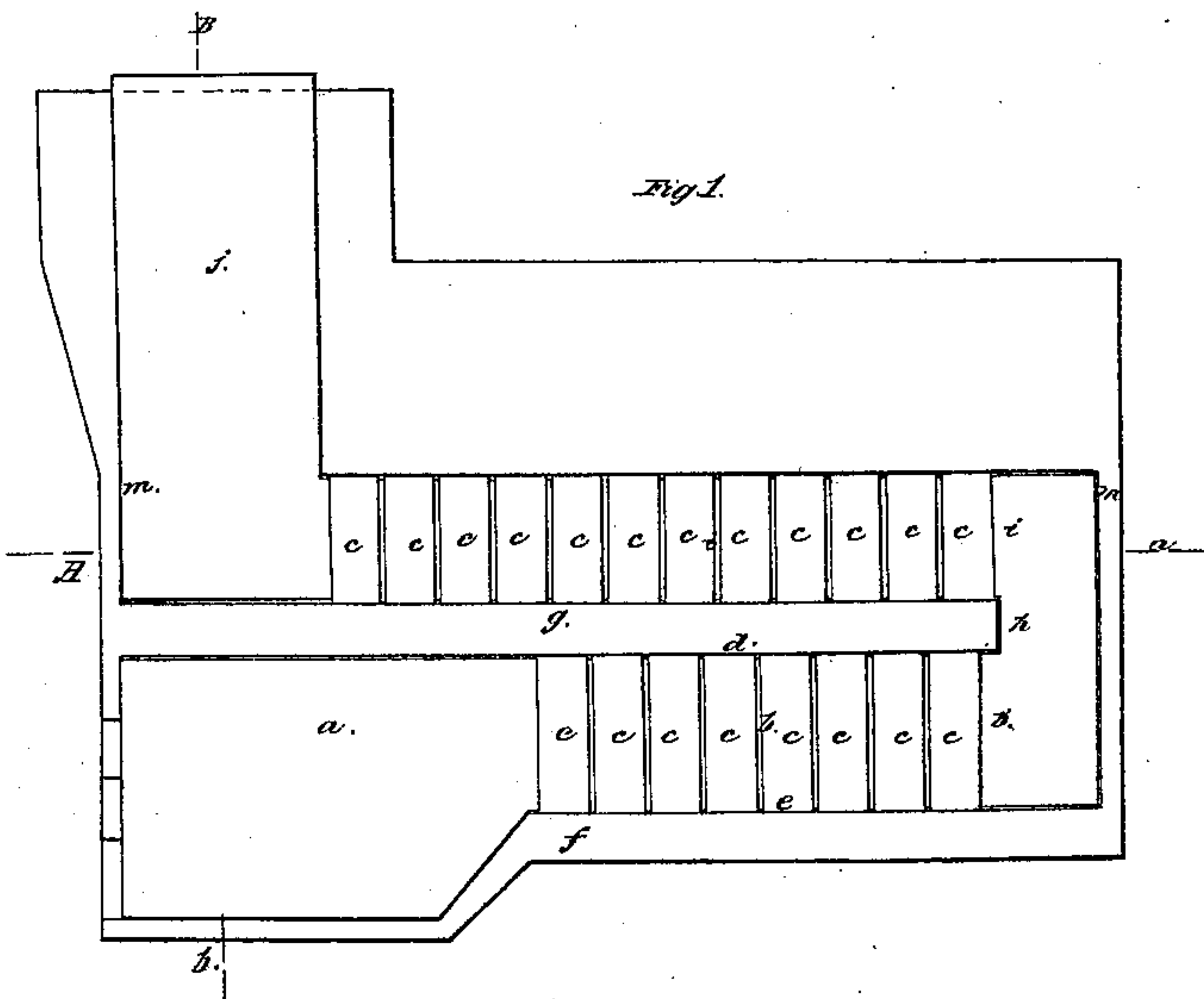
