April 12, 1955 A. W. NELSON 2,706,091

WIRE PAY-OFF MACHINE

Filed July 3, 1952 5 Sheets-Sheet 1

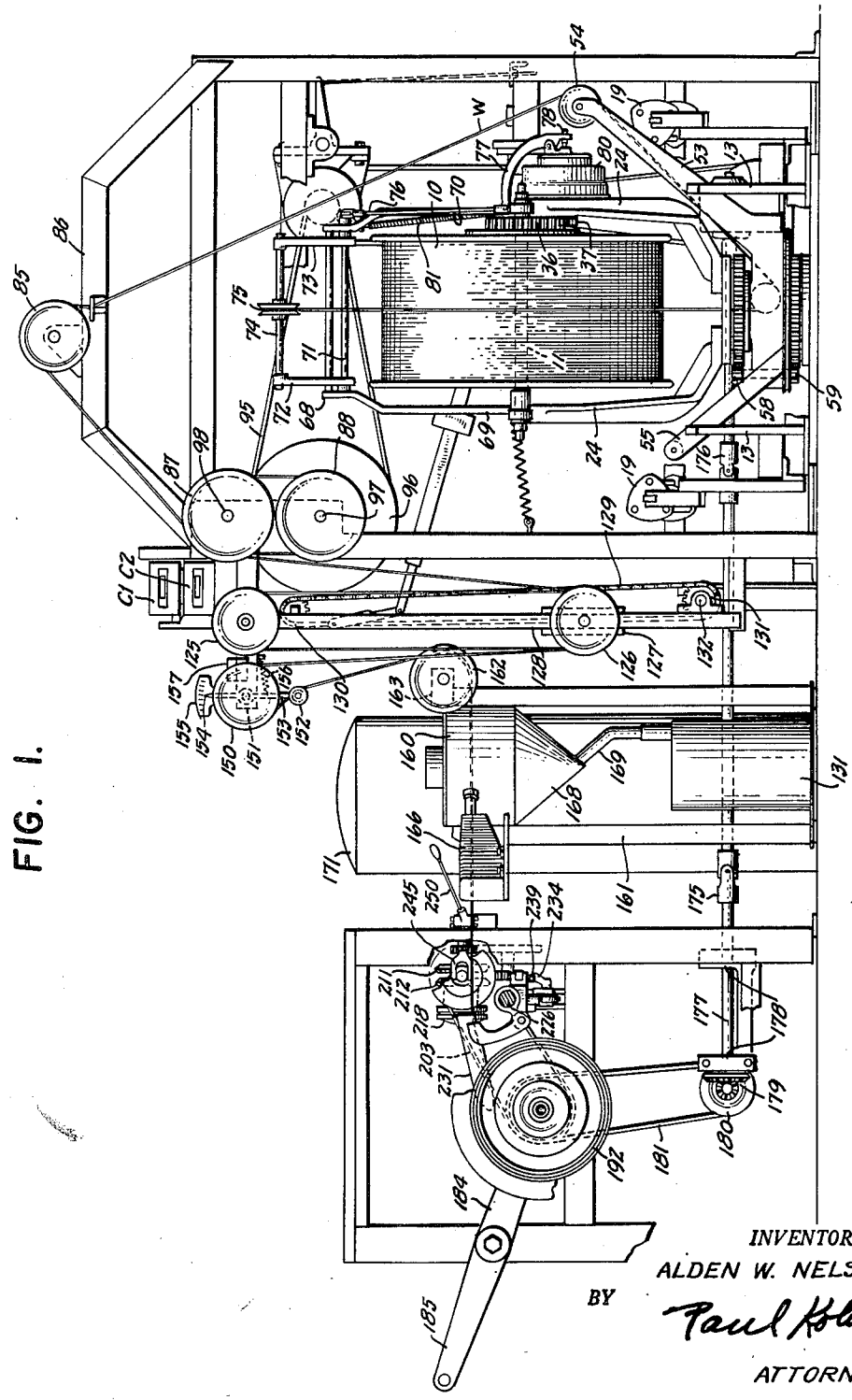

FIG. 1.

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WIRE PAY-OFF MACHINE

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FIG. 2.

