alongside, made of all manner of designs and material, from the first-class boats designed by experts to the yachts made by the farmer boys, from fence rails and ice skates, with a table cloth or bed sheet for sails, this particular one outclassed them all, for speed at any rate.

The material can be easily procured, in most cases from the lumber pile in the back yard or wood shed. But in any case it should cost but a few dollars complete.

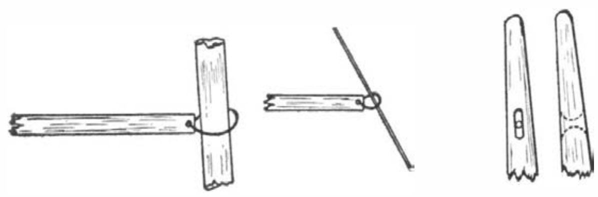
The general view of the yacht is shown in Fig. 1, with the various parts lettered to correspond with the details on Fig. 2, and the plan of boat shown in Fig. 3.

The backbone *A* is made from 3 by 4-inch pine, notched where shown, for the cross arm or runner plank *B* and the rudder *K*. The cross arm *B* is made from 2 by 8-inch timber. Two parallel saw cuts are ripped up the ends, 3 inches apart and 2 feet in length, one foot of which is cut away as shown. The other foot is to give pliability to the boat, should the side runners strike any object, when racing. The 2 by ¼-inch recess at either end is to fit over the piece marked *F*, which bears on the upper side of the runners *G*. Holes for ¼-inch bolts are bored and drilled through each, as indicated. Find the middle of the cross arm, and secure it to the backbone with spikes. A notch for the mast, one inch deep, is cut in the backbone with a chisel, and a ¾-inch hole is bored in the end for the rudder.

The side frames *C* are made from hardwood chamfered at one end, 4¾ inches in one foot. Care must be taken to make them right and left, or else cut the notches at the other end, the last thing. These notches must be carefully cut, to escape the free ends of the cross arm when they spring. Referring to Fig. 3, their location will be seen. Secure the chamfered ends 18 inches from the end of the backbone, spreading them 5 feet 8 inches apart, on the cross arm *B*, and nailing them to the 3-inch tongues with a single nail driven from the top, and with small toe nailing. Holes should be bored for the former. The flooring *T* can be made from almost any kind of boards nailed to the sides *C*, and finished off with nailing strips *D*, 1 inch square.

The side runners *G* are made from 2¼ by 2¼ by 3/16-inch angles, though a piece of steel or iron, bent into shape, or even an old pair of skates will do. The heel and toe should be rounded off at the corners, the bearing edges being sharpened to a 45-degree V point.

The rudder blade *K* is made from a piece of steel 2¼ by 3/16 or ¼ inch thick, served in the same way as the side runners. A ¼-inch hole is drilled as shown, for the jaw of the rudder stem *H*. The stem



The mast and gaff rings and detail of the mast head.

H had better be made by a blacksmith, from ¾-inch round iron, flattened and split at the lower end to take the runner *K*. Two small holes are drilled a little above the jaw, for 3/16-inch bolts, to connect the wooden block *J*, which is in two parts, and nailed together when in position, clearly shown assembled in Fig. 1. A block of wood *E*, 1¾ by 4 by 11 inches long, tapered at the ends, is secured in position over the rudder stem, and the small plate *I* screwed down before the tiller *L* is put on.

The tiller is made from a ⅝-inch round iron, flattened at the end, and provided with a square hole, to fit the end of the rudder stem *H*. The other end can be wrapped with string or cloth to make it comfortable for the hands. Eight screw-eyes *M*, shown in Figs. 1 and 3, can be used to fasten the free ends of the ropes.

Fig. 4 shows the spars and plan of sails. The latter can be laid out on the floor of a room, using the corner to get the right angle necessary. The jib *O* is a right-angled triangle, having complementary angles of 30 and 60 degrees, but it will be well to lay out the sail by using the sides, 3 feet 9 inches and 6 feet 6. The mainsail *N* is laid out in the same manner, by using the corner of the room to obtain the right angle, and stepping back from the wall 10½ inches and 2 feet 3 inches, to obtain the intersecting points. Allowance must be made for turning over, and eyelets can be worked in, about 12 inches apart. The sails can be made from ordinary sail cloth, linen, or, as in this case, of linen floor covering; care being taken to get the seams as shown, or the sail will not hang well.

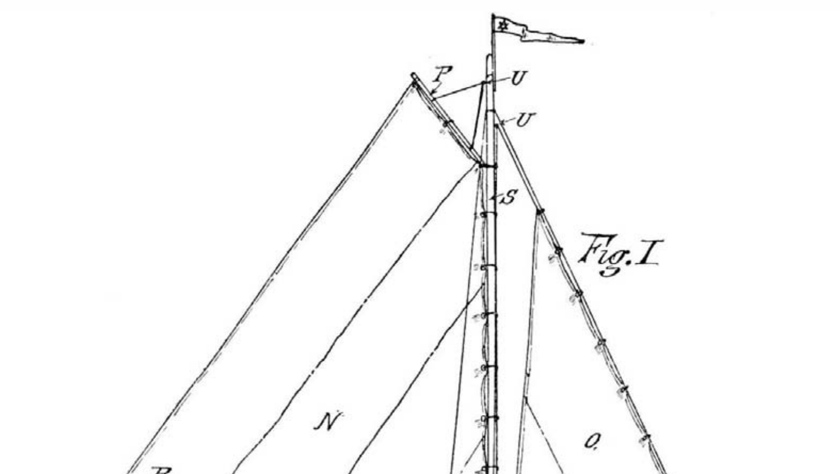
The gaff *P* and the jib-boom *Q* can be made from dowel sticks or light curtain poles. A rope can be used in place of the jib-boom if desired. The main-boom *R* can be a pine stick, about 1½ inches in diameter by 8 feet in length. Make the mast from spruce or yellow pine, 2½ inches diameter at the heel, tapered at the top to about 1⅞ inches. The heel is to be shaped to fit the 2½ by 1½-inch mortise in the backbone *A*. With a pair of wire nippers and pliers, the mast hoops and sail rings can be made from copper wire. Holes should be bored in the ends of the booms and gaff for a ring, as illustrated.

Five small sheaves or blocks, with screw attachment, are connected at various points, marked *U* in Figs. 1 and 3, for the sheets and halyards, the free ends of which can be fastened to screw-eyes. Holes can be bored through the masthead for these ropes, as shown in the sketch, instead of using blocks, although the latter will give more satisfaction.

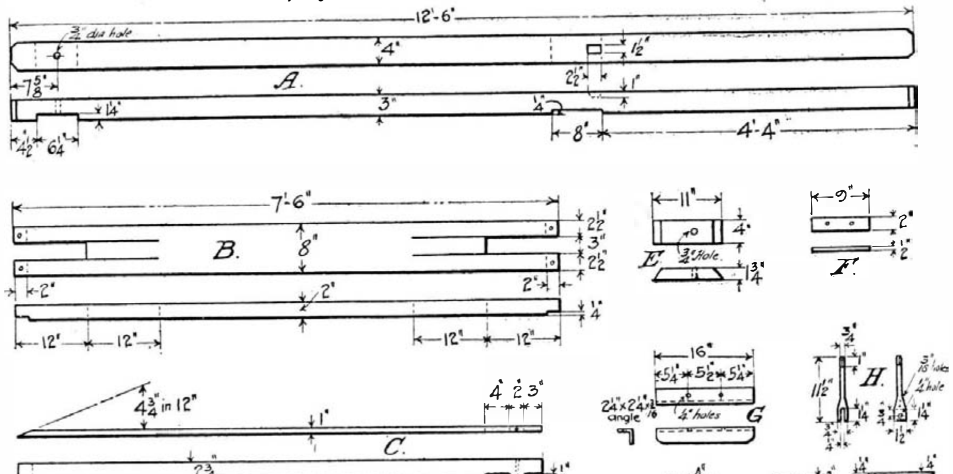
The shrouds and stay for the mast are fastened to the latter, about 1 foot from the top, and drawn through the screw-eyes when the mast is set up. The mainsail and jib are drawn up by ropes passing over sheaves or blocks *U*, and fastened to cleats, or else screw-eyes, on both sides the lower end of the mast. About 65 feet of rope will be necessary all told, which should be of the finest quality for the mast shrouds and jib-stay. The pennant can be either attached to the head of the mast or at the end of the gaff *P*.

When sailing on smooth ice, the runners should be set to a sharp edge, but when the ice is soft, the edges need to be dulled a little. The mainsail need seldom be swung out of line too much, and great care should be taken when sailing before the wind. It will be well to take a few lessons before venturing out on too large a sheet of ice.

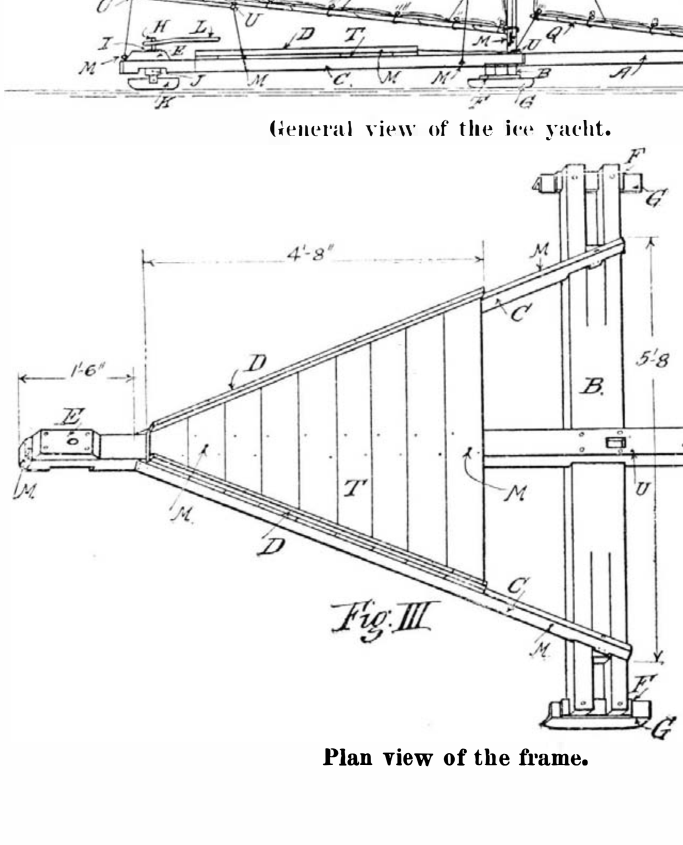
While it is a nice thing to be able to sail an ice yacht, it is a useful, and often necessary, accomplishment to know how to stop one. The boat should be thrown up into the wind, i. e., turned around to face the direction of wind, and the rudder turned at right angles to the side runners *G*. When turning around to go in an opposite direction, a firmer hold should be taken, to avoid accident; it being no unusual sight to see a novice flung out of the cockpit at a tangent, and skimmed across the ice on all fours.