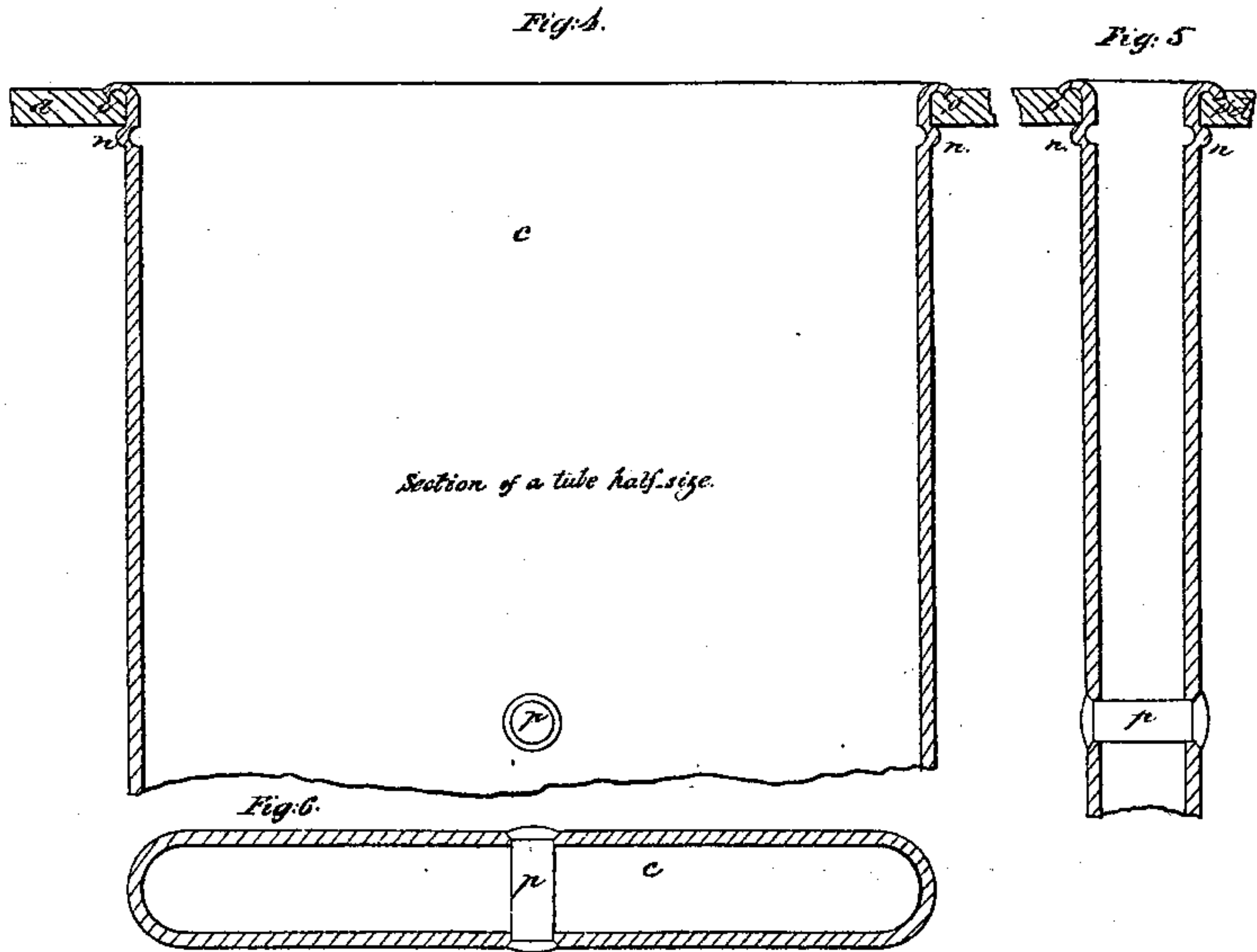
