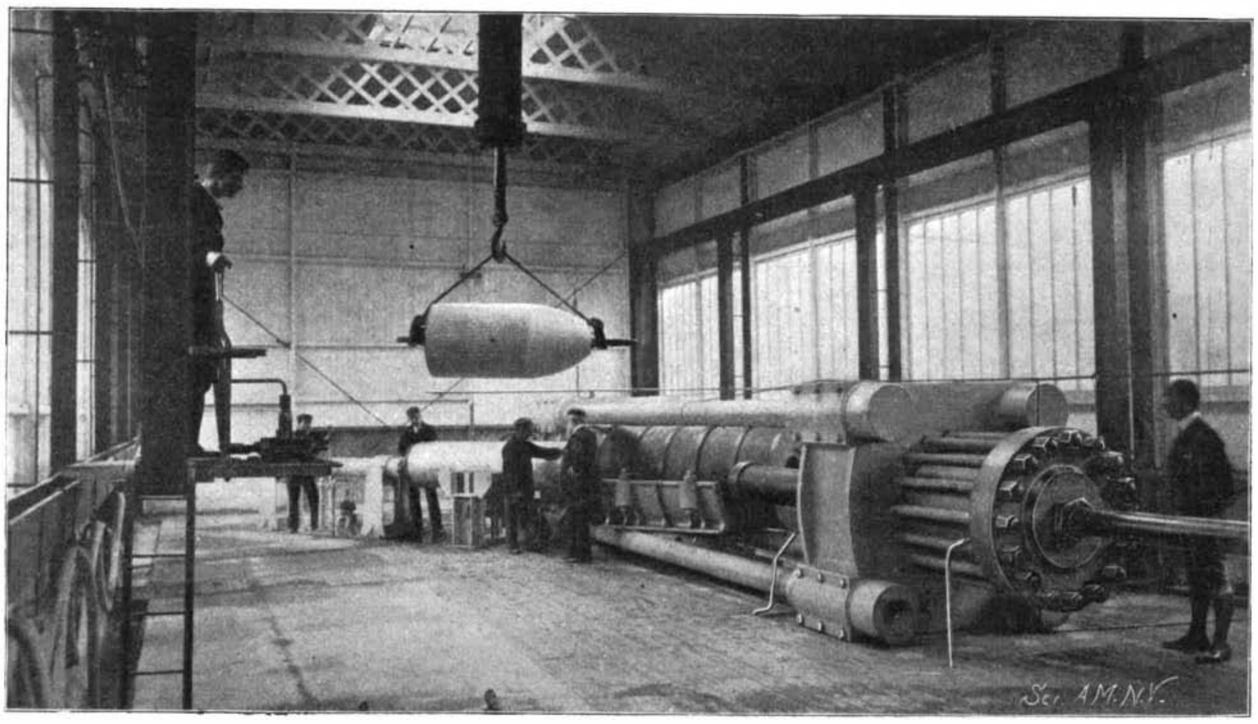
crib, and the cribbing ring laid in, the circular scaffold is so lowered that it is slung immediately inside the crib, and between it and the crib a stout rubber tube is provided which, being connected with the compressed air main, may be inflated, thus making an absolutely water-tight joint, compelling all the dropping water to flow to the crib channel, and thence to the pump sump. The circular opening to allow the free passing of the hoppet, is fitted with automatically closing doors, so that when the hoppet is above the scaffold, there is not only a complete floor for the bricklayers, but a dry and protecting roof for the sinkers.

Another important point is the advantage obtained by the guide ropes for the sinking frame. These serve as a steady for the hoppet when being lowered, thus abolishing all risk of a swaying rope when the banksman has improperly signalled for lowering. The motive power for driving the apparatus is compressed air. Experiments have been tried with electricity, but this motive power has not given very great success, while steam of course is out of the question. But the utilization of air serves a dual purpose; for since approximately 100 cubic feet of free air may be discharged from each drill in the bottom, it will be seen that the atmospheric conditions for the workmen are always highly satisfactory; a very important factor in shaft sinking

The rapidity of boring naturally fluctuates with the nature of the soil to be penetrated; but through hard limestone a speed of 30 feet per week 25 feet 6 inches diameter has been attained, with an average (including all stoppages) of 22 feet. In the softer and coal measures power drills are unnecessary and hand drills may be applied to the frame and the proportional speed of sinking equally well maintained. Another noticeable feature of this contrivance is that when the desired depth has been reached the greater part of the plant may be efficiently used for driving and general purposes.



