Sept. 16, 1947. R. C. OSGOOD 2,427,471

HOIST CONTROL MEANS

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Fig. 1.

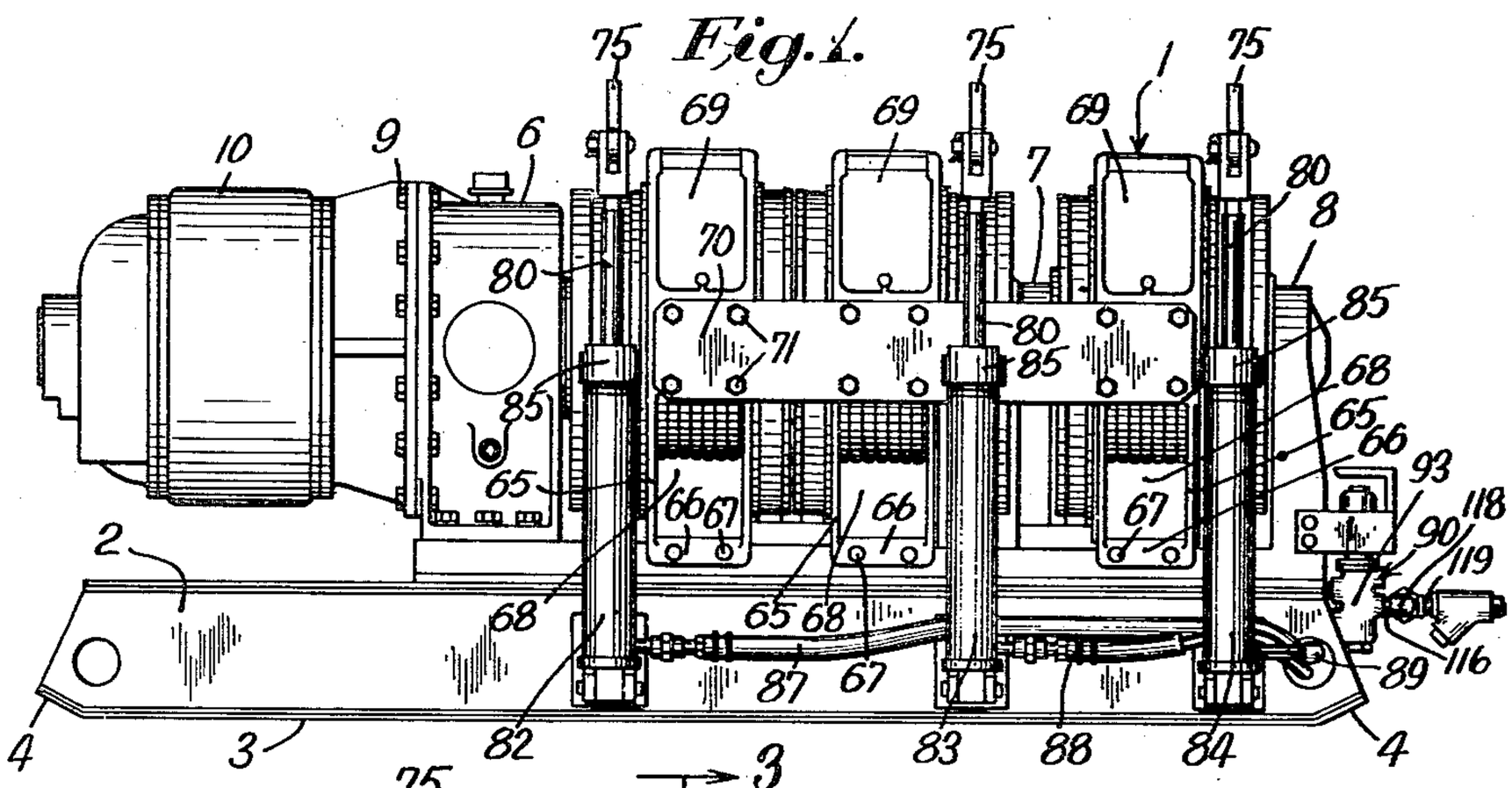

Fig. 2.

