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COATING CONTROL DEVICE

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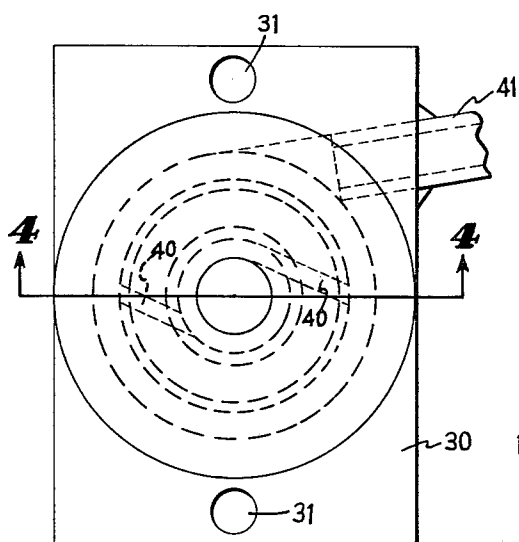


**FIG. 3.**

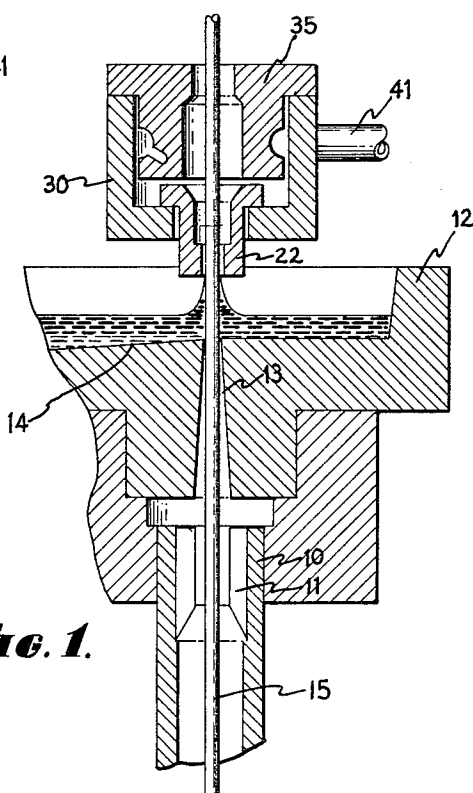


**FIG. 1.**

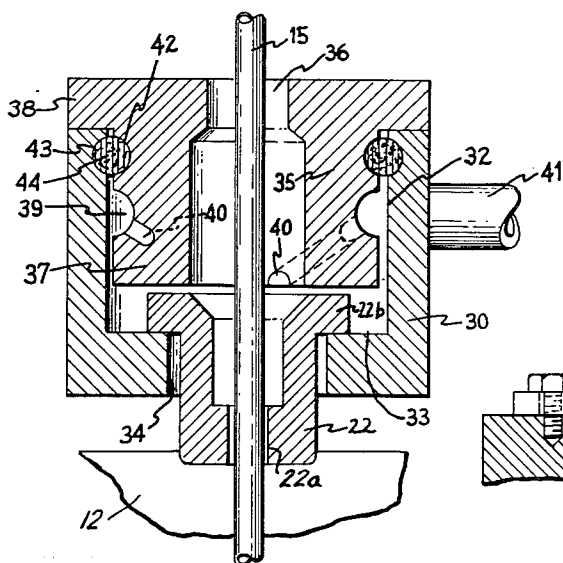


**FIG. 4.**

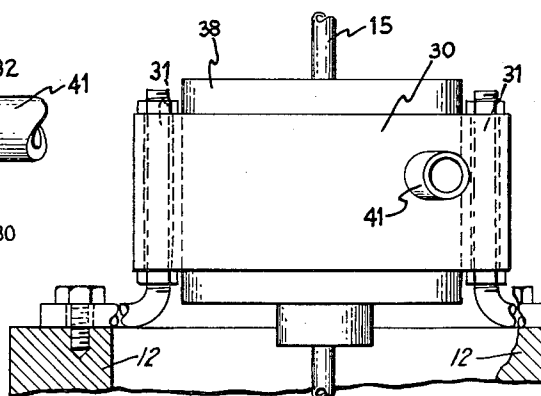


**FIG. 2.**

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3,060,889

## COATING CONTROL DEVICE

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8 Claims. (Cl. 118-63)

This invention relates to a coating control device and more specifically to a coating control device for use with an apparatus of the hot dip type for the coating of metallic strands with a molten coating metal.

The invention herein disclosed is particularly useful in connection with an apparatus such as disclosed in the Knapp Patent No. 2,914,423 dated November 24, 1959. In that patent, there is disclosed and claimed an apparatus wherein a metal strand passes through a container for molten coating metal which has an orifice in its bottom so that the strand moves vertically upward through the coating bath and emerges therefrom in a vertical path. Above the coating bath the strand passes through a coating control element of non-wettable material which has an aperture for the passage of the strand in its freshly coated condition with clearance thereabout.

