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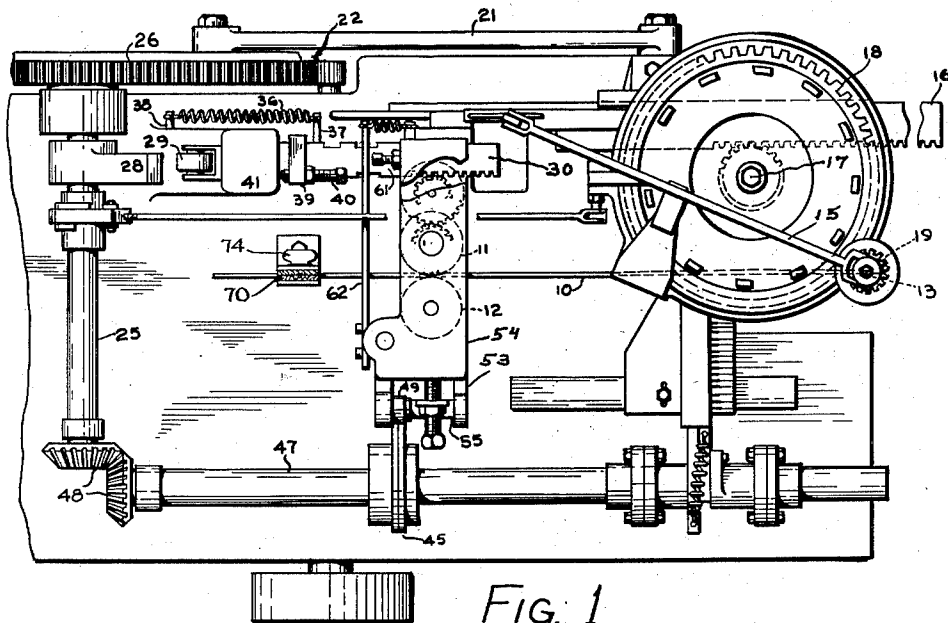
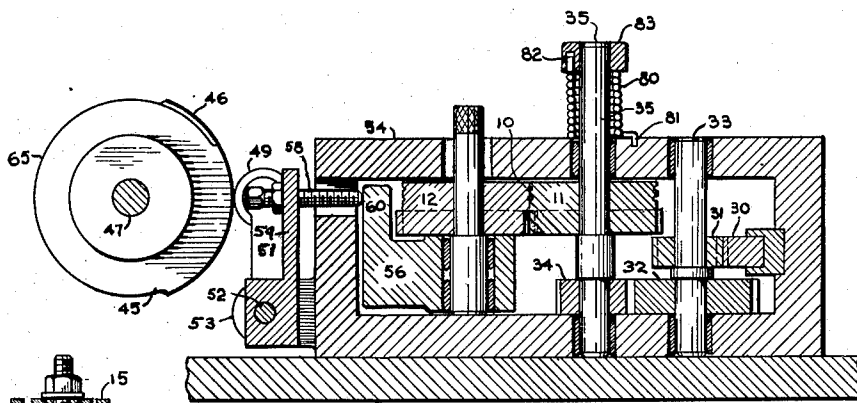
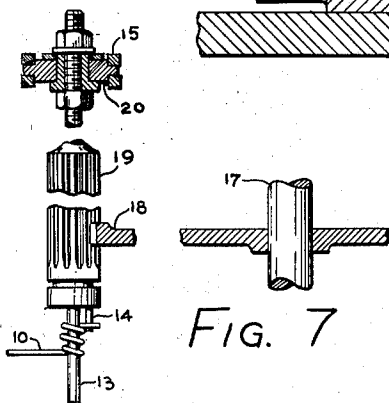
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WIRE COILING MACHINE HAVING AN ACCURATE WIRE FEEDING MECHANISM

