United States Patent [19]

Mosley

[11] **3,776,513**

[45] **Dec. 4, 1973**

[54] **CRANE**

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[52] **U.S. Cl.** ..... **254/150 FH,** 254/186 R

[51] **Int. Cl.** **B66d 1/24**

[58] **Field of Search** ..... 254/144, 145, 139, 254/150, 186, 187; 60/53 WR; 192/4, 17

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[57] **ABSTRACT**

A crane is provided with winch drums for hoisting and closing the bucket or grapple and for a dragline, and mechanisms for lifting and swinging the boom. All operated by hydraulic motors each controlled by single lever actuated valves so as to be readily manipulated by a semi-skilled operator. The mentioned winch drums are powered through special differential gear trains and hydraulic systems such that the single control lever for each kind of motion may power the bucket in either direction or release its cable for rapid pay out.

5 Claims, 8 Drawing Figures

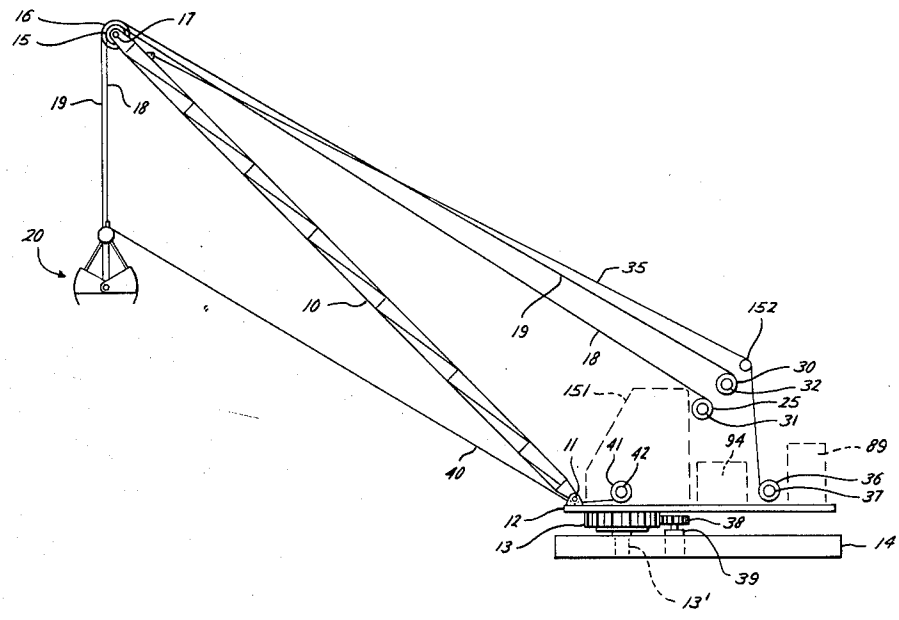


Fig. 1

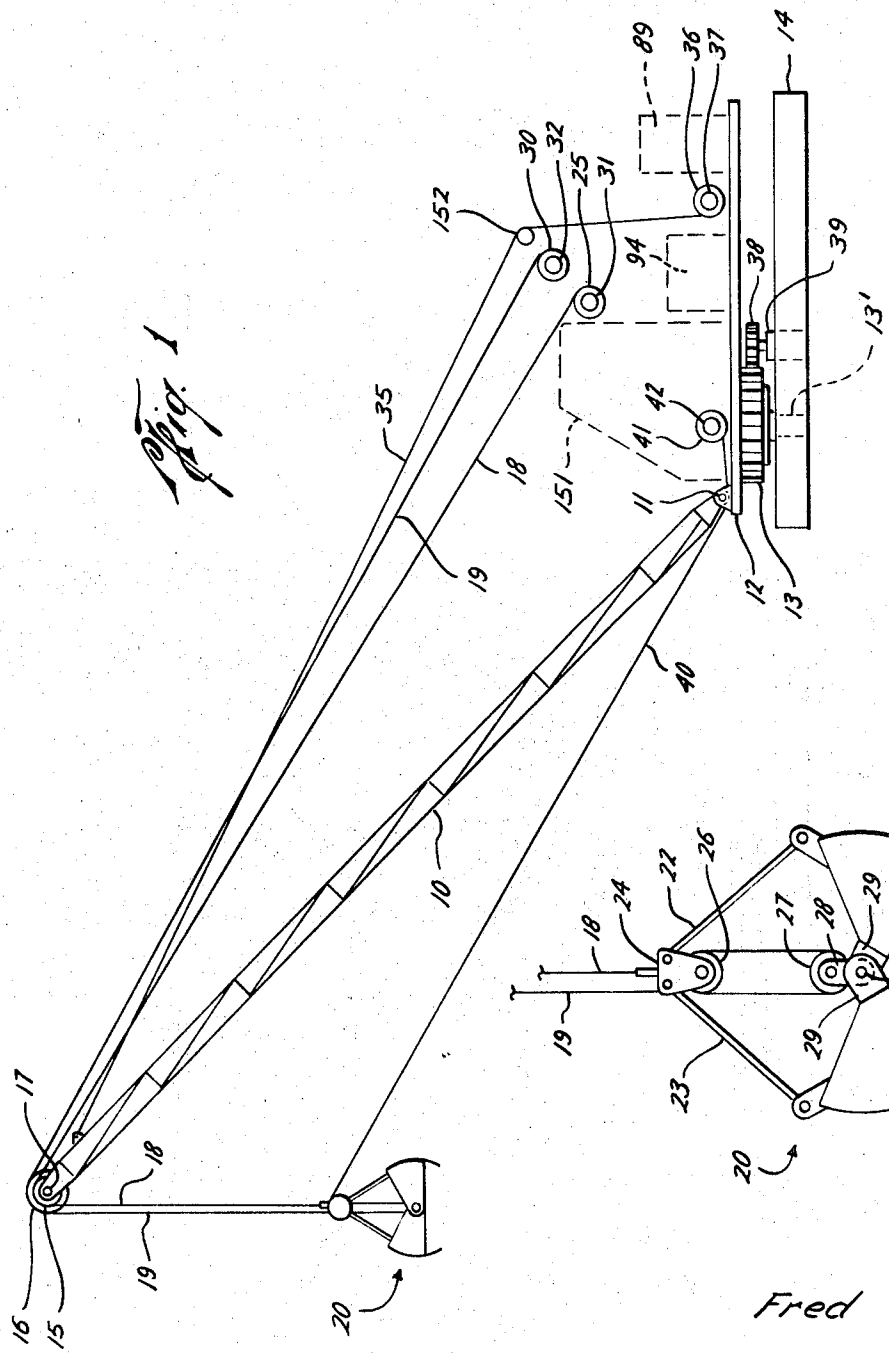


Fig. 2

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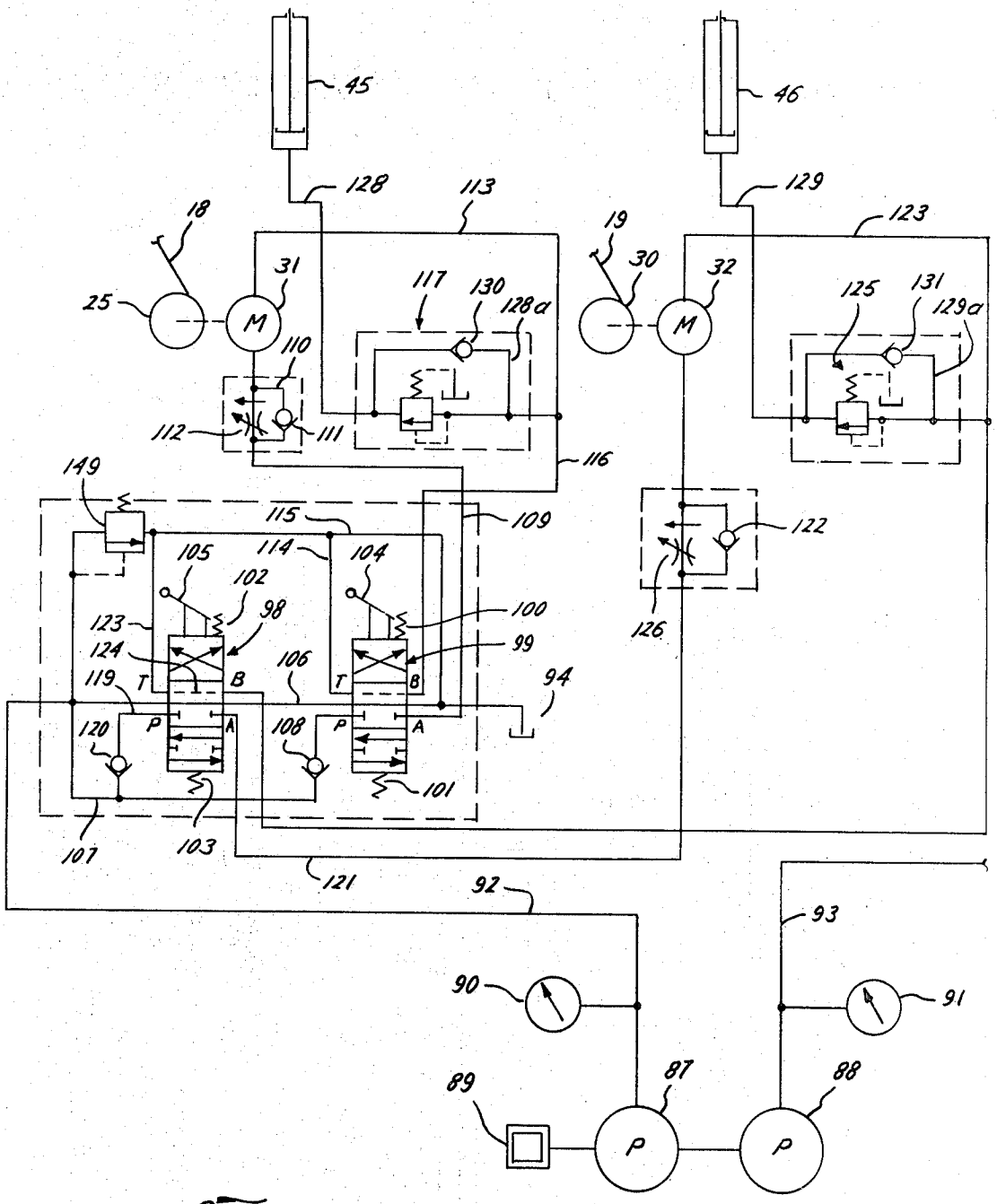
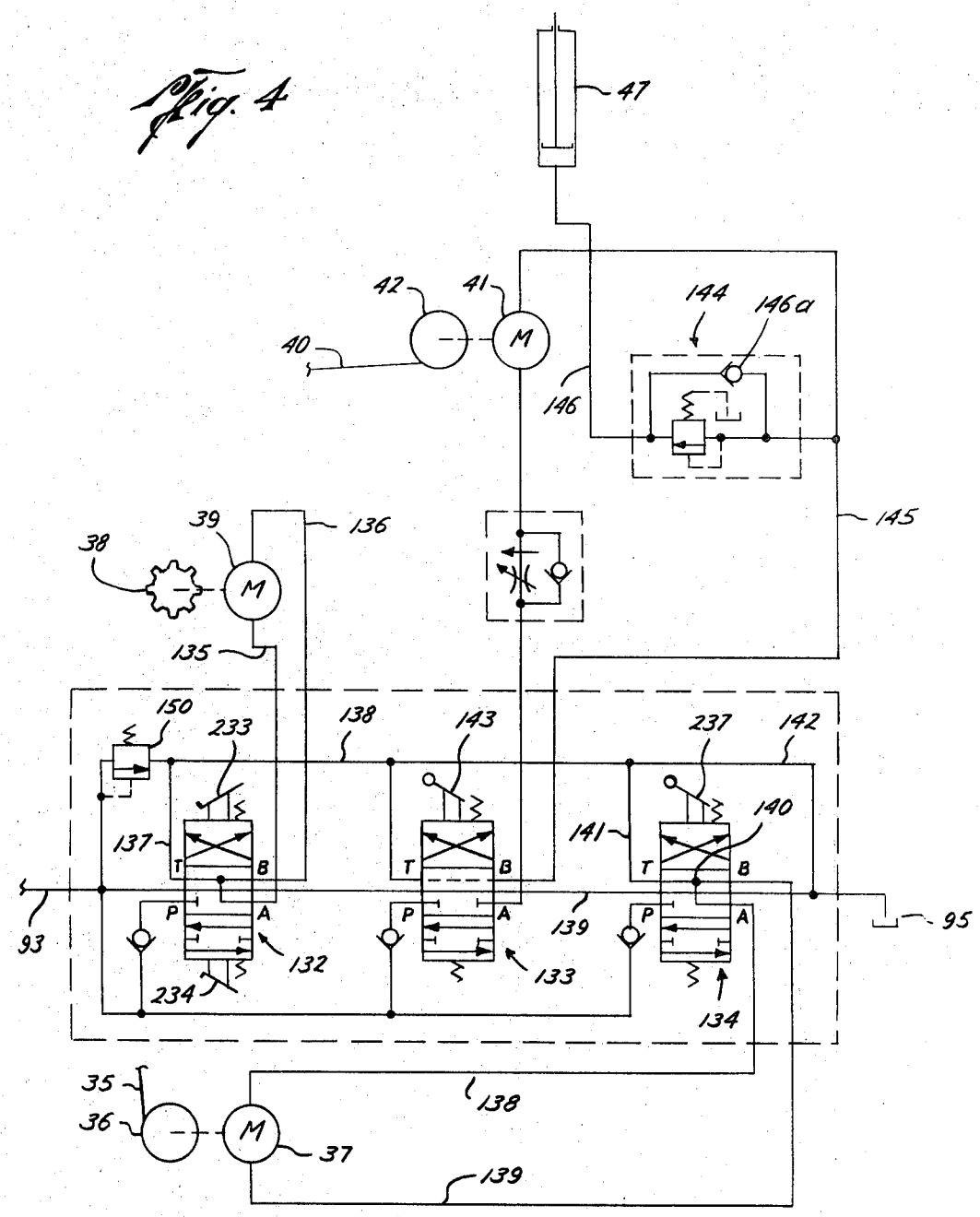