PRESSING AND MOLDING GUNCOTTON IN SOLID BLOCKS OF HIGH DENSITY BY THE HYDRAULIC PRESS.

SCHNEIDER-CANET LAUNCHING APPARATUS FOR SUBMARINE TORPEDOES.

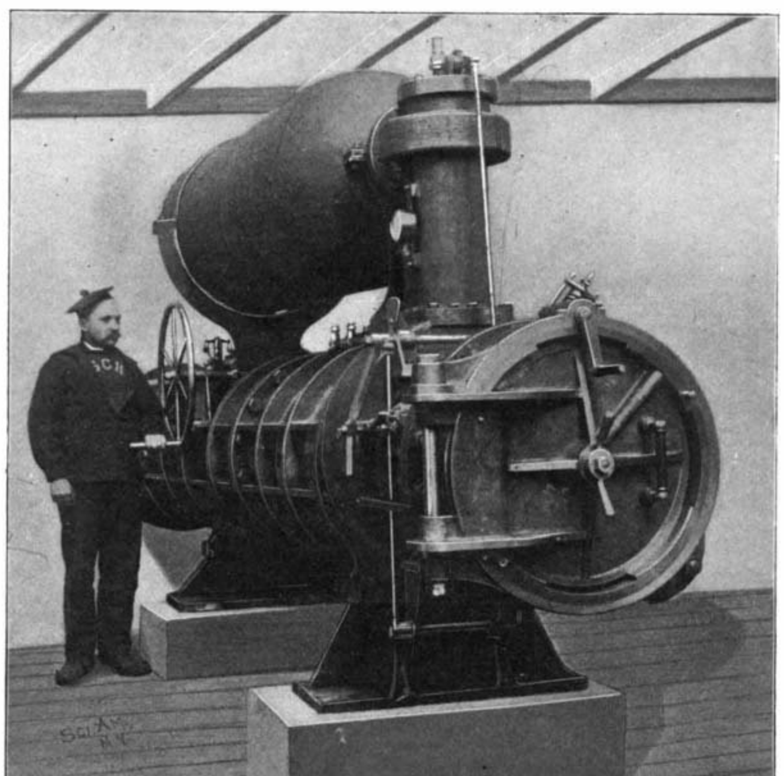
The Schneider-Canet torpedo launching apparatus consists essentially of a tube or barrel, a guiding spoon or bar, and a launching reservoir.

The tube proper is formed of a cylinder fixed to the side of the vessel and closed at one end by a gate, or valve, and at the other end by a breech-block. In this tube the spoon is arranged to slide, and is grooved to form guides for the torpedo.

This spoon is formed with a cylindrical portion and with a semi-cylindrical portion. The latter portion is formed with openings to permit the passage of the liquid, in order to regulate the pressure as much as possible on the entire surface of the torpedo at the moment of launching. The spoon is operated by means of a hydrostatic ram situated at one side of the tube. When the spoon has been run out, the launching of the torpedo is effected by means of compressed air, contained in the reservoir which is seen situated above the tube.

