(No Model.)

E. C. CONVERSE.

TUBING.

No. 399,244. Patented Mar. 12, 1889.

Fig. 1.

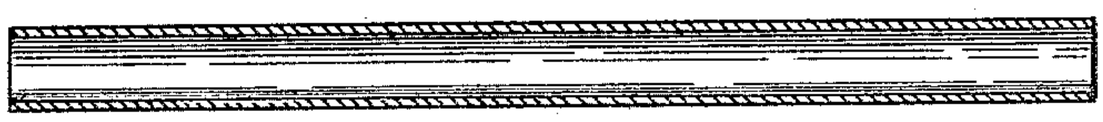


Fig. 2.

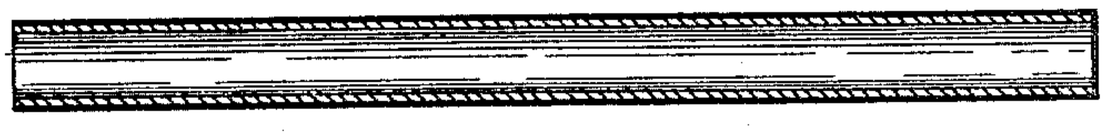
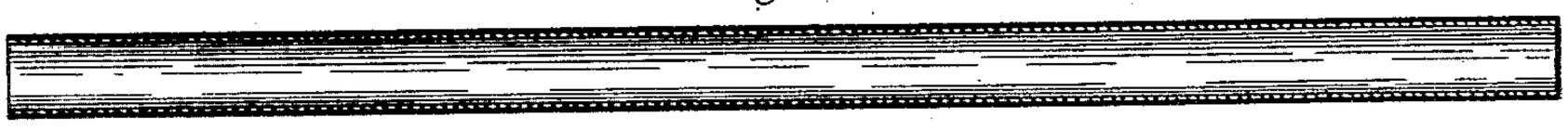


Fig. 3.



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UNITED STATES PATENT OFFICE.

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

TUBING.

SPECIFICATION forming part of Letters Patent No. 399,244, dated March 12, 1889.

Application filed October 22, 1888. Serial No. 288,761. (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 a new and useful Improvement in Tubing; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to wrought-iron and steel tubing, its object being to provide such a 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 required.

The pneumatic tubes now in use are generally made of brass or copper, which class of tubing is found especially applicable, on account of its smooth surface, 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, and it was liable to rust or corrode. Its weight also was objectionable, as the ordinary tube could not be welded of plates or sheets sufficiently light for the purpose. Objection 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 the oxidizing-waters, and the rapid incrusting thereof with lime or other deposits from the water.

The objects of my invention are to provide a wrought-iron or steel tube in which these objections are overcome, and to adapt such tubing for uses for which it has not heretofore been considered applicable.

To these ends my invention consists, generally stated, in a drawn-iron or soft tubing having a soft metal or alloy compressed into and forming a composite alloy with the molecules of the tube on the interior and exterior surfaces thereof, it being found that such a tube having such a finish to it will prevent corrosion on account of the composite alloy formed between the soft-metal coating and the molecules of the iron, while at the same time a tube is provided having the interior and exterior surfaces thereof smooth and polished, and the tube formed is light in weight and has all the requisites for pneumatic purposes, while the surface-finish prevents rusting or incrustation, so rendering it specially applicable for use in steam boilers or condensers.

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

Figure 1 is a view of the ordinary wrought-iron or steel tube. Fig. 2 is a view of said tube when coated, and Fig. 3 is a view of the finished tube.

In forming my improved tubing I employ a suitable coating-pot for holding the molten metal or alloy, and a suitable draw-bench in which both the inner and outer surfaces of the tube can be drawn, such as through a suitable die with an interior mandrel, or between concave rolls and such mandrel. For the purpose of coating the tubing I employ a metal which will alloy with the iron or steel body of the tube at a comparatively low heat, and will also adhere thereto under the drawing operation, it being therefore necessary 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 purposes. I have substantially found that the metals best suited for coating the tube are lead and its alloys, the alloys formed with lead generally alloying with the iron or steel body of the tubing, 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 thereof.

In forming my improved tubing I generally take wrought-iron or soft-steel tubing, preferring soft because 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 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 in the treatment, however, being carried on in whatever way is considered proper for coating 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 in its manufacture. The tube so coated is then taken to the draw-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 between 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 die or rolls and the mandrel employed being changed as it is found necessary to complete the drawing operation. The soft metal or alloy coating the exterior and interior surfaces of the tube is by this operation forced into the surface-pores thereof, it being found that by the great pressure and friction applied to the surfaces 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 to the molecules of the iron is created and the metal or alloy united with such molecules, the coated metal being thus carried into and caused to penetrate the body of the tube and forming a composite alloy therewith, the composite formed 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 with the soft metal, 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 operation. I also obtain a tube which is much thinner and lighter in proportion to its length, the tube being generally reduced from, say, twelve-gauge to between eighteen and twenty-four gage, and being sufficiently light for all pneumatic purposes. If desired, where the tube is 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 operation, and providing the soft metal or alloy 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. The soft metal or alloy thus acts to incorporate itself with the iron or steel body of the tube and imparts thereto the non-corrosive quality of such 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. Where the tube is coated on the interior and exterior surfaces and subsequently drawn to form the composite alloy on both its interior and exterior surfaces, as above referred to, it is found in practice that a much greater elongation of the tube can be obtained at each operation without affecting its strength, as the soft metal, by overcoming the friction, acts to maintain the fibrous condition of the body of the tube, and also that the drawing of the tube can be accomplished 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.

By the formation of the composite alloy between the soft metal and the iron body I obtain a tube which is not only highly polished on the interior and exterior surfaces thereof, but substantially non-corrosive, having partaken of the nature of the soft-metal or alloy surface thereof, and which can be formed sufficiently light for use for pneumatic purposes and many of the uses for which brass or copper tubing has been heretofore almost exclusively employed, and which can be produced at considerable less cost. The tube has also great advantages for boiler-flues and condensers, especially where the water contains any acid or alkali, as the metals so incorporated with the iron or steel tube will protect it from the action of acids, and the polished non-corrosive surface of the tube will prevent the formation of incrustation on the tube, so that oxidation becomes impossible, and the finished surface prevents the adhesion of any alkaline deposits.

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

A new article of manufacture, consisting in a drawn-iron or soft-steel tube having a soft metal or alloy compressed into and forming a composite alloy with the molecules of the metal of the tube, on the interior and exterior surfaces thereof, 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.