Fig. 3

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Fig. 4



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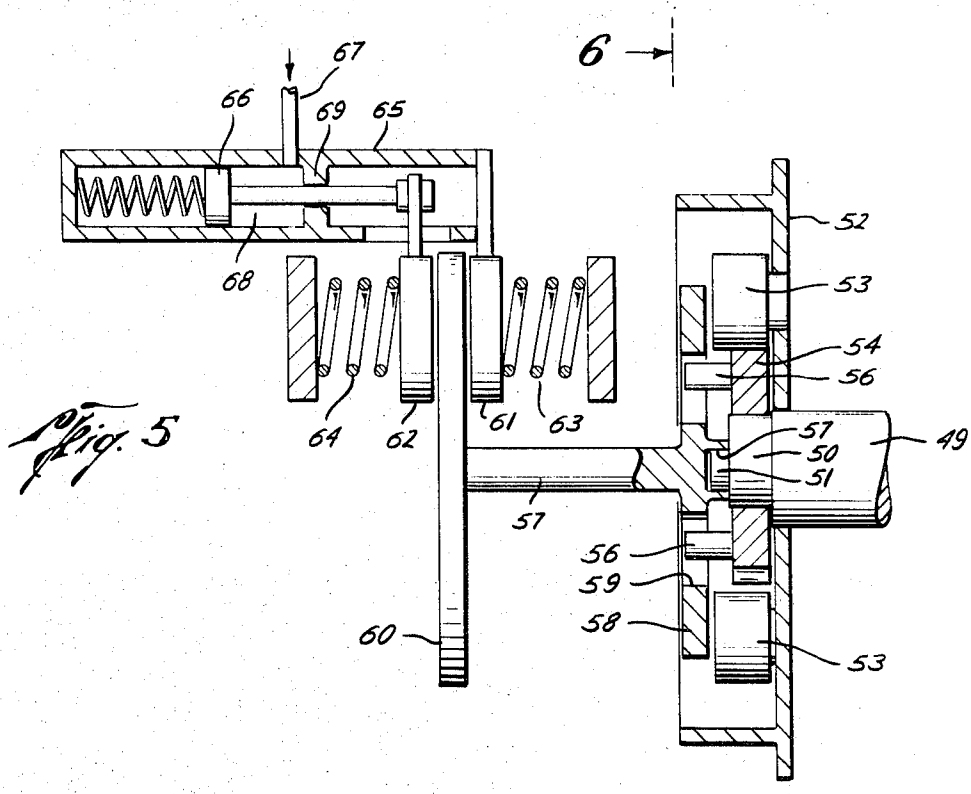