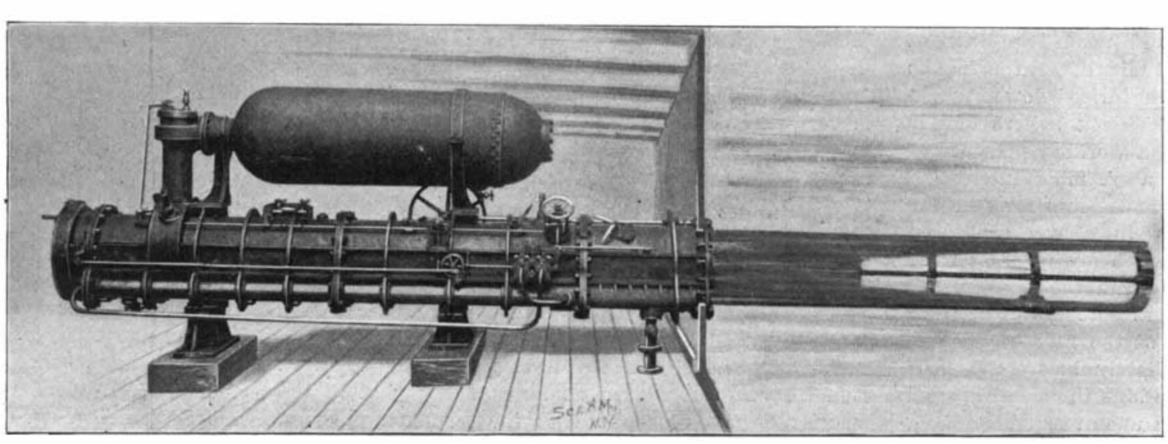
The gate being closed and the tube empty, the torpedo is launched in the following manner: The breech is opened; the torpedo introduced; the breech closed; the gate or valve opened; the spoon ejected; the torpedo launched; the spoon returned; the gate or valve closed; the tube is emptied, and the necessary precautions taken to prevent improper operation of the mechanism.

The necessary steps preceding the actual launching can be taken beforehand so that the torpedo can be ejected at any given moment or at command.



TORPEDO DISCHARGE TUBE; VIEW SHOWING BREECH CLOSED READY FOR FIRING.

The principal merits of this system are the following: First, simplicity of construction; second, durability; third, trustworthiness and regularity of launching; and finally, exact estimation of the time of launching by reason of the operator's precise knowledge of the volume and the pressure of air.



ADSIDE VIEW SHOWING GUIDE "SPOON" PROJECTED THROUGH SIDE OF VESSEL IN PREPARATION FOR LAUNCHING A TORPEDO.

HYDRAULIC PROCESS FOR MANUFACTURING GUNCOTTON CHARGES.

A new process of manufacturing guncotton charges for torpedoes, shells, submarine mines, etc., has been devised by the New Explosives Company, Ltd., of Stowmarket, England. Large charges are made by hydraulic pressure in a single homogeneous block, instead of being built up of a number of small segments. Hitherto it has not been possible to make a block exceeding a maximum weight of 9 pounds or over 2 inches in thickness in one piece. For instance, the number of small sections contained in the guncotton charge of an 18-inch Whitehead torpedo is about one hundred. The introduction of the hydraulic process has involved several important changes in the manufacture of the guncotton, particularly in the working up of the pulp, by which means all air is forced out of it. Several safety devices are introduced into the hydraulic machinery, by means of which all danger of detonation is absolutely obviated.

The guncotton pulp is first placed in a vertical cylinder made of finely-perforated sheet metal surrounded by a strong casing. Here all air that may be contained in the pulp is removed, which is a most important essential in the manufacture of the charge. A vertical shaft, equipped at the lower end with a small propeller-like screw and numerous agitators, fixed to a sleeve mounted to rotate independently of the propeller, descends into the vessel, and thoroughly disintegrates the pulp. The shaft not only revolves, but works up and down, so that the pulp is tightly compressed. By this means, all the water is forced out and it carries the air with it, through perforations in the cylinder. The cylinder is fixed to a table which has a perpendicular travel actuated by a screw. As the kneading proceeds and the charge is formed, the table leaves the screw, but the same pressure is excited by the agitators and propeller, and even distribution of the pulp is preserved throughout the charge, no matter what its length may be. One important point that has to be observed in the manufacture of the charge by this process, is that once the agitators have been set in motion, they must continue without cessation until the charge is finished; for should a breakdown occur, the agitators when restarted would cause a plane of cleavage in the block, which would subsequently result in a break at that point.

