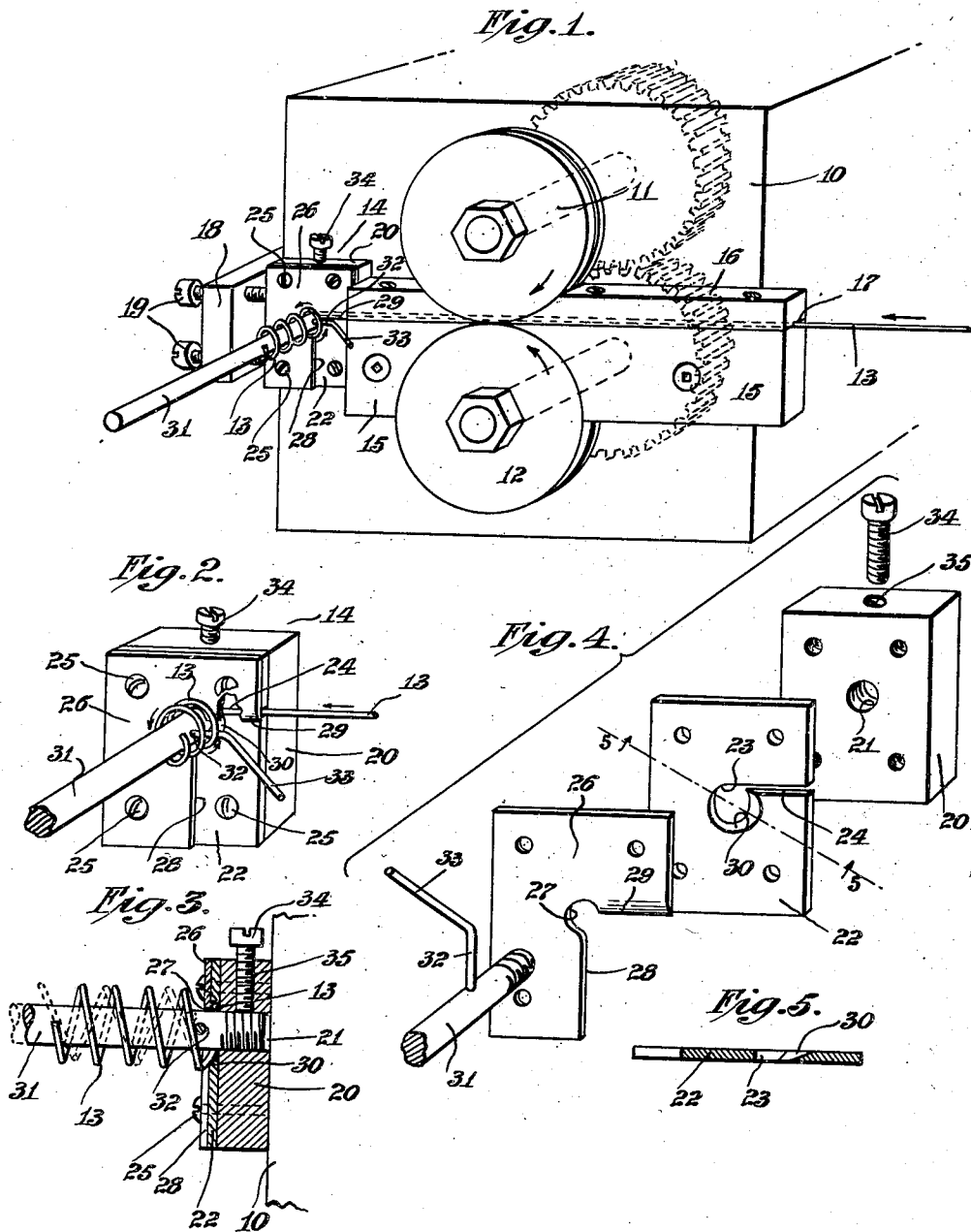


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WIRE COILING MACHINE
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WIRE COILING MACHINE

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The invention relates to wire coiling machines, and more particularly to a mechanism for the production of coils for use in the binding of books.