Filed July 29, 1954

2 Sheets-Sheet 1



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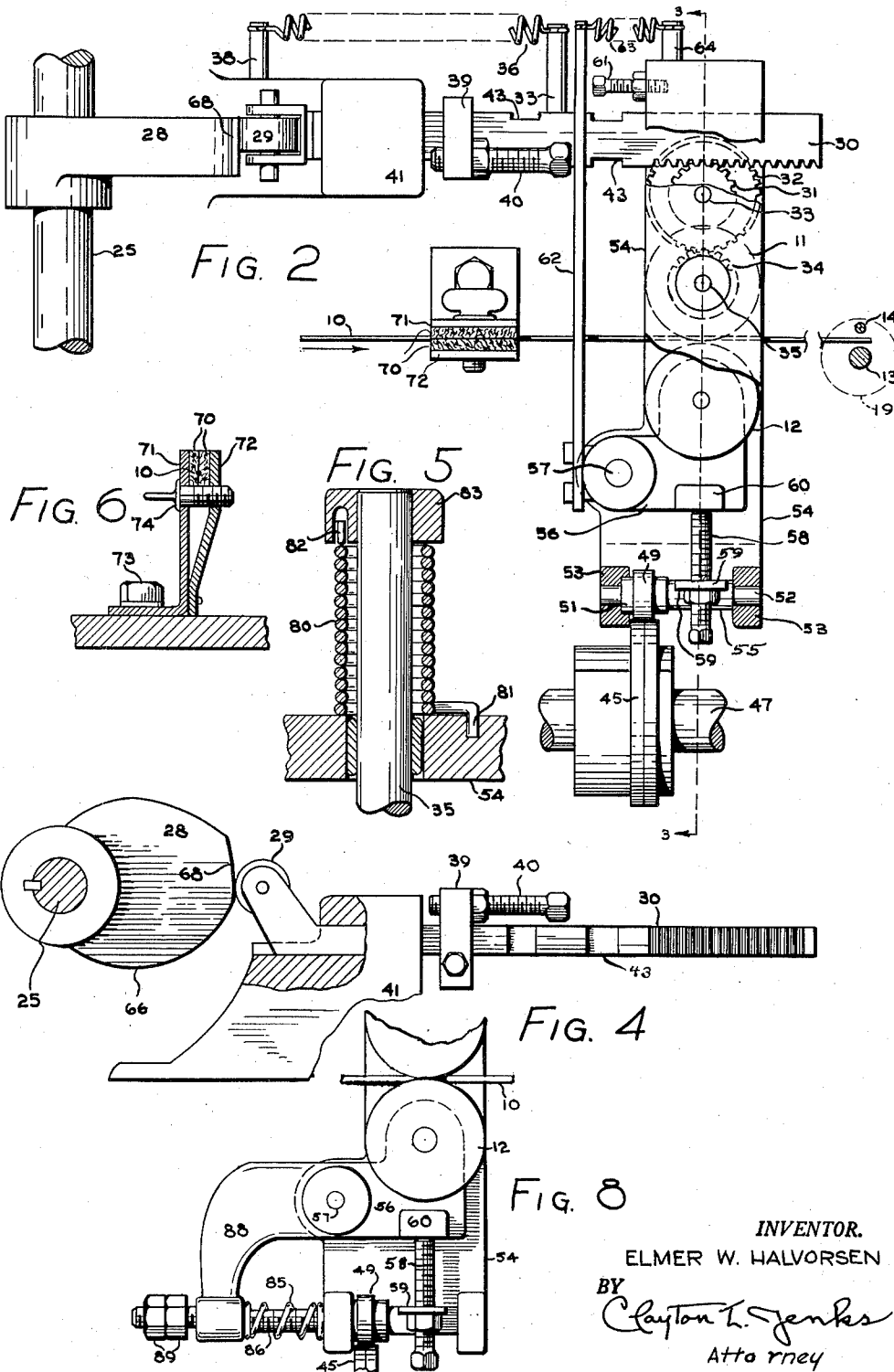
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WIRE COILING MACHINE HAVING AN ACCURATE WIRE FEEDING MECHANISM

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This invention relates to a wire coiling machine, and more particularly to an improvement in the construction described in the patent to Blount and Fisher, No. 2,163,019, of June 20, 1939.