The accompanying photograph illustrates the machinery employed for the compression of the larger charges of guncotton. With this press blocks 2 feet 6 inches in diameter and 3 feet 6 inches in length can be produced. Moreover, the specific gravity of the guncotton is appreciably increased, being 1.523 as compared with the previous maximum gravity of 1.4. The perforated container in which the guncotton is placed is held within an outer holder, between which is a space for the admittance of water under pressure, which prevents the pulp being forced through the orifices in the container, and also acts as a lubricant when the guncotton is forced out of the container into the mold where the guncotton is forced into its desired ultimate form, by the hydraulic ram. The container, with its charge of guncotton, is attached on a cradle, fixed at an angle to the center line of the press. At the back of the container is a side hydraulic ram, which forces the guncotton from the container into the mold mounted on a swiveling carriage. The mold is constructed with an inner lining, divided longitudinally into two or three sections surrounded by a jacket, also in longitudinal sections, but more numerous than in the case of the lining. Outside this jacket is a thick casing, wire-wound to insure extra strength. Both the lining and its jacket are perforated to drain off the water, which escapes into annular channels provided between the jacket and the wire-wound casing. Provision is made, in case of an expansion of the guncotton charge, when the compression ceases, for permitting water to be absorbed by the guncotton instead of allowing the air to enter.

As soon as the guncotton is forced into the mold it is turned round, so as to come in line with the rams of the press. The lining and its jacket project slightly at one end and rests against the head of one ram, while an annular ring placed over the projecting lining and casing against the outer casing, rests against a corresponding annular ring attached to the head of the same ram. The guncotton is then compressed between the two rams. This operation completed, the rams are withdrawn, and the mold swung into alignment with the side ram, which forces it out onto a cradle.

There is one serious danger in connection with this process of hydraulic compression, which is, however, ingeniously guarded against. There is always the liability of a few fibers of the guncotton adhering to the side of the mold. The friction of the ram against the inside of the mold might ignite these particles when dry and detonate the entire charge within. To guard against such a possibility the head of the ram is grooved spirally, and at the bottom of the grooves are numerous fine perforations, through which water is forced, while similar orifices are provided in the face of the ram itself. This water acts as a lubricant and prevents particles of guncotton adhering to either the ram head or the mold, or if any fibers should so adhere they are kept in a wet condition. The great advantage of this system of manufacturing solid blocks of guncotton charges to fit any desired torpedo or shell is the saving of space within the missile. It has been proved that by this method about 15 per cent more guncotton can be contained within a specific area than with segment charges. Also, as the density is uniform throughout the block, detonation is far more perfect. According to results so far achieved, the cost of manufacturing is reduced by 25 per cent.

THE NEW YORK EDISON POWER STATION.

In few branches of steam and electrical engineering have the great advantages of concentration been so completely realized as in the mammoth power stations which are being built in the city of New York. The largest of these, at the present time, is the magnificent plant at the New York Edison power station which, when the whole of it has been installed, will have a maximum capacity of 125,000 horse power. A visit to a station of this kind teaches more in a half-hour regarding the remarkable advancement of the United States in mechanical and electrical engineering than can be gained in a whole day's study of the literature of the subject; for this vast aggregation of boilers, mechanical stokers, mammoth engines and generators, and all the thousand-and-one accessories with their endless devices for labor-saving, represents one of the very latest phases of our twentieth century development. With a view to making clear the general arrangement of the power house, we present, on our front page, a large sectional view through the engine room and boiler house, and also a diagram showing the means by which coal is taken up from barges in the river and carried to the 10,000-ton bunkers in the roof of the boiler house.

The power house, which occupies the block between 38th and 39th streets, First Avenue and the East River, extends 197½ feet north and south, and 272½ feet east and west, the western façade of the building fronting on the East River. A dividing wall extends longitudinally through the building, separating it into a boiler house 79½ feet in width and an engine house 118 feet wide. The boiler house is divided into four stories. In the roof of the building is a huge coal storage bin, capable of holding 10,000 tons of coal. The sides of the bin, which are carried on deep lattice girders, slope at an angle of 45 degrees to the floor, the weight of the structure with its load of coal being carried upon the side walls and upon two lines of columns which extend longitudinally through the building, as shown. The next two stories below are occupied by fifty-six Babcock and Wilcox boilers of 650 horse power, which are run at a working pressure of 175 pounds to the square inch. A most interesting feature of the plant is the arrangements for mechanical stoking. From the coal bin above, sheet-iron chutes lead down to hoppers which are placed on the fronts of the Roney stokers. From the hoppers the coal is fed by mechanical stokers onto the grate bars. The ashes fall from the grate at the rear of the furnace into bins located immediately below the floor of each boiler room. From the bins the ashes are led by chutes to ash cars which run upon tracks extending the full length of the basement.

