

Nov. 7, 1939.

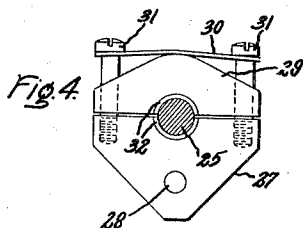
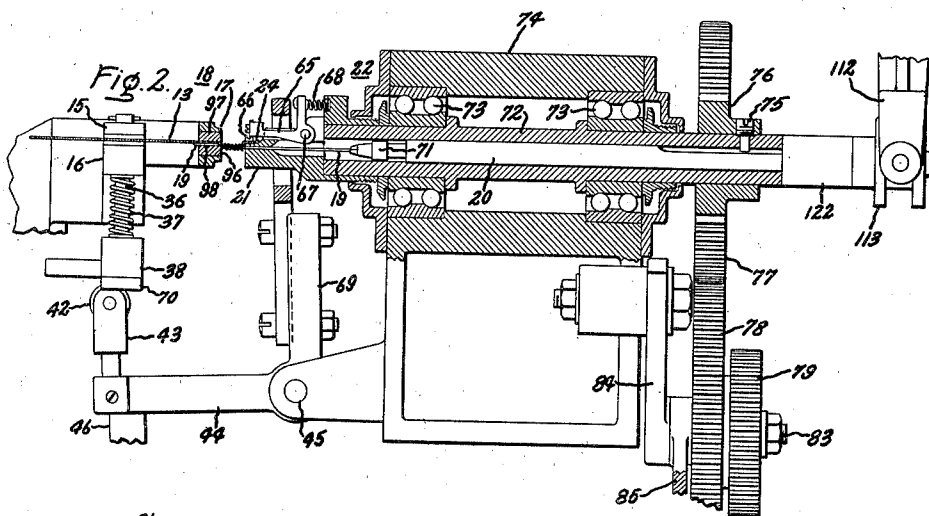
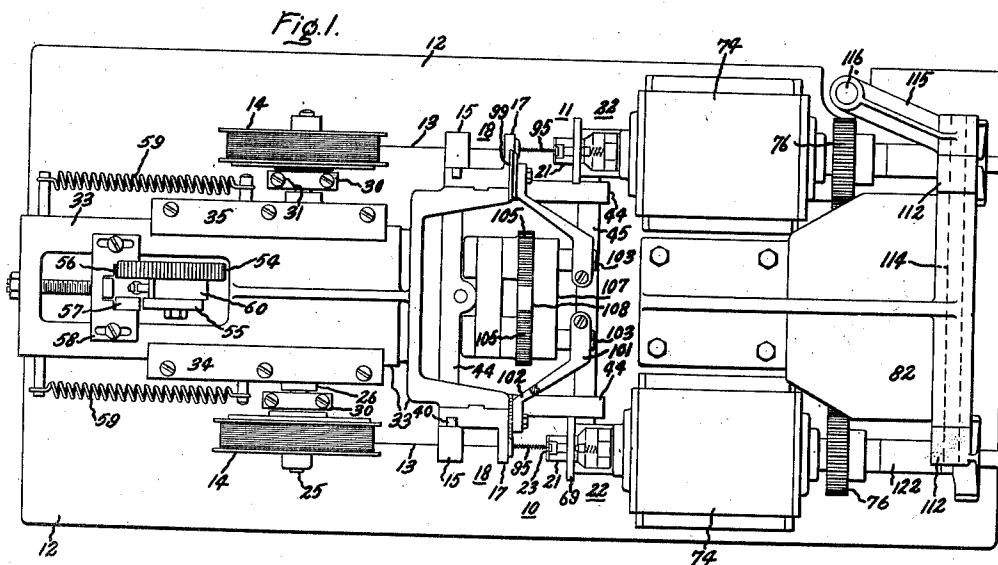
F. B. IDEN