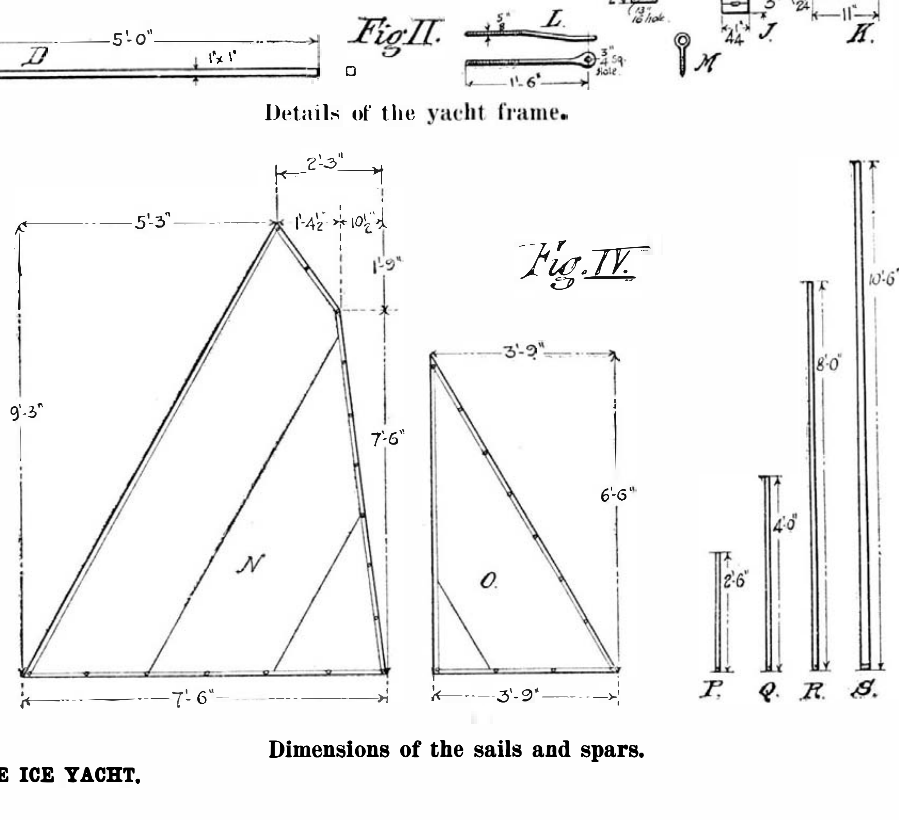
General view of the ice yacht.



Details of the yacht frame.



Plan view of the frame.



Dimensions of the sails and spars.

AN INEXPENSIVE ICE YACHT.

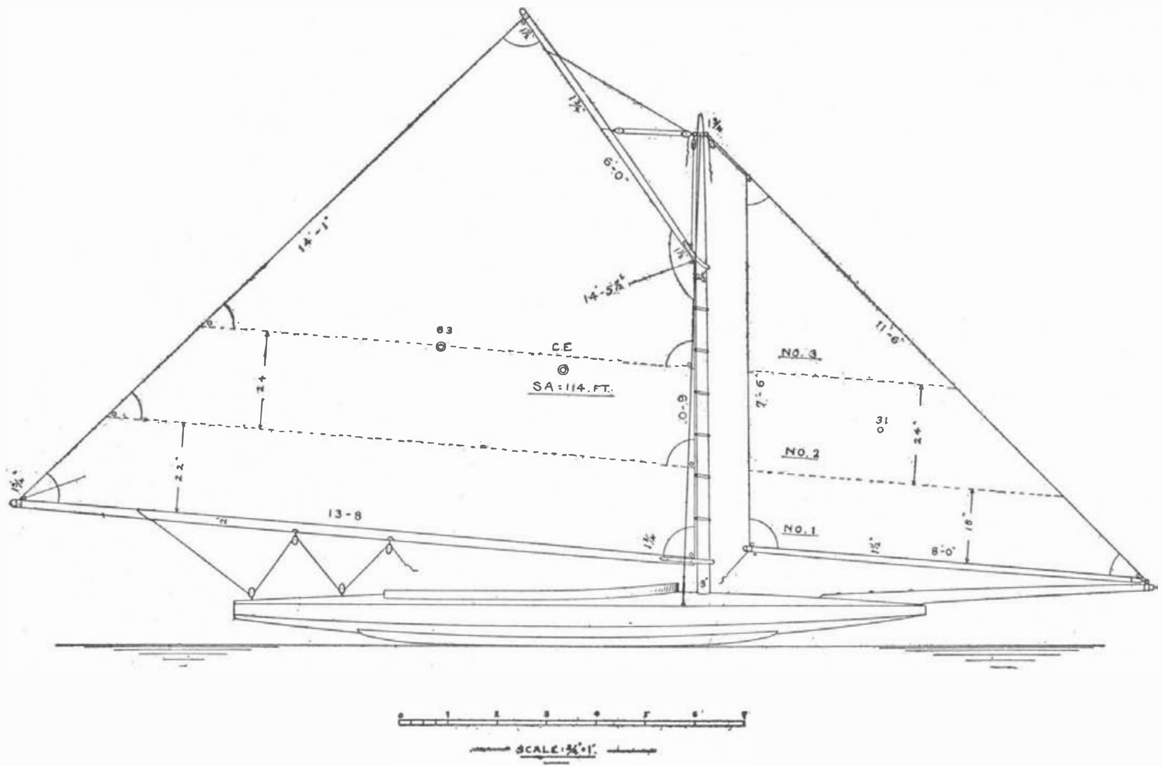
HOW TO BUILD A SCOOTER.

BY FREDERICK K. LORD.

The rudderless amphibious ice yacht called the "scooter" is a product of the sailors of the Great South Bay, Long Island. In former years, when the bay would freeze over solid, the regular ice yacht was a very familiar sight. Recently, however, the mild winters produced so little ice fit or safe for sailing that the sport almost died out. The conditions caused by these winters have been met successfully in that new and ingenious type of ice boat, the scooter. Roughly, the scooter is a Barnegat "sneak box" mounted on runners.

This craft will sail in the water as well as on ice, consequently the sailor does not fear soft ice or air-holes, but sails merrily along taking ice or water, whichever happens to be in his course. They are sailed without a rudder by simply trimming the sails and shifting position in the boat so that the point of contact of the rockered runner upon the ice is just under the center of effort of the sails. A single occupant sailing the boat sits about amidships, and holding the jib sheet in his hand pulls in or slacks out until the boat heads just as desired. When two are in the boat they spread their weight about an equal distance from the center; one shifts as required, while the other tends the sails.

A pole with a spike and a hoe is carried, a slight scratch of the former being sufficient to get the boat on her course, while the latter is used to pull the boat out of the water in case the wind dies out. An oar is also carried to steer while in the water, but this is not necessary when crossing an air-hole less than forty or fifty feet, as the speed of the scooter, with a good wind, is sufficient to carry her across and out on the ice again in jig time. This ability to pop in and out of the water constitutes a novel sensation and makes scootering a very fascinating sport.



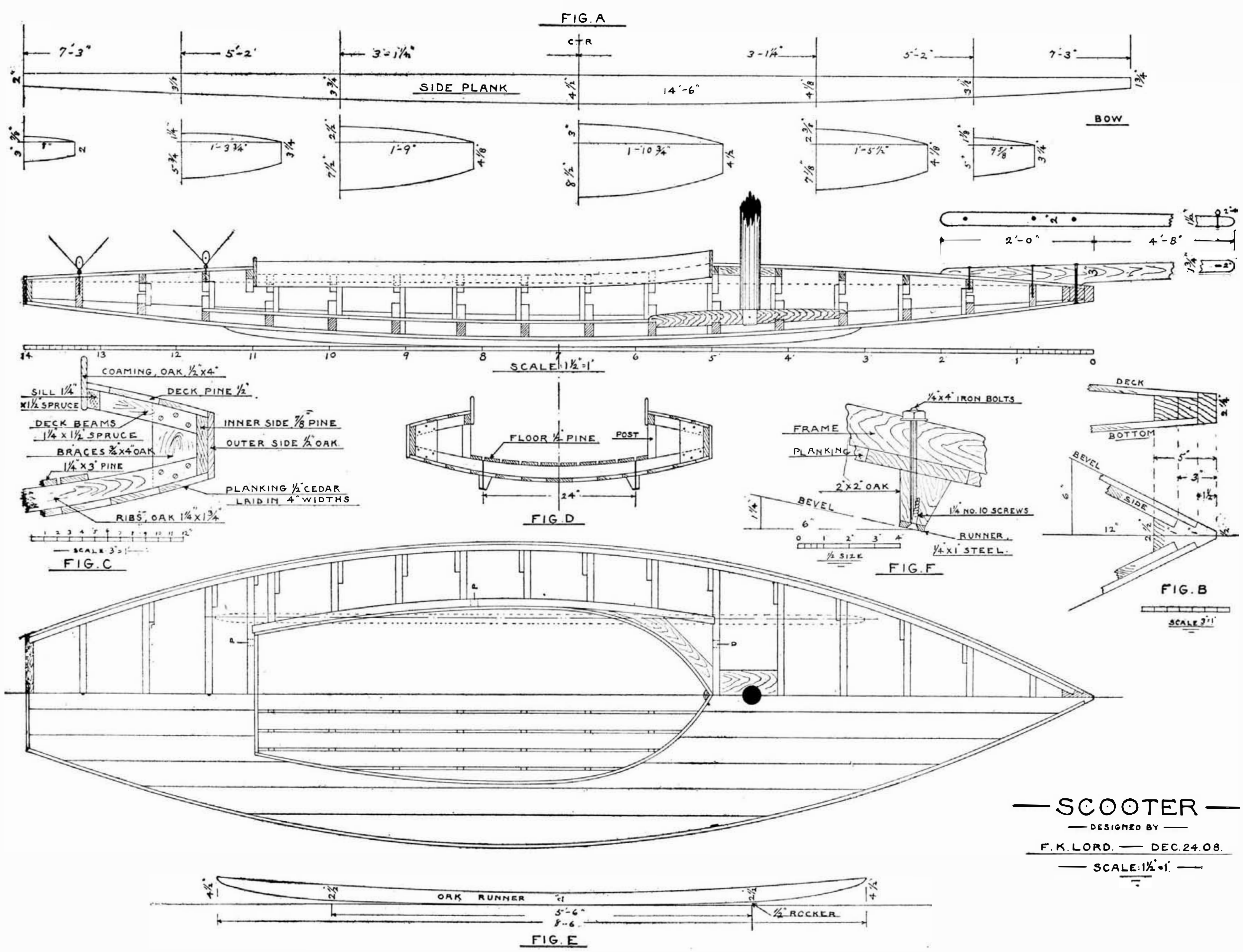
SAIL PLAN OF THE SCOOTER.

Notwithstanding appearances to the contrary, they are a very speedy little craft and can make 30 miles an hour in a good steady breeze, running up to over 50 in a heavy puff.

The cost of a scooter is between $100 and $125, but they could be built at home by an amateur for about $50.

The scooter shown in the accompanying plans is 14 feet in length and 4 feet beam. The sail area may be from 80 to 130 square feet, according to speed required and local weather conditions. The sail area in the plan is 114 feet and should make a good average rig. The construction is fairly heavy, making a serviceable boat. For pure racing it could be lightened considerably. Study the plans carefully before beginning work.

The first step in constructing the boat is getting out the side planks and springing them around "molds," which are simply temporary forms, to hold the elemental construction in place until it can stand alone and keep the boat in shape. The inner side planks are of ⅞-inch white pine and of the dimensions shown in Fig. *A*. The molds are next made, of ⅞-inch pine, and dimensioned according to Fig. *A*. The curves are arcs of circles and care should be taken to get the sides perfectly plumb, or else they will throw a twist in the side planks, and the upper edges will not lie in the same plane. The transom is ⅞-inch oak and the stem of oak, size as shown in Fig. *B*. It has a double rabbet. The inner is for inside plank and the other for the outer or covering plank. Screw the side planks to the stem and spring them around the molds and screw to transom. The molds are spaced 2, 4, 7, 10, and 12 feet from the stem head. This gives the rough form. Put the boat upside down on three saw horses and spring on the oak keel, which is 4 inches wide and ⅝ inch thick. This makes a fair line for the frames, which are next put in. Make them of oak 1¼ inch thick and 1½ inch deep, increased to about 2 inches along the center line of bottom in cockpit. They are spaced 10 inches on cen-



CONSTRUCTION PLAN OF THE SCOOTER.

ters. Beginning, start the spacing 5 feet from the bow and 3 feet from the stern in order to come right for the cockpit opening. Then turn the boat over and put in the deck beams by the same method. They are 1¼ x 1½-inch spruce spaced 10 inches and fastened to the side and ribs by oak braces ¾ x 4 inches, securely screwed together. Fig. *C* shows this clearly. A sill or stringer of 1¼ x 1½-inch spruce is run along cockpit side and a backing piece at the forward end is put in to take the curve of cockpit coaming. Posts are put in at the places marked *P*, to bind the deck and bottom together. The mast step is now put in. It is of oak, 2 inches deep and 5 inches wide, jogged over and ½ inch into four frames and securely fastened thereto. A backing piece of oak 1¼ x 8 inches wide is also put in between two deck beams to take the strain of the mast. Now turn the boat bottom up and proceed to plank her. The planking is of white cedar ½ inch thick laid in straight strips 4 inches wide. It is fastened to the frames with either brass screws or 1½-inch galvanized nails countersunk and puttied. The bottom is then carefully planed and sandpapered smooth, the seams calked with two threads of candle wicking and the whole given three coats of good lead paint. The runners are next put on, and with these be very careful. See that they are absolutely parallel and of the correct rocker and bevel. The distance between centers of runners should be 2 feet. They are of oak and shaped as shown in Figs. *E* and *F*. The runner commences 3 feet from the bow and runs aft 8½ feet. It is 2 inches deep amidships and reaches up at the ends. The middle 6 feet of the runner should have a rocker which is the arc of a circle with ½-inch curve in 6 feet. Referring to Fig. *F*, the outer edge of the oak stands plumb and is 2 inches wide at planking, tapering to 1 inch at face. The runner plank is fastened on with ¼ x 4-inch iron bolts set up on top of every frame. Carefully face up the runners by laying a straight edge across them both and fitting a bevel board. The bevel of the runners is 1¼ inch in 6 inches or about 11½ deg. Put on the shoes, which are of ¼ x 1-inch steel and 7 feet long. Bend them at ends so there will be no undue strain upon the screws, which are 1¼ inch, No. 10 size. The screws should be countersunk until they are flush with runners, and their slots lie fore and aft. The steel shoe should be very smooth, with sharp, square edges.

