Aug. 5, 1958 L. O. LARSEN ET AL 2,845,986

MACHINE FOR AUTOMATICALLY COILING STIFF WIRE INTO A HELIX

Filed May 17, 1954 2 Sheets-Sheet 1

FIG 1

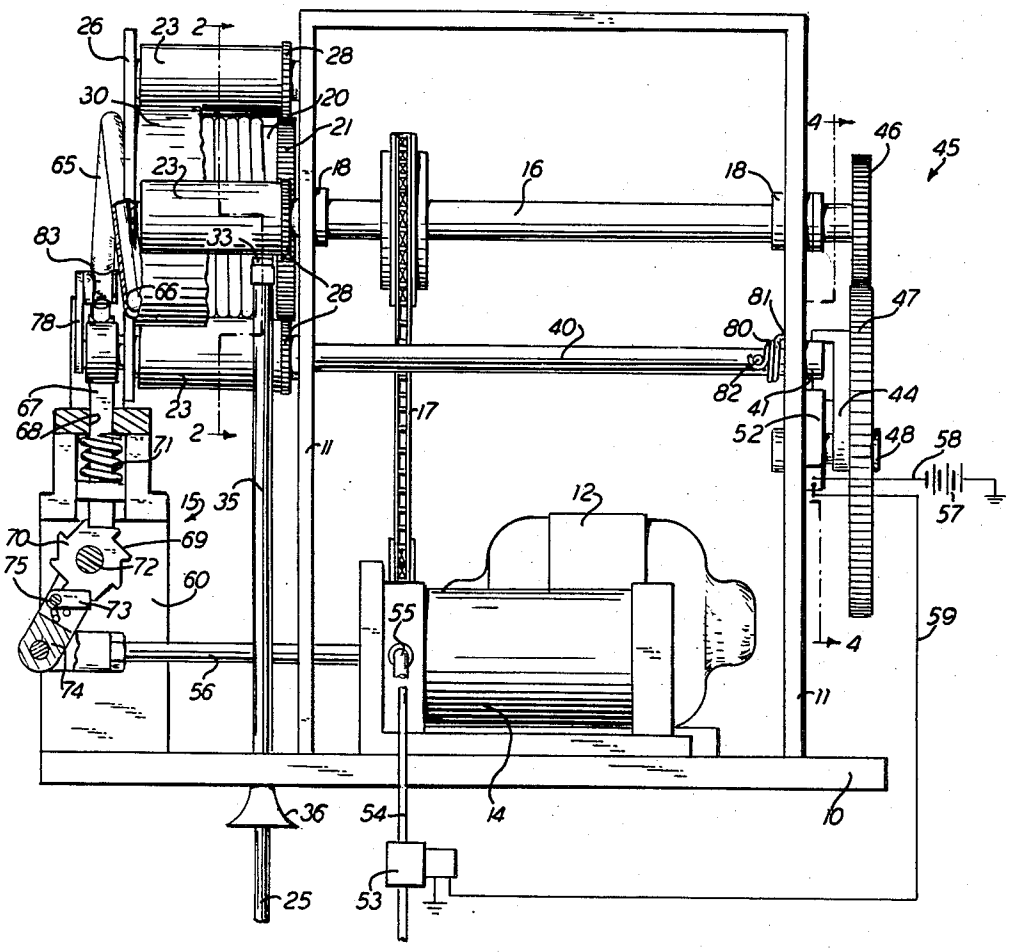


FIG 5

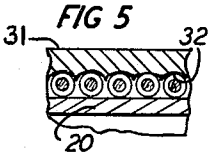
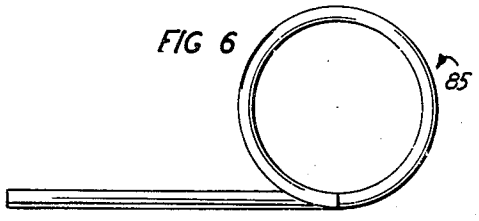


