

May 27, 1930.

S. WADSTEN

1,760,675

METHOD OF FORMING DIES

Filed Jan. 12, 1928

2 Sheets-Sheet 1

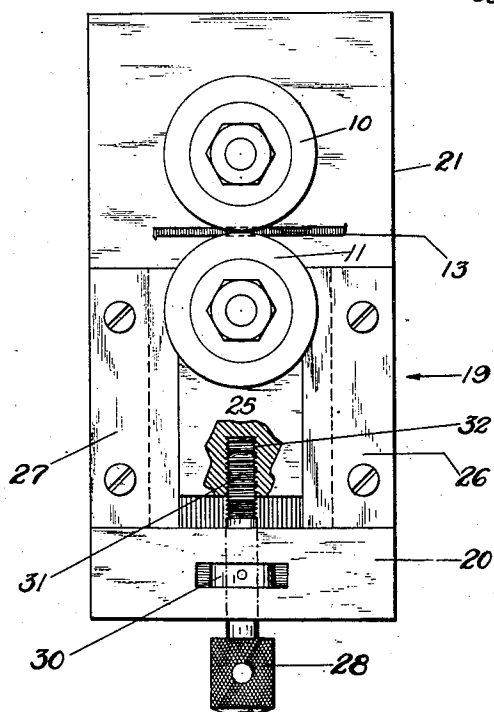
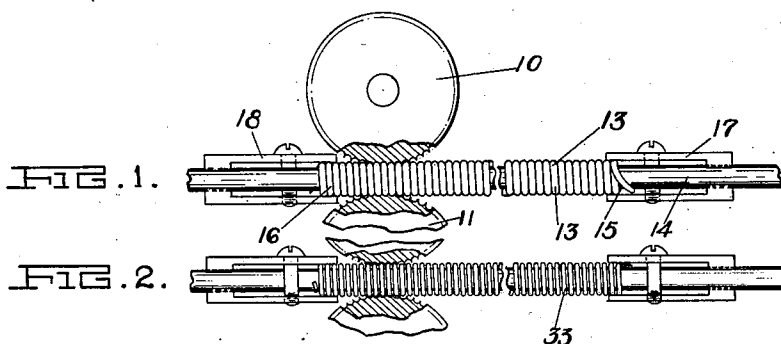


FIG. 3.

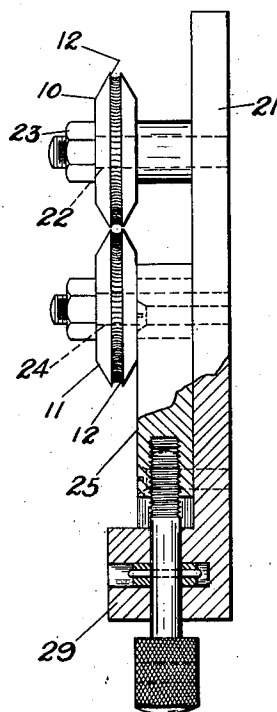


FIG. 4.

INVENTOR
STEN WADSTEN
BY *M. F. Regan*
ATTORNEY

May 27, 1930.

S. WADSTEN

1,760,675

METHOD OF FORMING DIES

Filed Jan. 12, 1928

2 Sheets-Sheet 2

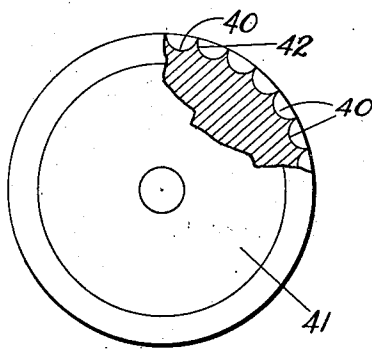


FIG. 5.

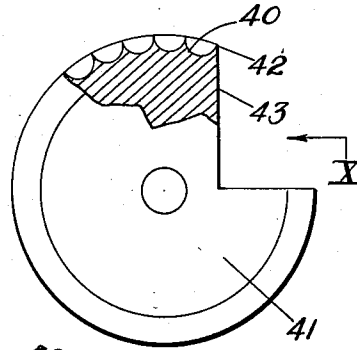


FIG. 6.