At the present time, spirally wound or coiled wire is extensively used in binding certain kinds of books. The leaves of such books have a sequence of openings along one edge thereof, and in the binding operation the coiled wire is threaded through these openings. The length of the coil required is determined by the length of the book to be bound therewith, and the pitch of the coils is determined by the spacing of the openings in the leaves.

The gauge of the wire and the diameter of the coil vary according to the dimensions and thickness of the book, so that in a bindery, coils having varying diameters made of wires of different gauges must be produced to meet varying demands.

In producing the coils for use in binding books, wire is drawn from a spool and formed in a continuous coil which is subsequently cut into lengths corresponding with the length of books to be bound therewith.

With the above conditions in mind, I have produced a wire coiling machine capable of rapidly coiling wire by a continuing operation, the coil being of a desired diameter and the pitch thereof being capable of exact regulation. The mechanisms employed are such that they may be adjusted to produce coils having different pitches so as to adapt the machine for the production of coils for use in the binding of books in which the openings through the leaves vary as to the spacing thereof, this adjustment also ensuring uniformity in the pitch of succeeding convolutions of the coil.

The mechanism is also so constructed as to permit not only the replacement of a worn part acting to form the coil, but to permit the production of coils of different diameters by the removal of such a part having dimensions suitable for the production of a coil of one diameter, and the substitution of another part suitable for forming a coil having a greater or small diameter.

The machine of the invention may be operated continuously at high speed with a uniform product.

The invention consists primarily in a wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, and a

guide slot extending tangentially of the opening in said forming die, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, and a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, and feed rollers forcing a strand of wire toward and about said opening; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawing,

Fig. 1 is a perspective view of a wire coiling machine embodying the invention;

Fig. 2 is a view, upon a larger scale, of the coiling die mechanism removed from the machine;

Fig. 3 is a sectional view of said coiling die;

Fig. 4 is an exploded view showing the different parts of the die mechanism; and

Fig. 5 is a section on the line 5—5 of the forming die as shown in Fig. 4.

Like numerals refer to like parts throughout the several views.

In the embodiment of the invention shown in the drawing, the head of the machine is shown at 10. Mounted in this head are two entrained feed rollers 11 and 12 adapted to engage a length of wire 13 and feed it by a pushing movement through a die mechanism for forming the wire into a coil. This mechanism is indicated at 14.

Carried by the head 10 is a guide formed of upper and lower guide members 15 and 16 having registering guide openings indicated at 17 upon opposite sides of the feed rollers 11 and 12. The guide members 15 and 16 are recessed at the top and bottom to permit the perimeter of the rollers 11 and 12 to engage the wire 13 within guide openings 17 and feed same toward the die mechanism 14.

The die proper 14 is removably mounted in relation to the guide members 15 and 16 and the head 10 by any suitable means such as a plate 18 carrying set screws 19 engageable with one side of the die mechanism and clamping it between said plate and the end of the guide members 15 and 16. In this manner, the die

mechanism in its entirety is removably mounted in relation to the feed mechanism, thus permitting the substitution of one guide mechanism for another, or the removal of the guide mechanism for purposes of repair or the substitution of one forming die for another to produce coils of different diameters.

In the operation of the machine, the wire 13 is gripped between the feed rollers 11 and 12 and fed through the guide openings 17 toward the die mechanism 14. This die mechanism comprises a base 20 having a screw threaded opening 21 therein. Mounted upon this base is a forming die 22 having a circular opening 23 therein concentric with the screw threaded opening 21 in the base. Leading from and tangential to the upper portion or top of the opening 23 is a guide slot 24 adapted to be registered with the guide openings 17 in the guide members 15 and 16.

The forming die 22 is in the form of a flat plate adapted to be brought flush against the face of the base 20 and is held in position in relation to said base by screws 25 passing through openings in a face plate 26 and the forming die 22 and engaging the base 20. The face plate 26 is provided with an opening 27 concentric with, but of a smaller diameter than, the opening 23 of the forming die.

