Jan. 27, 1953 J. M. BIDDISON 2,626,765

WIRE GUIDING DEVICE

Filed Jan. 27, 1951 2 SHEETS—SHEET 1

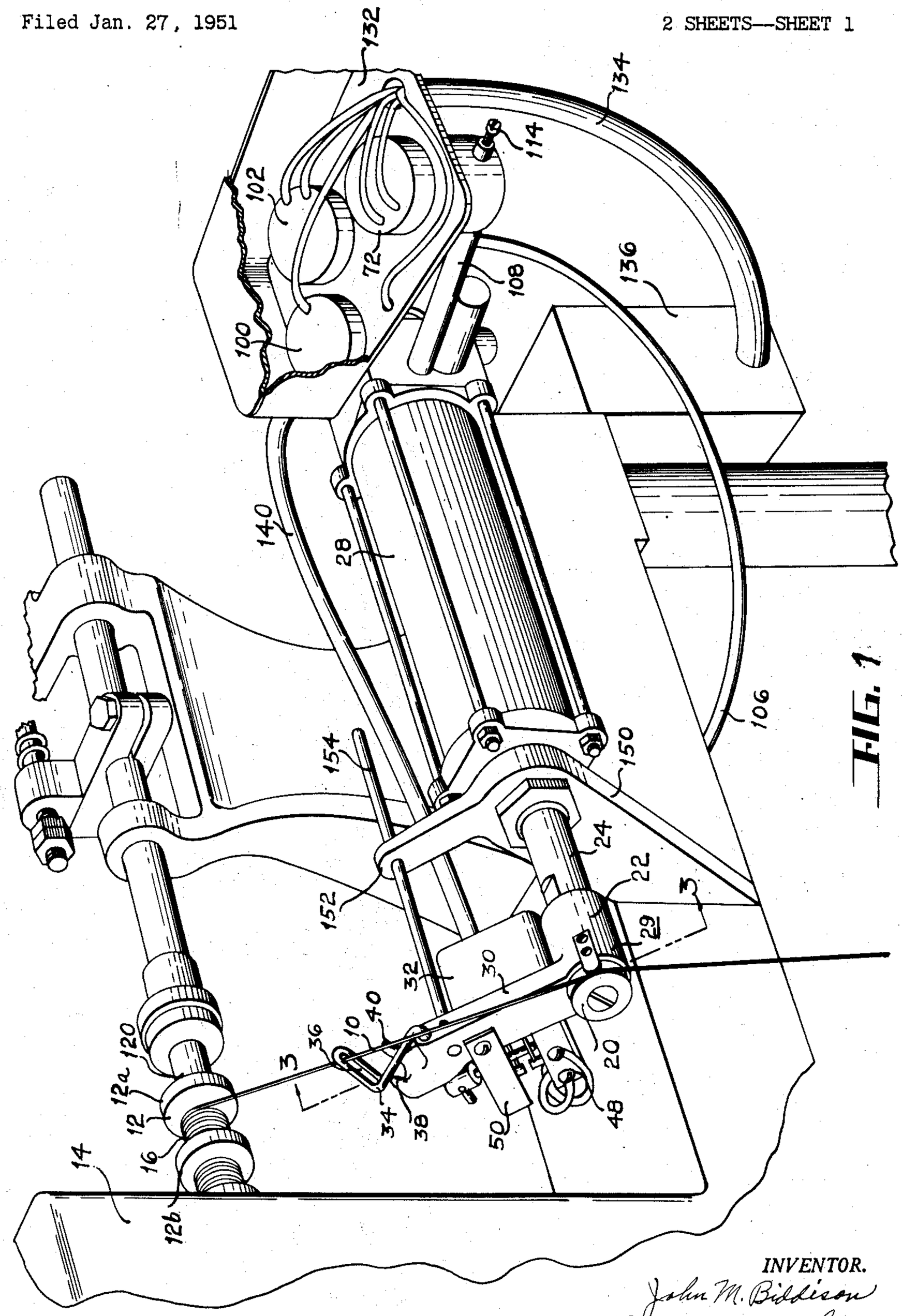

