

May 18, 1943

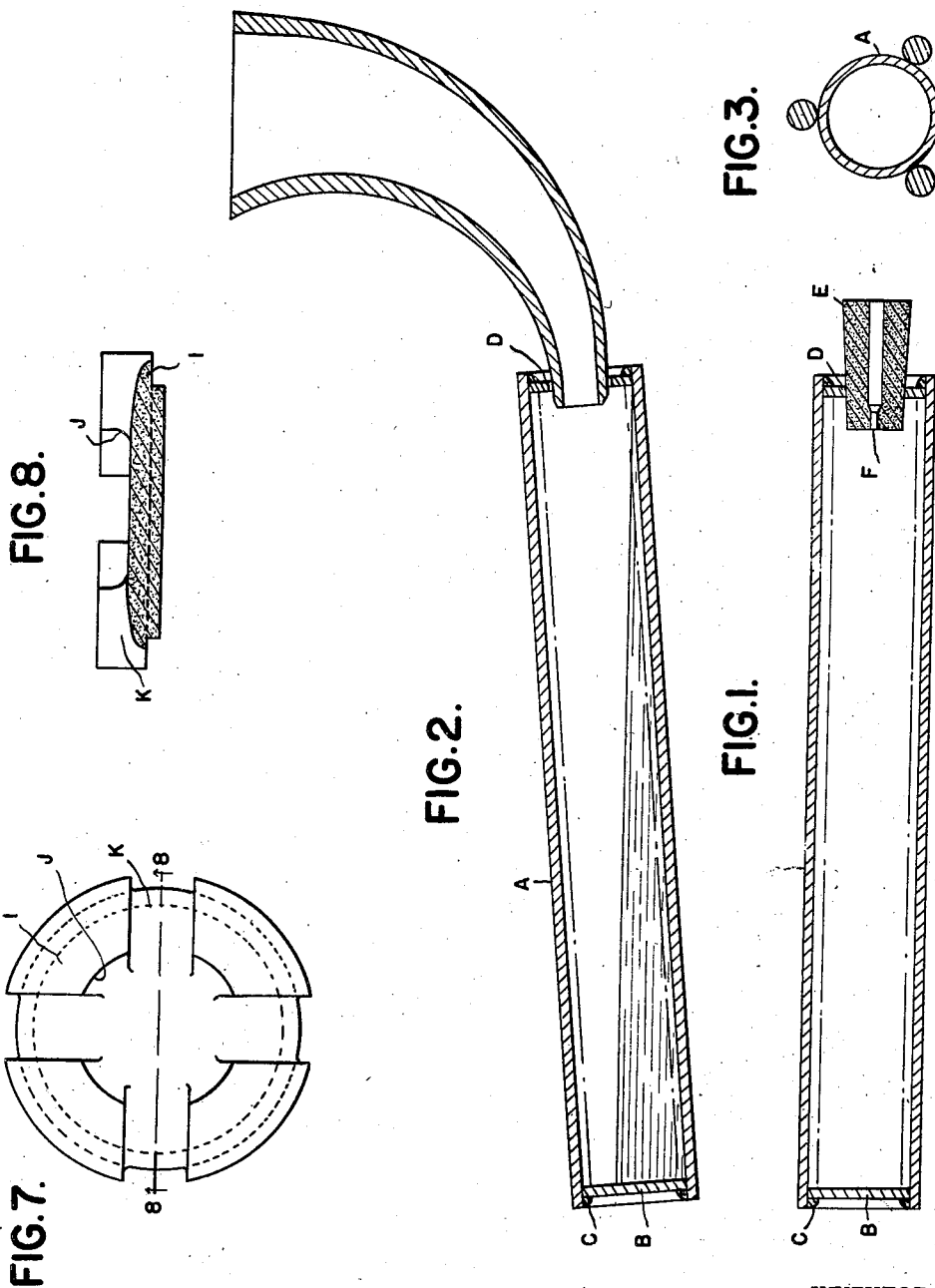
W. BROWN

2,319,657

METHOD FOR COATING TUBING

Filed Jan. 21, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG.6.

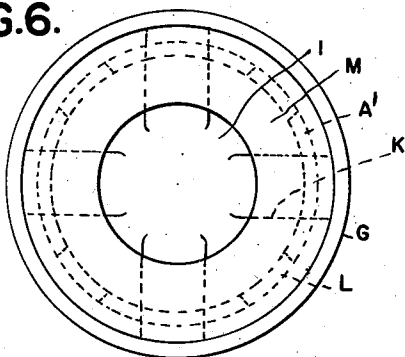


FIG.9.

