

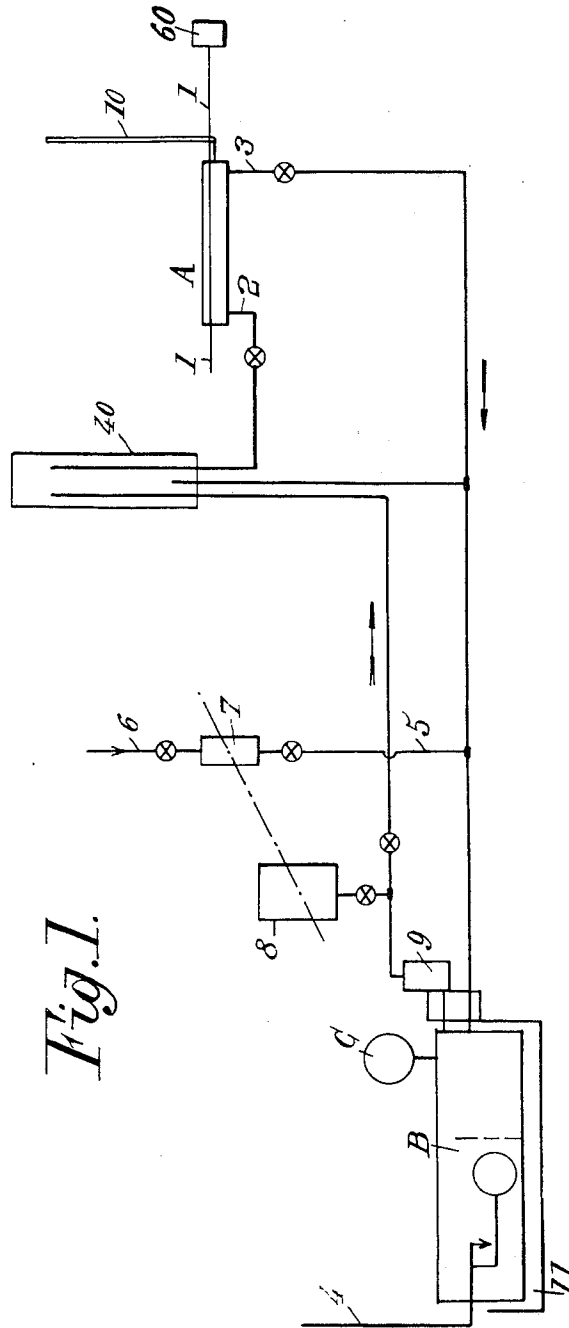
Nov. 26, 1968

R. A. GOYFFON
DEVICES FOR COATING WIRES AND IN PARTICULAR
FOR ENAMELLING ELECTRIC WIRES

3,412,709

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4 Sheets-Sheet 1



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Fig. 2.