Fig. 5

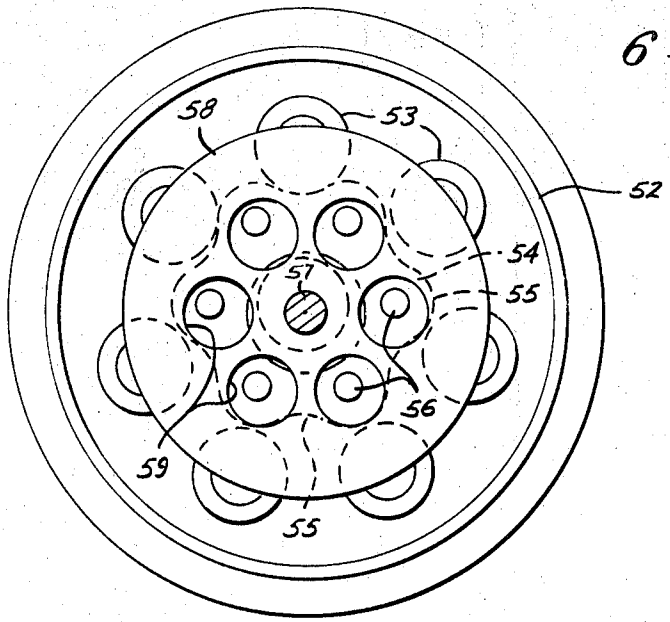


Fig. 6

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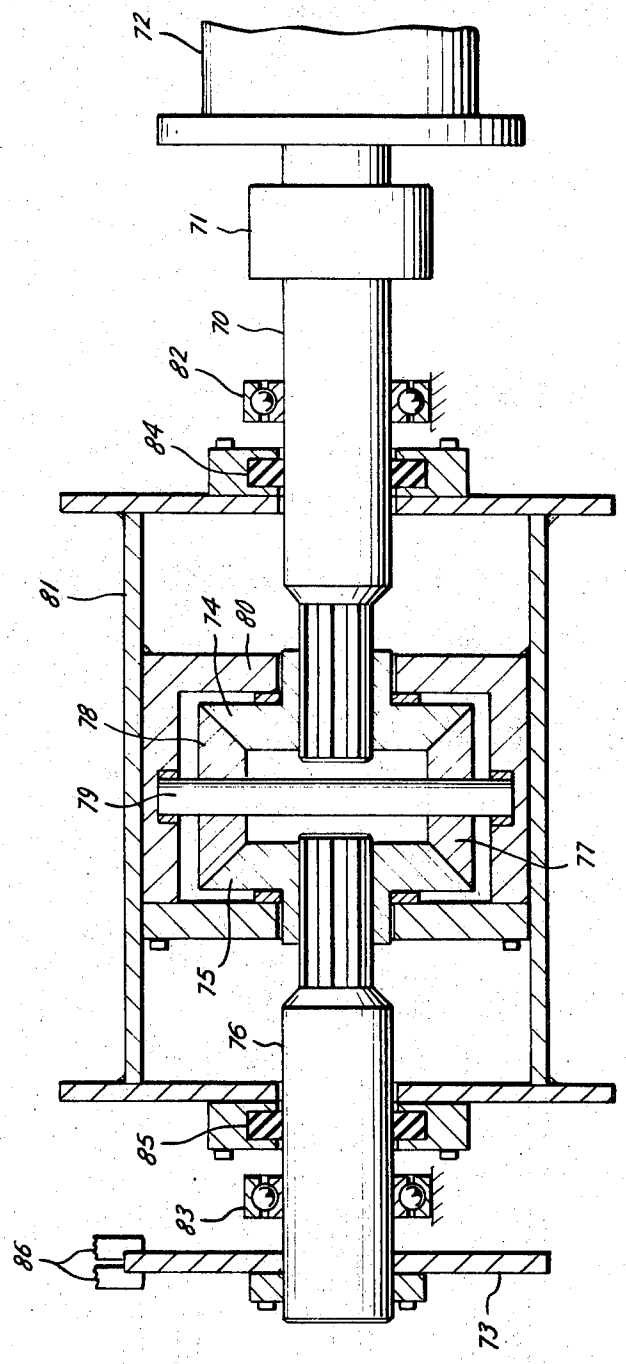


Fig. 7

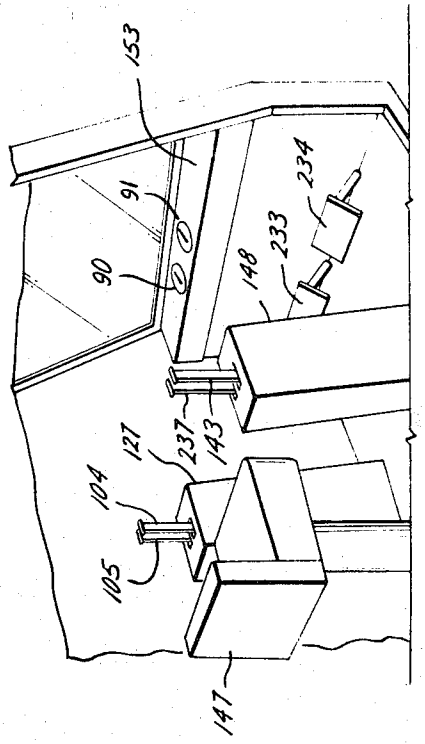


Fig. 8

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CRANE

BACKGROUND OF THE INVENTION

This invention relates to cranes and, particularly, hydraulic controls therefor.

Cranes designed for handling inexpensive or rough materials, such as gravel or sand or metallic scrap should be primarily designed for endurance and speed in handling great tonnages, rather than for extreme accuracy. Such a crane, generally, is mounted on a rotating frame and has a boom that can be raised or lowered by a winch line and also has either one or two additional winch lines for hoisting and closing the load-carrying device, as a shovel, clam-shell bucket, or grapple. For good operation, when the load-carrying device is closed, the hoist line should be simultaneously drawn in so that both lines are kept taut. In order to drop the load from the device, it is necessary for the operator to hold the hoist line and allow the closing line to pay out, thus opening the bucket and causing it to drop its load. When the operator desires to pick up a load from one location and move it to another, it is necessary to raise and lower the boom if any accuracy at all is required. Such raising and lowering of the boom may be avoided by "throwing" of the bucket, or other load-carrying device, but this maneuver is dangerous and requires the highest degree of operator skill and experience.