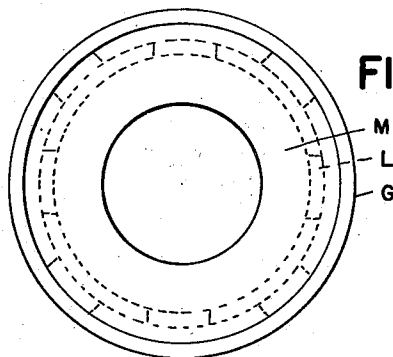


FIG.4.

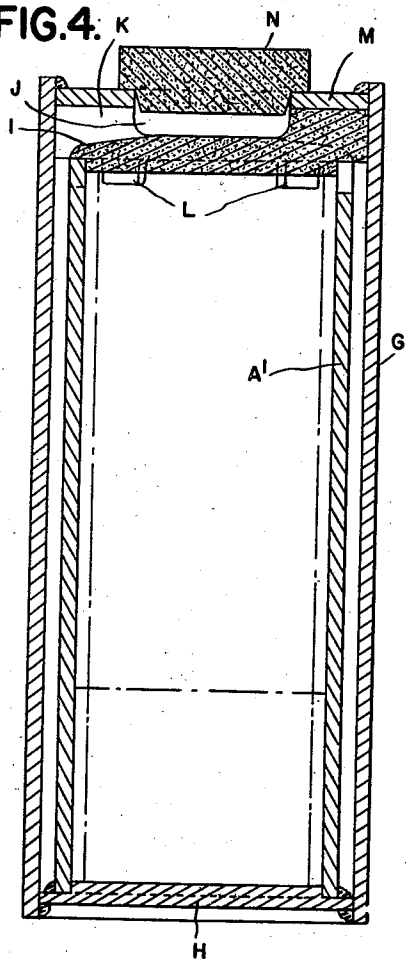
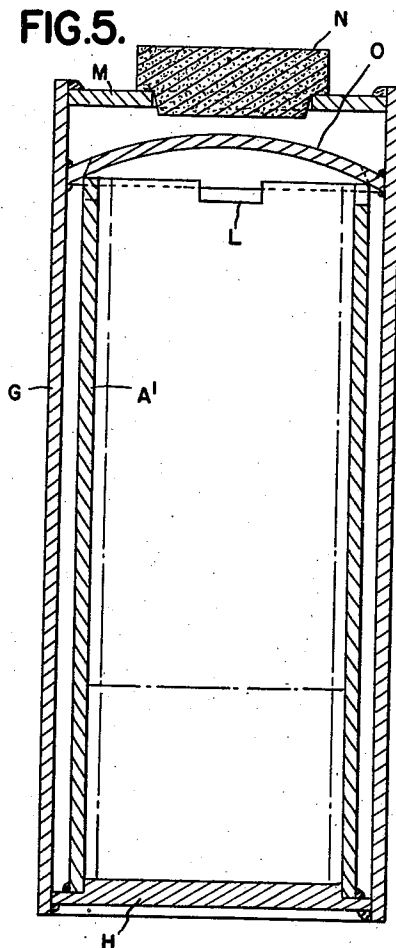


FIG.5.



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METHOD FOR COATING TUBING

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Application January 21, 1941, Serial No. 375,346

4 Claims. (Cl. 117-97)

The invention relates to the manufacture of tubing comprising a plurality of integrated layers of different metals. More specifically, the invention relates to the method and apparatus for lining or coating tubing formed of one metal with another metal which is integrated therewith. Heretofore tubes or cylindrical shells have been coated with another metal by melting the coating metal within the tube to be coated which latter is substantially sealed to maintain therein a non-oxidizing atmosphere. After the melting of the coating metal, the tube is transferred to a spinning apparatus which distributes the molten metal to form a uniform coating around the surface of the tube. It has been found, however, that in such process the molten metal will be contaminated by its contact with the heated surface of the tube so as to objectionably change its characteristics.

It is the object of the instant invention to obtain a method in which the coating metal and the tube are separately heated and are only in contact with each other for a brief interval during the spinning operation. It is, however, necessary to protect the surface of the tube which is to be coated against oxidation during the heating process. The invention, therefore, consists in the method and the apparatus as hereinafter set forth.

In the drawings:

Figure 1 is a longitudinal section through the tube to be coated prior to the introduction of the molten metal;

Figure 2 illustrates the method of introducing the molten metal into the tube;

Figure 3 is a cross section illustrating the spinning operation;

Figure 4 is a vertical longitudinal section through an apparatus for coating the tube both inside and outside the same;

Figure 5 is a similar view through a slightly modified construction;

Figure 6 is a top plan view of Figure 4, with the closure plug removed;

Figure 7 is a plan view of the closure head;

Figure 8 is a section on line 8-8 of Figure 7; and

Figure 9 is a top plan view of Figure 5 with the closure plug removed.

