SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

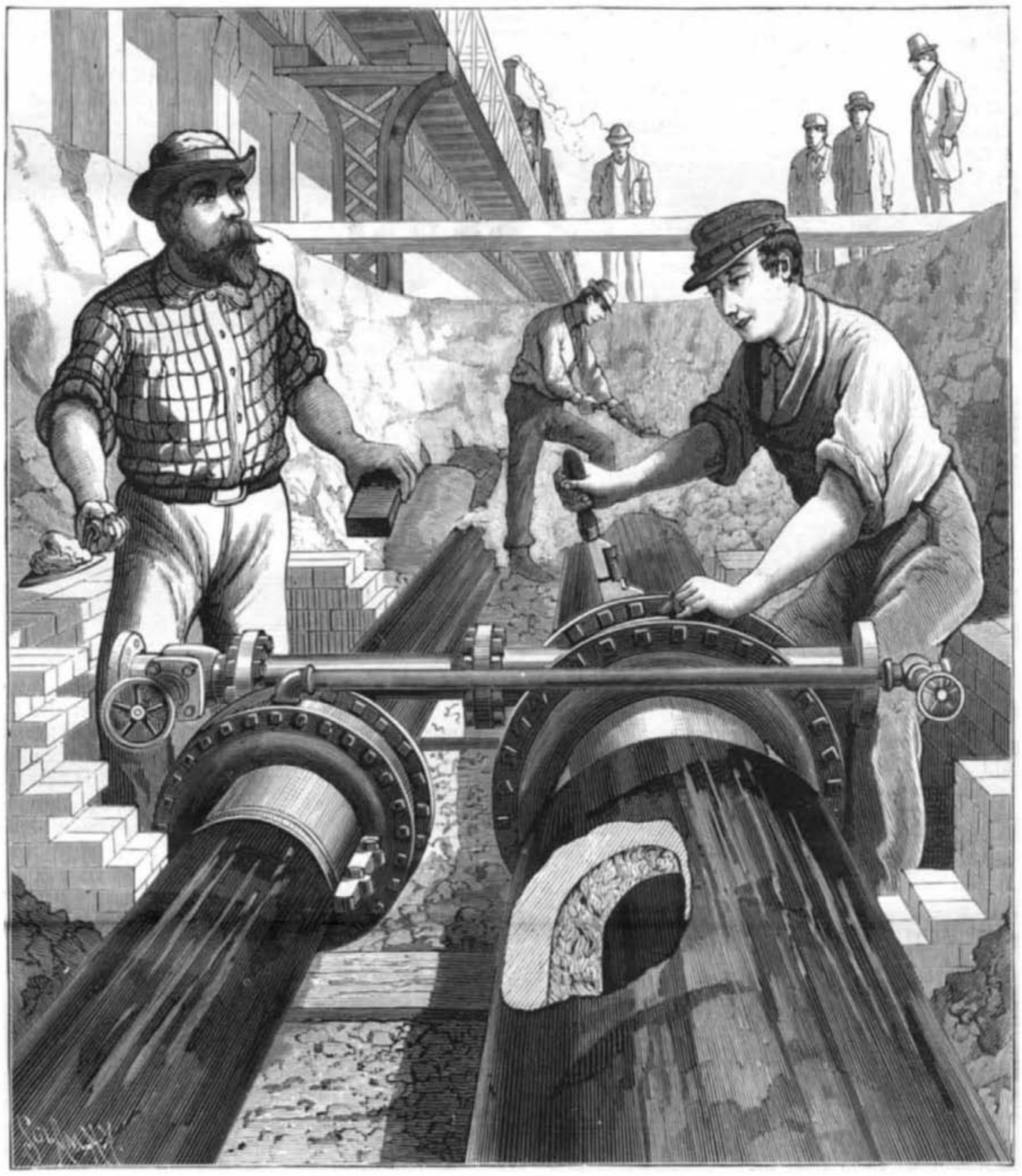
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLV.—No. 21. [NEW SERIES.] NEW YORK, NOVEMBER 19, 1881. [$3.20 per Annum. [POSTAGE PREPAID.]