The operation of the winches in such presently conventional crane arrangements requires a hand-operated clutch lever for each winch and also a foot brake control for each of the two main winch drums, that is, those for hoisting and closing the load-carrying device. Another required control for the crane is that employed in causing the crane to swing about, preferably on a 360° arc in either direction. Thus, it can be seen that the operator must have good natural coordination of limbs and mind and long experience in order to operate this equipment properly. To lift his load, the operator pulls one of the clutch levers towards him, thus engaging the clutch to cause the load to lift. When the load reaches the desired height, the operator must apply a foot brake pedal while he releases the hand clutch lever in a coordinated action. If he releases the hand clutch lever too soon before engaging the brake, the load will drop; if he depresses the foot brake pedal too quickly, he creates unnecessary additional loading on his motor and clutch. In order to ease the bucket downward, the operator must disengage the brake by manipulating the brake pedal very delicately and in minute degrees. If he desires to drop the bucket in a free fall, he completely disengages the foot brake and clutch. Thus, the operator must use both hands and both feet in controlling the winches for hoisting and dropping or closing and opening the bucket. Also, there is usually a third hand lever which demands a portion of the operator's time and attention in causing the crane to swing about its axis. It can be readily seen, therefore, that the operator has all he can do with the three hand and two foot controls, so that it is not feasible to provide a third working drum, for instance, to operate a dragline which would be very useful in controlling the bucket in this type of crane.

In summary, therefore, current types of cranes for handling rough materials have an excess number of hand and foot controls requiring attention of the operator and also require perfect coordination of the clutch and brake controls. Furthermore, the movements required are not natural movements, but are awkward and physically difficult to accomplish. Accordingly, efficient operation of such cranes requires prolonged training and experience in the acquisition of a high degree of skill with resultant high wage requirements. Finally, no means are provided conventionally to apprise the operator of the weight of the load he is handling or to prevent overloading. Moreover, present types of hydraulic cranes are of the power up and down type for handling expensive materials and lack the ability to allow rapid fall of the bucket.

Accordingly, an object of the present invention is to provide a crane having a hydraulic control which may be manipulated to cause rapid fall and opening of the bucket or the like.

Another object is to provide such a crane control which utilizes only a single lever or foot actuated control element to cause powered action in one direction, say, hoisting of the load, and either relatively slow, powered, or rapid, free action in the opposite direction.

Another object is to provide such a crane control which, upon release by the operator, will lock the controlled part, as the bucket, in its assumed position or may permit coasting of the controlled part, as the boom in its rotational movement about its axis.

Still another object is to provide a crane control in which powered closing and lifting and free or powered opening and dropping of the bucket may be effected simply by manipulation of two levers, for example by two fingers of one hand, thus leaving the other hand and the feet of the operator free for other controls.

Another object is to provide such a crane control in which only natural, easily coordinated movements of the operator are required.

Another object is to provide such a crane with a dragline whereby the operator may pick up and drop his load at different locations without necessarily having to manipulate the boom.

Another object is to provide for hydraulic interconnection of the bucket closing and hoisting mechanisms so arranged that both cables are utilized in lifting the load after closing of the bucket.

Another object is to provide novel means for indicating the loading and preventing overloading of the equipment.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, the crane is provided with a traveling boom, a shovel, bucket, grapple or the like, hydraulic motors and winches for actuating the boom and bucket through cables, a dragline cable with its motor, special differential speed reduction gearing arrangements between the motors and at least the bucket control winches whereby the bucket may be power hoisted or drawn in and released rapidly without recourse to the usual individually operated clutch and brake, and hydraulic controls and simplified control elements for the motors and transmissions. The hydraulic powering and control system are provided with readily visible meters indicating the pressure conditions of the systems and therefore the loading thereof and, also, overload relief devices.

BRIEF DESCRIPTIONS OF THE DRAWINGS

In the accompanying drawings which illustrate the invention,

FIG. 1 is an overall schematic representation of a crane embodying the invention including driving mo-

tors and winches, a clam-shell bucket, and support and control members.

FIG. 2 is a more detailed elevation illustrating the bucket and its control mechanism.

FIG. 3 is a partial schematic representation of the hydraulic controls.

FIG. 4 is a schematic representation showing the remainder of the hydraulic controls.

FIG. 5 is a cross sectional view of one form of differential gear train transmission which may be incorporated in the crane controls.

FIG. 6 is an elevation taken on line 6—6 of FIG. 5.

FIG. 7 is a cross section illustrating another form of differential transmission which has been used successfully in the invention.

FIG. 8 is a schematic isometric showing the operator's station and manual controls.

DETAILED DESCRIPTIONS OF THE DRAWINGS

FIG. 1 shows a crane including a boom **10** pivotally mounted at **11** on a platform **12** which carries a bull gear **13.** Platform **12,** in turn, is pivotally mounted by means of a center pin **13'** and suitable bearings (not shown) upon a carriage or other platform **14** which may be mobile. A pair of sheave wheels **15** and **16** are rotatable on a shaft **17** at the upper end of boom **10** for guiding the bucket hoisting cable **18** and bucket opening and closing cable **19.** At the distal ends of cables **18** and **19** there is secured a clam-shell bucket generally designated **20.**

Bucket **20** has jaws **20***a* and **20***b* (FIG. 2) pivotally secured together at **21** and provided with corner bars **22** and **23** which extend to and support an upper head **24.** Hoisting cable **18** extends from its winch drum **25** around sheave **15** to upper bucket head **24,** while closing cable **19** extends from winch drum **30** around crown sheave **16** and upper and lower bucket sheave sets **26** and **27** and thence is dead ended on upper head **24** to form a block and tackle jaw closing arrangement. The bottom bucket head **28** supporting sheaves **27** and jaw pivot **21** is secured to the bucket jaws by toggle links **29.** This arrangement is such that when closing cable **19** is pulled upwardly, pivot **21** is lifted with power multiplication through the block and tackle to cause powered closing of jaws **20***a*, **20***b*. When cable **19** is let out, traveling sheaves **27** and the pivot are lowered, tending to align toggle links **29** and open the jaws. Winch drums **25** and **30** are driven, respectively, by main hydraulic motors **31** and **32** through special differential gear train transmissions to be described.