In a machine of this general type, wire is coiled on a rotating arbor which is moved axially as the winding proceeds. Wire is fed forward to the arbor by positively driven rolls which thereafter release the wire and permit it to be drawn forward by the rotating arbor. The wire feed rolls have been driven in one direction by a pawl and ratchet mechanism or a free wheeling clutch, which, in turn, is moved by a reciprocating rack bar. The rack bar is reciprocated in one direction by a rotatable cam and returned by a spring. The wire coiling arbor is moved axially as the coil is made by means of a rocking beam whose motion is controlled by an adjustably positioned cam bar. The coiling arbor is rotated only in one direction through a special clutch and associated mechanism which provides for stopping the arbor in an exact position relative to a pin on the coiling arbor which serves to grip the end of the wire and start the coiling procedure. Immediately after the wire has been gripped between the pin and arbor, the feed rolls release the wire and thereafter the coiling arbor draws the wire forward. The free wheeling clutch in such a machine, which drives the feed rolls only in one direction, does not provide an exact wire feed, since the momentum of the wire and feed parts may cause the wire to move forward too far and thus affect the coiling operation. Moreover, there is a back lash in the roll driving system, and this affects the accuracy of wire feed.

A primary object of this invention is to overcome such disadvantages and to provide a positively acting and accurate wire feeding mechanism which serves to feed an exact predetermined length of wire to the coiling arbor. Other objects will be apparent in the following disclosure.

Referring to the drawings illustrating one embodiment of this invention as applied to said patented construction:

Fig. 1 is a plan view of the machine with parts broken away or removed which shows the relationship of the feed mechanism to various other units;

Fig. 2 is an enlarged fragmentary plan view of the mechanism shown in Fig. 1;

Fig. 3 is an enlarged view of the gear train taken on the line 3—3 of Fig. 2;

Fig. 4 is a detail showing the cam construction for moving the wire feed rack bar;

Fig. 5 is an enlarged view of the spring and associated parts which serve to take out the back lash of the driving rolls gear train;

Fig. 6 is an elevation of the friction wire grip;

Fig. 7 is a fragmentary elevational detail of the wire coiling arbor and associated driving gears; and

Fig. 8 is a fragmentary detail of a modified arrangement of the spring pressed lever which rotates the feed rolls in the opposite direction.

In this machine, a piece of wire 10 is fed forward to

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the coiling zone from a suitable supply by means of two feed rolls 11 and 12 connected by meshed gears to rotate together. The wire is fed by the feed rolls to a rotating, axially movable, cylindrical coiling arbor 13, where the wire is gripped between a revolving pin 14 (Fig. 7) and the arbor surface and drawn forward by and wound on the rotating arbor, as is fully described in said patent 2,163,019 and to which reference may be had for details of the machine construction not herein described. The arbor is reciprocated or moved axially by a centrally pivoted rocking beam 15 (Figs. 1 and 7), the motion of which is governed by a cam mounted to move with a rack bar 16. The rack bar rotates the arbor by meshing with a gear on the axle 17 carrying a large gear 18 which drives an elongated reciprocating gear 19 fixed to rotate the arbor 13. The beam 15 connects with the top of the rotating gear 19 through a yoke and collar 20. The rack bar is in turn moved by a pitman rod 21 driven by a crank arm adjustably mounted on a slideway on the side of the driving gear 26 driven by the power shaft and gear 22 and which is so arranged as to give a variable stroke to the rack bar and consequently vary the number of turns of rotation of the coiling arbor 13, as is shown and described in the patent.

A special feature of this invention pertains to the driving of the feed rolls 11 and 12. As shown in Figs. 1 and 2, a cross shaft 25 suitably mounted in the machine frame is directly connected by being keyed to the gear 26. A cam 28 on the shaft 25 cooperates with a cam follower roller 29 mounted in a fork on the end of a reciprocable rack bar 30, suitably mounted in a slideway, to move that bar in a controlled cycle. This bar in turn operates through a gear system to turn the drive roll 11. This rack bar connects with a small gear 31 suitably mounted in the gear housing (Fig. 3) and which has a larger gear 32 fixed to the same shaft 33 and arranged to drive a smaller gear 34 fixed to the shaft 35 which carries the fixed feed roll 11. This is a positive driving connection, since the upper feed roll 11 is rotated in opposite directions as the rack bar is reciprocated, the motion in one direction being caused by the cam 28 and the other by an associated coil spring 36 under tension connected between a pin 37 on the side of the rack bar and a stationary pin 38 suitably mounted on the framework of the machine. This spring returns the cam roller 29 towards the cam, the roller being mounted in a yoke suitably carried on the end of the slidable rack bar. A clamp 39 (Fig. 2) on the rack bar carries a set screw 40 which is adjustably mounted to engage a fixed portion 41 of the framework and thus limit the return stroke of the rack bar toward the left. The clamp 39 may be suitably mounted in any one of a set of grooves 43 spaced along the bar 30 so arranged that the permitted spring return of bar 30 may be adjusted.