Now turn the boat right side up and start finishing up the deck and cockpit. An oak partner piece ½ x 5 inches is laid on center line of deck. A 3-inch hole is bored for the mast 4½ feet from the bow. The bowsprit is next put in. This is of spruce, of the dimensions shown, and fastened with three bolts as indicated in the plan.

The deck is now laid. This is of ½-inch white pine or cedar laid in about 4-inch strips fastened and treated same as the bottom. Next the cockpit coaming is sprung in. It is of oak scant ½ inch thick, 4 inches wide, and stands 2 inches above deck. Fasten to stringer with 1½-inch No. 10 brass screws countersunk and plugged with oak plugs. Lay a light flooring of pine in the cockpit in 2½-inch strips ½ inch apart.

Now plane up the edges of the bottom and deck flush with the inner side plank and then put on the outer side plank. This is of ½-inch oak and comes flush with the deck and bottom. It is also carried around the transom, thus covering up the raw edges of the ends.

Now for the rig. All spars should be of straight-grained spruce. Mast 10½ feet from step to truck, 9 feet 8 inches above deck, and 9 feet 3 inches from deck to center of band at top. To be 1¾-inch at head, 2½ inches at gaff, and 3 inches at deck. Make all the spars with a swell or barrel taper. Boom 14 feet, 1¾ inch at ends, 2 inches along middle. Gaff 6 feet 2 inches, 1½ inch at ends, 1¾ inch in center. Jibboom 8 feet 2 inches, and about 1½ inch tapering to 1¼ inch at ends. Fit wooden jaws to gaff and boom and use six mast hoops. A sliding rig is neater but would cost a little more. Use a single ¼-inch wire shroud with turnbuckles, the chain plate of steel ¼ x 1 x 7 inches long, to be fastened with rivets through the side planks. Eight small ⅜-inch bronze yacht blocks are needed and can be obtained from a yacht chandler. Rigging to be of ⅜-inch rope. The sails should be of about No. 4 yacht duck. The mainsail to be fitted for two reefs, the first taking off 22 inches and the second 24 inches. Have a permanent forestay and put the jib on with snap hooks. For reefing, get two extra jibs as shown in sail plan and set them with a small sprit, if necessary.

The boat may be finished all over with three coats of spar varnish or painted white with buff-colored decks and varnished cockpit and coaming, which makes a very good finish.

A CEMENT GRINDSTONE.

A grindstone made from one-half best Portland cement and one-half silica sand may be used in grinding glass to take the place of the wheel caster. The materials must be thoroughly mixed and evenly tamped. The advantage of this stone is that when properly made there will be no hard and soft spots, and it will grind glass without scratching. The cost is about ten per cent of that of the common grindstone. The Onward Manufacturing Company, of Menasha, Wis., to whom we are indebted for this information, has been using cement grindstones successfully for a year.

FURTHER DETAILS OF THE HOME-MADE VACUUM CLEANER.

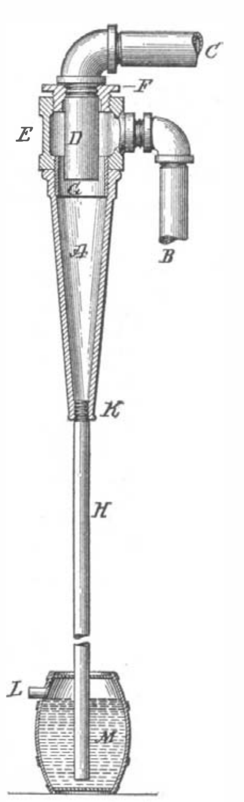
BY W. J. C.

The following particulars regarding the construction of the vacuum cleaner described in the issue of November 7 will answer some of the questions received regarding the apparatus:

The pressure of water in the pipe *B* has no effect on the amount of vacuum obtainable. This depends on the column of water in the pipe *H*, which, as stated, must be at least 34 feet from *K* to *L*. This distance corresponds to the height of the barometer, or in other words, to the weight of the atmosphere. The best and most economical method of controlling the water supply is to place a tank, similar to the ordinary bathroom tank, above the apparatus and control the amount of water through a valve. The tank would get its supply from the house mains through a float-operated valve.

The apparatus described in the previous issue was meant to supply a small private dwelling where not more than one or two openings would be in use simultaneously, and if required for a larger installation must be increased in size.

The nozzle *A* is a standard size nozzle and can be used if desired for larger installations by changing the bushing *F* to correspond to the increased size of the pipe *C* and using the proper opening at *B*. The pipe *H* when increased must be attached to the nozzle by means of a coupling which in turn is screwed on the outside of the nozzle, the latter being turned and threaded to suit. The nozzle described has a ¾-inch hole at this point and can stand being bored to 1 inch, as the metal is pretty heavy.



THE HOME-MADE VACUUM CLEANER.

The reservoir mentioned is not absolutely necessary. Most of the dust is carried over and goes down with the water and only the larger particles will drop in the reservoir. If the latter is omitted, an opening must be left in the lowest part of the pipe *C* through which this dust is removed.

The efficiency of the apparatus depends in the first place on the joints in all pipes being absolutely airtight. If pipe with good threads, fitting tightly, is used and made up with red lead in a proper manner, airtight joints may be expected. If it is necessary to make a bend in the pipe *H* at a point 10 feet below *K*, 45-degree ells should be used to make it as gradual as possible. In figuring out the size of the pipe necessary for any size machine the starting point must be the sum of the areas of openings in use. This will give the area of the pipe *C*. The seal pot *M* can if desired be dispensed with if the pipe *H* is connected to the waste water connection. The dimensions of all pipes are inside. This holds good in all cases up to 14 inches when outside diameter is usually given.

The quantity of water will depend of course on the size of the machine. The following formula will be found accurate enough for all purposes:

$$g = 28\sqrt{d^5}$$

g = gallons of water per minute and d = diameter of pipe *H* in inches. The amount of vacuum necessary for ordinary cleaning purposes should not be less than 15 inches, but for light work such as walls, hardwood floors, etc., satisfactory results can be obtained with 8 to 10 inches. The higher figures are necessary where heavy rugs, carpets, and similar articles are to be cleaned.

The cleaning implements are far too numerous in design to describe and can be procured on the market much cheaper than they can be made at home.

As regards mechanical efficiency this apparatus will create sufficient vacuum to do all necessary cleaning, but it has a fixed volume, therefore its volumetric efficiency is less. The apparatus is intended not to supply a cleaning system for hotels, clubs, churches, and buildings of such a character, but is thoroughly capable of cleaning private dwellings. In a pump plant, for instance, its cleaning power can be increased by running the pump at a greater speed and thereby taking care of a larger number of openings, of course up to a certain point. In the water system nothing is gained by increasing the flow of water in the pipe *B*. Therefore if the capacity of this apparatus is to be increased the only method of doing so is to increase the size of the pipe *C* and all other fittings accordingly. For large installations this would mean a considerable increase and therefore render the apparatus impracticable.

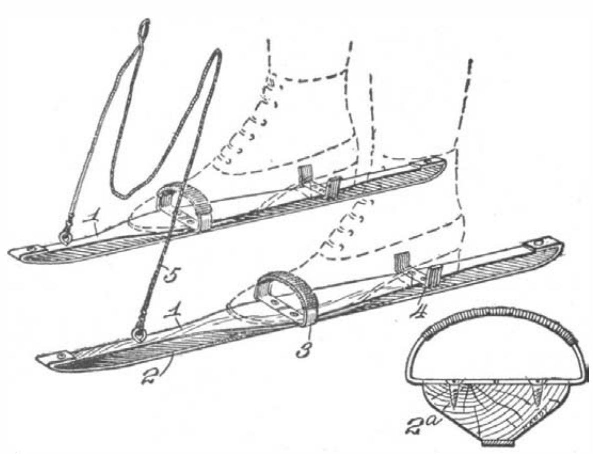
COASTING SKATES.

BY L. GESSFORD HANDY.

There are more ways than one of enjoying an icy hill. The accompanying illustrations show a pair of coasting skates. These skates can be well made by any amateur at little or no expense.

The base 1 is of hard wood and is 20 inches long. It is 3 inches wide at the middle, and tapers to 1 inch at either end. It is 1¼ inch thick and dressed off on the under side, as clearly shown at 2*a*, leaving a flat section ⅝ inch wide along the center line. The front end is curved upward, and a strap of iron or thin steel 2 is fitted to the flat section and serves as a runner. The ends of the runner are turned over upon the top of the base and held by screws. No screws are necessary in the bottom. In use the ball of the foot rests at a point approximately midway in the length of the skate. A stiff strap, 3, preferably of metal and designed to fit over the toe of the shoe, is screwed or otherwise secured to the base at this point. This strap may be wrapped with padding if desired, but if properly shaped the padding is not necessary. A U-shaped iron as 4 is fixed to the base as shown, so as to prevent sidewise movement of the heel.

It will be appreciated that these skates may be



COASTING SKATES.

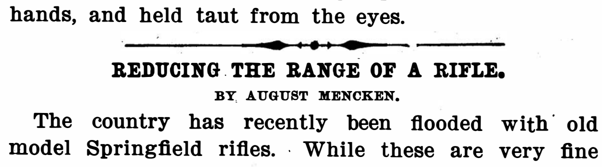
readily removed from the feet after a coast down hill, and as readily readjusted at the top of the hill. To facilitate the use of the skates, a guide rope 5 is used. The opposite ends of this rope are secured to eyes, one in each of the skates at the forward end. When coasting, the rope is grasped in one or both hands, and held taut from the eyes.

REDUCING THE RANGE OF A RIFLE.

BY AUGUST MENCKEN.

The country has recently been flooded with old model Springfield rifles. While these are very fine guns, they have too long a range for use in a thickly-populated region. As the writer could not use a rifle that carried over two hundred yards, he reduced the range by the following method:

Taking an empty regulation shell, 0.45 caliber, the



REDUCING THE RANGE OF A RIFLE.

head was bored out so that a 0.44 caliber revolver cartridge would fit snug. Then the head of the regulation shell was turned out, so that the head of the revolver cartridge would be flush, as shown in accompanying sketch. The writer is using these cartridges up to a hundred yards with good results.

THE NEXT ISSUE OF HANDY MAN'S WORKSHOP.

A special automobile number of the SCIENTIFIC AMERICAN will be published next week and will contain a large Handy Man's Workshop Department.

How to convert a buggy into an automobile and how to build a portable automobile house will be explained in detail. In addition to this there will be many valuable hints on emergency repairs.

