March 9, 1948. M. F. WILLIAMS ET AL 2,437,630

WIRE PAY-OFF MECHANISM

Filed July 17, 1945 3 Sheets-Sheet 1

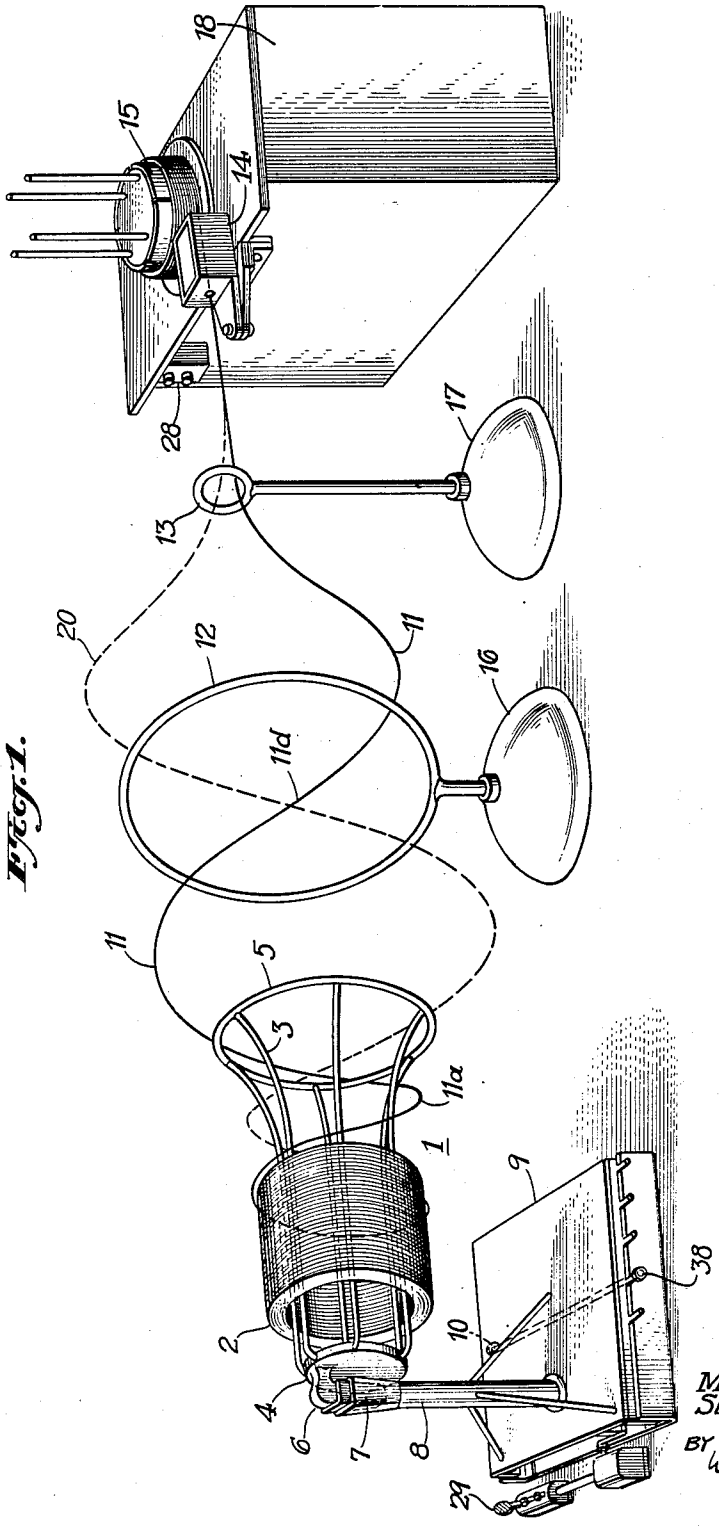

FIG. 1.