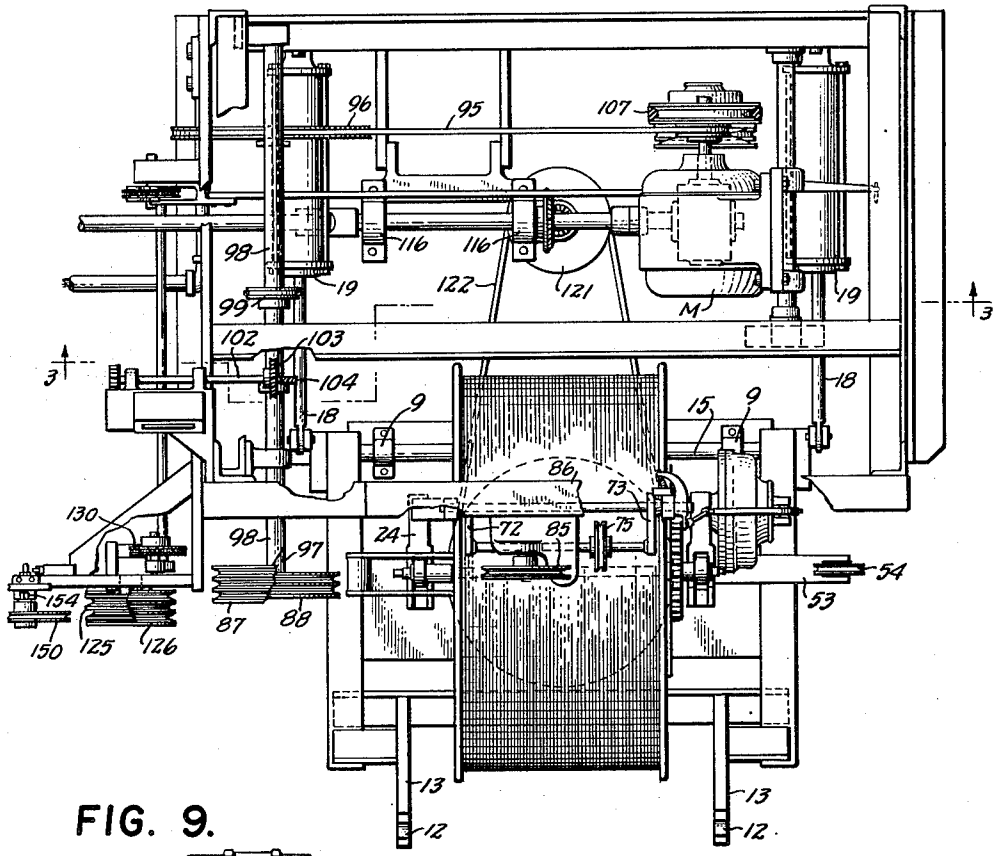


FIG. 9.

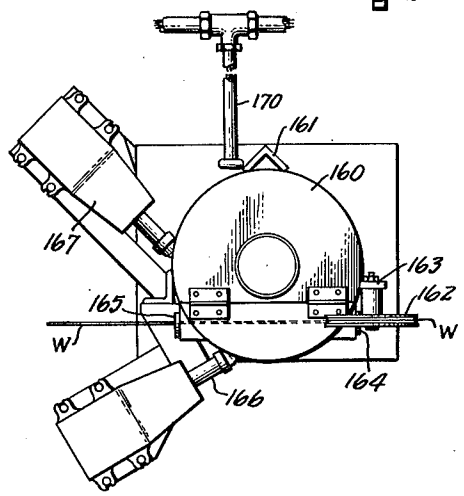
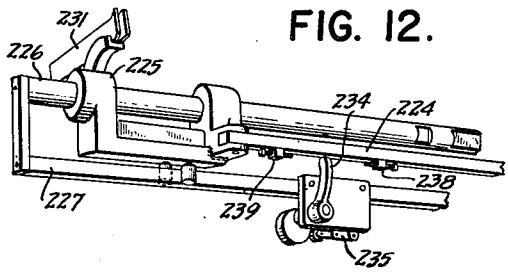


FIG. 12.



