## NEW TEN-WHEELED PASSENGER ENGINE.

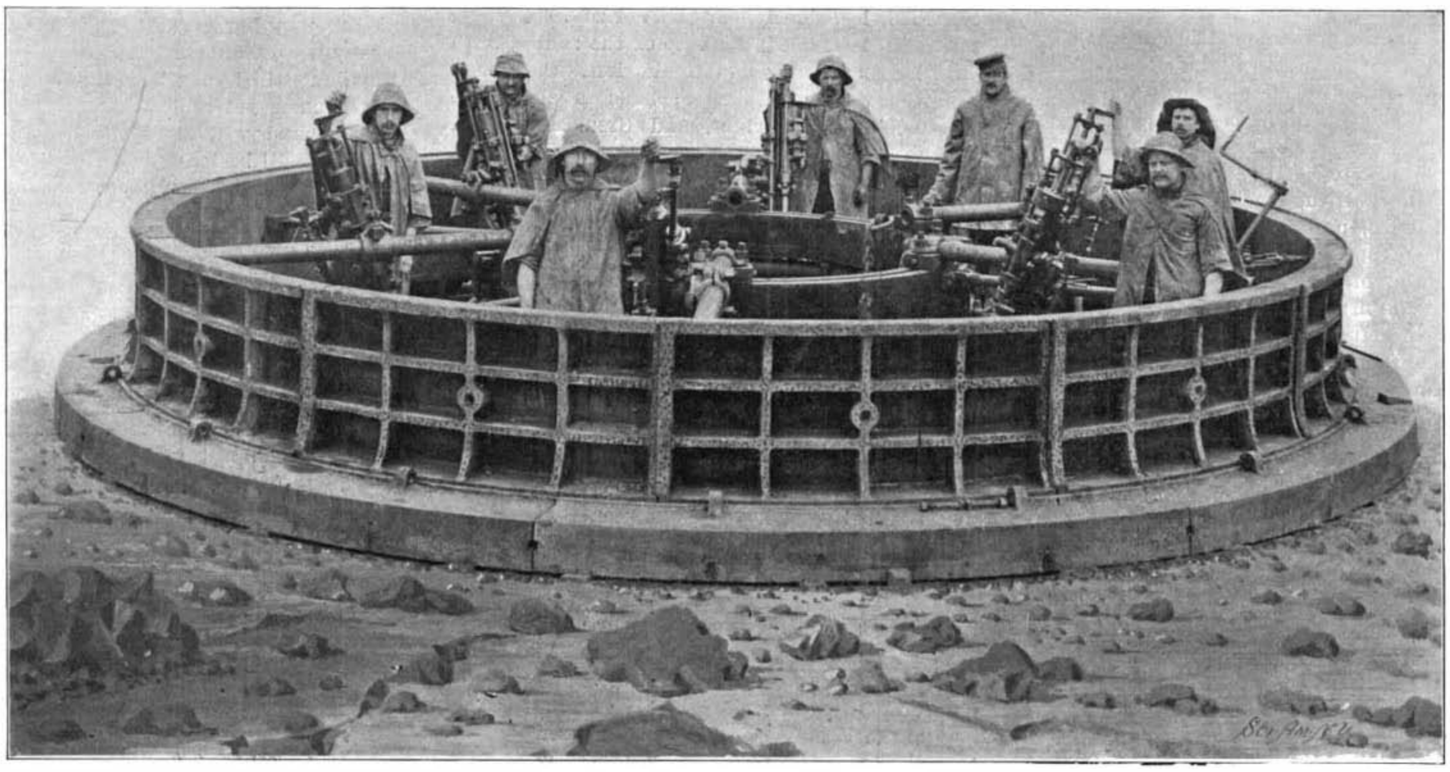
There have lately been built for passenger service of the Central Railroad of New Jersey twenty-five powerful and handsome locomotives. It will be seen from our illustration that No. 624 (one of the consignment) is of the six-coupled, ten-wheeled type, with wagon top, wide-firebox boiler, and a standard two-truck tender. There are a great many points of excellence in the design of this engine for the service in which it is to be engaged. The peculiarity of its contour, with two separate cabs, one for the engineer forward of the firebox, and another for the fireman in the customary position at the back of the boiler, is due to the fact that the boiler carries the wide firegrate designed to burn fine anthracite coal, and the great bulk of the firebox renders it advisable to place the engineer forward over the barrel of the boiler, where he has an unobstructed view. The unusual area of the grate, 67.7 square feet, is obtained by carrying the firebox out laterally over the rear pair of drivers. Its dimensions are: Length, 109 inches; width, 91 inches; depth at the front, 59½ inches, and at the back, 46 inches. It is provided with both rocking and water-tube grates, and the box is radially stayed to the outer shell.