It is desirable to provide a floating mount for the coating control element which accomplishes the function of determining the thickness of coating metal by fluid friction and without contact with the strand. Thus, if the strand wanders radially of its axis the coating control element should be capable of free movement in a radial direction so as not to damage the fresh coating on the strand.

In connection with the coating of strands, it is also desirable that they be subjected to a gas finishing operation. Such finishing operation may be of the type disclosed and claimed in the Coburn Patent No. 2,526,731 dated October 24, 1950, wherein the strand in its upward passage is subjected to a non-oxidizing or a reducing gas whereby the formation of "berries" is avoided. According to the teachings of the Coburn patent, the gas should have a downward flow with respect to the strand and the gases introduced are caused to burn at the lower end of the finishing chamber and upon the surface of the coating bath. Any gas which escapes at the upper end of the chamber is also caused to burn.

Reference is made to the above mentioned Coburn patent and the above mentioned Knapp patent for various details as to the coating operation in general, the function of the coating control element and the gas finishing operation.

It is an object of the present invention to provide a coating control device which permits the coating control element to float radially of the strand so as to avoid damage to the strand or its coating if the strand should wander in a radial direction. It is another object of the invention to provide novel means for the introduction of the non-oxidizing gas whereby a swirling action is imparted thereto to insure a more uniform application of the gas to the surface of the strand.

These and other objects of the invention which will be pointed out in more detail hereinafter are accomplished by that certain construction and arrangement of parts of which the following discloses certain exemplary embodiments.

Reference is made to the drawings forming a part hereof and in which:

FIGURE 1 is a vertical cross-sectional view through a portion of a coating apparatus similar to that disclosed in the Knapp patent above mentioned.

FIGURE 2 is a side elevational view of the coating control device itself as seen from the right of FIGURE 1 and on an enlarged scale.

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FIGURE 3 is a top plan view of the coating control device on a still larger scale, and

FIGURE 4 is a cross-sectional view of the same taken on the line 4-4 of FIGURE 3 showing a modification.

Briefly, in the practice of the invention, a holder is provided which is fixed to the coating apparatus in any desired manner. The coating control element is mounted in said holder in such manner as to permit of movement radially of the strand and a swirl imparting member is also mounted in said holder and is also capable of radial movement. The swirl imparting member has an external annular groove providing a manifold from which passages lead to an axial bore through said member, said passages being substantially tangential to the internal surface of the bore and being symmetrically distributed around said member. A conduit for introducing a non-oxidizing gas enters the holder substantially tangentially to its internal surface and in alignment with the external annular groove mentioned above, so that the gas passes around the member through the annular groove and thence through the passages above described into the interior where it swirls about the strand being finished.

Referring now in greater detail to the drawings, a portion of the coating apparatus is shown in FIGURE 1, comprising the coating pot 12 which may or may not have the sloping bottom surface 14 to provide negative head as described in the Knapp patent. The strand 15 moves upwardly through the apparatus of FIGURE 1 coming from a pretreatment chamber where the strand may have been treated as described in the Sendzimir Patents No. 2,110,893 and 2,136,957. The pretreatment forms no part of the present invention and reference may be had to the Sendzimir patents for the details of the pretreatment. The portion of the apparatus indicated at 10 and 11 forms the subject matter of a copending application in the name of Earle L. Knapp, Serial No. 58,272, filed September 26, 1960.

The strand passes upwardly through the bottom of the pot 12, through the orifice 13 and emerges vertically from the coating metal. It thereupon immediately passes through a coating control element 22 as described in the said Knapp patent.

The coating control element, which is of non-wettable material, is mounted in a holder 30. The holder 30 is secured to the coating apparatus in any desired manner and is fixed in position in relation to the coating bath. By way of example, there have been shown (FIGURES 2 and 3) the bolt holes 31 through which bolts may be passed to secure the holder 30 in the desired position. The holder has a cup-like internal configuration, i.e. the bore 32 is cylindrical and has the flat bottom 33 (FIGURE 4). Centrally of the bottom 33 is a bore 34 in which the coating control element is mounted. As will be clear from a consideration of FIGURES 1 and 4, the element 22 has a bore 22a which serves to determine the thickness of the coating on the strand 15 as described in the Knapp patent and it is provided with an upper flange 22b. As will be clear, the diameter of the main body portion of the element 22 is substantially less than the diameter of the bore 34 while the diameter of the upper flange 22b is larger than that of the bore 34. Thus, the element 22 is supported by its flange 22b bearing against the surface 33 with the main body portion extending through the bore 34 with substantial clearance so that the member 22 is free to slide radially of the strand in any direction. This is what is meant by the expression that the coating control element "floats."

The swirl imparting member is shown at 35. It has an axial bore 36 for the passage of the strand and for the swirling gas and it comprises a main body portion 37 and an upper flange 38. Similarly to the mounting of the element 22, the member 35 is supported on the holder 30

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by its flange 38 with the main body portion 37 extending downwardly into the holder and into close proximity to the element 22.

