

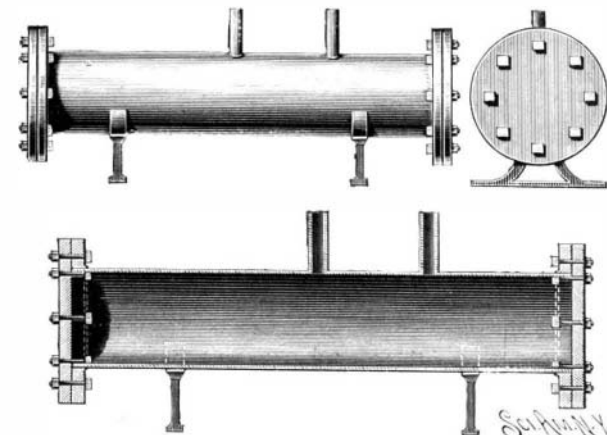
soil under Broadway. In construction, the shield consisted of a wood cylinder made on the principle of barrel staves clamped endwise between two cast iron rings, the front one being tapered to a cutting edge, while the back one was square shaped. Through this hydraulic rams, arranged equidistant apart around the circle of the shield, protruded, and when forced out by the pump fixed on the side of the shield, rested against the edge of the completed tunnel, an intervening buffer plate, composed of wood sheathed with iron plates, being provided to equally distribute the pressure of the rams. These were all connected by pipes to the pump, and all were pushed backward simultaneously. Separate valves attached to each ram enabled some to be shut off at pleasure; thus by increasing or decreasing the pressure on one side or the other, the shield could be diverted in its course to the right or left or upward or downward, and could be made to adapt itself to any of the conditions of the work, such as going around corners or taking a course nearer the surface of the ground or deeper in the earth, according to the exigencies of the case. The shield, in a word, was under the complete control of a single operator.

Extending rearward from the rear cast iron ring, and overlapping the end of the finished tunnel, was a thin metal hood about three-eighths of an inch thick, for a distance of three feet, in which the new tunnel work was built after the extended ram had been pushed inward.

The conditions surrounding the work were peculiar, because debris removed from the tunnel had all to be carried to the street through the basement and cellar of the building where the operations were begun. It was not possible to interrupt traffic in the street above, and access to the opening was effected through this cellar to the side street adjacent to Broadway. This shield was put in operation in 1869, the same year in which Barlow was engaged in putting his shield in operation in the work of the Tower subway in London. It will be seen that the main feature of this advanced method of tunnel construction was being introduced by different engineers in different continents at the same time without knowledge of each other's work, but the Barlow shield was constructed, it would appear, more on the principle of the early Beach shield of 1868, in which jack screws alone were used as a propulsive power, while the new form of hydraulic shield was a direct step in advance, and was, we believe, the first shield of its kind which was put into practical operation in which the entire shield structure was moved forward by hydraulic power.

The hydraulic shield has since that time remained the vital factor in nearly all great tunnel construction. It is probable that the most conspicuous example of its use is in the Blackwall tunnel under the Thames, in London, in which the largest shield ever used is

trates the method of operation and construction of the Beach shield. The remarkable similarity between the two is at once apparent, even in features of minute detail, and shows what little necessity there has been for change since the earliest days of this form of construction. By comparing the two structures we find nearly all the main features to be common to both. The cutting edges are of the same form, and the hydraulic jacks are mounted in the same manner, and the divisional platforms also appear, although their function was rather to prevent the sand from falling in mass into the shield than to afford a standing place for the laborers. In the cut, B is the cutting wrought iron rim; A is the wooden framework; D are the hy-



LABORATORY STILL FOR TAR.

draulic jacks; C are the retaining shelves, and F represents the pump connection.

In the larger view we represent the shield used in the St. Clair tunnel. It will be seen from an examination of this view that the shield as used there, as well as in the Blackwall tunnel, had a closed head or drum. The necessity for closing the head became evident in carrying on the work under the bed of rivers, and has always, we believe, been adopted under such circumstances. Of course in Mr. Beach's shield under Broadway, no such conditions existing, and no sudden flood of water being expected, the head of the shield was left quite open.