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WIRE PAY-OFF MACHINE

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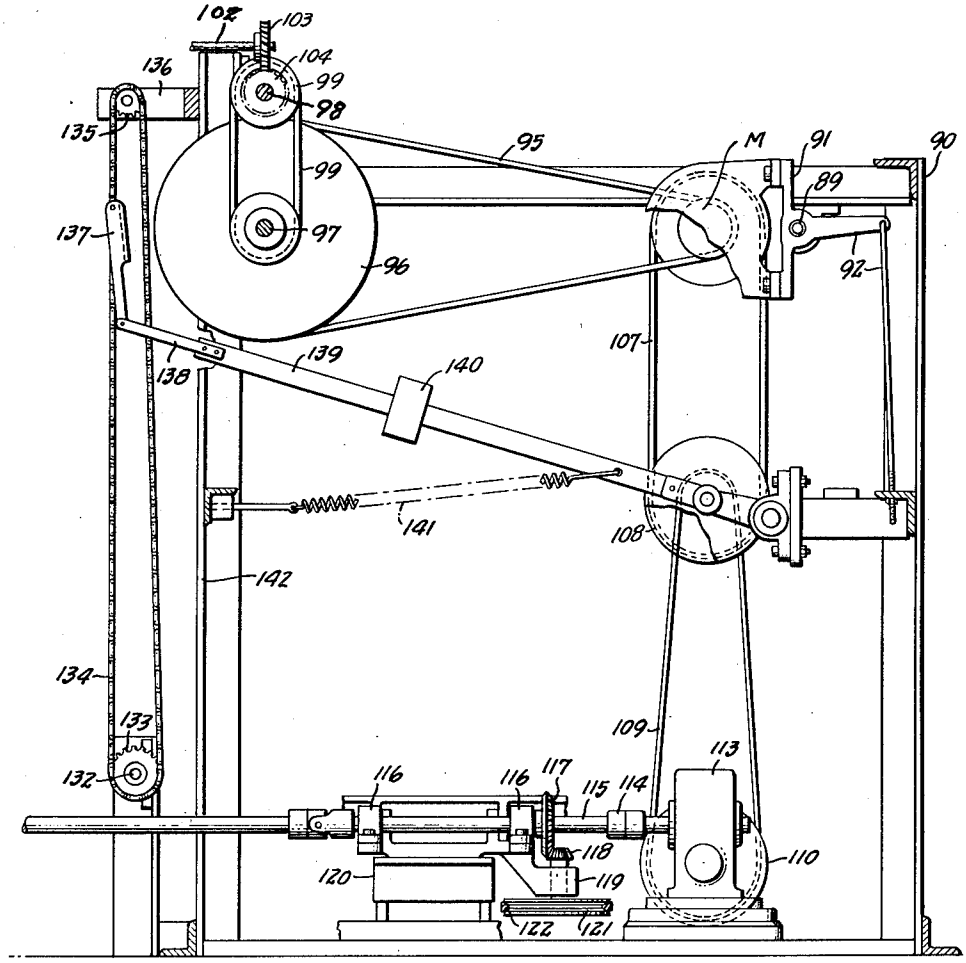
FIG. 3.



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WIRE PAY-OFF MACHINE

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FIG. 4.

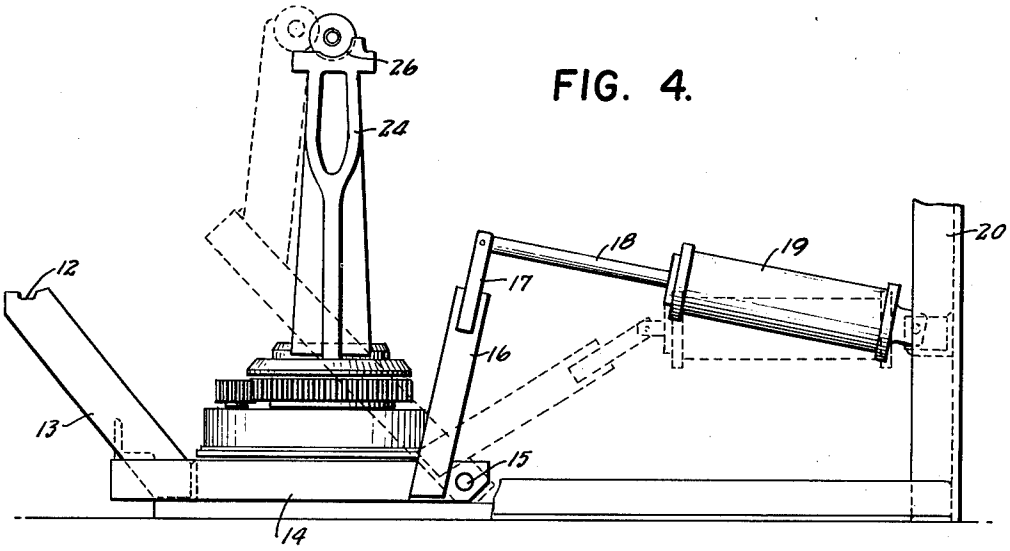


FIG. 5.

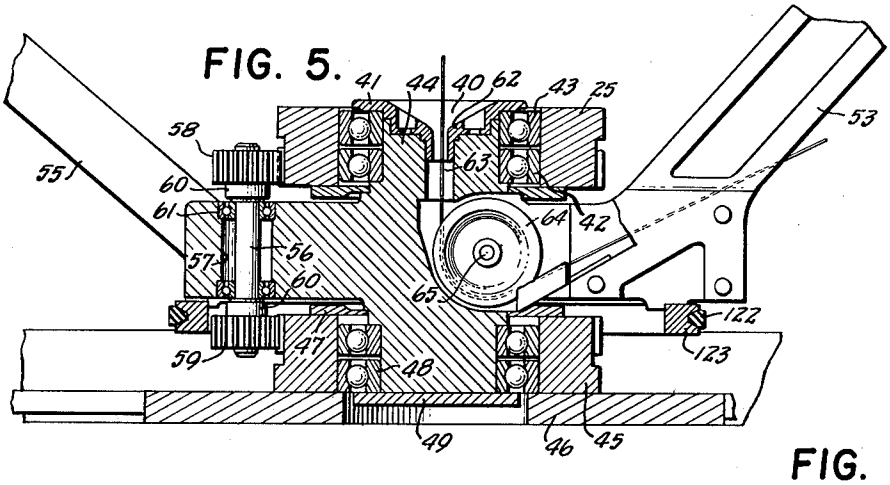


FIG. 6.