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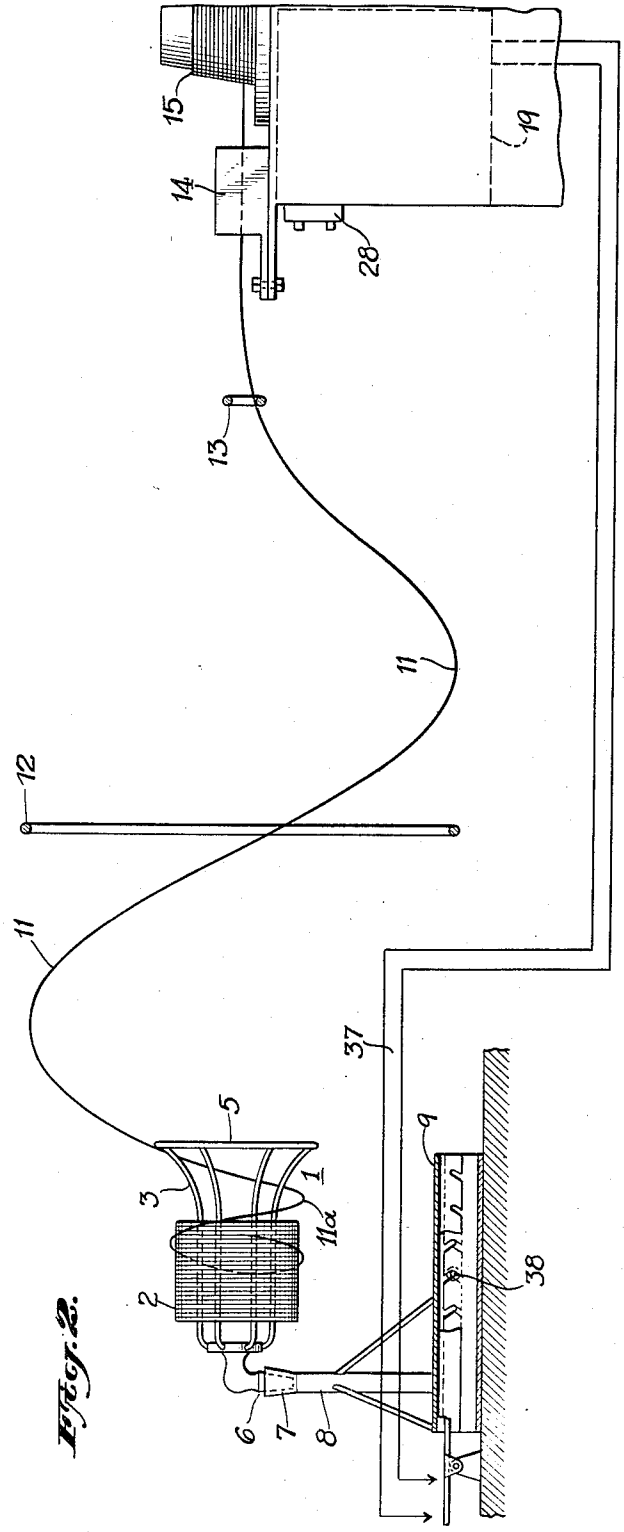

Fig. 2.