We have not been able to find room, in the present number, for the promised article on the hand-operated motor sled, but expect to publish it in the first issue of Handy Man's Workshop following the automobile number.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

GRAIN-SHOCKER.—E. COWIN, York, N. D. The shocker is adapted to be used in connection with a binder, and has means for receiving the bundles of grain from the binder and arranging them upon a carrier to form a shock, and has means for releasing the carrier, whereby the shock is positioned upon the ground and the carrier withdrawn from under the same by the forward movement of the machine. Used in connection with the binder, it has actuating machinery operable from the driving mechanism of the binder.

Of General Interest.

AMALGAMATOR.—W. F. BEDELL, North Yakima, Wash. The amalgamator is designed for treating placer material, dredge material, and mill and slime material, and is arranged to insure the complete separation of the heavy valuable particles, such as platinum, coated gold and the richer parts of amalgam, from the tailings. The invention relates to amalgamators such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Bedell.

STRINGED MUSICAL INSTRUMENT.—S. W. BUERCKLIN, Prague, Oklahoma. The instrument may be arranged to be picked in the manner of a guitar, mandolin, etc., or played with a bow in the manner of violins, violas, etc. The sound is amplified by the body when a hollow body is used, and is transmitted by the bridge to sound boxes and amplified by horns. These horns are arranged low enough not to interfere with the bow, and one horn may be put out of the way when the instrument is used in the manner of a guitar.

MOVABLE BARRAGE HAVING ROTARY SLUICE-PONTOONS.—E. M. AUDOUIN, 12 Rue du Jardin des Plantes, Poitiers, Vienne, France. The following requirements are met by this invention. Ease and rapidity of working in opening and closing the barrage. Security of the movable parts, especially during floods and frost. Perfect barrage (i. e., freedom from leakage). Possibility of varying at will the level of the water held back. Cheapness of construction. The barrage is constituted by pontoons in the form of closed tanks capable of being floated or sunk to the bottom according to the quantity of water let into them.

WRITING-TABLET.—M. A. DREES, Peshtigo, Wis. The invention relates to letter sheets and tablets therefor, the more particular object being to provide a device in which one or any larger number of sheets of paper may be kept temporarily together, and arranged in connection with suitable parts for facilitating the folding and pasting of the letter sheets.

MOLD.—F. B. HARDING and J. J. BRUBECK, Rockville, Ind. In the present patent the invention has reference to the manufacture of concrete fence posts and like articles, and the object in view is to provide a new and improved mold which is simple and durable in construction and readily adjusted for making posts of different sizes.

FIRE-TANK.—J. W. KANE, New York, N. Y. This invention relates to improvements in fire tanks as are ordinarily located at the top of large buildings for fire extinguishing purposes, the invention being directed to a novel heating arrangement acting to prevent the water in the tank from freezing in extreme cold weather.

ADJUSTABLE SKID.—W. MCCADDIN and G. SUTHERLAND, New York, N. Y. The invention relates to skids designed to be used in unloading heavy rolls of paper. The invention has for its object the provision of means adapted to permit rolls of paper of different length to be readily up-ended from a skid without damage or injury to the paper.

Hardware.

FAUCET.—P. F. CAVANAUGH, La Crosse, Wis. The invention relates to faucets used for plumbing or other purposes, and is especially useful in connection with faucets which automatically shut off the flow of liquid when released. It will not permit the leakage of water when it is not in use, and which is closed by the pressure of the water.

Heating and Lighting.

GAS-LIGHTER.—J. PASTERNAK, New York, N. Y. The object in this case is to produce a device which can be readily attached to an ordinary gas lighter, and which will operate as a shield or cover for the flame so as to protect the chandelier or fixture from the flame in the act of lighting the gas.

COMBINATION GAS AND GASOLINE BURNER.—G. A. MANSHARDT, Naperville, Ill. In this patent the object is to provide a combination gas and gasoline burner arranged to permit of burning gas or gasoline in such a manner that it requires no tedious waiting for producing the desired flame when gasoline is used as the fuel.

Machines and Mechanical Devices.

TIMEPIECE-REGULATOR.—R. G. NORTON, Madison, Wis. The invention relates to chronometers, watches, and like time-pieces, and its aim is to provide an improved regulator, arranged to permit easy and accurate adjustment of the hair spring of the balance, with a view to accurately regulate the vibrations of the balance of the time-piece.

DRILL.—J. D. TULLY, Pearl, Colo. The inventor provides means for operating a plurality of drills from a single source of power, means being such that a gang of drills may be placed along in a row in a straight or crooked line at the same or different levels, and connected to each other and to a single source of power, the particular connecting means being shafts and tumbling joints, to transmit power. Clutches are provided at each drill, so that one or more drills may be stopped as desired, and friction clutches are used, so that if one drill becomes caught its clutch will slip and the others continue to operate.

SHAFT-COUPLING.—W. A. PERRY, New York, N. Y. The invention relates more particularly to that type of coupling which includes a casing surrounding the adjacent ends of the shafts to be coupled, and including a wedge forced into position by the action of a key. The coupling operates with the same efficiency irrespective of the direction of rotation of the shaft, which is easily applied, and cannot possibly work loose.

THERMOSTATIC CONTROLLER.—C. A. DUNHAM, Marshalltown, Iowa. The invention has reference more particularly to means whereby a thermostatic device disposed in one conduit or passage may be operated not only by a variation in the temperature of the fluid in that conduit, but also by a variation in the temperature of a fluid flowing in a conduit separate and distinct therefrom.

Railways and Their Accessories.

CAR-TRUCK.—G. ROUY, New York, N. Y. The invention provides a truck for railway or other cars having the inventor's special truck mechanism applied thereto, and so constructed that the parts of the truck mechanism are rigidly held and braced. Screw posts controlling the brake beams which carry the brake shoes, cross frames and transoms forming supports for the posts, the transoms serving rigidly to brace the frame, and a bolster resiliently supported by the longitudinal frame members of the truck and cross frames are provided.

Pertaining to Recreation.

SCORE-BOARD.—J. P. KEENAN, Waterbury, Conn. The invention relates to games played on bowling alleys. The board is arranged to permit the use of a continuous sheet of plain paper, and allows of cutting off and removing a filled-in portion after the game is finished, thus providing a permanent record of the game and presenting a clean portion of the paper, for scoring the next game.

Pertaining to Vehicles.

MEANS FOR AUTOMATIC CLOSING OF PUNCTURES IN PNEUMATIC TIRES.—J. LINDHARTH, Aaboulevarden 6, Copenhagen, Denmark. The invention has for its object an arrangement and method for the automatic closing of punctures in pneumatic tires of cycles, automobiles and other vehicles, and the like, caused either by involuntary damage during the riding or by willful injury. This is accomplished by introducing into the tube an adhesive fluid of suitable composition and consistency and enveloping the tube by a loosely fitting bandage consisting of a soft, non-elastic and fibrous substance.

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

Notes and Queries.

Full hints to correspondents were printed at the head of this column in the issue of November 14 or will be sent by mail on request.

(11076) C. M. G. writes: A remark was made about a local drunkard, and it was stated he had consumed enough whisky to "float a battleship." A bystander said that would not be much, as he could float the "Dreadnought" with one gallon of water. By making a skin exact shape of ship under-water body and 1/100 inch larger, he could support ship with one gallon of water. Others claimed that at least the weight of ship in water must be in tank before ship would leave the bottom, and cited the law of gravity, where a floating body displaces exactly its own weight of water. The other "school" claims that if ship was set in dry tank and water was poured in, when water level rose in containing tank to her normal waterline that ship would rise, citing the fact that the head of water, say 26 feet, would exert hydraulic pressure on bottom as per Pascal law and support ship. Personally, I am as much at sea as the alleged ship ever was, and think that the ship and water will act the same one place as another. It is evident that ship in free water of ocean must bear down upon water under bottom with exactly same force as water at head in feet of bottom below surface forces up, else ship would either sink lower or rise higher until such would be the case. Another view is this: Take the 10,000-ton ship, set her down in free water, and she displaces 10,000 tons of water. Place ship in a balance, and the displaced water at other end of balance beam at same distance from fulcrum, and the two will balance. Put the gallon of water in place of 10,000 tons and set ship on, and as party stated it, "the water would be thrown clear over the moon." I have strung this out further than a concise statement of problem would require, but do it to give you the spirit of the argument, and hope you can show us where we are both wrong, as I certainly think we are. A. The argument is not at all an uncommon one, and was discussed at some length in our Notes and Queries some months ago; the question came to us in terms almost identical to those of your letter and the "school" among your friends which discredits the possibility of a ship's being supported by so small a quantity of liquid, may be consoled to hear that it created a somewhat heated argument among some of our specialists, who are at least practised controversialists in such problems as well as trained in physics. All your reasoning on the subject is entirely sound, except where (perhaps quoting another) you refer to the hypothetical conditions arising if the ship could be placed on one side of a balance and the gallon of water on the other. It is unquestionably the case that if a "Dreadnought" were placed in a drydock of so nearly the same shape and size that it were at no place more than 1/100 of an inch away from the hull, and that 1/100 of an inch thick space filled with water up to the load waterline of the ship, the ship would actually *float* (a gallon of water would not begin to fill such a space in the case of the "Dreadnought," it would take 50 gallons at the very least, but the *amount* is beside the point, and may be referred to as a gallon). The gallon of water does not *balance* the ship; it is the difficulty of getting away from the idea of balanced weights that causes so much controversy on the subject. One is inclined to think that the enormous weight of the ship must *squeeze out* the thin film of water and rest on the bottom, forgetting the pressure due to head, which is independent of the thickness of the film. It is of course true that the weight of water displaced by a floating ship is equal to the total weight of the ship, i. e., the ship weighs as much as the quantity of water which *would* fill the space occupied by its submerged part *were the ship not there.* What would balance the ship in your case is not the gallon of water in which it floats, but something that is not there, namely, the quantity of water which would fill the same space were the ship removed, and which would have to be there filling the imaginary dock up to the same level in order to create at the bottom of the dock the same hydrostatic pressure as is caused in the 1/100-inch film by the weight of the ship. That such a pressure may be present in so thin a film to balance the weight of the ship is unquestionable; it is an absolute axiom of physics that the pressure of water is directly proportionate to its depth entirely regardless of the shape or size of the containing vessel. If you have a closed box a foot square and a foot high, full of water, and a pipe of only ¼ inch diameter projecting from the top to a height of 233 feet (the "head" corresponding to 100 pounds per square inch pressure) there will be 14,400 pounds pressure on the bottom of the box, exactly as if the box were a foot square all the way up to 233 feet; and in exactly the same way sufficient hydrostatic pressure to support the ship may be transmitted in your 1/100-inch film. You may therefore tell your friend that as far as purely hydrostatic principles are concerned, he may safely claim that he can drink—not, we hope, at a sitting, but in a month or two—"enough whisky to float a battleship."

(11077) J. M. asks: Am I correct in thinking that the Mitchell lifeboat (a rough sketch of which has been sent you under separate cover) should pull easier against a heavy wind than the lifeboat at present in use on both sides of the Atlantic? This boat, being covered and smooth, pulls fast with only four oars, draws very little water and easily steered, weight 1,400 pounds, seated for 24 persons. It seems to me that a boat made on this plan, large enough to require 8 or 10 oars to propel, that the open boat must be the hardest to pull against a heavy wind with all the men offering resistance to the wind as they sit in their positions; the open boat must also offer a good deal of resistance, especially in descending a wave. I would like to know how the weight of this covered boat compares with the open boat of the same capacity. A. We should certainly say that a lifeboat as shown in your sketch would pull more easily against a head wind than the ordinary lifeboat, supposing it to be submerged to the same depth. Whereas, for the purposes of comparison, it may be considered roughly as an ordinary lifeboat with a lid on, one would at first sight suppose that a boat of that structure would be heavier than an ordinary lifeboat of equal capacity, but on account of the cigar-like shape lending itself to greatest rigidity with least material, we should say that your boat could be built with no more, and possibly even less, weight of material than an equivalent boat of older pattern.