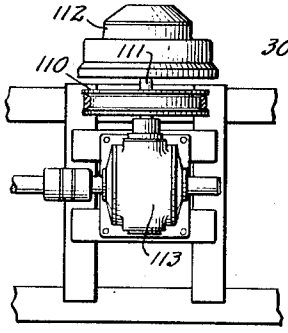


FIG. 7.

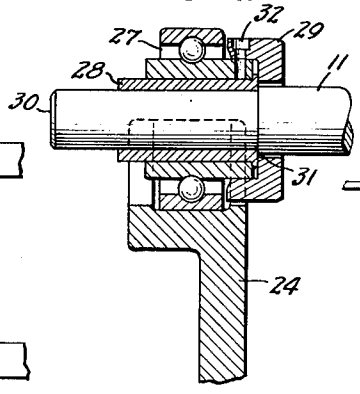
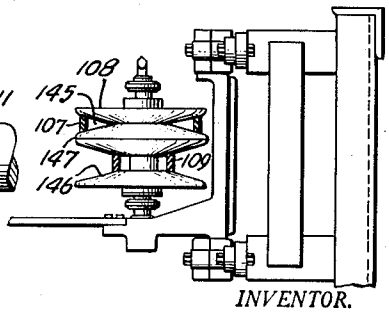


FIG. 8.



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WIRE PAY-OFF MACHINE

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FIG. 10.

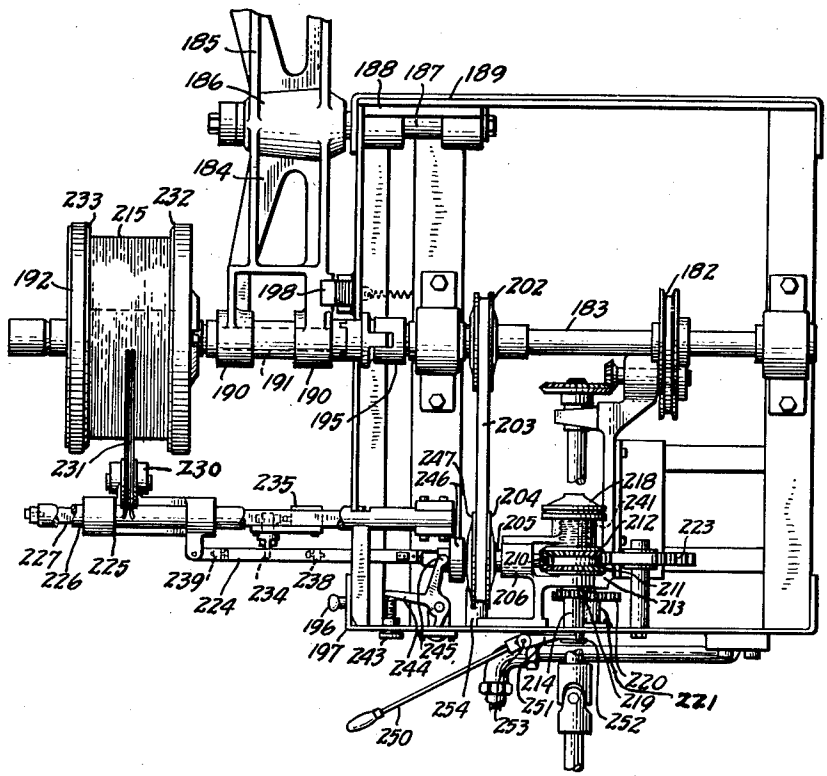


FIG. 13.

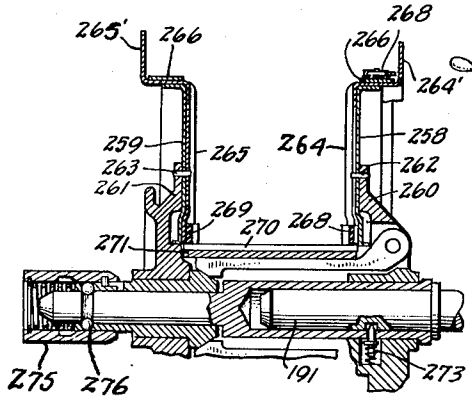
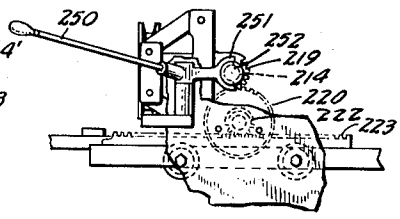


FIG. 11.