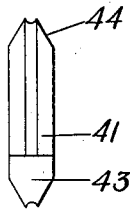


FIG. 8.

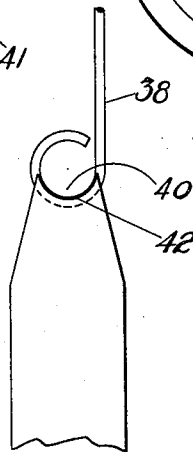


FIG. 7.

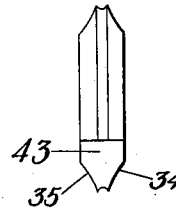


FIG. 9.

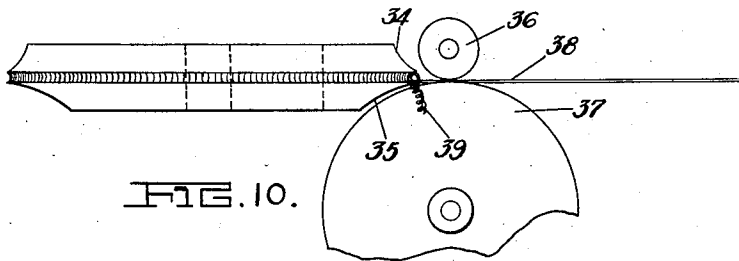


FIG. 10.

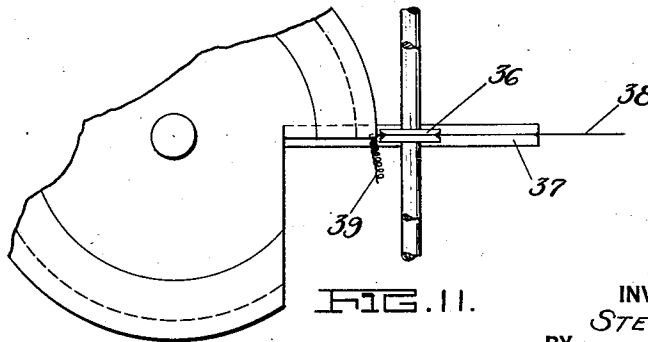


FIG. 11.

INVENTOR
STEN WADSTEN
BY *M. F. Reyes*
ATTORNEY

UNITED STATES PATENT OFFICE

STEN WADSTEN, OF BLOOMFIELD, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA

METHOD OF FORMING DIES

Application filed January 12, 1928. Serial No. 246,294.

The present invention relates to an improvement in coil winding machines such as shown and described in copending application Serial No. 121,156, filed July 8, 1926, and assigned to the same assignee as is the present application.

lamps of different wattage and the data relating to such dimensions and proportions is known as the "rating" so that a coiled section for a given rating must be made in accordance with a predetermined set of dimensions. For example, a filament for a 60 watt 115 volt lamp must contain a length of wire of 517 mm., it must have a diameter of .0108 inches and the coiled section must contain 398 turns per inch. The diameter of the wire also varies in filaments of different wattage lamps and the diameter of the wire of a coiled filament of a 60 watt lamp is preferably .00187 inches.

In the above mentioned application, a machine is shown for coiling fine hair like wire to helical form in the absence of a mandrel and particularly for the production of such coiled wire to serve as filaments for incandescent electric lamps. The machine shown comprises mechanism for moving a wire through a given path when tangentially engaged by a pair of oppositely disposed driving rollers which drive the wire endwise into a cavity die from which the wire issues in the form of a continuous helix. Means are also provided for cutting the helix into sections of proper lengths to constitute filaments for incandescent electric lamps.

It will be obvious that in order to produce a lamp filament and hold the coil formation to the required proportions and dimensions it is necessary to accurately form the coil winding die and to provide accurately adjustable means for holding the said die in a given relation to the path of movement of the wire thereto. In the above mentioned copending application, a coil winding die is shown and described as preferably consisting of an extremely hard material such as a diamond. A diamond die, although having indefinite life, is difficult to produce and owing to variations in the properties of a diamond, it is very often brittle to the extent that portions of the coil winding lip are broken off rendering the die inoperative for the purpose intended.

