S. W. WOOD.

MANUFACTURE OF METAL TUBING.

No. 169,878. Patented Nov. 9, 1875.

Fig. 1.

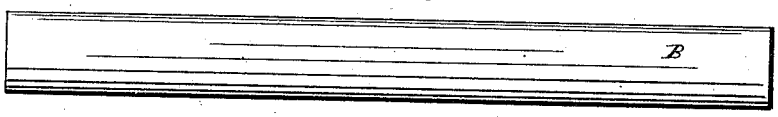


Fig. 2

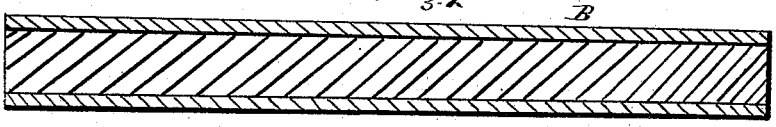


Fig. 3

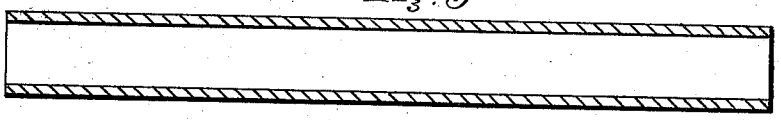


Fig. 4.

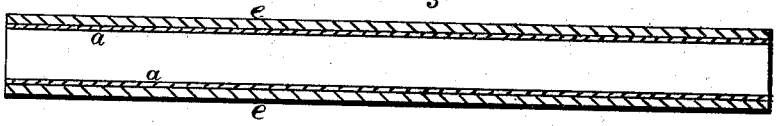


Fig. 5.

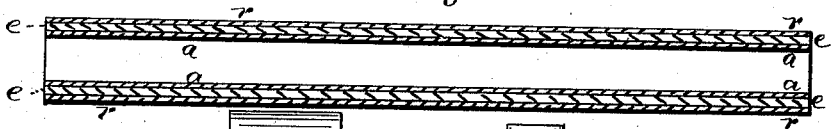


Fig. 6.

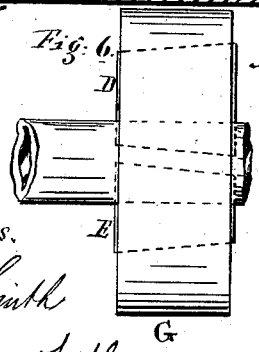
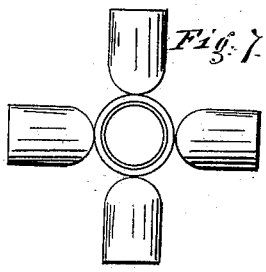


Fig. 7.



Witnesses.

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Inventor.

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UNITED STATES PATENT OFFICE

STEPHEN W. WOOD, OF CORNWALL, NEW YORK.

IMPROVEMENT IN MANUFACTURE OF METAL TUBING.

Specification forming part of Letters Patent No. **169,878**, dated November 9, 1875; application filed October 28, 1875.

To all whom it may concern:

Be it known that I, STEPHEN W. WOOD, of Cornwall, county of Orange and State of New York, have invented a new and useful Improvement in Metallic Tubing, and the process of making the same, patented in England October 30, 1873; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making part of this specification, in which—

Figure 1 represents a side elevation of a metallic mandrel upon which to deposit metal or metals for tubing; Fig. 2, a central longitudinal section of a tube drawn over a solid rod of metal, upon which to deposit metal for tubing by electro-deposition; Fig. 3, a central longitudinal section of a tube removed from the mandrel upon which it was deposited; Fig. 4, section of a tube removed from its mandrel, consisting of two different metals, or, as may properly be expressed, a tube having a lining of different metal from the exterior or main body thereof deposited by electro-deposition; Fig. 5, section of a tube removed from the mandrel upon which it was deposited, being lined on its interior and covered on its exterior with different metal from the middle or main body; Fig. 6, view of a system of rollers, by the action of which a deposited tube is enlarged or loosened from its mandrel, so as to be removed therefrom; Fig. 7, revolving burnishers, by which deposited tubes may be removed from their mandrels, reduced in diameter, or shaped, and for imparting hardness or spring-temper thereto.

Tubing of metal has heretofore been made, either by casting, drawing, or being folded from flat sheets, and the edges thereof soldered together.

The nature of my invention consists, first, in making or forming tubing by electro-deposition of the metal or metals composing it upon a mandrel of the required diameter for the interior thereof, substantially in the manner herein set forth; second, forming tubing by electro-deposition of the metals composing it, first depositing a body of metal of the desired thickness upon a mandrel forming the interior surface or lining, and subsequently depositing an outer coating or body thereon of different metal, substantially as herein set forth; third, depositing metal or metals for tubing upon a metallic mandrel or form, and removing the same therefrom by rolling or burnishing, substantially in the manner herein set forth, or the equivalent thereof. Rolling might be applied to the removal of other articles formed by electro-deposition besides tubing with equal facility without departing from my invention.