(11078) J. T. asks: Will you kindly explain through your columns a phenomenon observed while looking at moving pictures? The wheels of rapidly-moving vehicles sometimes revolve in one direction, sometimes in another, and sometimes are stationary relative to their axes. I explain this as follows: If the interval from the moment the spoke of a wheel leaves any certain position till the following spoke occupies that position coincides exactly with the interval between each successive photograph, then the wheel will appear not to revolve. If the interval is shorter for the wheel, it will seem to revolve in a contrary direction; if longer, it will revolve in the direction of the vehicle. As this apparent absurdity detracts from the realism of certain pictures, perhaps a discussion of the laws involved may lead to improvements. A. Your explanation of the phenomenon of a revolving wheel on a vehicle in a moving picture is, we think, the correct one. There does not appear to be any way in which it can be remedied. It is inherent in the nature of the motions of the apparatus.

(11079) W. W. S. asks: Will you kindly inform me what causes the compass to point north? Is it the influence of the North Star or the North Pole? Has the North Star any influence or control over the compass? A. The magnetic needle comes to rest pointing north and south because the earth acts as if it were a great magnet. A compass needle would come to rest pointing lengthwise of a bar magnet placed under the compass needle, just as it does under the influence of the earth. For this reason we think of the earth as a great magnet. The North Pole and the North Star have no influence over the compass needle.

(11080) L. G. McA. asks: Kindly advise me in your Notes and Queries column if it is possible to intensify a thin negative which has fairly good details but is in such a condition because taken in such strong light, such cases as happen at the seashore in most amateur photographing. If you can give me a solution with operation for same, your kindness will be appreciated by a reader. A. The best intensifier we have ever used is prepared as follows:

Solution No. 1.

Mercuric bichloride	240 grains
Ammonium chloride	240 grains
Water, distilled	20 ounces

Solution No. 2.

Ammonium chloride	240 grains
Water, distilled	20 ounces

Solution No. 3.

Part A.

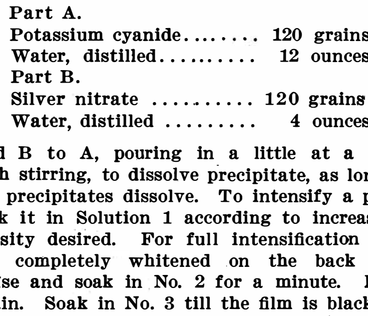
Potassium cyanide	120 grains
Water, distilled	12 ounces

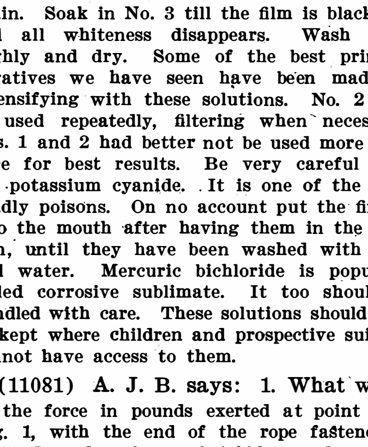
Part B.

Silver nitrate	120 grains
Water, distilled	4 ounces

Add B to A, pouring in a little at a time, with stirring, to dissolve precipitate, as long as the precipitates dissolve. To intensify a plate, soak it in Solution 1 according to increase of density desired. For full intensification soak till completely whitened on the back side. Rinse and soak in No. 2 for a minute. Rinse again. Soak in No. 3 till the film is blackened and all whiteness disappears. Wash thoroughly and dry. Some of the best printing negatives we have seen have been made by intensifying with these solutions. No. 2 may be used repeatedly, filtering when necessary. Nos. 1 and 2 had better not be used more than once for best results. Be very careful with the potassium cyanide. It is one of the most deadly poisons. On no account put the fingers into the mouth after having them in the solution, until they have been washed with soap and water. Mercuric bichloride is popularly called corrosive sublimate. It too should be handled with care. These solutions should both be kept where children and prospective suicides cannot have access to them.

(11081) A. J. B. says: 1. What would be the force in pounds exerted at point *A* in Fig. 1, with the end of the rope fastened at point *D* and a force of 1,000 pounds pulling at point *B*, the other end of the rope? The direction of the two parts of the rope is such as to make the angles between *A* and *D*, *A* and *B*, and *B* and *D* 120 degrees each. A. The force exerted at point *A* is the resultant force of *D* and *B*, or 1,000 pounds.





2. Please explain the term "triangle of forces." A. If three forces acting at the same point balance each other, they are proportional to the sides of the triangle formed by any three straight lines parallel to their directions. Example: In triangle *ADC* of Fig. 2 we have angle *C* equal to 90 degrees and angles *A* and *D* each equal to 45 degrees. Let side *AD* or the hypotenuse of the triangle represent a force of 1,000 pounds. Then, by

the use of the following rule the other two forces $A\,C$ and $D\,C$ can be found. Rule for right-angled triangles: The side opposite an acute angle equals the sine of that acute angle multiplied by the hypotenuse of the triangle.

Therefore $A\,C$ = sine of $D \times A\,D$,
and $D\,C$ = sine of $A \times A\,D$.

From table sine of A and D or 45 deg. = .707
Therefore $A\,C$ and $D\,C$ = 707 pounds.

(11082) C. J. H. asks: What is the most desirable formula for making soap bubbles? I am in doubt in regard to the amount of glycerine and soft soap to use and as to whether there were any other ingredients that could be added to advantage. A. A good soap bubble solution is not to be obtained by simply mixing soft soap and glycerine. It is very difficult to secure a good solution. Only the purest oleate of soda, or the best white soap, white Castile for example, can be used. Only the best glycerine can be used. Price's glycerine is reliable. The manipulation is tedious. If, however, you wish to undertake it, proceed as follows: Take the purest caustic soda 1 part, and dissolve in distilled water 40 to 50 parts. All parts by weight, of course. Take pure oleic acid. Set it for a few days in a refrigerator and decant the clear fluid, if a separation takes place. Of this take 7 parts, and mix with the soda solution. Shake till the reaction is complete. Now add water up to 350 parts with the previous water. To two measures of the oleate of soda add one measure of Price's glycerine. Run no risk with poor glycerine. Let this stand a few days in a cool place, and siphon off the clear solution, which is to be used for soap bubbles. Some add a little ammonia to this, but it works well as we have given it.

(11083) M. E. P. asks: 1. I am operating a single-phase light plant with about 800 lights. My transformer and lines are nearly all overloaded. Could I raise the voltage from 1,000 to 2,000 volts and use 200-volt lamps in place of 100-volt, or would it be better to parallel the secondary coils in the transformer and still run 100-volt lamps and change the generator to 2,000 volts? A. An additional generator to relieve the overload is a more natural solution of your difficulty than to change all your lamps and transformers, since 2,000 volts is a much greater strain on the insulation everywhere than 1,000 volts is. 2. What voltage is required to make a 15-inch spark, such as is given by a static machine? A. We have not exact data at hand for the voltage required to force a spark through 15 inches of dry air under all circumstances. A paper read before the American Institute of Electrical Engineers showed that 150,000 volts were required to force a discharge between points, and that a different pressure was necessary if spheres, disks, etc., were employed. We have from time to time published valuable papers concerning the work of Prof. Trowbridge, of Harvard University, in this direction. These can be had for ten cents each. 3. Is the current or discharge from a static machine giving 15-inch spark, such as is used in X-ray work, dangerous? Will it produce death? A. A discharge through 15 inches of air is a very dangerous current to encounter. Any discharge from a coil capable of giving such a spark should be avoided. The only safe rule is not to touch the secondary while the coil is active; and if necessary to touch any part of the apparatus, to place the hand not in use behind the back. No circuit can then be made through the body from arm to arm. 4. Will the 200-volt lamp last as long as the 100-volt? A. One of the largest lamp makers says of 200-volt lamps: "Owing to the increased strain to which the carbons or filaments are subjected by the high voltage, these lamps are uncommercial except in the lower efficiencies. The efficiency of our regular product is 4 watts per candle, and in its average life and maintenance of candle power it corresponds to our standard 100 to 125-volt 3.1 watt lamp." This shows that it will cost more to run a 200-volt lamp than a 100-volt lamp for the same candle power.

(11084) B. W. L. asks: If a bridged, grounded telephone wire came in contact with one wire of a lighting circuit carrying 5,000 volts, would there be any disastrous effects to either? A. It would be very bad for the telephone. You would need to put in a new one, since there would not be much left of the old. 2. If one wire of this lighting line were to break and fall across the telephone wire, what would be the probable effect. A. If these wires were bare, the best course would be to call out the fire department immediately. In the description which you give of what took place in your case, we judge that there was no contact of bare wires, and perhaps no wires came into contact at all. The swinging of the light wire near your telephone wire would produce all the phenomena you describe; while the fact that you could get no circuit from the ground showed that the wire had not broken and fallen anywhere along the line.

(11085) J. R. H. asks: Do you have a SUPPLEMENT that treats of intercommunicating telephones and setting up and construction of same? A. We have no article giving practical details on this point. You can find various systems described in Miller's "American Telephone Practice," price $4 by mail.

(11086) O. M. S. asks: 1. How may opaque objects be seen under the microscope? A. By the use of the bull's-eye condenser, a lens which will focus the light of a lamp upon the upper surface of the object. One of these usually accompanies a microscope. 2. How can the glimmering of artificial light be overcome? A. If the light is too strong turn the reflecting mirror till the field is illuminated to suit your eye. Shaded glasses can be had from dealers in microscopes which cut down and also color the light agreeably. These may be blue or gray. They are also made so that they are deeper in color in one portion than in another, and a nicer adjustment may be made of the illumination. 3. Will the best window or plate glass do for glass slips to use with a microscope of sixty-five diameters? If not, why? A. Any sort of glass will answer if it is smooth. It is better to buy the regular slips. These are 3×1 inch and are polished on the edges. They present a much better appearance than pieces of glass cut and left rough. 4. What proportion should the liquid, zinc and carbon be for a bichromate cell? A. A good bichromate mixture is composed of water 100 parts, potassium bichromate 17 parts, and sulphuric acid 10 parts, all by weight. The zinc and the carbon may be of any size which the battery jar will hold. It is better to have a carbon on each side of the zinc, two carbons to each zinc. This gives a larger current and utilizes the action on both sides of the zinc. 5. How to make an induction coil which will not induce a current strong enough to kill a person. A. A good induction coil is described in SUPPLEMENT, No. 160, price 10 cents. It is not necessary to injure one's self with a large coil. A simple rule for safety is to put the left hand in your pocket or behind your back when doing anything to the coil with the right hand, if the coil is running. 6. What are the preserving fluids used in the museums and laboratories? A. Alcohol is the fluid ordinarily used in museums for preserving specimens in jars and bottles.

(11087) R. B. asks: Could you please tell me why a lamp chimney becomes heated when placed on a lighted lamp, glass being diathermanous for luminous rays of heat? A. A lamp chimney becomes heated because there is a hot mass of matter inside it. So does the earth's atmosphere by the sun's rays. The atmosphere absorbs about 40 per cent of the rays of the sun, so that they do not reach the earth at all. The flame of a lamp is luminous from solid particles of carbon in the flame. This radiates heat. The glass intercepts much of that heat, and by this it is itself heated. There is no substance which can transmit all the heat which strikes it. Glass becomes hot in the sun's rays.

(11088) L. H. H. asks: 1. What size spark should an induction coil give in order to give satisfactory service on a one-mile wireless telegraph "line"? A. A coil giving a 4 or 6-inch spark will work over a distance of one mile for wireless signals under ordinary circumstances. You will find a 4-inch coil described in SUPPLEMENT No. 1527, and one for a 6-inch spark in SUPPLEMENT No. 1124, each 10 cents. 2. What is a polarized relay? A. A polarized relay is one with permanent magnets, so that the armature is easily drawn over as soon as the current starts. 3. Would a 150-ohm relay such as used on commercial lines work on the above-stated wireless telegraph line? A. We think a 150-ohm relay will be sufficient for a distance of one mile.