The barrel of the boiler is 60⅞ inches in diameter at the front and 69⅜ inches at the throat. It is built of steel varying from ½ inch to 11-16 inch in thickness. There are 282 charcoal-iron tubes, 2 inches in outside diameter, the length over tube sheets being 13 feet 10⅛ inches. The heating surface in the firebox is 156 square feet and in the tubes 2,031 square feet, making a total of 2,187 square feet. The weight on the leading wheels is 41,000 pounds and on the driving wheels 120,000 pounds, making a total weight of 161,000 pounds. The weight of the tender loaded is 106,000 pounds. The cylinders are 19 inches diameter by 26 inches stroke and the drivers are 69 inches in diameter. The steam ports are 24.2 inches in length by 2 inches in width, and the least area of the exhaust is 65 square inches. Piston valves are used. They have a greatest travel of 5⅜ inches; a steam lap (inside) of 1⅛ inches, and a lead in full gear of 1-32 of an inch. The working pressure is 210 pounds to the square inch. The engine is of a decidedly handsome and imposing appearance, which is due partly to the great height of the boiler, whose center is 9 feet 5½ inches above the rail. We are indebted for our information to the American Locomotive Company, at whose Brooks Works this handsome engine was constructed.

## A NEW SYSTEM OF SINKING SHAFTS.

FROM OUR ENGLISH CORRESPONDENT.

A short while ago we described in the Scientific American the ingenious freezing process for boring shafts through sandy soil. We illustrate herewith another method applicable to all kinds of soil from sand to rock, which has been devised by the Hardy Patent Pick Company, of Sheffield, England, and which has already been submitted to practical tests with highly satisfactory results.