THE DISTRIBUTION OF LIGHT AND HEAT IN NEW YORK CITY.

The tendency of the day toward the centralization of capital and effort, and the simplification of domestic service through more perfect organization in the supplying of our material wants, is strikingly illustrated in two gigantic enterprises now in progress in this city, both dealing in problems of vital importance in social and domestic economy, and both calculated to do away with time-honored customs and methods.

We have become used to elaborate and wide-reaching systems of conveyance, which have displaced the use of private carriages—to a large extent even the use of the means of conveyance which nature provides. Equally wide-reaching systems of telegraph and telephone lines have brought every man in the community within hailing distance of every other. Our water supplies are laid on in every apartment by means of public water systems employing scores of miles of large aqueducts and thousands of miles of smaller pipes. Night is converted almost into day for us by illuminating gas supplied from central stations. And the next steps of social and domestic organization promise to be the distribution of motive power with our illuminant, and the displacement of our heaters and cooking stoves by steam conveyed through the streets in pipes, making it possible to banish fire absolutely from our dwellings, offices, and factories, either for warming or lighting, for cooking or for mechanical operations, heat, light, and motive power being generated in and supplied from huge central stations.



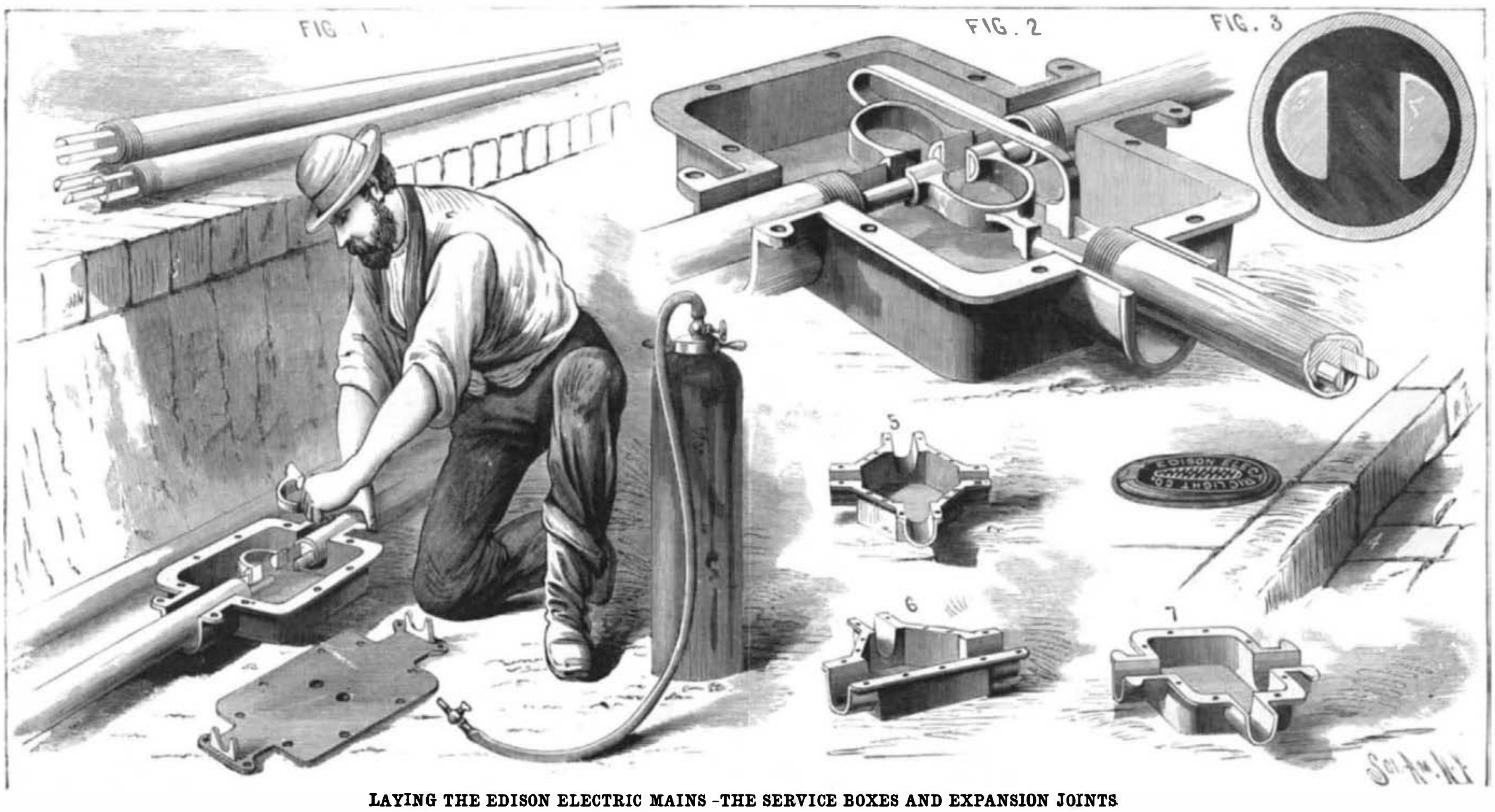
STEAM DISTRIBUTION—THE STEAM PIPES AND EXPANSION JOINTS.