One of the most spectacular features of the plant are the four great steel-plate stacks, each of which is 17 feet inside diameter, and extends to a height of 200 feet above the grate bars. These stacks are built of steel and lined internally with brick, the weight of each chimney being about 500 tons. The steel varies from ⅝ of an inch in the lowest portion of the chimney, to ½ an inch at its middle section, and ⅜ of an inch in the upper third. The lining of the lower third is of firebrick, and the rest of the chimney lining is red brick.

When every unit of this great plant is installed there will be sixteen Westinghouse-Corliss engines of 8,000 indicated horse power. Each engine will be direct-connected to its generator, and the units will be arranged down the building in two long lines of eight each. At present eight of the engines are installed and two are nearing completion. The other six will be added from time to time, as the business of the company calls for them. When running at 70 revolutions per minute, under 175 pounds steam pressure, the most economical capacity of each unit will be about 5,500 indicated horse power, but they will be capable of working up to a maximum of 8,000 horse power. The engines, which are exceedingly handsome specimens of the engine builder's art, are of the compound, vertical, three-cylinder type, with the high-pressure placed in the center and the two low-pressure cylinders on either side. The crank-shaft is built up in three forged sections with a 10-inch axial hole, which is reduced to 8 inches at the crank cheeks. The cranks are so arranged with regard to each other as to secure as even a turning moment on the shaft as possible. With a stroke of 5 feet at 75 revolutions, the piston speed is 750 feet per minute. The steam enters the 43½-inch high-pressure cylinder through a 14-inch throttle valve, thence it passes to a reheating receiver of about 4¼ times the displacement of the high-pressure and 7-10 the combined displacement of the two low-pressure cylinders. From the 75½-inch low-pressure cylinder the steam is led by 26-inch mains to the surface condensers, of which there is one to each engine. As shown in the drawing, they are located in the basement, each beneath its respective engine. Each of them contains 3,752 ¾-inch brass tubes, which give a cooling surface of 9,200 square feet. A point of interest in these engines is that they are the first engines of great size to be equipped with poppet valves, which were adopted because they lend themselves to the use of superheated steam. This form of valve lifts from its seat without any rubbing friction and, therefore, it does not involve those difficulties of lubrication which are often so troublesome when superheated steam is used. The low-pressure cylinders have double-parted Corliss valves. By means of a mechanical adjustment of the governor, which can be made while the engine is running, the speed of the latter can be varied at any time. In addition to this there is an electrically operated device for controlling the speed from the switchboard, for the purpose of synchronizing the alternators that are operated in parallel.

The fly-wheel is of cast steel in five segments, consisting of two arms and 72 degrees of the rim, which are joined by I-links, shrunk into pockets in the sides, the links being bolted to the hub. The generator armature is pressed onto the shaft beside the fly-wheel, and in addition to being keyed to the shaft, is bolted direct to the fly-wheel hub. The outer end of the generator shaft is supported by a heavy pedestal, as shown in our engraving. The total weight of the main shaft, which is 29 inches in diameter at the bearings, is 136,000 pounds.

We have spoken of the many labor-saving devices by which the operation of this vast plant is carried on expeditiously and at a minimum cost. Of these the most important is the system of bucket conveyors and elevators by which the coal is transported from the East River to the big storage bin. The coal is brought alongside the company's dock, opposite the eastern façade of the building, in barges, from which it is raised by a grab bucket operated from a cantilever conveyor derrick, and after being dumped into a screen, falls into an endless conveyor that carries it to the boiler house. Here it is unloaded into a vertical conveyor, by which it is taken to the roof of the boiler house and distributed through the length of the coal bin, which extends for 270 feet. A similar automatic disposal is made of the vast amount of ashes which is continuously being dumped from the ash pits of the boilers. The coal-handling apparatus is shown in detail in the sectional view in our front page engraving. For our information we are indebted to the engineers, Westinghouse, Church, Kerr & Co.