There is no clutch, ratchet or other free wheeling between the driving gear mechanism and the feed rolls. A positive forward feed of the wire is effected by moving one of the feed rolls 12 into and away from driving engagement with the wire and the mating feed roll 11. This is accomplished by means of a cam 45 which may be made of two cams that are adjustable angularly so as to determine the duration and times of separation and operation of the feed rolls, as described in the patent. The high portion 46 of the cam (Fig. 3) is adjusted to provide the desired duration of time during which the drive rolls grip the wire and feed a predetermined length of wire between the coiling pin 14 and the coiling arbor 13. This adjustable cam 45 is fixed to the shaft 47, which is driven through a pair of bevelled gears 48 (Fig. 1) from the shaft 25 so that the cam revolves in timed relation with the other parts of the mechanism. A cam

roller 49 is suitably mounted in a swinging yoke 51 (Fig. 3) carried on a pivot 52 suitably mounted in lugs 53 projecting laterally from the feed roll and gear housing 54. The pivot 52 (Fig. 2) has a central rocking portion 55, and the yoke and part 55 move as a unit. The feed roll 12 is suitably supported in bearings on a swinging mount 56 pivoted on a pin 57 carried in the housing 54 and arranged to swing the roll 12 toward the roll 11, as shown in Fig. 2. A set screw 58 adjustably mounted in a resilient arm 59 (Fig. 3) movable with the swinging part 55 and yoke 51 is adjustably positioned relative to a lug 60 on the swinging mount 56 to transmit the thrust of the cam 45 to move the roller 12 forward into a pinching engagement with the wire 10 which rides in matching peripheral slots in the two feed rolls 11 and 12. To provide a return movement of the mount 56, a long rigid arm 62 (Fig. 2) fixed by set screws to the side of the swinging mount is connected to one end of a spring 63 which has its other end fixed on a pin 64 projecting from the feed roll housing. This spring is under tension and serves to swing the movable feed roll 12 quickly away from the wire as soon as the cam follower falls from the long high part 46 of the cam 45 onto the low part 65 of the cam. An adjustable set screw 61 on the casing 54 and normally spaced slightly from the lever 62 serves to limit the throw of that lever and prevent the wire from falling out from the feed rolls.

The driven feed rolls are rotated positively in a wire feeding direction in accordance with the movement of the rack bar 30. This positive movement is provided by the cam 28 (Figs. 2 and 4) and the return movement by the spring 36. The cam 28 is provided with a special shape comprising the lifting and lowering cam face portions 66 of desired shape which merge into and are connected by a partial cylindrical portion 68. That portion 68 has an angular length, as shown in Fig. 4, sufficient to hold the rack bar 30 stationary for a required period of time during which the forward end of the moving wire is being caught between the pin 14 and the cylindrical face of the arbor 13, and before or as the wire coiling begins. This insures that the rising cam surface 66 feeds an exact length of wire between the pin 14 and arbor 13 and that the driven feed roll will be stopped positively and remain stationary while the coiling arbor turns far enough to grip the end of the wire and start drawing the wire forward. After the wire has been thus gripped, the cam roller 29 has run off the high surface 68 and the driving rolls 11 and 12 are again rotated in an opposite or counter-feeding direction by the spring 36. At the same time, the cam 45 (Fig. 3) has released the movable feed roll 12 from gripping engagement with the wire and thus the feed rolls 11 and 12 may reverse in their direction of rotation as required by the rack bar reciprocation without in any way affecting the wire movement. This is a positive action and the timed relationship of the two cams 28 and 45 insures that the positively driven feed roll 11 will bring the right amount of wire up to the coiling arbor and that the rolls 11 and 12 will then stop in their rotation until the arbor pin has gripped the wire and the coiling can proceed. There is no possibility of overfeeding of the wire and therefore an exact length of wire may be fed.