FIG. 1

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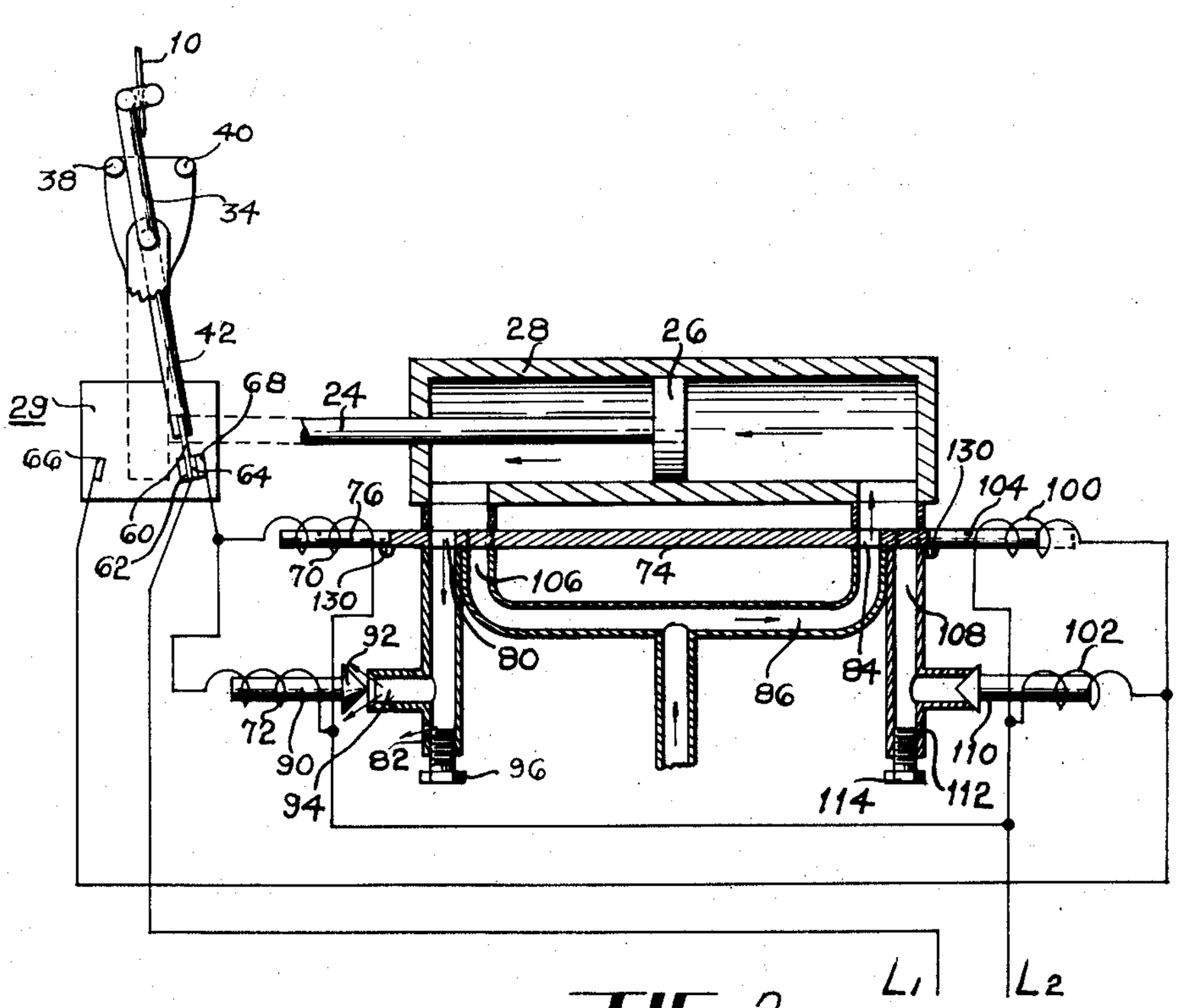