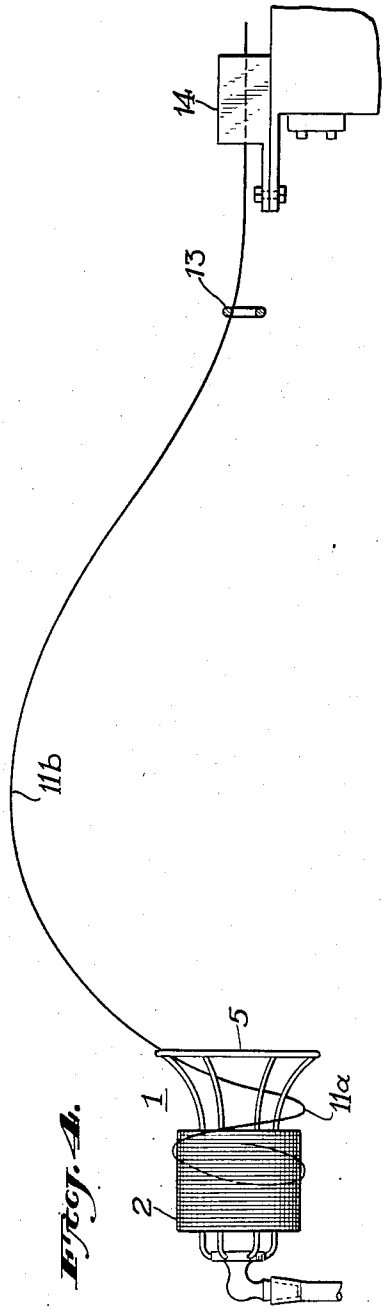

Fig. 4.

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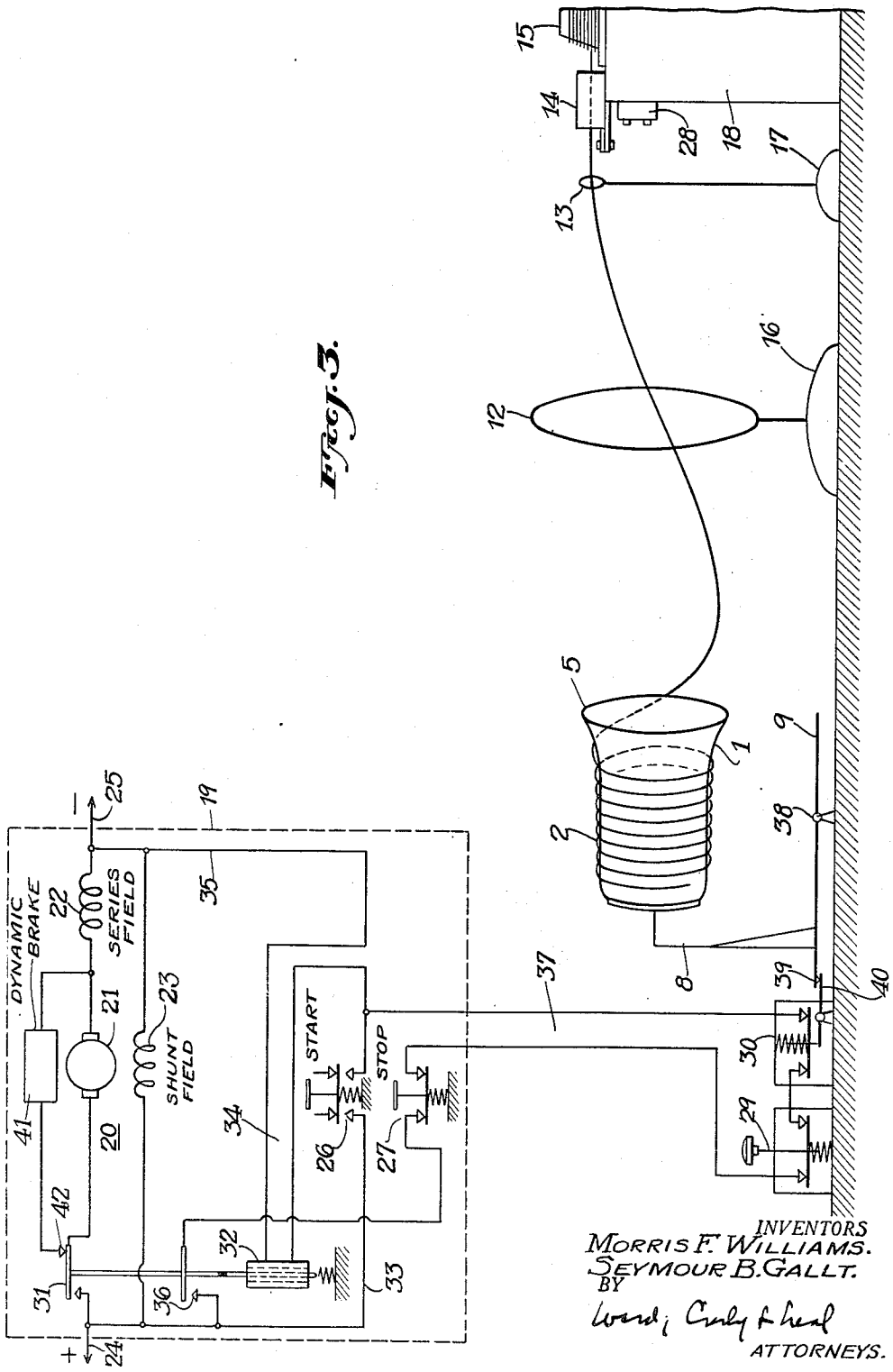
Fig. 3.