2,179,296

FILAMENT COILING MACHINE

Filed Oct. 1, 1938

2 Sheets-Sheet 1



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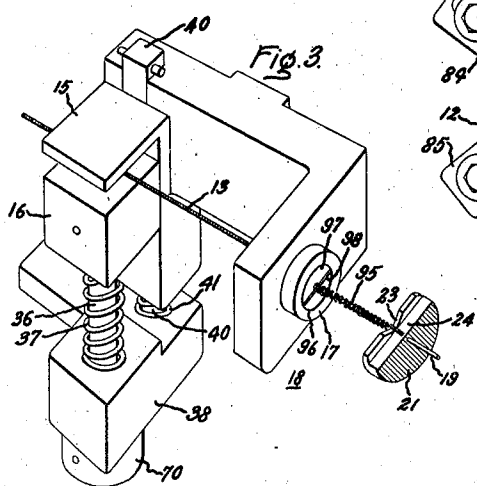
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,179,296

FILAMENT COILING MACHINE

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7 Claims. (Cl. 153—67)

My invention relates to a machine for coiling filaments for electric incandescent lamps and other similar electrical devices. More particularly, my invention relates to a machine for successively forming individual coiled filaments by first coiling the desired length of filament wire about a mandrel and then, following the severing thereof, withdrawing said mandrel from the filament coil. The present invention is an improvement upon the general type of machine disclosed in Patent 1,771,927, G. Illingworth, which issued July 29, 1930.

The formation of coiled lamp filaments is a very exact and difficult operation as the said filaments must be extremely uniform in order to function properly. The filaments must also be economically produced and therefore must be formed at a high rate of speed. These and other objects are most easily attained by the use of a coiling machine of the type disclosed in the above-mentioned Illingworth patent which I now provide with a more convenient and accurate apparatus for controlling the pitch of the coiling and with an improved means of starting and stopping the rotation of the coiling head at the start and the end of the coiling operation for each filament. Another object of my invention is to improve the balance of this type of coiling machine by causing the mandrel to rotate instead of the spool on which uncoiled filament wire is wound.

This type coiling machine has heretofore been used for coiling wire to form the relatively short filaments used on low voltage circuits since the mandrel can only be withdrawn from the filament when sufficient uncoiling takes place therein to loosen it on the mandrel. Now, however, I find that the machine is equally as useful for performing the second coiling operation in the manufacture of the coiled-coil filaments used on higher voltage circuits. In coiling the filament a second time, the filament wire and the primary wire mandrel on which it has been first coiled at a uniform rate are preferably treated as a single wire and are coiled about the removable mandrel of my machine in the normal manner. The manufacture of coiled-coil filament is more exacting because of the greater weight and mass of the filament wire being coiled, the possibility of greater error due to differences in length, and because it is highly important to eliminate all irregularities due to the higher temperature of operation of the filament in a lamp. The machine comprising my invention is adapted to produce filaments having straight end sections which assist in the proper mounting thereof.

Other features and advantages of my invention will be apparent from the detailed description which follows of the species thereof shown in the accompanying drawings.

In the drawings, Fig. 1 is a plan view of a machine comprising my invention; Fig. 2 is a vertical section through one of the two coiling mechanisms of the machine; Fig. 3 is a perspective view, on a larger scale, of the filament wire clamping jaws, guiding head and a portion of the nose of the coiling head; Fig. 4 is a side elevation of the brake for the filament wire supply spool; Fig. 5 is a perspective view of the cams and other operating means of the machine; and Fig. 6 is an end view of the driving gear chain for both coiling heads.

Referring now to Fig. 1, it will be seen that the machine comprises two duplicate coiling mechanisms 10 and 11 mounted at the front and back respectively of the table 12 and operated in unison by one interconnected mechanical system. In this particular instance, each coiling mechanism is shown performing the second coiling operation in the making of a coiled-coil filament although it can be used to coil single coil filaments equally as well since the already coiled filament wire 13 is treated as a single wire. The filament wire 13 which is still coiled on the wire mandrel used in the first coiling operation is contained on the spools 14 and, in each instance as shown in Figs. 1 and 2, is drawn between the jaws 15 and 16 and through the nose 17 of the head 18. The mandrel 19 on which the filament wire 13 is to be coiled is held by the spindle 20 and extends through the nose 21 of the coiling head 22 to a position adjacent the nose 17 of the head 18.

At the start of a cycle of operation of each of the coiling mechanisms, the end of the filament wire 13 extends a definite distance beyond the nose 17 and the head 18 is advanced toward the mandrel 19 until said filament end is carried through the V-shaped notch 23 and over the plane surface 24 of the nose 21 of the coiling head 22 as shown in Fig. 3. During this movement, the jaws 15 and 16 are closed so that the filament wire 13 is pulled from the spool 14 and the mandrel 19 passes into an aperture in the nose 17 adjacent that holding the filament wire 13.