Although electric lighting and steam heating have nothing in common, the circumstance that progress in each is represented by gigantic enterprises in vigorous prosecution in this city makes it proper to treat of them together in this place.

On the Eastern side of our city, down town, the Edison Electric Light Company is placing a complete system of conductors in the streets, while the New York Steam Company is occupying the streets on the Western side in the work of laying down pipes for the general distribution of steam for heat and power. The central stations of both companies are in process of erection, and preparations for business are making with a prospect of early completion.

The Edison Electric Light Company has laid about three miles of conductor in an area scant three-quarters of a mile square, south of Spruce street and east of Nassau street. When this district is complete there will be fourteen miles of conductor under the streets and seven miles of service conductor. These conductors will supply 16,000 lamps, and 400 horse power for driving machinery.

The operations of laying the conductors is shown in Fig. 1. In a trench about two



LAYING THE EDISON ELECTRIC MAINS—THE SERVICE BOXES AND EXPANSION JOINTS.

NEW ENTERPRISES IN NEW YORK CITY.

feet below the surface are laid pipes containing the conductors, the pipes and conductors terminating at intervals in boxes forming a sort of expansion joint. The pipes are cemented in the boxes with an elastic insulating cement, and the conductors are connected by copper loops which are capable of springing sufficiently to compensate for expansion and contraction. These loops are soldered to the conductors, a cylinder of compressed gas and a blowpipe being employed for this purpose.

Fig. 2 represents a service box in which the two copper loops are provided with arms extending to one side of the box and attached to service conductors leading to the building to be illuminated.

The conductors might be described as half round. They are of drawn copper of the size and shape shown in the transverse section, Fig. 3, and are supported throughout their entire length by insulating material in an iron pipe. The conductors thus mounted are made in different sizes for different localities, as there is a definite relation between the interest on the investment and the price of coal. When coal is cheap the conductors are made smaller, when it is dear they are made larger. Throughout a system the conductors are of the same size, and they are connected together at the corners of the blocks so as to practically increase capacity of the system.

Various forms of boxes are shown in Figs. 5, 6, and 7. Fig. 4 shows a street connection for the purpose of making electrical tests and for special purposes. There are thirteen varieties of street boxes and five for buildings.

The central lighting station is to be provided with twelve large Edison generators requiring 2,200 horse power. These machines are in process of construction.

The works in Goerick street are turning out from twenty to twenty-four of the smaller generators per week.

The New York Steam Company is placing pipes in Greenwich street, while at the same time an immense boiler house or heating station is being erected on the same street to supply steam to one of the ten districts into which the city is divided. The majority of the stations are located, and the work in the district in progress is being advanced with all possible speed.