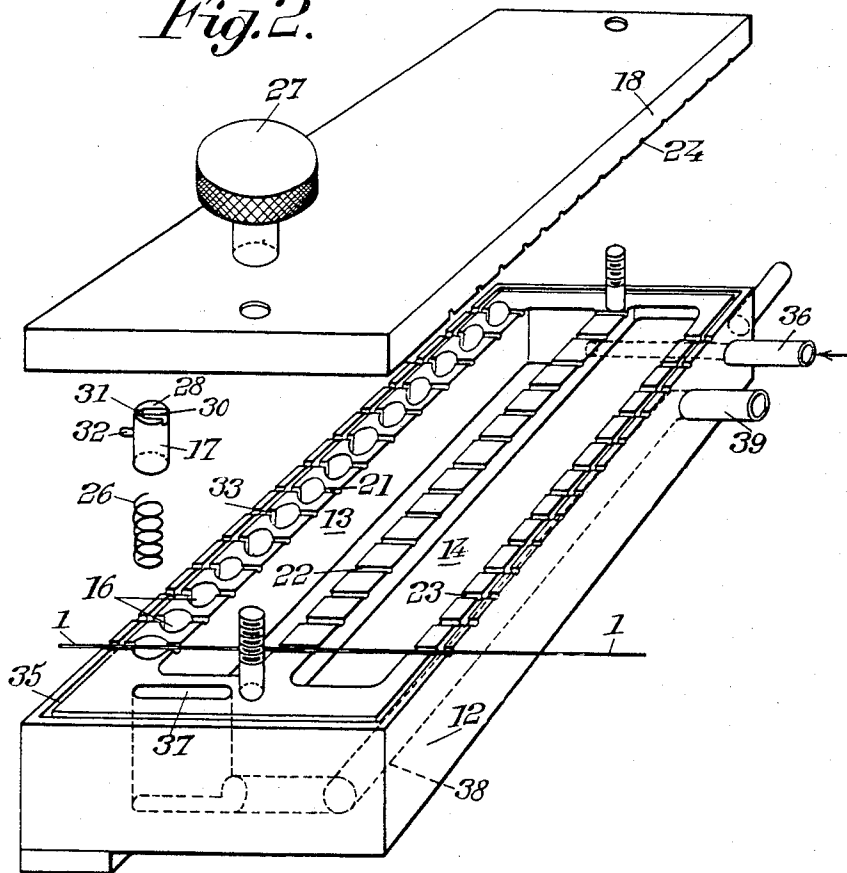
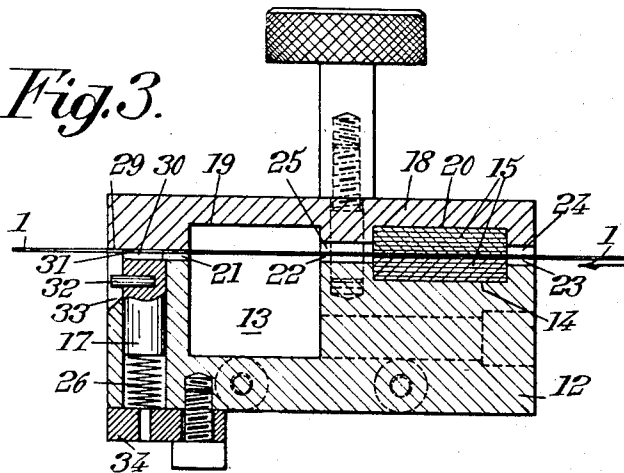


Fig. 3.