FIG 6



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FIG 2

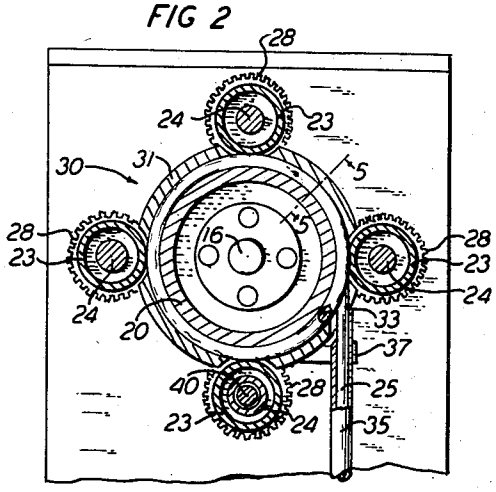


FIG 3

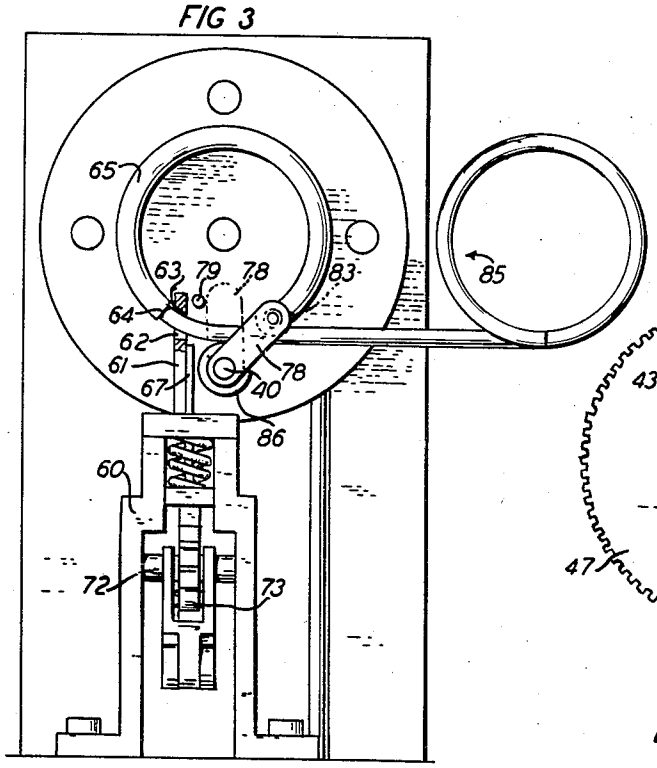
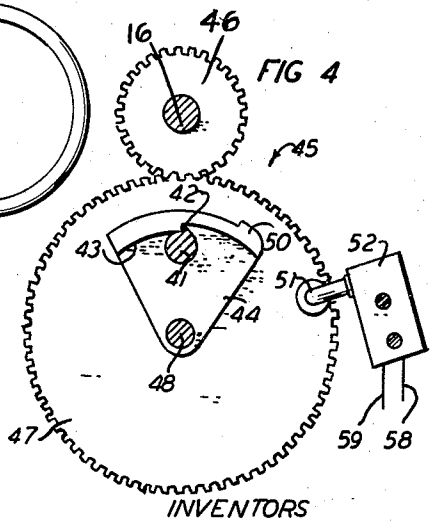


FIG 4



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MACHINE FOR AUTOMATICALLY COILING STIFF WIRE INTO A HELIX

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4 Claims. (Cl. 153—64)

This invention relates to apparatus for forming wires and more particularly to apparatus for spiraling predetermined lengths of stiff wires.

Certain electrical apparatus units are manufactured wtih stiff wire leads of definite lengths attached thereto and for convenience in shipping such units, the lengths of wire required for the leads are formed into helixes or spiral turns with a straight section at the end which is to be attached to the unit.

An object of the invention is an apparatus which is simple in structure but highly efficient in forming such wires.

With this and other objects in view, the invention comprises an apparatus adapted to advance a wire longitudinally continuously and to form like successive spiral turns therein. A unit of the aparatus is adapted to restraighten portions of predetermined spiral turns of the wire after which means is actuated to cut the wire successively adjacent each of the straightened portions.

