April 19, 1960 L. LORENZ 2,933,265

WINDING MACHINE TRAVERSE MECHANISM

Filed Sept. 23, 1955 3 Sheets-Sheet 1

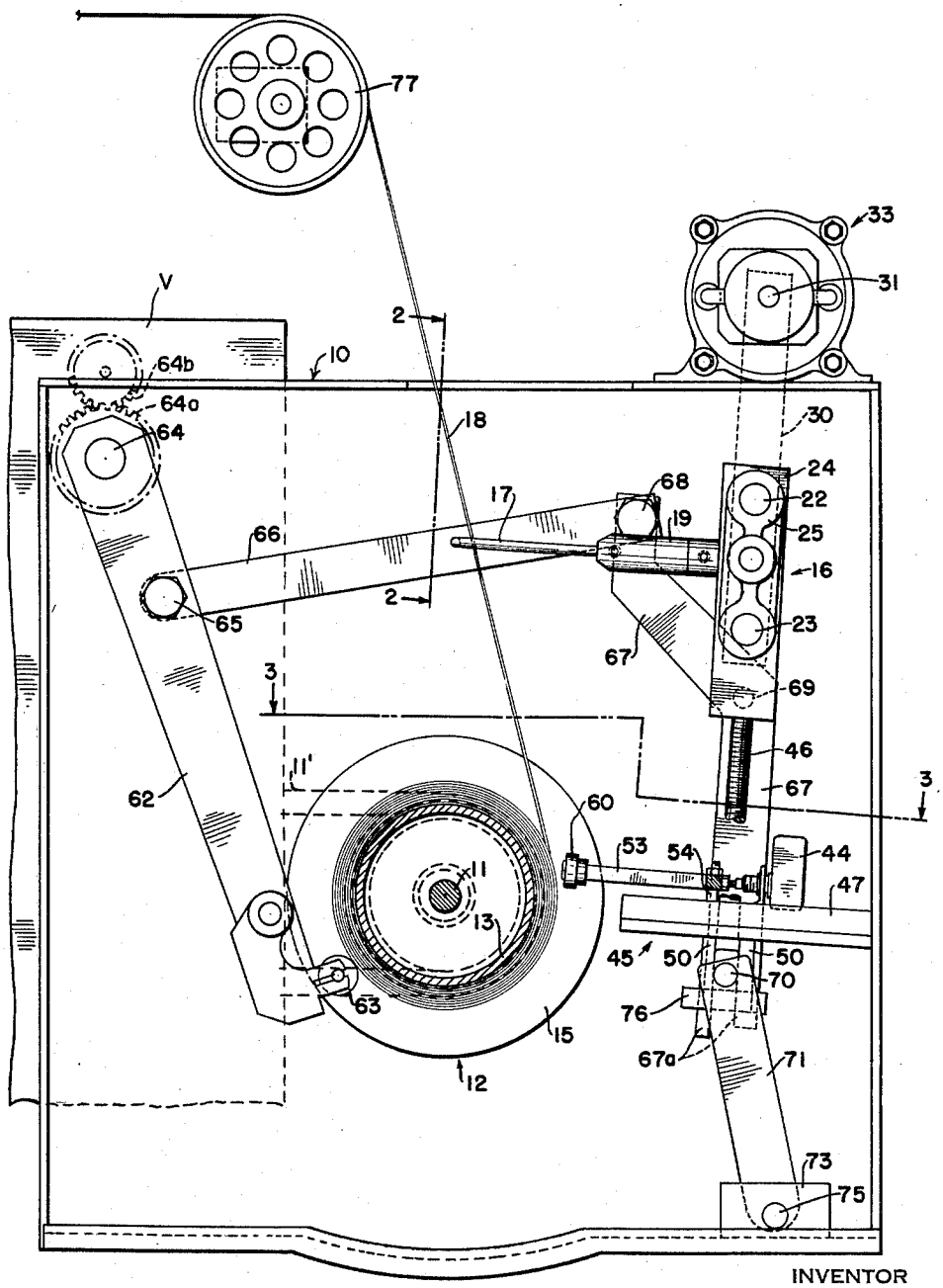


FIG. 1

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Filed Sept. 23, 1955 3 Sheets-Sheet 2

