

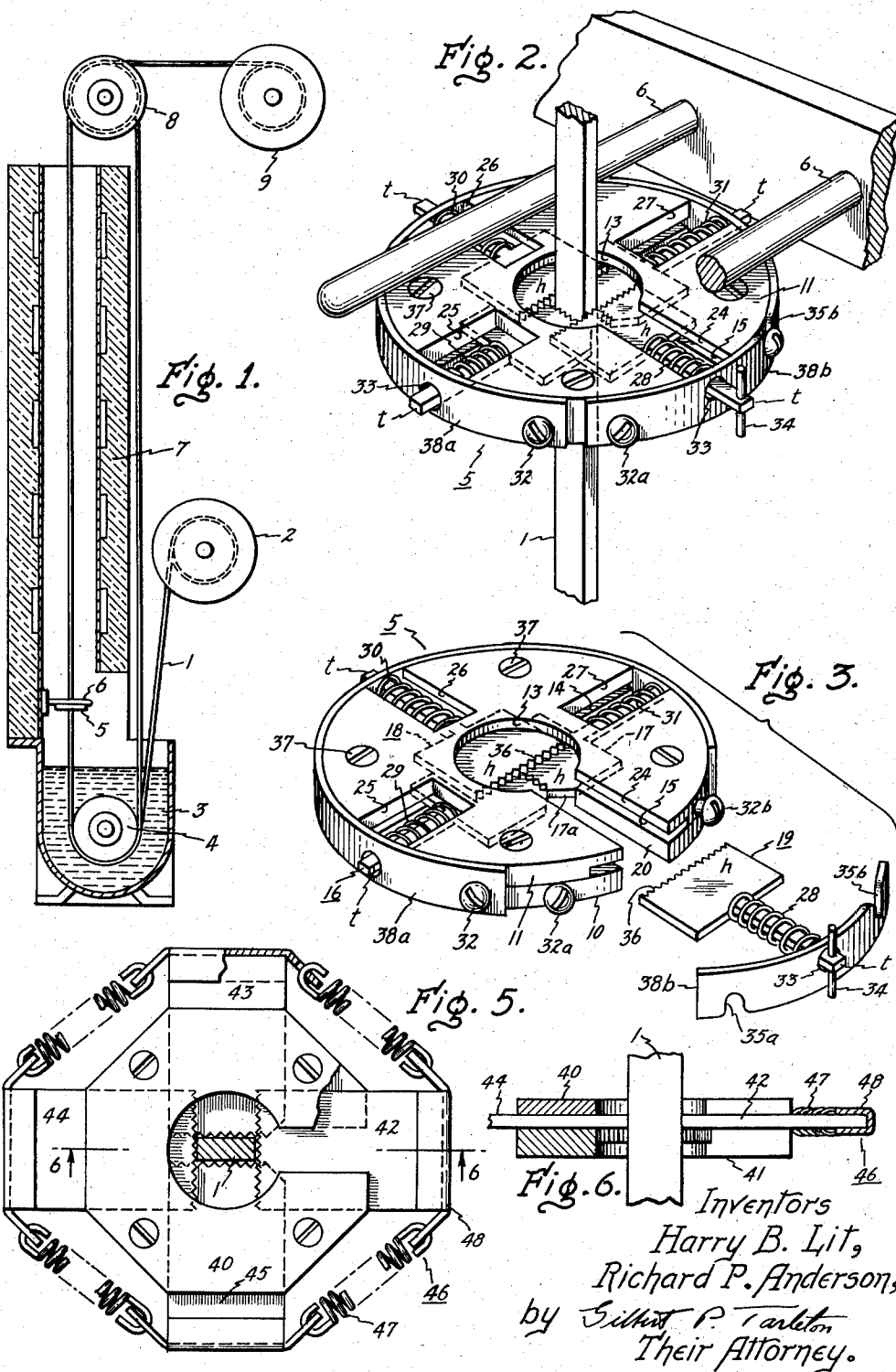
March 3, 1959

H. B. LIT ET AL
WIRE COATING DEVICE

2,875,725

Filed June 26, 1956

2 Sheets-Sheet 1



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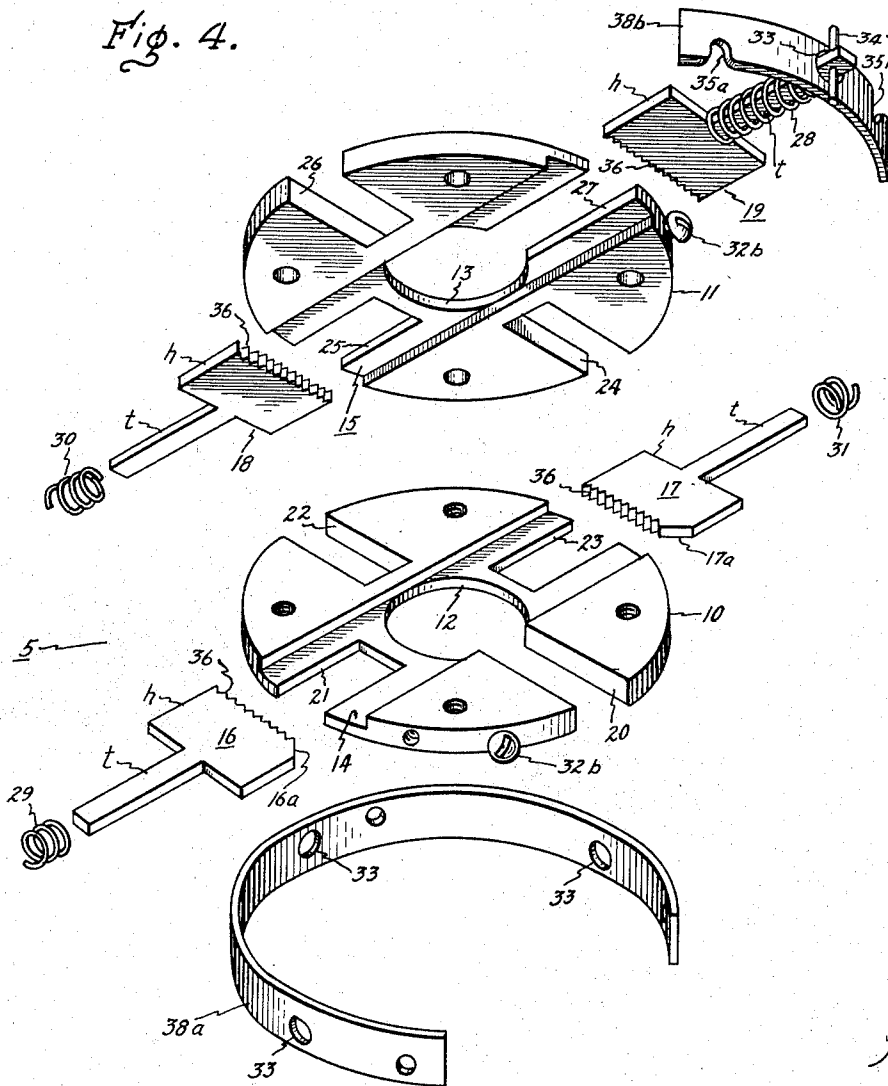
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Fig. 4.



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WIRE COATING DEVICE

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6 Claims. (Cl. 118—125)

The present invention relates to apparatus for coating elongated articles, such as wire or the like, of rectangular cross section with liquid coating compositions. More particularly, the invention is concerned with a die device for coating rectangular wire with a viscous solution of a resin composition, such as polyvinyl formal, for providing the wire with a uniform insulating film thereon.

Known devices adapted for coating rectangular wire are generally of elaborate and intricate construction incorporating a multiplicity of parts, and for this reason the manufacture and assembly of these devices are excessively expensive and time consuming. A further difficulty residing in such known devices is the tendency of the viscous coating composition of accumulate after a period of operation in and between the parts, particularly between movable elements where the coating material hardens, which leads to improper operation of the device and the necessity for frequent dismantling of the die for cleaning and maintenance of the parts. The prior structures also are such as to require nearly complete disassembly of the die apparatus in order to mount them in operative position on a wire already inserted in a continuous coating apparatus. A further disadvantage of certain of the known arrangements is that wear of the wire contacting surfaces of the die necessitates replacement of practically the entire die structure.

It is an object of the invention to provide a simplified die device for uniformly coating rectangular wire or the like which overcomes the disadvantages of the known devices of this type, which is economical to manufacture and maintain, is reliable in operation over prolonged periods, and is readily applied to and removed from a wire to be coated.

It is a further object of the invention to provide an improved die for coating rectangular wire in a continuous coating apparatus wherein the die is self-centering with respect to the wire being coated without hindrance by the coating apparatus.