The spool 14 is mounted on the pin 25 which is pivotally mounted in the standard 26 and is kept from overrunning by the brake shown in Fig. 4 which engages the pin 25. The brake comprises the lower shoe 27 which is held in position by the pin 28 extending from the standard 26 and the

upper shoe 29 which is pressed down by the leaf spring 30 also engaging the screws 31 attached to the lower shoe 27. A chamois friction surface 32 is preferably provided between the shoes 27 and 29 and pin 25. The standard 26 is fastened directly to the table 12 so as to remain stationary at all times whereas the jaws 15 and 16 and the head 18 are mounted on the slide or carriage 33 located in ways in said standard 26 in which it is held by the plates 34 and 35. Jaw 15 is fastened to a portion of the head 18 engaging the slide 33 whereas jaw 16 is movable and is mounted on the end of the pin 36 and rests on the spring 37. The jaw 16 is raised to grip the filament wire 13 by the upward movement of the block 38 which is slidably mounted on the end of the pin 36 and engages the lower end of the spring 37. The block 38 is also fastened to the rod 40 which is slidably mounted in a portion of the head 18 and said block is separated from said head portion by the spring 41 which surrounds the lower end of said rod. The means for actuating the blocks 38 of each of the coiling mechanisms consists of a roller 42 (Fig. 2) mounted through the yoke 43 at one corner of a substantially horizontally disposed U-shaped arm 44 which is pivoted at its ends on the rod 45 (see Fig. 1) and actuated through the universal joints 46 and 47 (Fig. 5), the rod 48, the plate 49 and the roller 50 which engages a slot (not shown) in the cam 51. The rod 48 and the plate 49 are held in position for vertical movement by the block 52, which is fastened to another portion of the machine and slidably engages the rod 48, and by the engagement of the snug fitting vertically elongated aperture 53' in the plate 49 with the cam shaft 53. The cam shaft 53 is driven at a constant rate by means (not shown) and provides the means of operating all portions of the machine.

The movement of the jaws 15, 16 and head 18 is produced by movement of the slide or carriage 33 in the ways of the standard 26 and is brought about by a downward movement of the cams 54 and 55 (Figs. 1 and 5) the sloping surfaces 54', 55' of which are engaged by the rollers 56 and 57 respectively carried by the cross bar 58 on the slide 33. Each of the cams 54 and 55 controls a separate portion of the movement as each extends along a different portion of the slide 60 and is brought into engagement with the rollers 56 and 57 at separate intervals of time. The slide 33 is pulled to the right by the contracting force of the springs 59—59 which extend between posts in standard 26 and the slide 33 so that either roller 56 or 57 is kept against its cooperating cam 54 or 55 respectively. The cams 54 and 55 are fastened to the slide 60 which is located in ways in standard 26 behind the cover plate 61 and which engages the cam 62 on the cam shaft 53 through the roller 63. The contractive force of the spring 64 which extends between posts in slide 60 and a portion of the frame (not shown) causes the roller 63 to engage the cam 62 at all times.

Following the complete advancing movement of the head 18 which places the end of the filament wire 13 over the nose 21 of the coiling head 22, the finger 65 in said coiling head is lowered so that said filament end is gripped between the block 66 held by the finger 65 and the plane surface 24 of the nose 21. The finger 65 is located in a slot in the nose 21 on the pin 67 and is operated through the spring 68 and the arm 69 which is fastened to the rod 45. The rod 45 is a part of the operating means for the jaws 15 and

16 and movement of the U arm 44 turning the rod sufficiently to operate the finger 65 also allows the block 38 to drop lower and said jaws 15 and 16 to separate. The block 38 is forced down by the expanding force of the spring 40 (Fig. 3) which carries it downward into contact with the collar 70 on the end of the rod 36 which in turn is fastened to jaw 16. That portion of the filament wire 13 held by the nose 21 of the coiling head 22 remains uncoiled and, as coiling starts, serves to fasten said filament wire 13 to the coiling head 22.

