Nov. 24, 1964 J. H. WILSON 3,158,355

MULTI-DRUM WINCH

Filed Jan. 8, 1962 6 Sheets-Sheet 1

Fig. 1

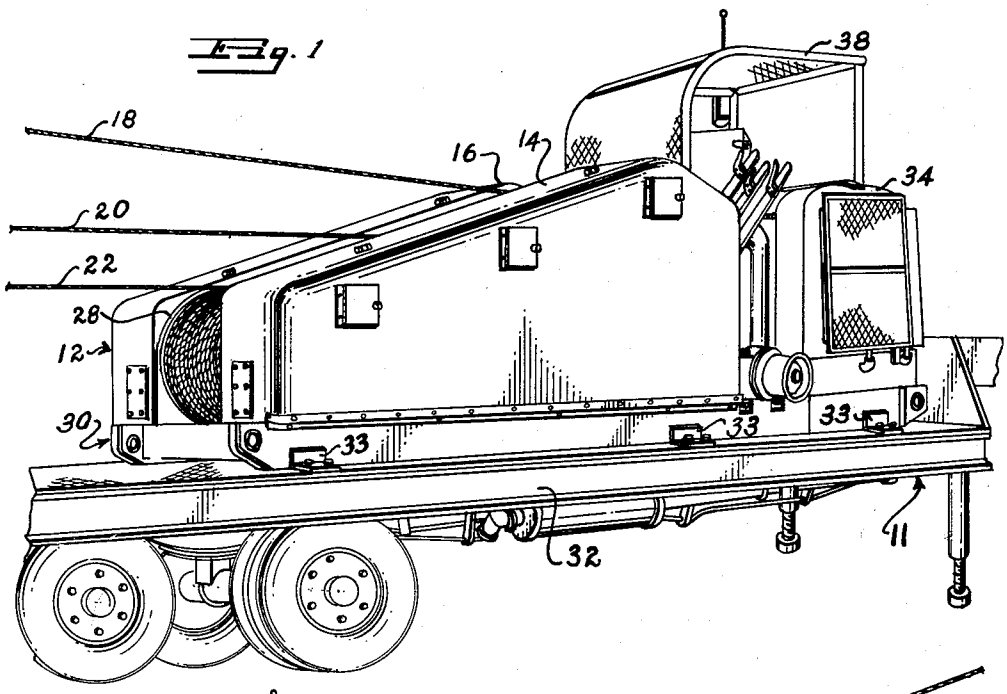


Fig. 2

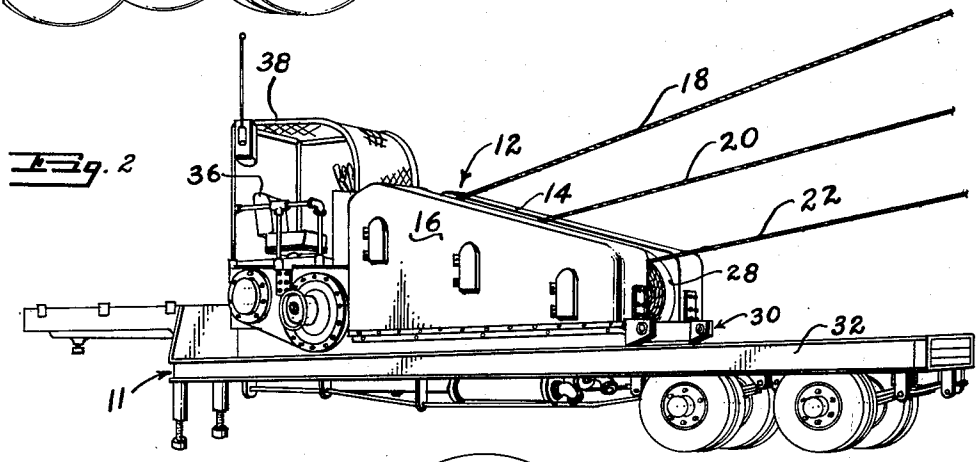
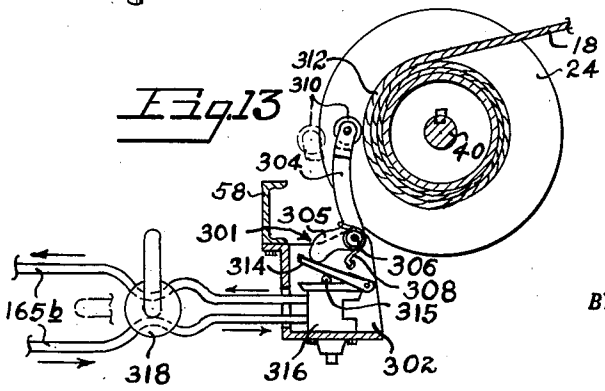