(11089) G. W. S. asks: 1. What causes the percentage of oxygen in the air to remain constant when such enormous quantities are being constantly consumed by animals and direct combustion? A. The plant world takes the carbon dioxide which animals exhale and breaks it up again, forming other products and restoring the oxygen to the air again. The processes of nature balance, and there is as much decomposition as there is formation in the long run. 2. Will not a given tank or reservoir empty itself more rapidly of water if provided with a vertical outlet pipe extending in a downward direction and of considerable length, than if provided with the same size hole discharging directly into the air? Would not the increasing velocity of the water as it falls through the pipe cause a partial vacuum in the upper part of the pipe, thus drawing the water out of the tank more rapidly? A. The quantity of water discharged through a vertical pipe is not increased by lengthening the pipe. As the velocity of the falling water is increased, the stream leaves the sides of the pipe and has a smaller cross section. Thus there is an air space around the water in the lower part of the pipe, and the water does not fill any vertical pipe through which it flows freely. You could not draw water out of the side of such a pipe. This would prove that the pipe was not full of water. There is no pressure on the side of such a pipe.

(11090) P. J. L. asks how to make tracing cloth. A. 1. Boiled linseed oil (bleached), 10 pounds; lead shavings, ½ pound; zinc oxide, 2½ pounds; Venetian turpentine, ¼ pound. Boil for several hours, then strain, and dissolve in the strained composition 2½ pounds white gum copal. Remove from the fire, and when partly cold, add oil of turpentine (purified), sufficient to bring it to proper consistence. Moisten the cloth thoroughly in benzole and give it a flowing coat of varnish. 2. Varnish the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry. Try a little piece first with a small quantity of varnish. The kind of cloth to use is fine linen; don't let the varnish be too thick.

(11091) H. H. H. asks: 1. In central station telephone exchange work, where they have party lines with as many as four 'phones connected with the switchboard with only two wires, how is the operator enabled to ring any one of the 'phones she wishes without disturbing the others? I understand they use an alternating current for ringing, and that the 'phones are all alike in construction, that any one of them could be used in place of any other one, that is, they are interchangeable, provided that the connections in the instrument are properly changed. Is this right? Of about what potential is the current that is ordinarily used to actuate the ringer movements? A. The methods for selective calling upon party lines of telephones are divided by Miller into three classes: 1. Those employing step-by-step movements for completing the calling circuit. 2. Those employing currents of different directions or polarity. 3. Those employing currents of different frequencies for actuating the different signals, a harmonic system. These several methods are fully discussed and described for 37 pages in Miller's "American Telephone Practice," which we send for $4, to which we would refer you for further information. 2 In winding the armature of a D. C. shunt motor, to carry a current of say ten amperes, is it necessary to select a size of wire that will carry ten amperes without heating, or is one of a five-ampere capacity large enough? Does not the current, on entering the armature, separate, and flow half around one way, and half the other? And how does the rule apply in the case of a dynamo? A. In a direct-current motor armature as ordinarily wound and connected, the current divides at one brush and goes in opposite directions, uniting at the opposite side at the other brush. Each side carries but half the current, and thus need be wound with wire of a size suitable for half the current. 3. Can you give directions for recharging a battery of dry cells with a dynamo? About how many amperes would you force through, and for how long? Is the voltage of the charging current an essential factor? A. We have had no experience in recharging dry cells with a dynamo or otherwise, and do not think the game is worth the candle. The voltage of the charging current should be about 2 volts per cell in series.

(11092) A. J. C. asks how to polish German silver. A. Take 1 pound peroxide of iron, pure, and put half of it into a wash basin, pouring on water, and keeping it stirred until the basin is nearly full. While the water and crocus are in slow motion, pour off, leaving grit at the bottom. Repeat this a second time, pouring off into another basin. Cleanse out grit, and do the same with the other half. When the second lot is poured off, the crocus in the first will have settled to the bottom; pour off the water gently, take out the powder, dry it, and put both when washed clear of grit, and dried, into a box into which dust cannot get. If the silver work is very dirty, rub the mixture of powder and oil on with the fingers, and then it will be known if any grit is on the work. If the work is not very black, take a piece of soft chamois leather, and rub some dry crocus on, and when well rubbed, shake out the leather, and let the powder fall off that is not used, or rub it off with a brush. Do not put down the leather in the dust.

(11093) J. V. B. says: Is it a scientific fact that when a fluid issues from an orifice, a rectangular aperture for example, the flow, which just after issuing is rectangular in section like the hole, twists about so that a short distance from the orifice the section is a rectangle having its corresponding sides at right angles to those of the hole? A. It is a fact that a fluid, issuing from a rectangular orifice, twists about in position as you describe. This is due to the fact that fluid rushing through the corners of the rectangular orifice tends to flatten out after leaving the orifice, while that part of the fluid coming through at the sides tends to bulge, thus giving the effect of apparently twisting in the flow. We have no SUPPLEMENT articles with regard to this matter, and we know of no published data on the subject.

(11094) B. F. B. asks: I wish to procure the best method for drilling glass. A. For drilling glass make a solution of 1 ounce gum camphor, 1½ ounces spirits of turpentine, and 3 drachms of ether. Keep the end of the drilling tool wet with this fluid. The sharp corner of a freshly broken point of a file is one of the best drilling tools for this purpose.

(11095) L. E. B. asks: Does the space occupied by the spokes in a carriage appear to be filled with black dots when the moving carriage is seen through a lace curtain? I did not notice it when the carriage moved rather slowly, but when it was moving at a brisk rate. A. The phenomenon of the moving wheel viewed through a mesh of lace is due to the persistence of vision. Through the openings in the lace we see only a part of the spokes, and then this part disappears. We thus get a discontinuous view, broken more rapidly as the carriage moves more rapidly.

(11096) W. W. G. says: We would consider it a great favor if you will have the kindness to advise regarding driftwood fire powder. This is a powder which, as we understand it, is thrown on the fire and produces the same lights as driftwood does. Kindly advise if possible where same can be obtained. A. We do not know the composition of the driftwood powder. You can, however, make driftwood for yourself, which will give a color equal to any, by dissolving chloride of copper in water. Use a wooden pail for this, since it will corrode a metal pail. Place pieces of wood endwise in the solution, and allow them to soak till they are well saturated. Then dry them, and throw some pieces upon a bright fire. They will show the colors of the burning copper. A pound of copper chloride will make a great deal of driftwood.

(11097) F. S. J. asks: 1. Can you tell me what a wattless current is? How is it caused? A. The so-called "wattless current" is the component of the total current which is in quadrature with the energy current. It may be found explained in Sloane's "Electricians' Handy Book," which we send for $3.50. 2. Why do telephone companies always ground on a cold-water pipe? I know of a case where a lineman carried the ground wire past a hot-water pipe to a cold-water pipe. Why not ground on a gas or steam pipe? They are all connected to the ground. A. We cannot tell why telephone companies "always ground on a cold-water pipe," since we have just examined ours and find it grounded on the hot-water pipe. It is not proper to infer that a thing is always done in a certain way because we have never happened to notice it done in any other way. There is no reason for grounding on one pipe rather than the other. Gas pipes should not be used because of risk of setting fire, if a break occurs. 3. Is there any point on the American coast where there is no ebb or flow of tide? Is so, where is it? A. We do not know of any place where there is no tide. There are places so situated that a tide flowing one way meets a different phase of a tide from another direction and a very small change of tide results.

(11098) G. A. R. asks: 1. A spark cannot be passed between two electrodes separated by a vacuum. Are we to infer from this that a vacuum is a perfect insulator? A. A perfect vacuum would be a perfect insulator. 2. The distance separating two particles can be halved. This second distance can then be halved and so on—according to mathematics, infinitely—which would require infinite time. Yet practically it can be accomplished in a finite time. How is this explained? A. It is quite true that mathematical zero cannot be reached by the successive division of a number by two, or by halving a certain space. But that need disturb no one. It is easy to reach a value less than any assignable value, and that is practically zero. Thus in the case of our money. When a sum has been halved successively till it is reduced to less than one mill, the process must end, since there is no denomination in which to express the value. Practically the problem you present is a logical quibble, of interest only to a mathematical quibbler. There ought always to be common sense back of logic, but unfortunately it is not always plainly visible.

(11099) A. A. F. asks: 1. How do they get this very low zero you speak of in February 10, 1906, No. 9887? A. Absolute zero is computed from the behavior of gases when cooled. Their contraction leads to the belief among scientific men that all heat would be gone from matter if it were cooled to 459 deg. F. below zero. 2. What is the lowest natural temperature known, and the lowest artificial cold yet produced? A. The lowest thermometer reading ever reported upon the earth is from a self-registering thermometer which was left for a number of years in the Arctic regions. It showed 95 deg. F. below zero. Previous to this the lowest observed was at a place in Siberia, 90 deg. F. below zero. 3. Please explain this. Haswell on page 879 asks: How many fifteens can be counted with four fives, operation

$$\frac{4 \times 3 \times 2 \times 1}{1 \times 2 \times 3} = \frac{24}{6} = 4.$$

A. The formula you give for fifteens to be made from four fives is the ordinary formula for combinations demonstrated in algebra. You will find it in any large algebra. 4. Why is it colder at the south pole than at the north? A. The southern hemisphere is largely covered with water, hence it is colder. The earth is farthest from the sun in July, which is the mid-summer month of the southern hemisphere. This makes the summer there a little colder than the northern summer.

(12000) E. H. asks: Would you kindly inform me where I could find a good description of Marconi's magnetic detector which is used in connection with a Wheatstone recorder? How are the inductance coils that are used in both the receiving and sending station wound and what size wire is used? What is the resistance of the choke coils used in the receiving circuits? A. You will find the Marconi magnetic detectors described in Maver's "Wireless Telegraphy," which we can send you for $2. Several sizes of choke coils are also described in the same book, as also are the induction coils.

(12001) J. D. writes: I have purchased some selenium for the purpose of making electro-light experiments, about which I have read so much in technical papers. I think it must go through some sort of a process before it can be used, for I find it to be a poor conductor of electricity. With a 1,000-ohm telephone ringer not the slightest effect is produced upon so delicate an apparatus as a telephone receiver. A. Selenium is not a conductor of electricity in any condition. It is a better conductor after it has been prepared than in the ordinary condition. It is kept for several hours at a temperature just below its melting point. It is then spread over the space between parallel wires, better wound upon a porcelain tube, so that the two wires are quite near together. When it has cooled it is in the sensitive state. The current sent from one wire to the other will be increased by allowing light to fall upon the selenium cell, as it is called. The resistance will be several hundred ohms probably at the lowest. We would advise you to apply to the professor of chemistry or physics at the university in your city. These men are always glad to give advice and assistance to others.

(12002) R. S. McF. asks: Would you kindly explain how I could use a 100-volt induction motor on a 110-volt current? I tried one way by connecting a 10-volt lamp in series with it, but had no satisfaction. A. A small resistance coil placed in series with your motor will take up the extra ten volts and enable the motor to run with safety. The wire must be of a size which will carry the current without heating too much. The small lamp you used was not able to carry the current required. Its filament had too high a resistance to allow current enough to flow for the motor, and so the motor did not get current enough to turn it.

(12003) C. W. asks: In your issue of February 10, 1906, page 137, Notes and Queries (No. 9887), you state that absolute zero is —459 deg. Is it a fact that scientists have accepted this as absolute zero? On what is it based? How was it determined? And how is it measured? What does absolute zero mean? Is it a condition of temperature at which no heat whatever exists or is radiated? A. It may be positively stated that all modern scientists accept —273 deg. C. as absolute zero, or the temperature at which molecular motion would cease, all heat would be gone from matter. Astronomers believe that this is the temperature of the space outside of the earth's atmosphere. The degree we gave, —459 deg. F., is the Fahrenheit equivalent of —273 deg. C. The idea of absolute zero is based upon the fact that all gases at the freezing point of water expand and contract by the same amount if the temperature is changed one degree and this amount is 1/273 of their volume if the temperature is changed one degree Centigrade. Since the volume of a gas is dependent upon its temperature it is evident that the cooling of a gas degree by degree will cause it to shrink proportionately till if it is cooled 273 degrees its power to shrink will be gone also; that is, all the heat will have left the gas. This reasoning is not weakened by the fact that the gas would change to liquid before the absolute zero is reached. Dewar has gone within a very few degrees of absolute zero in the attempts to liquefy helium. The absolute scale was devised by Lord Kelvin and is very frequently employed in giving temperatures in scientific papers. It is the only scale in which the degrees have a direct quantitative relation.