FIG. 2

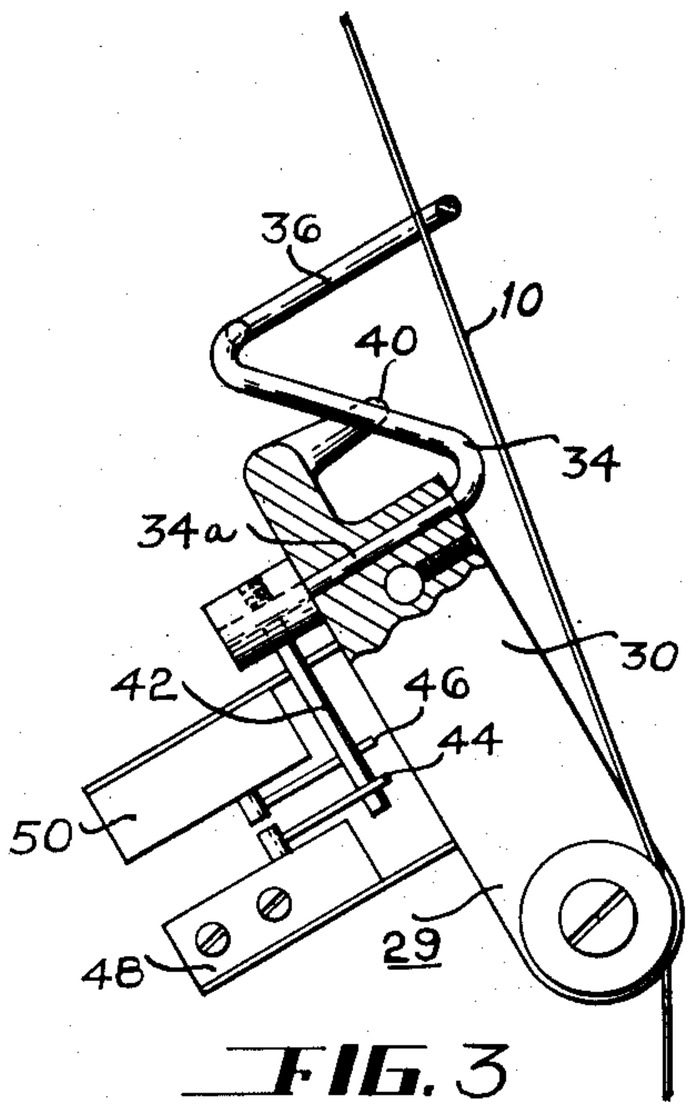

FIG. 3

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WIRE GUIDING DEVICE

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14 Claims. (Cl. 242—158)

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This invention relates to a wire guiding device and more particularly to a guiding device for use with a wire, cord, rope and the like reeling mechanism, although not necessarily so limited.

In connection with prior art wire reeling devices and the like where it is found desirable to uniformly wind a wire, a wire guiding mechanism is used which requires adjustment whenever there is a change in the size of the wire or a change in the width of the spool.

An object of this invention is to provide a wire guiding device that automatically feeds the wire to a place where it is to be used in such a manner that the wire is uniformly laid in position without making changes or adjustments when shifting from one type of wire or one type of spool to another, as the case may be.

Another object of this invention is to provide a wire guiding device that is electrically controlled and fluid driven, the electrical controls being used to control the quantity and the direction of the fluid flow.

Another object of this invention is to provide a feeler or a control arm that is responsive to the angular position of the wire from the control mechanism to the place where the wire is used for use in determining the rate of speed and the direction of movement of the wire guiding mechanism.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

Referring to the drawings, Figure 1 is a perspective view of the wire guiding mechanism used in association with a coil winding device, only a portion of the coil winding device being shown.

Figure 2 is a schematic view illustrating the circuit arrangement and the fluid passages, together with the controls therefor.

Figure 3 is a fragmentary cross sectional view taken substantially on the line 3—3 of Figure 1.

In the drawings, the reference character 10 indicates a wire fed from a suitable source of supply, not shown, to a spool 12 that is being rotated by means of a coil winding or reeling mechanism 14, shown schematically. In laying the wire 10 upon the spool, the wire is preferably laid in uniformly spaced convolutions 16, laid in contact with each other. If the wire has a reasonable thickness or diameter it has a tendency, if properly fed, to be wound in equally spaced convolutions.

A wire guiding mechanism has been provided

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for positioning the wire on the coil or spool. This wire guiding mechanism includes means for feeding the wire in one direction or the other at the approximate speed required to lay the wires in proper position on the spool. In addition thereto, this wire guiding mechanism is provided with a control mechanism that may temporarily accelerate the movement of the wire guiding mechanism by increasing the speed thereof, or in the event that the wire has been fed too rapidly, it will temporarily reverse the direction of movement of the wire guiding mechanism until the wire guiding mechanism has been properly positioned with respect to the demand on the spool.