Fig. 13



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MULTI-DRUM WINCH

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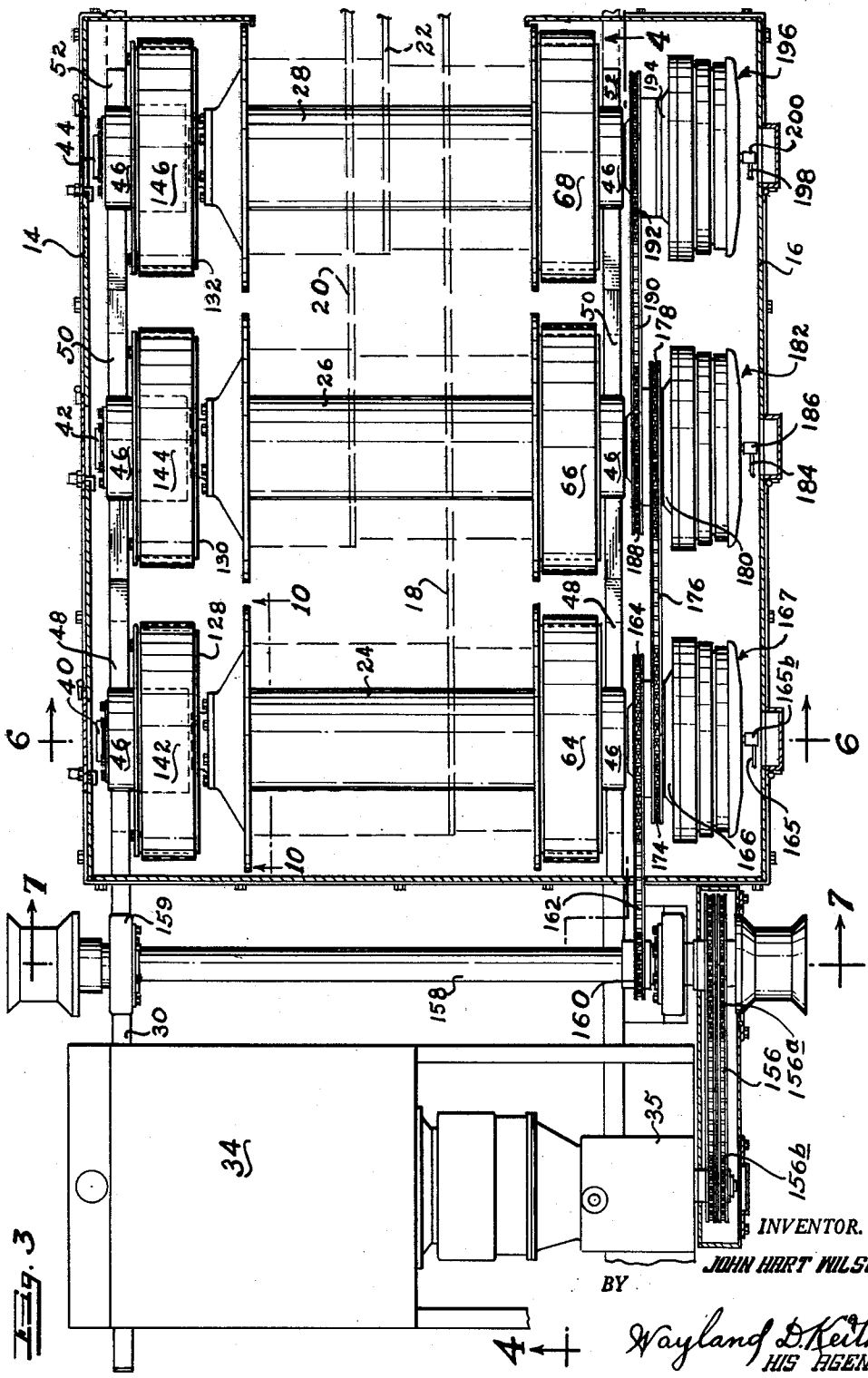


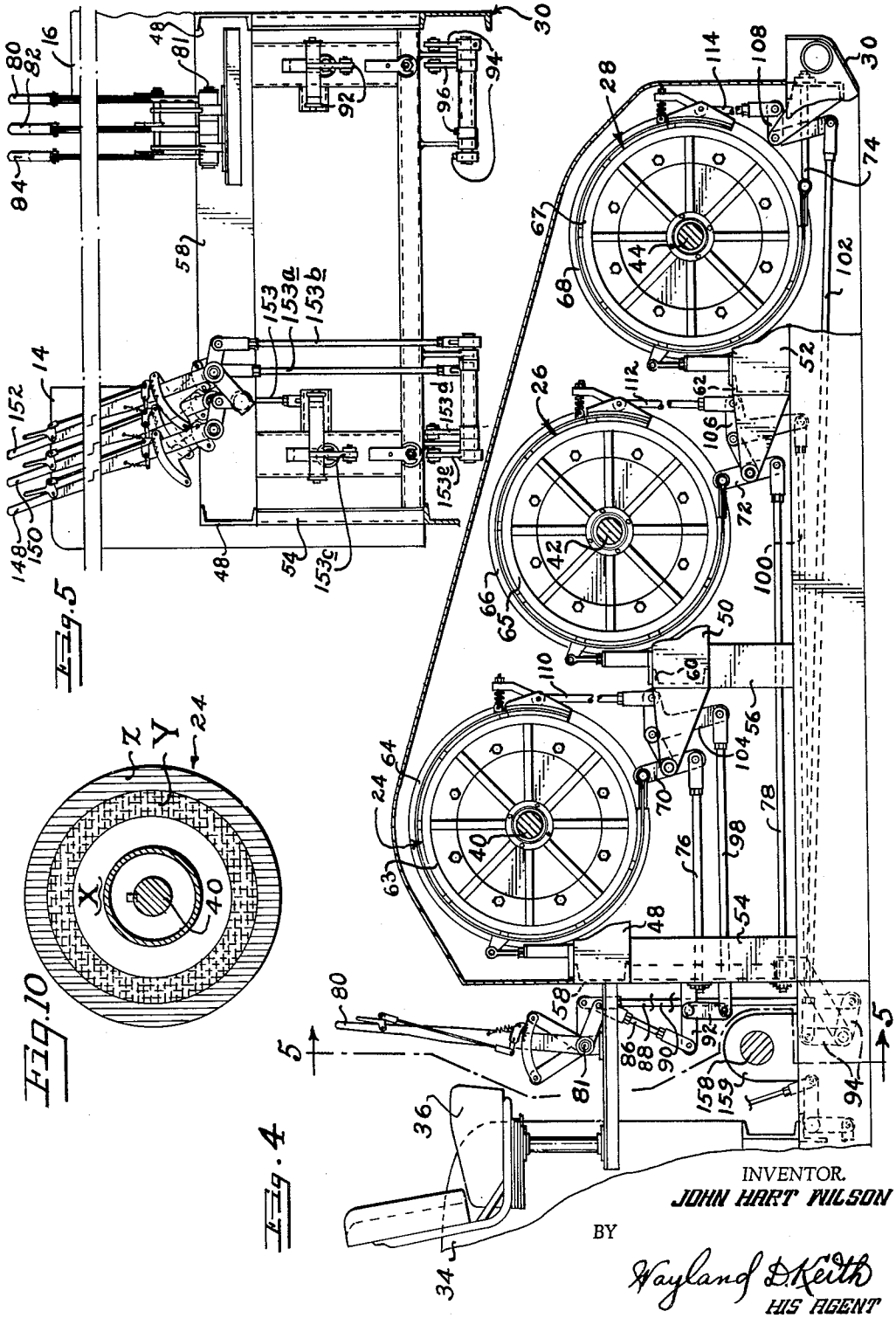
Fig. 3

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MULTI-DRUM WINCH

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MULTI-DRUM WINCH

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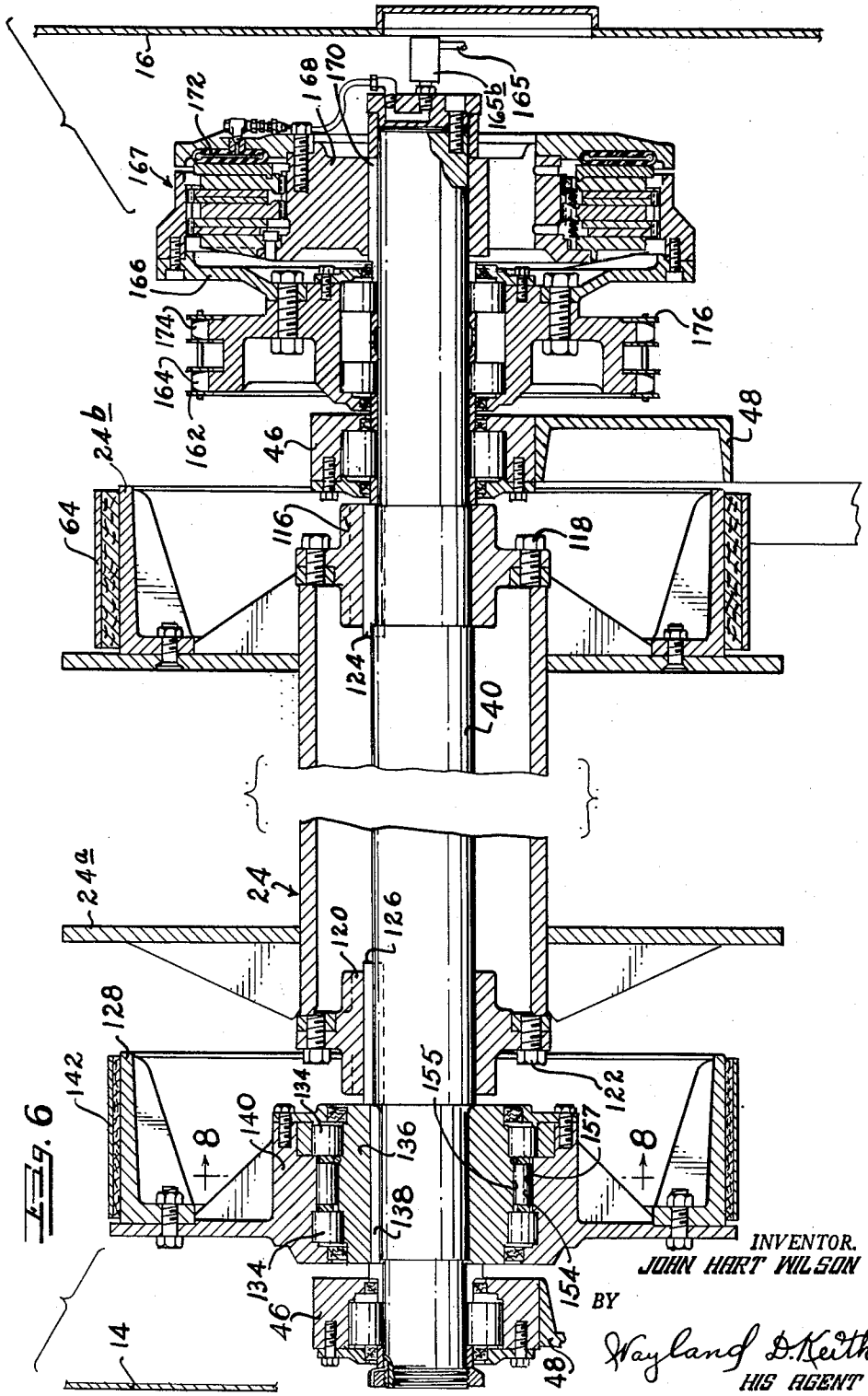


Fig. 6

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MULTI-DRUM WINCH

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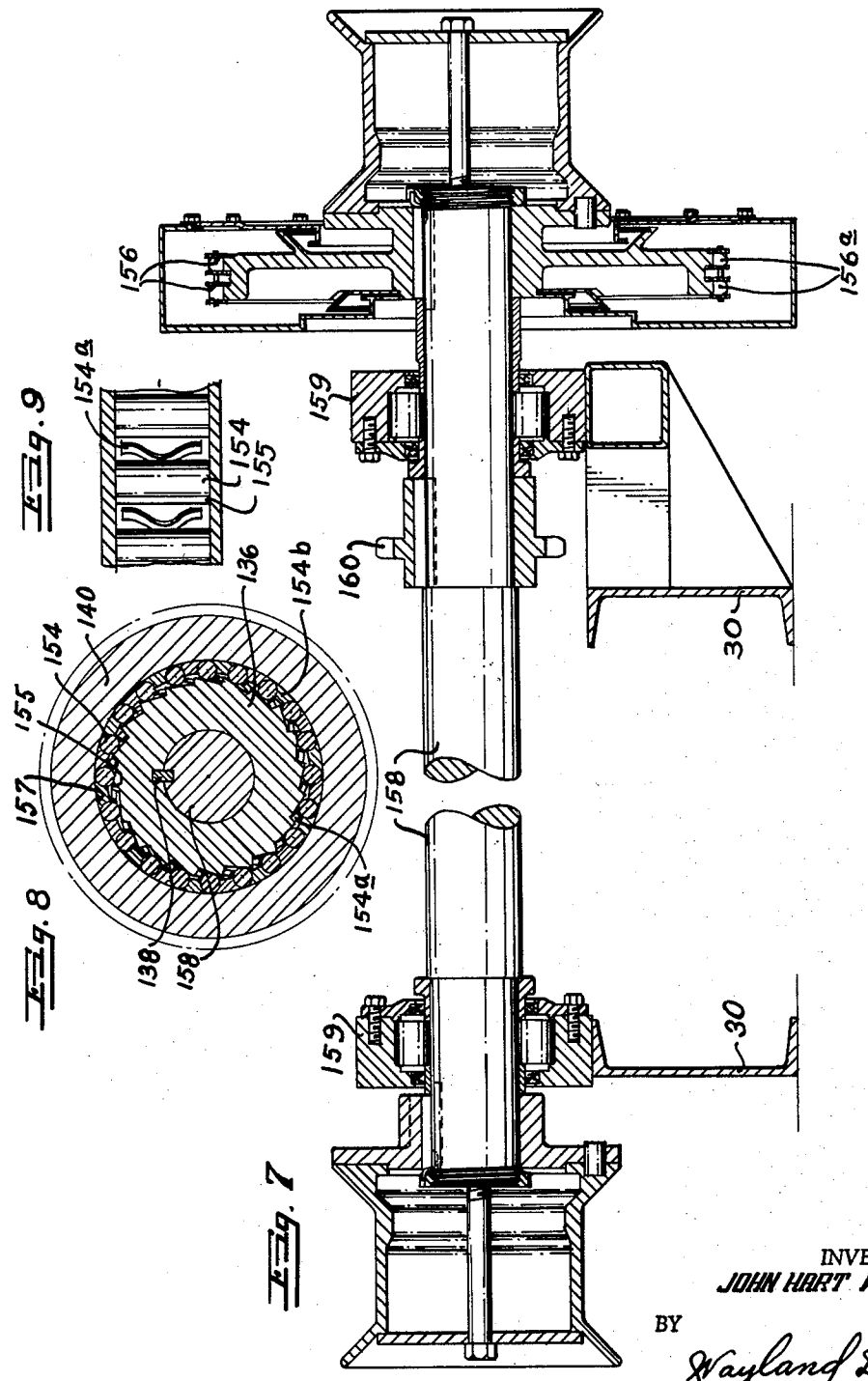


Fig. 9

Fig. 8

Fig. 7

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MULTI-DRUM WINCH

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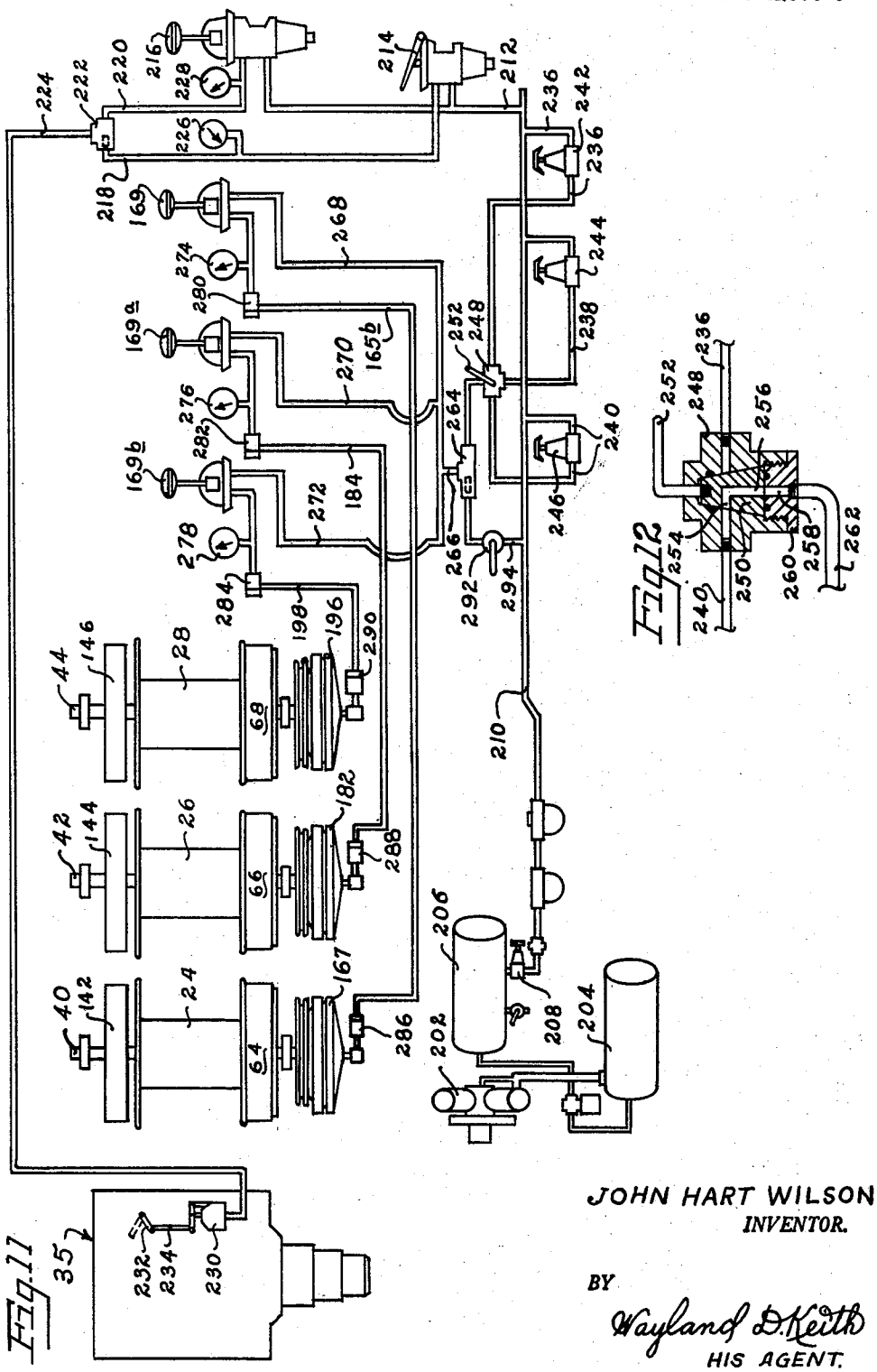


Fig. 11

Fig. 12

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United States Patent Office 3,158,355 Patented Nov. 24, 1964

3,158,355

MULTI-DRUM WINCH

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Filed Jan. 8, 1962, Ser. No. 164,864
1 Claim. (Cl. 254—173)

This invention relates to winches and more particularly to multi-drum winches such as used in connection with the pulling of high tension power lines and the like. In the present instance three winch drums are shown mounted in substantially tandem relation, and are so arranged that the winches may be controlled to give individual tightness to the respective cables being wound thereonto.

Various multi-drum winches have been proposed heretofore for winding a cable onto the respective drums, but these winches, for the most part, were awkward and cumbersome to handle, and great care had to be exercised in the pulling of the high tension power line wires and the like, or tension greater than a predetermined amount might be applied to the high tension power line, which would cause the high tension power line to be pulled in two.

The present multi-drum winch is so constructed that a clutch can be so adjusted as to exert a predetermined tension on each cable thereby obviating the possibility of pulling the respective high tension power lines in two, as the tension limits of the lines being pulled is known in advance.

Furthermore, the present multi-drum winch is also provided with a braking system whereby the brake may be set and the drum so rotated as to pull the cable with the brake in set position, so upon cessation of the pulling operation the cable will be maintained in taut relation.

An object of this invention is to provide a portable, multi-drum winch unit which may be moved from place to place to perform pulling operations, such as the pulling of high tension power lines over poles, towers, or the like by means of a cable wound on the respective winch drums.

Another object of the invention is to provide a multi-drum winch wherein the clutch system may be so adjusted as to pull a predetermined tension on each of the cables which attach to the respective high tension power lines.

Still another object of the invention is to provide a braking system which will enable a brake to be set and the drum rotated to wind the cable thereonto yet retain the cable against retrogression upon cessation of pulling.

Still another object of the invention is to provide the use of an overrunning clutch with a brake drum, to enable the winch drum to rotate freely in one direction while maintaining it against rotation in the opposite direction to prevent slackening of the cables and high tension power lines.

Still another object of the invention is to provide brake adjusting means for adjusting the respective brake bands from points remote from the brake bands.

Still another object of the invention is to provide, for a winch drum, a brake for positively braking the drum against rotation in either direction.

Yet another object of the invention is to provide a portable, multi-drum winch which is easy to manipulate by a single operator, versatile in use and relatively low in cost of manufacture, as compared to other equipment for performing a similar operation.

A final object of the invention is to provide an air pressure regulating system whereby a substantially constant tension may be maintained on the cable throughout the entire winding capacity of the winch drum.

With these objects in view and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a perspective view showing a side and rear portion of the multi-drum winch, which winch is mounted on a semi-trailer; the cable is shown to be wound on the drums and extending outward therefrom;

FIG. 2 is a view similar to FIG. 1, but on a smaller scale, and shows the opposite side of the trailer and multi-drum winch;

FIG. 3 is an enlarged top plan view of the winch mechanism shown apart from the trailer and showing a cable wound on each drum thereof, which cable extends outward from the drum, the cable being shown in dashed outline;

FIG. 4 is a longitudinal, sectional view taken through the multi-drum winch on line 4—4 of FIG. 3 and being shown apart from the trailer;

FIG. 5 is a fragmentary, sectional view taken on line 5—5 of FIG. 4, looking in the direction indicated by the arrows;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 3, looking in the direction indicated by the arrows;

FIG. 7 is a sectional view taken on line 7—7 of FIG. 3, looking in the direction indicated by the arrows;

FIG. 8 is a sectional view taken on line 8—8 of FIG. 6, looking in the direction indicated by the arrows;

FIG. 9 is an enlarged, fragmentary view, partly in section, of the overrunning clutch rollers as shown in FIG. 8 and showing the pressure springs therein.

FIG. 10 is a sectional view taken on line 10—10 of FIG. 3, looking in the direction indicated by the arrows;

FIG. 11 is a diagrammatic view of the piping system, control valves and regulators of the control system of the winches;

FIG. 12 is an enlarged sectional view through an air distributor valve which leads from the pressure regulators to the respective clutches, and

FIG. 13 is a fragmentary, diagrammatic view of a modified constant pressure control actuating mechanism.

With more detailed reference to the drawings, the numeral 11 designates generally a vehicle, such as a semi-trailer, on which the multi-drum winch unit generally designated at 12 is mounted. The winch unit preferably has housings or cover elements 14 and 16 mounted thereon which enclose the winch mechanism, including the drum ends, but which leave the face of the winch open for the spooling of cables 18, 20, and 22 onto the respective drums 24, 26, and 28.

The multi-drum winch 12 has a base or frame generally designated by the numeral 30 which base or frame is attachably secured to the frame 32 of trailer 11 by means of brackets 33. The winch frame 30 has a power unit 34, such as an internal combustion engine, mounted thereon near one end thereof. An operator station, such as a seat 36, is mounted in close proximity to the engine 34, as are the control levers and control mechanisms, as will be more fully brought out hereinafter. A canopy or safety shield 38 is shown to be positioned around and above the operator's seat 36 to protect the operator from injury, should a cable break or other unforeseen mishap arise.

The drums 24, 26, and 28 are mounted on shafts 40, 42, and 44, respectively, which shafts are mounted on pairs of bearings 46, of the type shown in FIG. 6, which bearings are secured to the respective support beams 48, 50, and 52 which are mounted on winch frame 30. The support beams 48 and 50 are supported by upstanding beams 54 and 56 so as to make a rigid frame. Cross members 58, 60, and 62 brace the respective support beams 48, 50, and 52 transversely, so as to hold the beams 48, 50, and 52 in spaced apart relation.

The drums 24, 26, and 28 each have a brake band as-

sembly 64, 66, and 68 respectively thereon, one end of each of the brake bands 64 and 66 being connected to the respective levers 70 and 72 pivotally mounted on frame 30. The end of the brake band 68 being connected to a screw threaded bolt 74 so the adjustment of the brake band may be made. The adjustment of brake bands 64 and 66 may be accomplished from a point remote therefrom and without removing the housing 16, as the respective adjustment bolts 76 and 78 are connected to the respective pivoted levers 70 and 72 by clevises, so upon tightening the nuts on the respective screw threaded bolts 76 and 78, bands 64 and 66 may be readily adjusted.

Brake levers 80, 82, and 84 are pivotally mounted on a support shaft 81 on the frame 30 of the winch, so as to be within the reach of an operator seated on seat 36. The levers 80, 82, and 84 are connected through the respective linkages 86, 88, and 90 with the respective levers 92, 94, and 96, pivotally mounted on frame 30, which levers in turn connect to the respective pull rods 98, 100, and 102, which pull rods in turn pivotally connect to bell crank levers 104, 106, and 108, which are mounted on the winch frame 30, so as to exert a pulling action on the respective pull rods 110, 112, and 114, so as to draw the respective brake bands 64, 66, and 68 into binding engagement with the respective brake drums 63, 65, and 67, as will best be seen in FIG. 4.

Each of the brake drums 63, 65, and 67 is secured to the respective barrels of the respective winch drums 24, 26, and 28, which drum barrels are in turn attachably secured to hubs, such as indicated at 116 in FIG. 6, by bolts 118. The other end of each barrel of the respective drum barrels is secured to a hub 120 by bolts 122, which hubs in turn are keyed to the respective shafts 40, 42, and 44 by keys 124 and 126.

A second series of brake drums 128, 130, and 132 is provided, each of which is mounted on the respective drum shafts 40, 42, and 44 on bearings 134 on frame 30 for turning in one direction on the respective hubs 136. However, each hub 136 is keyed to the respective shafts by keys 138, so upon reverse rotation of the respective shafts 40, 42, and 44 with respect to brake drums 128, 130, and 132, an overrunning clutch in each hub of the respective brake drums 128, 130, and 132, which overrunning clutches are each generally designated by the numeral 140, will restrain the respective hubs from turning in the opposite direction when the brake bands 142, 144, and 146 on the respective brake drums 128, 130, and 132 are set.

Each brake drum 128, 130, and 132 has the respective brake bands 142, 144, and 146, which are similar in construction to brake bands 64, 66, and 68, and which brake bands 142, 144, and 146 are connected with respective brake levers 148, 150, and 152 by linkages 153, 153*a*, and 153*b* respectively and by the respective levers 153*c*, 153*d*, and 153*e* to operate the brake bands in substantially the same manner as set out for respective brake bands 64, 66, and 68. Furthermore, the brake bands are adjustable in the same manner as set out for the aforementioned brake bands.

The respective overrunning clutches, each designated generally by the numeral 140, are of the character which will permit rotation of the respective shafts 40, 42, and 44 in one direction, when the respective brake bands 142, 144, and 146 are in binding engagement with respect to the respective brake drums 128, 130, and 132. However, upon reverse rotation, the rollers 154, which are disposed between the cam faces 155 on each hub 136 and each bore 157 within the hub of the respective brake drums 128, 130, and 132, as best seen in FIGS. 6, 8, and 9, will roll along inclined cam faces to cause interengagement between the respective hubs 136 and the respective brake drums. In so doing, retrogression of the respective drums 24, 26, and 28 is prevented, thereby enabling the prime mover 34 to drive through transmission 35 to drive chain 156, to sprocket 160, which sprocket 160 is mounted on

and secured to a countershaft 158. The countershaft 158 is journaled in bearings 159 which are mounted on frame 30. A chain 162 passes over sprockets 160 and 164 to rotate the sprocket 164, which sprocket 164 is journaled on shaft 40 and is connected in driving relation with a rotatable portion 166 of the air actuated clutch 167. The driven part 168 of the clutch is secured to shaft 40 by a key 170.

The clutch, as shown in FIG. 6 and generally designated by the numeral 167, is of the air actuated type, and when desired, air may be directed into axially expansible air tube 172, which will cause the clutch plate and the clutch friction elements therein to move into axial engagement for rotating the shaft 40 upon the rotation of sprocket 164. The clutch 167 as well as clutches 182 and 196, which are identical in construction, are usually operably controlled from the operator's position by the respective air control valves 169, 169*a*, and 169*b* to selectively engage the respective clutches 167, 182, and 196 in driving relation with the respective shafts 40, 42, and 44 of the respective winch drums 24, 26, and 28. A further sprocket 174 is mounted on the rotatable part 166 of the clutch 167 and has a chain 176 positioned therearound and around sprocket 178 which is mounted on the rotatable part 180 of clutch 182. The clutch 182 is air actuated and air is conducted thereto through a conduit 184 and through rotatable seal 186 so that the clutch may be remotely controlled by the control valve 169*a* from a position within reach of the operator. A further sprocket 188 is positioned on the rotatable part 180 of clutch 182 and it is rotatable with sprocket 178 on the rotatable part 180 of clutch 182.

Upon engagement of the friction and clutch plate elements in clutch 182, the shaft 42 is connected in driving relation with chain 176.

A chain 190 surrounds sprockets 188 and 192, which sprocket 192 is positioned on rotatable portion 194 of clutch 196. The clutch 196 is also remotely controlled by the control 169*b* in a manner set out for clutch 182 and has an air conduit 198 leading from the rotary air seal 200 to the control valve 169*b*, which is accessible to the operator, thereby to enable the operator to selectively direct air under pressure thereto for engaging chain 190 in driving relation with shaft 44 through clutch 196 for the turning of drum 28.

When it is desired to reel out the cables 18, 20, and 22 from the respective winch drums 24, 26, and 28, the brake bands 64 and 142 on drum 24, brake bands 66 and 144 on drum 46, and brake bands 68 and 146 on drum 28 are at least partially released to permit the spooling out of cables 18, 20, and 22 therefrom.

By the arrangement set out herein, either of the clutches 167, 182, or 196 may be selectively driven upon engaging the prime mover 34 in driving relation with counter shaft 158 to selectively drive drums 24, 26, or 28, either singly or in any combination.

As best seen in FIG. 11, a power driven compressor 202 is provided to pump air into tanks 204 and 206 at the usual pressure of such compressors, which pressure may often reach 150 pounds or more. The main conduit pressure regulator 208 is provided in the conduit 210 which leads from the air tanks 204 and 206 so as to reduce the air pressure to a predetermined controlled pressure. As a matter of illustration, it is preferred to use a pressure of 66 pounds on the output side into conduit 210. A branch conduit 212 connects to conduit 210 to which a foot controlled throttle valve 214, and a hand actuated throttle valve 216 are connected. Outlet pipes 218 and 220 lead from the respective valves 214 and 216 and connect to opposite ends of a two-way or shuttle check valve 222 of conventional character, which valve 222 has a branch outlet on a side thereof to which a conduit 224 is connected. The check valve 222 is of a type which enables either of the throttle valves 214 or 216 to be used, however, the conduit exerting,

the highest pressure will block off the conduit from the other of the valves automatically. A pressure gauge 226 and a pressure gauge 228 positioned in the respective conduits 218 and 220 enables the operator to determine the pressure in these respective conduits. The conduit 224 leads from the branch outlet of valve 222 to a pneumatic throttle actuator 230 on engine 35 which actuator is connected to a fuel control lever 232 by a linkage 234 so the fuel to engine 35 may be accurately controlled from a remote point, as is well understood in the art of pneumatic controls. Further branch conduits 236, 238, and 240 are connected to conduit 210 and to the respective pressure regulators 242, 244, and 246, each of which regulators has the respective conduits leading to an inlet opening of a distributor valve 248. The distributor valve 248 has a rotatable member 250 therein which is rotatable by a lever 252 connected thereto so as to connect a passage 254 selectively with one of the ports in valve 248 to which the respective conduits 236, 238, and 240 are connected. The passage 254 in valve 248 connects with an axial passage 256 in rotatable member 250 therein to direct air outward therethrough and into passage 258 in cap 260 of valve 248. A further conduit 262 is connected to passage 258 to direct air to and through a two-way shuttle check valve 264 into conduit 266 which conduit leads therefrom. Branch conduits 268, 270, and 272 lead from distributor valve 248 to the respective manually actuated control valves 169, 169*a*, and 169*b*. Further conduits 165*b*, 184, and 198 connect to the respective control valves and to the respective rotary air seals which lead to the respective clutches 167, 182, and 196. Each of the conduits 165*b*, 184, and 198 have the respective pressure gauges 274, 276, and 278 therein so that the pressure in the respective conduits 165*b*, 184, and 198 may be accurately determined. Furthermore, each of the respective conduits 165*b*, 184, and 198 has a release valve therein, which release valves are numbered 280, 282, and 284 respectively, and which valves release air from the respective conduits upon a drop of pressure within the respective conduits. The quick release valves are in addition to those quick release valves usually constructed within the respective clutches 167, 182 and 196.

To prevent a surge of pressure from the air supply, through the conduits to the respective clutches, metering valves 286, 288, and 290 are provided within the respective conduits 165*b*, 184, and 198, which metering valves are of a type which have an orifice of a given size therein in order to constrict the flow of air therethrough which metering valves are well known in the art of air controls.

As a matter of illustration, the pressure regulators 242, 244, and 246 are each adjustable and can be set at any desired pressure within, but not exceeding, the pressure within conduit 210, however, as a matter of illustration, pressure regulator 242 may be set to reduce the output pressure to nineteen pounds per square inch, pressure regulator 244 may be set to reduce the output pressure to 29.5 pounds per square inch and pressure regulator 246 may be set to reduce the pressure to 43 pounds per square inch, and since the pressure in the main conduit 210 has been reduced to a predetermined presure, such as 66 pounds per square inch by regulator 203, any of the above mentioned pressures may be directed to the clutches 167, 182 and 196 by the respective control valves 169, 169*a* and 169*b*.

As the respective cables wind onto the respective barrels of the winch drums 24, 26, and 28, the pull exerted on the first wrap of the cable on the drum barrel will be greater before the respective clutches will slip, whereas, as the layers of cable build up, one upon the other, the slippage of the clutches at a lesser tension on the cable will result, since it is desired to pull the cables at a substantially uniform tension, it is preferable to have rings or markings on the ends of the drums, as indicated in FIG. 10 at X, Y, and Z, with X representing white for a predetermined distance outward from the drum barrel, Y representing yellow for an additional distance outward therefrom and red indicating the outermost ring from the drum barrel on the drum end. These color rings are in view of the operator at all times. While the above colors have been set out as a matter of illustration, it is to be understood that any color or any indicia may be used to mark the maximum number of turns of cable wound onto the drum before it is necessary to shift the distributor valve 248 to the next higher pressure so that the clutch will exert a substantially uniform tension on the respective cables for the pulling action and when the cable is wound the maximum number of turns, as indicated by the colors, the distributor valve 248 may be shifted so as to direct air from the conduit with the next higher pressure so that the respective clutches may be utilized to pull the respective cables until slippage occurs. By pulling each cable in this manner until each clutch on the respective drum shafts slips, a uniform tension will be imparted to the cable which cable is held against retrogression by the respective overrunning clutches 140 which prevent the drums from turning in reverse when the respective brake bands 142, 144, and 146 are set on the respective brake drums. Although a distributor valve 148 with only three pressure regulators connected therto has been shown, to direct air pressure to the clutches at the respective pressures, a distributor valve connected to any number of regulators may be used to give the desired steps of tensioning to the cables, however, when each of the respective cables has been pulled the maximum amount until the clutch slips, at the selected pressure, by air passing through the distributor valve 248, then the valve 292 within branch conduit 294 may be opened, which will direct air from conduit 210 at a maximum predetermined pressure, which will cause the movable element in two-way check valve 264 to close branch conduit 262, whereupon, the control valves 169, 169*a*, and 169*b* will each be utilized to direct air at full predetermined pressure to the respective clutches 167, 182, and 196 to cause the respective drums 24, 26, and 28 to give the desired maximum pull to the cable spooled thereonto, which in turn will give the final stretch or tensioning of the high tension power lines to remove the desired amount of sag from such lines, whereupon, the high tension power line cables are anchored to the insulators, in a manner well understood in the art of construction of high tension power lines, to hold these lines taut.