A positive control of the wire is aided by the friction gripping felts 70 (Figs. 2 and 6) held between two pressure plates 71 and 72. As shown in Fig. 6, the plate 71 may be connected to a suitable portion of the machine framework by a set screw 73, and the other plate 72 may be a spring member suitably fixed to the first plate. An adjustable screw 74 is threaded through the spring plates 71 and 72 and serves to draw them together for a desired pressure of the two felts 70. The wire 10 is gripped between the felts, and by adjusting their pressure the forward motion of the wire may be frictionally retarded so that the instant the driving rolls are stopped by the circular or cylindrical portion 68 of the cam 28,

the wire will in turn stop and will not be fed too far forward. Thus, the wire stops instantly when the cam surface 68 comes into play and there will be no overrun. A further use of this wire clamping unit is to always maintain pressure on the wire at the moment that the wire is severed and until the wire is gripped by the feed rolls 11 and 12 for the next cycle.

A further feature of this construction involves a helical spring 80 under compression which is arranged to take up all back lash in the gear system that drives the wire feed roll 11. This spring, as shown in Figs. 3 and 5, surrounds a projecting end of the arbor 35 which carries the feed roll 11. One end of this helical spring is fixed at 81 on the machine framework and its other end 82 is connected to a collar 83 fixed on the end of the shaft. This spring exerts a force at all times which serves to hold the front end of each rack bar tooth during its feed stroke tightly against the associated gear tooth as the rack bar moves forward. This in turn holds all of the gear teeth in that same relationship so that there is no lost motion anywhere in the gear system between the rack bar and the final driving gear 34 which turns the feed roll 11. Hence, however much freedom of motion there may be between the associated gear teeth, these teeth are always held in their forward driving stroke positions and an extreme accuracy of wire feed is thereby obtained.

In the modification of Fig. 8, the movable feed roll 12 is urged away from contact with the wire by means of a coiled compression spring 85 surrounding a pin 86 secured at one end to the side of the casing 54 and passing freely at its other end through an opening in an arm 88 which is secured to and projects from the swinging mount 56 carrying the movable feed roll 12. The arm 88 is spaced from and is substantially parallel to the casing 54 to provide room for the spring. The pin 86 has an adjustable nut and check nut 89 at its outer end spaced from the arm 88 to provide needed movement of the arm 88. The arm 88, as shown, extends in the opposite direction from arm 62 of Fig. 2, which is replaced by the structure of Fig. 8, and it is so shaped and located that the spring 85 urges it outwardly about the pivot 57, subject to its position being controlled by the cam 45. The check nut 89 limits the outward movement of the arm 88, so as to minimize lost motion. Thus, the cam 45 swings the feed roll 12 towards the wire against the back pressure of the spring 85 and the latter separates the rolls when permitted by the low part of cam 45 engaging its follower 49.

Various other features of the machine may be made in accordance with the patent, such as the wire cutting and shaping operations there described, and numerous modifications may be made in the machine within the scope of the above disclosure.

In the machine operation, the wire 10 is suitably fed forward between the friction felts 70 and into the peripheral grooves of the lower movable feed roll 12 and the driven feed roll 11. On the forward stroke of the rack bar 30 and after the cam 45 has moved the lower movable roll 12 into a frictional engagement with the wire, the applied pressure causes the wire to be moved forward toward the coiling arbor as the rack bar 30 rotates the gear connected feed rolls. When the rack bar cam follower 29 (Fig. 4) has reached the high part 68 of the cam 28, the rack bar movement is stopped because that high portion 68 is concentric with the drive shaft 25. At this time, the coiling pin 14 revolves sufficiently relative to the axis of the arbor 13 to grip the wire and start pulling it around the arbor for making a new wire helix or spring. When the wire has been thus gripped, the cam 45 moves its high point 46 away from the cam follower 49 and the tension of the spring 63 quickly swings the pivoted mount 56 of the roller 12 to disengage the wire from a driving association with the rolls. The rollers 11 and 12 reverse in their rotation because of the return movement of the rack bar 30. During this time of reversal of rotation of the feed rolls, the coiling of