When one layer of wire has been laid on the spool, the direction of movement of the wire guiding mechanism is automatically reversed, the wire guiding mechanism being reversed in response to the angular position of the wire extending from the wire guiding mechanism to the spool. Immediately upon the reversal of the direction of movement of the wire guiding mechanism, the wire guiding mechanism travels at what might be referred to as high speed until the wire guiding mechanism is properly aligned with the wire fed to the spool, at which time the wire guiding mechanism automatically reverts to a slow speed, the approximate speed required to properly lay the wire in position. In the event the slow speed movement of the wire guiding mechanism is too slow, the guiding mechanism is automatically shifted to a high speed movement until it is again properly aligned. If the slow speed movement of the wire guiding mechanism advances it too rapidly, the direction of movement of the wire guiding mechanism is reversed temporarily, then re-reversed, when the guiding mechanism is properly aligned. These operations are repeated until the spool is completely wound, at which time the coil winding or reeling mechanism 14 automatically stops the reeling operation, as will become more apparent from the description that follows.

The wire guiding mechanism includes an idler 20 rotatably mounted upon a bracket 22 fixedly mounted upon the end of a piston rod 24 connected to the piston 26, as best seen in Figure 2, mounted in a cylinder 28. The bracket 22 includes an arm portion 30 supporting a switch box 32 and a pivotally mounted rocker arm 34 provided with an elongated eye 36 through which the wire 10 extends. The arm portion 30 is provided with a pair of stops 38 and 40 limiting the oscillatory movement of the rocker arm 34. This rocker arm 34 is mounted in an opening

or aperture in the arm portion **30**. The portion **34***a* extending through the arm portion **30** supports a switch-actuating lever **42** mounted between a pair of switch levers **44** and **46** connected to suitable switches in the switch boxes **48** and **50** respectively.

In Figure 2 the switch-actuating lever **42** has been shown schematically as connected to a switch lever **60** having a pair of switch contacts **62** and **64** adapted to engage fixed contacts **66** and **68**. This has been shown to schematically illustrate the operation of the electrical control. When the wire **10** actuates the rocker arm **34** towards the left, as viewed in Figure 2, the switch contacts **64** and **68** close the circuit through a pair of relays **70** and **72** energized from the lines L_1 and L_2. When the relays **70** and **72** are energized, a valve member **74**, connected to the armature **76** of the relay **70**, is actuated into the full line position shown in Figure 2, so as to connect the portion of the cylinder to the left of the piston **26** through a port **80** to the exhaust passage **82** and the portion of the cylinder to the right of the piston **26** through a port **84** to the intake conduit **86** connected to a source of fluid such as air under pressure or a hydraulic fluid, as the case may be. At the same time, the relay **72** actuates an armature **90** connected to a valve member **92** opening a by-pass passage **94**, permitting the fluid to the left of the piston **26** to escape at a very rapid rate, thereby permitting the piston **26** to travel at a high speed towards the left, as viewed in Figure 2, thereby actuating the guide unit including the idler **20** at a high rate of speed towards the left, as viewed in Figures 1 and 2, until the wire **10** moves the rocker arm **34** to a central or neutral position, so as to disconnect the contacts **64** and **68** and thereby de-energize the relays **70** and **72**. By de-energizing the relay **70**, the valve member **74** remains in the position shown in Figure 2. By de-energizing the relay **72**, the armature **90** is spring-urged to the right, as viewed in Figure 2, to close the passage **94**, thereby reducing the rate at which the fluid is exhausted from the left of the piston **26**, causing the piston to travel at a slower speed, which will be referred to as slow speed. This slow speed may be adjusted by adjusting the needle valve or metering screw **96**, disclosed as a set screw, opening or closing the exhaust port **82**, to thereby control the rate of fluid discharge.

In the event the wire guide unit including the idler **20** should travel at too rapid a speed, the wire **10** would actuate the rocker arm **34** towards the right, thereby actuating the switch contact **62** into contact with the fixed contact **66**. Upon the switch contact **62** moving into contact with the fixed switch contact **66**, the relays **100** and **102** are energized. The relay **100** exerts a pull upon the armature **104**, so as to actuate the valve member **74** from the full line position shown in Figure 2 into the dot dash position. This results in the port **80** being moved into registry with an intake passage **106** and the port **84** being moved into registry with an exhaust port **108**.