The boiler house is something over 100 feet in height, and contains four floors of boilers, with sixteen boilers on a floor, making sixty-four boilers, having an aggregate of 15,000 horse power. The two chimneys of this immense boiler house will be a little taller than Bunker Hill Monument. The steam from these boilers is to be discharged into large vertical pipes or separators—to separate the water from the steam—whence it passes into the street mains, of which there are five, two of ten inch, two of twelve inch, and one of twenty-four inch diameter. These huge pipes are laid in sections, connected together by expansion joints of peculiar construction which permit the pipes to expand and contract without injury. The pipes are protected from the effects of external cold by a layer of mineral wool surrounded by a wooden jacket.

A return pipe runs parallel with the supply pipe to carry the water of condensation back to the boiler house. This pipe is much smaller than the supply pipe and is protected in the same manner. The steam pressure is generally relied on to force the water back, but in case of a great inclination in an adverse direction, a pump will be employed to force the water back. Steam will be taken from the supply pipes for heating, for cooking, and for power, and the water of condensation will be delivered to the return water pipe. We are unable in this connection to give the details of the steam meter or of that portion of the system that relates to the building.

This system is based upon the inventions of Mr. B. Holly, but the credit for the perfection of the system is due in a great measure to Mr. C. E. Emery, engineer of the company.

Accidents at the Paris Exhibition.

The correspondent of the London *Times* reports in that paper's issue of the 4th Oct., the following accidents at the Exhibition. He says:

"Yesterday a gentleman was leaning over a balustrade to examine an extremely interesting machine of M. Christofle, when his gold chain made a connection between two conducting wires which happened to be exposed. His chain became red hot and set fire to his waistcoat. To-day I had some conversation with a gentleman who was nearly killed the other day by a Brush dynamo electric machine. Part of the conducting wire was not insulated and was lying on the floor. He touched the stand of a lamp which formed part of the conducting system. His body then formed a connection through the ground to the naked wire, and contracted his muscles so as to cause his hand to clinch the lamp. Ten lamps were in circuit at the time, and so much current was passed through him that eight of them were extinguished. He was powerless to unclasp his hand. Every muscle in his body was paralyzed. His face was distorted; his lungs were so acted upon that he could scarcely breathe. He could only utter a faint and unnatural cry. The workmen in the place fled from the workshop, believing that some explosion was about to happen. A friend came up and tried to unlock his hand. It was impossible. He then lifted his legs from the ground. This broke the circuit and his hands were released, while burning sparks flew to his hands in the action of breaking the circuit. He was insensible, but has since then greatly recovered, and has devised an improvement to the lamp which will prevent a recurrence of such an accident."

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, NOVEMBER 19, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 307,

For the Week ending November 19, 1881.

Price 10 cents. For sale by all newsdealers.

THE MADGE AND HER VICTORIES.

For two or three years the interest in English yacht racing has centered mainly in the ten tons class. The results of 1879 proved beyond a doubt that the Madge was the best British ten-tonner afloat. The next year she met her match in the Neptune and later in the Maharanee. The champions of the past season were the Neptune and the Buttercup, the former winning substantially everything in the north, the latter everything in the south. The record of the Madge, however, is a proud one, she having won in three years fifty-six prizes out of sixty-eight starts. Foreseeing possibly a better chance for continued victories in other waters, the owner of the Madge had her brought by steamer to this port to try conclusions with American craft.

