June 3, 1924. 1,496,309

H. F. GIRVIN

PROCESS AND APPARATUS FOR COATING METAL ARTICLES

Filed Dec. 31, 1921

Fig. 1.

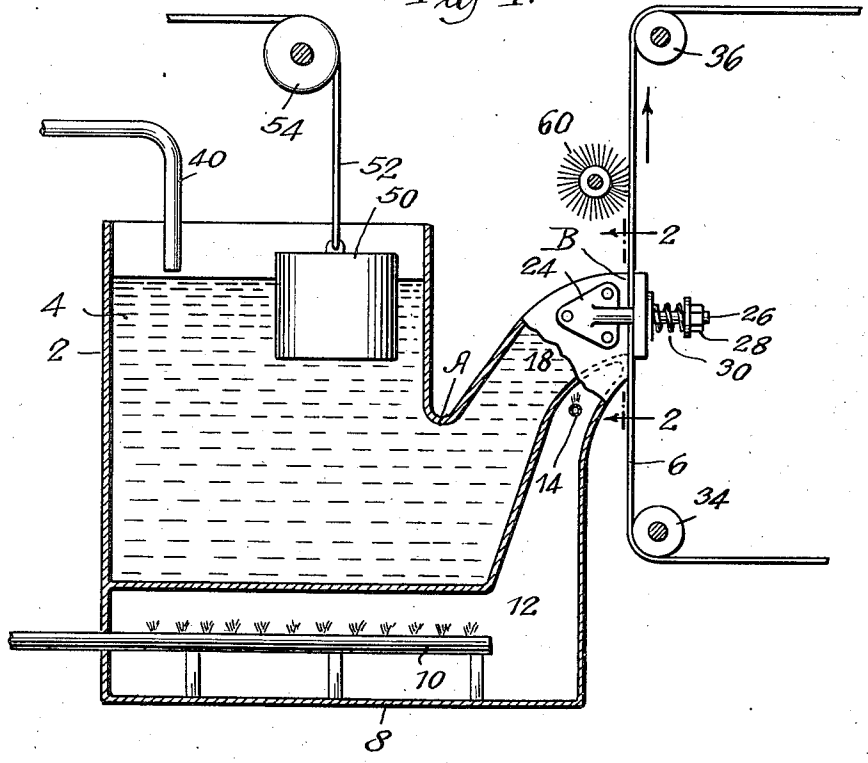



Fig. 3.

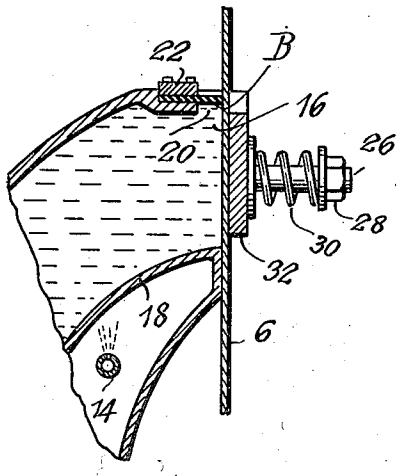
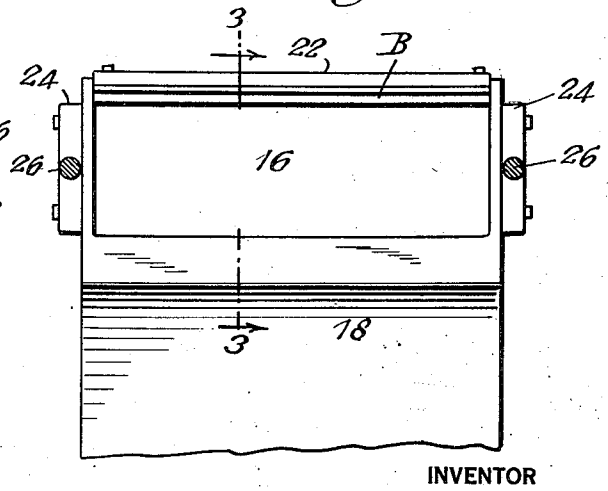



Fig. 2.




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# UNITED STATES PATENT OFFICE.

HARVEY F. GIRVIN, OF ANSONIA, CONNECTICUT.

## PROCESS AND APPARATUS FOR COATING METAL ARTICLES.

Application filed December 31, 1921. Serial No. 526,141.

*To all whom it may concern:*

Be it known that I, HARVEY F. GIRVIN, a citizen of the United States, residing at Ansonia, county of New Haven, State of Connecticut, have invented certain new and useful Improvements in Processes and Apparatus for Coating Metal Articles, of which the following is a specification.

This invention relates generally to a process and apparatus for applying molten metal to solid metal bodies and more particularly to a process and apparatus for coating or plating one of the surfaces of sheets or bodies of other shapes of solid metal with molten metal.

One of the objects therefore of the invention is to coat one side of a sheet or body of solid metal with a layer of molten metal. Another object is to provide a process and apparatus by the use of which the solid materials may be continuously coated without interrupting the procedure. Another object of the invention is to make provision for coating objects in a substantially uniform manner so as to have an equal or substantially equal amount of coating per unit of coated area of the object operated upon.