The face plate 26 is adapted to be brought flush against the outer face of the forming die 22, so that the die mechanism consists in a block consisting of a base, a face plate, and an intermediate, forming-die plate, the last named having a circular opening therethrough corresponding in diameter with the diameter of the coil to be formed. One side of this opening is closed by the base. The other side of the opening has an overhung flange resulting from the presence of the opening 27 of smaller diameter than the opening in the forming-die plate.

The face plate 26 has one corner thereof, as indicated at 28, cut away forming a gap in the opening 27 of about 90° in arc adjacent the lower diameter of this opening. The edge of the plate above the cutaway portion 28 is bevelled as indicated at 29.

The opening 23 of the forming die, as to the lower portion thereof, is provided with a bevelled portion 30 presented toward the face plate 26, so that, as will more fully appear hereinafter, as the wire is being formed it will be directed outwardly of the forming die and of the face plate, the bevelled portion 29 being provided to ensure this continued outward movement of the wire during the operation of the machine.

Mounted within the screw threaded opening 21 and passing through the openings 23 and 27 is a core member 31 carrying a gauge pin 32 having a deflected portion 33 by means of which said core may be turned to vary the distance of the gauge pin 32 in relation to the face plate 26. The core 31 may be of a diameter to have a close fit with the opening 27, but it is essential that this core be of a diameter relatively less than that of the opening 23 in the forming die.

A set screw 34 passing through a screw threaded opening 35 in the base 20 is provided to lock the core 31 in any adjusted position.

The upper portion of the face plate 26 closes the guide opening 24 extending tangentially from the top of the die opening 23, so that in its passage through the machine the wire 13 is held against any tendency toward buckling, the ar-

range being such as to act as a wire straightener.

The operation of the machine is substantially as follows:—

The end of a strand of wire is drawn from a spool or reel and fed by hand through the right hand end of the guide opening 17 and thus brought into engaging relation with the feed rollers 11 and 12. The surface of these rollers is grooved, as shown in Fig. 1, such grooves being of a depth to grip the wire without deforming the surface thereof, the polish of which must be preserved to permit the feeding of the wire through the collated leaves of a book being bound.

The rotation of the rollers 11 and 12 advances the wire toward the forming die 14, pushing the end of the wire through the guide opening 24 in the forming die and against the surface toward the top of the opening 23 in this die. The end of the wire, as a result of the thrust thereon from the rollers 11 and 12, moves along and conforms to the circular wall of said die opening until it engages the bevelled surface 30 which forces the end of the wire outwardly of the face plate 26 about the opening 27. During this bending of the wire, it is confined between the base 20 and the face plate 26 until it reaches the cutout portion of said face plate. Thereupon, the wire passes from the die opening 23 with an outward trend, the bevelled edge 29 of the plate 26 preventing any interference with the free movement of the wire or any scraping of the wire by a sharp surface of the plate 26.

During the bending of the wire, it passes about the portion of the core 31 within the die opening 23. While the presence of this core forms a closed channel through which the wire passes during the bending operation, contact of the wire with said core is unnecessary because the thrust upon the wire will cause it to follow the wall of the die opening, there being no tendency of the wire to spring inwardly of this wall.

The wire 13 is confined at every point thereof after it enters the openings 17 until it passes from the die opening 23.

While the bevelled portion 30 will give a trend to the wire away from the forming die 22, the pitch of the wire is not determined by this bevel and, in fact, if other means were not provided to give the desired pitch to the wire, a coil would be formed in which the succeeding convolutions are closed one against the other.

To give the desired pitch to the wire, the core 31 is adjusted in relation to the base 20, so as to position the gauge pin 32 away from the face plate 26, and the end of the wire, as it moves about said face plate 26, is brought outwardly thereof and engaged with the face of the gauge pin most remote from said face plate. This spacing of the wire from the face plate determines the pitch of the coil, since the continued operation of the machine will have the two-fold effect of giving the wire a circular form of a predetermined diameter while within the die opening 23, and spacing the coils apart a distance determined by the spacing of the gauge pin 32 from the face plate 26. To increase the pitch of the coiled wire, the gauge pin may be moved toward the face plate 26, and to lower the pitch, it may be moved away from said face plate. The screw threaded connection between the core 31 and the base 20 permits this adjustment of said core.

