

Dec. 30, 1947.

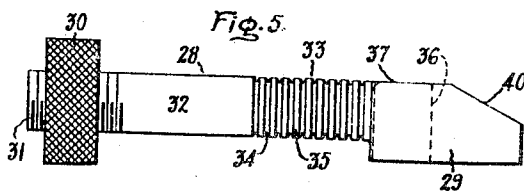
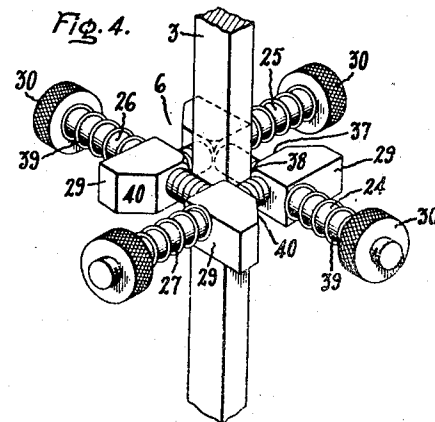
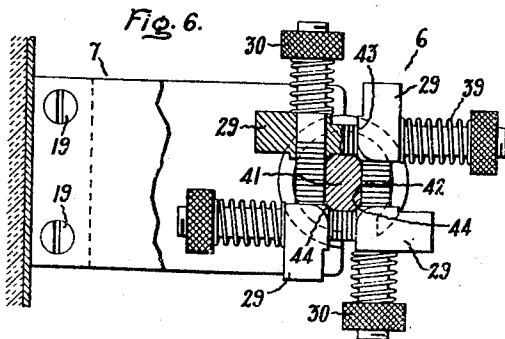
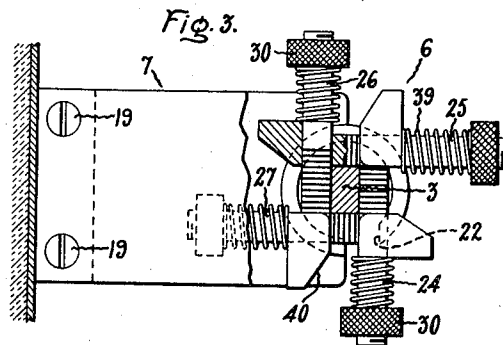
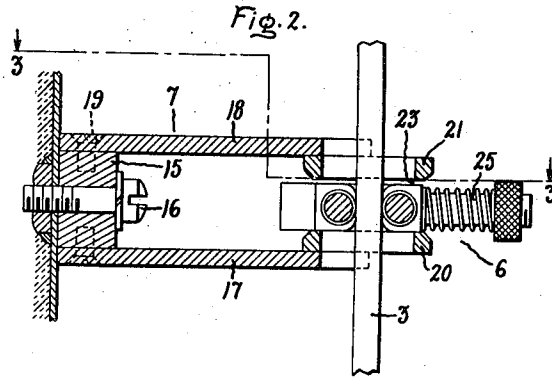
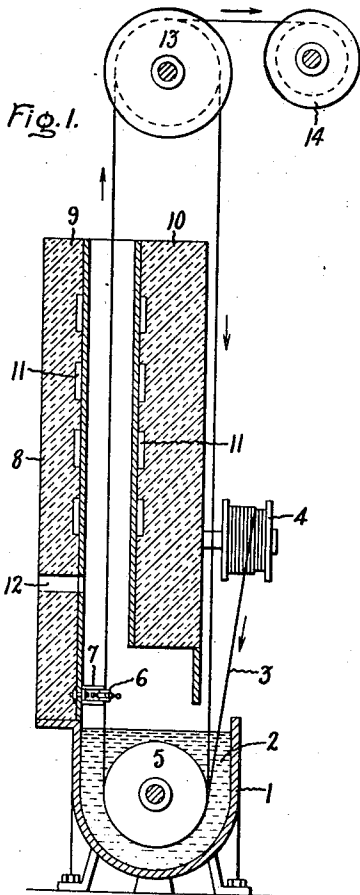
C. A. BAILEY

2,433,642

WIRE COATING DIE

Filed April 24, 1945

2 Sheets-Sheet 1



Inventor:
Carl A. Bailey,
by *Harry E. Dunham*
His Attorney.