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2,437,630

WIRE PAY-OFF MECHANISM

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2 Claims. (Cl. 242—128)

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This invention pertains to a pay-off mechanism for rapidly feeding wire or other stranded material, from a randomly coiled reel thereof, through a guide or aperture, such for example as a wire-drawing die or the like, to a pulling device, such as a motor driven wind-up reel.

In accordance with the invention, the coil to be unwound is carried by a normally stationary supporting frame or pay-off mechanism, both the frame and the coil proper remaining stationary during normal operation, and the wire or the like passing off the coil in a direction generally endwise with respect to the coil, but with certain special modifications in the path of movement.

More specifically, the pay-off mechanism of the invention comprises a substantially bell-shaped, coil-supporting frame, this frame being mounted with its axis horizontal and being removably supported at its smaller end by a vertical standard. The coil to be unwound is placed on the frame by first removing the latter from the vertical standard, and thereupon thrusting the small end of the frame through the coil, whereupon the frame is again mounted on the standard.

In accordance with the simplest modification of the invention, and one which illustrates the basic principles of operation involved, the outer free end of the coil is now fed over the larger or unsupported end of the bell-shaped frame to a pulling device, such as a motor-driven reel, through a relatively small diameter, circular guide member rigidly mounted along the axis of the bell frame, a considerable distance therefrom and adjacent the pulling device. The large diameter end of the bell frame thus constitutes the delivery end, and is of a diameter considerably greater than that of the coil to be unwound.

If now the pulling device is started up at a high rate of speed, it will start pulling the wire rapidly over the delivery or large diameter end of the bell frame. The wire in passing from the coil to the pulling device will thus be deflected radially outward by the flared-out delivery end of the bell frame, while at the same time whipping around the delivery end thereof in process of unwinding from the coil, the latter remaining stationary. This combined radial deflection and whipping action will set up strong centrifugal forces in the wire being payed out, causing it to swing, as it unwinds from the coil, in a large rotating loop about the delivery end of the bell frame, and such that the wire comes off the coil in a substantially radial direction without touching the delivery end of the bell frame, except occasionally. By the

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very nature of the action thus described, kinking or snarling of the wire is eliminated in normal operation, the whipping action and substantially radial pay-off from the coil serving, in general, to overcome any such tendencies. The small diameter guide ring through which the wire is fed adjacent the pulling device, eliminates the whipping action of the wire at this point, thus permitting the same to be coiled without disturbance on the motor-driven wind-up drum, after passage, for example, through an interposed wire-drawing die or the like.

By interposing a second and relatively large diameter stationary guide ring about midway between the bell frame and the above-mentioned small diameter guide ring, a nodal point can thus be created in the rotating loop of payed-out wire, whereby the loop assumes an S-shaped contour, the centrifugal forces of one-half of which substantially balance those of the other half, thus removing most of the radial stress from the small diameter guide ring adjacent the pulling device. This modification greatly facilitates the ease of feeding the wire through a drawing die or the like, and thus constitutes the perferred form of the invention.

Referring now to the drawings:

Fig. 1 is a perspective view showing the above-mentioned preferred form of the pay-off mechanism constructed to operate in accordance with the invention.