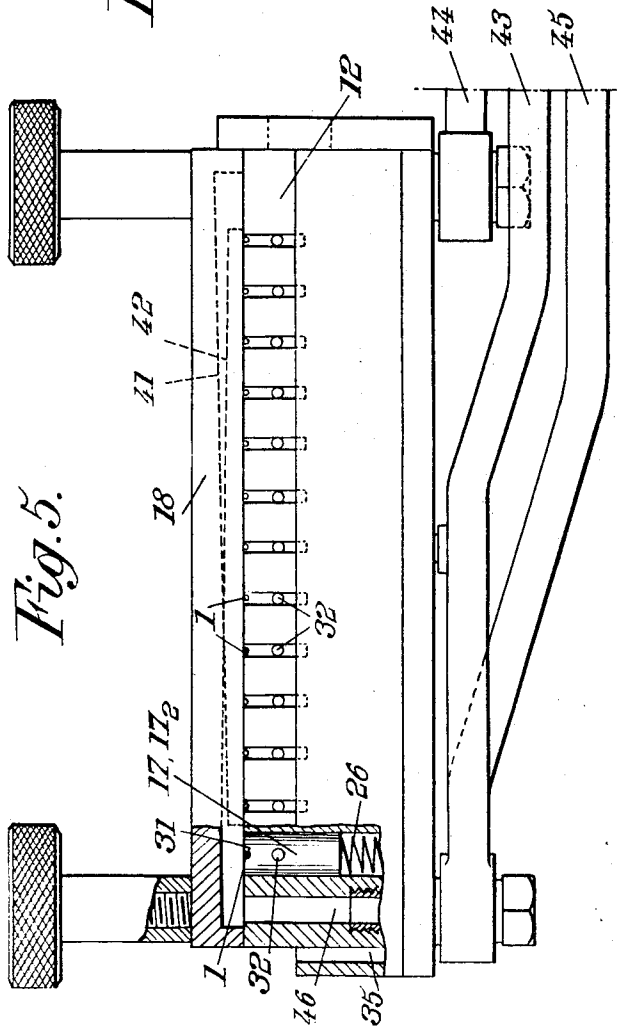
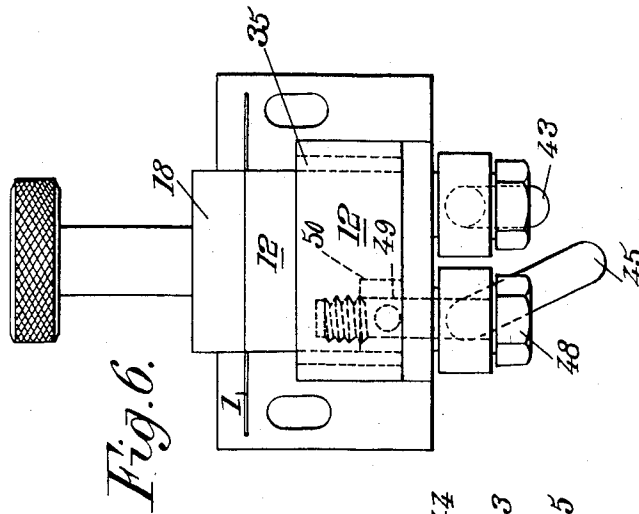
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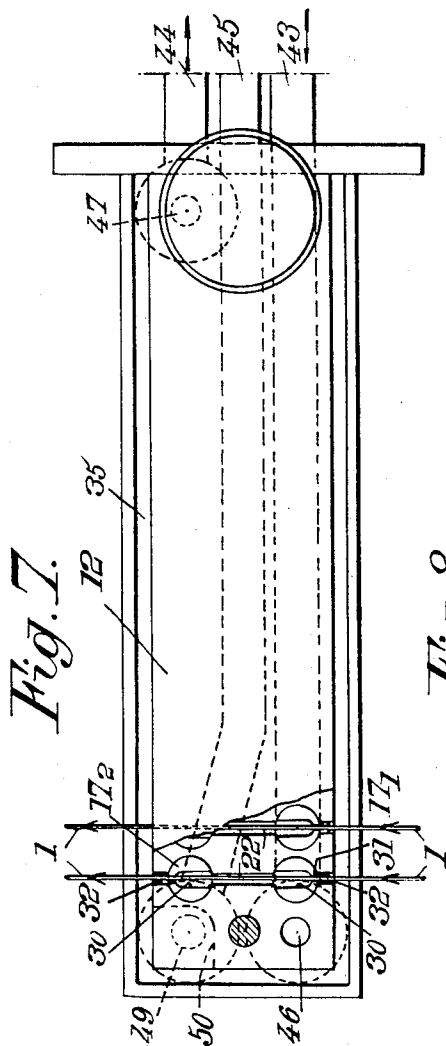
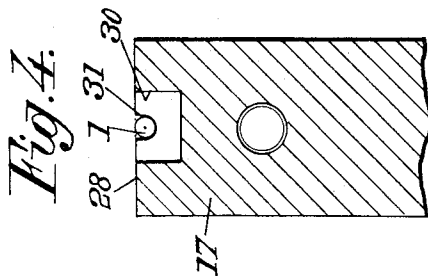
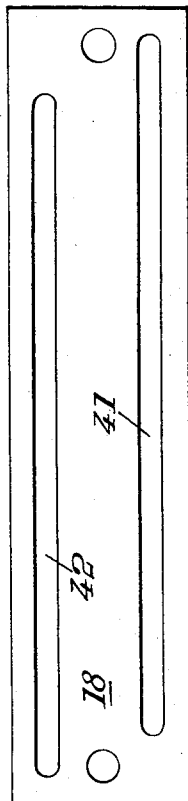


Fig. 8.