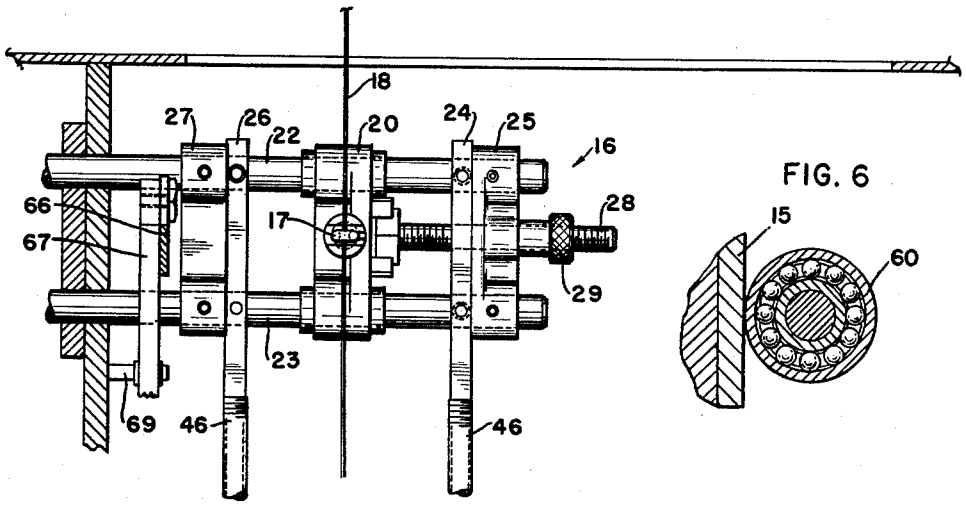


FIG. 2

FIG. 6

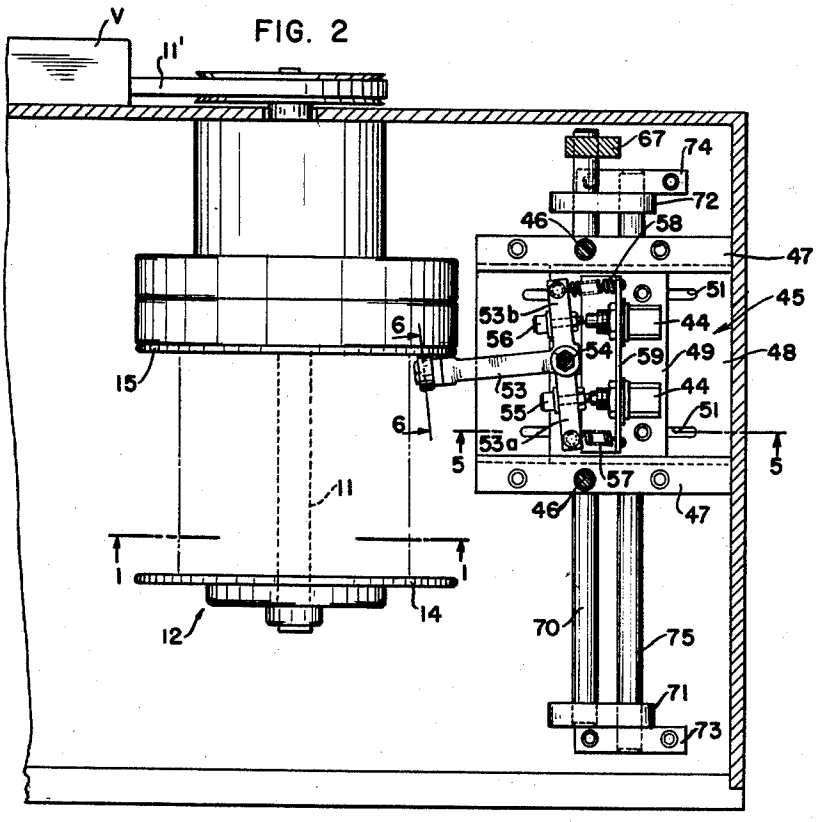


FIG. 3

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Filed Sept. 23, 1955 3 Sheets-Sheet 3