It is still a further object of the invention to provide a die device of the above type which has interchangeable parts, is adapted to be arranged in various positions on the wire without affecting its operation, and which is readily adapted to various sizes of rectangular wire.

With the above objects in view, the present device for coating wire and the like of substantially rectangular cross section comprises a pair of relatively flat plate members each formed with a groove extending along one of their surfaces and with an aperture therethrough opening into the groove, the plate members being superimposed on each other in flatwise contact and with the grooved surfaces facing one another, the apertures being in register to define a die opening for receiving the wire, and the grooves crossing one another at the opening and extending substantially at right angles to each other, a pair of die members arranged in each groove between the plate members on opposite sides of the aperture therein and being movable along the groove, and means constantly urging the die members toward the axis of the

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opening for bringing the members into yieldable contact with the wire passing through the opening.

In a preferred embodiment of the device, the plate members are each formed with a slot extending from the aperture to the outer edge of the plate member, these slots being in register to provide a composite passage through which the wire may be inserted and received in the central aligned apertures of the plate members.

The invention will be better understood from the following description taken with the accompanying drawings in which:

Fig. 1 is a view in elevation partly in section showing a continuous coating apparatus in which the present invention may be embodied;

Fig. 2 is a detailed view of an embodiment of the present die device as applied to rectangular wire in a continuous coating apparatus such as shown in Fig. 1;

Fig. 3 is a perspective view of the die device partially disassembled;

Fig. 4 is an exploded view of the parts of the present device;

Fig. 5 is a plan view of another embodiment of the invention; and

Fig. 6 is a fragmentary sectional view of the device shown in Fig. 5 taken along the line 6—6.

Referring now to the drawings and particularly to Fig. 1, there is shown an arrangement for coating a continuously moving rectangular wire 1, wherein the wire passes from supply reel 2 through a bath 3 of a suitable insulating coating liquid, such as polyvinyl formal, around a guide sheave 4. Wire 1 having coating material adhering thereto then passes through die device 5, constructed as more fully described hereinafter, which is carried upwardly by the moving wire until restrained from further upward movement by fixed spaced fingers 6 (see Fig. 2), or other suitable stop means, which permit free lateral or rotational movement of the die 5 in response to any swaying or twisting movement of the wire. The wire, with a uniform coating formed thereon by the die 5, then continues upwardly through a baking or drying oven 7 of any suitable or conventional type wherein the varnish coating applied by the die 5 to the wire is heat-hardened. Thereafter, wire 1 passes around sheave 8 and back to guide sheave 4 spaced axially from the initial turn of wire. Wire 1 then passes through the coating and drying apparatus in repeated stages in the manner described and as illustrated in Fig. 1 until a coating of the desired thickness is finally built up, it being understood that a die 5 and coating fingers 6 are provided for each strand of wire passing upwardly in the apparatus. The coated wire is ultimately conducted to a take-up reel 9 or other storage means.

Figs. 3 and 4 show the structure of die 5 in greater detail, and as illustrated therein the die comprises in a preferred embodiment a pair of thin flat plates or discs 10 and 11 constituting the supporting frame of the die device and having apertures 12 and 13 and grooves 14 and 15 formed respectively therein, the grooves preferably extending entirely across the plates and intersecting the respective central apertures therein. Slidably arranged in the grooves 14 and 15 are pairs of movable die members 16, 17 and 18, 19, one pair arranged in each groove and the die members in each pair being arranged on opposite sides of the central aperture in its plate. Each die member has a head portion *h* and an elongated attenuated tail portion *t*.

As shown in the illustrated embodiment, each plate 10, 11 is further formed with four slots 20, 21, 22, 23 (in plate 10) and slots 24, 25, 26, 27 (in plate 11) extending radially inwardly from the outer edge of the plates, only slots 20 and 27 opening into the central apertures in the plates.

In assembled form, as shown in Figs. 2 and 3, plates 10 and 11 are superimposed with their grooved surfaces facing each other and arranged with the grooves 14 and 15 lying at right angles to one another. The plates are held together by screws 37 or any other suitable means. The assembled arrangement is such that the slots in the two plates 10, 11 register with one another, slots 20 and 27 being superimposed to form a composite passage leading to the aligned central apertures 12, 13. In the assembly, the grooves 14 and 15 and the faces of the plates 10 and 11 cooperating therewith form crossed laminar channels in which the likewise laminar die members 16, 17, 18 and 19 closely fit with sufficient clearance to be freely slidable therein in radial direction.