Another object of the invention is to so perform the operation of coating that the object to be coated forms a portion of the side wall of the tank which contains the coating material, thereby preventing loss of the coating material from the tank and also enabling the performance of the operation without causing oxidation of the coating material.

Other objects and advantages of the invention will appear from the subjoined description and claims.

In carrying out this invention a tank or vessel for containing the coating material is provided with means for heating the material to render it plastic, or liquid, and the tank is also provided with a mouth or outlet over the face of which the object to be coated is passed in such manner that the desired layer of coating material is applied in a rapid and uniform manner, in the absence of air, thus providing against the oxidation of the coating material as it is applied to the object being coated.

The invention therefore is especially applicable to the coating of thin sheets of metal, such as copper or iron, with a layer or coating of tin or other metal in a molten state which quickly becomes solid and clings tenaciously to the surface of the object that is being coated.

Referring to the drawings in which the same reference character indicates the same part in the several views:

Fig. 1 is a side elevation partly broken away of an apparatus for carrying out my invention.

Fig. 2 is a detail in section on line 2—2 of Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 2.

In the drawing, 2 designates a tank or vessel for containing the liquid or coating material 4 that is to be applied to the sheet 6 or other object to be coated. The tank 2 is mounted on a base or standard 8 and may be heated by a gas jet 10, situated in a heating chamber 12, or in any other suitable manner, an auxiliary jet 14 which will be hereinafter more particularly referred to being also utilized for this purpose.

The tank 2 is provided with a mouth or outlet 16 provided in the end of a spout 18 leading from the lower part of the tank, as clearly shown. The mouth of the spout is cut away at its upper portion at 20, over which extends a plate of heat resisting material such as asbestos secured by a bolted bar 22, or other suitable means, as will be clearly understood.

At each side of the tank adjacent the mouth of the spout is secured a bracket 24 which carries an arm 26 threaded for engagement with an adjustable nut 28, said nut engaging a compression spring 30 mounted on the arm 26 which in turn compresses a plate 32 which is also mounted on the arm 26 inwardly towards the edges or lips of the mouth 16, thus firmly closing the same. Rollers 34 and 36 are so mounted that a sheet 6 of flexible material, such for example as a thin sheet of iron or copper, may be passed from one to the other, as indicated by the arrow, along the face of the outlet or mouth 16 between the plate 32 and the lips of the outlet. The rollers 34 and 36 may be so placed that the act of drawing the sheet 6 over the rollers by any convenient means (not shown) will cause the sheet 6 to move into close contact with the end of the outlet and at the same time the spring 30 will press the plate 32 against the other side of said sheet 6, thereby causing it to be pressed firmly into contact with the mouth of the outlet, thus closing the

same, and preventing the coating material from escaping along the edges of the outlet. The sheet 6 will, of course, be at least as wide as the outlet 16.

A feed or inlet pipe 40 may be provided for the liquid material and a weight 50 suspended by a cord 52 passing over a pulley 54 may be varied in depth in the liquid in the tank for the purpose of regulating the height of the surface of the liquid in the tank.

A power driven brush or swab 60 is mounted just above the mouth of the tank for the purpose of removing any excess metal that might adhere to the sheet, and it is placed sufficiently close to the tank so that it will operate upon the metal coating before it solidifies.

The purpose of providing a spout or teapot construction for the tank is to guard against and effectually prevent any deterioration of the coated product because of oxidation of the heated metal when it is being applied to the solid sheet. Air is prevented from coming into contact with the metal by means of the construction of the spout, for the reason that the exposed surface of the metal is at the upper portion of the chamber, as clearly shown in the drawing and no part of the metal in the spout or at the place of application is permitted to come into contact with the atmosphere. Furthermore, it is possible to protect the metal with a layer of burning charcoal at the metal level, thus reducing the oxidation even at this point to a very low degree. The charcoal and what small amount of dross might be formed is prevented from reaching the coating point by always keeping the metal level above the point A at the neck of the spout. The spout or plating mouth is always kept full by an adjustment of the weight to the level B at all times when the machine is in operation. This is done by raising and lowering the weight, which may be automatically controlled by means of a float, or may be raised and lowered by hand as desired. By thus keeping the spout filled, air is prevented from coming into contact with the heated metal at this point, thus preventing oxidation. The heating chamber is formed entirely underneath the tank both at its lowermost portion and also underneath the spout, so that the entire metal content may be heated at all times.

The operation is as follows: The coating material is introduced into the tank 2 to the proper depth and heated by means of the burner 10, or in any other convenient way, to cause it to assume a liquid or semi-liquid state.

The sheet or object to be coated is passed over the guide rollers between the spring pressed plate and the lips of the mouth of the spout by any suitable mechanism for drawing or pulling the sheet in any desired manner. The sheet itself closes the mouth or outlet and the liquid metal in the tank comes into contact with one side thereof and coats the same as it is drawn upwardly in contact with that portion of the liquid, in the absence of air, thus avoiding oxidation.