More specifically, the apparatus includes a power means for driving a drum and a timing unit. The drum is associated with a stationary cylindrical element, with a spiral groove on its inner surface to guide the formation of successive spiral turns in the wire, while pressure rollers, driven by the power means at like speeds faster than the peripheral speed of the drum, cause tightening of the spiral turns on the drum to assure formation of like spiral turns in the wire. At the exit end of the drum, a means is provided to guide the continuous spiral turns from the drum through a cutting unit under the control of the timing unit to cut the wire after a straightening element has been actuated to straighten a predetermined portion of one of the spiral turns.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Fig. 1 is a front elevational view of the apparatus, portions thereof being broken away;

Fig. 2 is a fragmentay sectional view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is an end elevational view of the apparatus, looking from the left (Fig. 1);

Fig. 4 is a fragmentary sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is an enlarged fragmentary sectional view taken substantially along the line 5—5 of Fig. 2, and

Fig. 6 is an end elevational view of an article produced from stiff wire by the apparatus.

In the present embodiment of the invention, the apparatus includes a base 10 with a vertical frame 11, the base supporting a power means or electric motor 12, an air cylinder 14 and a cutting unit indicated generally at 15. The motor 12 is operatively connected to a shaft 16 by sprocket and chain connection 17, the shaft being journalled in suitable bearings 18 mounted in the frame 11. A drum 20 is fixedly mounted on one end of the shaft 16 together with a gear 21. Pinch rollers

23, mounted on spindles 24, are spaced equally about the drum 20 and have their peripheries like distances from the drum, depending upon the diameter of a stiff wire 25 to be fed longitudinally continuously to the drum from a supply (not shown). The spindles 24 are journalled in suitable bearings (not shown) in the adjacent portion of the frame 11 and in a fixed cover plate 26. Pinions 28 are fixedly mounted on the spindles 24 and interengage the gear 21 to cause their respective pinch rollers 23 to travel at a faster surface speed than the contacting surface speed of the spiral turns of the wire to cause them to move faster than the surface speed of the drum until the spiral turns are tightened on the drum.

A cylindrical unit, indicated generally at 30 and formed of arcuate segments 31 disposed concentric with the axis of the drum 20 and the shaft 16 between the pinch rollers 23, is fixed to the cover plate 26 and has a spiral groove 32 therein starting with the entrance position 33 for the wire 25 (as shown in Figs. 1 and 2) and continuing to the exit end of the drum. Actually the spiral groove 32 has open areas adjacent the pinch rollers 23 but the pinch rollers assure continuous guidance through the open areas. A guide tube 35, having a funnel shaped end 36, extends through the base 10 and has its upper end of the contour (shown in Fig. 2) supported at 37 to guide the wire 25 through the entrance 33 of the cylinder 31 into the space between the drum 20 and the cylinder adjacent one of the pinch rollers 23.

While viewing Fig. 2, attention is directed to the spindle 24 for the lowermost pinch roller, this spindle being hollow and mounted concentric with a shaft 40. The shaft 40 extends through the vertical portions of the frame 11 and has a pawl-like element 41 fixed to one end thereof. The element 41 has a projection 42 positioned to be engaged by an inner high portion 43 of a cam 44 of a timing unit 45 (shown in Figs. 1 and 4). The timing unit 45 includes a gear 46 mounted on the shaft 16 and interengaging gear 47 mounted for rotation on a spindle 48. The cam 44 is mounted on the spindle 48 and may be adjustably secured to the gear 47 by any suitable means (not shown).

The outer surface of the cam 44 has a high portion 50 adapted to actuate a roller arm 51 of a microswitch 52 which causes operation of the cutter unit 15. A schematic illustration is shown in Fig. 1 associated with the air cylinder 14 in the form of a solenoid valve 53 disposed in a fluid line 54, extending from a supply (not shown) to an air cylinder at 55. In the present embodiment of the invention, due to the fact that the cutting unit is instantaneous in its action, let it be assumed that the air cylinder, with its piston rod 56, is of the automatic return type. The electrical circuit (shown in Fig. 1) includes a source of electrical energy in the form of a grounded battery 57, connected to the switch 52 by line 58 and from the switch to the grounded solenoid valve 53, by line 59.