(12004) A. N. B. says: Will you kindly let me know how to boil a meerschaum pipe that has been in use some time, so as to color readily? Also how to fix the color in the pipe when it is once there? A. Ordinarily the pipe is boiled for coloring in a preparation of wax which is absorbed, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. They are first soaked in melted tallow, then in white wax. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Where the color has once existed it can be brought back by careful heating, which will drive the color out toward the surface.

NEW BOOKS, ETC.

AGE OF MENTAL VIRILITY. By W. A. Newman Dorland. New York: The Century Company, 1908. 16mo.; pp. 229. Price, $1 net.

The widely-quoted statement of Dr. William Osler, "Take the sum of human achievement in action, in science, in art, in literature, subtract the work of the men above forty, and while we should miss great treasures, even priceless treasures, we would practically be where we are to-day. The effective, moving, vitalizing work of the world is done between the ages of twenty-five and forty," might be the text of this interesting little volume, part of which originally appeared in the Century. The pages show that Dr. Dorland has gone into his investigation earnestly and faithfully; and he has cast into interesting and valuable tabulated form the records of four hundred men famous in all lines of intellectual activity, upon which his conclusions are based. Dr. Dorland is convinced, and most readers will find his claims convincing, that the age of the acme of mental activity, as shown by these fairly chosen records of the famous men of modern times, lies between forty and sixty, and that, provided health and optimism remain, the man of fifty can command success as readily as the man of thirty. It is a stimulating little book.

THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF SEWAGE DISPOSAL WORKS. By Hugh P. Raikes, A. M. Inst C. E., etc. New York: D. Van Nostrand Company, 1908. 8vo.; pp. 414; fully illustrated with photographs. Price, $4.

Whereas the chemical and biological aspects of sewage disposal have been fairly fully dealt with by a number of more theoretical scientists there has been no recent publication dealing as fully with experiment and practice. This need Mr. Raikes's work seems to completely supply, being a record of fifteen years experience of the practical application of approved principles in the design and construction of sewage disposal works. Due credit is given for the initiation of experiments and the publication of valuable reports by the Massachusetts State Board of Health, but the book deals principally with sewage works in England, where the congestion of urban centers is so much greater and more frequent, the pollution of the much smaller streams and estuaries consequently greater, so that the need is more urgent and developments have been more rapid there. Particular methods of sewage disposal highly successful in one case will not necessarily prove equally satisfactory elsewhere owing to wide divergence of local conditions, but Mr. Raikes's experience as a consulting engineer has given him exceptional facilities for collecting, comparing, and coordinating the results of different methods and he presents his information not merely as a collection of clearly classified data valuable to the sanitary engineer desirous of comparing the results of the best practice, but in a manner interesting to the non-technical public.

FORGING. By John Lord Bacon. Chicago: American School of Correspondence, 1909. 112 pp.; 8vo., fully illustrated. Price, $1.

Most of the publications of this school are practical condensations or simplifications, suited to the sometimes limited academic training of its students, of the subject matter of deeper or more complex text books, but we know of none of the contents of which less may be found elsewhere to take the place than the present work in forging. The author has obviously learned his subject in the workshop, but his position as instructor in forge-work at the Lewis Institute has given him a facility in explaining the reasons of what he knows to be the correct method which few expert smiths can possess. The book is full of simple practical instructions, illustrated by admirably clear diagrams for the performance of all simple and more complicated operations in blacksmithing as well as the making of a large number of tools—just the things that every amateur and many a professional smith wants to know but cannot find in large and more comprehensive works on metallurgy and mechanics—and it is brought completely up-to-date by descriptions of the operation of the latest labor-saving devices for mechanical forging and electric welding.

HANDBUCH ÜBER TRIEBWAGEN FÜR EISENBAHNEN. By C. Guillery. Berlin and Munich: R. Oldenbourg, 1908. 200 pp.; 93 ill.

This work consists of an exhaustive description of the construction and details of all the self-propelled passenger, inspection, and similar cars in use on the railways of the world, including electrical, gasoline, and steam cars. The necessity for and use of such cars being much greater in Europe, especially in the composition of multiple unit trains running at regular intervals all day into the suburbs of large cities and consisting of a single car at midday or of as many cars as may be required in the rush hours, it is not surprising to find the English and continental developments occupying most of the space, but the inspection and pay cars of the Union Pacific, Missouri Pacific, and C., R. I. & P. railways receive due attention and comparison. The author expresses no theoretical opinions and confines himself to a careful collection and comparison of methods and designs adopted and results obtained.

STEAM BOILERS. By C. H. Peabody and E. F. Miller. New York: John Wiley & Sons, 1908. 8vo.; 420 pp.; fully illustrated with diagrams and five folding plates. Second edition revised and enlarged. Price, $4.

A considerable amount of new material and illustrations and a chapter on superheating added to the first edition of "Steam Boilers," bring the present work up to date, the latter chapter especially being all that was required for completely covering the subject. Though the book is primarily intended as a college text book, it contains much more that is useful to the boilermaker, fireman, or amateur, than the average text book, and, which is more to the point, extremely little that is not readily intelligible to them. There is little of the mathematics of thermodynamics or strength of materials, such calculations as are given being relative to practical boilermaking, simpler calculations of the stresses in members, and the strength of riveted joints, etc. The customary size, form, method of staying, and system of firing of boilers for various purposes are carefully described and clearly illustrated, tables of properly proportioned grate areas and heating surfaces have been compiled from the best practice, the methods and conditions for testing materials used, and the construction of boilers are briefly described and the results adequately discussed of the most recent investigation on the exact nature, causes, and effects of combustion, corrosion, and incrustation. Not the least valuable feature of a thoroughly useful book is a table of the composition and comparative heating value of all common American fuels.

PRECIOUS STONES. By W. Goodchild, M.B. Ch.B. With a Chapter on Artificial Stones by Robert Dykes. New York: D. Van Nostrand Company, 1908. 12mo.; pp. 309. Price, $2.

After a general discussion of the subject, each form of gem is taken up in detail. Some of the illustrations are so good that it is hoped in subsequent editions their number may be very materially increased. There is an excellent glossary at the end of the book.

ALTERNATING CURRENTS SIMPLY EXPLAINED. By Alfred W. Marshall. London: Percival Marshall & Co. 18mo.; 82 pages. Price, 20 cents.

This is No. 33 of the "Model Engineer" Series, and gives a simple outline of the subject.

HYDRAULIC ENGINEERING. By F. E. Turneaure, C.E., and Adolph Black, C.E. Chicago: American School of Correspondence, 1909. 8vo.; 267 pp.; fully illustrated with diagrams and photographs. Price, $3.

The last of the text books of the Chicago School begins the hydraulics and leads up to the latest developments of modern uses of water power. The necessary formulæ for the measuring and calculation of rates of flow, power possibilities, pressure of, and strains generated by water under all conditions are given, and in accordance with the methods of the school, suitably to the general class of its students the development of each formula is carefully and simply shown. The second part of water power development does not seem to us comparably as good as the rest of the book. It is profusely illustrated with interesting photographs of large water-power works, with no very special reference to the text, and lettered diagrams from a number of sources are sometimes described in the text only by the names of the parts without reference to the principles involved or even to all the letters.

VALVE SETTING. By Hubert E. Collins. New York: Hill Publishing Company, 1908. 8vo.; 210 pp.; fully illustrated with photographs, diagrams, and tables. Price, $2.

In this work Mr. Collins has collected a number of articles by himself and others which have appeared in "Power," but in their collection and arrangement has made a complete series which tells a continued story of the whole art of valve setting. The elementary principles of valve setting and the use of Zeuner diagrams are explained in a manner intelligible to the practical mechanic who may have no theoretical training. The tracing of the action of the valves in detail is more complete than usual and explained by diagrams throughout admirably clear, and the application of the quite general rules first given for plain slide-valve engines to automatic and other cut-off, Corliss and all well-known types of engines is carefully shown.

THE FRESHWATER AQUARIUM AND ITS INHABITANTS. By Otto Eggeling and Frederick Ehrenberg. New York: Henry Holt & Co., 1908. Large 12mo.; 352 pp. Price, $2.

This volume gives clear and complete instructions to the amateur. It describes, and illustrates by some of the finest photographs ever taken from life, the great variety of plants, fishes, turtles, frogs, and insects that may be kept indoors in health and contentment. It furnishes information concerning food, treatment in health and sickness, methods of capture and handling, and what aquatic creatures will or will not live in peace together.

MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By J. S. and D. Reid. New York: John Wiley & Sons, 1908. 8vo.; 440 pp.; fully illustrated with photographs and line drawings. Price, $3.

The present issue constitutes a revised and enlarged edition of a former work under the same name, of which six thousand copies have been sold. The additions probably most valuable to the teacher—the principal purpose of the book being academic—are the assignment of a minimum time of execution to each problem such as would be allowed in a commercial drafting room and chapters on recent drafting room conventions as to the expression of details, bills of material, titles, etc., on working drawings. Beginning with simple instructions as to the use of instruments, lettering, and figuring, the student is taken through a complete course from the simplest to the most complex mechanism. The author professes only to give the elements of mechanic design, but if all the mechanical draftsmen knew as much about the *object* of the different parts of a machine—the slide valve for instance—as is given under "Engine Details" it would save much friction between designer, draftsman, and shop foreman.

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Inquiry No. 8885.—For manufacturers of the "Mysterious Ball" like that of Mr. Lepere's—a man in a ball.

Inquiry No. 8886.—For makers of bean harvesting machines.

Inquiry No. 8889.—Wanted to buy a machine which breaks and divides apricot stones.

Inquiry No. 8890.—For manufacturers of a milking machine.

Inquiry No. 8891.—For manufacturers of a patent vise with an attachment for boring small holes.

Inquiry No. 8893.—Wanted to buy a second-hand adding machine.

Inquiry No. 8894.—For manufacturers of an automatic camera for making photographs on pin trays, etc.

Inquiry No. 8896.—For the manufacturers of earthenware vessels.

Inquiry No. 8897.—For the manufacturers of the "Lid on" can opener.

Inquiry No. 8898.—For manufacturers of kites.

Inquiry No. 8899.—For manufacturers of steel balls used for cutting sapphires or jewelry and also corn crisp used in cleaning and polishing sapphires.

Inquiry No. 8900.—For the address of Electric Service Supplies Co.

Inquiry No. 8901.—For the address of the Electrose Manufacturing Co.

Inquiry No. 8902.—For the manufacturers of an axle grease known as "Ironside."

Inquiry No. 8903.—For firms dealing in motor cars to suit Indian climate.

Inquiry No. 8904.—Wanted to buy new or second hand machinery for making "bow type," mouse and rat trap springs and wire parts, single machine or full outfit.

Inquiry No. 8906.—For the address where Benz Gasoline Engine is built.

Inquiry No. 8907.—For address of New England Coil Winding Co.

Inquiry No. 8908.—For a dealer in tapes and cords for Venetian blinds.

Inquiry No. 8909.—For a machine to paint shade or blind rollers.

Inquiry No. 8910.—Wanted to buy a device for mending tin-ware without soldering.

Inquiry No. 8911.—Wanted to buy steamfitter's tools and screw-cutting lathes.

Inquiry No. 8912.—Wanted to buy an apparatus for counting currency of different denominations.

Inquiry No. 8913.—Wanted to buy machinery for shelling castor beans.

Inquiry No. 8914.—Wanted to buy a kettle without a bail but has a handle on the lid and clasps on the side to hold the lid. The kettle to be about 5½ inches high and 7 inches in diameter.

Inquiry No. 8915.—For parties who sell plans and specifications for building ice boats.

Inquiry No. 8916.—Wanted to buy a shoe-shiner that can be attached to a wall with a last to fit any man's shoe.

Inquiry No. 8917.—For a manufacturer who will make palmetto brushes to order.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug.