Since the laminar channels formed by the respective grooves are in different planes, the respective pairs of die members overlap each other in the vicinity of the crossing of the grooves, with the result that there is no interference with their freedom of operation or their firm engagement of the wire.

Coil springs 28, 29, 30, 31 are arranged encircling the tail portions of the die members in the composite recesses formed by the aligned slots and are placed in the die assembly with their inner ends bearing against the die members urging the latter inwardly, and with their outer ends bearing against band members 38a and 38b which jointly encircle the periphery of the plates 10, 11 and are mounted thereon by studs 32 or other suitable means. The separable band portions 38b is disposed at the outer opening of composite passage 20, 27 in order to enable insertion of the device on a wire through the composite passage by simply removing portion 38b and associated die member 19 without necessitating further disassembly of the die device or disturbing the movement of the wire. Bands 38a, b have apertures 33 aligned with the axes of the radial slots, through which apertures the outer ends of the tail portions *t* of the die members may pass. The apertures 33, however, are small enough to prevent passage therethrough of coil springs 28-31.

A pin 34 or the like is arranged extending through the outer end of the tail portion of die member 19 in order to retain the band portion 38b and associated parts in assembly during its removal and replacement for the purpose of mounting the die device on a wire. To further facilitate dismounting and replacing these parts for this purpose, band portion 38b is formed with recesses 35a, b opening in opposite edges thereof and adapted to engage studs 32a, b. By this means, the wire receiving passage 20, 27 may be opened by simply twisting band portion 38b to disengage recesses 35a, b from studs 32a, b and sliding die member 19 out of its channel. After the die device has been inserted on the wire by passage of the wire through composite slot 20, 27, die member 19 is replaced in its channel and band portion 38b locked again on studs 32a, b.

Die members 16 and 17 between which the wire is to be initially positioned as it enters the aligned central apertures 12, 13 are provided with beveled corners 16a, 17a respectively, so that as the wire strikes the corners, members 16 and 17 are automatically forced apart to receive the wire therebetween. Fig. 2 shows the rectangular wire in operating position with the four die members urged into contact against the respective surfaces of the wire. As shown, the wire-engaging edge faces of the die members are formed with a series of vertical ridges 36 between which the liquid enamel coating is drawn as the wire moves upwardly. The spacing and depth of the ridges determine the thickness of the coating applied to the wire for any given coating material. While the wire-contacting faces 36 of the die members are shown as straight, they could be made of various shapes in order to provide a desired form of coating film on the wire. For example, the faces 36

could be made convex to apply thicker coatings at the wire corners than along the sides of the wire.

In the operative position of the die as shown in Fig. 2, the slidable die members in the respective pairs are urged against opposite faces of the wire 1 by their respective coil springs, the outer ends of the die members being moved outwardly of the periphery of the die plates a distance corresponding to the dimensions of the wire being engaged. As the die members are in yieldable engagement with the surfaces of the wire and closely follow any variations of the surface contour thereof, a layer of coating material of uniform thickness is applied to the wire over its entire length as it proceeds upwardly through the die device. Such upward movement of the wire and enamel liquid coating thereon carries the die 5 upwardly into contact with fingers 6 which prevent further upward motion, but which still permit rotational and lateral movement of the die 5 in accordance with the swaying or twisting movements of the upwardly moving wire 1 and thus provide automatic self-centering of the die 5 on the wire.

The position of the die device about the wire may be varied as desired from that shown. For example, satisfactory results may be obtained with the device rotated 90° about the wire from the position shown, or with either side of the device facing upward.

Figs. 5 and 6 illustrate a different embodiment of the device, wherein the frame plates 40, 41 are of polygonal shape, and wherein slidable die members 42, 43, 44, 45 are substantially rectangular and project outwardly beyond the plates. In this form, a peripheral spring assembly 46 composed of alternating sections of tension springs 47 and cap members 48 is arranged encircling plates 40, 41 with cap members 48 engaging the projecting ends of the die members and urging them inwardly into yieldable contact with the surfaces of rectangular wire 1. In the Fig. 5 embodiment, as will be noted, the spring-receiving slots in the plates shown in the Fig. 1 device are omitted, as are the spring-retaining peripheral band portions 38a, b.