The relay **102**, upon being energized, opens valve member **110** communicating with the exhaust port **108**. When the valve members have been adjusted into this position, the fluid used in actuating the piston **26** is then applied to the left of this piston and the compartment to the right of the piston is connected to the exhaust port, causing the piston rod **24** to reverse the movement of the carriage **29** supporting the arm portion **30**. The carriage **29** is then caused to travel at high speed towards the right, as viewed in Figure 2, that is, in the reverse direction to that described above. The carriage **29** continues to travel at high speed to the right until the wire **10** aligns the pivotally mounted rocker member **34**, so as to disconnect the switch contact **62** from the fixed contact **66**. This permits the valve **110** to close by means of a spring, not shown, thereby reducing the size of the effective exhaust port to the size of the exhaust passage **112** controlled by the adjustment of the needle valve or metering screw **114**. The valve member **74** remains in this position, causing the carriage **29** to travel at slow speed. The rate of travel of the slow speed is controlled by adjusting the metering screw **96** or **114**, as the case may be.

The rate of travel of the carriage at slow speed is preferably slightly less than the rate at which the coil is being wound, so that intermittently the carriage will be advanced to high speed until it catches up with the winding operation. When it comes to the end of a layer of convolutions on a spool, the flanges **12***a* or **12***b*, as the case may be, arrest the continued winding of the convolutions in a layer. The carriage proceeds to travel in the same direction until the rocker arm **34** closes the switch contact **62** with either the fixed switch contact **64** or **66**, as the case may be, to actuate the valve member **74** into the reverse position. This causes the carriage **29** to first travel at a high speed in the opposite direction until the carriage is directly in line with the winding operation, at which time the carriage travels at low speed, which again is preferably slower than the rate of travel of the laying of the convolutions. When the carriage is misaligned, the contact **62** is again actuated in contact with the fixed switch contact, to energize the relays so as to increase the effective exhaust area of the exhaust port then in use to cause the carriage to travel at a high speed until it catches up with the wire being wound. These operations continue until the winding operation of the coil is completed. If, for example, eight convolutions are found in each layer and there are five layers to a coil, the coil winding machine is preferably set so that as soon as the spool being wound has been rotated through 40 revolutions, the rotation of the spool is arrested.

Instead of mounting a new spool, several spools aligned axially, may be used, as clearly shown in Figure 1, in which event the wire is moved across the flange **12***a* to start the winding of the spool **120**, which is then wound in the same manner, the coil winding machine automatically stopping the rotation of the spool when a predetermined number of convolutions have been wound upon the spool forming the core of a coil. This is made possible by using a sufficiently long cylinder permitting the piston to operate through various positions in the cylinder.

It can readily be seen that it is not necessary to in any manner adjust the operation of the wire guiding mechanism disclosed herein if another size of spool, either differing in width or differing in diameter, is being wound. In the event the diameter of the wire is either very materially decreased or increased, it may be found necessary to adjust the metering screws **96** and **114**, so as to change the rate of the slow speed travel of the carriage guiding the wire to the spool.

Suitable stops **130** have been shown schematically in Figure 2 for limiting the movement of the valve member **74** in either direction. In actual

usage the valve member may be so designed that its movement is limited within the casing or the chest housing the same.

Instead of mounting the relays upon opposite ends of the cylinder **28**, the relays may be mounted upon a support **132** shown in Figure 1, the relays being energized by means of electric leads forming a cable **134** connected to an outlet box **136**. A cable **140** carries the leads from the switch boxes **48** and **50** to the respective relays. The cylinder **28**, together with the parts supported thereon, is mounted upon a bracket **150** provided with an apertured arm **152** receiving a guide rod **154** connected to the arm portion **30**.

Although the device has been described in connection with forming coils of wire, the device could be equally as well used with a device for reeling rope, cord, twine and other continuous length members, and, for that matter, it could be used in actuating a carriage to and fro in response to the angular direction for which there is a demand for the material to be guided.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage mounted for to and fro movement, said carriage having an idler over which the wire is fed, a pivotally mounted guide arm mounted on the carriage, said guide arm having an opening through which the wire passes, said guide arm being deflected in response to the angular displacement of the wire with respect to the carriage, means for actuating the carriage, said means including a piston and a cylinder, the piston being connected to a piston rod used in actuating the carriage, fluid for actuating the piston, and control means for controlling the supply of fluid to the cylinder to thereby cause movement of the carriage, said control means being responsive to the angular position of the guide arm to thereby actuate the piston in response to the angular direction that the wire forms with respect to the carriage.

2. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which the wire is fed, a pivotally mounted guide arm mounted on the carriage, said guide arm being guided by the wire so that as the angular position of the wire with respect to the carriage is changed the guide arm is moved accordingly, means for actuating the carriage, said means including a piston and a cylinder, the piston being connected to a piston rod used in actuating the carriage, fluid for actuating the piston, and control means for controlling the supply of fluid to the cylinder to thereby cause movement of the carriage, said control means being responsive to the angular position of the guide arm to thereby actuate the piston in response to the angular direction that the wire forms with respect to the carriage.

3. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which the wire is fed, a pivotally mounted guide arm mounted on the carriage, said guide arm being guided by the wire so that as the angular position of the wire with respect to the carriage is changed the angular position of the guide arm is changed accordingly, driving mechanism for actuating the carriage, said driving mechanism having two speeds, a low speed and a high speed, and means for shifting the driving mechanism from one speed to the other, said means including an electromagnet, an electric circuit for energizing the electromagnet, said electric circuit including a switch, and means for actuating the switch in response to angular deflection of the guide arm so that when the guide arm is deflected the relay shifts the driving mechanism into high speed and when the guide arm is returned to home position the driving mechanism is shifted into low speed.

4. A wire guiding device for use with a coil winding machine, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which the wire is fed to the coil winding machine, a guide arm pivotally mounted on the carriage, said guide arm having an opening through which the wire passes, the guide arm being so positioned with respect to the guide over which the wire passes and the laying of the wire on the spool that when the carriage is in the proper position for properly laying the wire the guide arm is aligned with the wire, driving mechanism for actuating the carriage, said driving mechanism having a high speed and a low speed and including a reversing mechanism, means for controlling the driving mechanism, said means including electromagnetic means and electric circuit means, said circuit means including a pair of switches one of which is actuated by the guide arm being deflected in a clockwise direction and the other being actuated by the guide arm being deflected in a counterclockwise direction, said driving mechanism actuating the carriage at low speed when the guide arm is aligned with the wire, the guide arm swinging in one direction by an angular displacement of the wire shifting the driving mechanism from low speed to high speed and when actuated in the opposite direction reversing the direction of the driving mechanism to reverse the direction of movement of the carriage.

5. A device according to claim 1 wherein the control means includes a plurality of electromagnets, electric circuit means for energizing said electromagnets, and a pair of switches one of which closes the circuit through some of said electromagnets when the guide arm is deflected in one direction and the other of which closes the circuit through other electromagnets when the guide arm is deflected in the opposite direction.

6. A device according to claim 1 wherein the control means includes at least a pair of valves controlled by electromagnets, electric circuit means including the electromagnets for actuating said valves, and a pair of switches one of which is closed when said guide arm is deflected in one direction to close the circuit to one of the electromagnets to actuate one of the valves, and the other of which is closed when the guide arm is deflected in the opposite direction to close the circuit to another of the electromagnets to actuate another valve.

7. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage, means for actuating the carriage, said means including a piston and a cylinder, said piston being connected to a piston rod used in actuating the carriage, fluid for actuating the

piston in the cylinder, and control means for controlling the supply of fluid to the cylinder to thereby control the movement of the carriage, said control means including a movable member mounted on the carriage, said movable member being actuated laterally to the left or to the right as the wire is deflected to the left or to the right respectively, an electric circuit, said electric circuit including a pair of switches mounted in association with the carriage, one of the switches being closed when the movable member mounted on the carriage is actuated to the left and the other switch being closed when the movable member is actuated to the right, said switches controlling electromagnetic means in the electric circuit for controlling the fluid supplied to the cylinder to thereby actuate the piston in response to the angular direction that the wire forms with respect to the carriage.

8. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which the wire is fed from the source of supply to the reeling mechanism, movable guide means mounted on the carriage for to and from movement thereon, said guide means being actuated by the wire so that as the angular position of the wire with respect to the carriage is changed the guide means is moved accordingly, means for actuating the carriage, said actuating means including a piston and a cylinder, the piston being connected to the piston rod used in actuating the carriage, fluid for actuating the piston, and control means for controlling the supply of fluid to the cylinder to thereby cause movement of the carriage, said control means being responsive to the lateral position of the guide means to thereby actuate the piston in response to the angular direction that the wire forms with respect to the carriage.