Fig. 2 is a view in side elevation of the Fig. 1 mechanism, and showing in addition, partly in section, certain mechanism employed in conjunction therewith for automatically stopping the feed, in the event the wire becomes knotted, snarled or kinked.

Fig. 3 is a further view substantially in side elevation of the Fig. 1 mechanism, but showing, in addition, the circuit diagram of the electrical control equipment employed for starting and stopping the feed of the mechanism, both manually and automatically, the latter in the event of snarling or kinking of the wire, etc.

Fig. 4 is a view in side elevation of the simplified form of the pay-off mechanism above referred to.

Referring to Figs. 1 and 2, the pay-off mechanism in accordance with the preferred form of the invention comprises a substantially bell-shaped supporting frame 1 for the coil 2 to be unwound, this frame comprising a series of coil-supporting wires, such as 3, extending in a generally axial direction and secured at the small end of the bell frame to a mounting disc 4, and at the

larger or delivery end to a ring 5 of substantially larger diameter than the coil 2 to be unwound. Rigidly secured to the disc 4 is a truncated mounting lug 6 which fits into and frictionally engages a corresponding recess, as indicated at 7, in a supporting post 8, mounted on a pedestal 9, this supporting assembly or standard being generally designated by the numeral 10.

For mounting the coil 2 upon the bell frame 1, the frame is lifted vertically to disengage the lug 6 from the recess 7, whereupon the coil is placed over the small end 4 of the bell frame, and the frame returned to the position shown by reseating the lug 6 in the recess 7. With this mounting assembly, it will be seen that the bell frame is positioned with its axis horizontal, and with its larger end 5 comprising the delivery end.

For purposes of unwinding the coil, the outer free end 11 thereof, is manually extended over the delivery end ring 5 of the bell frame 1, thence through a guide ring 12, of appreciably larger diameter than ring 5, thence through a second guide ring 13 of quite small diameter, as shown, thence, in the particular modification shown in the drawing, through a wire-drawing die block, indicated generally at 14, and thence finally onto a motor-driven wind-up reel 15. The guide rings 12 and 13 are mounted on supporting bases, such as 16, 17, and are arranged in substantially axial alignment with the axis of the bell frame 1, as shown, the planes of the rings being substantially perpendicular to this axis. Likewise, the drawing die 14 is mounted on the motor housing 18 in substantially axial alignment with the bell frame.

If now the motor, which drives the wind-up reel 15 (shown within the dashed rectangle 19, Fig. 3, and referred to hereinafter), is started up at a relatively high rate of speed, the payed-out portion 11 of the wire from coil 2 will be pulled rapidly over ring 5 of the bell frame, thence through guide rings 12, 13 and through a drawing die 14 onto the wind-up reel 15. The initial tendency will be to pull the wire in a substantially axial direction, but, as the wire comes off the reel 2, it will be deflected radially outward by the larger diameter of the guide ring 5, and at the same time will be forced to unwind or uncoil from reel 2, as shown by the convolutions 11*a*. This combined radial outward deflection of the wire portion 11*a* and its concurrent uncoiling, will set up strong centrifugal forces which will throw the wire clear of ring 5 in a relatively large, revolving loop, such as is indicated at 11*b*.

Perhaps at this point it will be well to refer momentarily to the modification of Fig. 4, wherein the central guide ring 12 is omitted, in which case the wire portion leaving the reel 2 is thrown outward in a single large rotating loop, such as 11*b*, extending from the bell frame 1 to the small diameter guide ring 13. As this loop whips around, it causes the payed-out wire portion 11*a* adjacent to coil 2 to leave the coil in an almost radial direction, the centrifugal forces in the payed-out portions 11*a*, 11*b*, being sufficient to whip this portion away from the coil with such force as to eliminate such tendencies to knotting or snarling of the wire as would be ordinarily encountered.