As illustrated in Figure 1, A is a tube which is to be lined with another metal. B is a head for closing one end of the tube being preferably welded thereto as indicated at C. D is a centrally apertured head for closing the opposite end of the tube which also is preferably secured

by welding. E is a tapering plug formed of graphite or other refractory material which is adapted to close the aperture in the head D. F is a small vent aperture, preferably in the plug E, which will permit the escape of gases from the interior of the tube.

The tube A or a series of tubes of this character are placed within a heating furnace and raised to the desired temperature. When properly heated, the plug E is removed, a funnel is inserted into the aperture in the head D and a suitable quantity of the molten lining metal is introduced through said funnel into the tube. During this step the tube is preferably held in inclined position so that the molten metal will form a pool in the lower end portion. The funnel is then removed, the plug E reinserted to close the aperture after which the tube is transferred to a spinning apparatus such as illustrated in Figure 3. This will rapidly rotate the tube so as to uniformly distribute the molten metal by centrifugal action. After cooling, the heads B and D are removed from the tube and may be re-used in connection with other tubes. By this method, the molten metal only contacts with the heated tube for a comparatively short time interval and, therefore, does not absorb the metal of the tube to any objectionable extent.

The process as thus far described is particularly applicable for the lining of comparatively long tubes. Where it is desired to not only line the tube but also to externally coat it, I may employ the apparatus as illustrated in Figures 4 to 8. As shown in Figure 4, G is a cylindrical container of slightly larger diameter than the tube A' which is to be coated. H is a head for closing the lower end of the container G. This head has an inner concentric portion of smaller diameter adapted to be inserted in the lower end of the tube A' to properly center the same within the container G. The container G is of greater height than the tube B' and has inserted in its upper end a head I formed of graphite or refractory material and which, in cooperation with the head H, centers the tube A'. The head I is preferably formed with a central recess J in its upper portion which is connected by radial channels K with the space between the tube A and container G. The tube A' is also provided at its upper end with notches L establishing communication between the interior of the tube and the annular space between the tube and the container. M is an upper closure head preferably of metal which is welded to the container G and serves to hold

the head I in position. The head M is centrally apertured to receive a removable closure plug N.

With this construction, the container G and its enclosed tube are first heated to the desired temperature after which the plug N is removed and molten coating metal is introduced through the central aperture into the recess J. From here it will flow into the radial channels K to the space between the tube and container first filling this space and later overflowing through the notches L into the tube where it will form a pool at the lower end. The device is then transferred to the spinning rolls which will distribute the molten metal within the tube by centrifugal action.

Figure 5 shows a construction similar to Figure 4 differing therefrom only in substituting a convex metallic head O for the graphite head I.

What I claim as my invention is:

1. The method of coating metallic tubes with a different metal layer of substantial thickness comprising heating the surface to be coated to a high temperature within a substantially closed cylinder containing a non-oxidizing atmosphere, separately melting the coating metal, opening said cylinder and introducing through said opening a quantity of the molten metal, and spinning the cylinder to distribute the molten metal uniformly over said surface and to solidify the same before contamination occurs.

2. The method of coating metallic tubes with a different metal layer of substantial thickness comprising heating the surface to be coated to a high temperature within a cylinder having substantially closed ends and containing a non-oxidizing atmosphere, separately melting the coating metal, opening one end of said cylinder and introducing through said opening a quantity

of the molten metal, closing said opening, and spinning said cylinder to distribute the molten metal over said surface and to solidify the same before contamination occurs.

3. The method of lining tubes with a different metal layer of substantial thickness comprising closing the opposite ends of a tube to maintain therein a non-oxidizing atmosphere, heating the tube to a high temperature, separately melting the coating metal, opening a central port in one of the closed ends of the tube and introducing through said port a quantity of the molten metal while said tube is in an inclined position, closing said port, and spinning the tube with its axis horizontal to uniformly distribute the molten metal about the inner surface thereof and to solidify the same before contamination occurs.

4. The method of coating tubes upon both the inner and outer surfaces thereof with a different metal in layers of substantial thickness comprising positioning a tube concentrically within a cylindrical container with an annular space between the tube and container, closing the opposite ends of said container to maintain therein a non-oxidizing atmosphere, heating the container and the tube therein to a high temperature, separately melting the coating metal, opening one of the closed ends of the tube and introducing through said opening a quantity of the molten metal, and spinning the cylindrical container to distribute the molten metal by centrifugal action around the inner surface of said tube also filling the annular space surrounding said tube to solidify the molten metal before contamination occurs.

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