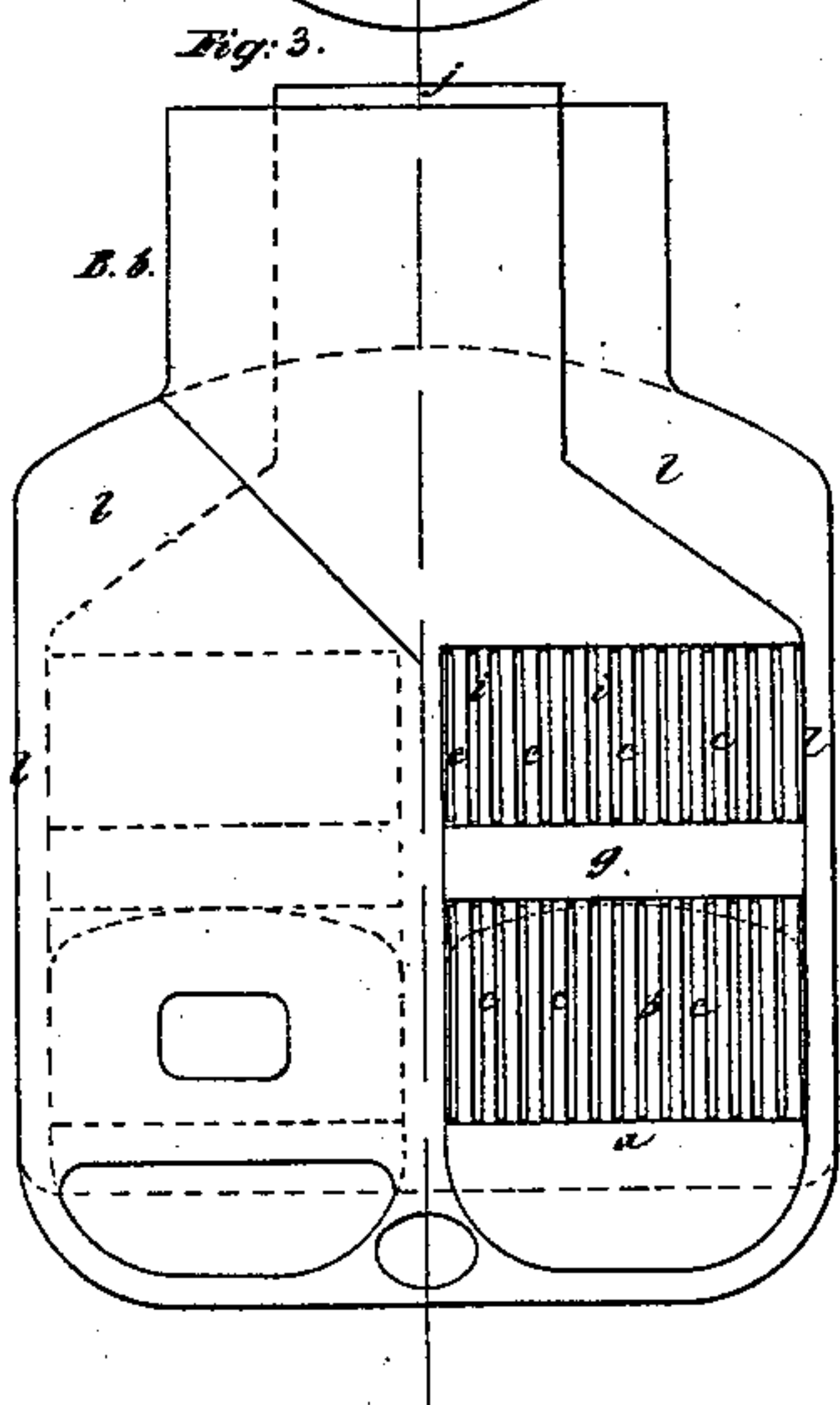
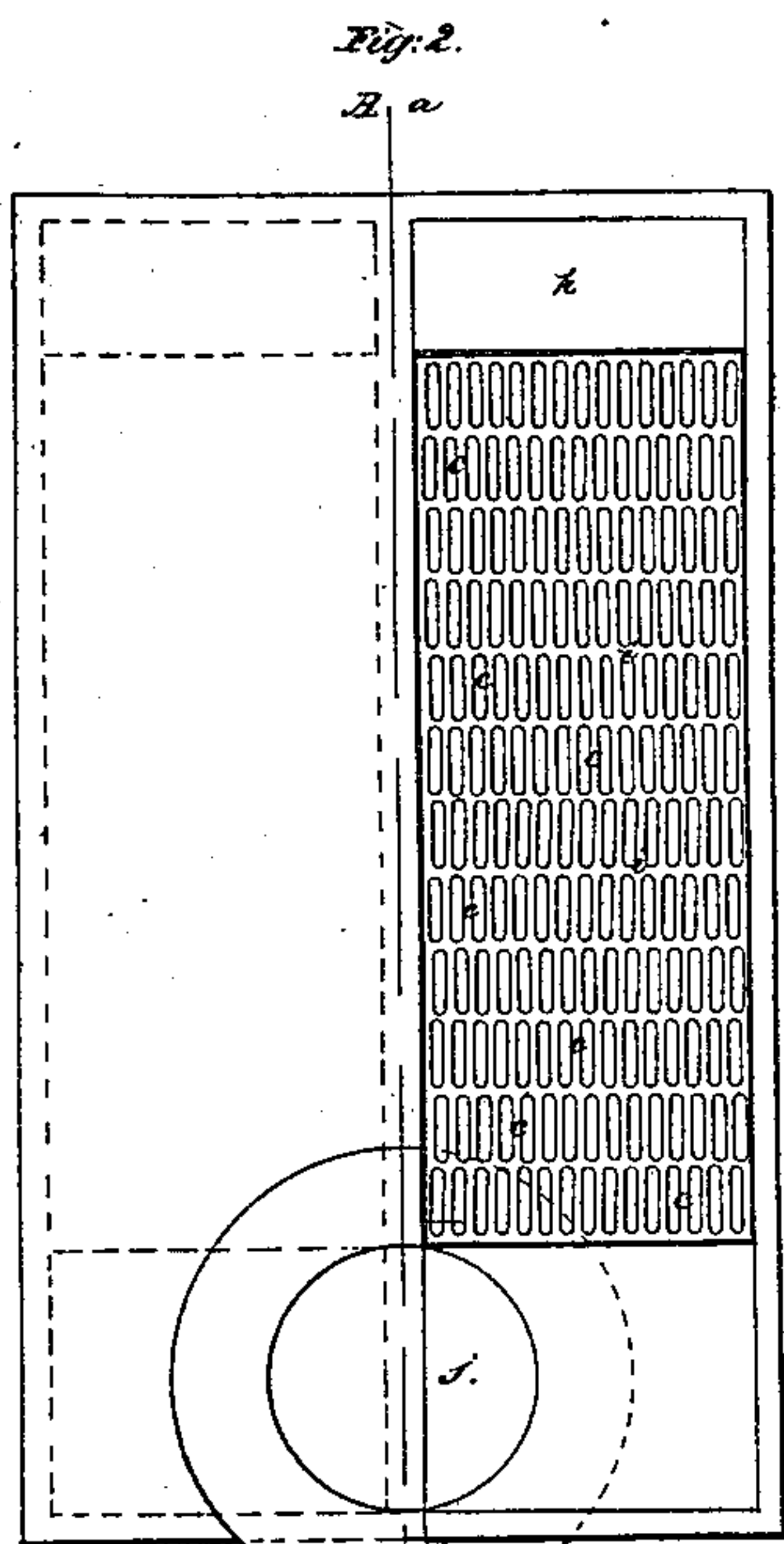


J. Murphy,
Steam-Boiler Tube.

N^o 13,223.

Patented July 10, 1855.



Witnesses:
W. H. Bishop
Andrew De Lacy

Inventor:
James Murphy

UNITED STATES PATENT OFFICE.

JAMES MURPHY, OF NEW YORK, N. Y.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. 13,223, dated July 10, 1855.

To all whom it may concern:

Be it known that I, JAMES MURPHY, of the city, county, and State of New York, have invented certain new and useful Improvements in Tubular Steam-Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a longitudinal vertical section of a boiler on my improved plan; Fig. 2, a horizontal section taken at the line A *a* of Fig. 1; Fig. 3, a cross vertical section taken at the line B *b* of Fig. 1; and Figs. 4, 5, and 6, sections of a tube and part of the tube-sheets on an enlarged scale.

The same letters indicate like parts in all the figures.

In that class of tubular steam-boilers in which the water circulates through the tubes and the heated products of combustion outside the use of cylindrical or oval tubes is attended with serious inconveniences. In the first place the amount of surface exposed to the direct action of the flame and other heated products of combustion is proportionally small, for the reason that the products of combustion traveling in one direction can only impinge on that half of the circumference of the tubes facing the current, while the other half is only heated by radiation. In the second place it is very difficult to remove the incrustation from the inside of cylindrical or oval tubes, for the reason that the scale presents an arched form, which resists with great tenacity the action of the tool, and in consequence the tubes are often so seriously injured as to yield to the pressure and burst, and with cylindrical tubes of small diameter it is extremely difficult to introduce suitable instruments for removing the scale; and in the third place it has been found extremely difficult to secure oval tubes to the tube-sheet on account of the supposed necessity of employing flanges on the ends of the tubes to effect the union, it being well known that when flanges are used the tubes cannot be placed sufficiently near to each other to obtain the required amount of fire-surface within a small compass, and although the use of oval or elliptical or flattened cylindrical tubes has been suggested as substitutes for cylindrical tubes the difficulty of securing them to the tube-sheets and their

liability to be crushed or collapsed or forced outward on the flat sides must have prevented the introduction of them into practical use, notwithstanding the many advantages which they present in other respects.

The object of my invention is to secure tubes of such form to the tube-sheets, so as to prevent the pressure from loosening the joints; and to this end my invention consists in grooving the surface of the tube-sheets wholly or partly around the holes to receive the edges of the metal of the tubes when turned over and riveted, which effectually holds the flat sides of the tubes and makes tight and strong joints not liable to leak.

In the accompanying drawings, *a* represents the place for the furnace, and *b* a horizontal flue-space containing a series of vertical water-tubes *c*, secured at bottom and top to the tube-sheets *d e*. The lower ends of the tubes communicate with the bottom water-chamber *f* and their upper ends with a water-space *g*. The rear end of the flue-space *b* communicates by a vertical flue *h* with another horizontal or return flue *i* above, which leads to the chimney *j*, and in this flue *i* are also arranged other flat vertical water-tubes *c*, which communicate with the water-space *g* and with the chamber *k* above.

The drawings represent a double boiler with two furnaces, and as both are alike only one of them will be described. The water-spaces and chamber above are all connected by water-spaces *l l* and *m m* at the sides and ends, that the water may rise in the tubes and descend in the water-spaces *l l* and *m m*, thus keeping up a circulation in manner well known. The flat tubes are arranged with the flat sides parallel and in the direction of the length of the flues and in series of rows, the second row being opposite the spaces between the tubes of the first row, and so with any number of rows, so that the products of combustion after passing the tubes of the first row shall impinge against the semi-cylindrical front surface of the second row, and so with the series of rows in succession. They may, however, if desired, be differently arranged with reference to the line of passage of the current of the products of combustion.

The tubes *c* are, as represented, flat with the sides parallel and the front and back connecting the sides semi-cylindrical. The tubes

are beaded, as at *n n*, and so near to each end as to leave the required length beyond the beads to pass through the tube-sheets and to be riveted. The tubes pass through holes of corresponding size in the tube-sheets, and the beads rest against the inner surface of the tube-sheets, in the manner of a flange or collar, and the tubes are riveted over the surface of the tube-sheets.

The surface of the tube-sheets is grooved, as at *o*, around or partly around the holes through which the tubes pass, so that when the ends of the tubes are bent over in riveting the metal will be forced into the grooves and thus effectually bind the tubes to the tube-sheets in all directions. If desired, the grooves may be dispensed with around the curved portions of the tubes, as the principal object is to hold the flat portion, which from the form would be likely to be bent or collapsed; but being thus held by the lapping of the end of the tubes into the grooves in riveting good permanent joints are secured. Stay-bolts, as at *p*, are to be inserted across the tubes to brace the two flat and therefore

weakest portions of the tubes. In this way, by the use of the beads acting as shoulders or flanges and the riveting or bending over the ends of the tubes into the grooves in the surface of the tube-sheets, I am enabled to make the joints more tight and firm and at less cost than with flanges riveted, and without occupying so much room as when flanges are employed, from which it follows that the tubes can be placed much nearer.

What I claim as my invention, and desire to secure by Letters Patent in the construction of tubular steam-boilers, is—

In combination with beads or their equivalents on the tubes, grooving the surface of the tube-sheets around or partly around the tube-holes to receive the metal of the tube when riveted, substantially as described, by means of which I am enabled more effectually to secure tight and strong joints than by any other known method, as set forth.

JAMES MURPHY.

Witnesses:

L. N. GLOVER,
ANDREW DE LACY.