LIQUID APPLYING APPARATUS FOR STRIP MATERIAL

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This invention relates to apparatus for applying liquids to material which passes in a horizontal direction. More particularly, this invention is related to the manufacture of steel tubing by continuous process in which a strip of metal passes in a horizontal direction through tube-forming, welding and annealing apparatuses and through devices which apply flux and a coating metal.

An object of the invention is to provide devices which apply liquids such as flux and a melted metal to the tubing while it moves in a horizontal direction and which provide for the circulation, without the use of pumps, of the liquids to an elevation above the level of these liquids in the vessels which contain them. In the disclosed embodiments of the invention, this object is accomplished by the use of a horizontal trough through which the material passes, a pipe partly submerged in the liquids and open at its lower end and connected at its upper end with the trough, by means located within the pipe for causing the column of liquid in the pipe to rise above the level of the liquid in the containing vessel.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

Figs. 1 to 7 illustrate apparatus for applying flux to tubing.

Fig. 1 is a plan view.

Fig. 2 is a sectional view on line 2—2 of Fig. 1.

Fig. 3 is an end view.

Fig. 4 is a sectional view on line 4—4 of Fig. 1.

Fig. 5 is a sectional view on line 5—5 of Fig. 1.

Fig. 6 is a longitudinal sectional view of a trough, fragments of which are shown in Fig. 4.

Fig. 7 is a sectional view of a nozzle.

Figs. 8 to 14 illustrate apparatus for applying coating metal to tubing.

Fig. 8 is a plan view.

Fig. 9 is a sectional view on line 9—9 of Fig. 8.

Fig. 10 is an end view.

Fig. 11 is a sectional view on line 11—11 of Fig. 8.

Fig. 12 is a sectional view on line 12—12 of Fig. 8.

Fig. 13 is a sectional view on line 13—13 of Fig. 11.

Fig. 14 is a sectional view on line 14—14 of Fig. 12.

Referring to Figs. 1 to 7, which show the fluxing apparatus, the flux tank 20 comprises side plates 21, end plates 22 and a bottom plate 23 assembled with horizontal angles 24, 25, 26 and 27, T-bars 28 and 29, plates 30 and 31 and vertical angles 32 which provide supporting legs. The plates 21, 22 and 23 are lined with acid resisting bricks 33 bonded with acid resisting cement 34 and a layer 35 of acid resisting cement between the bricks and the plates. The structure supports a top plate 37 having an oblong opening 38. The vessel is kept filled with flux to a level indicated approximately by the dot-dash line 39 and it is heated by a hot gas coil 40 immersed in the flux.

Plate 31 supports brackets 41, two of which support a trough 42 and one supports an excess flux remover 43. The tube 44 passes toward the right through a guide tube 44, through the trough 45, the flux remover 43 and out through a guide tube 45. The trough 42 is notched at 46 to receive a short, inclined trough 47 having an end wall 48 and a side opening 49. A pipe 50 is connected to the higher end of the trough 47 and extends into the lower portion of the tank 20. The lower end of the pipe 50 receives a nozzle 51 connected by a pipe 52 with a chamber 53 supplied with compressed air which issues from the nozzle openings 54 (see Fig. 7) and causes the column of liquid in the pipe 50 to rise above the liquid level 33 and flow into the trough 47. The liquid flows down through the inclined trough 47, out through the side opening 45 and on to the trough T travelling rapidly through the trough 42. The liquid which is agitated by the rapidly moving tube is directed downwardly on the tube by baffles 55. The liquid which does not cling to the tube returns to the tank. A plate 56 suspended from the trough 42 conducts heat thereto from the liquid in the tank to raise the temperature of the trough before the circulation of the liquid begins. The excess liquid clinging to the tube T is removed by a jet of compressed air supplied through a pipe 57 and issuing through a nozzle 58 provided by the excess liquid remover 43. A plate 59 (Fig. 5) supports the compressed air container 53 and provides the cover therefor. A bracket 61 suspended from plate 60 supports the pipe 50. An opening 62 (Fig. 1) in the plate 60 provides for the admission of compressed air from a pipe not shown.