The University of Cincinnati has ordered from Alvin Clark & Sons, the famous telescope makers, a 16-inch refractor. The objective will be figured by C. A. R. Lundin, who has played so important a part in the success of the Clarks during the last thirty years. Ever since the death of Alvin G. Clark, Mr. Lundin has figured the large telescopes.

Correspondence.

George M. Hopkins.

To the Editor of The Scientific American:

In the death of Mr. George M. Hopkins science has suffered a great loss. By his pen and handicraft he had instructed a larger class than any professor in his lecture room and laboratory has the opportunity to teach. By his books and articles he reached many thousands and his printed words will still continue to inform and instruct multitudes to whom he will be only a name.

The leading characteristic of Mr. Hopkins' work was its genuineness. He printed nothing unless he had demonstrated its truth by actual experiment. His numerous designs of apparatus for the illustration of physical principles were all wrought out, mostly by his own hand, for he was a skillful mechanician, before they were given to the world. Many a time he came to me, saying: "I suppose you have always known this, or have always done this in this way, but I thought of it the other day, and wonder if it is new." He would proceed to show me some ingenious device which, so far as I knew, was novel. It certainly was original. It was in this way that his widely used "Experimental Science" was produced. Everything was tried before it was inserted. The book contains the results of his thinking and patient working for many years.

A controlling trait of Mr. Hopkins' character was his simplicity. In the scripture sense he was simple, a man without guile. He envied no one the most brilliant discovery. At the same time he desired to be protected in his own. The only person of whom in many years I ever heard him speak with impatience was one who had, as he thought, published without acknowledgement something he had obtained from him. His keen sense of honesty and fairness forbade such conduct.

Mr. Hopkins had numerous friends among scientific men of the vicinity in which he lived. For a number of years before the reorganization of the Brooklyn Institute upon scientific lines, there was in Brooklyn a club of men whose interests and occupations drew them together in scientific study. Of this club Mr. Hopkins was the sole officer, and the only one it ever had. The club ultimately became the Department of Microscopy of the Brooklyn Institute, he going with it into that organization. For several years he had been a sufferer from nervous disorders, and had been but little among his scientific friends. During this time he had, however, not been idle.

The suddenness of his exit from this life has terrors for some, but we are sure it had none for him.

A Personal Friend.

New Automobile Records.

On August 23 an automobile race was run on the Brighton Beach track under the auspices of the Long Island Automobile Club. The steam-carriage built by a Harvard student, George Cannon, naturally attracted the most attention. The record which it made of 1 minute 7 3-5 seconds for the mile, eclipses all records made by steam vehicles over any track or road. The best previous record for the mile on a track was held by T. E. Griffen, and was made at Chicago, the time being 1 minute 38 seconds. The best record on a straight-ahead course, was made by S. T. Davis, Jr., on May 31 of this year, on Staten Island, the time being 1 minute and 12 seconds. Cannon was barred from racing, but made his record in an exhibition mile. The other events, although interesting, did not result in the breaking of any records.

At Deauville on August 26, M. Gabriel, on a Mors car, beat the world's record for the kilometer, the time being 26 2-5 seconds, or 84 miles an hour. Not so long ago W. K. Vanderbilt, Jr., covered the same distance in 29 2-5 seconds, but his record was subsequently lowered by C. Jarrott to 28 1-5 seconds. Serpollet was the favorite for the race won by Gabriel; but the great Serpollet failed a hundred yards from the finish, when a steam joint gave away under enormous pressure.

Hezekiah Conant, who died a few weeks ago at his home in Central Falls, R. I., was an extremely useful and benevolent man. He had accumulated a great deal of money, and during his lifetime was noted for the generosity with which he made use of his wealth in order to help his fellows. In his early manhood he devised a number of minor implements which enabled him to cultivate his taste for invention, and in 1857 he designed and patented several mechanical improvements for the manufacture of thread of all grades, and ten years after he was at the head of a large business concern which bore his name at Pawtucket, R. I. This has been since consolidated with the Scotch firm of J. & P. Coats. The establishment at Pawtucket now covers about forty acres of land, and is valued at $4,000,000.