While the device has been described in some particularity for use in pulling long power lines, some of which may extend as much as ten miles, and some of which may be as much as two inches in diameter, it is to be understood that the device may be used in any field of endeavor to which its is applicable, as uniform tensioning can be exerted on the line being pulled and immediately upon cessation of the pulling operation, the line is maintained against retrogression by overrunning clutches 140 when the respective brake bands 142, 144, and 146 on the respective brake drums in which these bands are in engagement.

Being able to hold the cable without permitting it to sag or to touch the ground prevents the loss of cable, as once the cable falls onto the soil it is damaged to the extent that it is no longer suitable for high tension power line of high voltage, as the corona effect sets up therearound at the points where the cable contacts the ground, and since a reach of such cable often costs many thousands of dollars, it is of utmost importance that such high tension power line being pulled be maintained tight at the cessation of the pulling until a greater pull can be exerted thereon to give the final tensioning pull to the lines. When this final tensioning pull is completed, the cable is ready to be anchored in place, but the cable must be maintained taut until such action is completed. The present device is so constructed as to per-

form these functions with a minimum hazard due to mechanical mishap or to the human element.

Modified Form of Air Pressure Control Actuating Mechanism

An air control actuating mechanism is shown in FIG. 13, which mechanism is used in conjunction with the respective winding drums, one control mechanism unit for each winding drum, in lieu of the respective pressure regulators **242**, **244** and **246**. The present mechanism comprises air pressure control actuating mechanism units; each being designated generally by the numeral **301**, each of which units is mounted on a bracket **302**, which brackets are secured to frame **30** so as to mount each actuating unit mechanism **301** so that the respective arms **304** thereof will be intermediate the inner faces of the flanges of the respective winding drums **24**, **26** and **28**. Each arm **304** is pivoted at **306** to the respective brackets **302**. A spring is provided between each bracket **302** and the respective arms **304**, which springs are designated at **308**, and which springs urge each roller **310** inward against the convolutions **312** of the respective cables **18**, **20** and **22** being spooled onto the barrel of each of the drums **24**, **26** and **28**. Each arm **304** is of a length for a roller **310** mounted on the distal end thereof to swing outward from the barrel of the respective drums, as indicated in dashed outline in FIG. 13, a sufficient distance to compensate for the respective drums becoming filled with convolutions of cable, with the respective rollers **310** riding on the outer-most convolution of the cable being spooled onto the respective drums.

The respective arms **304** each has a further arm **305** thereon to form a bell-crank, with the arm **305** of each bell-crank being connected in operative relation with a pivoted lever **314** of each of the variable pressure regulator valves **316** mounted on the respective brackets **302**.

A variable pressure regulator valve **316** is provided for each of the winding drums, with an air conduit **165***b* being connected thereto and to air actuated clutch **167**. A second variable pressure regulator **316** is connected to air conduit **184** on the inlet side thereof and to the pipe **184** on the outlet side, with the outlet side of the pipe leading to the air actuated clutch **182**.

A third variable pressure regulator valve **316** is connected to the air conduit **198** on the inlet side, with the outlet side thereof leading to the air actuated clutch **196**. Each of the air conduits **165***b*, **184** and **198** is connected to the respective manual control valves **169**, **169***a* and **169***b*. An air supply conduit **210** has a branch conduit **294** leading therefrom to a two-way check valve **264** to a conduit **266**, to which conduits **268**, **270** and **272** are connected to connect with the respective manual control valves **169**, **169***a* and **169***b*.

With the present control valves **316** connected within the respective conduits leading to the respective clutches, the air pressure to the individual clutches will be accurately controlled, as the low air pressure will be exerted on the respective clutches by the variable regulator control valves **316** when there is the fewest convolutions **312** on the respective drums, however, as the convolutions increase, the rollers **310** will cause the arms **304** to move outward and the variable pressure regulator valve **316** is of such character that, as the lever **314** thereon is depressed, it will move the plunger of the variable pressure regulator valve **316** inward to cause the variable pressure regulators **316** to increase the air out-put pressure to air conduits leading from the respective valves **316**, which will cause the respective clutches to transmit more torque to the respective drums, however, since the radius of pull of the cable being wound thereonto is farther from the axis of the drum, the pull on the respective cables will remain substantially constant, thereby preventing breaking of the cables.

When the maximum pull has been utilized, by the air from the respective variable pressure regulator valves **316** acting upon the respective air clutches, a four-way valve **318**, one of which is positioned within each of the conduits **165***b*, **184**, and **198** in by-pass relation with respect to the respective variable pressure control valves **316**, may be moved into a position to by-pass the pressure directly from the supply conduit **210** to the respective clutches at the pressure determined by the master pressure regulator **208** in supply conduit **210**. In this manner, the final tensioning to remove excess sag from the high tension power lines may be performed in the same manner as set out above.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

A portable unit for pulling at least one high tension line by a cable being wound onto a winding drum with the high tension line having substantially uniform tension imparted thereto; which unit comprises

(*a*) a base,

(*b*) at least one drum shaft journaled on said base,

(*c*) a winding drum mounted on and secured to said drum shaft for rotation therewith,

(*d*) an air actuated clutch mounted on said drum shaft,

(*e*) a source of power,

(*f*) a source of air pressure,

(1) conduit means connecting said air actuated clutch with said source of air pressure,

(*g*) transmission drive means connecting said air actuated clutch in driving relation with said source of power,

(*h*) means selectively connecting said clutch in driving relation wtih said winding drum,

(*i*) cable contact means mounted on said base and being engageable with the layers of cable on said winding drum as the layers of cable are built up thereon or payed out therefrom,

(*j*) air pressure regulator within said conduit intermediate said air actuated clutch and said source of air pressure,

(*k*) means interconnecting said cable contact means and said air pressure regulator to actuate said air pressure regulator to direct air under pressure to said air actuated clutch to exert a constant tension on the cable being wound onto said drum in accordance with the layers of cable thereon.

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