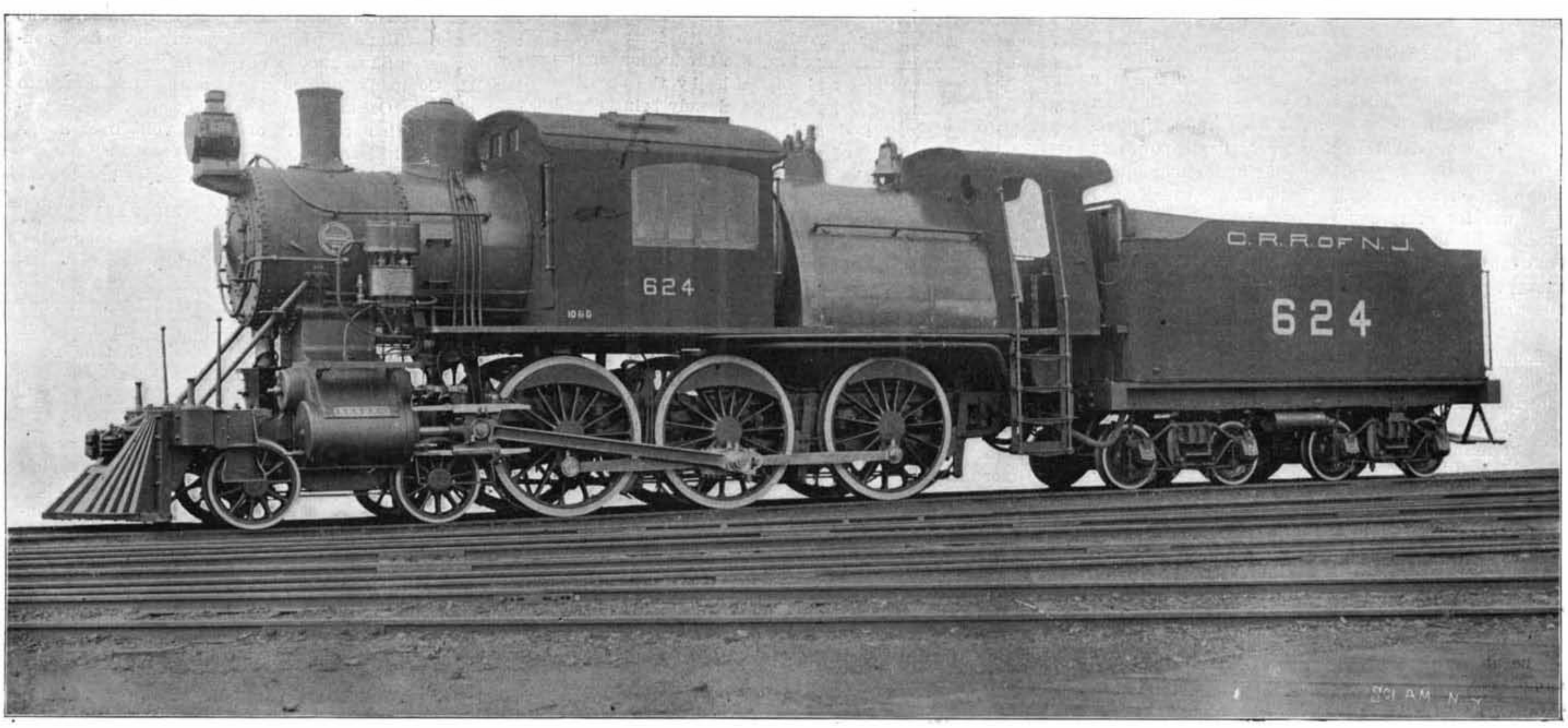


A NEW SYSTEM OF SINKING SHAFTS.

It is a curious fact that there have been comparatively few developments in the process of shaft sinking, either to minimize the cost of the undertaking or to expedite its progress. Yet the sinking of shafts must always necessarily be accompanied by enormous initial expenditure, such as the installation of surface plant. The process of sinking almost universally adopted, however, is either by the hammer and pick system, or by boring machines, and as a matter of fact under certain circumstances even now the latter process, although slow, cannot be equalled; but where rock or hard ground is encountered even the machine boring process becomes a very expensive and protracted operation. The appliance illustrated herewith is a decided improvement, in the way of utilizing a mechanical plant for shaft sinking, and in the north of England where it has been employed it promises to supersede all other methods of shaft sinking. The three most noteworthy characteristics of this invention are the speed of boring, the comfort and absolute immunity of the men working within the shaft from accident, and a decided minimizing of the risks generally incurred in such work.

Our illustration will supply a very comprehensive idea of the general appearance of the appliance. Two shafts each 25 feet 6 inches in diameter are at present being bored by this machine at a colliery at Mansfield, Yorkshire, and a description of the plant being used will supply a very good idea of its operation.

A circular steel frame, 8 feet in diameter, has cast in its entire circumference an annular tee-slot. Fitted in this slot are suitable clamps, each carrying telescopic arms, projecting so that the diameter over such arms corresponds approximately with the diameter of the shaft to be sunk. Upon these arms are mounted an improved form of compressed air drill, preferably two on each arm. This plant is put together complete on the bank and lowered by means of winch and guide ropes to the bottom. It will, therefore, be seen that the whole of the drilling plant can be lowered at once, and raised again after the completion of the boring, thus abolishing the slow and tedious methods of clearing the pit bottom. In fact, from the time of rapping to the lowering and starting of eight drills in the bottom, less than ten minutes have elapsed. This, however, is not the only feature in connection with the frame. Its circumference is so indexed that any number of holes may be drilled mathematically correct without the trouble of marking out, an item which has hitherto been of very serious moment, involving loss of time. Reducing this to actual figures, it may be taken that a round of 60 holes, 6 feet deep, can be drilled through hard limestone (25 feet 6 inches diameter) and the gear raised to the bank in two hours and a half, a result which we venture to think has never before been approached. In combination with the sinking frame a new form of scaffold has been introduced, by means of which bricking, or tubbing, can be carried on at the same time as the sinking. After a suitable spot has been found for the first