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DEVICES FOR COATING WIRES AND IN PARTICULAR FOR ENAMELLING ELECTRIC WIRES

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8 Claims. (Cl. 118—405)

ABSTRACT OF THE DISCLOSURE

Wires 1 to be enamelled are passed through an apparatus including a body 12 provided, on the one hand, with a tank 13 through which enamel under pressure is made to circulate continuously and, on the other hand, with housings 16 intended to accommodate die-blocks 17 provided with notches 31 for the passage of the wires therethrough, said body 12 being further provided with a chamber 14 containing felt elements 15. The die blocks 17 are positioned, against the action of springs 16 by a cover 18. Enamel flows continuously through tank 13. The wires 1 to be enamelled pass transversely to tank 13 and to chamber 14 through grooves 21, 22, 23 provided in said body 12. The enamel leaks are collected through a groove 35. The cross section of the die block notches 31 is U-shaped, the lower cross section of the U being semi-circular and of a diameter just a little greater than that of the wire, the height of the U being substantially equal to said first mentioned diameter.

The present invention relates to devices for coating wires with a suitable substance and in particular for enamelling electric wires.

The object of the invention is to provide an improved devices of this kind and in particular to permit of increasing the speed of enamelling while avoiding too great an evaporation of the enamelling bath.

The essential feature of this invention consists in making use of die blocks movably mounted in an apparatus fed with coating liquid and consisting of cylindrical elements engaged in corresponding housings of said apparatus.

Other features of the present invention will become apparent during the detailed description of two embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawings, given merely by way of example, in which:

FIG. 1 diagrammatically shows a plant for enamelling electric wires according to the present invention;

FIG. 2 is a perspective view of the enamel coating device according to the present invention, the cover plate of this device being shown detached from the body thereof;

FIG. 3 is a cross sectional view of the device of FIG. 2, the lid being fitted in position;

FIG. 4 is a detail view, showing on an enlarged scale and in vertical section one of the die blocks of the device;

FIG. 5 is an elevational view, partly in section, of a device made according to a second embodiment of the invention;

FIG. 6 is an end view corresponding to FIG. 5;

FIG. 7 is a plane view, with parts cut away, corresponding to FIGS. 5 and 6, and

FIG. 8 shows the cover plate of the device of FIGS. 5 to 7, seen from under.

It should be reminded that there exist several types of devices for coating wires with a liquid, and in particular electric wires with enamel.

Some of these devices make use of roller dies consisting of steel cylinders provided with grooves of triangular cross section for calibrating the enamel or varnish liquid with which the wires are to be coated. Other devices make use of felt elements.

The devices making use of roller dies have some drawbacks, due in particular to the necessity of driving said roller dies in rotation and to the difficulties which result therefrom, in particular for adjusting the roller dies or for replacing them. Furthermore, the triangular shape of the groove cross sections leads to a quick wear and tear thereof due to the action of the spring necessary for maintaining the wire at the bottom of the groove.

The devices where the wire is passed between two felt elements impregnated with varnish, also involves serious drawbacks. In particular they do not permit a sufficient accuracy. It is true that there are devices of this kind with a channel provided in the felt elements for the passage of the wire, enamel being fed to this channel from a pump having a controlled output. Such devices constitute an improvement to the current practice but they can be used only with limited outputs because there is no return of enamel from the above mentioned channel. It follows that the rates of enamelling remain low and furthermore there are risks of rises of temperature involving losses by evaporation.

The various prior systems have in common the drawback that they permit only relatively low rates of enamelling.

According to the present invention, the wire coating device comprises stationary die blocks having calibrated notches, preferably U-shaped, for the outflow of the coating liquid around the wires, said blocks being mounted removable so that they can be changed very easily, said device being fed in a continuous manner with the coating liquid through a chamber which is closed (with the exception of the passages for the inlet and outlet of the wires), the outflow through said passages returning to the liquid feed means, whereby there is no risk of elevation of the temperature and therefore enamelling can be performed at high rates.

Furthermore the U-shaped section permits of limiting leaks and obtaining layers of enamel or varnish of very great accuracy, even when they are very thin.