A third cable **35** extends between the top of the boom and a third winch drum **36** powered by a hydraulic motor **37.** Winch drum **36** and cable **35** serve to elevate and lower the boom. Rotation or swinging of the boom and platform **12** is effected by means of a pinion **38** meshing with bull gear **15** and powered by a main motor **39.** The last bucket control illustrated is the dragline **40** which extends from bucket **20** to a winch drum **41** powered by a hydraulic motor **42.**

Each of the winch drums **25, 30,** and **36** is directly controlled from its main hydraulic motor by means of a differential gear train, for instance, epicyclic, as shown in FIGS. **5** and **6.** These are encased within the drums and each includes a brake operating, supplementary fluid motor, as at **45, 46** and **47** in FIGS. **4** and **5.** FIGS. **5** and **6** illustrate in detail one of these gearing arrangements, all three being substantially identical. The gearing includes a power input shaft **49** having at its end an eccentric disk **50** from which projects a pintle **51** which is coaxial with drive shaft **49.** A drum-forming disk member **52** is rotatively received upon the end of drive shaft **49** and has axially projecting nubs or bosses as **53** located thereabout concentrically with respect to drive shaft **49.** Seven of these tooth-simulating bosses are provided at equal intervals about member **52.**

Rotatively received upon eccentric disk **50** is an inner orbiting member **54** having scalloped periphery as at **55,** forming six equally-spaced, radial, tooth-like projections with tooth spaces therebetween. In other words, member **54** has one less peripheral projection than the number of tooth forming nubs on driven drum member **52.** Inner member **54** also has six axial pins, as at **56,** spaced about its periphery. Received upon pintle **51** which is coaxial with drive shaft **49** is the hollow end of a rod **57** whose end bears against the outer face of eccentric disk **50.** Rigidly secured to the right hand end of rod **57** (FIG. 5) is a disk **58** which has six apertures **59** near its periphery and each receiving one of the aforementioned pins **56.** At the opposite end of rod **57** there is a second, brake disk **60** with which there are associated a pair of brake shoes **61** and **62** constantly urged toward brake disk **60** by opposed coil springs **63** and **64.** Shoes **61** and **62,** respectively, are secured to movably supported cylinder **65** and piston **66** slidable therein. A fluid pressure line **67** connects with pressure chamber **68** between piston **66** and packed rod guide **69** rigid with the cylinder to cause expansion of the chamber and release of the brake shoes from the brake disk. Some features of this kind of epicyclic gearing are illustrated in Hill U.S. Pat. No. 1,682,563. The gearing operates as follows:

With brake shoes **61** and **62** in their normal, braking position, that is, preventing rotation of disks **58** and **60** on rod **57,** pins **56** on inner, scalloped member **54** are constrained to rotation within their respective apertures **59** in disk **58** so that, as power input shaft **49** is rotated, the center of member **54** is caused to rotate about the center of drum-forming member **52** and to assume a kind of orbital motion which is transmitted from the scalloped periphery **55** thereof to bosses **53** on drum **52,** the driven member. This, in turn, causes rotation of the drum member in the same direction as drive shaft **49,** but at a speed reduction, in this case, of six to one with corresponding step up of the power ratio. Now, if chamber **68** is pressured, brake shoes **61** and **62** are caused to release brake disk **60,** whereupon, inner and outer gearing members **54** and **52** may rotate freely about the drive shaft.

It is contemplated that outer drum forming member **52** will receive the operating cable wrapped thereabout, thereby replacing the usual winch drum and the entire gear train, between the drive shaft and the brake disk **60,** will be housed within this drum. The result is that by variation of the pressure in brake motor chamber **68,** the gearing can be adapted for powered operation of associated cable, as in hoisting or closing the bucket or drawing in the drag cable. On the other hand, release of the brake shoes permits such cable to unwind freely, as for fast dropping or opening of the bucket or release of the dragline.

FIG. 7 illustrates another type of differential gear train, namely, an automotive type differential, which is presently preferred for connecting drive shaft **70,** cou-

pled at 71 to hydraulic motor 72, to drum 81. A pair of bevel gears 74 and 75 are splined, respectively, to drive shaft 70 and brake shaft 76. Spider gears 77 and 78 rotate on a shaft 79 journaled in a cup 80 secured internally to drum 81. Shaft support bearings are shown at 82 and 83 and shaft packings at 84 and 85. Brake disk 73 is provided with normally applied shoes 86 which may be released by a fluid motor, as in FIG. 5. A load-carrying cable is wound upon drum 81 for powering through the differential gear train, when shoes 86 are applied, and for free unwinding when the brake is released.

The hydraulic system is illustrated schematically in FIGS. 3 and 4. Two separate systems are pressured by hydraulically interconnected, hydraulic gear pumps 87 and 88 jointly operated by a prime mover engine 89. Pressure gauges 90 and 91 are connected to pump output lines 92 and 93 for indicating the loads being handled by the motors. The return to hydraulic pumps 87 and 88 is from a collection tank, or a pair of such tanks as shown at 94 and 95.