Dec. 30, 1947.

C. A. BAILEY

2,433,642

WIRE COATING DIE

Filed April 24, 1945

2 Sheets-Sheet 2

Fig. 7.

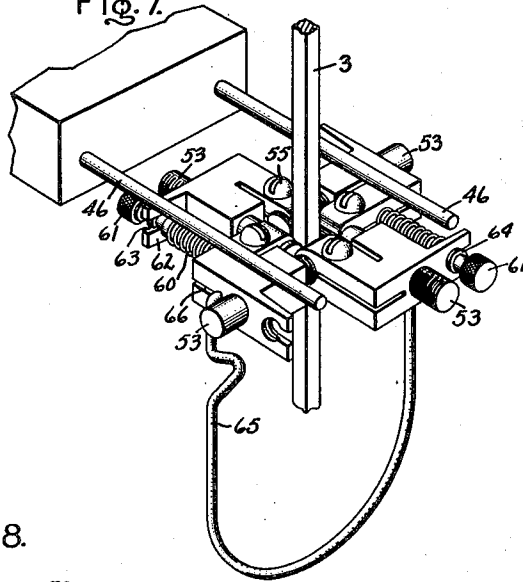


Fig. 8.

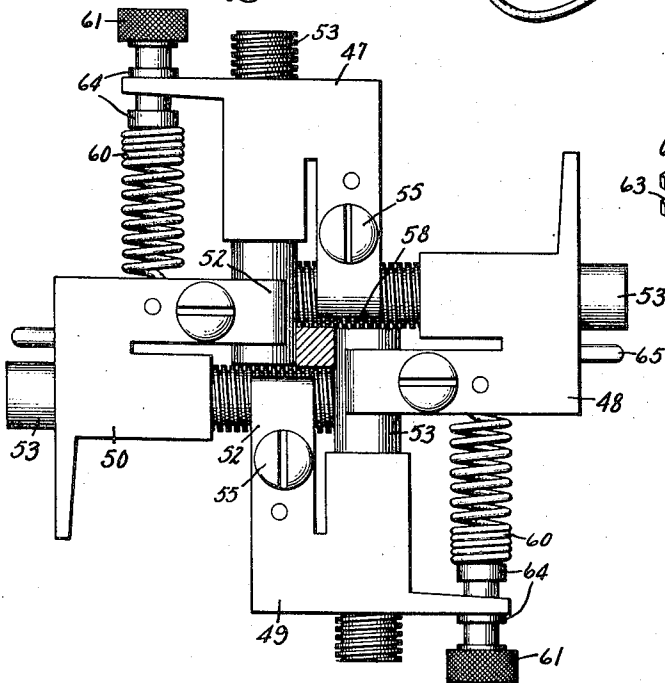


Fig. 10.

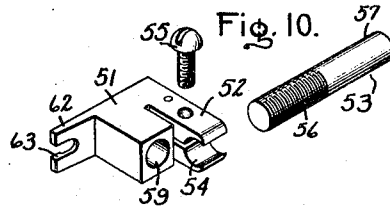
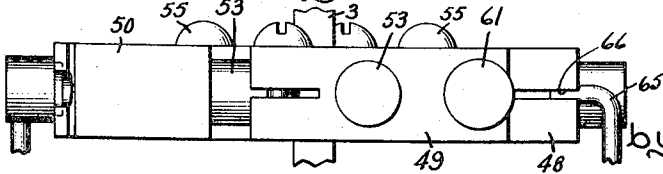


Fig. 9.



Inventor:
Carl A. Bailey,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,433,642

WIRE COATING DIE

Carl A. Bailey, Scotia, N. Y., assignor to General Electric Company, a corporation of New York

Application April 24, 1945, Serial No. 589,970

11 Claims. (Cl. 91-53)

1

This application is a continuation-in-part of my copending application, Serial No. 537,711, filed May 27, 1944, for "Die for coating rectangular wire" and assigned to the same assignee as the instant application. Application 537,711 has become abandoned.

