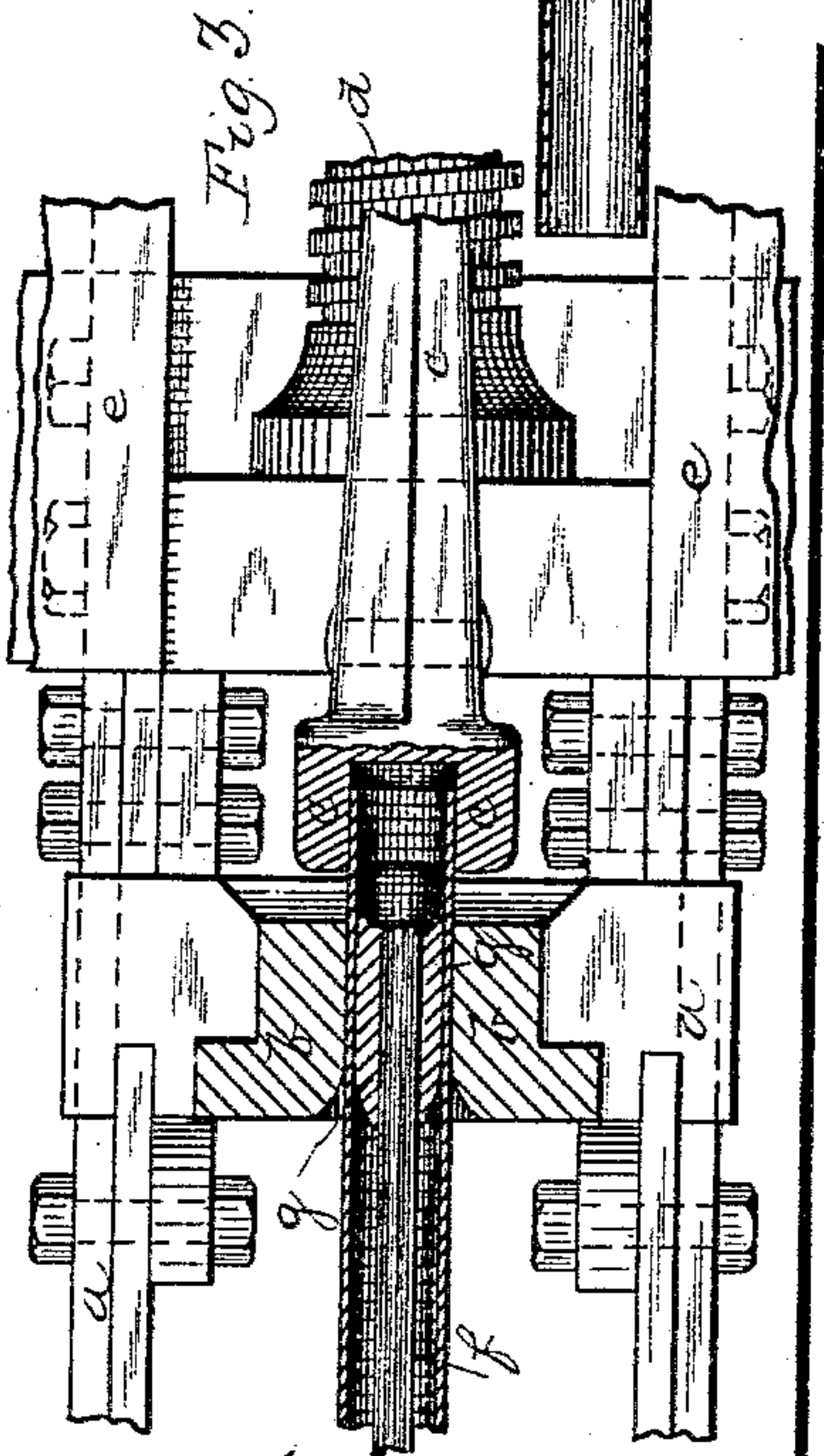
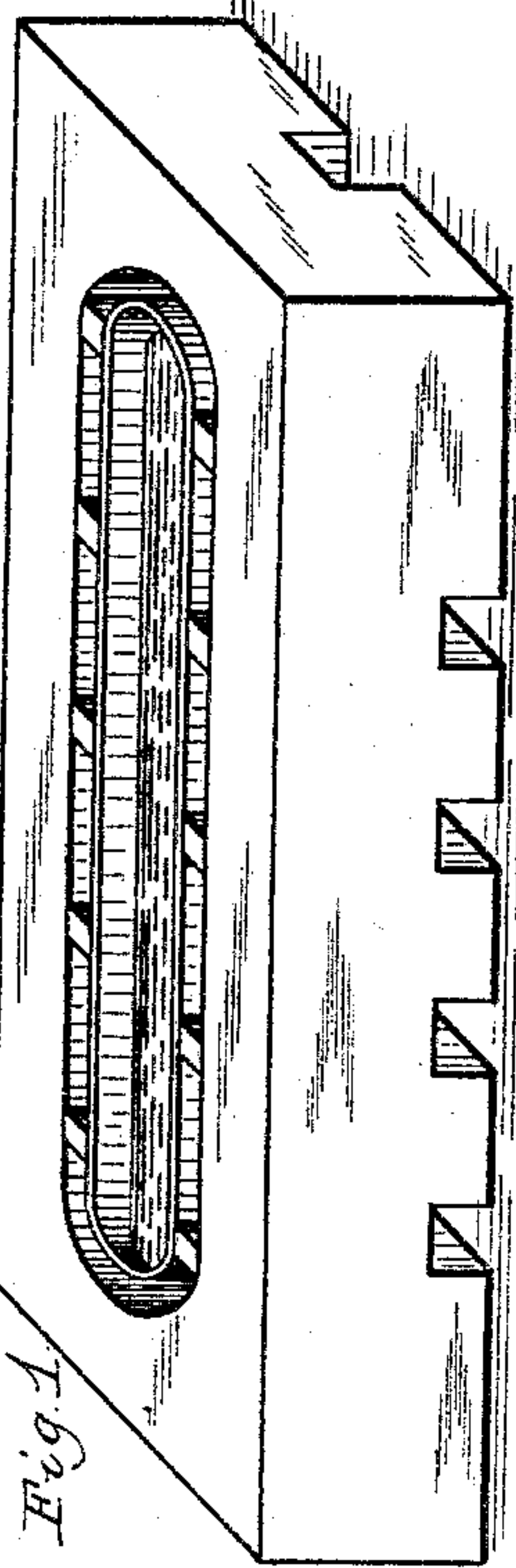