The operation of coiling the filament wire 13 about the mandrel 19 consists in the rotation of said mandrel 19 and the nose 21 of the coiling head 22 to wind said filament wire 13 thereabout and the withdrawing or retracting movement of the head 18 away from the coiling head 22 to space the turns of the filament wire 13. As shown in Fig. 2, the mandrel 19 is held by the usual form of chuck 71 on the end of the spindle 20 which is located within the hollow shaft 72 supporting the nose 21. The hollow shaft 72 rides in the ball bearings 73 of the standard 74 and, together with the spindle 20 which is keyed thereto by the screw 75, is rotated by the gear 76. The gear 76 corresponds to a similar gear 76 of the adjacent coiling mechanism and is driven together therewith by the gear train shown in Fig. 6 consisting of the gears 77, 78, 79 and 80. The gear 77 rotates on the pin 81 extending from the bracket 82 which is attached to the table 12 between the coiling mechanisms 10 and 11, and gears 78 and 79 are rotatably mounted on the pin 83 held by the arms 84 and 85 which are attached by bolts to one of the standards 74 and the table 12 respectively. The gear 80 is mounted on the stub shaft 86 which is driven from the cam shaft 53 as shown in Fig. 5 through the gear 87 and the pinion gear 88. Since the coiling operation only takes place during a portion of each cycle of operation, the gear 87 does not have teeth completely around the periphery thereof and pinion gear 88 is not always in mesh. When the coiling head 22 is caused to begin rotating, the gear 87 is in such a position that the dog 89 is just beginning to engage the cam 90 and the teeth of the gear 87 are about to engage the teeth of gear 88. As the gear 87 continues to rotate, the dog 89 moves ahead and, through engagement with the cam 90, gradually brings the stub shaft 86 up to full rotating speed so that the teeth of the gears 87 and 88 engage perfectly without shock or jar. Prior to being rotated, the coiling head 22 and the gear train are held in one position by a body comprised of the studs 91 extending from the side of the cam 90 which, as shown, ride on the raised flange portion extending from the cam 92. The cam 92 is attached to the gear 87 and only extends far enough to prevent the cam 90 from turning until it engages the dog 89.

The withdrawing or retracting movement of the head 18, which spaces the turns of the filament wire 13 on the mandrel 19, is caused by an upward movement of the slide 60 and the cams 54 and 55 as the rise portion of the cam 62 passes under the roller 63. During the coiling, the motion of the head 18 is controlled by the cam 54 which has a uniform inclination from one end to the other and which, together with cam 62, causes said motion to occur at a uniform rate. The cam 54 is fastened to the slide 60 by a single bolt (not shown) and also engages said slide 60 through the curved raised portion or boss 93 which fits into a similarly shaped groove in the

said slide 60 and which allows the inclination of the cam 54 about its lower extremity to be changed as desired. This construction provides an easy means of adjusting the pitch of the coiling as markings 54' are provided on the top of the cam 54 which show directly the exact pitch of coiling if compared with a master mark 60' on the slide 60.

The timing of the operations is such that the required number of turns have been coiled about the mandrel 19 when the roller 56 reaches the lower end of the cam 54 and rotation of the coiling head 22 is stopped. At this time, the pinion gear 88 passes over the toothless portion of the gear 87 and the speed of the head 22 is reduced by the engagement of the dog 94, which corresponds to the dog 89, with the cam 90. The studs 91 extending from the cam 90 then pass over the cam 92 and the coiling head 22 is held definitely in position. The longitudinal movement of the head 18 does not end at this point but continues as the roller 57 is engaged by the other cam 55 carried by the slide 60. This motion pulls additional filament wire 13 through the nose 17 so that a leg portion parallel to the mandrel 19 is formed on the end of the coiled filament 95 equal in length to that held by the nose 21 of the coiling head 22 plus sufficient filament wire 13 for a second leg for the succeeding filament. If longer or shorter legs are desired, the cam 55 is adjusted so as to protrude more or less beyond the lower end of the cam 54 and the movement of the slide 60 is not changed. Different length legs require different forward limits of movement of the head 18 so that corresponding leg portions of the filament wire 13 are carried between the finger 65 and the nose 21 and therefore means are provided for shifting the cross bar 58 on which the rollers 56 and 57 are mounted on the slide 33. When the coiling stops, the end of the mandrel 19 passes from the cooperating aperture in the nose 17 which aperture consists of a centrally located groove in the die 96 which groove in turn is separated by a thin plate 98 from the eccentric groove in die 97 in which the filament wire 13 is located. The dies 96 and 97 and plate 98 form a cylindrical body which fits snugly in the nose 17.