The main function of the core 31 is as an adjustable support for the gauge pin. This core, beyond the gauge plate, also serves as a support

for the coil as it is delivered from the composite die block as a result of a continued feeding movement of the wire by the rollers 11 and 12 and the camming action of the bevel 30 and the gauge pin 32. The deflected end 33 of this gauge pin is for the purpose of facilitating the turning of the core when adjusting said pin. The set screw 34 is merely for the purpose of preventing possible displacement of the core after it has been properly set, due to vibrations in and about the machine.

The setting of the gauge pin for one pitch of wire is shown in Fig. 3 in full lines, and its setting for a lower pitch is indicated in dotted lines in said figure.

By adjustment of the gauge pin toward or from the face plate 26, the pitch of the coil is determined. The diameter of each convolution, however, is determined solely by the diameter of the die opening 23. If it be desired, therefore, to produce a coil of a different diameter, it is essential to remove the face plate 26 and the forming die 22 and replace the latter with a die having a larger or smaller opening 23.

The forming die 22, being separable from the other portions of the die, may be hardened to resist wear, but in the event that wear occurs after long use, this forming die 22 may be removed and a new hardened plate having the desired exactitude of dimensions substituted therefor.

A machine embodying the invention may be operated continuously to produce coils of the desired diameter and desired pitch until the supply of wire upon a reel or spool is exhausted. During this operation, the convolutions of every portion of the coil produced will be of the same diameter and of the same pitch. If it be desired to change the pitch of the coil before the wire upon the reel or spool is exhausted, this may be done by adjusting the gauge pin 32 in the manner above described, so that it is possible to produce coils having different pitches from the same length of wire.

The bevelled portion 29 will give an outward trend to the end of the wire after it leaves the forming die, so that this end may be readily grasped by pliers or any other suitable tool and brought into the proper relation to the gauge pin.

In making the coils for binding books, soft wire is used having a bright, non-corrosive finish, and with the mechanisms described, this wire is given the desired form without destroying the surface finish of the wire, so that when threading the coil through the leaves of books, the smooth finish will facilitate this movement of the wire and avoid any tendency toward mutilation of the edges of the openings through the paper leaves of a book.

The feeding rollers 11 and 12 are of an ordinary spring pressed type, permitting them to adjust themselves to wires of different gauges while developing pressure sufficient to ensure the required feeding of the wire.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawing, it being obvious that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of

the convolutions of a coil being produced, and a guide slot extending tangentially of the opening in said forming die, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, and a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, and feed rollers forcing a strand of wire toward and about said opening.

2. A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, and a guide slot extending tangentially of the opening in said forming die, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, and a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, means capable of imparting movement to said gauge pin axially of said openings toward or from said outlet to vary the pitch of a coil being formed, and feed rollers forcing a strand of wire toward and about said opening.

3. A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, and a guide slot extending tangentially of the opening in said forming die, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, the portion of said core within said circular opening being of a diameter relatively less than that of the opening, and the portion thereof passing through the opening in said means having a close fit with the walls of said opening, and a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, means capable of imparting movement to said gauge pin axially of said openings toward or from said outlet to vary the pitch of a coil being formed, and feed rollers forcing a strand of wire toward and about said opening.

4. A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, a guide slot extending tangentially to said circular opening, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said

means, and a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, guide members having guide openings for wire passing therethrough alined with said guide slot, and oppositely positioned recesses extending into said guide openings, and feed rollers projecting through said recesses, drawing a wire through a portion of said guide members and forcing it through another portion thereof and said guide slot toward and about said opening.

5 A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, a guide slot extending tangentially to said circular opening, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, means capable of imparting movement to said gauge pin axially of said openings toward or from said outlet to vary the pitch of a coil being formed, guide members having guide openings for wire passing therethrough alined with said guide slot, and oppositely positioned recesses extending into said guide openings, and feed rollers projecting through said recesses, drawing a wire through a portion of said guide members and forcing it through another portion thereof and said guide slot toward and about said opening.