The die is so arranged that the cavity is positioned to receive the wire from the driving rollers, the bottom of the cavity being inclined or grooved so that the wire is bent into a succession of coils which pass over a lip or separator member at the edge of the cavity. The helix or successive turns of the coil which issue from the die are consequently spaced a given distance apart and a helix is, therefore, provided of a certain diameter and pitch depending upon the dimensions of the spacer member and the radius of curvature of the effective surface of the cavity as well as the position of the die with respect to the driving rollers.

As set forth in the said copending application, the coil winding die may be constructed from hardened steel but inasmuch as the wire passing over the die results in excessive wear, it is necessary to replace the steel die at shorter intervals than is necessary with a diamond die. Ordinarily the replacement of one die for another would offer a considerable disadvantage since when applying a die into position for the winding of a coiled filament, it is necessary to adjust the die in several planes until the cavity is accurately located in such position that the diameter and pitch of the coil produced will be in accordance with the data supplied for the rating of the particular lamp for which the filament is to be used.

In the manufacture of coiled filamentary bodies which serve as electrical resistance elements when used as lamp filaments, it is essential to exercise extreme accuracy in the formation of the coils, since each filament or coiled section must be made in accordance with specified dimensions so that each coiled section will have a length of wire therein equal to the succeeding coiled section. Furthermore, the diameter of the coil as well as the spacing or pitch of the turns of the coil must be uniform.

The dimensions of the diameter and the proportions of the coiled sections vary for

When using a diamond die, the die re-

mains in the machine for such a long period that the amount of labor and inconvenience involved in a change from one die to another is negligible. A steel die, although easier to produce, must be changed at comparatively short intervals and the advantage given by the facility accompanying the production of the die is lost by the time and labor involved in replacing the same.

10 An object of the present invention is, therefore, to provide a method of producing a steel or other easily manufactured die having a coil winding cavity so arranged as to expedite the disposition of the cavity for a coil winding operation.

15 Another object of the invention is to provide a method of producing a plurality of coil winding apertures adapted for substitution one for the other.

20 Another object of the invention is to provide a coil winding die having a cavity so formed as to be disposed in accordance with the pitch of the coil to be produced.

25 Other objects and advantages of the invention will be more fully understood from the following description.

The invention may be practiced by providing a coil wound tightly upon a mandrel and with the turns of the coil in contacting relation so as to make what is termed a closed coil. This coil may then be used as a primary embossing matrix and may be suitably supported so that a pair of die blanks in the form of discs may be disposed with their edges or peripheries in contact with opposite sides of the coil. The blanks may then be rotated in the presence of sufficient force to compress the blanks upon the embossing matrix during a movement of the blanks from the matrix which movement may continue until an initial depression is obtained in the blanks.

30 Another or secondary embossing matrix may be provided by winding a wire upon a mandrel with the spaced relations of the turns of the coil of a predetermined degree or pitch in accordance with the desired pitch to be obtained in the die produced and consequently in the coil produced by means of the die. Blanks with the initial depression therein may then be rolled over the secondary embossing matrix in the presence of a sufficient force to impress the blanks with an impression of the properly spaced coil. The blanks may then be hardened and employed as coil winding elements, or dies in a mandrelless coil winding machine.

35 The foregoing description briefly sets forth the general operation of practicing the present method which operation will be more fully understood by reference to the accompanying drawings in which:

40 Fig. 1 is a side elevational view of a primary embossing matrix showing die blanks in contact therewith and partly in section;

45 Fig. 2 is a side elevational view of the sec-

ondary embossing matrix showing the die blanks in contact therewith partly in section;

Fig. 3 is a side view of a fixture for holding die blanks in position to be rolled over a matrix during the application of a compressive force;

Fig. 4 is an end view of the fixture shown in Fig. 3;

Fig. 5 is a side view of a die blank partly broken away to show the depressions in the periphery thereof;

Fig. 6 is a side view of the die blank having a portion cut away to facilitate the use of one of the cavities or depressions of the blank;

Fig. 7 is an enlarged view of a portion of the die blank shown in Fig. 6 looking in the direction of the arrow X;

Fig. 8 is an edge view of a die blank after the depressions have been made therein and with a portion cut away;

Fig. 9 is a view of a die blank similar to that shown in Fig. 8 but having concave chamfered edges to accommodate the proper disposition of the blank in relation to a coil winding machine;

Fig. 10 shows a die positioned in operative relation to a coil winding machine for the performance of a coil winding operation; and,

Fig. 11 is a top view of the die and coil winding elements shown in Fig. 10.