As the end of the movement of the head 18 is reached, the knives 99 and 100 (Figs. 1 and 5) move together to sever the straight portion of filament wire 13 extending beyond the end of the mandrel 19. This movement divides said straight portion in the middle so that a straight leg remains on the coiled portion of the filament wire and the desired filament 95 is formed. The knives 99 and 100 are mounted on the arms 101 and 102 respectively which are attached to the shafts 103 and 104 respectively and are operated together by the gears 105 and 106 which are located on said shafts 103 and 104 and mesh together. The shafts 103 and 104 of the cutting means for each coiling mechanism are supported by the standard 107 which is fastened to the table 12 and are operated by engagement of the gears 106 with the teeth of the rack 108. The rack 108 is located in ways in the standard 107 and is attached to the plate 109 which engages a slot in cam 110 through the roller 111.

Following the severing of the filament wire 13, the finger 65 is raised so that both ends of the filament 95 are free and a certain amount of back winding takes place which loosens it on the mandrel 19. The mandrel 19 is then pulled back into the coiling head 22 and withdraws from the

coils of the filament 95 which either falls free of the coiling apparatus or is transferred mechanically to a tray or other conveying means. The mandrel 19 which is attached to the spindle 20 is withdrawn by movement of said spindle 20 into the coiling head 22 caused by the lever 112 which engages the grooved collar 113 on the end thereof and which is operated from the shaft 114 carried by the outer end of the bracket 82. The shaft 114 supports corresponding levers 112 of both coiling mechanisms and is actuated through the arm 115 and rod 116 by the means shown in Fig. 5 consisting of the lever 117, the roller 118 and the cam 119. The lever 117 is pivoted on the pin 120 which extends from a portion of the frame of the machine (not shown) and is pulled by the contraction of the spring 121 so that the roller 118 engages the periphery of the cam 119. All other operations of the machine have been described except for the return movement of the mandrel 19 which is brought about by the means just described and consists in a forward movement of the spindle 20 until the spacing collar 122 butts against the end of the hollow shaft 72.

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

1. An automatic machine for forming coiled lamp filaments comprising a mandrel, means for advancing an end of the filament wire to a position adjacent said mandrel, a coiling head surrounding one end of said mandrel and aligned therewith, means mounted on the coiling head for gripping said end of the filament wire, means for rotating said mandrel and the coiling head to cause said filament wire to be coiled around said mandrel, means for engaging the wire being coiled and moving along the length of the mandrel at a predetermined rate with respect to the rotation of the coiling head for advancing the wire therealong to space the turns of the wire as it is being coiled, means for actuating the gripping means on said coiling head to release the end of the filament wire held thereby, means for severing said filament wire adjacent the end of the mandrel to separate the coiled portion forming the lamp filament from the remainder and means for retracting the mandrel into the coiling head to withdraw it from the coiled filament.

2. An automatic machine for forming coiled lamp filaments comprising a mandrel, a carriage adapted to be moved toward and away from the mandrel, means mounted on said carriage for gripping an end of the filament wire during the forward movement thereof to position said end adjacent the mandrel, means for clamping the said filament wire end in said position, means for rotating said mandrel together with said filament wire end to cause the wire to be coiled around the mandrel, means mounted on the carriage for guiding the filament wire onto the mandrel, means for advancing the carriage along the mandrel to space the turns of the wire as it is being coiled comprising a cam movable in a direction intersecting the direction of movement of the carriage and engaging a portion of said carriage to move it at a predetermined rate, and means for withdrawing the mandrel from the coiled filament.

3. An automatic machine for forming coiled lamp filaments comprising a mandrel, a carriage adapted to be moved toward and away from the mandrel, means mounted on said carriage for gripping an end of the filament wire during the forward movement thereof to position said end adjacent the mandrel, means for clamping the

said filament wire end in said position, means for rotating said mandrel together with said filament wire end to cause said wire to be coiled around the mandrel, means mounted on the carriage for
 5 guiding the filament wire onto the mandrel, means for advancing the carriage along the mandrel to space the turns of the wire as it is being coiled comprising a cam movable in a direction intersecting the direction of movement
 10 of the carriage and having a sloping surface engaging a portion of said carriage to move it at a predetermined rate, and means adjusting the angularity of said cam with respect to the direction of movement of the carriage to change the
 15 pitch of the coiling, and means for withdrawing the mandrel from the coiled filament.