The Madge was built by G. L. Watson, of Glasgow, in 1879. Her dimensions are: Length over all, 45 feet 8½ inches; on the water line, 38 feet 9 inches; beam, 7 feet 9 inches; depth 6 feet 6 inches; draught, 7 feet 10 inches. Her keel is of oak, 10x12 inches, to which is bolted nearly eleven tons of lead; her inside ballast is only 500 pounds. The stem and stern posts are of oak. Every third frame is oak, 2x3 inches. The intermediate frames are of elm, 2x1½ inches, spaced twelve inches from center to center. In the wake of the chain plates the frames are double. The deck beams are of elm, 3x2¾ inches, placed twenty-four inches apart. On these is laid a light deck of pine. Below the water her planking is of oak and elm, 1½ inches thick; above she is planked with cedar. She is coppered to above the bends. Her deck is flush, and she has no bulwarks. Her mast is 36 feet in extreme length, and 8 inches in diameter at the partners. Her boom is 36 feet long; gaff, 26 feet; bowsprit, outboard, 20 feet; topmast, 26 feet; spinnaker boom, 40 feet. She carries an enormous spread of canvas, the fitting of which is superb. Her extreme narrowness and great depth are in striking contrast with the breadth and shallowness of American small craft.

With these differences in style of construction came disputes as to the proper vessels to match with the Madge. The representative of the Madge refused to sail except upon the water line area rule of measurement—a rule which few American clubs recognize, and which shut out from competition vessels of an actual capacity corresponding with that of the Madge.

The first victories of the Madge were won over the Seawanhaka course in races with the Schemer, whose dimensions are: Extreme length, 38·95 feet; at water line, 37·17 feet; beam, 14.5 feet; depth, 4 6 feet; draught without center board, 3 feet.

In two races with the Shadow, at Newport, the Shadow won the first and the Madge the second. The dimensions of the Shadow are: Length over all, 36 feet 8 inches; water line, 33 feet 5 inches; beam, 14 feet 4 inches; depth, 5 feet; draught, 5 feet 4 inches.

The Madge was also sailed against the Wave at New York and at Newport, winning both races.

A race was refused with the Gracie of the New York Yacht Club, whose length over all is 48 feet 9 inches, and on water line 44 feet, a difference in favor of the Gracie considerably less than that of the Madge over the Shadow.

The controversy seems to hinge on the question whether length, breadth, and depth shall be taken as factors of capacity, or length and breadth only, a question which yachtsmen will have to settle for themselves.

Seeing that stability and speed can be secured either by great depth with narrowness, or by great breadth of beam with light draught, it would seem as though there ought to be some satisfactory means of determining fairly the comparative rating of the two types of vessels.

That the two methods of measurement and estimating time allowances are important elements of the problem may be seen from the fact that, applying the rules of the Atlantic Yacht Club, the Madge was beaten in all of her races save one, the New York race with the Wave.

THE ST. GOTHARD TUNNEL.

The first complete railway train, carrying one hundred passengers, passed through the St. Gothard Tunnel, Tuesday, November 1, time fifty minutes.

The St. Gothard Tunnel, nine and a third miles long, pierces the Helvetic Alps, and forms a link in the St. Gothard Railway, connecting the Swiss railways with those of Upper Italy. It exceeds the Mont Cenis Tunnel in length by 8,856 feet. The northern end of the tunnel, Goeschenen, is 82 feet from the southern end of the station platform, situated 3637·5 feet above the sea level, and 2,204 feet above Lake Lucerne. From this point the line rises with a gradient of 1 in 171 for 24,600 feet, then with a gradient of 1 in 1,000 for 4,428 feet, where it reaches the highest point of the tunnel 3,785 feet above the sea. Then after a length of 1,279 feet it descends with a gradient of 1 in 200 for 3,870, when the gradient is reduced to 1 in 500 for 13,792 feet, which brings it to within 984 feet of the platform of the station at Airolo, situated 3,755 feet above the sea, and 3,109 feet above Lake Majeur. The normal width of the tunnel is 24 feet $11\frac{3}{16}$ inches at the level of the rails, and 26 feet 3 inches at the height of 6 feet 6 inches above the rails. The height of the tunnel is 20 feet; the roof is semicircular. The floor of the tunnel is formed with a fall of 2½ per cent from each side toward the center, and at the lowest part is a drain 21⅝ inches deep. Up to the level of the top of the railway sleepers the floor is filled with ballast. The nature of the revetment varies with the rock traversed. In addition to the main tunnel there are fifty-two subsidiary tunnels on the line, having a total