6. A wire coiling machine embodying therein a die mechanism comprising a base, a forming die having a circular opening therethrough and a guide slot extending tangentially thereto, and a face plate having a circular opening therethrough of smaller diameter than the opening through said forming die and concentric therewith, and a cutaway portion adjacent said opening to form an outlet to said forming die, said forming die being intermediate and separable from, said base and said face plate, said forming die and said face plate having a flush fit one with the other, means removably securing them in relation to each other, a core member secured to said base concentric with and passing through said openings, and extending beyond said face plate, and a gauge pin carried by said core member exteriorly of said face plate and adjacent said outlet, said circular opening being provided with means directing the wire axially of said opening and through said outlet, and feeding rollers forcing a strand of wire through said guide slot toward and about the circular opening in said die.

7. A wire coiling machine embodying therein a die mechanism comprising a base, a forming die having a circular opening therethrough provided with a bevelled edge directing the wire from said base and a guide slot extending tangentially thereto, and a face plate having a circular opening therethrough of smaller diameter than the opening through said forming die and concentric therewith, and a cutaway portion adjacent the bevelled portion of said opening to form an outlet to said forming die, said forming die being intermediate and separable from, said base and said face plate, said base, said forming die and said face plate having a flush fit one with the

other, means removably securing them in relation to each other, a core member secured to said base concentric with and passing through said openings, and extending beyond said face plate, and a gauge pin carried by said core member exteriorly of said face plate and adjacent said outlet, and feeding rollers forcing a strand of wire through said guide slot toward and about the circular opening in said die.

8. A wire coiling machine embodying therein a die mechanism comprising a base, a forming die having a circular opening therethrough provided with a bevelled edge directing the wire from said base and a guide slot extending tangentially thereto, and a face plate having a circular opening therethrough of smaller diameter than the opening through said forming die and concentric therewith, and a cutaway portion adjacent the bevelled portion of said opening to form an outlet to said forming die, said forming die being intermediate and separable from, said base and said face plate, said base, said forming die and said face plate having a flush fit one with the other, means removably securing them in relation to each other, a core member secured to said base concentric with and passing through said openings, and extending beyond said face plate, a gauge pin carried by said core member exteriorly of said face plate and adjacent said outlet, and means capable of imparting movement to said gauge pin axially of said openings toward or from said face plate to vary the pitch of a coil being formed, and feeding rollers forcing a strand of wire through said guide slot toward and about the circular opening in said die.

9. A wire coiling machine embodying therein a die mechanism comprising a base, a forming die having a circular opening therethrough provided with a bevelled edge directing the wire from said base and a guide slot extending tangentially thereto, and a face plate having a circular opening therethrough of smaller diameter than the opening through said forming die and concentric therewith, and a cutaway portion adjacent the bevelled portion of said opening to form an outlet to said forming die, said forming die being intermediate and separable from, said base and said face plate, said base, said forming die and said face plate having a flush fit one with the other, means removably securing them in relation to each other, a core member secured to said base concentric with and passing through said openings, and extending beyond said face plate, a gauge pin carried by said core member exteriorly of said face plate and adjacent said outlet, and means capable of imparting movement to said gauge pin axially of said openings toward or from said face plate to vary the pitch of a coil being formed, guide members having guide openings for wire passing therethrough alined with said guide slot, and oppositely positioned recesses extending into said guide openings, and feed rollers projecting through said recesses, drawing a wire through a portion of said guide members and forcing it through another portion thereof and said guide slot toward and about said opening.

10. A wire coiling machine embodying therein a forming die having a circular opening therein of a diameter corresponding with the diameter of the convolutions of a coil being produced, a guide slot extending tangentially to said circular opening, means having an opening therethrough concentric with, but of smaller diameter than, said circular opening, said means having an outlet for the formed wire, said circular opening having

5 a bevelled portion directing the formed wire through said outlet, a core member concentric with and passing through the openings in said forming die and said means, and extending beyond said means, a gauge pin carried by said core member exteriorly of said means and adjacent the outlet of said die, a screw threaded connection between said core and said forming die, whereby

said gauge pin may be adjusted toward or from said outlet to vary the pitch of a coil being formed, and means locking said core in any adjusted position, and feed rollers forcing a strand of wire through said guide slot, toward and about said opening. 5

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