By virtue of the simplicity of the described arrangement, there is largely avoided in the present structure the accumulation of coating varnish between the parts which has been a troublesome factor in the prior types of die apparatus, where the hardened varnish in the several working parts interfered with proper operation of the wire-engaging members and the uniform engagement thereof with the wire surfaces, thus leading to poor coatings on the wire.

The present device is, further, extremely versatile in its application and assembly, and considerably simplifies maintenance. The insertion of the device on the wire, even when the wire is already threaded on the continuous coating apparatus, is considerably facilitated and makes possible ready replacement of the dies on the wire with minimum effort and time. The reduced number, small size and thinness of the parts make the device light in weight and extremely economical to produce as compared to the prior types of devices, and because of its relatively smooth faces and lightness, the present die device readily moves with the wire, even when the latter is subjected to severe twisting, without being hindered in its lateral or rotational movement by restraining fingers 6. The slidable die members being identical are interchangeable and are easily replaced, if this becomes necessary because of wear to their edge faces or for the purpose of using members with differently shaped edge faces, without requiring replacement of any other parts of the assembly or necessitating a slow down or stoppage of the wire during the coating process. Moreover, the arrangement of the die members and actuating springs is such that the spring force is directed along the axis of each die member against the wire, thereby further contributing to a uniform coating film on each surface of the rectangular wire.

While the present invention has been described with reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the scope of the invention. Therefore, the appended claims are intended to cover all such equivalent variations as come within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A device for coating wire and the like of substantially rectangular cross section comprising, in combination, a pair of relatively flat plate members superimposed in flatwise contact with each other, each formed on its inner contacting surface with a groove extending transverse to the groove of the other plate member, and defining with the other plate member crossed laminar channels lying in different planes, said superimposed plate members having a wire-receiving aperture passing therethrough at the crossing of said channels; a pair of laminar die members slidably arranged in each channel on opposite sides of the aperture therein; and means constantly urging the die members in each pair toward each other.

2. A device for coating wire and the like of substantially rectangular cross section comprising, in combination, a pair of relatively flat plate members superimposed in flatwise contact with each other, each formed on its inner contacting surface with a shallow groove extending substantially at right angles to the groove of the other plate member, and defining with the other plate member crossed laminar channels lying in different planes, said superimposed plate members having a wire-receiving aperture passing therethrough at the crossing of said channels, said superimposed plate members being further formed with a slot extending from said aperture along one of said channels to the periphery of said superimposed plate members; a pair of laminar die members slidably arranged in each channel on opposite sides of the aperture therein; and resilient means urging said die members toward the axis of said aperture for bringing said die members into yieldable engagement with the wire adapted to pass through said aperture.

3. A device as defined in claim 2, wherein said die members project beyond the periphery of said superimposed plate members, and said urging means comprises annular resilient means extending circumferentially around said superimposed plate members and engaging said projecting die members for urging them toward the axis of said opening into contact with the wire.

4. A device for coating wire and the like of substantially rectangular cross section comprising, in combination, a pair of like, relatively flat plate members superimposed in flatwise contact with each other, each formed on its inner surface with a shallow groove extending substantially at right angles to the groove of the other plate member, and defining with the other plate member crossed laminar channels lying in different planes, said superimposed plate members having a wire-receiving aperture passing therethrough at the crossing of said channels, said superimposed plate members being further formed with a slot extending from said aperture along one of said channels to the periphery of said superimposed plate members; a pair of laminar die members slidably arranged in each channel on opposite sides of the aperture therein; means urging said die members toward the axis of said aperture for bringing said die members into yieldable engagement with the wire adapted to pass through said aperture; main holding means for holding said plate members and three of said die members in operative assembly; and auxiliary holding means removably mounted on said plate members for holding the remaining die member in operative position in the channel extending along said slot, whereby removal of said auxiliary holding means and said remaining die member enables insertion of said assembly on the wire via said slot without further disassembly thereof.

5. A device as defined in claim 4, wherein said main and auxiliary holding means comprise a pair of band members which jointly encircle the periphery of said superimposed plate members.

6. A device as defined in claim 4, wherein said laminar die members have attenuated portions extending radially outwardly, said superimposed plate members being further formed with radially extending recesses in the region of the attenuated portions of said three die members, and said urging means comprises resilient means in each of said recesses and in said slot for urging said die members radially inwardly.

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