Furthermore, as the layers of varnish or enamel are very thin it is possible to increase the speed of the wire, that is to say the rate of enamelling, since polymerization of such thin layer can be obtained very quickly in ovens provided for this purpose. For the obtainment of thick layers, it suffices to pass the wire through the device in successive operations separated from one another by a passage through the oven, the number of these operations being variable according to the desired thickness of coating.

Embodiments of devices according to the present invention will now be described.

FIG. 1 shows an enamelling plant which comprises: at A a device for applying the enamel through which wires 1, corresponding to several successive steps of the enamelling operation, are pulled by pulling means 60, enamel or varnish arriving at 2 into the apparatus and leaving it at 3,

at B a constant level tank heated by a water bath at 11, fed with enamel or varnish at 4 and receiving solvent from conduit 5 (for instance leading to return conduit 3), in such manner that the viscosity remains constant, this solvent arriving for instance from a circuit 6 past an electrovalve 7 controlled by viscosimeter 8,

at C a circulation pump, at 9 a filter, and

at 10 a pressure gauge to measure and maintain a given pressure of enamel or varnish in device A.

In the embodiment illustrated by FIGS. 2 to 4 the device for applying the enamel or varnish comprises felt elements and die blocks, the wire passing successively through these two means.

In this embodiment, the coating device A comprises the following elements:

On the one hand, a die block carrying body 12 of elongated parallelepipedal shape containing a longitudinal tank 13 forming a channel for circulation of enamel under pressure, a longitudinal recess 14 for felt elements 15 and housings 16 for receiving the die blocks 17, and

On the other hand, a cover plate 18 adapted to fit on the upper face of said body 1 so as to close the recesses thereof and to leave only inlet and outlet passages for wires 1.

Body 12 and cover plate 18 are in contact with each other through fluidtight plane surfaces, but there is provided in cover plate 18, to complete the recesses of body 12 and to permit the passage of the wires, recesses 19 and 20 located opposite tank 13 and recess 14.

Grooves are provided in body 12 at 21, 22, 23 for the passage of the wires and above grooves 22 and 23 the cover plate is also provided with grooves 24 and 25 adapted to cooperate with notches 22 and 23, respectively. The felt elements 15 are housed in recesses 14 and 20.

Housings 16 and die blocks 17 are of cylindrical shape and springs 26 are interposed between the bottoms of housings 16 and the die blocks to push said die blocks against the cover plate 18. Said cover plate 18 is secured to body 12 by screws such as 27.

As illustrated by FIG. 4, die blocks 17 have a perfectly plane upper face 28 against which is to be applied the under face 29 of cover plate 18, which is also perfectly plane. In the top portion of every die block 17 there is provided a channel 30 provided with a notch 31 for the passage of the wire, said notch being in the form of a U, the lower portion of said notch 31 being of semi-cylindrical shape, with a diameter equal to the sum of the diameter of the wire 1 passing therethrough and of the thickness of the layer of enamel to be formed on said wire, the upper portion of notch 31 being limited by two straight surfaces at a distance from each other equal to the notch lower portion diameter and the total height of the notch being equal to said last mentioned diameter.

This U-shaped section is the most favorable one for reducing to a minimum the amount of enamel permitted to leak out and for inserting the wires to be enamelled into the die blocks.

FIG. 2 shows that, cover plate 18 being lifted and die blocks 17 being in position, it is very easy to insert the wires to be coated with enamel or varnish, after which cover plate 18 is lowered and fixed on body 12.

Die blocks 17 are provided with positioning pins 32 adapted to engage in vertical slots 33 of body 12, whereby channels 30 are correctly positioned with respect to grooves 21. The bottom of housings 12 is closed by a plate 34 which is removable to permit access to said housings (FIG. 3).

In order to recuperate the enamel that has leaked out from grooves 21 and 23, there is provided, around body 12, a collecting gutter 35 through which said enamel is returned to the general circuit.