The cutting unit (shown in Figs. 1 and 3) includes a stationary bracket 60 mounted on the base 10 and supporting a stationary cutting element 61 having an aperture 62 with a cutting edge 63 disposed adjacent the exit end 64 of a stationary spiral tube 65. The tube 65 is formed with an entrance end 66 fixed to the cover plate 26 and extending therethrough to receive the spiral turns of the wire 25 as they leave the exit end of the drum 20. A movable cutter 67 has V-shaped cutting edges at the upper end thereof (as shown in Fig. 1) to cooperate with the cutting edge 63 of the stationary cutter 61 to sever the wire 25 after a portion of one of the spiral turns has been straightened. If desired, the fixed cutting edge 63 may be V-shaped to cooperate with the V-shaped cutting

edge of the movable cutter **67**. The movable cutter **67** extends through an aperture **68** in the bracket **60** and is normally urged downwardly so that its lower end will rest on one of the adjacent ratchet teeth **69** of an actuating element **70** by the force of a spring **71**. The element **70** is mounted fixedly on a spindle **72** and is actuated by the piston rod **56** through the aid of a spring actuated pawl **73** and the pivotal connection of the piston rod with a lever **74**, which is bifurcated to straddle the element **70** and the pawl **73** and to pivotally support the pawl at **75**.

The means to straighten a portion of one of the spiral turns of the wire includes an arm **78** fixedly mounted on the adjacent end of the shaft **40**, which is normally urged counterclockwise (Fig. 3) into its dotted line position against a stop **79** by a helical spring **80** (Fig. 1). It will be noted that one end of the spring **81** is fixed to the adjacent portion of the frame **11** while the other end is connected to a pin **82** fixed to the shaft **40**. The arm **78** carries a grooved roller **83** positioned above the spiral turns of wire leaving the guiding means or tube **65** and always in contact with the wire so that whenever the high portion **43** of the cam **44** engages the projection **42** of the element **41**, the arm will be moved to the position (shown in Fig. 3) causing straightening of a given length of the wire or a given portion of one of the spiral turns thereof.

Considering now the operation of the apparatus, let it be assumed that the motor **12** is energized, driving its shaft **16** to drive the drum **20** and the gear **46** of the timing unit **45**. It will be apparent that the wire **25**, initially, may be fed manually through the guide tube **35** until its leading end passes through the entrance **33** and is gripped between the drum **20** and the adjacent pinch roller **23**. From this point on, the apparatus is completely automatic in its actuation causing continuous feeding of the wire longitudinally. The leading end of the wire may be followed as it is guided by the spiral groove **32** and the cylindrical unit **30** between the pinch rollers **23**. Each time the wire passes by one of the pinch rollers, it is given an added urge or linear push about the drum to form continuous like tight spiral turns through the guidance of the spiral groove **32** until eventually the leading end enters the stationary guide tube **65** to lead the spiral turns from the drum where they will be self-supporting. The ratios of the gears **46** and **47** determine the length of the wire in each article indicated at **85** (in Fig. 6). The length of the wire in each article determines the number of spiral turns allowed to pass from the drum and beyond the straightening roller **83** before the cam **44** is brought into action to first, through the rocking motion of the element **41** and the shaft **40**, cause the arm **78** with its roller **38** to move into the position (shown in Fig. 3) to physically restraighten the wire at one of the spiral turns and to hold the wire so that when passing beneath the roller **83** and over a collar **86**, the successive portions of the wire will be restraightened. This continues until the high portion **43** of the cam leaves the element **41** and allows the spring **80** to return the shaft **40** together with the arm **78** to its normal position determined by the stop **79**. Immediately after the restraightening operation has been completed, the switch **52** is actuated into closed position, energizing the solenoid valve **53** to cause actuation of the air cylinder **14**, or movement of the piston rod **56** to the left, to rock the lever **74** with its pawl **73**, to move the ratchet-like element **70** one position and, in doing so, cause rapid action of the movable cutter **67** relative to the stationary cutter **61**. This action, resulting in cutting the wire, is so rapid that the continuous operation of the apparatus is not disturbed. Although there may be a momentary pause in the continuous advancement of the wire at the point of exit **64** of the tube **65**, the action of the cutter is so rapid that it is difficult to observe visually. The new leading end of the wire is already fed through the aperture **62** of the stationary cutter **61** and will travel beneath the roller **83** of the straightening arm **78**. In this manner, the spiral turns for the next article may continue in their movement beyond the drum, the stationary arm and the cutting unit until the desired length of wire for this next article has moved beyond or substantially beyond the drum. At this time, the timing unit **45** again will come into action to rock the shaft **40** with the straightening arm **78** and its roller **83**, after which the switch **52** will be closed to cause actuation of the cutting unit to produce successive articles **85** (as shown in Fig. 6).