In order to instruct others in the art of using my invention, I will proceed to describe one practical method of preparing the mandrels upon which to deposit metal or metals for tubing, and to remove the deposited metal therefrom, forming a tube, after being taken from the depositing-bath.

Notwithstanding there is no adhesion of the deposition forming the tube to the mandrel, still, by the process of depositing one metal upon another, the deposited metal rests upon its mandrel or form so closely that it becomes necessary to enlarge or loosen the deposition to remove it. The mandrels upon which to deposit metal or metals for tubing by electro-deposition may be solid, as represented in Fig. 1, or of one metal drawn over a mandrel, as in Fig. 2, the surface of which should be smooth, to assist in the removal of the deposited tube. If desired, this mandrel may have a coating of silver, nickel, or other suitable metal deposited upon it, which will assist materially in the removal of the tube. A mandrel made of brass drawn over a solid rod of iron or steel, by which a smooth, even surface is produced, is found in practice to answer a good purpose, and which will remain straight in the operation of removing the deposition therefrom. If required, the surface of the mandrels may be rendered sensitive by any of the well-known processes or applications, but which not being part of this invention, description of them is omitted. After the mandrels shall have been prepared they are immersed in an electro-depositing bath, and the metal or metals deposited thereon to the required thickness, forming the tubes. When the deposition has attained the required thickness upon the mandrels the mandrels are removed from the depositing-bath and subjected to rolling, burnishing, or drawing to loosen

the deposit thereon. One practical method of enlarging or loosening the deposit upon these mandrels, that the deposited tube may be readily taken therefrom, is to subject the mandrels, with their deposit, to the action of a system of rollers, A, between which they pass or are carried by their peculiar construction with sufficient pressure to accomplish the purpose. By the peculiar construction and arrangement of these rollers A the mandrels, with their deposit, are presented at one side and carried through by them from one end to the other, and by the action thereof every portion of the deposited metal forming the tubes is subjected to pressure, by which they are sufficiently enlarged to be removed. These rollers may be constructed as shown in the accompanying drawing—two being conical and one cylindrical or straight on its surface—which construction is found to perform the work of enlarging the depositions uniformly to the required extent to be taken from the mandrels, the action of the rollers being uniform throughout the entire length of the tube. It will be observed, by reference to the drawing, that the axes of the two conical rollers D E are in different planes, nor are they in the same plane with the axis of the upper roller G, the axis of which is in a horizontal plane, so that when a mandrel, with its deposition, is presented to them, it will be carried through between this system, by their combined action, in a plane parallel with the axis of the upper or straight roller G. Rotating burnishers, as represented in Fig. 7, might be employed with similar effect; but, having tried them, the rollers are preferred. Drawing through dies might in some cases be substituted for the rollers or burnishers; but because of the danger of destroying the depositions or injuring their texture, the rollers are still preferred.

After the tubes have been removed from their mandrels, they may be reduced in diameter, their texture hardened, or embellished by designs on their exterior by any of the well-known methods.

Drawing a tube deposited by electricity through a die to reduce it in diameter would have the effect of hardening the metal.

When it is desired to deposit two or more different metals composing a tube, or to line a tube with different metal from the main body, the metal for the lining is first deposited upon the mandrel to the required thickness, and then removed, with its deposit *a*, to a bath or solution of metal for the next layer or exterior, wherein it remains until of the desired thickness, when the mandrel B, with its deposition of the two metals, one upon the other, is subjected to the action of the rollers or burnishers, and the compound tube *a e*, consisting of the two metals—the lining *a* and main body *e*—are removed together, as though composed of but one metal.

Tubes consisting of several layers, *a e r*, may thus be made: An inside layer or lining, *a*, a middle, *e*, and an exterior or covering, *r*, as represented in Fig. 5, by simply changing from one solution to another.

To form compound tubing consisting of two or more metals, one layer or thickness deposited upon another, the mandrels or forms are first placed in a solution composed of the desired metal for the interior. After having received a deposit of the required thickness for this lining or inner coating, these mandrels, with their deposit, are removed to a second solution of metal to receive the second or following layer, and so on the said mandrels or forms may be changed from one solution to another, by which tubes consisting of several metals laid or deposited one upon another may be produced at pleasure, and the same removed from their mandrels or forms as though composed of but one metal, instead of several metals combined.

Having thus fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The method of forming internally-coated tubing or pipe by electro-deposition of the metals composing it, depositing first upon a suitable mandrel or form a coating or lining of one metal, and depositing thereon an exterior covering of a different metal, forming the main body, substantially as herein set forth.

2. The method of fabricating tubing or pipe by electro-depositing metal or metals for the same upon a metal mandrel or form, and rolling or burnishing the same to facilitate its removal, substantially in the manner herein set forth.

S. W. WOOD.

Witnesses:

GEO. H. SMITH,

WM. W. REYNOLDS.