In this cut there also appears another feature not to be found in the early shield—namely, the movable arm for manipulating and putting the sectional plates in position. This is quite an independent construction, and although it is an exceedingly useful adjunct to the efficacy of the work, it can hardly be considered as a component part of the shield proper, as its function is merely auxiliary to the main work to be done by the shield.

To those who may not be familiar with the circum-

LABORATORY STILL FOR TAR.

Chemists who have had occasion to distill tar for one purpose or another in organic laboratories with ordinary equipment no doubt have frequently been perplexed as to how to secure a comparatively cheap yet efficient still. Glass retorts will not do as a rule, says the Pharmaceutical Review, to which we are indebted for engraving and particulars, on account of the water contained in the tar and the bumping caused thereby. Good copper retorts of satisfactory size are expensive and oftentimes not readily obtainable. A still of wrought iron pipe, however, can be readily made even in small cities. Such a still has given satisfaction during the past year in the distillation of pine tar, and for the sake of others may deserve description. Students, while working with charges of from 10 to 20 K° of tar, have not met with a single accident.

This particular still was made of a piece of 8 in. wrought iron pipe, 40 in. long, threaded for an inch at each end. Both ends are fitted with cast iron flanges, 14 in. in diameter and 3/4 in. thick. Heads of same diameter and thickness are bolted to the flanges by 3/8 in. x 2 in. bolts. Two 1 inch pipes lead out of the top of the still. One is used as exit tube for the distillate, the other as a safety tube. The still rests upon two cast iron legs, its center being 12 inches above the floor. It is heated by a low gas furnace. Large bottles surrounded by cold water are used as condensers.

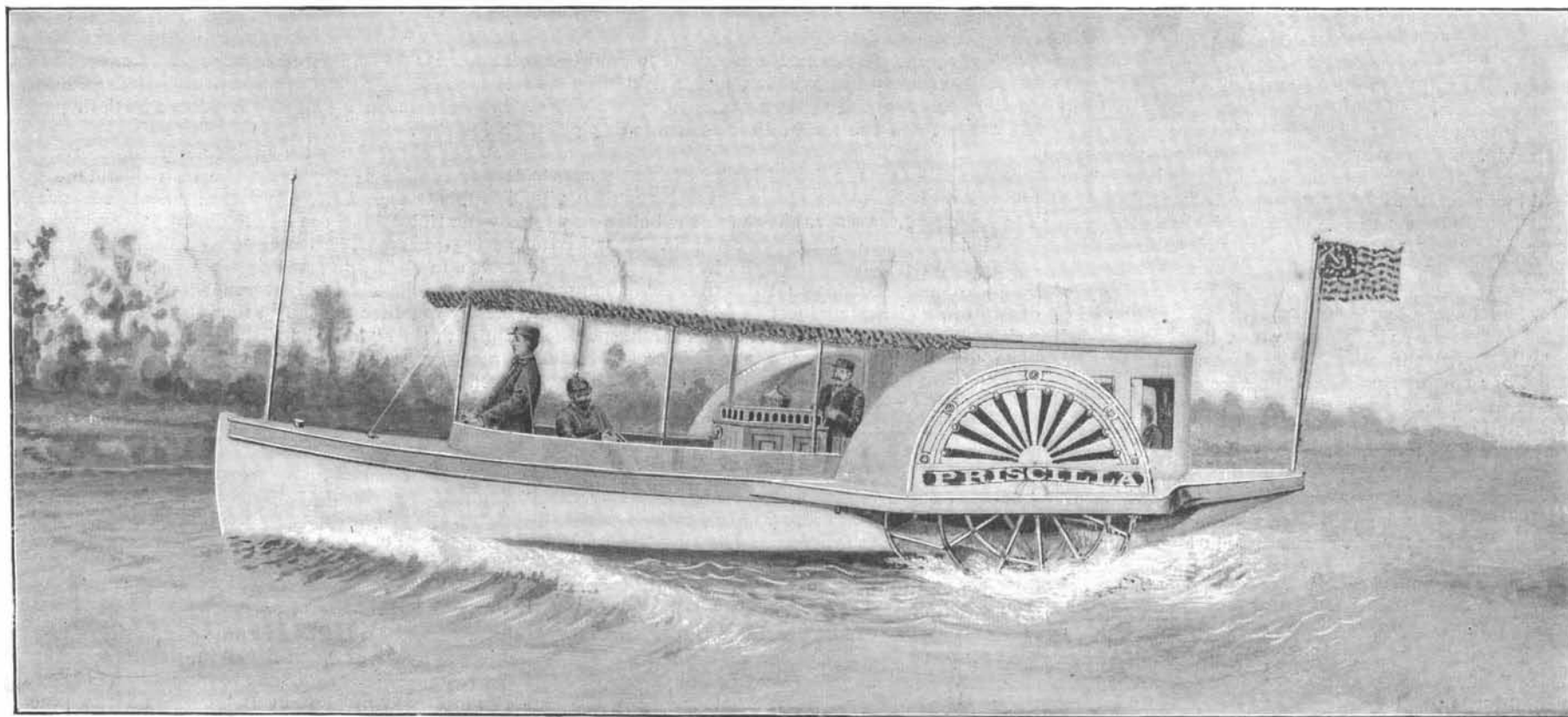
THE DAIMLER SIDE WHEEL LAUNCH PRISCILLA.