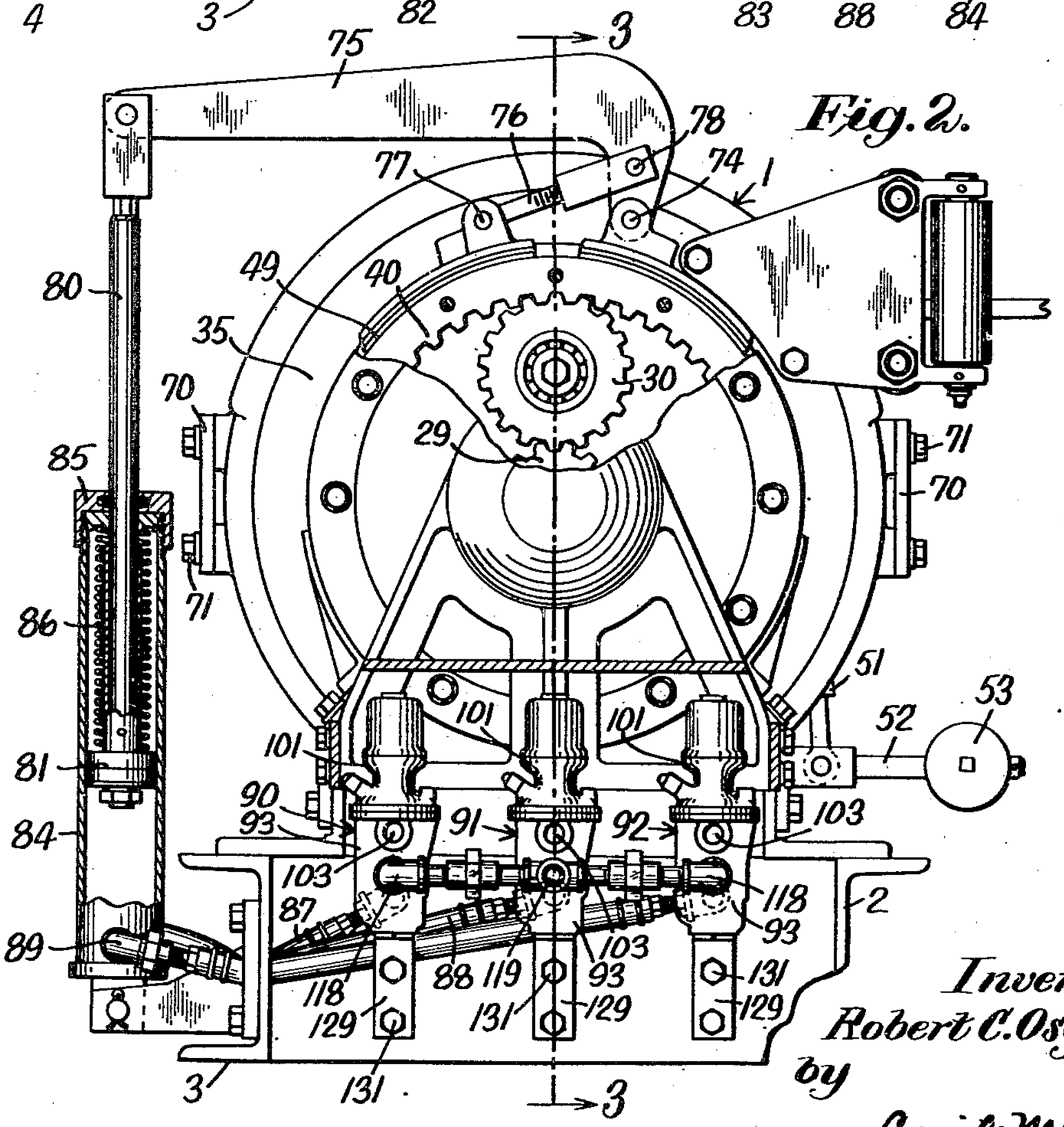

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Fig. 3.

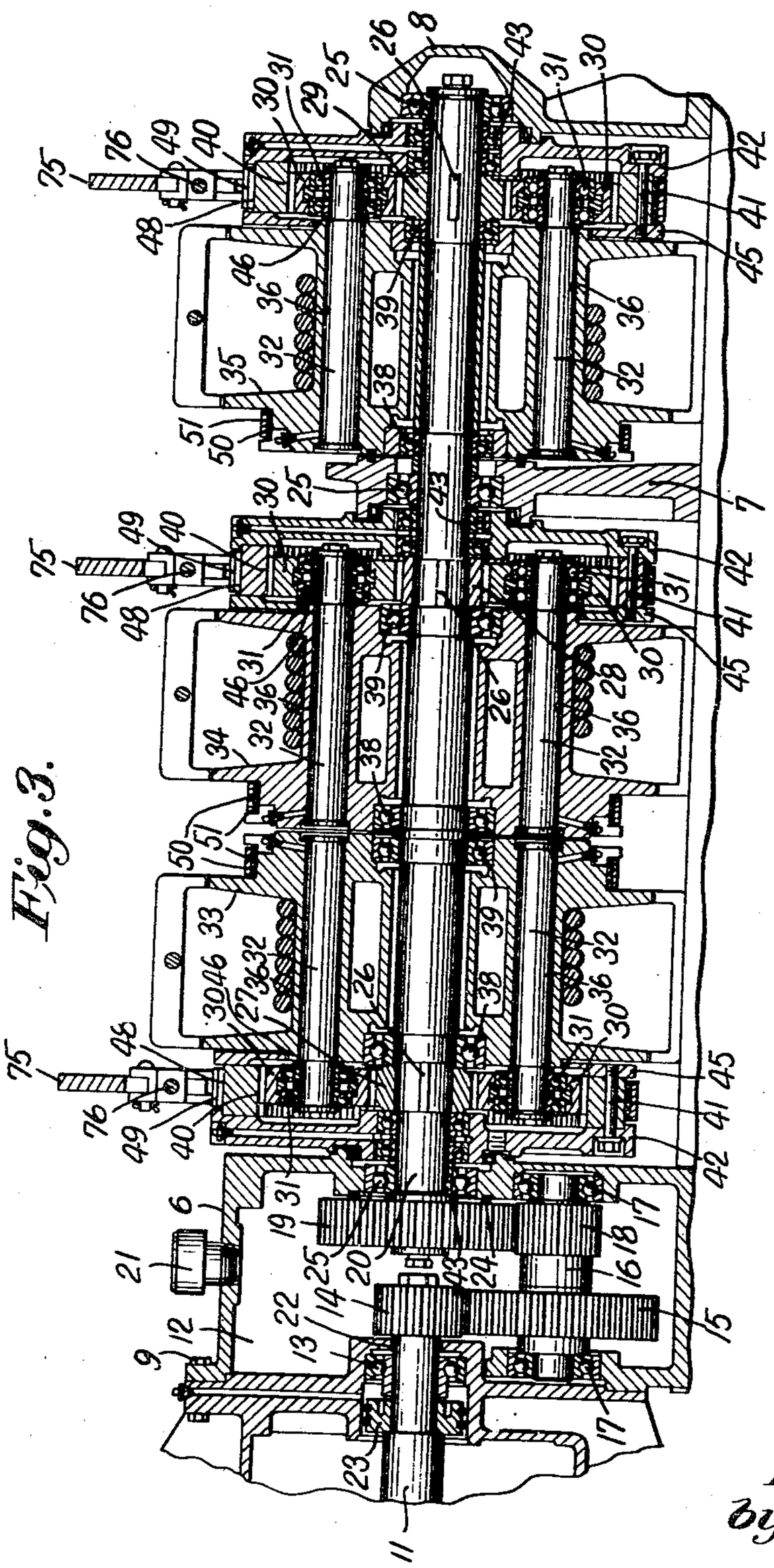

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Fig. 4.

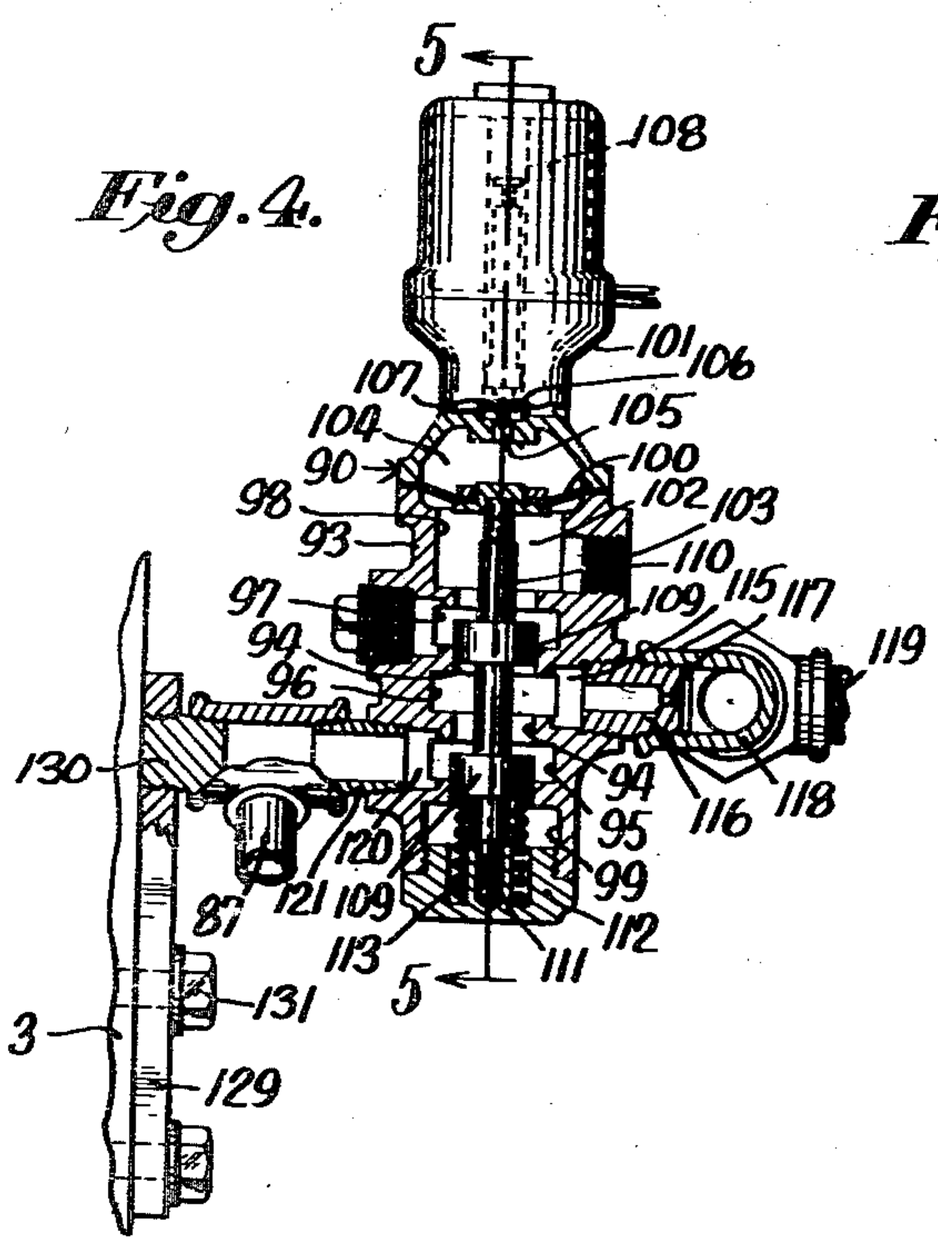


Fig. 5.

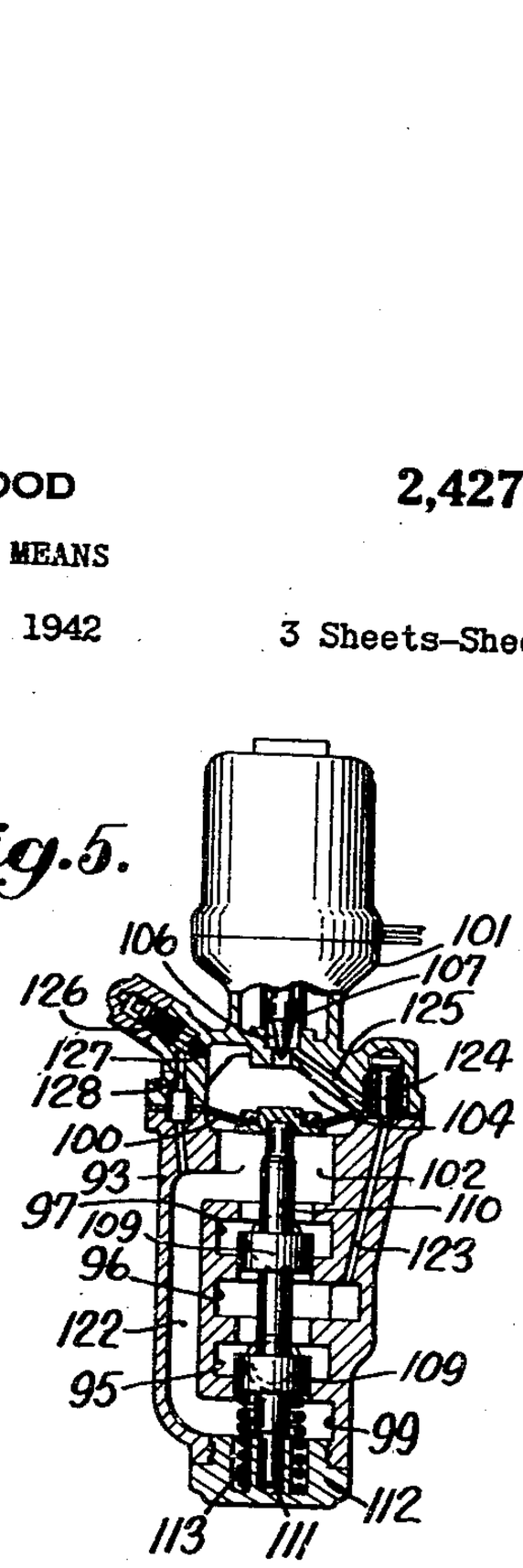
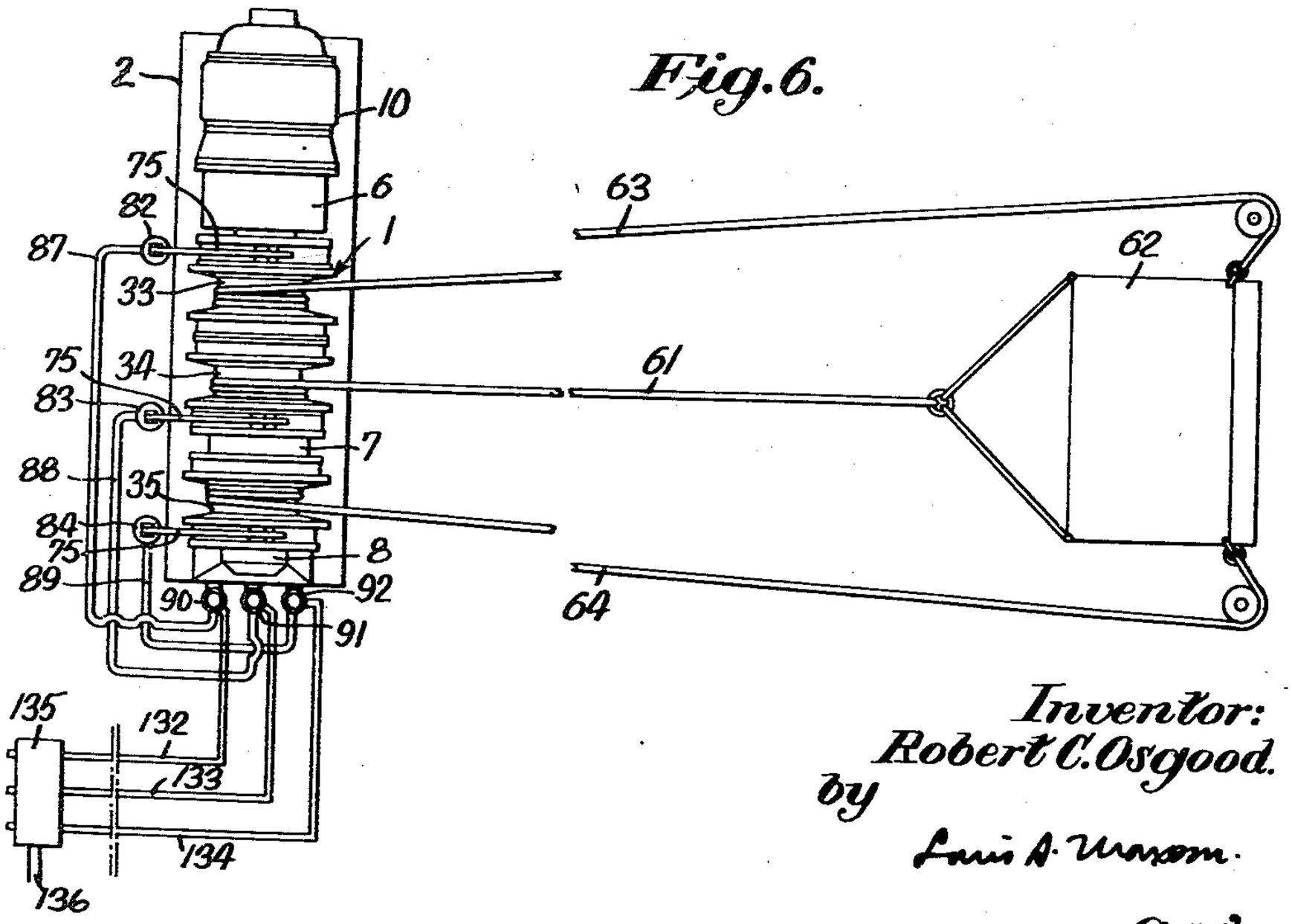


Fig. 6.



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Patented Sept. 16, 1947 2,427,471

UNITED STATES PATENT OFFICE

2,427,471

HOIST CONTROL MEANS

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Application January 12, 1942, Serial No. 426,417

5 Claims. (Cl. 254—185)

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This invention relates to hoisting mechanisms and more particularly to improved control means for such mechanisms.

During the operation of a hoist, it is necessary frequently to connect the drums in driven relation with driving means, and to disconnect them therefrom. It is desirable that the connection of the drums to the driving means be made gradual so that a sudden tension on the drum ropes is avoided, and so that a strain is not put on the driving connections. It is also desirable that a quick disconnection of the drums from the driving connections be made possible so that a fine control of the device operated by the drum ropes may be obtained.

It is an object of this invention to provide an improved hoist. It is another object to provide improved means for controllnig the operation of a hoist. Still another object is to provide improved control means for a hoist whereby a gradual connection of the drums in driven relation with driving means is obtained. Another object is to provide improved means for disconnecting quickly the drums of a hoist from driven relation with a driving means. Still another object is to provide improved means whereby an operator stationed at a point distant from a hoist may control its operation to obtain a gradual connection of the drums in driven relation with driving means and a quick disconnection of the drums from the same. Another object is to provide improved means for controlling the flow of operating fluid relative to a fluid actuated brake control device for a hoist. These and other objects of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a side elevational view of a hoist with which my invention is associated.

Fig. 2 is an enlarged end elevational view, with parts shown in section to facilitate illustration, of the hoist shown in Fig. 1.

Fig. 3 is an enlarged vertical sectional view of the hoist shown in Fig. 1, and taken on line 3—3 of Fig. 2, with parts omitted.

Fig. 4 is a vertical sectional view, with parts shown in full, of a control valve associated with the hoist of Fig. 1.

Fig. 5 is a vertical sectional view, with parts shown in full, of the control valve taken on line 5—5 of Fig. 4.

Fig. 6 is a diagrammatic plan view of the hoist with the remote control means therefor, and connected for controlling the operation of a scraper.

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In this illustrative embodiment of the invention, the improved control means is shown associated with a hoist generally designated 1, of the scraper loading type, but it is evident that this control means may be associated with hoists of various other types. The hoist is shown mounted on a base 2 having a plane bottom surface 3 and upturned ends 4 for slidably supporting the hoist over a mine floor, or for permanent association with a loading slide. Extending upwardly from the base and suitably secured thereto are supports 6, 7 and 8. Attached to the suppor. 6, as by bolts 9, is a motor 10 having its power shaft 11 (shown in Fig. 3) horizontally disposed and extending longitudinally of the base. The support 6 is recessed, as shown in Fig. 3, and the casing of the motor is bolted to this support and closes the opening of the recess to form a chamber 12. The motor shaft 11 is journaled in a bearing 13 supported by the motor casing and extends through an opening in the casing into the chamber 12. Fixed to the end of the power shaft within the chamber 12 is a motor pinion 14 which meshes with a gear 15 fixed to a shaft 16 journaled at its ends in bearings 17 carried by the support 6. Fixed to the shaft 16 is a spur gear 18 meshing with a gear 19 fixed to one end of a longitudinally extending horizontal driving or transmission shaft 20.

The chamber 12 is adapted to receive lubricant through an opening closed by a plug 21 to provide a lubricant bath for the bearings 17 and the gears arranged within the chamber. In order to prevent the escape of lubricant from the chamber along the power shaft 11, there is provided a close fit between the shaft and the motor casing at 22, and an oil ring 23 surrounding the shaft and engaging the walls of the opening through the motor casing. Arranged in an annular groove formed in the support 6 and surrounding the transmission shaft 20 is a sealing ring 24 engaging one face of the gear 19 for preventing the escape of lubricant from the chamber 12 along the transmission shaft.

In this instance, the horizontal transmission shaft 20 is arranged coaxial with the motor power shaft and is journaled in alined ball bearings 25 supported within the supports 6, 7 and 8. Secured, as by keys 26, to the shaft 20 are spur pinions 27, 28 and 29, each meshing with two planetary drum driver gears 30, as shown in Fig. 3. The gears 30 are journaled on ball bearings

31 supported by stub shafts 32 which are carried by cable winding drums 33, 34 and 35. The stub shafts are arranged in parallel bores 36 formed in the drum bodies with their axes lying in a diametric plane including the axis of the shaft 20 and at opposite sides of the shaft.

The drums 33 and 34 are arranged between the supports 6 and 7, and the drum 35 is arranged between the supports 7 and 8, and each drum is journaled on ball bearings 38, 39 supported by the transmission shaft 20. Surrounding the pairs of drum driver gears 30 and meshing with the latter, are internal gears 40 connected, as by bolts 41, to support members 42 which are journaled on bearings 43 carried by the shaft 20. Connected to the internal gears 40 at their sides adjacent the drums are annular flanged members 45 cooperating with annular shoulders 46 formed on the drums to enclose the drum driver gears in chambers which are adapted to contain a lubricant bath. On the outer periphery of each internal gear 40 is formed a brake surface 48 which is adapted to be engaged by a brake band 49 in a manner which will later be described. Formed on the end of each drum remote from the internal gear 40 is a braking surface 50 with which a brake band 51 cooperates. These brake bands 51 constitute spinning brakes for preventing rotation of the drums in an unwinding direction when the latter are disconnected from their driving means. To effect an application of the spinning brakes with the surfaces 50 on the drums, there is provided for each brake, as shown in Fig. 2, a lever 52 pivotally connected at its inner end to the base 2 and carrying an adjustable weight 53 at its outer end, and the brake band is connected at one of its ends to the lever 52 at a point between the pivoted end of the latter and the weight 53, while the other end of the band is connected by suitable means, not shown, to the base 2.

It will be seen that if the brake bands 49 are moved into engagement with the brake surfaces 48 on the internal gears to hold the latter stationary relative to the supporting frame for the hoist, the drum driver gears 30 will be caused to travel around the inner periphery of the internal gears as the driver gears are rotated by the gears connected to the transmission shaft 20. Since the driver gears are mounted on stub shafts fixed to the drums, the latter will be caused to rotate and wind in the cable or rope. The spinning brakes 51 are arranged so as to release themselves when the drums are being driven to wind in the cable. If the brake bands 49 are released from the surfaces 48, the internal gears will be caused to rotate on driving of the gears 30, and the drums will be held stationary by the slight drag of the spinning brakes and by the ropes on the drums. When the tensions on the ropes increase, the drums are rotated in an unwinding direction and the spinning brakes take a firmer grip so that the drums will be stopped again when rope tensions decrease.

In Fig. 6 the hoist is shown with its drum 34 having a pull rope 61 wound thereon and extending to a scraper 62 to which it is connected. Wound on the drums 33 and 35 are tail ropes 63 and 64 extending around pulleys anchored at distant points and connected to the scraper 62.

Surrounding each of the drums is a rope guard 65 having depending bottom flanges 66, as shown in Fig. 1, which are attached to the base frame 2, as by bolts 67. Each of the rope guards is provided with top and bottom openings 68 through which the rope wound on the drum may be extended from the top or bottom of the drum, respectively, and the opening not being used may be closed by a cover plate 69. In order to brace the rope guards in their upright positions, there is provided a plate 70 connected to each of the rope guards, as by bolts 71.

The means for controlling the application of the brakes 49 to the outer surfaces of the internal gears 40 will now be described. As shown in Fig. 2, the brake 49 controlling the driving of the drum 35 has pivotally connected to one of its ends, at 74, a lever 75. An adjustable link 76 is pivotally connected at 77 to the other end of the brake 49, and is pivotally connected at 78 to the lever 75 so that on upward swinging movement of the lever the brake 49 is pulled tightly around the internal gear 40 for holding the latter against rotation. The brakes 49 for controlling the driving of the drums 33 and 34 are similarly provided with operating levers 75 and links 76. Pivotally connected to the outer end of each of the levers 75 is rod 80 having a piston 81 connected to its lower end. The pistons 81 for the brakes controlling the driving of the drums 33, 34 and 35 are received, respectively, within cylinders 82, 83 and 84. Connected to the upper end of each of the cylinders is a packed cylinder head 85 through which the rod 80 extends, and arranged between each cylinder head and piston is a coil spring 86 which continuously urges the piston toward the lower end of the cylinder for moving its lever 75 in a direction to effect a release of the brake 49. Communicating with the lower ends of the cylinders 82, 83 and 84 are conduits 87, 88 and 89, respectively, and these conduits are connected to valve devices, generally designated 90, 91 and 92, which control the flow of pressure fluid relative to the cylinders beneath the pistons 81.

The valve devices 90, 91 and 92 are similar in construction, and each comprises, as shown in Figs. 4 and 5, a valve casing 93 provided with a bore 94 having spaced annular grooves 95, 96 and 97 formed in the walls thereof, the bore at its ends opening into enlarged bores 98 and 99 at the ends of the casing. Arranged at the top of the casing is a diaphragm 100 clamped in position by a housing 101 secured to the valve casing in any suitable manner. The diaphragm cooperates with the bore 98 to form a chamber 102 which is connected to atmosphere through an exhaust port 103. Between the diaphragm and the housing 101 is a chamber 104 opening through a port 105 into a chamber 106 which contains a valve 107 of the plunger type for controlling communication between the chambers 104 and 106. Arranged within the upper portion of the housing 101 is an electromagnet 108 which is adapted, when energized, to lift the plunger valve 107 for opening the port 105. Reciprocable within the bore 94 are valve pistons 109 connected together in spaced relation by a piston rod 110 which is connected at its upper end to the diaphragm 100 and which has a reduced portion at its lower end reciprocably guided in a bore 111 formed in a plug 112 threaded into the bore 99. A coil spring 113 surrounds the lower portion of the piston rod 110 and acts between the plug 112 and the lower piston 109 to urge the valve pistons and the diaphragm toward their upper positions. Opening through the valve casing into the annular groove 96 is a port 115 into which there is threaded a nipple 116 having a

restricted passage 117. These nipples may be changed to provide the desired flow area, different nipples having different sized ports 117 being of course possible. Threadedly connected to the nipple is a conduit 118 communicating with a pressure fluid supply conduit 119. Opening through the valve casing into the annular groove 95 is a port 120 to which one of the conduits 87, 88 and 89 is connected, as by a connecting element 121. Formed in the walls of the valve casing, as shown in Fig. 5, is a passage 122 connecting the bore 99 in communication with the chamber 102, and a passage 123 connecting the groove 96 past a check valve 124 to a passage 125 formed in the housing 101 and opening into the chamber 106 containing the valve 107. Within the housing 101 is an adjustable needle valve 126 for controlling the flow of fluid from the chamber 104 through a port 127 to a passage 128 opening into the chamber 102. The valve devices are connected to plates 129 by members 130 threaded into openings in the plates, as shown in Fig. 4, and the plates are connected to the end of the base 2 as by bolts 131. Connected to the electromagnets of the valve devices 90, 91 and 92 are circuits 132, 133 and 134 leading to a remote control switch 135 which is adapted to connect the circuits selectively to a power line 136.

When the control switch is operated to connect one of the circuits to the power line, the electromagnet connected in that circuit is energized and lifts the valve 107 to open the port 105. Pressure fluid is supplied continuously from the supply conduit 119 through the restricted port 117 to the annular groove 96, and, when the valve 107 is moved from the port 105, pressure fluid flows from the groove 96 through the passage 123, past the check valve 124, through the passage 125, and through the port 105 to the chamber 104 where it acts on the top of the diaphragm 100 to force the valve pistons 109 downwardly against the spring 113 and place the groove 96 in communication with the groove 95. Pressure fluid is delivered from the groove 95 through one of the conduits 87, 88 and 89, depending on which valve device is operated, to the lower end of one of the cylinders, 82, 83 and 84 for moving the piston in that cylinder upwardly and effecting an actuation of one of the brakes 49 to its braking position. Due to the restricted passage 117, the supply of pressure fluid will be such as to effect only a gradual application of the brake 49 for gradually placing the load of the hoist on its driving motor.

If it is desired to disconnect one of the hoist drums from driven relation with the motor, the control switch 135 is operated to open the circuit to the electromagnet of one of the valve devices so that its valve 107 is released and closes the port 105 to prevent the flow of pressure fluid to the chamber 104 above the diaphragm. Pressure fluid escapes continuously from the chamber 104 past the needle valve 126, through the passage 128 to the chamber 102 where it is vented to atmosphere through the vent port 103. The rate of escape of pressure fluid from the chamber is regulated by adjustment of the needle valve so that it is somewhat less than the rate of supply to the chamber when the valve 107 is open, but is sufficient to reduce the pressure in the chamber 104, soon after the valve 107 is closed, to a value at which the spring 113 moves the valve pistons 109 upwardly cutting off the supply of pressure fluid to the brake control cylinder and connecting this cylinder in communication with the bore 99 from which the pressure fluid is rapidly vented to atmosphere through the passage 122 and the vent port 103.

By operating the valve devices through the remote control switch so that the drums 33 and 35 are caused to rotate in a winding direction, and so that the drum 34 may unwind, the drum ropes 63 and 64 are wound in while the rope 61 is paid out, and the scraper 62 is moved outwardly from the hoist. To move the scraper in the opposite direction, the valve devices are operated to cause the drum 34 to rotate in a direction to wind in its rope while the drums 33 and 35 are permitted to rotate in an unwinding direction. As any one of the drums is connected in driven relation with the motor, its load is gradually picked up due to the restricted flow of pressure fluid to its brake operating piston, and the stalling of the motor is prevented. The drums are disconnected quickly from driven relation due to the rapid venting of pressure fluid from the brake operating pistons, and a close control of the scraper or other cable operated device is made possible.

As a result of this invention there are provided improved means for controlling the operation of a hoist. It will be noted that by reason of the improved control means, a gradual loading of the hoist motor is obtained when the hoist drums are connected in driven relation with the motor, and that the drums may be quickly disconnected from driven relation with the motor, when desired. It will further be noted that the improved control means are adapted to provide the desired control of operation of the hoist by an operator stationed at any distant point. Other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms which do not depart from its spirit and the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a hoisting machanism, in combination, a hoisting drum, driving means for said drum, fluid actuated means for controlling the connection of said drum in driven relation with said driving means, and means including a control valve for controlling the flow of fluid to said fluid actuated means, said control valve including a valve casing having fluid supply and exhaust spaces therein, a valve member movable in said casing to connect said fluid supply and exhaust spaces selectively to said fluid actuated means, restricted passage means for delivering pressure fluid to said fluid supply space, fluid actuated means for positioning said valve member, valve controlled passage means for supplying operating fluid to said last mentioned fluid actuated means, and means for restrictedly venting operating fluid from said last mentioned fluid actuated means.

2. In a hoisting mechanism, in combination, a hoisting drum, driving means for said drum, fluid actuated means for controlling the connection of said drum in driven relation with said driving means, and means including a control valve for controlling the flow of fluid to said fluid actuated means, said control valve including a valve casing

having fluid supply and exhaust spaces therein, a valve member movable in said casing to connect said fluid supply and exhaust spaces selectively to said fluid actuated means, restricted passage means for delivering pressure fluid to said fluid supply space, means for freely venting said exhaust space, fluid actuated means for positioning said valve member, means including an electromagnetically operated valve for controlling the supply of operating fluid to said last mentioned fluid actuated means, remote control means for said electromagnetically operated valve, and means for restrictedly venting operating fluid from said last mentioned fluid actuated means

3. In a hoisting mechanism, in combination, a hoisting drum, driving means for said drum, fluid actuated means for controlling the connection of said drum in driven relation with said driving means, and means including a control valve for controlling the flow of fluid to said fluid actuated means, said control valve including a valve casing having fluid supply and exhaust grooves therein, a valve member movable in said casing to connect said fluid supply and exhaust grooves selectively to said fluid actuated means, means including a diaphragm for controlling the position of said valve member, restricted passage means for delivering pressure fluid to said fluid supply groove, valve controlled passage means for supplying pressure fluid to said diaphragm, and means for restrictedly venting pressure fluid from said diaphragm.

4. In a hoisting mechanism, in combination, a hoisting drum, driving means for said drum, fluid actuated means for connecting said drum in driven relation with said driving means when pressure fluid is supplied thereto, means including a control valve movable to fluid supply and fluid venting positions for controlling the flow of fluid relative to said fluid actuated means, said last mentioned means operative in the fluid supply position of said control valve to supply a restricted

flow of fluid to said fluid actuated means and operative in the venting position of said control valve to exhaust fluid freely from said fluid actuated means, fluid actuated means for positioning said control valve, means including a valve member for controlling the flow of fluid relative to said last mentioned fluid actuated means, and means for controlling said valve member.

5. In a hoisting mechanism, in combination, a hoisting drum, driving means for said drum, fluid actuated means for connecting said drum in driven relation with said driving means when pressure fluid is supplied thereto, means including a control valve movable to fluid supply and fluid venting positions for controlling the flow of fluid relative to said fluid actuated means, said last mentioned means operative in the fluid supply position of said control valve to supply a restricted flow of fluid to said fluid actuated means and operative in the venting position of said control valve to exhaust fluid freely from said fluid actuated means, fluid actuated means for positioning said control valve and operative on the supply of pressure fluid thereto for moving said control valve to its fluid supplying position, means including a valve member for controlling the flow of fluid to said last mentioned fluid actuated means, and remote control means for controlling said valve member.

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