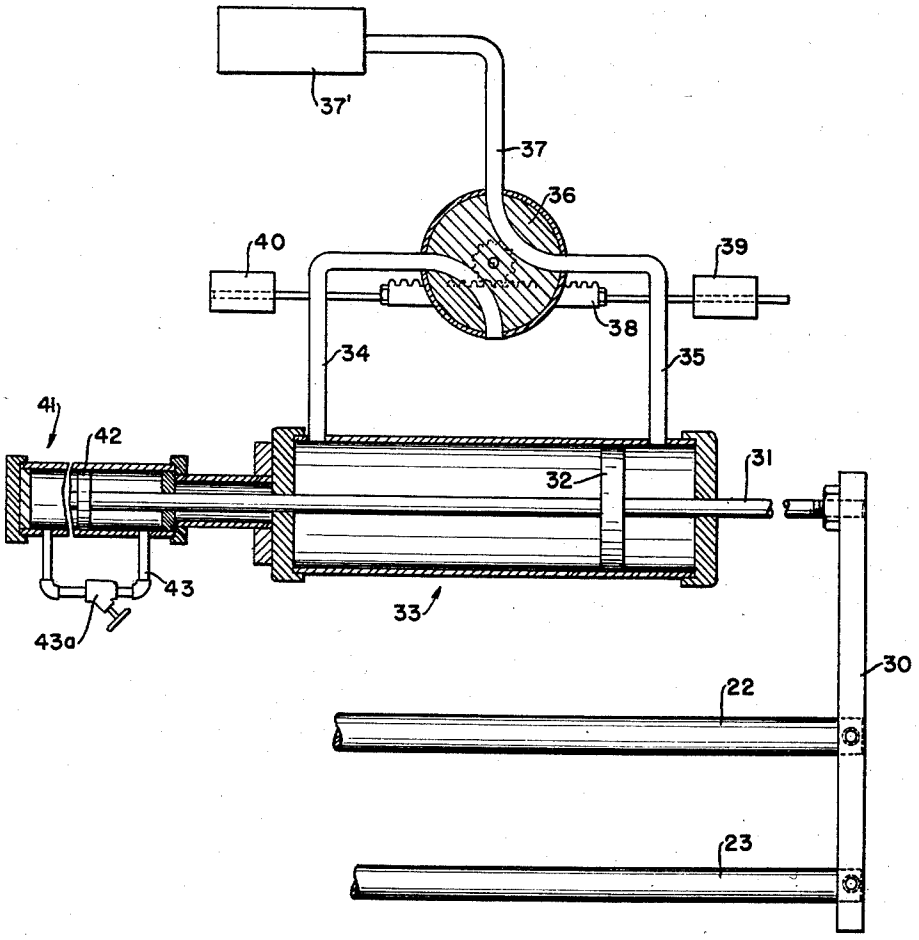


FIG. 4

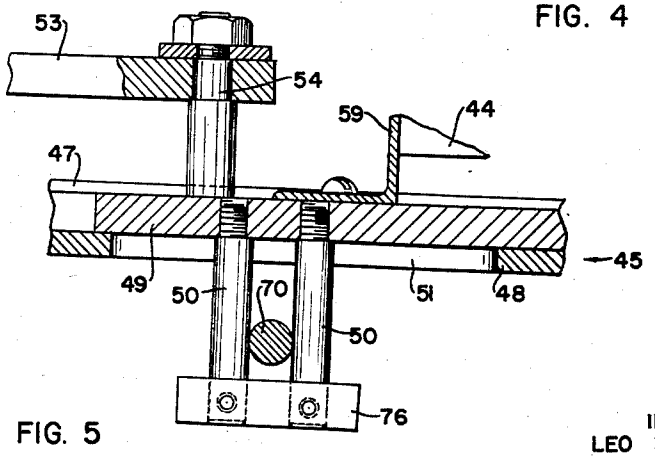


FIG. 5

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WINDING MACHINE TRAVERSE MECHANISM

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Application September 23, 1955, Serial No. 536,151

5 Claims. (Cl. 242—158)

This invention relates to an improved winding machine for winding wire on a spool and is particularly concerned with a control element for assuring that the wire completely fills the spool despite distortion of the end flanges of the spool.