The main body portion 37 is provided with an external annular groove 39 from which a plurality of passages communicate with the interior 36 of the member 35. These passages are indicated at 40. It will be noted that the passages 40 of which two only are shown, are symmetrically disposed with respect to the member 35 and are substantially tangential to the inner surfaces of the bore 36 where they enter and are directed downwardly. It will be understood that more than two passages 40 may be provided but they should be disposed in a symmetrical manner.

A conduit 41 for non-oxidizing gas enters the holder 30 in alignment with the groove 39 described above, and substantially tangentially of the internal surface 32 of the holder.

From the foregoing description, it will be clear that gas entering through the conduit 41 passes circumferentially about the swirl imparting member 35, through the annular groove 39 and thence through the passages 40 into the bore 36 where it swirls about the strand as it emerges without impinging directly upon the strand.

As described in the Coburn patent, the gases may be caused to burn below the element 22 and above the bath and also above the member 35 where the strand emerges.

It will be noted that there is sufficient clearance between the member 35 and the element 22 to prevent binding on the part of the member 22 during lateral movement. The weight of the element 22 together with the gas pressure will be sufficient to maintain an adequate seal for the finishing gas to prevent its escape on the outside of the element 22.

It will be understood that when the device is operating and the strand 15 is pulling molten coating metal up out of the bath, which coating metal contacts the element 22 at its lower end, it exerts sufficient lateral forces to maintain a uniform radial distance between the strand and the element 22. This feature together with the natural forces of surface tension of the molten metal produces a uniform flow of the coating metal around the strand. The details as to the vertical dimension of the bore 22a and the amount of clearance between the strand and the bore 22a may be determined as described in the Knapp patent mentioned above.

With respect to the finishing gas, the direct impingement of the gas stream upon the molten coating rising with the strand will produce finishes which are not as smooth as desired. The present invention avoids such direct impingement and produces smoother coatings than heretofore. The details of the gases used and their effect are disclosed in the above mentioned Coburn patent.

In FIGURE 4, there is shown an additional modification not shown in FIGURE 1, wherein the member 35 is provided with an additional groove 42 above the groove 39 and wherein the holder 30 is provided with a complementary groove 43. A suitable packing material 44 may be placed between the grooves 42 and 43 to provide a seal for the non-oxidizing gases.

While the invention has been described in considerable detail, it will be clear that numerous modifications may be made without departing from the spirit of the invention. No limitation not set forth in the claims is to be implied.

What is claimed is:

1. A coating control device for use with a hot dip coating apparatus wherein the strand being coated emerges from a bath of coating metal in a vertical path; comprising a holder fixed to said apparatus above said bath and having an opening in its bottom, a coating control element of non-wettable material having an axial bore for the passage of said strand in freshly coated condition with clearance, said element being positioned in said open-

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ing and having freedom of radial movement, a conduit entering said holder above said element and substantially tangential to the inner surfaces of said holder for introducing a non-oxidizing gas into said holder, and a swirl imparting member mounted in said holder above said element and having an axial bore for the passage of said coated strand with clearance, said member having an external annular groove substantially aligned with said conduit, and said member having a plurality of passages extending from said annular groove inwardly and downwardly through said member, and opening substantially tangentially into said last named axial bore.

2. A device according to claim 1, wherein said swirl imparting member has freedom of radial movement.

3. A device according to claim 1, wherein said member is provided with a second external annular groove above said first mentioned annular groove, and said holder is provided with an internal annular groove aligned with said second groove, and a packing material in said opposed grooves.

4. A device according to claim 1 wherein said last named passages are symmetrically distributed around said member.

5. A coating control device for use with a hot dip coating apparatus wherein the strand being coated emerges from a bath of coating metal in a vertical path; comprising a cup-like holder fixed to said apparatus above said bath and having an opening in its bottom, a coating control element of non-wettable material having an upper flange of a diameter greater than said opening and a main body of a diameter substantially less than said opening, said coating control element being seated in said holder with its main body extending through said opening and its upper flange resting on the bottom of said holder, said coating control element having an axial bore for the passage of said strand in freshly coated condition with clearance, a conduit entering said holder substantially tangential with respect to its inner surface and above said coating control element for introducing a non-oxidizing gas into said holder, and a swirl imparting member seated in said holder, said member having an external annular groove substantially aligned with said conduit, said member having an axial bore through which said coated strand may pass with clearance, and said member having a plurality of passages extending from said annular groove inwardly and downwardly through said member, and opening substantially tangentially into said last named axial bore.

6. A device according to claim 5, wherein said swirl imparting member has a main body of a diameter substantially less than the internal diameter of said holder, and a flange of a diameter greater than said holder internal diameter, said member being seated in said holder with its main body in said holder and its upper flange resting on top of said holder.

7. A device according to claim 5, wherein said swirl imparting member is provided with a second external annular groove above said first mentioned annular groove, and said holder is provided with an internal annular groove aligned with said second groove, and a packing material in said opposed grooves.

8. A device according to claim 5, wherein said last named passages are symmetrically distributed around said member.

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