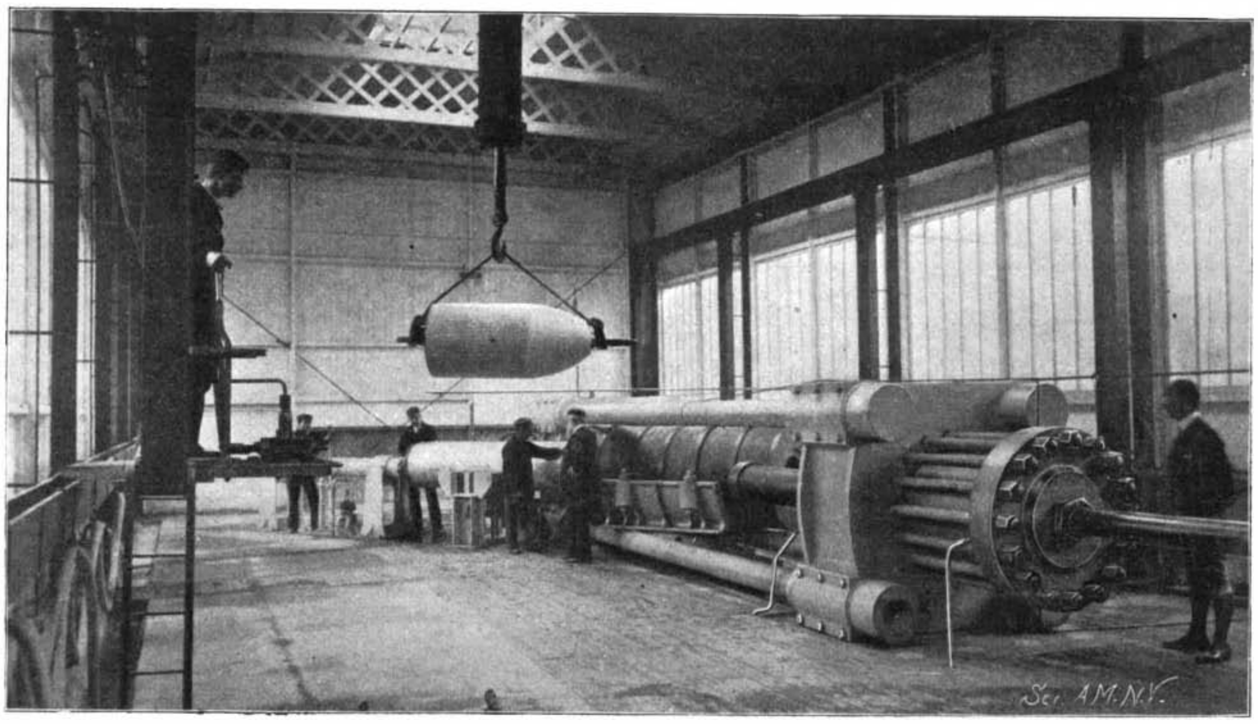

**Cylinders,** 19x26 inches. **Drivers,** 69 inches. **Heating Surface,** 2,187 square feet. **Weight,** 161,000 pounds.

NEW TEN-WHEELED PASSENGER ENGINE FOR THE CENTRAL RAILROAD OF NEW JERSEY.

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.