In the present issue we illustrate a recent production of the Long Island City factory of the Daimler Motor Company. The side-wheeler Priscilla is a little vessel designed for pleasure navigation, and which will doubtless attract much attention in Florida, whither she is destined to go.

The Priscilla is 30 ft. long and 8 ft. wide, drawing 13 in. of water. Her paddle wheels are 5 ft. in diameter and make 45 revolutions per minute, giving a speed of 8 to 9 miles per hour. The engine which drives her makes 540 revolutions per minute, so that the shaft is geared down from it in a ratio of 12:1. It weighs 840 lb. and occupies a central position in the hull.

The Daimler launches have the naphtha tank in the extreme bow, and the pipe for conveying naphtha to the engine runs along the outside of the boat, being partially sunk into the woodwork near the rail. Thence it is carried inward to the engine. Thus a fracture of the pipe, if a collision or similar accident should occur, simply results in letting any naphtha that may escape run off upon the water.

The vessel is of a novel and interesting type. For river work the absence of screws is particularly to be appreciated, on account of their liability to entanglement with floating or subaqueous vegetation—a trouble from which paddle wheels are almost exempt. So



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employed, the external diameter of the tunnel being 27 feet, as against 21 feet, the diameter of the St. Clair tunnel. It is a work of the first magnitude and importance and is now approaching completion. It is under the direction of Chief Engineer Mr. A. R. Binnie. We have reproduced an engraving from the London Engineer which represents a longitudinal section through the shield, showing how the work is now being conducted. We also reproduce a cut taken from the SCIENTIFIC AMERICAN of March 5, 1870, which illus-

trates the method of operation and construction of the Beach shield. The remarkable similarity between the two is at once apparent, even in features of minute detail, and shows what little necessity there has been for change since the earliest days of this form of construction. By comparing the two structures we find nearly all the main features to be common to both. The cutting edges are of the same form, and the hydraulic jacks are mounted in the same manner, and the divisional platforms also appear, although their function was rather to prevent the sand from falling in mass into the shield than to afford a standing place for the laborers. In the cut, B is the cutting wrought iron rim; A is the wooden framework; D are the hydraulic jacks; C are the retaining shelves, and F represents the pump connection.

stances surrounding the work under Broadway, it may be of interest to state that it was in pursuance of a well-formed plan to supply the residents of New York with an underground railway, to be operated by forced draught on the pneumatic system. The tunnel was constructed by Mr. Beach alone, at great expense, a distance of more than a city block, but the work finally had to be abandoned owing to the apathy of the general public. The tunnel, however, is still there, and is often visited by the curious.

small a side-wheeler is in itself a novelty. The motor used in connection with these boats has already been described in these columns and was fully illustrated and shown in SUPPLEMENT, No. 1024.

At the great salt deposits of New Iberia, La., the company described to ascertain the depth of the mass of rock salt, and sank a boring for the purpose. The drill penetrated through 600 feet of solid salt, the cores furnishing the evidence.