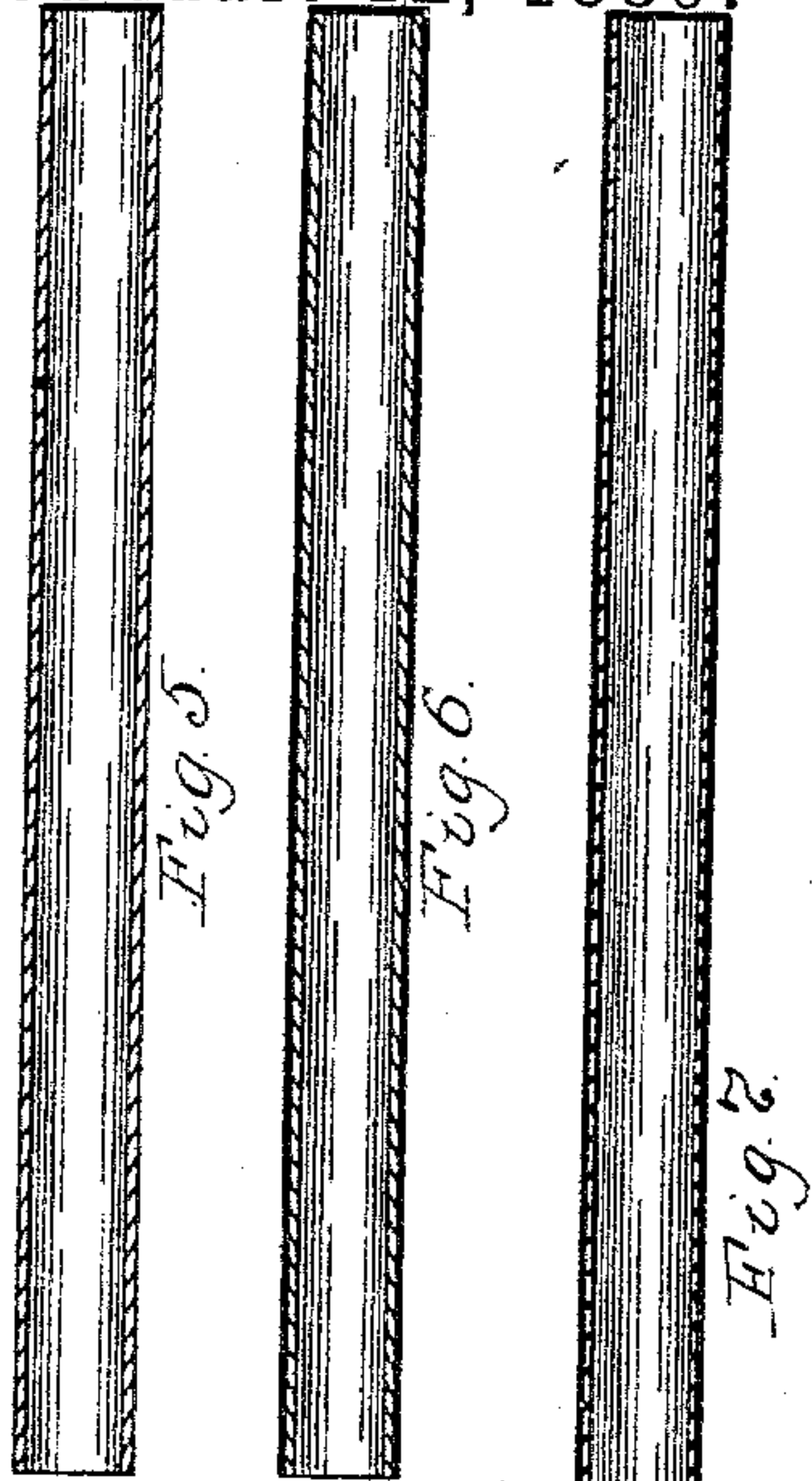