In the modification of Fig. 4, the single loop 11*b*, whipping about in space, sets up considerable radial stresses in the small guide ring 13, which are transmitted to some extent to the drawing die 14. To overcome this tendency, and referring now again to Fig. 1, the relatively large

diameter guide ring 12 is interposed about midway between the bell frame delivery ring 5 and the small guide ring 13. The single loop 11*b*, Fig. 4, which is set up when the guide ring 12 is absent, in striking against this guide ring when present, causes the loop to assume an S-shaped contour, comprising portions 11*b*, 11*c* of Fig. 1, having a nodal point, such as 11*d*, approximately within the plane of the ring 12. With this modification, therefore, the centrifugal forces set up in portion 11*b*, Fig. 1, of the loop are substantially counterbalanced by those set up in the portion 11*c*, in so far as concerns the small guide ring 13 and the drawing die 14, so that the wire is fed into the drawing die with very little lateral deflection. The dashed line 20 shows another path in space assumed by the wire in its traverse from coil 2 to guide ring 13, it being understood that various intermediate paths are simlarly traversed as coil 2 is unwound.

Preferably, the pay-off mechanism is arranged to throw the wire-pulling mechanism out of operation in the event the wire becomes so snarled that breakage would result unless the pulling mechanism were stopped. This, as well as the usually manually controlled starting and stopping of the pulling mechanism, is accomplished by means of the arrangement shown more particularly in Fig. 3 of the drawings, wherein the equipment shown diagrammatically within the rectangle 19, is assembled within the housing 18 on which the drawing die 14, and wind-up reel 15, are mounted. The motor for driving the wind-up reel 15 is shown generally at 20, and comprises a commutator type rotor 21, with associated series and shunt stator fields 22, 23, adapted to be energized from direct current power bus bars 24, 25. For manually starting and stopping the motor, push-buttons 26 and 27 are provided, these buttons being mounted on the motor housing 18, as indicated at 28. Also, for manually stopping the motor, a foot-actuated emergency switch 29 is provided adjacent the pedestal 9 of the bell-frame support 10, Figs. 1 and 3. In addition, there is provided at this point, an automatic safety switch 30, which is operated as explained below, when the wire becomes unduly kinked or snarled.

The action of these various switches in controlling the operations of the wire-pulling and pay-off mechanism will now be explained, as follows: The contacts of the start switch are normally open while those of the remaining switches are normally closed as shown in Fig. 3. Also, when motor 20 is not running, its armature circuit, between the power supply bus bars 24, 25, is open at the lower left-hand contact of a switch 31, actuated by a solenoid 32.

Assuming the circuit to be arranged as shown in Fig. 3, with the armature circuit of motor 20 open at the lower contact of switch 31 as aforesaid, the start button 26 is manually depressed momentarily. This closes a circuit from the positive bus bar 24, over a conductor 33, through the contacts of the start switch 26, thence over conductors 34 through the winding of solenoid 32, and thence to the negative power bus bar 25 over conductor 35. The solenoid 32 thereupon operates to close the lower contact of switch 31, thereby connecting the armature circuit 21 of motor 20 through to the power bus bars 24, 25. Also, solenoid 32, upon so operating, closes a holding circuit for itself, traced from the positive bus bar 24, through the solenoid auxiliary switch contacts 36, thence through the normally

closed contacts of the stop switch 30, thence over conductors 37 through the normally closed contacts in series of the foot switch 29 and the automatic safety switch 30, thence over conductors 34 through the winding of solenoid 32, returning thence to the negative bus bar 25 over conductor 35.

Due to operation of this holding circuit, the motor 20, once started up by momentary depression of the start switch 26 as aforesaid, will continue to run until either the stop switch 27, the foot switch 29 or the automatic safety switch 30 is operated. Since, however, the normally closed contacts of all three of these switches 27, 29 and 30 are connected in series in the holding circuit for solenoid 32 above traced, the actuation of any one of these switches will open this holding circuit, thereby releasing solenoid 32, the release of which will in turn open the armature circuit for the motor at switch contacts 31, and will also open the holding circuit for solenoid 32 at switch contacts 36, until the start switch 26 is again depressed.