The apparatus, for applying a coating metal, will now be described with reference to Figs. 8 to 14. The molten metal (which may be a tin-lead alloy) is contained in a tank 70 formed of metal side plates 71, end plates 72 and a bottom
plate 73. The level of the tin is approximately that indicated by the dot-dash line 74 and kept in molten condition by circulating hot air gases through a coll 75.

The tank 70 rests directly upon bars 76 supported by a bottom plate 77 which is supported by an angle iron structure similar to that used for supporting the flux tank. This structure supports a jacket 78 of suitable bricks with a dead air space between the jacket 78 and the tank 70. Tank 70 includes flange plates 79 and 80 fitting closely against the upper part of the pipe 83 and thereby forming material support brackets 81 (Fig. 8), two of which support a trough 82 and the other an excess metal remover 83. The two side flange plates 83 support a plate 84 which supports a frame 85 carrying an electric motor 86 (Fig. 10) which drives a shaft 87 supported by the motor and by a step bearing 88. Shaft 87 drives a propeller 89 enclosed by the lower end portion of a pipe 90 having a flange ring 91 attached to the plate 84. Pipe 90 carries a baffle rib 92 terminating above the propeller 95. A pipe 93 connects the upper portion of pipe 90 with the trough 92. The propeller 89 is rotated by the motor in the direction of arrows 84 which causes the molten tin to be lifted through the pipe 90 to a level at least that of the side pipe 93 so that molten metal will be discharged into the trough 92. The lifting of the molten metal through the pipe 90 is due not alone to the action of the propeller 89 but also to the presence of the rib 92 without which the propeller would be ineffective. The propeller alone will cause a mass of molten metal within the pipe to have a swirling motion. When the swirling of the molten metal is intercepted by the baffle rib 92, it rises above the level approximately indicated by line 74.

The tube T passes toward the right through a metal guide tube 95 occupying a notch 96 in the jacket and then through the trough 92, the excess metal remover 83 and a guide tube 97. The excess metal is removed by a jet of compressed air issuing from a nozzle 97 supplied by a pipe 88. The metal not clinging permanently to the tube T returns from the trough 92 and the remover 83 to the tank. Trough 92 supports a plate 98 extending below the level 74 for the purpose of transferring heat from the molten metal in the tank to the trough so that its temperature will be raised above the melting point of the metal before the circulation of the metal begins.

From the foregoing description of a flowing device and metal cooling device, it is apparent that each has a horizontal, material receiving trough located above the level of the liquid in the tank and supplied with liquid from the tank by causing circulation of liquid through a pipe suspended in the tank and extending to a level slightly above the bottom of the tank. Within the lower portion of the pipe there is located means which causes the rise of the column of liquid into the pipe below a level such that the liquid can gravitate into the trough, thus dispensing with the use of pumps.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Apparatus for applying liquid to horizontally moving material comprising a tank for containing the liquid, a horizontal tubular trough suspended within the tank above the normal of the liquid therein and open at its ends to permit passage of the material therethrough, said tank having openings through opposite side walls thereof in substantial alignment with the trough ends so that the material can pass into the tank through one wall thereof and out through the opposite wall of the tank, a vertical pipe in the tank extending below the liquid level and above the bottom of the trough and open at its lower end, a duct connecting the upper part of the pipe with the trough thereby venting the material contained in the trough and liquid level in the pipe is the same as the liquid level in the tank, means for heating the liquid in the tank, a heat conducting plate attached to the trough and extending below the liquid level whereby the trough receives heat the liquid in the liquid in advance of the passage of heated liquid into the trough, and means located within the pipe for causing the column of liquid in the pipe to rise and overflow through the duct into the trough.

2. Apparatus for applying liquid to horizontally moving material comprising a tank for containing the liquid therein and open at its ends to permit passage of the material therethrough, said tank having openings through opposite side walls thereof in substantial alignment with the trough ends so that the material can pass into the tank through one wall thereof and through the other tank and out through the opposite wall of the tank, a vertical pipe in the tank extending below the liquid level and above the bottom of the trough and open at its lower end, a duct connecting the upper part of the pipe with the trough thereby venting the liquid in advance of the passage of heated liquid into the trough, means located within the pipe for causing the column of liquid in the pipe to rise and overflow through the duct into the trough, said means comprising a
A power-driven rotary propeller within the pipe near its lower end and a baffle rib within the pipe and extending longitudinally thereof above the propeller.

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