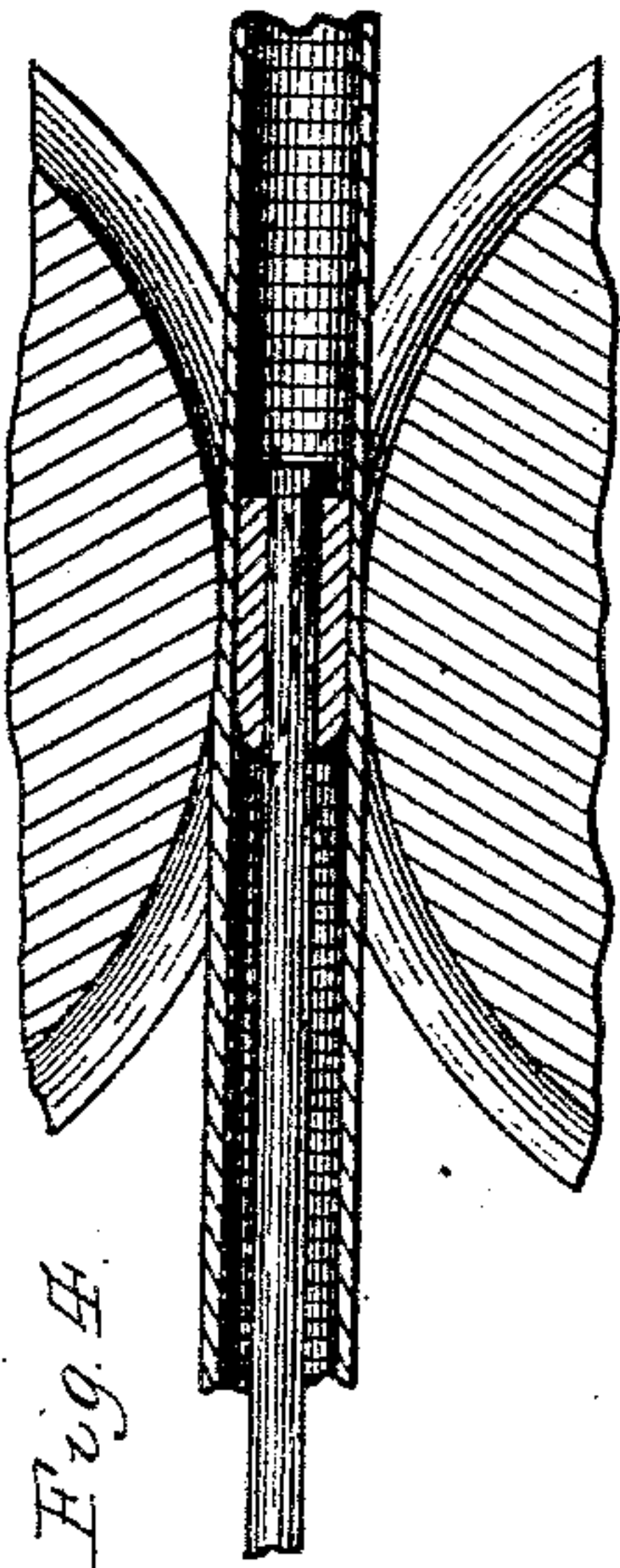
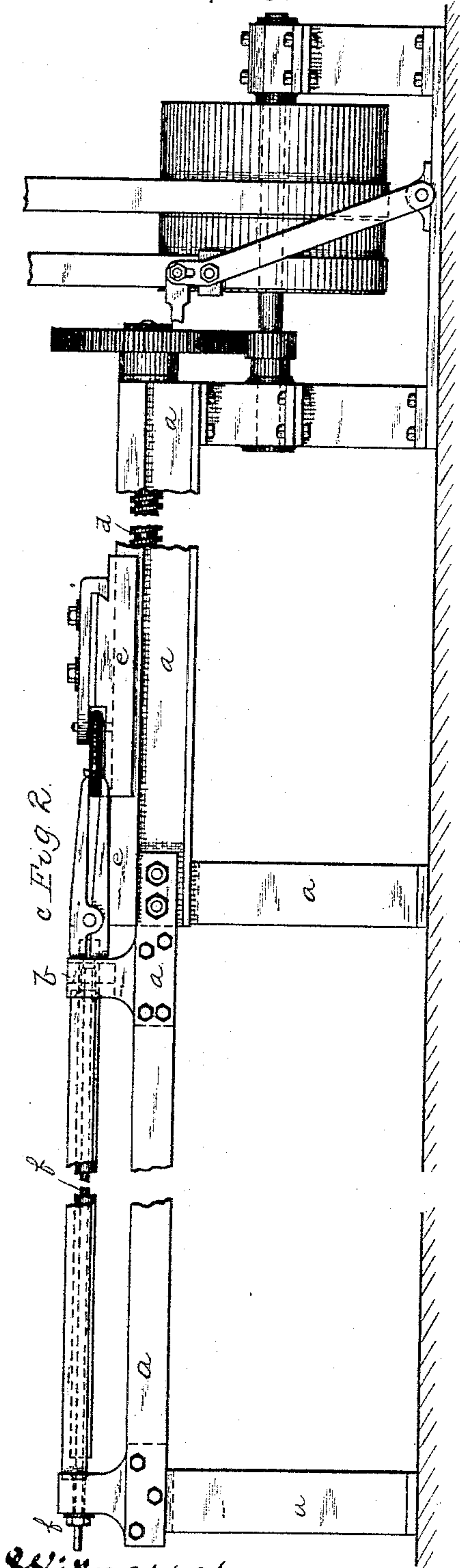