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for forming wire comprising a continuously rotatable drum having an entrance end and an exit end, a stationary guide mounted adjacent the entrance end of the drum to feed a wire continuously thereto, means cooperating with the drum to cause the wire to form successive spiral turns about the drum and thereby move axially of the drum to and beyond the exit end thereof, a tubular guide partially conforming to the successive turns and having an entrance and an exit, means to support the tubular guide to position its entrance adjacent the exit end of the drum to receive the successive turns therefrom, a fixed position roller mounted for rotation about its axis adjacent the drum to engage the outer periphery of each spiral turn beyond the exit of the tubular guide, an arm having one end mounted for rocking movement about the axis of the roller between a normal and an operated position, a movable roller mounted adjacent the other end of the arm and positioned normally to engage the inner periphery of the spiral turns, means urging the arm into its normal position, and means operable to rock the arm to cause the rollers to straighten successive portions of predetermined spiral turns.

2. An apparatus for forming wire comprising a continuously rotatable drum having an entrance end and an exit end, a stationary guide mounted adjacent the entrance end of the drum to feed a wire continuously thereto, means cooperating with the drum to cause the wire to form successive spiral turns about the drum and thereby move axially of the drum to and beyond the exit end thereof, a tubular guide partially conforming to the successive turns and having an entrance and an exit, means to support the tubular guide to position its entrance adjacent the exit end of the drum to receive the successive turns therefrom, a fixed position roller mounted for rotation about its axis adjacent the drum to engage the outer periphery of each spiral turn beyond the exit of the tubular guide, an arm having one end mounted for rocking movement about the axis of the roller between a normal and an operated position, a movable roller mounted adjacent the other end of the arm and positioned normally to engage the inner periphery of the spiral turns, means urging the arm into its normal position, means operable to rock the arm to cause the rollers to straighten successive portions of the predetermined spiral turns, cutting members disposed adjacent the exit of the tubular guide and operable in timed relation with the arm to cut the turn of the wire leaving the exit of the tubular guide at the juncture of the straightened portion.

3. An apparatus for forming wire comprising a continuously rotatable drum having an entrance end and an exit end, a stationary guide mounted adjacent the entrance end of the drum to feed a wire continuously thereto, means cooperating with the drum to cause the wire to form successive spiral turns about the drum and thereby move axially of the drum to and beyond the exit

end thereof, a tubular guide partially conforming to the successive turns and having an entrance and an exit, means to support the tubular guide to position its entrance adjacent the exit end of the drum to receive the successive turns therefrom, power means to drive the drum at a given speed to form the successive turns during predetermined time intervals, a rocking shaft, a fixed position roller supported for rotation on the rocking shaft to engage the outer periphery of each spiral turn beyond the exit of the tubular guide, an arm having one end fixed to the rocking shaft for rocking movement about the axis of the roller, a movable roller mounted for rotation adjacent the other end of the arm and positioned normally to engage the inner peripheries of the spiral turns without disturbing their spiral formations, and means operated at predetermined intervals during rotation of the drum to rock the shaft and the arm to cause the movable roller to cooperate with the fixed position roller to straighten successive portions of predetermined turns.

4. An apparatus for forming wire comprising a continuously rotatable drum having an entrance end and an exit end, a stationary guide mounted adjacent the entrance end of the drum to feed a wire continuously thereto, means cooperating with the drum to cause the wire to form successive spiral turns about the drum and thereby move axially of the drum to and beyond the exit end thereof, a tubular guide partially conforming to the successive turns and having an entrance and an exit, means to support the tubular guide to position its entrance adjacent the exit end of the drum to receive the successive turns therefrom, power means to drive the drum at a given speed to form the successive turns during predetermined time intervals, a rocking shaft, a fixed position roller supported for rotation on the rocking shaft

to engage the outer periphery of each spiral turn beyond the exit of the tubular guide, an arm having one end fixed to the rocking shaft for rocking movement about the axis of the roller, a movable roller mounted for rotation adjacent the other end of the arm and positioned normally to engage the inner peripheries of the spiral turns without disturbing their spiral formations, means operated at predetermined intervals during rotation of the drum to rock the shaft and the arm to cause the movable roller to cooperate with the fixed position roller to straighten successive portions of predetermined turns, and cutting members disposed adjacent the exit of the tubular guide and operable in timed relation with the arm to cut the turn of the wire leaving the exit of the tubular guide at the juncture of the straightened portion.

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