In drawing fine copper wire, it is normally fed from the drawing machine to a winding machine where it is wound onto a standard spool. Spools for this purpose are usually made of heavy material so that they will be rugged and unlikely to become deformed. Nevertheless, the flanges of these heavy duty spools frequently deform symmetrically about the spool's axis to a slight degree so that they become more widely spaced at their outer edges than adjacent to the spool barrel. The convex flaring of the spool flanges has presented a serious problem inasmuch as it is convenient to employ a traverse mechanism to distribute the wire on the spool and to set the traverse mechanism so that it moves between fixed limits defined by the inner surface of undeformed flanges of a spool. Where the flanges of a spool are equally spaced over their entire radius and exactly perpendicular to the axis of the spool and the limits of movement of the traverse mechanism are preset, the wire will be wound neatly layer by layer into a coil package on the spool which extends from one flange to the other. However, when the flanges are deformed a coil package of the same dimensions is formed so that in the usual case it does not extend into contact with the flanges. As a consequence of the gap which exists between each end of the coil package and its adjacent flange, particularly in the case of very fine wires, there has been a tendency for the ends of the coil package at various levels to slip into the gap and produce tangling of the wire. The problem has been so serious that in most instances where tangling occurs the whole spool of wire must be scrapped.

Unsymmetrical deformation of the spools will be readily detected by inspection and rejected, since unsymmetrical spools cannot ordinarily be reused. Symmetrical deformation, however, may go undetected and, as a consequence, an unusable coil of wire may be wound. However, in accordance with the present invention, there is no need to sort out symmetrically deformed spools since it is possible to fill a spool completely no matter what the spacing of the flanges at a particular radial level.

In accordance with the present invention a feeler arm is provided to contact the inside surface of a flange and to move to actuate a switch which produces reversal of the movement of the traverse mechanism when the wire in the coil being wound reaches that flange.

The winding machine is conventional in many respects, to wit: it consists of an arbor for accepting a spool and means producing rotation of the arbor, and a traverse mechanism providing a guide for directing wire onto the spool of the arbor. The motion of the traverse mechanism parallel to the axis of rotation of the arbor may be provided by a variety of means but a hydraulic or an air cylinder is preferred. The means for producing

movement must be provided with means for reversing the direction of movement of the traverse mechanism. Heretofore the limits of this reversing mechanism would have been preset, but, in this instance, sensing means on the traverse mechanism in the form of the feeler arm and its associated switch means plus whatever associated connections back to the drive means are required are employed. In the case of the hydraulic or air cylinder drive, the switches will commonly actuate solenoids to open and close valves of the cylinder in order to reverse the direction of movement.

Where the feeler arm has lateral movement without radial movement, it is useful to automatically determine the extent of the lateral movement of the traverse mechanism without the need for presetting the traverse mechanism. Even if a machine is to be used for only one size of reel, the feeler arm with only lateral movement is of considerable advantage in that it eliminates the added expense of spacing the flanges of spools to exact dimensions as well as insuring they are positioned at exactly the same position of the spool during each use.

In those instances where it is desired that the present invention compensate for spools which are symmetrically deformed, it is desirable to supply the feeler mechanism with a radial as well as a lateral movement. This radial movement is produced in preferred embodiments by a linkage between a feeler arm and a coil size speed control lever arm, a structural feature which is frequently used in winding machines.

In addition to advantages which will be apparent from the above discussion, the present invention has the advantages of simplicity and ruggedness. The machine of the present invention is able to be constructed with relatively few parts, many of which are commercially available. Furthermore, the machine of the present invention is so designed that it is as rugged as prior art machines despite the inclusion of sensitive control elements. Other advantages will appear from the specific description which follows hereafter.

For a better understanding of the present invention reference is made to the accompanying drawings in which

Fig. 1 is an elevational view of a winding machine embodying the present invention from one end with the end enclosure wall removed and showing the arbor and the spool in section along line 1—1 of Fig. 3;

Fig. 2 is a view taken along line 2—2 of Fig. 1 showing a front elevation of the traverse mechanism;

Fig. 3 is a view taken along line 3—3 of Fig. 1 providing a plan view from above of the feeler arm and the switches of the present invention;

Fig. 4 is a side sectional view through the air cylinder of Fig. 1 showing somewhat schematically the valve construction, and showing the mechanical coupling structure between the air cylinder and the traverse mechanism;

Fig. 5 is a detailed view taken along line 5—5 of Fig. 3; and Fig. 6 is a sectional view taken along line 6—6 of Fig. 3.