(No Model.)

E. C. CONVERSE.
MANUFACTURE OF TUBING.

No. 399,245.

Patented Mar. 12, 1889.



Witnesses:
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UNITED STATES PATENT OFFICE.

EDMUND C. CONVERSE, OF NEW YORK, N. Y.

MANUFACTURE OF TUBING.

SPECIFICATION forming part of Letters Patent No. 399,245, dated March 12, 1889.

Application filed October 22, 1888. Serial No. 288,762. (No model.)

To all whom it may concern:

Be it known that I, EDMUND C. CONVERSE, a resident of New York, in the county of New York and State of New York, have invented
5 a new and useful Improvement in the Manufacture of Tubing; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of
10 tubing, its special object being to provide a wrought-iron or steel tube suitable for pneumatic and steam-boiler purposes, as well as for hand-rails, fencing, hose, and awning-poles, and other uses where a polished tube is re-
15 quired.

The pneumatic tubes now in use are generally made of brass or copper, which class of tubing is found especially applicable for such
20 purposes on account of its smooth surfaces, lightness, and non-corrosive properties. Iron or steel tubing, though less expensive than the brass or copper tubing, could not, however, be employed for the purpose, because its interior surface was not sufficiently smooth
25 and it was liable to rust or corrosion. Its weight was also objectionable, as the ordinary tube could not be welded of plates or sheets sufficiently light for the purpose. Objection
30 has also been found to iron or steel tubing for steam-boilers on account of its liability to rust or corrode from the action of oxidizing waters and the rapid incrusting thereof with the lime or other deposits from the water.