The present method may be utilized by providing a pair of disc like members 10 and 11. These members may be provided with suitable peripheral grooves 12 and may be provided with beveled edges. The blanks may be of any suitable material such as relatively soft steel capable of being hardened. A suitable primary matrix may be provided by winding a wire 13 upon a mandrel 14 with the turns of the wire in contact so as to produce a closed coil 13'. The ends 15 and 16 of the coil may be held by clamps 17 and 18 of any suitable character.

The mandrel 14 may be supported in a holder (not shown) and the blanks 10 and 11 may be disposed so that the grooves 12 engage with the opposite sides of the coil 13'. Two blank rollers or discs are employed in order to balance the pressure and prevent a sagging of the mandrel during the operation of impressing the coil into the peripheries of the blanks. For the purpose of applying force to the rollers during their movement over the coil 13, a fixture 19 may be provided consisting of a bracket 20 having an extension 21 from which a spindle or shaft 22 may extend to receive the blank 10. The blank may be held rotatably in position by an end 23. The blank 11 may be mounted on a spindle 24 extending from a slide plate 25 suitably held between guides 26 and 27 secured to the fixture 19. The blanks 11 and 12 may be disposed in the same plane with the grooves 12

of their peripheries arranged to receive the coiled wire 13.

When the said blanks are in position at opposite sides of the coil 13' a relative movement may be effected between the coil and the blanks to cause a rotation of the blanks and at the same time a force may be applied by turning a set screw 28 extending through a base portion 29 of the fixture 19. The set screw may be provided with a collar 30 to prevent endwise movement of the set screw and a threaded end 31 of the set screw may enter a threaded aperture 32 in the slide 25 so that a rotation of the set screw will cause the slide and consequently the roller 11 to be moved to or from the roller 10 and thus the wire between the rollers may be compressed.

It is obvious that it is immaterial whether the fixture 19 is moved to cause a rotation of the rollers over the coil or whether the coil itself is reciprocated along its longitudinal axis. It has been found, however, preferable to mount the mandrel supporting the coil in a lathe.

In practicing the invention, it has been found that manufacturing conditions are met by performing the method in the following successive operations. For example, a die for a 10 watt lamp may be made in accordance with data calling for a coil of .004 of an inch outside diameter having 1000 turns per inch, formed from a wire of .0006 of an inch in diameter. In order to make a die for a coil in accordance with the above mentioned data, a tungsten wire of .00099 of an inch diameter is used and wound on a steel mandrel of .0025 of an inch diameter so as to produce a coiled section with the turns of the coil in contact or what may be termed a closed coil. In producing the said closed coil, a mandrel type coiling machine is employed which is said to obtain 1000 turns per inch and the coiled sections produced should be about 3 feet in length. This coiled section is what is termed the primary embossing matrix. This embossing matrix 13' may then be held in position so that the die blanks 10 and 11 may be rolled thereover. After each movement of the die blanks over the coil, the pressure between the coil and die blanks may be increased until an appreciable depression is produced in the blanks.

After the completion of the operation of forming the die blanks, another coiled section is produced with a left hand winding and made in accordance with the proper coil winding data. This second wound coil is spaced to the proper pitch and is termed the secondary matrix 33 as shown in Fig. 2. The operation of rolling the blanks over the coil is performed in the same manner as above described for the initial depression taken from the primary matrix 13'. The blanks may then be hardened and heat treated and the edges 34 and 35 of the blanks adjacent the

coil winding periphery may be ground to provide clearance for wire driving rollers 36 and 37 which contact with a wire 38 to be driven into a die to produce a mandrelless coiled section 39.

After the operation of forming the depressions in the blanks has been performed, the blank is provided with a plurality of coil winding depressions 40, each of the blanks being similar and constituting a die-member 41 as shown in Fig. 5. The die-member 41 may be employed as a wire bending element by utilizing one of the cavities 40 and a ridge 42 as a spacer member for the coils. By holding the die-member 41 in position so that the wire 38 is driven against the cavity 40, the coils will issue from the cavity and be spaced by reason of the ridge or lip 42. It has been found preferable, however, to cut away a portion of the die-member as shown in Fig. 6, leaving the lip or ridge 42 with a shorter face 43 so that the coils when issuing from the depression 40 will more readily escape from the die.

It will be evident that by reason of the plurality of depressions provided in the die-member, each depression constitutes a die bending surface and upon the failure of one as by wearing or breaking, another may be utilized by either moving the die-member 41 or by grinding away the face 43. It will be further appreciated that inasmuch as the depressions are formed exactly in accordance with the pitch of the mandrelless coil to be produced that a more accurate and uniform winding in so far as diameter and pitch are concerned will be produced.

The die-member 41 may be used in the form as shown in Fig. 8 in which the edges of the die have a tapered or chamfered face 44. The die-member, however, may be made more effective for the coil winding operation by grinding the edges 34 and 35 to a radius as shown in Figs. 9, 10 and 11 so that the die-member may be moved in close relation to the tangential point of the driving rollers 36 and 37 which constitute part of the coil winding machine set forth in the above mentioned copending application.

It is obvious that the die-blank may be made of any suitable material, as for example, soft steel which may be hardened as above set forth or the said blank may be of a soft material which will harden after the pressing operation as, for example, a soft heated material which hardens upon cooling. Furthermore, the blank need not be a disc, but may be in the form of a bar or block which may be pressed into contact with the coil forming matrix.

The present method, therefore, provides for the manufacture of a coil winding die in a convenient and expeditious manner at comparatively low cost. The die produced has long life by reason of the multiplicity

of coil winding surfaces and is easily adjustable to substitute one surface for another.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that variations and modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. The method of producing a coil winding die which consists in supporting a helically coiled section of wire having the turns thereof in given spaced relation, moving a blank having a curved surface in contact with said coil, applying a force to produce an initial impression of said coil in said blank and in moving said blank into contact with another coiled section having the turns thereof in a different spaced relation.

2. The method of producing a coil winding die which consists in supporting a coiled section, disposing a disc-shaped blank in contact with said coiled section of wire of a given diameter and having the turns in given spaced relation in moving said disc over said coiled section in the presence of an applied force to produce an initial impression of said coiled section in said blank and in moving said blank into contact with another coiled section of wire of a different diameter and having the turns thereof in a different spaced relation.

3. The method of producing a coil winding die which consists in supporting a section of helically coiled wire having the turns of a given space relation, moving a blank into contact with said coiled wire to produce an initial impression in said blank and in moving said blank into contact with a coiled section having the turns of a different space relation to increase the depth of said depression and produce a pitch in accordance with the second mentioned coiled section of wire.

4. The method of producing a coil winding die which consists in supporting a coiled section of wire of a given pitch with the turns of wire in a given space relation, moving the periphery of a disc-shaped blank in contact with said coiled section in the presence of an applied force to produce an initial depression in said blank, moving said blank into contact with a coiled section of a similar pitch but with turns of a different space relation in the presence of an applied force to increase the depth of said first depression and produce a pitch in accordance with the second mentioned coiled section.

5. The method of producing a coil winding die which comprises supporting a coiled section of wire of a given pitch with the turns of wire in contacting relation, moving the periphery of a circular blank into contact with said coiled section in the presence of an applied force to produce an initial depression in said blank, moving said blank

into contact with a coiled section of a similar pitch but with the turns disposed in spaced relation in the presence of an applied force to increase the depth of said first depression and produce a pitch in accordance with the second mentioned coiled section.

In testimony whereof, I have hereunto subscribed my name this 11th day of January, 1928.

STEN WADSTEN.