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United States Patent Office 2,706,091 Patented Apr. 12, 1955

2,706,091

WIRE PAY-OFF MACHINE

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Application July 3, 1952, Serial No. 297,145

4 Claims. (Cl. 242—25)

This invention relates to a machine for automatically coiling wire and particularly communication wire of the type used by the armed services in the field. While the invention will be particularly described with relation to such wire it will be obvious that the invention is applicable to other kinds of wire and cable and for different purposes.

When wire has been wound in a coil, and is thereafter unwound by pulling from the center of the coil, it will have a spiral twist. In certain applications such as where the army wishes to lay field communication wire at high speed as from a jeep or a low flying airplane it is important that the wire not only uncoil rapidly but that it lie flat along the ground.

The object of this invention is to provide a machine whereby coiled wire when it is unwound will be straight rather than spiraled and will lie flat along the ground.

A feature of the invention is that wire prior to coiling is given one 360° twist for each turn of the coiling reel. This counteracts the twist that the wire normally acquires when pulled from the center of the coil and will come out straight.

Another feature of the invention is that the supply of wire to be coiled is supported on a reel and permitted to revolve axially as wire is pulled from the reel and carried completely around the reel to impart two 360° twists to the wire.

Another feature of the invention is the manner in which the speed of the driving means of the motor is varied depending on the tension of the wire to maintain proper wire tension.

Still another feature of the invention is the application of an adhesive coating on the wire prior to coiling it so that when subsequently wound on a reel, the convolutions will stick together as a mass whereby when wire is unreeled therefrom, no more than one turn will pay-off at a time.

Still another feature of the invention is the manner in which the sectional coiling reel is connected to the machine.

And still another feature is the traversing mechanism for laying wire across the coiling reel.

These and other features of the invention will be made clearer from the following claims and detailed description taken in conjunction with the drawings in which:

Fig. 1 is a side elevation of the machine;

Fig. 2 is a top plan view of the pay-off spinning unit;

Fig. 3 is a side elevation of the pay-off spinning unit;

Fig. 4 is a side elevation of the part of the pay-off spinning unit showing the reel lifting arms;

Fig. 5 is a side elevation partly in section of the spinner;

Fig. 6 is a plan view of the speed reducer;

Fig. 7 is a cross section of one end of the supporting means for the pay-off reel shaft;

Fig. 8 is a top plan view of the variable speed pulley;

Fig. 9 is a top plan view of the adhesive applying unit;

Fig. 10 is a top plan view of the coiling unit;

Fig. 11 is a side elevation of a portion of the coiling unit showing the lever which may be operated to disengage the traversing mechanism so that it will commence operating from a desired position;

Fig. 12 is a perspective view of the traversing carriage and supporting mechanism;

Fig. 13 is a cross section of the take-up reel and an expansible mandrel mounting the reel on a drive shaft for rotation therewith.

The machine comprises three units, a pay-off spinning unit, an adhesive applying unit, and a take-up or coiling unit.

The pay-off spinning unit

A pay-off or supply reel 10 of coiled wire W is supported on a shaft **11** which is cradled in notches **12** of reel lifting arms **13** (Fig. 4). The reel lifting arms are fastened to a frame **14** having a fulcrum **15** supported in pillow blocks **9** about which the frame can be moved via rods **16, 17** connected between either side of the frame **14** and pistons **18** of two air cylinders **19**. Air cylinders **19** are movably fastened to frame **20** of the pay-off spinning unit and may be operated through a suitable air pressure supply valve to raise arms **13** to the position shown in the dotted lines (Fig. 4). In this position, the reel is brought in alignment with two reel supporting arms **24** bolted to a plate on an upper sun gear **25**. The reel and its supporting shaft may be conveniently pushed from arms **13** into notches **26** in arms **24** whereupon the lifting arms are lowered out of the way into the position shown in solid lines preparatory to receiving another reel.

The manner in which the reel **10** is mounted on arms **24** is shown in Fig. 7 which shows the supporting structure for one end of shaft **11**. A unit comprising ball bearings **27**, sleeve **28**, and reel locating sleeve **29** are slipped over end **30** of the shaft prior to placing the reel on arms **24** and is pushed on until sleeve **28** abuts a shoulder on shaft **11** at **31**. The shoulder is provided at a point on the shaft which will locate ball bearings **27** in depressions **26** of arms **24** when the reel is placed between the arms. Depending on the width of reel employed, locating sleeve **29** which is fastened to the ball bearings by pin **32** will be of varying size to prevent lateral movement of the reel. Near the other end of shaft **11** between the mounting unit and reel a gear **36** is provided which meshes with idler gear **37**. The pay-off reel is thus mounted so that it can rotate about its longitudinal axis as wire is pulled from it.