The objects of my invention are to improve
35 the ordinary wrought-iron or steel tubes so as to overcome these objections and adapt them for uses to which they have not heretofore been considered applicable.

To these ends my invention consists, generally stated, in coating the interior and exterior surfaces of the iron or steel tubing with
40 a molten metal or alloy which will alloy with the metal of the tube, and then forcing the metal or alloy into the body of the tube, and elongating the tube by cold rolling or drawing the tube interiorly and exteriorly, it being found that in so treating the tube the
45 metal or alloy under the drawing operation penetrates the body of the tube, filling all the surface-pores and drawing out with the body of the tube, even though a considerable elongation thereof is obtained, so as to form a

composite or alloy with the molecules of the iron, which will prevent corrosion, while at the same time the interior and exterior surfaces of the tube are rendered smooth and polished, and the body of the tube is reduced
55 in thickness and weight, the finished tube having all the requisites for pneumatic tubes, &c., as above set forth, and its surface finish preventing rusting and incrustation, so rendering it especially applicable for use in steam boilers or condensers.

To enable others skilled in the art to practice my invention, I will describe the same
65 more fully, referring to the accompanying drawings, in which—

Figure 1 is a view of the pot containing the coating metals or alloys. Fig. 2 is a side view of apparatus suitable for drawing the coated
70 tubing. Fig. 3 is a longitudinal section of the drawing-dies and mandrel, showing the drawing operation. Fig. 4 is a like view of another form of drawing apparatus. Fig. 5 is a section of the tube before coating. Fig.
75 6 is a like view of the coated tube, and Fig. 7 is a like view of the finished tube.

Like letters of reference indicate like parts in each.

In practicing my invention I employ a suitable
80 pot for melting the metals or alloys employed in coating the pipes or tubing, a tank or pot suitable for the purpose being shown in Fig. 1, and having a suitable furnace for heating the metal or alloy and maintaining it
85 at a proper temperature for coating purposes, and the metal or alloy being melted within said pot, and the tube to be drawn being first dipped within the pot in such manner as to
90 cause the molten coating metal or alloy not only to coat the exterior surface of the tube, but to coat the interior surface thereof, the tube being thus coated interiorly and exteriorly with the soft metal or alloy. For the
95 purpose of drawing or finishing the tube I employ any suitable form of drawing-bench, such apparatus being shown in the drawings, and having the bed or frame *a* provided at one end with the die *b*, and with suitable gripping apparatus, *c*, operated by the screw *d*, so
100 as to draw the tube through the die *b*, while in order to support the mandrel within the tube the draw-bench is provided with an extension, *e*, to which the bar *f* is secured, the

bar carrying the mandrel *g* within the drawing-die *b*, and in drawing the tube it is placed over the bar *f* and grasped by the gripping or drawing apparatus and drawn through or between the die *b* and mandrel *g*. Instead of employing the die *b* a suitable pair of concave rolls, as shown in Fig. 4, may be employed, these rolls fitting closely to the body of the tube and compressing it upon the mandrel, so as to act in the same manner as the drawing-die *b*.

For the purpose of coating the tubing I employ a metal which will alloy with the iron or the steel body of the tube at a comparatively low heat, and will also adhere thereto under the drawing operation, it being necessary, therefore, to employ a soft metal or alloy, and one which melts at such a temperature as not to injure the iron or steel body of the tube. I find that lead or tin, or alloys of lead and tin, or lead, tin, and antimony, or lead, tin, and bismuth, or tin and bismuth are well adapted for the purpose.

I have substantially found that the metals best suited for practicing my invention are lead and its alloys, the alloys formed with lead generally alloying with the iron or steel body of the tube, and being sufficiently soft to withstand the severe drawing operation without flaking or peeling off, and to enter into the surface-pores of the iron or steel body as it is elongated, and by forming the composite alloy therewith protect the metal body thereof.