the wire proceeds and the wire is thereafter suitably cut and the machine is then ready for another wire coiling cycle. The feed rolls are required to make about one revolution to feed the severed end of the wire forward to the coiling arbor after a spring has been made and cut off. The spring 80 is designed to wind up as the rolls rotate to feed the wire forward and to unwind on the reverse rotation of the rolls. The tension spring 80 prevents there being any backlash in the roll driving gear system, in that the gears are held always in a desired forward driving contact and there is no lost motion at the reversal of the rack bar and forward drive of the feed roll. This spring and the friction grip 70 insure that there is no backward movement of the wire causing inaccurate feeding.

By using cams of adjustable throw or replacing them with other desired shapes, the machine may be made to coil springs of desired lengths within its capacity. The construction is such that the wire is gripped positively by the feed rolls and an exact predetermined length of wire is fed forward into position for operative engagement by the rotating parts of the coiling arbor, as is determined by the relative positions of the cam roller 29, the adjustable positioning screw 40 and the rise of the cam surface 66 (Fig. 4) of the cam 28 which controls the amount of rotation of the feed rolls by the rack bar 30. When the follower roll 29 has reached the partly cylindrical high surface portion 68, the rack bar 30 is held stationary momentarily and the non-rotating feed rolls hold the wire immovable longitudinally while they still grip it, so that a predetermined length of wire may be held extended between the coiling arbor 13 and the pin 14. When the arbor 13 and coiling pin 14 have gripped the wire end for pulling it forward, the cam follower 49 (Fig. 3) falls onto the lower portion 65 of cam 45 and the spring 63 causes a separation of the feed rolls and so releases the wire for movement solely by the coiling arbor. Hence, the period of gripping and feeding the wire forward is exact as determined by the cam surface 46 which holds the radially movable feed roll 12 against the wire, and the length of wire fed by the rolls is governed by the other cam (Fig. 4) in conjunction with rolls 29 and stop screw 40 which rotates the feed roll positively at a desired number of turns as determined by the rising cam surface 66 until the roller 29 reaches the partly cylindrical surface 68 and stops the rotation of the feed rolls. Thus the wire movement is positively controlled, although the feed rolls are rotated intermittently in opposite directions. There is no waste of time for reversing the rotation of the feed rolls, since this takes place during the coiling cycle, and the rolls are ready to feed more wire as soon

as a coil has been made and cut off. Thus one coil or spring is made for each rotation of the cams 28 and 45.

I claim:

1. A wire coiling machine comprising an intermittently rotatable and reciprocable wire coiling arbor arranged to draw a wire forward and coil the same, driving mechanism for rotating the arbor and stopping it in a wire receiving position, relatively separable feed rolls arranged for gripping and feeding a wire, a longitudinally reciprocable rack bar, a gear train rotated by the rack bar which is connected to rotate a feed roll, a rack bar cam having both a rising and a cylindrical surface portion, a cam follower moved by the rising portion of the cam which is connected to move the rack bar through a definite stroke and to hold the bar stationary while the follower engages said cylindrical portion so that a definite length of wire is fed forward by the cam, mechanism including a cam and a follower operating in timed relation with said rack bar cam which causes the feed rolls to releasably grip and feed the wire and to hold the wire stationary when said rack bar is held stationary by said cylindrical cam portion, said cams being coordinated to feed a definite length of wire forward to the coiling arbor and to hold it momentarily stationary while the arbor grips the wire and thereafter release the feed rolls from driving engagement with the wire, a spring to return the rack for a further wire feeding stroke when the cam follower leaves said cylindrical portion, and an adjustable stop to limit the spring urged return movement of the bar and thereby determine the length of wire feeding stroke of the bar by said rack bar cam.

2. A machine according to claim 1 which comprises meshing gears fixed to rotate the feed rolls, and a compression spring having one end connected to one gear and the other held stationary, said spring being arranged to urge the associated gear in such a direction as to take up the backlash and hold the gears meshed in a forward driving stroke position.

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