The machine of the present invention is ordinarily used in conjunction with a drawing machine wherein wire is drawn through a succession of smaller and smaller dies in a manner well known in the art. The actual winding machine may take many forms but in one of its preferred forms it has a combined frame and housing 10 which supports much of the mechanism.

Within the housing 10 is a winding arbor 11 of the proper size to receive a spool generally designated 12. The spools employed for carrying wire are usually relatively heavy rugged structures having a heavy gauge metal barrel 13 and heavy end flanges 14 and 15, which are provided with reinforced spindle openings through which the arbor is received.

The arbor 11 is driven by a belt 11' connected to

a variable speed drive means indicated generally at V but which is located in its separate compartment behind the wall supporting the arbor.

The traverse mechanism generally designated **16**, is provided with a guide member **17** consisting of a pair of rods which are arranged parallel to each other and between which is passed the wire **18** to be wound on the spool **12**. Guide **17** moves with traverse mechanism **16** to cause the wire **18** to wind a single spiral layer at a time into a neat coil package of wire on the spool. The support **19** for the guide **17** is advantageously a cylindrical member of relatively large diameter compared to the diameter of the rods used for the guide and is, in turn, supported generally perpendicular to the traverse mechanism on a slide **20**. Slide **20** is slidably supported on heavy rod members **22** and **23**. Extending between rod members **22** and **23** is a rigid rectangular plate **24** and a cooperating reinforcing web piece **25**. A similiar plate **26** is placed on the opposite side of slide **20** with another web piece **27**. The structural members of the traverse mechanism are relatively heavy and are arranged generally perpendicular to one another to provide a rigid support for the guide member **17**. The guide support member **20** is slidable on rod members **22** and **23**, as previously indicated, and its position may be adjusted by means of threaded rod **28** which is held by a suitable piece on member **20** so that it is able to rotate but not to move laterally relative to said member. Threaded rod **28** is threaded through web member **25** and held in any desired position by lock nut **29**.

The rod members **22** and **23** are connected at one end by a rigid connection strap **30** to rod **31** on the piston **32** of air cylinder generally designated **33** as is best seen in Fig. 4. The air cylinder **33** is mounted on the top of frame enclosure **10** and is provided with access lines **34**, **35** on opposite sides of its piston **32**. These access lines may be generally described as valve lines because they include or terminate at valve means in order to control the flow of compressed air to actuate the cylinder. In a preferred construction a solenoid reversing valve **36** is employed. This valve has ports every 90° of revolution, and there are two conduits through the cylindrical block body of the valve each of which connects a pair of adjacent ports. Access lines **34**, **35** enter opposite ports of the valve **36** so that one is connected to compressed air line **37** leading to the compressor or high pressure air supply **37'** and the other is open to the atmosphere. By a 90° rotation of the valve, however, the portion of the cylinder on the opposite side of the piston **32** is connected to the compressed air source and the side previously at higher pressure is connected to the atmosphere. Thus, the piston will be urged in the opposite direction. The valve block bears a pinion which is driven by rack **38** in response to pull alternately exerted by solenoids **39** and **40** on their respective magnetic cores which are attached to the rack.

Piston rod **31** extends through the opposite end of the air cylinder from that at which it is connected to the rigid connection strap **30** and through a hydraulic speed control cylinder **41** which may contain oil or other fluid material of a selected viscosity. A piston **42** moves back and forth within the chamber and its movement is resisted by the fluid therein. It is possible to use a piston which is smaller than the chamber diameter in order to permit the fluid to flow from one side of the piston to the other, which it must do if the piston rod **31** is to move. However, in a preferred embodiment of the present invention a bypass line **43** from one end of the cylinder to the other is provided with an adjustable needle valve **43***a* which permits the rate of flow from one side of the piston to the other to be adjusted. Thus, in effect, the cylinder **41** with its piston and bypass line is a speed control device determining the rate of movement of the traverse mechanism.

It is of course apparent that other forms of speed, control devices, and other means than a pneumatic cylinder for supplying motion power to the traverse mechanism, may be used if desired.