The invention relates to dies for coating wire polygonal in section, particularly rectangular wire, with an enamel, varnish, lacquer or like viscous coating material and is of particular interest when used with coating materials applied in a highly viscous state such as the hydrolysis product of polyvinyl acetate.

The object of my invention is to provide an improved construction and arrangement of dies of the type aforementioned which may be used for coating wires of different rectangular cross-sections.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

In the drawing, Fig. 1 illustrates an apparatus for enameling rectangular wire including a die embodying my invention; Fig. 2 is an enlarged sectional view of part of Fig. 1 showing my improved die; Fig. 3 is a view along line 3-3 of Fig. 2; Fig. 4 is a perspective view of the die; Fig. 5 is an enlarged view of a part of the die; Fig. 6 is a view similar to Fig. 3 of one modification of my invention; Fig. 7 is a perspective view of another modified form of die; Fig. 8 is a plan view of the die of Fig. 7; Fig. 9 is an end view of the modified die; and Fig. 10 is an exploded view of part of the die of Fig. 7.

The enameling apparatus, shown in Fig. 1, comprises a container 1 for viscous coating material 2. Rectangular wire 3 to be coated is drawn from a pay-off reel 4 over a guide sheave 5 immersed within the liquid coating material 2. The wire leaves the container 1 with its surfaces covered with a non-uniform layer of coating material. In order uniformly to spread the coating material over the wire and to remove excessive coating material therefrom the wire passes through a die 6 floatingly supported on a support 7 secured to the lower end of a baking oven 8. The latter has spaced parallel walls 9, 10 and in the present example is heated by a plurality of electric heating elements 11 disposed within recesses of the walls 9, 10. A channel 12 for admitting air to the oven is formed in the wall 9. On its passage through the oven the coating material is baked. In many instances the wire is pro-

2

vided with several coatings. The wire therefore with its heat-hardened insulated coating of enamel thereon is passed over a driving sheave 13 and then recirculated through the coating material and additional dies and the oven and upon baking of the last coating the wire is wound onto a take-up reel 14. The die support, as best shown in Figs. 2 and 3, comprises a U-shaped bracket which has a base 15 secured to the inner lining of the oven wall 9 by bolts 16. The legs of the U-shaped bracket are in the form of two parallel plates 17, 18 secured to the base 15 by screws 19. The plates 18, 17 are vertically spaced and the outer or free end of each carries a ring 20 and 21 respectively secured to said outer ends, preferably by fusing. Each ring has a slot or mouth 22 which are in vertical alignment and through which the wire 3 may be inserted.

The die 6 rests loosely on the lower ring 20 and forms with the upper ring a small clearance 23 and is free to position itself radially and rotationally on the support.

The die itself comprising four like side members; a first member 24, a second member 25, a third member 26 and a fourth member 27. Each member, as shown in Fig. 5, includes a cylindrical rod 28, a head 29 integral with one end of the rod and a nut 30 screwed onto a threaded portion 31 at the other end of the rod. The rod 28 itself in addition to the threaded end portion 31 has a smooth cylindrical portion 32 near the threaded portion 31 and a grooved portion 33 between the smooth portion 32 and the head 29. The grooved portion 33 has a plurality of parallel annular grooves 34 essentially V-shaped in section and forming cylindrical rings or lands 35 between them. The thickness of the coating, as will be more fully understood hereafter, depends upon the depth of the grooves 34 and the width of the grooves 34 relative to the width of the lands 35. The head 29 is in the form of a block substantially rectangular in section with a bore 36 adapted to form a sliding fit with the cylindrical portion 32 of another side member. In the embodiment of Figs. 2 to 5 each head has a side surface 37 which is tangent to the cylindrical surface of the portion 32 and the lands 35 and therefore especially suited for the coating of rectangular wire with sharp corners, as indicated in Fig. 3. The corners 38 of the head 29 near said tangent surfaces are rounded or cut away. When assembled the rod 28 of each side member passes slidably through the bores 36 in the head of another side member. In the present example, the rod of the side member 24 passes through the