The sheet of iron or other metal to be coated with molten tin, for example, is to be suitably cleaned before passing through the machine by the application of hydrochloric acid or otherwise. After cleaning, it is necessary to heat the sheet slightly before plating, to remove any dampness which might remain from the cleansing solution. This step may be done by passing the sheet through a gas heated oven.

After the sheet leaves the coating spout it comes in contact with a power driven brush or swab 60 of the roller type. This brush or swab is for the purpose of removing any excess metal that may adhere to the sheet, and this of course, must be done before the metal coating has solidified.

It is to be understood that instead of coating one side of a thin sheet as above indicated, blocks or other shapes of solid material having a plain or uniform surface may be passed in close contact with the face of the mouth or opening of the tank and become coated.

As changes of construction could be made within the scope of my invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A method of applying a metallic coating which comprises, passing a surface to be coated in contact with a portion separated from a body of molten metal out of contact with the air, said surface preventing a contact of the molten metal with the air.

2. A method of applying metal coatings which comprises passing a surface to be coated along the face of an outlet of a tank containing a molten metal, said outlet being below the surface level of the metal in said tank and said surface closing said outlet to the escape of metal or exposure to air.

3. A method of applying metal coatings which comprises passing a surface to be coated over an outlet of a tank containing molten metal to be applied to said surface, said surface closing said outlet to the escape of metal or exposure to air, said outlet communicating with said tank below the surface level of said liquid in said tank and maintaining the level of said molten material at or slightly above the upper edge of said outlet.

4. A method of applying metal coatings which comprises passing a surface to be coated over an outlet from a tank positioned below the surface level of molten metal in said tank, said surface closing said outlet to the escape of metal or exposure to air and maintaining a reducing agent in contact with the surface of said molten metal.

5. A method of applying metal coatings which comprises passing a surface to be coated over an outlet from a tank below the level of molten metal therein and pressing the surface against the edges of said outlet to prevent the access of air and to permit a coating of the molten metal to adhere to the surface as it passes the edge of said outlet, said edge being at, or immediately below, the level of the molten metal.

6. A method of applying metallic coatings which comprises passing a surface over an outlet from a tank below the level of molten metal in said tank, the upper edge of said outlet being at or near the level of said molten metal in said tank and said surface closing said outlet to the escape of metal or exposure to air, and removing the excess of coating material adhering to said surface.

7. A method of applying coatings which comprises passing a sheet of material upwardly along the face of an outlet of a tank positioned entirely below the level of liquid in said tank and pressing said sheet against said outlet, the upper edge of said outlet being but slightly below the level of liquid in said tank.

8. A method which comprises passing a sheet of material to be coated upwardly across the face of an outlet of a tank containing a coating liquid in a manner to close said outlet while maintaining said liquid in said outlet out of contact with the atmosphere and feeding a supply of coating material to a part of said tank exposed to the atmosphere.

9. A method which comprises passing a sheet to be coated across the face of an outlet of a tank below the level of liquid in said tank in a manner to close the outlet to the atmosphere and maintaining a constant level of liquid in said tank entirely above said outlet by immersing a weight to greater or less depth in said tank.

10. A method which comprises withdrawing liquid from a tank below the surface level in said tank to an outlet orifice, passing a sheet of material to be coated across the face of said orifice in a manner to maintain the liquid in said orifice out of contact with the atmosphere and to coat said sheet and maintaining approximately atmospheric pressure on said liquid at the upper edge of said orifice.

11. Apparatus for coating sheets of material with metal which comprises a tank, an outlet from a side of said tank below the normal level of liquid in said tank, and having an upper edge near the normal level of liquid in said tank, means for resiliently pressing a surface to be coated against said opening to seal it against contact with the atmosphere and against the leakage of liquid and for permitting the passage of said surface over said outlet, means for adjusting the upper edge of said opening to or from said surface, means for maintaining the level of liquid in said tank at or above the upper edge of said outlet and means for maintaining the contents of said tank in molten condition.

12. An apparatus for coating sheets of material which comprises a tank having a covered spout inclined upwardly from the lower part of said tank to a distance slightly below the top of said tank to seal the liquid between the body of said tank and the opening of said spout from the air, means for passing a sheet of material to be coated across the face of the outlet of said spout to close said spout and form a coating on said sheet, means for maintaining the contents of said tank in molten condition, and a weight movable in said tank to control the level of liquid in said tank.

13. An apparatus for coating sheets of material with metal, which comprises, a tank having a covered spout inclined upwardly from the lower part of said tank to a distance slightly below the top of said tank to seal the liquid between the body of said tank and the opening of said spout from the air, means for passing a sheet of material to be coated across the face of the opening of said spout to close said spout and form a coating on said sheet.

In witness whereof, I have hereunto set my hand at Ansonia, county of New Haven, State of Connecticut, this 14th day of December, 1921.

HARVEY F. GIRVIN.