The solenoids **39**, **40** are actuated by microswitches **44** which are carried by the traverse mechanism on a platform generally designated as **45** (see Fig. 3). This platform is suspended by columns **46** connected to plates **24** and **26**. Columns **46** extend through edge members **47** of the platform **45**, and these members are joined together at their bottoms by a base plate **48**. The edge members **47** are formed with grooves in the faces which lie opposite one another, and a slide member **49** rides in these grooves. Pins **50** (Figs. 3 and 5) which are secured to the slide member extend through slots **51** in plate **48**. These pins provide the means by which the slide member is moved toward and away from the spool of wire, as hereinafter described.

Mounted on the slide **49** is a feeler arm **53** which is advantageously a T-shaped member having short lateral arms **53***a* and **53***b* to actuate the microswitches **44**. The support for the feeler arm is advantageously a post **54** on which the feeler arm is pivoted, and the arms **53***a* and **53***b* are provided with adjustable members **55** and **56** to engage and actuate the switches **44**. Balanced spring members **57** and **58** extend between the arms **53***a* and **53***b*, respectively, and a vertical support member **59** to hold the feeler arm normally in a position directed substantially radially toward the arbor **11**. The vertical support member **59** is bolted or otherwise securely fastened to the slide **49**, and is also the member to which the microswitches **44** are attached. On the end of feeler arm **53**, oriented generally normal to the arm, is a ball bearing **60**, the outer race of which serves as a contact member to engage the flanges **14** and **15** of the spool.

It has become common in the art to control the speed of rotation of the arbor **11** in accordance with the diameter of the coil of wire on the spool by means of a frame-supported lever arm **62** having a roller **63** at its end in position to contact the wire coiled onto a spool. The roller is so arranged that upon contact with the wire it actuates a microswitch. The microswitch in turn energizes a solenoid which drives a ratchet causing rotation of the lever arm to a position a slight distance away from the wire and out of contact therewith. This arm is connected to a speed control mechanism which functions to decrease the speed of arbor **11** as the diameter of the coil of wire on the spool increases, thus making it possible to maintain constant the linear speed of feed of the wire **18**. Such mechanism forms no part of this invention, but it is used in conjunction with the apparatus of this invention to control the approach of the feeler arm **53** to the coil of wire on the spool.

As shown in Fig. 1, the lever arm **62** is fixed to a shaft **64** which extends through the wall of the housing **10** into engagement through gears **64***a*, **64***b*, with the speed control mechanism V for the spool arbor **11**. As the diameter of the coil of wire on the spool increases, the arm **62** moves radially outwardly. Pivotally attached by a pin **65** to the arm **62** is a link **66** which is joined by a pivot pin **68** to a lever **67**. The lever **67** is supported on the wall of the housing **10** by a pin **69** about which lever **67** fulcrums. The other end of the lever **67** is slotted, as indicated at **67***a*, and fits over a rod **70** carried at the upper ends of supporting arms **71** and **72**. The lower ends of these supporting arms are rotatably connected by a rod **75** to brackets **73** and **74** on the floor of the housing **10**.

Beneath the support platform **45**, the pin members **50**, which are secured to the slide member **49** and which extend through the slots **51**, embrace the rod **70** rather closely. The pins **50** are attached at their lower ends to a connecting bar **76** to lend the structure increased rigidity. It is apparent that back and forth movement of the rod **70**, about its pivotal anchoring in the brackets **73** and **74**, causes the slide member **49** to move corre-

spondingly back and forth on the platform **45**. By virtue of the link **66** and lever **67**, the slide member **49** and the feeler arm **53** which it carries is moved radially outwardly from the spool in conformity with the similar movement of the speed control arm **62**.

A guide sheave **77** is supported (by means not shown) over the housing for guiding the wire **18** onto the spool.

In the operation of the device of the present invention, wire **18** is fed over the sheave **77** through an opening in the housing **10**, through the guide **17**, onto the spool **12**. The arbor **11** is rotated at the correct speed to coil wire **18** without slack. The guide **17**, being part of the traverse mechanism **16**, is moved laterally back and forth in a direction parallel to the axis of rotation of the arbor. In the course of its movement, wire is fed evenly onto the spool in a uniform cylindrical package.

The lateral movement of the traverse mechanism occurs because piston **32** moves (rather slowly) within cylinder **33** and hence drives rod **31** and strap **30** which also moves rods **23** and **24**, and hence the whole traverse mechanism, laterally. Since platform **49** is connected to the traverse mechanism, it will also move laterally.