Bucket hoisting and closing main motors 31 and 32 are controlled, respectively, by spool valves 99 and 98 normally maintained in their centered, neutral positions by opposed springs 100 and 101 and 102. The valve spools, respectively, may be shifted in either direction from neutral by levers 104 and 105. The valve spools are conventionally shown, each having motor ports A and B and pressure and exhaust ports P and T which are interconnected in the various valve positions as suggested by the flow lines. In neutral, none of the ports is pressured, the pumped pressure merely returning via a line 106 to tank 94. When lever 104 is actuated toward the operator, for instance, by a finger of the left hand, as will be explained, port 99-A will be pressured via line 107, past check 108, as will line 109, by-pass 110 containing check 111 around variable restriction 112, and bucket hoisting motor 31. Return line 113 from the motor 31 will be exhausted through ports 99-B and 99-T and lines 114, 115 and 106 into return tank 94. This will cause powered operation of hoisting motor 31 in the forward or hoisting direction.

If lever 104 is moved in the opposite direction (away from the operator) slightly beyond the neutral position, port 99-B and lines 116 and 113 will be pressured through restricted valve plug duct 114*a* and line 109 will be connected through port 99-T and line 114 to exhaust tank 94. This will cause low speed reverse operation of hoisting motor 33 for powering down the bucket. Because of restriction 114*a*, there will be insufficient pressure in line 116 to open pilot type sequence valve 117. However, if the reverse movement of lever 104 is continued, the valve plug ultimately will complete an unrestricted valving connection between said ports 99-B. At this time the pressure in line 116, will be sufficient to open preset sequence valve 117 to admit hydraulic pressure through line 128 to brake cylinder 45, thus releasing the brake disk in the corresponding differential transmission which will permit the transmission to free-wheel and cable 18 to pay out freely and the bucket to drop rapidly. This action is assisted by variable restriction 112. In fact, it is possible in some cases to eliminate sequence valve 117 and rely on restriction 112 to create sufficient back pressure in lines 116 and 128 to actuate brake motor 45. In case lever 104 is released by the operator to return to netural, the bucket will be locked in its assumed position by an automatic brake (not shown) built into winch 25.

Upon movement of valve lever 105 toward the operator, port A of valve 98 will be pressured through lines 107, 119, past check 120, and port 98-P directing the pressured fluid through line 121 past by-pass check 122 to bucket closing main motor 32. Exhaust line 123 from this motor will be connected through ports 98-B and 98-T and lines 123, 115, and 106 to return tank 94. This will cause powered closing of the bucket through the differential transmission and winch drum 30. Upon reverse movement of lever 105, slightly beyond its neutral position, motor 32 will be reversed to open the bucket at slow speed. This slow speed, reverse effect is symbolized by the dotted line 124 in valve spool 98. At the same time, preset sequence valve 125 will not respond to the relatively low pressure in line 123. However, when lever 105 is moved fully in the reversed direction, valve 125 will be opened which will pressure cylinder 46 and release the brake of the corresponding winch drum 30 to permit rapid opening of the bucket jaws. As previously indicated, valve 125 may be omitted, relying on restriction 126 to create sufficient back pressure in line 123 to release the brake. Upon movement of lever 104 or 105 away from its full reverse position, the brake motor 45 or 46 will be exhausted through line 128, 128*a*, or 129, 129a and past check 130 or 131.

Due to the preferred proximate positioning of levers 104 and 105 on left side console 127 (FIG. 8) they may be jointly shifted toward the operator by two fingers of the left hand. This will have the initial effect of closing the bucket jaws through the power multiplying effect of block and tackle elements 26 and 27. When the jaws have closed, the hydraulic pressure in the system will act on both cables 18 and 19 to first close, then lift the bucket. The load on the cables may be sensed by meter 90 which preferably is in position for ready observation by the operator. On the other hand, if it is desired to quickly open and/or drop the bucket, either or both levers 104 and 105 will be actuated fully in the reverse direction. Slow dropping and slow opening of the bucket and jaws may be effected by shifting levers 104 and 105 reversely a slight distance beyond their neutral positions, as explained. Finally, the bucket opening and closing and hoisting and dropping operations can be individually effected if desired. Significantly, all mentioned controls of the bucket are achieved with the use of the operator's left hand only, leaving his right hand and both feet free for other operations.

FIG. 4 shows the remainder of the hydraulic system which is powered by hydraulic pump 88 through line 93 and controlled by spool valves 132, 133, and 134. As previously, the spools of these valves are normally centered by opposed springs and their ports A and B and P and T are oppositely interconnected in the opposite positions of the valve spools. In the neutral positions of all valves, the hydraulic pressure is led directly through a line 139 to return tank 95, while ports A are cut off from pressure ports P.

Spool valve 132 may be oppositely actuated by means of a rudder bar 233 or, if desired, a pair of foot operated rudder bars 233 and 234. When the valve spool is moved in one direction (upwardly in the schematic), port 132-A and motor line 135 are pressured, while the other motor line 136 is exhausted to tank 95 through ports 132-B and 132-T and lines 137, 138, and

139. If the valve spool 132 is reversed, line 136 is pressured and line 135 is exhausted, causing reverse operation of motor 39. No release feature is provided for the boom swinging motor. However, in the neutral position of spool valve 132, both motor lines 135 and 136 will be connected to exhaust line 137, etc. which will permit the boom to coast rotationally until it is stopped by movement of the rudder control in either direction from its neutral position.

Spool valve 134 is actuated by a lever 237 and controls the powering up and powering down of the boom by means of boom motor 37 and winch drum 36. Again, no release action is provided for the boom winch. However, winch 36 is provided with a built-in automatic brake which locks the boom in its assumed position when lever 237 is in neutral. In the neutral position of valve 134, motor lines 138 and 139 are interconnected within the valve, as at 140. When the valve spool is moved in one direction, its port 134-A and motor line 138 will be pressured and the other motor line 139 will be exhausted through valve ports 134-B and 134-T and lines 141, 142, and 139. In the opposite position of lever 237 and valve 134, the operation of motor 37 will be reversed. As stated, no release for rapid fall or clutching is provided in connection with the boom raising winch.