The spinning mechanism which rotates around the reel while pulling wire from it will now be described.

Upper sun gear **25** (Fig. 5) has a hole **40** and bushing **41** through its center and is carried between ball bearings **42** and **43** which contact spinner **44**. A lower sun gear **45** is fastened to bed plates **46** and supports spinner **44** by bearings **47, 48** retained by a bearing retainer **49**. A spinner wheel arm **53** is bolted to spinner **44** and has a wire guide wheel **54** (Fig. 1) mounted at its free end. A single revolution of the arm **53** imparts two 360 degree twists in the wire W with one resultant 360° twist for every revolution of the take up reel (described below). By this means the spiral twist that would otherwise be formed when the wire is pulled out of the center of a completed coil is cancelled out. A counter-weight **55** is fastened to spinner **44** opposite arm **53**. A planet gear shaft **56** extends through a hole **57** in spinner **44** and carrier planet gears **58, 59** which mesh respectively with sun gears **25** and **45**. Ball bearings **60, 61** support the planet gears and shaft. Wire guide eye **62** is provided in the bottom of hole **40** and connects with a hole **63** through spinner **44** to wheel **64** which is mounted on a shaft **65** supported in spinner **44**. Wire W passes through holes **40** and **63** around wheel **64** and up arm **53** to guide wheel **54**.

A bracket generally indicated at **68** supports a wire tensioning arrangement which comprises mechanism to control the speed at which reel **10** rotates depending on the slackness of the wire. The bracket is mounted on arms **24** behind shaft **11** on two upstanding members **69, 70** between which a rotatable shaft **71** extends which carries one end of arms **72, 73** fastened thereto. A fixed shaft **74** is connected between the other end of arms **72, 73** and has loosely mounted thereon a wire guide wheel **75** which is free to move laterally along shaft **74** to follow the wire as it is unwound from one side of the reel to the other. Wire W comes directly up from the reel around wheel **75** and then down in front of the reel and through hole **40** thereby pulling wheel **75** down towards the reel and rotating shaft **71**, to one end of which a rod **76** is connected. The other end of

rod 76 is connected to a crescent-shaped member 77 whose end 78 controls the operation of a brake assembly or drag unit 80 which is connected to idler gear 37. A spring 81 is connected between arm 24 and shaft 71 against which pressure rod 76 must work to release drag unit 80.

From guide wheel 54, the wire passes around an idler pulley 85 mounted on frame plate 86 to capstan drive wheels 87, 88 which pull the wire from reel 10. The upper capstan has three sheaves and the lower two sheaves around which wire W is wound. The capstans are driven from motor M (Fig. 3) which is pivotally mounted on a shaft 89 in a bracket 91 fastened to frame 90. By means of bell crank arrangement 92 fastened to shaft 89 and frame 90 the position of the motor can be adjusted. Motor M drives a belt 95 on a large pulley 96 at the end of whose shaft 97 sheave 88 is mounted. Shaft 98 of sheave 87 is driven by a V-belt drive arrangement 99 connected to shaft 97.

Counters C1, C2 mounted on frame 86 are connected via shaft 102 and gears 103, 104 to shaft 98 to count the amount of wire passing through the machine. Counter C1 may be set through suitable switches to turn off motor M when about fifty feet less than the desired amount of wire has passed through the machine. The momentum of the machine will carry enough wire through until the desired amount is reached, whereupon counter C2 which has been set to that amount will be actuated to stop the machine completely.

The drive for spinner 44 will now be described. Motor M drives a belt 107 which is connected to a variable speed pulley 108 which drives a belt 109 on a pulley 110. Shaft 111 (Fig. 6) carrying pulley 110 is connected at one end to brake 112 and at the other end to a speed reducer 113 whose output is connected by a coupling 114 to a main drive shaft 115 supported in pillow blocks 116. A bevel gear 117 mounted on shaft 115 drives bevel pinion 118 supported in bracket 119 extending from stand 120. Wheel 121 is connected to pinion 118 and via belt 122 drives ring 123 connected to spinner 44 (Fig. 5).

After the wire has passed around capstans 87, 88, it goes down around a dancer sheave 126 whose supporting bracket 127 is vertically slidable on a bar 128. The wire continues up to sheave 125 fixedly mounted on bar 128. A chain 129 is fastened to slidable bracket 127 and passes over an idler 130 near the top of the frame and around a sprocket wheel 131 mounted on a shaft 132 on whose other end a sprocket wheel 133 and chain 134 are mounted (Fig. 3). Chain 134 passes around an idler sprocket 135 mounted on frame member 136. A chain connector 137 connects chain 134 to an extension 138 of arm 139 connected to the variable speed pulley 108. A counter-weight 140 may be moved along arm 139 to any desired position. A spring 141 is connected between arm 139 and frame member 142.

The operation of variable speed pulley 108 is well known and, as shown in Fig. 8 the pulley has two sheaves 145, 146 separated by a laterally movable wedge-shaped member 147 which will increase or decrease the speed of the driven belt depending on whether member 147 permits the belt to ride close or remote from the axis of the pulley. When dancer sheave 126 drops too far down bar 128, this indicates slack wire and that the take-up reel (to be described below) is not operating fast enough. Via the sprocket chains previously described, arm 139 will also be lowered and will cause member 147 to be moved to permit belt 107 to come closer to the axis and 109 further from the axis of sheave 146, thereby increasing its speed and that of the main drive shaft 115. Shaft 115 is connected in a manner to be described to the take-up reel. As the dancer sheave 126 and arm 139 with adjustable counterweight 140 is supported by the wire W; constant wire tension is maintained throughout coiling of the wire.

After going around double sheave 125 and triple sheave 126 the wire passes around a wheel 150 mounted on frame member 151 and then around a small roller 152 which is connected via an arm 153 to a pointer 154 pivotally mounted on member 151. Pointer 154 cooperates with an indicator plate 155 to indicate the amount of wire tension. A calibrated spring 156 is connected between arm 153 and member 151. In case the wire should break, roller arm 153 will be pulled up and via a projection (not shown) will contact a safety switch 157 which will stop the whole machine.

Adhesive applying unit

This unit comprises an adhesive spraying chamber 160 supported in a stand 161. Wire W is guided into the chamber by sheave 162 (Fig. 9) on a bracket 163 projecting from stand 161 through an opening 164 in the chamber. The wire passes through the chamber and out an opening 165 in the opposite side which it will be noted is larger than opening 164 permitting longitudinal movement of the wire as it is fed to the take-up reel and laid across the drum surface. Two solenoid operated spray guns 166, 167 are pointed into chamber 160 on opposite sides of the wire to deliver a fine spray of adhesive on the wire. A funnel 168 and drain tube 169 are positioned beneath the spray chamber to conduct the excess adhesive into a receptacle 131. Electrical conduits 170 electrically connect the spraying unit with the other units of the machine. A storage tank 171 for liquid adhesive is connected by hoses (not shown) to the spray guns. A source of compressed air (not shown) is also connected to the tank and spray guns. The adhesive on the wire functions to allow sufficient adherence of one turn of wire to its adjacent turns in the completed coil to prevent more than one turn at a time from being pulled from the coil center.

The take-up or coiling unit

Universal joints 175 and 176 (Fig. 1) connect the main drive shaft 115 to shaft 177 resting in pillow blocks 178 on the coiling unit. Provision of the universal joints permits flexibility in setting up the complete machine, which is shipped in separate detachable units. A bevel gear speed-up drive 179 drives pulley 180 which is connected via belt 181 to a pulley 182 on a shaft 183 (Fig. 10).

A take-up reel support having two similar arms 184, 185 has a hub 186 pivotally mounted on stud 187 supported by bracket 188 on frame 189. Bearings 190 in the free end of arm 184 support reel shaft 191 of reel 192. A clutching arrangement 195 for connecting shaft 191 to drive shaft 183 is released by hand operation of a lever 196 mounted in frame 197. Lever 196 controls a pneumatic arrangement (not shown) to release a locking member 198 which engages arm 184 to hold clutch 195 and shaft 191 in alignment. An empty take-up reel is mounted on arm 185 and is swung into coiling position after reel 192 is completed.

A spring loaded variable pitch diameter sheave 202 is mounted on shaft 183 and by means of a belt 203, drives a variably mounted pitch diameter sheave 204 mounted on a stub shaft 205 supported in bushing 206. A bevel pinion 210 mounted on shaft 205 engages bevel gears 211, 212 to rotate them in opposite direction. A clutch arrangement 213 and bevel gears 211, 212 alternately drives shaft 214 in opposite directions to control the traversing of the wire onto the drum 215 of reel 192. Air pressures applied on the end of rubber diaphragm 218 pushes shaft 214 to engage clutch drive 213 against bevel gear 211 and a spur gear 219 on shaft 214 drives an intermediate gear 220 supported in stud 221 in frame 197. Stud 221 has a small pinion 222 which drives a rack 223 which in turn drives a linkage arrangement 224 connected to traverse guide carriage 225 slidably supported on a shaft 226 and a rectangularly formed bar 227 beneath and parallel to shaft 226, both of which extend from frame 197. A pivotally mounted bracket 230 is fastened to traverse carriage 225 and supports at its free end two thin plates 231 between which the wire is guided onto drum 215 between reel flanges 232, 233. A trip lever 234 on bar 227 is adapted to contact stops 238, 239 connected to linkage 224. Assuming that the traversing mechanism is traveling outwardly or towards flange 233, stop 238 will contact the trip lever 234 just as guide plates 231 reach flange 233 whereupon air pressure supply valve 235 is tripped and turns off the air pressure being applied to air diaphragm 218 which under tension of a spring 241 permits clutch 213 to break its connection with bevel gear 211 and connect the clutch to bevel gear 212 which is turning in the direction opposite to gear 211 whereupon the traverse mechanism is driven through the connections previously described in the opposite direction until guides 231 approach the opposite flange 232 whereupon stop 239 engages trip lever 234 and the process is reversed.

In order to accommodate different sized reels, having different traverse lengths, stops 238, 239 may be ad-

justed laterally to vary the distance traveled by guide plates **231**.

The rate of travel of guide plates **231** may be varied by an adjustable screw **243** mounted on frame **197** which bears against a lever **244**, one of whose ends **245** bears against a ball thrust-bearing **246** which engages a flange **247** of the variable speed pulley **204**. The movement of flange **247** increases or decreases the pitch diameter of both driving pulley **202** and driven pulley **204**. The adjustment via screw **243** permits winding the wire on drum **215** to desired tightness.

When a reel **192** is started in coiling position, the arrangement is always such that wire guides **231** are against inside flange **232**. In order to permit this, a lever **250** pivotally mounted on the side of the frame **197** at **253** may be pulled laterally to disengage gear **219** from gear **220** via piece **251** one of whose ends is connected to a collar **252** connected to gear **219**. Rack **223** is now free to move until a stop (not shown) on linkage **224** strikes against a pin **254** mounted on the frame **197**.

The construction of the reel assembly (Fig. 13) is as follows: Two steel pressure plates **258**, **259** having radially recessed grooves are respectively mounted against a fixed flange **260** and a removable flange **261** by means of pins **262**, **263**. Two pieces of canvas **264**, **265** or other suitable material lie respectively against pressure plates **258**, **259** and have flap portions **264'** and **265'**. Steel hoops or garter straps **266**, having a cam locking arrangement **268**, one of which is shown, hold the canvases in position around the peripheries of the pressure plates. Grommets **268**, **269** of the canvas pieces closely surround a removable rubber sleeve **270** mounted on a collapsible barrel **271**. Shaft **191** extends into a collapsible reel shaft **272** and is locked in position by detent lock **273**. The reel assembly may be pulled off clutch shaft **191** by releasing the detent **273** which will be pushed down and release the reel assembly when sufficient pull is exerted on shaft **272**.

The coil may be removed from the collapsible reel by pushing on hub **275** to release a ball lock **276** allowing flange **261** to be pulled off. Barrel segments **271** having no support on this end will collapse allowing the coil on rubber sleeve **270** to be removed.

What I claim is:

1. A wire pay-off machine comprising a motor, a reel of wire, means connected to the motor for pulling the wire from the reel, means for supporting the reel in pay-off position, stationary gear means mounting said reel support, a spinner member driven by said motor, gear means on said spinner engaging said stationary gear means, and a spinner arm for carrying the wire completely around the reel as it is unreeled.

2. A wire pay-off machine comprising a motor, a reel of wire, a reel shaft, a pair of reel supporting arms in pay-off position for receiving said reel shaft, a first sun gear to which the reel supporting arms are fastened, a second sun gear spaced from the first sun gear, a spinner member driven by said motor, two planet gears on the spinner each meshing with one of the sun gears, a spinner arm for carrying the wire completely around the reel, means connected to the motor for pulling the wire from the reel, a dancer sheave around which the wire travels, a variable speed pulley connected to said motor, and a connection from the variable speed pulley to the dancer sheave.

3. A wire pay-off machine comprising a motor, a reel of wire, a reel shaft, a pair of reel supporting arms in pay-off position for receiving said reel shaft, a drag assembly connected to the reel shaft for controlling the speed at which it revolves, a wire tensioning arrangement through which the wire passes as it leaves the reel and connected to said drag assembly, a first sun gear to which the reel supporting arms are fastened, a second sun gear spaced from the first sun gear, a spinner member driven by said motor and positioned between said sun gears, two planet gears on the spinner each meshing with one of the sun gears, a spinner arm for carrying the wire completely around the reel, means connected to the motor for pulling the wire from the reel, a dancer sheave around which the wire travels, a variable speed pulley connected to said motor, a connection from the variable speed pulley to the dancer sheave.

4. The device according to claim 3 and a shoulder in said reel shaft, a ball bearing and reel locating sleeve slipped over the end of said shaft, and abutting said shoulder and the reel whereby the reel is properly positioned and is free to rotate about the shaft.

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