4. An automatic machine for forming coiled lamp filaments comprising a mandrel, a carriage adapted to be moved toward and away from the
 20 mandrel, means mounted on said carriage for gripping an end of the filament wire during the forward movement thereof to position said end adjacent the mandrel, means for clamping the said filament wire end in said position, means for
 25 rotating said mandrel together with said filament wire end about the said mandrel to cause said wire to be coiled around the mandrel, means mounted on the carriage for guiding the filament wire onto the mandrel, means for advancing the
 30 carriage along the mandrel to space the turns of the wire as it is being coiled comprising a cam movable in a direction intersecting the direction of movement of the carriage and engaging a
 35 portion of said carriage to move it at a predetermined rate, means for causing the rotation of the mandrel to be discontinued, a second cam also movable in a direction intersecting the direction of movement of the carriage and engageable
 40 therewith to cause said carriage to continue its movement upon cessation of the rotation of the mandrel so that a length of filament wire is drawn out parallel to the mandrel, means for severing the uncoiled portion of said wire adjacent the end of the mandrel and means for withdrawing
 45 the mandrel from the coiled filament.

5. An automatic machine for forming coiled lamp filaments comprising a mandrel, means for advancing an end of the filament wire to a position adjacent said mandrel, means for clamping
 50 the said filament wire end in said position, means for rotating said mandrel together with said filament wire end about the said mandrel to cause said wire to be coiled around the mandrel comprising a coiling head for supporting the mandrel and gripping the said end of the filament wire, a gear for rotating the coiling head, a gear segment for rotating said gear during the coiling interval, a cam connected to the gear and rotatable therewith, a pair of dogs adapted to rotate with the gear segment and to engage said
 55 cam just prior to and after the engagement of said gear segment with the gear to cause the latter to be gradually brought up to speed and retarded

respectively at said coiling intervals, means for advancing the filament wire along the length of the mandrel to space the turns of the wire as it is being coiled, and means for withdrawing
 5 the mandrel from the coiled filament.

6. An automatic machine for forming coiled lamp filaments comprising a mandrel, means for advancing an end of the filament wire to a position adjacent said mandrel, means for clamping
 10 the said filament wire end in said position, means for rotating said mandrel together with said filament wire end about the said mandrel to cause said wire to be coiled around the mandrel comprising a coiling head for supporting the mandrel and gripping the end of the filament
 15 wire, a gear for rotating the coiling head, a gear segment for rotating said gear during the coiling interval, a cam connected to the gear and rotatable therewith, a pair of dogs adapted to rotate with the gear segment and to engage said
 20 cam just prior to and after engagement of said gear segment with the gear to cause the latter to be gradually brought up to speed and retarded respectively at said coiling intervals, means for preventing rotation of the coiling head during the
 25 interval between coiling operations comprising a body extending from said gear and a second cam connected to said gear segment and of sufficient length to engage said body during the interval the gear and gear segment are not engaged,
 30 and means for withdrawing the mandrel from the coiled filament.

7. An automatic machine for forming coiled lamp filaments comprising a mandrel, a carriage adapted to be moved toward and away from the
 35 mandrel, means mounted on the carriage for gripping an end of the filament wire during the forward movement thereof to position said end adjacent the mandrel, means for rotating said mandrel together with said filament wire end
 40 about the said mandrel to cause said wire to be coiled therearound comprising a coiling head for supporting the mandrel and gripping the said end of the filament wire, a gear for rotating the coiling head, a gear segment for rotating said
 45 gear during the coiling interval, a cam connected to the gear and rotatable therewith, a pair of dogs adapted to rotate with the gear segment and to engage said cam just prior to and after the engagement of said gear segment with the gear to cause the latter to be gradually brought
 50 up to speed and retarded respectively at said intervals, means mounted on the carriage for guiding the filament wire onto the mandrel, means for advancing the carriage along the mandrel to space the turns of the wire as it is being coiled comprising a cam movable in a direction intersecting the direction of movement of the carriage and engaging a portion of said carriage to move it at a predetermined rate, and means
 55 for withdrawing the mandrel from the coiled filament.

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