The stop switch 27 and the foot switch 29 are, of course, manually operated, as and when desired. The safety switch 30, however, is arranged to be operated automatically by the pay-out mechanism, in the event the wire becomes unduly snarled or tangled, in process of being fed to the drawing die. To this end, and as shown more particularly in Fig. 3, the pedestal 9, which supports the bell frame 1 through the intermediary of post 8, is mounted so that it may be tilted about a pivot point 38, the mounting being off-center and such that the pedestal normally tilts down at its rear end 39, and thereby rests upon one end of a pivotally supported arm 40, the other end of which carries the movable arm of the automatic safety switch 30, thus maintaining this switch normally closed. In the normal feeding of the wire, there is little longitudinal strain on the wire leaving coil 2, so that the weight of the coil, the bell frame, and its support, suffice to maintain the pedestal 9 tilted backwardly to close switch 30, as shown in Fig. 3. When, however, the wire becomes unduly snarled or knotted, the longitudinal tension exerted thereon by the pulling device, will tilt the pedestal 9 forward, causing the fulcrum 39 to disengage the switch arm lever 40, whereby the switch opens and stops the motor in the manner above explained. In order to bring the motor to rest abruptly, a dynamic brake 41 is provided around the motor armature, the circuit for which is closed through to the motor armature, through a back contact 42 of switch 31.

The motor control circuit contains the usual protective devices against overload currents, line failures, also starting equipment, etc., but these have been omitted for the sake of simplicity, as constituting standard equipment forming no part of the present invention.

Heretofore, the speed at which it was practical to pay out the wire from a coil, such as the above-described coil 2, has been a bottleneck, so to speak, in respect to the speed at which wire drawing or like operations of the above-described character could be performed, speeds of about 300–350 ft. per minute being impractical. Also, it was necessary to open up the convolutions of the coil to be unwound by elongating the coil so as to separate adjacent convolutions somewhat

and reposition them accurately with respect to each other, to prevent tangling during the unwinding operation. It has been found that a pay-off mechanism operating in accordance with the present invention will function satisfactorily at speeds four or five times or more higher than heretofore, and without requiring the preliminary step of opening up and carefully positioning the convolutions of the coil to be unwound, which heretofore has been a tedious and time-consuming job. Also snarling, snagging or overrunning of the wire leaving the coil, occurs much less frequently, resulting in substantially increased production.

The coil-supporting frame may be readily removed from operating position when desired, and another coil to be unwound slid into position on the frame 1. A construction of the above character is adaptable to continuous pay-off operations where the rear end of one coil is butt-welded to the front end of another coil (the latter being mounted on another frame like 1 placed beside the first) so that operation can proceed without interruption after one coil is completely unwound by continuing to pay off from the second coil.

We claim:

1. A pay-off mechanism of the character described including a coil supporting frame having a portion receivable within a coil of wire or the like to be unwound, mechanism for continuously pulling the wire or the like in a direction endwise of said frame, guiding means for normally producing a revolving outwardly whipping motion of the wire or the like in passing from said frame to said pulling mechanism, a tiltable platform for supporting said frame, and means operable upon abnormal tilting movement of said platform in a direction toward said pulling mechanism for throwing the latter out of action.

2. A pay-off mechanism of the character described including a unitary coil supporting frame having an intermediate portion receivable within a coil of wire or the like to be unwound, means adjacent one end of said supporting frame for detachably holding the latter in operative position, a substantially circular guide member adjacent the opposite end of said frame and of larger diameter than the intermediate portion thereof, mechanism for continuously pulling the wire or the like endwise off said frame in the direction of said guide member, a tiltable platfor detachably supporting said frame adjacent its smaller end, and means including said platform for throwing said pulling mechanism out of action upon the occurrence of abnormal tension in the wire or the like in passing from said frame.

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