Trace, D. McAulay	908,309
Traction wheel, M. Goodfellow	907,991
Transmission mechanism, R. E. Northway	908,419
Transporting apparatus, C. Kramer	907,819
Tray handle, H. Seward	908,042
Trolley, J. Franklin	907,984
Trolley guard and replacer, Schultz & Taggart	907,899
Trolley harp, Brennan & Mullen	908,068
Trolley switch, A. Palmros	908,031
Trolley wheel, C. M. Bradfield	907,746
Truck, W. F. Rachal	908,327
Truck, brick, H. H. Walsh	907,923
Truck, car, H. W. Wolff	907,934
Truck, equalizing, A. E. Brown	907,964
Truck, hay, F. A. Kime	908,106
Truck, lumber, M. Ackerman	908,372
Tube clamp and elevator, B. Andrews, Jr.	908,061
Tubing reinforcement, metallic, L. M. Passmore	908,127
Turbine, elastic fluid, S. Z. de Ferranti	907,981
Turbine, elastic fluid, O. Krahenmann, Jr.	908,280
Typewriting machine, A. T. Brown	907,730
Typewriting machine tabulating appliance, Dukes & Clayton	908,220
Typewriting machine tabulating mechanism, Dukes & Clayton	908,221
Umbrella, L. F. Teets	907,916
Umbrella, folding, F. G. Christensen	908,072
Valve, A. P. Broomell	907,729
Valve, W. M. Fulton	907,771
Valve, A. C. Ricksecker, Jr. 908,138,	908,139
Valve, F. E. Guyott	908,250
Valve, R. Koch	908,278
Valve, A. Lotz	908,413
Valve for furnaces, reversing, J. C. & J. A. Swindell	908,353
Valve for steam boiler water gages, check, W. D. Gelser	908.240
Valve mechanism for closet bowls, C. M. Eckland	908,224
Vault, burial, W. B. Hall	908,253
Vehicle driving wheel, electrically propelled, Balachowsky & Caire	907,715
Vehicle fender, A. L. McGregor	908,025
Vehicle, motor driven, Molesworth & Masterman	907,847
Vehicle steadying device, E. A. Sperry	907,907
Vehicle suspension system, C. W. Larson	907,822
Vehicle, toy, W. H. Fahrney	908,229
Vehicle wheel, H. M. Specht	907,906
Vehicle wheel, Newman & Davidson	908,026
Velocipede, C. C. Cleverdon	907,743
Vending machine, S. Kleinman	908,276
Ventilator, F. C. Kasch	907,813
Vessels, raising sunken, S. Lake	908,016
Vulcanizing mold, J. K. Williams	908,181
Wagon, dumping, H. W. Neal	908,417
Wagon end gate, H. M. Sheldon	908,339
Wall tie, T. J. McDonald	908,310
Washing machine, W. C. Foster	907,766
Washing machine, W. D. Whitney	908,057
Washline hanger, H. Gillar	907,777
Watch bow, H. Ginnel	907,779
Watchcase, F. Jacobson	908,103
Water closet seat, J. T. Knott	908,011
Water closet ventilating device, W. H. Cline	908,393
Water gage, J. O'Connor	908,122
Water heater, J. A. Dillon	907,756
Water heater, J. F. Miles	908.301
Water heater, C. A. Wood	908,370
Water strainer, H. Mueller	908,308
Water tank, C. H. Van Wagoner	907,920
Wheel, A. B. Day	907,750
Wheel clip attachment, fifth, W. A. Schleicher	908,334
Wheel regulator, tangential water, Boyle & Roller	907,725
Wheel truing brake shoe, J. M. Griffin	908.247
Whip socket lock, H. R. Arnold	908,062
Whistle, H. W. Aylward	908,063
Wick for wax matches, tapers, candles, etc., J. E. & G. W. Glenister	908.242
Winding drum rope guide, S. H. Libby	907.825
Windlass, A. D. Hulburt	907,803
Window, A. Corbeille	908,394
Window closing device, automatic, MacVicar & Magaw	908,020
Window lock, C. Rosine	908,143
Window screen, T. L. A. Hellwig	908.260
Wire fabric, Stuewe & Marquardt	907,914
Wire reeling and unreeling machine, J. Brott	907,963
Woodworking machine, P. J. Joecken	908,269
Wrench, H. B. Winfield	908,185

DESIGNS.

Automobile lamp casing, H. Saxon	39,734
Bottle, G. B. Beiderhase	39,730
Bottle, S. Loewenthal	39,731
Brooches, scarf pins, or similar articles, head of, Z. Freund	39,727
Electric fuse case, T. E. Murray.... 39,735,	39.736
Emblem, C. E. Hansen	39,723
Emblem, A. Schickerling....39,724,	39,725
Neck and chest protector, J. S. Mead, 39,732.	39,733
Pen box, desk tray, and paper weight, C. R. Smead	39,729
Plate, E. E. Walter	39,728
Souvenir badge, D. M. Westcott	39,726

TRADE MARKS.

Beer, M. B. Foster & Sons....72,027,	72.048
Belting, leather, Detroit Oak Belting Co.	72,038
Belts and back combs, ladies', Morris, Mann & Reilly	72,005
Beverages, certain, Ohio Mineral Water Co.	72,049
Bitters, F. J. Mampe	72,070
Blood forming and blood improving preparation, Aktiengesellschaft Hommel's Haematogen	71,984
Boots and shoes and overshoes, Hood Rubber Co.	72,044
Boots and shoes, leather, Civilian Shoe Co.	71,990
Boots and shoes, leather, Starner-Copeland Co.	72,015
Boots and shoes, leather and canvas, Allen-Foster-Willett Co.	71,985
Boots, shoes, and clothing, rubber, American Rubber Co.	71,986

Boots, shoes, and slippers, leather, D. Davidovitz 71,996
Boots, shoes, oxfords, and slippers, Cutler Shoe Co. 71,993
Bread, loaf wheat, G. F. Leipold 72,047
Butter, Hilmer Commission Co. 72,066
Buttons and buckles for personal wear, Appelbee & Neuman 71,987
Cameras, moving picture machines, and films, photographic, Ste des Etablissements Gaumont 72,032
Cane and corn syrups, compound of, Shreveport Syrup and Molasses Co. 72,054
Canned fruits and vegetables, Stevens Brothers 72,033
Canned salmon, Alaska Packers' Association 72,058, 72,059
Caramel paste, Borden's Condensed Milk Co. 72,078
Carbonated beverage, non-alcoholic, J. J. Tobin 72,075
Cathartic, B. D'E. Krembs 72,026
Certain clothing, Tootle Campbell Dry Goods Co. 72,017
Chairs and davenports, C. F. Streit Mfg. Co. 72,021
Chemicals, certain, Solvay & Cie 72,031
Chocolate creams, J. G. McDonald Candy Co. 72,045
Chocolates, Fuller-Greene Co. 72,040, 72,041
Chocolates, J. G. McDonald Candy Co. 72,046
Clams, minced, Quiniault Canning Co. 72,074
Clothing, certain, Frentz Biederman Co. 72,073
Cloths of wool, worsted, or hair, H. Longbottom 72,003
Coats and wraps, ladies' and misses', W. Fischman 71,997
Cocks, valves, and hose couplings, Pioneer Brass Works 72,008
Coffee, blended, Woolson Spice Co. 72,077
Coffees, W. McMurray 72,028
Corset stiffeners, Royal Worcester Corset Co. 72,009
Corsets, Sanger Bros. 72,010
Cutlery, certain, Cattaraugus Cutlery Co. 72,060
Disinfectants for waste pipes and sewers, C. C. O'Beirne 72,071
Electric supplies, certain, Crouse-Hinds Co. .. 71,992
Explosives and blasting caps and fuses, high, Eastern Dynamite Co. 72,064
Face powders and face creams, J. A. Schmitz 72,011
Flour, wheat, Red Wing Milling Co. 73,052
Fruit and vegetables, hermetically sealed, Griffin & Skelley Co. 72,023
Gloves, G. A. Moss 72,006
Gloves, leather, California Glove Co. .. 71,989, 72,000
Heaters, steam and hot water, Pierce Butler & Pierce Manufacturing Co. 72,072
Lamp shades and reflectors, C. J. Branch 72,020
Laundry machines, certain, Troy Laundry Machinery Co. 72,082
Macaroni, Atlantic Macaroni Co. 72,035
Magazine, Carter's Ink Co. 72,079
Medicated chest protectors, Scott & Co. 72,012
Medicinal preparation containing albumen, Tropon Works 72,055
Medicinal product, A. von Poehl 72,076
Medicinal remedy for certain diseases, W. P. Cabler 72,037
Medicine for certain diseases, W. D. Bowen 71,988
Medicines for certain diseases, Franco-American Ferment Co. 71,998, 71,999
Medicines for treatment of certain diseases, Franco-American Ferment Co. 72,039
Metal, expanded, Chess Brothers, The Central Expanded Metal Co. 72,061
Metal ware and jewelry, solid and plated precious, C. Grunebaum 72,043
Milk, Franco-American Ferment Co. 72,065
Mineral water obtained by condensing ocean-water, J. W. Pack 72,050
Musical instruments, certain, A. B. Chase Co. 72,056
Paints, Dallinan & Cooper Supply Co. 72,062
Paints, asphaltic, Barber Asphalt Paving Co. 72,036
Pianos and player pianos, Lauter Co. 72,068
Piece goods, certain, J. Lonke 72,004
Polish for certain articles, H. C. Watt 72,018
Porcelain crockery and earthenware, C. G. Schierholz & Sohn, Porzellan-Manufaktur Plaue, G. m. b. H. 72,022
Remedy for certain diseases, Palmetto Chemical Co., Inc. 72,051
Remedy in the form of a pastil, M. B. Spellman 72,014
Ribbons, taffeta, L. & E. Stirn 72,016
Rubber boots and shoes and rubber and oiled clothing, Goodyear Rubber Co. 72,002
Sardines, Aktieselskabet Stavanger Blikemballag fabrik 72,057
Saw set, Henry Disston & Sons 71,983
Saws, Henry Disston & Sons 71,982
Shades, folding window, W. J. Abernethy 72,019
Shoes and oxfords, women's leather, Goller Shoe Co. 72,001
Shoes, leather, Sharood Shoe Corporation 72,013
Shoes, women's leather, D. Davidovitz 71,994
Smalt, W. C. Estes 71,795
Soap, J. G. Haas Soap Co. 72,024
Spices, Gasser Coffee Co. 72,042
Stogies and cigars, Draknel Co. 72,063
Syrups and sugar creams, certain, Rigney & Co. 72,030
Tablets, peppermint, A. Muller 72,029
Tea, A. Koppel 72,025
Tea, Ridgways Limited 72,053
Tobacco leaf, Luckett-Wake Tobacco Co. 72,069
Undershirts and drawers, F. Conde 71,991
Whisky, Edward & John Burke, Limited ... 72,080
Whisky, blended, John T. Barbee & Co. 72,067
Whisky, pure malt Scotch, G. S. Grant .. 72,081
Wine made in Villanova, red, G. Aquino 72,034
Wire, steel music, C. Newman 72,007

LABELS.

"Ammonia Laundry Soda," for laundry soda, National Chemical Co. 14,578
"Ceylana Tea," for Ceylon tea, Ceylana Tea Co. 14,574
"Diploma del Rey," for cigars, Las Dos Naciones Cigar Co. 14,572
"Freeman's Violet Talcum," for Talcum Powder, Freeman Perfume Co. 14,577
"Golden Rule Brand," for apples, P. G. Sheehy 14,576
"Highestgrade" handkerchiefs, for handkerchiefs, F. J. Crystal 14,579
"Nutrio," for nut chocolate, Huyler's 14,575
"Perfecto Garcia & Bros.," for cigars, Perfecto Garcia & Bros. 14,573
"Pirate and Traveler," for a game, New Idea Game Co. 14,580
"Superior Genuine Hand Made 2nd Growth Handles," for handles for tools, Hartwell Brothers 14,581

PRINTS.

"A Better Drink Never Came Out of a Bottle," for straight Bourbon whisky, A. J. Hensler 2,405
"Bull Dog Kraft Paper," for paper, Coy, Hunt & Co. 2,406
"Full Dress Tailor," for men's and boys' coats, vests, and trousers, Ed. V. Price & Co. 2,407
"Novelty," for ranges and stoves, Abram Cox Stove Co. 2,408

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.