3

head of the side member 27; the rod of the side member 27 passes through the head of the side member 26; the rod of the side member 26 passes through the head of the side member 25; and the rod of the side member 25 passes through the head of the side member 24. Each side member carries a compression spring 39 surrounding the cylindrical portion 32 to bias the head 29 of another side member toward its own head. Thus, the spring 39 on the side member 25 biases the head of the side member 24 toward the head of the side member 25. When not in use the heads of the different side members are actually forced into contact with each other. In this case the surface 37 of each head engages the end surface of another head facing the grooved portion 33 and the rounded corners of the different heads engage each other. To permit the heads to engage each other when not in operation, and more particularly to permit their use in connection with wires of very small cross-section, an outer part 40 extending from the side surface 37 toward the outer end of the head is cut away or chamfered to preclude interference with and to provide space for the springs 39. To place the die into operation its different side members are forced apart by hand and the end of a rectangular wire to be coated is passed through the rectangular opening formed between the four side members. Upon manual release of the side members they are biased toward the side surfaces of the rectangular wire by the biasing action of the several springs. A die may be replaced by removing one of the side members upon first removing its nut 38 and its spring 39. During operation the grooved part 33 of each side member cooperates with and is biased towards the plane side surface of the wire. The lands 35 make line contact with the surfaces of the wire substantially completely removing liquid coating therefrom, while the grooves 34 remove only a part of the liquid coating material and leave a predetermined amount of coating material on the side surfaces. Thus, upon leaving the die each side surface is provided with parallel streaks of coating material. The material in liquid form has a tendency to spread and flow sidewise. Thus the streaks of coating material leaving the die, spread and form a uniform coating before the wire portion enters the oven and is ready to be baked therein.

In the arrangement of Fig. 6, like reference characters designate like parts corresponding to those of Figs. 2 to 5. This arrangement is particularly suited for coating rectangular wires 41 with a large corner radius 42. If the wire has only a small corner radius the die described above can be used. To this end each head 29 on each side member has a surface 43 corresponding to the surface 37, Fig. 5, but spaced toward the end surface of the head cooperating therewith. In other words, each head 29 has a rounded thickened portion or corner facing the center of the die so that when out of operation the heads are not forced into contact with each other the same as in the example described above but form between them a small opening. The edges 44 of the several heads facing the center of the die are rounded to avoid the removal of an excessive amount of coating material from the edges of the wire.

In Fig. 7, a modified form of die is shown carried by the wire 3. As the wire is moved upwardly, the die is brought to rest against spaced rods 46 which act to position the die in the same man-

4

ner as the rings 20 and 21. The die of Fig. 7 is constructed so that it may be easily and quickly applied to, or removed from, the wire. The construction is such that the rods which engage the wire may be adjusted when worn to present new surfaces to the wire.

Referring to Fig. 8, the die includes four side members 47, 48, 49 and 50 which are disposed around the circumference of the wire and closely engage its surface to remove the excess insulating coating. As shown by Fig. 10, each side member includes a head 51 provided with two spaced arms 52 which are adapted to engage the rod 53 and form a clamp. The arms 52 are formed with curved surfaces 54 which closely grip the rod 53 and hold it in any adjusted position. The rod is clamped tightly to the head by means of a screw 55. A portion of the length of the rod is provided with grooves 56 while the remainder of the rod is left smooth, as indicated at 57. Either the grooved or smooth portion of the rod may be positioned to engage the wire. The grooves 56 may be formed as a screw thread or they may be formed as spaced parallel slots extending around the periphery of the rod. As indicated most clearly in Fig. 8, the arms 52 of the head do not extend completely around the rod but are cut off so that the side of the rod is exposed, as indicated at 58, to engage the surface of the wire. The head 51 is also provided with a bore 59 which is adapted to receive the rod 53 of another one of the side members for sliding movement therein, the arrangement being such that the side members slide toward each other to engage the surfaces of the wire.

In Fig. 8, the four side members are shown assembled around the wire. The rod member 53 forming part of the side member 48 is slidable in the head of the side member 49. One end of a spring 60 is fastened to the head of the side member 48 and the other end is wound around an adjusting screw member 61 carried by the head of the side member 49. Tension of the spring is adjusted by threading the screw member onto the spring. As shown by Fig. 10, the head 51 is provided with an extending ear 62 having a slot 63 for receiving the screw member 61. Each screw member 61 is provided with spaced shoulders 64 which cooperate with the ear 62 on opposite sides of the slot 63 so that the adjusting screw 61 is securely held in position on the head by the tension in spring 60. At the same time, the screw member may be easily slipped out of the slot 63 when it is desired to disassemble the side members from each other.