The laterally moving feeler arm **53** will contact a flange **15** at one end of the spool. When it does, race **60** will prevent any interruption of the winding operation due to friction, but the feeler arm will be forced to rotate on its supporting post **54**. At the end of its lateral path (substantially the position shown in Fig. 3), one switch **44** is closed, thereby energizing solenoid **39**, connecting port **35** to the compressed air source and opening port **34** to the atmosphere. Accordingly, the direction of movement of the piston **32**; and hence of shaft **31**, reverses, as does the movement of the traverse mechanism, and the movement continues until the feeler arm **53** strikes the other flange of the spool and closes the other microswitch. At that point solenoid **40** is energized, rotating the valve 90° about its axis so that compressed air is again fed through port **34** and again the motion is reversed.

Since the inside surfaces of flanges often become slightly dished, it is usually important that the machine be arranged so that the feeler arm moves radially outward just ahead of the coil package so that the spool will fill to the side walls at every level. In fact, this radial movement preferably keeps the feeler arm barely out of contact with the wire being wound on the spool. Radial movement of the feeler arm is preferably accomplished by coupling the feeler arm to the speed-control lever **62** since it is ordinarily standard equipment in the winding machine. When this coupling is done through the links and levers described above, the pivot points are preferably so spaced that the feeler arm **53** moves outwardly at the same rate as the speed control lever **62**.

Although but a single embodiment of the present invention has been described, other embodiments will occur to those skilled in the art. It is possible, of course, to use various features of the embodiment described separately or in various combination. Furthermore, many structural changes are possible and are intended to be within the scope of the present invention.

I claim:

1. A winding machine for coiling wire onto a spool comprising on a supporting frame, an arbor for accepting the spool and means producing rotation of the arbor, a traverse mechanism supported on the frame and including a guide for directing wire onto the spool on the arbor, drive means supported on the frame for producing lateral movement of the traverse mechanism parallel to the axis of rotation of the arbor, means for reversing the direction of movement of said drive means, a pair of switches on the traverse mechanism for actuating the direction reversing means and a feeler arm supported on the traverse mechanism and arranged in a normal position approximately radial to the arbor, said feeler arm having a ball bearing at that end of the arm nearest the arbor, said ball bearing being arranged generally normal to the direction of extension of the feeler arm so that its race provides a contact member for the flanges at the respective ends of the spool, and said feeler arm being arranged to cooperate with the switch means so that when the feeler arm contacts one of the flanges of a spool on the arbor, the feeler arm will be moved out of its radial position and against a switch to cause reversal of the direction of the movement of the traverse mechanism and so that when it contacts the opposite flange the feeler arm will be moved against the other switch.

2. A winding machine for coiling wire onto a spool comprising on a supporting frame, an arbor for accepting the spool and means producing rotation of the arbor, a coil-size, speed-control lever on the supporting frame which lever is connected to the means producing rotation of the arbor to control its speed, a traverse mechanism supported on the frame and including a guide for directing wire onto the spool on the arbor, said traverse mechanism being mounted so that a portion of it is movable radially toward the arbor and so that it is laterally movable parallel to the arbor, drive means supported on the frame for producing lateral movement of the traverse mechanism parallel to the axis of rotation of the arbor, means for reversing the direction of movement of said drive means, a pair of switches on the traverse mechanism for actuating the direction-reversing means and a feeler arm radially directed toward the arbor mounted on the radially movable portion of the traverse mechanism and movably supported on the traverse mechanism so that when the feeler arm contacts one side flange it will be urged against one of the switches and so that when said feeler arm contacts the other side flange it will be urged against the other of the switches.

3. A winding machine for coiling wire onto a spool comprising on a supporting frame, an arbor for accepting the spool and means producing rotation of the arbor, a coil-size, speed-control lever supported on the frame and connected to the means for producing the rotation of the arbor to control its speed, a traverse mechanism mounted on the frame to move laterally and having a portion able to move radially of the coil on the spool, said traverse mechanism including a guide for directing wire onto the spool on the arbor, an air cylinder mounted on the frame and having a movable piston therein connected to the traverse mechanism for producing lateral movement of the traverse mechanism parallel to the axis and having valves on opposite sides of the piston for reversing the direction of movement, a supply of compressed air, a solenoid reversing valve for connecting the valves of the air cylinder on the opposite sides of the piston alternatively to the air supply and an exhaust port, a pair of switches on the traverse mechanism for actuating the solenoid reversing valve, and a feeler arm radially directed toward the arbor and movably supported on the radially movable portion of the traverse mechanism so that when said feeler arm contacts one of the flanges of the spool on the arbor, one switch will be actuated and, when it contacts the other flange of a spool on the arbor, the other switch will be actuated.