Enamel arrives through a conduit 36 leading to tank 13, whereas the outflow of said enamel takes place freely through a passage 37, channel 38 and an outlet conduit 39. It is therefore possible at any time, by adjustment of pump C or through any other suitable means, to have in tank 13 a given pressure indicated by pressure gauge 10 (FIG. 1). In order to adjust this pressure as exactly as possible, an air separator 40 (FIG. 1) may be provided.

This pressure being determined, it controls accurately the amount of enamel carried along by the wire 1 passing through the notch 31 of every die block.

During operation, every wire 1 enters through a groove 23, passes between felt elements 15 impregnated with enamel, is coated with enamel in tank 13 and passes out through notch 31, the amount of enamel adhering to said wire being accurately calibrated. The wire then passes through a polymerization oven and, if necessary, comes back to the device for another coating operation to pass through the next die block, of suitable size, and so on.

It is therefore possible to obtain a final coating of any desired thickness. Of course, by varying the pressure in tank 13, it is possible to modify this thickness.

Such a device complies with all the required conditions, to wit:

- possibility of easily replacing the die blocks,
- high resistance of these die blocks to wear and tear,
- easy insertion of the wires in their die blocks, when the cover plate is removed,
- possibility of coating the wire, on every operation, with a small amount of enamel, which facilitates polymerization and therefore permits of increasing the speed of passage of the wires,
- possibility, owing to the fact that the device comprises means for returning the liquid to the feed circuit, of avoiding any heating of the enamel, and therefore any evaporation,
- possibility of working with a liquidtight device, which therefore contributes in preventing evaporation, and
- possibility of easily controlling the delivery of enamel, in particular by acting upon the pressure.

By way of indication, for wires of a diameter of 8/100 mm. it is possible to reach wire passage speeds of 600 meters per minute with enamel coating thickness averaging 10/1000 mm. and a number of successive operations averaging nine, the pressure in the device being for instance of 4 cms. of mercury above atmospheric pressure. An increase of this pressure above 4 cms. would permit of increasing the mean thickness of the coating from one to two microns.

The speed of 600 meters per minute, which is much higher than that generally used, is not at all a limit speed. It corresponds to the obtainment of an excellent wire when some factors are imposed, for instance the temperature of the polymerization oven.

In the embodiment illustrated by FIGS. 5 to 8 there are no felt elements to oppose enamel leakage at the inlets of the wires. But two sets of die blocks are provided, respectively at 17₁ and 17₂.

The tank of FIGS. 2 to 4 is in this case replaced by feed channels 41, 42 provided in the cover plate and disposed above the die blocks.

The circulation of liquid enamel takes place in the following manner.

The inflow of the liquid takes place through a feed conduit 43 communicating through a vertical passage 46 with channel 42. The liquid flows through grooves 22 into channel 41 leading through vertical passage 47 to return channel 44. Grooves 22 serve both to the passage of the wires therethrough and to the flow of the liquid from channel 42 to channel 41. In each of these grooves 22 the wire is therefore located in a stream of liquid flowing in the same direction as said wire is travelling. This is very important for very fine wires (of a diameter lower than 8/100 mm.) which can withstand only low pulling stresses. The inlet die blocks 17₁ serve merely to limit the outflow of liquid but their resistance to the travel of the wire is lower than in systems making use of felt pieces. The outlet die block 17₂ is, on the contrary, a calibrating die block. Channel 42 may have, as shown, by FIG. 5 a cross section decreasing from the left toward the right so as to compensate for the decrease of volume of the liquid in circulation, thus maintaining a constant pressure (and therefore a constant flow rate) in each of the grooves 22. On the contrary, the cross section of channel 41 is increasing from the left to the right. A conduit 45 evacu-

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ates the amounts of liquid that have leaked out into gutter 35. Conduit 45 is in communication with the collecting gutter 35 through a hollow bolt 48, 49 communicating with a passage 50 provided in an angle of body 12.

Of course, the invention applies to the case where die blocks would be provided for the passage of the wires upstream of felt elements.