The side members 47 and 50 are assembled together in the manner already indicated and they are held in slidable cooperation by means of a second spring 60 shown in the left hand portion of Fig. 8. The two heads 48 and 50 are biased toward each other by means of a U-shaped spring clip 65 which extends beneath the die in the position shown by Fig. 7. The ends of the U-shaped spring clip are turned inwardly and are seated in grooves 66 in the head members, as indicated in Fig. 9. The U-shaped spring clip has the advantage that it may be quickly detached from the side members of the die so that the two side members 48 and 50 may be pulled apart, separating the die for mounting on, or removal from, the wire. The tension in the U-shaped clip may be adjusted by bending the clip to secure the desired amount of spring action. The spring tension in the springs 60 may be adjusted to some

extent by winding or unwinding the springs from the screw member 61.

As shown by Fig. 8, the rods 53 may be adjusted in position on the heads so that either the grooved portion or the smooth portion engages the surface of the wire. This depends upon the particular cross section of the wire being coated, the viscosity and type of coating material which is being applied to the wire, and the thickness of the coating to be applied to the wire. In the arrangement shown by Fig. 8, two of the rods present grooved surfaces to the wire while the other two present smooth surfaces. However, if a very fine coating were to be applied to the wire, the die would be adjusted so that the smooth surfaces of the rods 53 are presented to the wire whereas if a thicker coating were desired on all four surfaces of the wire, the grooved portions of the rods would be used in the die.

Another advantage of making the rods 53 adjustable in the heads 51 is to take care of wear in the die. In normal operation, the rods 53 make what may be termed a line contact with the surface of the wire since the wire is tangent to the circular surfaces of the rods. When this line contacting surface on the rods becomes worn, the rods may be turned slightly in the heads 51 to present a new surface to the wire. The arrangement greatly simplifies the problem of maintenance of the dies because the rods 53 may be easily adjusted when worn.

Thus, with my invention I have provided a simple, effective and efficient tool for coating wires. The tool may be produced at low cost. It is of the universal type in that it will fit almost any commercial size of copper wire. It is easily placed in operation and during operation floats on the support and is free to position itself, particularly to rotate about its axis. This enables the die to follow an occasional twist which may find its way into rectangular wire. The die makes substantially line contact with the surfaces of the wire. As a result of this line contact a slight imperfection such as a minute bump on the wire surface will not hold the die open for an appreciable distance along the surface of the wire. With the provision of a thickened portion at the head, the die is suited for coating wires having rounded corners and in such case to provide the rounded corner portions likewise with a uniform coating of a thickness equal to that on the center side portions of the wire.

Broadly, my improved die is suited for coating wires polygonal in section and with plane or flat side surfaces. The die has like side members equal in number to the number of surfaces of the polygonal wire to be coated. Each side member has a rod which may be provided with a plurality of parallel annular grooves cooperating with the side surfaces of the wire and a head forming a bore slidably fitting the rod of another side member. The centerline of the bore and the centerline of the rod are at an angle equal to that of the angle formed between adjacent side surfaces of the wire that is 90° in case of a rectangular

wire.

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

1. In an apparatus for applying liquid coating material to a wire of polygonal cross-section, the combination of a support having two horizontally extending vertically spaced plates, two aligned rings secured to the plates and having aligned openings through which the wire to be coated may be inserted, and a die for removing excessive

coating material from such wire after having passed through a body of liquid coating material, said die being disposed between the rings and resting loosely on the lower one thereof, said die comprising a plurality of like side members equal in number to the number of side surfaces of the wire, each side member having a rod with a smooth cylindrical portion and another portion with parallel spaced annular grooves, a head secured to the end of the grooved portion and having a bore forming a sliding fit with the cylindrical portion of another side member, and separate spring means biasing the heads of the side members towards each other to effect line-to-line contact between the grooved rod portions with the respective side surfaces of such wire when passing through the die.