9. A wire guiding device for use with a reeling mechanism, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which a wire is fed, movable guide means mounted on the carriage for to and fro movement thereon, said guide means being actuated by the wire so that as the angular position of the wire with respect to the carriage is changed the lateral position of the guide means is changed accordingly, driving mechanism for actuating the carriage, said driving mechanism having two speeds, a low speed and a high speed, and means for shifting the driving mechanism from one speed to the other, said shifting means including an electromagnet, an electric circuit for energizing the electromagnet, said electric circuit including a switch, and means for actuating the switch in response to the lateral deflection of the guide means so that when the guide means is deflected the electromagnet shifts the driving mechanism into high speed and when the guide means is returned to home position the driving mechanism is shifted into low speed.

10. A wire guiding device for use with a coil winding machine for use in winding wire upon a spool, said wire guiding device including a carriage having to and fro movements, said carriage having a guide over which a wire is fed to the coil winding machine, guide means adjustably mounted on the carriage, said guide means being adjustable laterally from one side of the carriage to the other, said guide means having an opening through which the wire passes, the guide means being so positioned with respect to the guide over which the wire passes and the laying of the wire on the spool that when the carriage is in proper position for properly laying the wire the guide means is aligned with the wire, driving mechanism for actuating the carriage, said driving mechanism having a high speed, a low speed and a reversing mechanism for reversing the direction of movement of the carriage, means for controlling the driving mechanism, said controlling means including electromagnetic means and electric circuit means, said circuit means including a pair of switches one of which is actuated by the guide means when actuated towards one side of the carriage and the other being actuated by the guide means when actuated to the other side of the carriage, said driving mechanism actuating the carriage at low speed when the guide means is aligned with the wire when the guide means is actuated in one direction on the carriage by an angular displacement of the wire, said electromagnetic means shifting the driving mechanism from low speed to high speed and when the guide means is actuated in the opposite direction said electromagnetic means reversing the direction of the driving mechanism to reverse the direction of movement of the carriage.

11. A wire guiding device for use with a reeling mechanism for use in winding a coil, said wire guiding device including a carriage mounted for to and fro movement, said carriage having a guide over which a wire is fed, movable guide means mounted on the carriage for to and fro movement thereon, said guide means being actuated upon the carriage by the wire so that as the angular position of the wire with respect to the carriage is changed the lateral position of the guide means is changed accordingly, driving mechanism for actuating the carriage, said driving mechanism having two speeds, a low speed and a high speed, the rate of travel of the carriage at low speed being slightly less than the rate at which the coil is being wound, and means for shifting the driving mechanism from one speed to the other, said shifting means being controlled by the movable guide means so that as the wire deflects the guide means in one direction due to the carriage moving slower than the winding of the coil the shifting means shifts the driving mechanism from low speed into high speed when the carriage travels at a higher rate of speed than the rate at which the coil is being wound, said movable guide means causing the shifting means to shift the driving mechanism into low speed when the carriage aligns the guide thereon with the winding position of the coil.

12. A wire guiding device for use with a reeling mechanism used in winding a coil according to claim 11, wherein the driving mechanism includes an electromagnet and an electric circuit for energizing the electromagnet, said electric circuit including a switch, and means for actuating the switch in response to lateral deflection of the guide means so that when the guide means is deflected the electromagnet shifts the driving mechanism from one speed to the other speed.

13. A wire guiding device for use with a reeling mechanism used in winding a coil according to claim 11, wherein the driving mechanism for actuating the carriage includes a cylinder and a piston, the piston being connected to a piston rod used in actuating the carriage, fluid for actuating the piston, control means for controlling the supply of fluid to the cylinder to thereby cause movement of the carriage, and adjustable means for changing the size of the fluid passage used at

low speed to thereby adjust the low speed to accommodate changes in the size of the wire.

14. A wire guiding device for use with a reeling mechanism used in winding a coil according to claim 11, wherein the means for actuating the carriage includes a cylinder and a piston, the piston being connected to a piston rod used in actuating the carriage, fluid for actuating the piston, means for adjusting the low speed of the

piston by changing the size of the fluid passage used in association with the low speed movement of the carriage, and means for providing a larger fluid passage for the fluid used in actuating the carriage at high speed.

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No references cited.