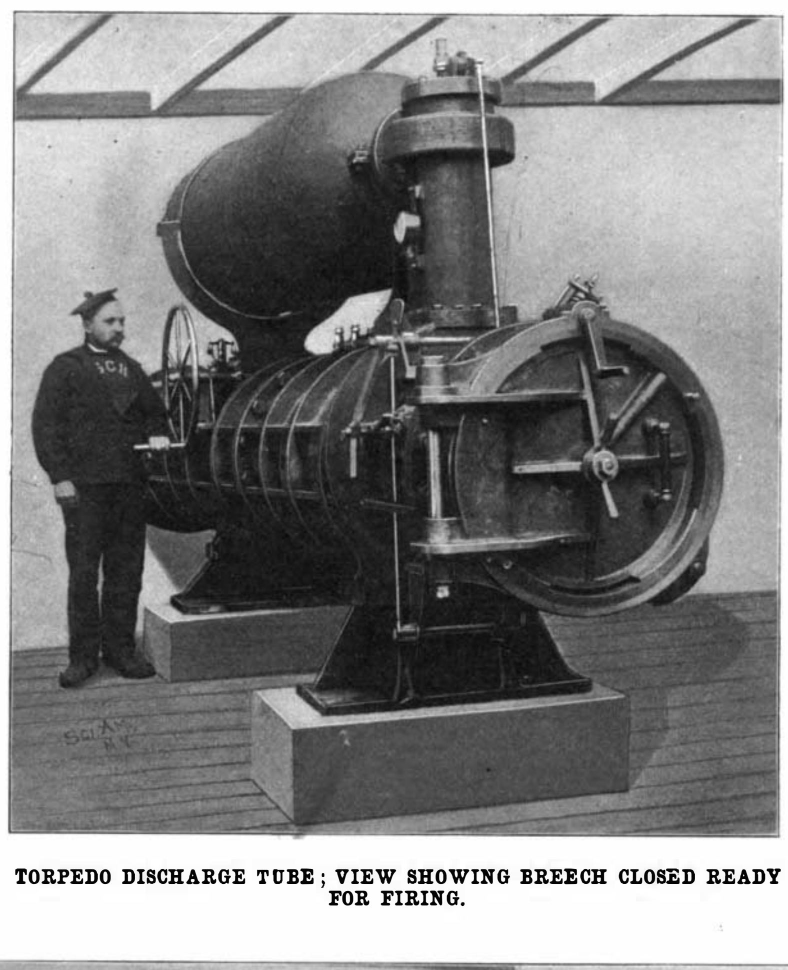
The tube proper is formed of a cylinder fixed to the side of the vessel and closed at one end by a gate, or valve, and at the other end by a breech-block. In this tube the spoon is arranged to slide, and is grooved to form guides for the torpedo.

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.

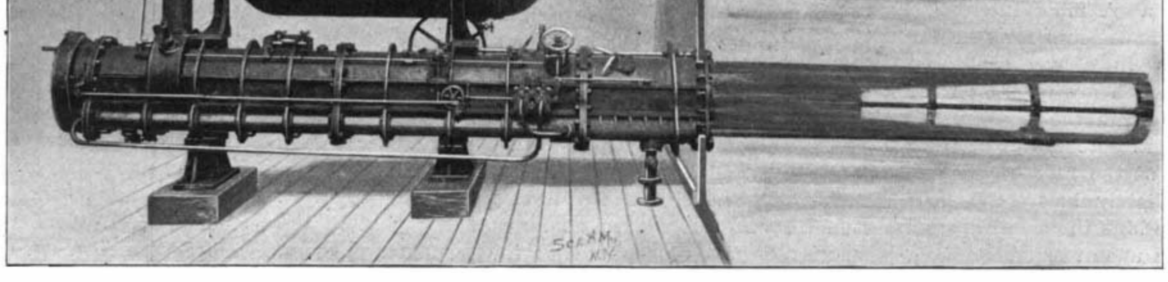
The gate being closed and the tube empty, the torpedo is launched in the following manner: The breech is opened; the torpedo introduced; the breech closed; the gate or valve opened; the spoon ejected; the torpedo launched; the spoon returned; the gate or valve closed; the tube is emptied, and the necessary 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.

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.



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



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-