2. A die for removing excessive liquid coating material from a wire polygonal in section, said die having a plurality of like side members equal in number to the sides of the wire to be coated, each side member comprising a rod having a smooth cylindrical portion and another cylindrical portion with a plurality of spaced annular grooves defining annular lands between them and a head secured to the end of the grooved portion and having a bore with a centerline forming an angle with the centerline of the rod which is equal to the angle formed between the side surfaces of the wire to be coated, the rod of each side member having sliding fit in the bore of the head of another side member, and spring means biasing the head of each side member towards the head of another side member.

3. A die for coating rectangular wire comprising four like side members each having a cylindrical rod cooperating with the wire and a block-shaped head secured to the rod, said head having a bore forming a sliding fit with the rod of another side member, and spring means biasing the side members towards each other.

4. A die for coating rectangular wire comprising four like side members each having a cylindrical rod cooperating with the wire and a block-shaped head secured to the end of the rod and having a bore forming a sliding fit with the rod of another side member, the head having one side surface tangent to the rod, and means including a spring for each rod and a nut screwed onto the end of such rod for biasing the heads towards each other.

5. A die for coating rectangular wire comprising four like side members adapted to form rectangles of various sizes between them, each side member having a cylindrical rod cooperating with the wire and a head integral with one end of the rod and having a bore forming a sliding fit with the rod of another side member, each head having a surface tangent to the rod, said head being provided with rounded corners adjacent the rod, and means biasing the head of each side member towards the head of another side member.

6. A die for coating rectangular wire with rounded corners comprising four like side members arranged at right angles towards each other and adapted to form rectangular openings of various sizes between them, each side member having a cylindrical rod, a head integral with one end of the rod, a rod portion adjacent the head having a plurality of spaced parallel grooves forming lands between them facing the center of the die, and means including a separate spring surrounding each rod to bias the head of one side member towards the head of another side

7

member, each head having a rounded thickened portion facing the center of the die to cooperate with the rounded corners of the wire to be coated.

7. A die for coating polygonal wire comprising a plurality of like side members each having an elongated cylindrical rod adapted to engage one of the walls of the wire and having a head portion associated therewith, said head portion having a bore to receive the rod of another side member, and spring means cooperating with some of the head portions to bias the side members toward each other around the wire.

8. A die for coating polygonal wire comprising a plurality of like side members each having an elongated cylindrical rod adapted to engage one of the walls of the wire, each rod having associated therewith a head portion provided with a bore to receive the rod of another side member for sliding movement therein, said side members being arranged around the wire, and means biasing the side members for sliding movement toward each other whereby the die formed by said side members accommodates itself to variations in the size of the wire as the wire passes through the die.

9. A die for coating polygonal wire comprising a plurality of side members each having a head portion provided with a bore therein, and an elongated cylindrical rod carried by each head and being adjustable thereon, the rod of one side member being slidably mounted in the bore of another member, and spring means biasing the side members toward each other.

10. A die for coating polygonal wire comprising a plurality of side members each having an elongated cylindrical rod adapted to engage one of

8

the walls of the wire, each rod having associated therewith a head portion provided with a bore to receive the rod of another side member for sliding movement therein, said side members being arranged around the wire and adjustable spring means for biasing the side members for sliding movement toward each other.

11. A die for coating polygonal wire comprising a plurality of side members each having a head portion provided with a bore therein and an elongated cylindrical rod carried by each head for adjustment thereon, the head being provided with means for holding the rod in adjusted position, the rod of one side member being slidably mounted in the bore of another member, said side members being adapted to be arranged around the wire, and spring means biasing the side members for sliding movement toward each other, said spring means including a U-shaped spring clip, the arms of the U engaging two of said head portions.

CARL A. BAILEY.

REFERENCES CITED

25 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
30 1,702,676	Vocisano	Feb. 19, 1929
2,271,986	Mungall	Feb. 3, 1942
2,346,697	Mungall	Apr. 18, 1944

FOREIGN PATENTS

Number	Country	Date
35 508,618	France	July 29, 1920