In practicing my invention I generally take wrought-iron or soft-steel tubing, preferring soft steel on account of its greater capability of elongation, and in making a light tube for pneumatic purposes I generally employ for the smaller sizes—such as from two to three inches in diameter—a tube of about twelve-gage, this being the lightest gage of wrought-iron or steel tubing which can be conveniently and successfully made. I first cleanse the tube to remove therefrom any scale or other impurities, and then wash the tube to remove the acid or like materials used in cleansing the same, the tube being then in proper condition to receive the soft metal or alloy. I then dip the cleansed iron tube in a solution of chloride of zinc or chloride of tin, which will prepare the iron or make a solder for the adhesion or alloying of the soft metal or alloy with the surface of the iron body, these steps of the process, however, being carried out in whatever way is proper for the coating of the tube with the particular metal or alloy. The tube is then dipped within the molten metal or alloy with which it is to be coated—such as an alloy of lead, tin, and antimony—and in dipping care is taken that the interior surface of the tube, as well as the exterior surface thereof, is properly coated, the soft metal or alloy forming an alloy with the body of the tube and preparing it for the next step of the process. The tube so coated is then taken to the drawing-bench, and it is

drawn thereon by any suitable mechanism which acts to draw both the inner and outer surfaces of the tube, and the tube is subjected to this drawing operation until it is considerably elongated, being passed through the drawing-dies or between the drawing-rolls, and drawn over the inner mandrel a sufficient number of times to increase its length from one-fourth to one-half, the dies or rolls and the mandrel employed being changed as is found necessary in completing the drawing operation. By this drawing operation I force the soft metal or alloy coating the exterior and interior surfaces of the tube into the surface-pores thereof, it being found that by the great pressure and friction applied to the surface of the soft metal or alloy, as the molecules of the iron are moved under the drawing operation, a greater affinity of the soft metal or alloy with the molecules of the iron is created and the metal or alloy unites with such molecules, the coating metal being thus carried into and caused to penetrate the body of the tube, forming a composite alloy therewith, the composite form becoming neutral to oxidation or corrosion. The composite surfaces formed on the tube are dense, smooth, and highly polished. At the same time all the imperfections in the body of the tube are filled by the soft metal or alloy, and therefore a perfect surface-finish to both the interior and exterior surfaces of the tube is obtained. By the elongation of the tube in the drawing process I also obtain a tube which is much thinner and lighter in proportion to its length, the tube being reduced generally—say from twelve-gage to between eighteen and twenty-four gage—and being sufficiently light for all pneumatic purposes. If desired, where the tube is to be reduced to a very thin gage, it can be redipped in the coating metal, this redipping acting to anneal the body of the tube, so as to prepare it for the further reduction and elongation by the drawing process, and providing the soft metals or alloys for uniting with any other molecules of the iron which might be brought to the surface during such second drawing of the tube, and which might not have been previously alloyed with the soft metal, as well as to increase the proportion of the soft metal in the composite alloy formed with the iron. By my improved process the soft metal or alloy thus acts to incorporate itself with the iron or steel body of the tube and impart thereto the non-corrosive quality of the soft metal or alloy, and where the tube is reduced to a very thin gage the soft metal or alloy practically penetrates through the body of the tube. It is found in practice that by coating and drawing both the interior and exterior surfaces of the tube I am enabled to draw it to a much greater extent at each operation without affecting its strength, as the soft metal by overcoming friction acts to maintain the fibrous condition of the body of the tube, and also to obtain the drawing

of the tube without injury to the soft metal or alloy, as a more even frictional action is created where it acts upon both the interior and exterior surfaces at the same time.

5 The tubing thus formed, while specially applicable for pneumatic purposes, as above set forth, and possessing the polished interior and exterior surfaces, will be found advantageous for many of the uses for which brass
10 and copper tubing-pipe have heretofore been almost exclusively employed, and can be produced at considerably less cost. The tubing has also great advantages for boiler-flues and condensers, especially where the water con-
15 tains any acid or alkali, as the metals so incorporated with the surface of the iron and steel tube will protect it from the action of acids, and the polished non-corrosive surface of the tube will prevent the formation of in-
20 crustations on the tube, as oxidation becomes

impossible, and the polished surface will prevent the adhesion of any alkaline deposits.

What I claim as my invention, and desire to secure by Letters Patent, is—

The herein-described improvement in the 25 art of forming tubing, consisting in coating the interior and exterior surfaces of the tube with a molten soft metal or alloy which will alloy with the metal of the tube and then forcing the soft metal or alloy into the body 30 of the tube and elongating it by cold-drawing the tube interiorly and exteriorly, substantially as and for the purposes set forth.

In testimony whereof I, the said EDMUND C. CONVERSE, have hereunto set my hand.

EDMUND C. CONVERSE.

Witnesses:

JAMES I. KAY,
ROBT. D. TOTTEN.