4. A winding machine for coiling wire onto a spool comprising on a supporting frame, an arbor for accepting the spool and means producing rotation of the arbor, a coil-size, speed-control lever supported on the frame and connected to the means for producing the rotation of the arbor to control its speed, a traverse mechanism mounted to move laterally and having a portion able to move radially of the coil on the spool, said traverse mechanism including a guide for directing wire onto the spool on the arbor, an air cylinder having a movable rotatable piston therein connected to the traverse mechanism for producing lateral movement of the traverse mechanism parallel to the axis of rotation of the arbor and having valves on opposite sides of the piston for reversing the direction of movement, a supply of compressed air, a solenoid reversing valve for connecting the valves of the air cylinder on

the opposite sides of the piston alternatively to the air supply and an exhaust port, a pair of switches on the traverse mechanism for actuating the solenoid reversing valve, a feeler arm radially directed toward the arbor and movably supported on the radially movable portion of the traverse mechanism so that when said feeler arm contacts one of the flanges of the spool on the arbor, one switch will be actuated and, when it contacts the other flange of the spool on the arbor, the other switch will be actuated, a linkage between the coil-size speed-control lever and the radially movable portion of the traverse mechanism whereby as the lever is moved outward as a result of the increase in size of the coil, the feeler arm will also be moved outward at the same rate, said linkage extending in a plane normal to the arbor and including a rigid link on the coil-size, speed-control lever extending almost to the traverse mechanism, a link pivoted to the rigid link at one end and to the traverse mechanism at the other end, and a link pivotally connected at one end to the traverse mechanism and pivotally connected at the other end to the frame.

5. A winding machine for coiling wire onto a spool comprising on a supporting frame, an arbor for accepting the spool and means producing rotation of the arbor, a coil-size speed-control lever supported on the frame and connected to the means for producing the rotation of the arbor to control its speed, a traverse mechanism mounted on the frame to move laterally and having a portion able to move radially of the coil on the spool, said traverse mechanism including a guide for directing wire onto the spool on the arbor, drive means supported on the frame for producing lateral movement of the traverse mechanism

parallel to the axis of rotation of the arbor, means for reversing the direction of movement of said drive means, a pair of switches on the traverse mechanism for actuating the direction-reversing means, a feeler arm radially directed toward the arbor and movably supported on the radially movable portion to the traverse mechanism, so that when said feeler arm contacts one of the flanges of the spool on the arbor one switch will be actuated and when it contacts the other flange of the spool on the arbor the other switch will be actuated, a linkage between the coil-size speed-control lever and the radially movable portion of the traverse mechanism whereby as the lever is moved outwardly as a result of the increased size of the coil the feeler arm will also be moved outward at the same rate, said linkage extending in a plane normal to the arbor and including a rigid link on the coil-size speed-control lever extending almost to the traverse mechanism, a link pivoted to the rigid link at one end and to the traverse mechanism at one end, and a link pivotally connected at one end to the traverse mechanism and pivotally connected at the other end to the frame.

References Cited in the file of this patent

UNITED STATES PATENTS

1,078,861	Koch	Nov. 18, 1913
1,538,510	Bonk	May 19, 1925
1,641,300	Spencer	Sept. 6, 1927
2,254,221	Hubbard	Sept. 2, 1941
2,626,765	Biddison	Jan. 27, 1953

FOREIGN PATENTS

465,742	Italy	Sept. 22, 1951

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,933,265 April 19, 1960

Leo Lorenz

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 45, for "wires" read -- wire --; column 2, line 56, after "3; and", "Fig. 6 is a sectional view taken along line 6-6 of Fig. 3." should appear as a new paragraph; column 4, line 6, for "as" read -- at --.

Signed and sealed this 20th day of September 1960.

(SEAL)
Attest:
KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents