

June 20, 1961

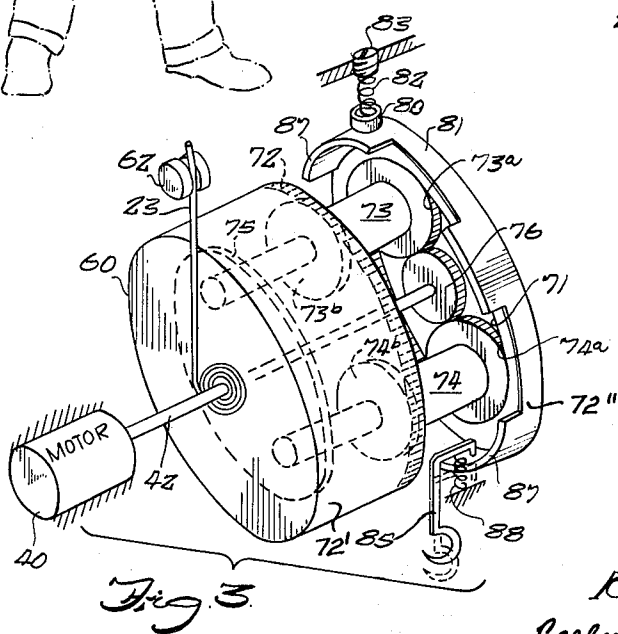
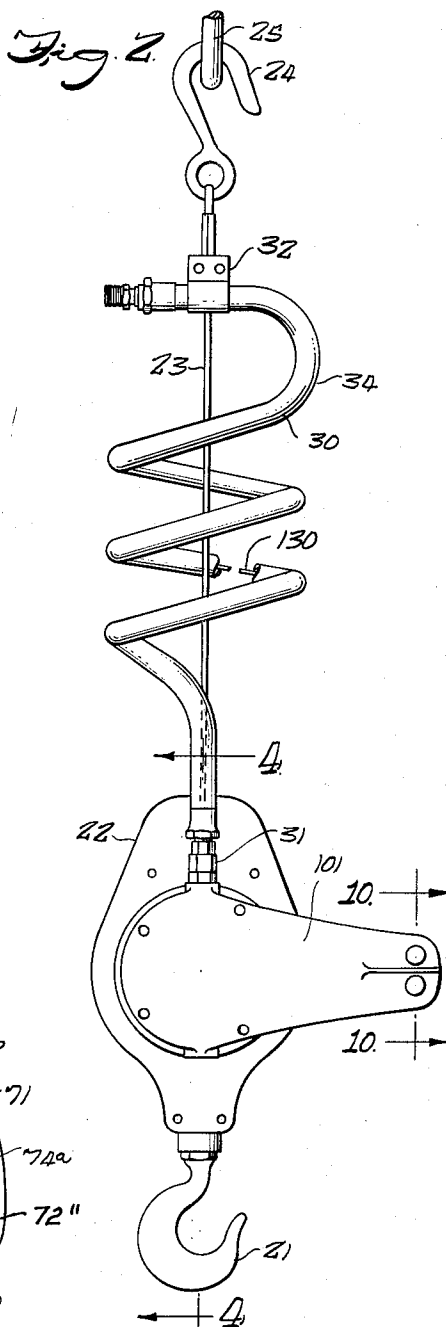
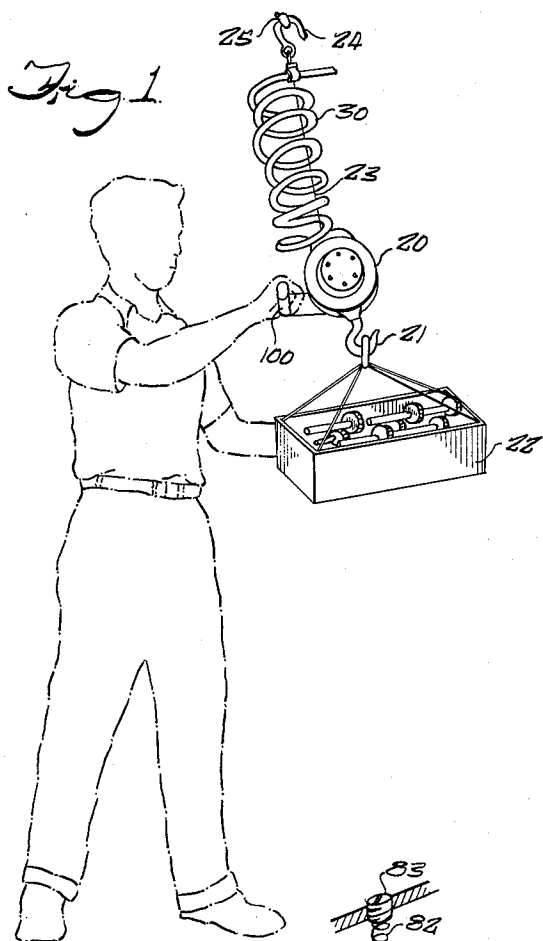
R. E. SMITH

2,989,288

AIR HOIST

Filed June 3, 1955

3 Sheets-Sheet 1



Inventor
Ralph E. Smith
Carlson Pitzer Hubbard & Neale
Attorneys

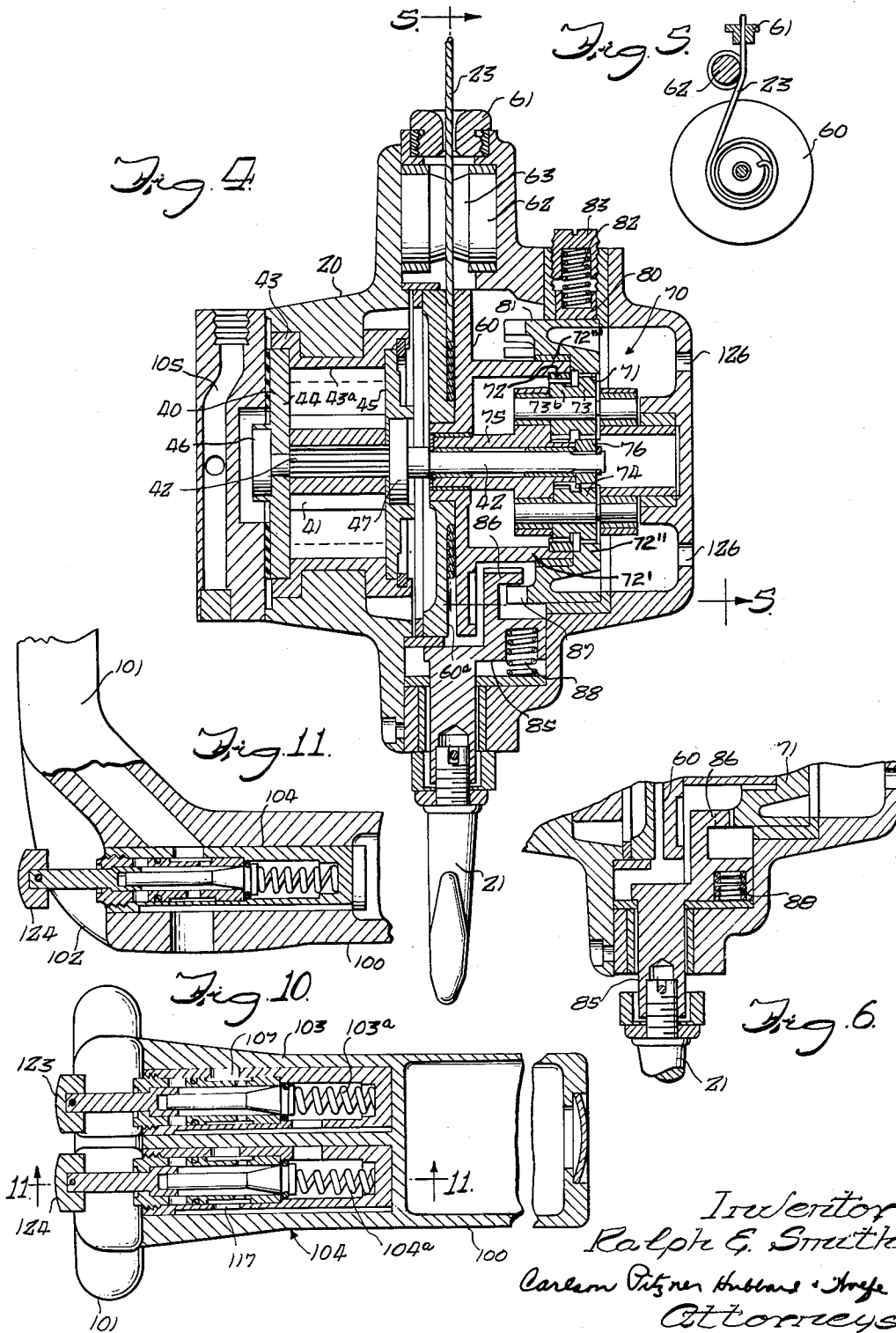
June 20, 1961

R. E. SMITH
AIR HOIST

2,989,288

Filed June 3, 1955

3 Sheets-Sheet 2



June 20, 1961

R. E. SMITH

2,989,288

AIR HOIST

Filed June 3, 1955

3 Sheets-Sheet 3

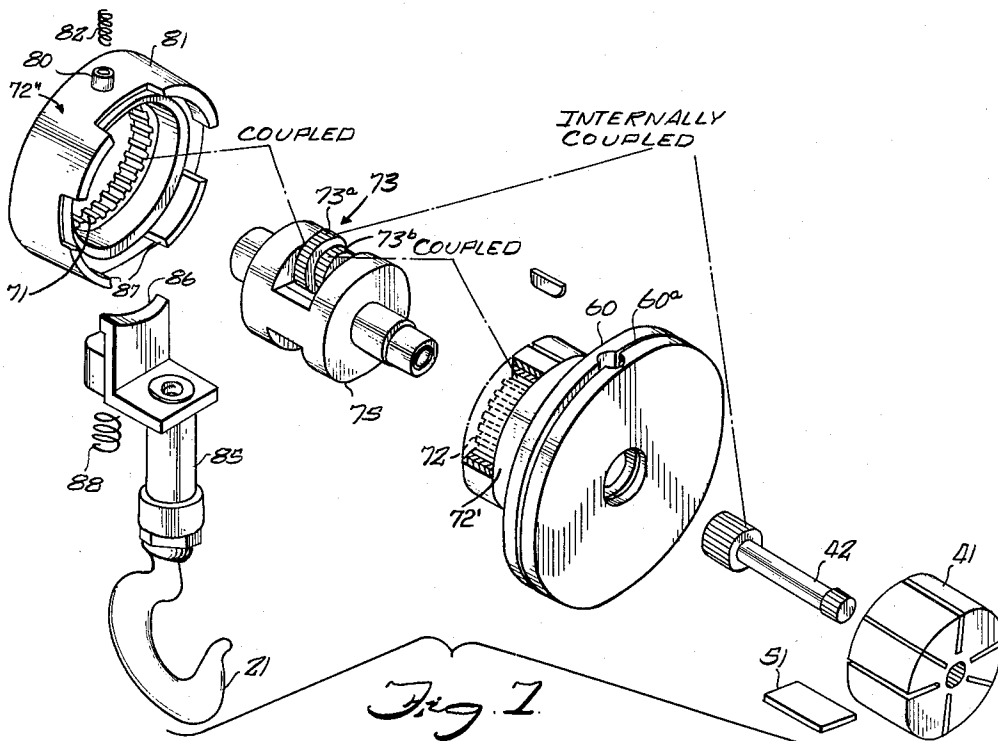
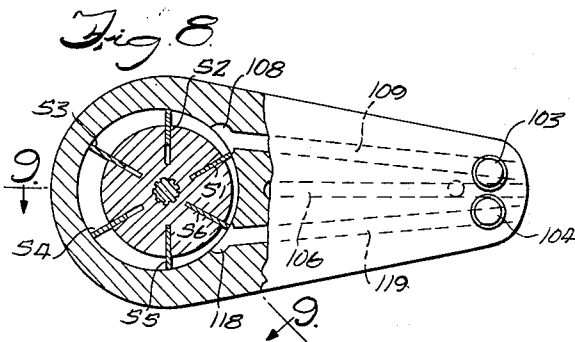
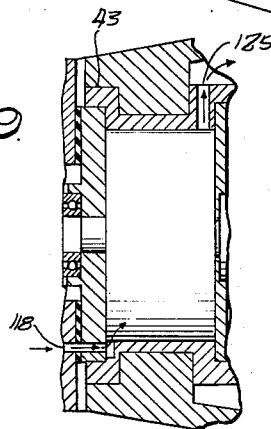


Fig. 9.



Inventor
Ralph E. Smith
Carlson Fitzner Hubbard & Hoyle
Attorneys

1

2,989,288
AIR HOIST

Ralph E. Smith, Spring Lake, Mich., assignor to Gardner-Denver Company, Quincy, Ill., a corporation of Delaware

Filed June 3, 1955, Ser. No. 513,126
13 Claims. (Cl. 254-168)

The present invention relates to hoists and more particularly to a light-duty hoist intended for manual manipulation.

It is an object of the present invention to provide an improved hoist in which the power unit, together with its associated hook, is suspended at the lower end of a fixedly anchored supporting cable, the hoist being referred to herein for convenience as of the "inverted" type. It is another object of the invention to provide a hoist of the above type which is ideally suited for picking up loads under manual guidance which are relatively small, say, on the order of ten pounds to about two hundred pounds and for enabling such loads to be swung from the point of overhead support laterally through a useful range. It is a related object to provide a hoist in which the load may be easily controlled in its vertical movement and guided horizontally for accurate placement as required in the lifting of work pieces from the floor or platform to a position on a bench or a machine. It is still another object to provide a hoist which enables one hand to be used both for guiding and for determining direction and rate of lifting or lowering, the other hand being free to control other parts or machinery.

It is a further object to provide a hoist which is especially useful for repetitious operations involving the picking up and putting down of loads formerly requiring the services of a husky workman. It is a related object to provide a hoist which enables women to take care of production jobs formerly requiring men and which enables either a man or woman to work more comfortably and without fatigue.

It is a still further object to provide a hoist which may be drawn downwardly by application of light manual pressure for hooking on to a load and which makes use of the natural bending and lifting motion of the body without, however, requiring the normal lifting effort, permitting the operator to follow his natural impulse to reach down quickly to pick up a work piece. It is an object to provide a manually manipulated hoist of the inverted type, i.e., having a combined hook and power unit, which may be drawn downwardly without applying motive power and with an easy free-wheeling action simulating a condition of perfect counterbalance.

It is an important object of the present invention to provide an inverted hoist which may free-wheel downwardly into a load engaging position but which causes positive lifting of the load simply by pressing the "raise" control button and without any intentional clutching or engaging action on the part of the operator. It is another object to provide an inverted hoist in which power engagement is not only automatic but direct and positive, insuring against reversion to the free-wheeling condition or dropping of load. For this and other reasons which will be apparent as the discussion proceeds it is an object of the invention to provide a hoist which is safe and foolproof in operation and which may be manipulated safely by an operator without training or skill. It is yet another object of the invention, related to the foregoing, to provide a hoist in which the cable remains taut at all times and under all conditions thereby avoiding the difficulties of snarling which so frequently accompany use of a cable-type hoist by inexperienced hands.

It is furthermore an object to provide a hoist which is light and compact and which is sufficiently inexpensive, as

2

to justify use by a single operator at a single working position at a bench, machine, or station in a production line. It is an object to provide a hoist of the above type which makes use of an efficient high-speed motor and in which speed reduction to normal and safe lifting speeds is brought about by a novel arrangement of speed reducing elements having a minimum number of parts. It is an object to provide a hoist which is not only rapid and efficient in operation but which is easy to install, requiring no overhead tracks or the like, and which may be easily and quickly transferred or removed for bench work when servicing becomes necessary.

In one of its aspects, it is an object of the invention to provide a hoist particularly suited for powering by a compressed air motor and in which the air line is constructed and arranged to follow the power unit of the hoist while remaining in an out-of-the-way position free of damage or entanglement with nearby objects. In this connection it is also an object to provide an air-operated hoist which requires little or no maintenance and in which all the parts are arranged for effective lubrication by oil in the exhaust air and in which the noise level is substantially lower than that normally associated with hoists of the air-driven type.

It is an object of the present invention to provide an improved hoist of the inverted type which remains in balance under all conditions and regardless of the amount of cable which has been payed out.

Other objects and advantages of the invention will become apparent upon reference to the attached detailed description and upon studying the drawings, in which:

FIGURE 1 is a general view of a hoist constructed in accordance with the present invention and showing the manner in which the hoist and load are manipulated in use.

FIG. 2 is an elevation of the hoist of FIG. 1 together with its associated cable and conduit.

FIG. 3 is a diagram, partially schematic, for facilitating understanding of the internal mechanism.

FIG. 4 is a vertical section taken along the line 4-4 in FIG. 2.

FIG. 5 is a diagram showing the path of the cable within the hoist body as viewed along the line 5-5 in FIG. 4.

FIG. 6 is a fragmentary view showing the position of the hook and associated latch when a load is applied.

FIG. 7 is an exploded perspective of the main elements in the reel driving mechanism.

FIG. 8 is a fragmentary view, partially schematic, of the motor and air supply conduits.

FIG. 9 is a section taken through the motor along the line 9-9 in FIG. 8, showing the motor inlet and exhaust passages.

FIG. 10 is a section taken through the handle along the line 10-10 in FIG. 2, showing the details of the valve construction.

FIG. 11 is a fragmentary view of the handle taken along the line 11-11 in FIG. 10.

While the invention has been discussed in connection with the preferred embodiment, it will be understood I do not intend to limit the invention thereto but intend to cover all alternative constructions falling within the spirit and scope of the appended claims.

Turning to the drawings and particularly FIGS. 1 and 2, there is shown a hoist constructed in accordance with the present invention having a body 20. Arranged at the bottom of the hoist body is a hook 21 for supporting a load 22. Extending upwardly from the hoist body and in line with the hook 21 is a supporting cable 23 having a hook 24 for engagement with a fixed overhead support 25. For the purpose of supplying power to the hoist body 20 a conduit 30 is provided encircling the cable.

23. In the present instance the conduit is in the form of an air hose coupled to the hoist body at its lower end by a suitable fitting 31 and anchored to the upper end of the cable by a clamp or the like 32. Air is fed into the conduit 30 from any suitable high pressure source which preferably includes means for imparting lubricant to the air stream.

The internal mechanism of the hoist is shown in FIG. 4 which is a vertical section in the plane of the motor drive shaft; however, it will be helpful in referring to FIG. 4 to keep in mind FIG. 3 which illustrates the operation diagrammatically and FIG. 7 which shows some of the parts in perspective. Arranged at one side of the hoist body is an air motor 40 having a rotor 41 and shaft 42. The motor is of conventional rotary vane type. For the present, it will suffice to say that it includes a cylinder 43 mounting end plates 44 and 45, which plates carry bearings 46, 47 respectively supporting the motor shaft 42. The rotor is of the usual slotted construction having blades 51-56 (FIG. 8), the outer ends of which engage the eccentric inner surface 43a of the cylinder 43. More detailed reference will be made at a later point to the means for admitting air to and exhausting air from the motor. It will be understood by one skilled in the art that the air is admitted between the rotor and cylinder at a point where the inter-blade space is a minimum and the pressure, acting differentially on the blades, urges the rotor around to a point where the air is exhausted, the blades acting in concert to rotate the shaft 42 at high speed.

Prior to discussing the speed reduction gearing, reference may be made to the reel 60 on which the cable 23 is wound. In accordance with one of the aspects of the present invention, the reel 60 is of a disk shape having a relatively narrow slot 60a just slightly larger than the diameter of the cable so that the cable is wound upon the reel in spiral formation. For the purpose of leading the cable 23 from the hoist body, an annular guide or fair-lead 61 is provided which is substantially centered over the reel 60 as shown in FIG. 4. For maintaining the cable centered in the opposite direction a circular guide or roller 62 is provided having a slot 63, the root of which is aligned with the center of the fair-lead 61. Consequently, the cable tends to be fed into the fair-lead in aligned position regardless of the amount of cable stored on the reel 60.

In accordance with one of the important aspects of the present invention a speed-reducing driving train is connected between the motor and the reel having a clutch for enabling free-wheeling of the reel together with means responsive to the presence of a load on the hook for automatically engaging the clutch to permit raising of the load. The invention also contemplates, in association with the above, friction means for inhibiting the paying out of cable when the driving train is in its free-wheeling condition so that the body of the hoist is supported in fixed position on the cable, while permitting the hoist to be drawn quickly downward by light manual effort preparatory to engaging the load. In the present instance, the speed reducing gearing employed between the motor shaft and the reel 60 is of the differential type and is indicated generally at 70. The gearing includes what may be termed, for convenience, a "fixed" ring gear 71 and a rotatable ring gear 72, the rotatable ring gear being mounted inside an annular sleeve 72' which is integral with the reel 60 as shown. Such ring gears are arranged side by side with the teeth thereof spanned and in mesh with a pair of planetary or idler pinions 73, 74 mounted in a rotatable cage 75. The motor shaft 42 is centrally arranged within the cage 75 and includes a drive pinion 76 at its outer end for meshing with the idler pinions 73, 74. The annular sleeve 72' is rotatably mounted within the annular member 72'' which surrounds the sleeve. In the present instance a bushing 72''' which is held within the annular member, allows the annular sleeve to turn

with a minimum of friction and, as shown, the "fixed" ring gear 71 is formed inside the annular member but spaced axially of the bushing.

To bring about the desired high ratio of speed reduction each of the idler pinions consists of two integral portions of unlike diameter arranged side by side, the two portions in the case of the idler pinion 73 being designated at 73a and 73b, respectively. The pitch diameter of the two ring gears correspondingly differs by a small amount. In a practical case, the pitch diameter of the fixed ring gear 71 may be 2.100 inches while the pitch diameter of the movable ring gear 72 is 2.033 inches. Upon rotation of the motor shaft in a given direction, the movable ring gear will tend to turn very slowly but with high torque in the same direction, provided that the fixed ring gear 71 remains fixed in position relative to the body of the hoist.

For the purpose of applying the controlled frictional drag to the cable under the free-wheeling condition so as to permit paying out of the cable when the hoist body is drawn manually downward, a friction drag is applied to the annular member 72'' and thus to the fixed ring gear 71. In the present instance, a friction shoe 80 is used, received in the wall of the hoist body as shown in FIG. 4 and riding on the periphery 81 of the annular member 72''. To adjust the amount of friction a coil spring 82 is provided having an adjusting screw 83. Since the driving train is non-reversible, i.e., non-retrograde, drawing the hoist body downwardly against the force of friction is accompanied by bodily rotation of the driving train including the two ring gears 71, 72, the differential cage 75 and rotor 41 of the motor.

In practicing the invention, means are further provided, as stated above, for positively clutching the driving train incident to applying a load to the hook 21. Such clutching means in the present instance includes a locking plunger 85 for locking the annular member 72'' and thus the fixed ring gear 71 in place, the plunger having a lug 86 which registers with spaced teeth 87 projecting from the face of the annular member. As shown in FIG. 4, the locking plunger 85 is mounted for limited vertical movement and is normally urged to the upper or disengaged position by means of a coil spring 88. Since the load hook 21 is secured to the lower end of the locking plunger 85, applying a load to the hook causes the locking member to be drawn downwardly into the position shown in FIG. 6, thereby causing the lug 86 to move into blocking relation with respect to one of the teeth 87 on the annular member. With the ring gear 71 locked in place, the path of power transfer is complete. Thus, rotation of the motor shaft 42 causes planetary rotation of the idler pinions 73, 74 relative to the fixed ring gear 71. And because of the difference in diameter of the two ring gears, the movable ring gear 72 is slowly advanced to reel in or pay out the cable depending upon direction of rotation of the motor.

In analyzing the operation of the driving train, it is helpful to consider it as a differential having an input element in the form of the motor shaft 42, an output element in the form of the movable ring gear 72 and a control element in the form of the annular member 72'', and the fixed ring gear 71. When the fixed ring gear is locked in place, the path of power flow is complete and rotation of the motor shaft causes slow positive rotation of the reel. However, if the fixed ring gear 71 were permitted to spin freely, rotation of the motor shaft would simply cause idle rotation of the gearing and no torque would be applied to the reel. The presence of the friction shoe 80 establishes an intermediate condition, i.e., the gearing is locked in place for small values of transmitted torque but yields when a pre-determined torque is exceeded. Thus, when no power is applied to the motor 40 and with the gearing stationary, sufficient reaction torque is transmitted to the reel 60 so that the body of the hoist is suspended at a fixed position relative

to its supporting cable 23. The friction is adjusted by turning the adjusting screw 83 so that only light manual pressure is required in order to overcome the frictional drag and to move the body of the hoist downwardly relative to the cable for engagement of a load by the hook. Starting the motor to raise the hoist body is accompanied by movement of the lug 86 into locking position between the teeth 87 so that from that point on the fixed ring gear is positively locked in place relative to the body of the hoist. Continued rotation of the motor is thus effective, acting through the reduction gearing, to rotate the reel 60, thus winding up the cable 23 to raise the load. It will be apparent that with the ring gear 71 locked by the presence of the load, it will be impossible to restore the driving train to the unlocked condition until the load is removed from the hook. Such unlocking is generally brought about by reversing the rotation of the motor by the valving to be described below, whereupon the hoist is lowered for depositing of the load on a suitable support.

It is to be particularly noted that locking of the control element (ring gear 71) occurs automatically upon application of the load, thereby "taking over control" from the friction shoe and no intentional locking movement is required on the part of the operator.

It is part of the present invention to provide a novel guiding and valving arrangement thereby permitting the hoist to be completely controlled and positioned, both vertically and horizontally, by one hand of the operator leaving the other hand free to control the load itself or to control associated parts or machinery. In the present instance, the guiding arrangement includes a horizontally arranged handle 100 which is laterally spaced from the body of the hoist, being connected thereto by an integral arm or extension 101, the handle and arm being arranged at approximately right angles to form an elbow 102. Located at one end of the handle, in the present instance at the elbow 102, are air control valves 103, 104. Both of these valves are supplied with compressed air from the helical conduit 30, the air being fed into the body of the hoist through a passage 105 (FIG. 4) which is connected to a passage 106 provided centrally within the arm 101. For rotation of the motor in the "raise" direction the valve 103 has its outlet 107 connected to a motor inlet port 108 via a passage 109. In similar fashion, the valve 104 has its outlet 117 connected to inlet port 118 on the motor via a passage 119. The valves 103, 104 are controlled by buttons 123, 124 (FIG. 10). The specific valve construction does not per se form a part of the present invention. For one skilled in the art it will suffice to say that the valves are so arranged that the amount of air supplied to the motor is dependent upon the degree to which the valve buttons 123, 124 are depressed against the force of return springs 103a, 104a, respectively. Preferably also, the non-pressurized one of the two inlet ports is vented to provide what is termed in the art "secondary" exhaust.

In carrying out the invention, the primary exhaust from the motor 40 is vented into the body of the hoist through a vent opening 125 (FIG. 9) formed in the motor housing. In view of the turbulence and throttling effect which occurs at the motor, the pressurized exhaust air emitted from the motor into the hoist body contains finely vaporized lubricant which is dispersed throughout the interior of the hoist body, effectively lubricating all of the working parts. The exhaust air also serves to keep the hoist and its working parts cool even where used on a continuous basis, the exhaust air finally escaping through ports 126 (FIG. 4) provided in the side wall. It is found that one important by-product of the present arrangement is that the tortuous path through which the exhaust air must flow acts to muffle the sound of the air escaping from the motor so that the hoist operates

much more quietly than conventional air hoists or other conventional air-operated devices.

The advantages of the above construction will be apparent upon considering a typical cycle of operation. The hoist will normally be stored in an up-raised position out of the way of the operator but with the handle 100 easily accessible. In order to raise a load, for example, a box of machine parts, from the floor or a pallet, the operator simply grasps the handle, pulling the body 20 of the hoist downwardly as rapidly as desired. This requires only a light force determined by the adjustment of the friction drag 83. This downward, free-wheeling movement is accomplished without applying power to the motor. The operator may follow his natural impulse to reach quickly to the floor to raise the object without the hoist offering any impediment. The "feel" of the hoist under such conditions is just as though the hoist were accurately counterbalanced. The hook is quickly engaged with the load simply by pushing the body of the hoist a small amount laterally. The load may, if desired, be located at a distance of several feet from the point of suspension, the light weight of the hoist making it possible to swing the hoist pendulum-wise into engagement with the load. Following this, the "raise" button 123 is depressed. As we have seen above, this causes the hook to be shifted outwardly relative to the body of the hoist through a short distance and causes automatic engagement of the positive lock permitting transmission of the torque to the reel 60 which proceeds to wind up the cable 23 at a rate which is under the control of the operator. The speed may be easily controlled at the same time that the hand of the operator is guiding the body of the hoist to a position where the load is to be deposited. If necessary, the combined hoist and load may be swung pendulum-wise to the final location, with the free hand of the operator being used to either guide the load on to the position or to operate other parts or mechanisms. The effectiveness of the one hand control is brought out by the fact that the hoist may be efficiently and safely operated even when the operator is disabled and lacks the use of a second hand. After the load has been raised to the desired height, the "lower" button 124 is depressed which allows the load to settle into final position thereby freeing the hook 21.

Having understood the construction and operation, it will be apparent that the hoist remains constantly in a condition of balance, with the hook aligned with the cable at all times and regardless of the amount of cable which remains on the reel, and regardless of the amount of loading. Nor is there any tendency for the cable to snare as in conventional hoists. The cable, since it is loaded by the weight of the hoist body, keeps taut, but, even in the event of momentary slackening, the turns on the reel maintain the desired spiral relationship for unwinding in orderly fashion.

The arrangement described above, is particularly effective for machine operations and the like requiring the lifting of loads in the range of twenty to one hundred pounds which are conventionally handled by a machine operator, as well as loads somewhat greater than this for which the machine operator would normally have to call for assistance. It is feasible for the first time to install a hoist directly at a machine or work station, reducing operator fatigue and making it possible for women to handle jobs normally requiring the services of a man.

The invention has been described above as embodied in an air hoist, air being let in through the helically arranged conduit or air hose 30. For the purpose of supporting the air hose with its convolutions spaced uniformly apart, a coiled spring 130 of steel or other suitable metal may be threaded into the hose. Such spring not only supports the hose itself, but may also provide additional counterbalancing for the body of the hoist. It

will be apparent to one skilled in the art that a motor may be used which is driven by other motive power without departing from the invention. The conduit 30 may, for example, be an electric conduit supported and reinforced by a coiled spring 130. In any event the upper end of the conduit is desirably anchored to the upper end of the cable 23. The complete combination of hoist body, cable and conduit, therefore forms an easy, transportable unit weighing but a few pounds which may be carried from one work station to another simply by unhooking the hook 24. So arranged, the conduit is out of the way, yet forms a barrier to warn others of the presence of the relatively thin steel cable when the hoist is in its lowered position.

In the following claims the term "hook" has been used for convenience, and it will be understood that it is intended to cover any equivalent load-engaging means. The term cable is also intended to be generic to a flexible, tension member of any well-known type.

I claim as my invention:

1. In a hoist the combination comprising a hoist body, a reel mounted therein, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, means for controlling application of power to said motor, a speed-reducing driving train connected between said motor and said reel, a load hook on said body, said driving train having a normally engaged friction coupling having sufficient friction so that the hoist body is supported in fixed position on said cable while permitting the hoist body to be drawn downward into load engaging position by light manual effort, said driving train having a positive coupling engageable for positive driving of the reel by the motor, and means responsive to the presence of load on said hook for engaging the positive coupling.

2. In a hoist the combination comprising a hoist body, a reel mounted therein, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, means on said hoist body for controlling application of power to said motor, a speed-reducing driving train connected between said motor and said reel, a load hook on said body, said driving train having a normally engaged friction coupling and a normally disengaged positive coupling, and means responsive to the presence of load on said hook for engaging the positive coupling for raising of a load by said motor.

3. In a hoist the combination comprising a hoist body, a reel mounted therein, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, a speed-reducing driving train connected between said motor and said reel, a load hook on said body, said driving train having a friction coupling and a positive drive coupling, a handle on said body for laterally guiding the same and for pulling down said body against the force of the friction drive connection to a load engaging position, means responsive to the presence of load on said hook for engaging the positive drive coupling, and control means directly associated with said handle for operation by the guiding hand of the operator for energizing the motor for rotation in a desired direction.

4. In a hoist the combination comprising a hoist body having a hook, a reel mounted in said body, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, a speed-reducing driving train connected between said motor and said reel and having a positive clutch normally disengaged for free-wheeling of said reel, a handle on said hoist body for gripping by an operator for lateral guidance of the hoist body, means including a friction element for inhibiting the paying out of cable so that the body of the hoist is stationarily supported on said cable during non-use while permitting the hoist to be drawn quickly downward by light manual effort applied to said handle, means responsive to the presence of load

on said hook for automatically engaging the clutch, and control means accessible for operation by the operator's gripping hand for energizing said motor for rotation in a desired direction.

5. In a hoist the combination comprising a hoist body having a hook, a reel mounted in said body, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, means for controlling application of power to said motor, a speed-reducing driving train connected between said motor and said reel and having a normally disengaged clutch for enabling free-wheeling of said reel, means including a friction element bridging said clutch so that the body of the hoist is supported in fixed position on said cable while permitting the hoist to be drawn quickly downward by light manual effort for engagement of the load, and means responsive to the presence of load on said hook for automatically engaging the clutch for positive raising of the load by the motor.

6. In a hoist the combination comprising a hoist body having a hook, a reel mounted in said body, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a motor, means for controlling application of power to said motor, a speed-reducing driving train connected between said motor and said reel and having a clutch for enabling free-wheeling of said reel, means including a friction element for inhibiting the paying out of cable so that the body of the hoist is supported in fixed position on said cable while permitting the hoist to be drawn quickly downward by light manual effort for engagement of the load, and means responsive to the presence of load on said hook for automatically engaging the clutch for positive raising of the load by the motor.

7. In a hoist the combination comprising a hoist body; a reel mounted in said body; a supporting cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support; a driving motor having means for applying power thereto for rotation of the motor in one direction or the other; a speed-reducing driving train of the differential type having an input connected to said motor, an output connected to said reel, and a rotatable control element; a hook mounted on said body; means providing a friction drag on said control element, the friction being sufficient so that the weight of the said hoist body suspended on said cable is insufficient to overcome the friction drag while permitting the hoist body to be drawn quickly downward into load engaging position by application of light manual effort; and means responsive to the presence of a load on said hook for locking said control element with respect to said hoist body.