The U-shaped notches might be used in the case of movable die blocks.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the present invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. A wire coating device which comprises, in combination:

a body, including a fluidtight cover, forming at least one channel for the continuous flow therethrough, in a given direction, of a coating substance in the liquid state, said body having opposed walls extending in said direction, said walls being provided with respective wire passages locate opposite each other, means for pulling a wire to be coated with said liquid substance through said passages across said channel transversely to the direction of flow of said substance, so that said wire enters said body through one of said passages, called inlet passage, and leaves said channel through the other of said passages, called outlet passage,

means for opposing outflow of said coating liquid through said inlet passage,

a piece carried by the wall of said body containing said outlet passage, said piece being provided with a U-shaped notch forming said outlet passage, the bottom portion of said notch being of semi-circular cross section of a diameter equal to the sum of the diameter of said wire and of the desired thickness of said liquid coating and the top portion of said notch being of a cross section limited by two parallel straight lines, tangent to the ends of said semi-circular cross section, whereas the depth of said U-shaped notch is equal to the diameter of the semi-circular bottom portion thereof, the top of said U-shaped notch being closed by said cover.

2. A wire coating device which comprises, in combination,

a body, including a fluidtight cover, forming at least one channel for the continuous flow therethrough in a given direction of a coating substance in the liquid state, said body having opposed walls extending in said direction, said walls being provided with respective wire passages located opposite each other, means for pulling a wire to be coated with said liquid substance through said passages across said channel transversely to the direction of flow of said substance, so that said wire enters said body through one of said passages, called inlet passage, and leaves said body through the other of said passages, called outlet passage,

means for opposing outflow of said coating liquid through said inlet passage,

the wall of said body containing said outlet passages having an upper edge co-operating with the inner face of said cover, said last mentioned wall being provided with a cylindrical housing transverse to the direction of said wire and opening into said upper edge,

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a cylindrical block removably mounted in said housing and slidable in said housing, said cylindrical block having a flat end face portion adapted to fit in a fluidtight manner against a corresponding flat inner face portion of said cover,

spring means in said housing urging said cylindrical block against said cover inner face,

said cylindrical block being provided at its top, adjacent to said cover inner face portion, with a notch forming said outlet passage, whereby said cover closes the upper side of said outlet passage.

3. A device according to claim 2 wherein said notch is U-shaped the bottom portion of said U-shaped notch being of semi-circular cross section of a diameter equal to the sum of the diameter of said wire and of the desired thickness of said liquid coating and the top portion of said notch being of a cross section limited by two parallel straight lines tangent to the ends of said semi-circular cross section, whereas, the depth of said U-shaped notch is equal to the diameter of the semi-circular bottom portion thereof.

4. A device according to claim 3 including means for constantly placing the liquid in said tank under pressure.

5. A device according to claim 3 wherein the means for opposing outflow of the coating liquid through said inlet passages consist of felt elements located on opposite sides of the wire and held tightly against said wire, said felt elements being housed in said body on the other side of said inlet passage from said tank.

6. A device according to claim 3 wherein the means for opposing outflow of the coating liquid through said inlet passages consist of a cylindrical block slidable in a cylindrical housing of the wall of said body containing said inlet passages, said last mentioned block being resiliently urged against the inner face of said cover, said last mentioned cylindrical block being provided, at the end thereof where it is applied against said cover inner face, with a U-shaped notch the bottom portion of which is, in a direction transverse to said wire, of semi-circular cross section of a diameter substantially equal to the diameter of said wire and the top portion of which is of a cross section limited by two straight lines tangent to the ends of said semi-circular cross section, whereas the depth of said last mentioned U-shaped notch is equal to the diameter of the semi-circular bottom portion thereof.

7. A device according to claim 6 wherein there are two channels for the flow of said coating substance, said channels being provided in the inner face of said cover, said body being provided with grooves extending between said channels and serving for the passage of the wire and also to the flow of the liquid coating substance from one of said channels to the other.

8. A device according to claim 7 wherein that of said two channels which communicates directly with said outlet passages is of decreasing cross section from the inlet end thereof, whereas that of said two channels which communicates directly with said inlet passages is of increasing cross section from the inlet end thereof.

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