8. In a hoist the combination comprising a hoist body, a reel rotatably mounted therein, a cable having one end wound about said reel and having its other end arranged for connection to a fixed overhead support, a motor having means for controlling application of power thereto, a fixed ring gear and a movable ring gear arranged side by side and of slightly different diameter, a planetary pinion spanning said ring gears and having portions of unlike diameter meshing therewith, a cage for supporting said planetary pinion, means including a drive shaft coaxially arranged in said cage for coupling said motor and said planetary pinion, means providing a friction drag on said fixed ring gear so that the body is normally supported by said cable while permitting the body to be drawn downwardly by light manual effort accompanied by rotation of said fixed ring gear against the frictional drag, a hook on said body, said hook being mounted for limited endwise movement and having means for biasing the same inwardly with respect to the body, and locking means actuated by outward movement of the hook incident to the picking up of a load for locking said fixed ring gear with respect to the body.

9. In a hoist the combination comprising a hoist body;

9

a reel rotatably mounted therein; having one end wound about said reel and having its other end arranged for connection to a fixed overhead support; a motor having means for controlling application of power thereto; a differential speed-reducing mechanism having an input coupled to the motor, an output coupled to the reel, and a rotatable differential member; means providing a friction drag on said differential member, a hook on said body, said hook being mounted for limited endwise movement and having means for biasing the same inwardly with respect to the body; and locking means actuated by outward movement of the hook for locking said differential member with respect to the body, the friction drag means providing sufficient torque to overcome the hook biasing means when the motor is energized incident to picking up of a load.

10. In a hoist the combination comprising a hoist body, a reel mounted therein, a cable having one end wound about said reel and having means at its other end adapted for connection to a fixed overhead support, a hook on the underside of said body for engaging a load, a reversible motor, means including a step-down drive connection between said motor and said reel, said hoist body providing a generally horizontal handle for gripping by an operator for lateral guiding of the hoist body and suspended load, a pair of control buttons arranged one above the other in said handle adjacent the thumb position of the operator for operation incident to lateral guiding, control means operated by said buttons for application of power to the motor for respective raising and lowering of the hoist body, and means in said step-down drive connection automatically effective upon application of load to the hoist for braking said reel against lowering movement to suspend the hoist at a fixed position relative to its supporting cable.

11. In a hoist the combination comprising a hoist body and a reel mounted in said body, a cable having one end wound about said reel and having the other end adapted for connection to a fixed overhead support, a hook mounted on the underside of said hoist body, a fair-lead mounted at the top of said hoist body in alignment with said hook so that the hook and supporting cable are maintained in alignment independently of the amount of cable payed out from said reel, a reversible motor having a step-down reversible drive connection for rotating said reel, means on said hoist body for controlling application of power to said motor, and means in said step-down drive connection for braking said reel against lowering movement to suspend the hoist at a fixed position relative to its supporting cable yet allowing said hoist while under load to be raised and lowered by power.

12. In a hoist the combination comprising a hoist body having a hook on the underside of said body for carrying a load, a reel rotatably mounted therein, a cable having one end wound about said reel and having its other end arranged for connection to a fixed overhead support, a

10

motor mounted in said hoist body to one side of said reel and having a step-down drive connection for rotating said reel, said reel having an annular sleeve integral therewith and extending to the opposite side of said reel from said motor, an annular member surrounding the free end of said sleeve and rotatably mounting said sleeve in the hoist body, said drive connection comprising a drive ring gear formed inside said sleeve adjacent the free end thereof, a differential ring gear of slightly larger diameter than said drive ring gear mounted in the hoist body and fixed against rotation during operation of the hoist to raise a load, said ring gears being arranged adjacently in the hoist body, idler gears spanning said ring gears and having portions of unlike diameters meshing therewith, a cage for supporting said idler gears, and a shaft coaxially arranged in said reel and said cage for coupling said motor and said idler gears.

13. In a hoist the combination comprising a hoist body, a reel mounted in said hoist body, a cable having one end wound about said reel and the other end adapted for connection to a fixed overhead support, a hook on the underside of said body for engaging the load, an air motor having a step down drive connection with said reel, a handle integral with said hoist body for gripping by an operator for lateral guiding of the hoist body and a suspended load, a pair of control buttons arranged in said handle adjacent the thumb position of the operator for operation incident to lateral guiding, control means operated by said buttons for application of power to the motor for respective raising and lowering of the hoist body, a flexible air hose for supplying power to said motor through said control means, said air hose having a permanent set in the form of a helix, said air hose being arranged substantially coaxially of said cable and having its lower end connected to the hoist and its upper end arranged for anchoring with respect to the overhead support so that the helix is elongated when the cable is paid out and shortened when the cable is reeled in.

References Cited in the file of this patent

UNITED STATES PATENTS

771,761	Barrow	Oct. 4, 1904
1,555,094	Adams	Sept. 29, 1925
2,206,703	Lowe	July 2, 1940
2,277,864	Horvath	Mar. 31, 1942
2,500,326	Shaff	Mar. 14, 1950
2,543,134	Smith et al.	Feb. 27, 1951
2,560,853	Eickmeyer et al.	July 17, 1951
2,570,833	Metcalf et al.	Oct. 9, 1951
2,600,887	Lannen	June 17, 1952
2,640,502	Powers	June 2, 1953
2,719,696	Palka	Oct. 4, 1955

FOREIGN PATENTS

880,897	Germany	June 25, 1953
---------	---------	---------------