The last valve 133 is controlled by a lever 143 and actuates a dragline 40, which extends from winch 42, powered by motor 41, to the bucket or other load-carrying device for drawing the same toward the operator when, for instance, it is desired to drop the load at a point other than the pick up point without raising or lowering the boom. Winch 42 is operated through a differential gearing arrangement, as shown in FIGS. 5 and 6 or 7 including the brake release cylinder 47. In one extreme position of spool valve 133, motor 41 is energized to draw in dragline 40. In the reverse, cracked position of lever 143, motor 41 is operated slowly in the reverse direction, while in the full reverse position of lever 143, preset sequence valve 144 passes pressure from port 133-B and line 145 through by-pass line 146 to cylinder 47 for releasing the gearing brake disk. This permits the bucket to swing quickly toward its centered position. Check valve 146a, as in case of check valves 130 and 131, permits exhausting of cylinder 47 when pressure is removed therefrom, as when valve 133 is in neutral or motor 41 is being powered in its forward or reverse direction.

In addition, there are provided in the separate systems pressure limiting valves 149 and 150 which prevent overloading the equipment for instance by the hoisting of excessive loads. These in cooperation with gauges 90 and 91, the fail safe gear train brakes, and the automatic boom lock provide a machine that is safer and more easily operated than any of its type available today.

The operation of the crane should be apparent from the above. To recapitulate, the crane is rigged, in general as illustrated in FIGS. 1 and 2, suitable framing supports being provided for mounting the various winches and motors on platform 12 at the side of the operator's cab 151 containing the seat, control levers, and instrument panel, as in FIG. 8, and between prime mover 89 and the vertically and horizontally pivoted boom 10. Also carried on the platform is the hydraulic fluid return tank 94, only one being necessary. Boom lift cable 35 extends from the outer end of the boom to winch 36 powered by motor 37. Bucket closing cable 19 extends from blocks 26, 27 over sheave 16 to winch 30 powered by motor 32. Bucket hoisting cable 18 extends from upper bucket head 24 over sheave 15 to winch drum 25 powered by motor 31. Each of the last mentioned winches incorporates a differential or planetary or functionally equivalent gearing as in FIGS. 5 and 6 or 7. Horizontal swinging of the platform is effected by bull gear 13 on the under side of the platform meshing with pinion 38 powered by motor 39. Dragline 40 extends from the bucket or other load-carrying device to winch 41 powered by motor 42. Each motor is hydraulically connected to one of the pumps 87 or 88 and its control valve 98, 99, 132, 133 or 134 by hydraulic lines as sketched in FIGS. 3 and 4, while the valve cores are connected to their control levers or equivalent control elements 104, 105, 233, 234, 237 or 143 arranged conveniently with respect to the operator's station, as in FIG. 8. Gauges 90 and 91 as well as other indicators may be positioned in a dash or instrument panel, as at 153 in FIG. 8.

To close and hoist the bucket, the operator moves levers 104 and 105 toward him individually or together, using the left hand. To open the jaws and lower the bucket slowly, these levers are pushed slightly beyond their neutral positions, whereupon insufficient pressure will be generated in motor lines 116 and 123 to actuate brake motors 45 and 46 so that motors 31 and 32 will be slowly powered in the reverse direction. Upon movement of levers 104 and 105 fully in the same direction, pressure will be built up in lines 116 and 123 sufficient to shift motors 45 and 46 and release the brakes associated with drums 25 and 30, whereupon the cables thereon will be paid out rapidly. With levers 104 and 105 in neutral, the bucket and its jaws will be locked in their momentary assumed positions. The same type of action will be applied to the bucket through dragline 40, by actuation of lever 143 either toward the operator or partially or fully away from him using the right hand. The right hand is used, also, to lift or lower the boom or lock it by movements of lever 237, either toward or away from the operator or to neutral position. Finally swinging of the boom is achieved by foot manipulation of pedal equipped levers or rudders 233 and 234. As stated, when both pedals are in neutral, the boom is free to coast and may be stopped and/or rotated in either direction by manipulation of one or the other pedal levers in rudders 233, 234.

FIG. 8 shows bucket hoisting and closing levers 104 and 105 mounted on left side console 127 convenient for operation by two fingers of the left hand. Valve levers 237 and 143 will be positioned on right hand console 148 for operation of the operator on seat 147 by the right hand, usually individually. Rudders 233 and 234 may then be actuated by the otherwise unoccupied feet of the operator. All of the control levers are relatively light and they are judiciously positioned for actuation in the manner stated. Thus, the five valves are convenient for operation in both directions by the operator for complete control of the crane, to wit, hoisting, dropping of the bucket, opening and closing of the bucket, lifting and lowering of the boom, swinging the boom in either direction, and manipulation of a dragline. No previous crane with which I am familiar has had provision for such controls and, particularly, by easy and natural movements of the operator. For instance, in lifting and closing the bucket, levers 104 and

105 are drawn toward the operator. Opposite actions of the bucket are achieved by pushing of the levers away from the operator. Similarly, the boom may be lifted or dragged in by shifting of lever **237** or **143** toward the operator and vice versa. Thus, not only is the crane more versatile, but it may be operated by a less skilled operator and there is practically no chance of accidents, for instance, by inadvertent dropping of the bucket. This is because the bucket hoisting motor **31** is fully controlled by the single lever **104** and can only be dropped when the lever is consciously shifted its full movement in the reverse direction. Of course, no coordination of heretofore separate clutch and brake actuators for the respective motors is needed.

While the hydraulic controls are exemplary, other types, for instance, pneumatic or electric may be provided by those skilled in the control art. The particular type of crane and bucket or handling mechanisms is not essential. These and other modifications may be made as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. In a crane, an hydraulic pressure source, a winch having a drum, a winch motor having reversible pressure and exhaust connections, a load carrying cable received about said drum, gearing interposed between said motor and said drum, said gearing being of the type incorporating brake means engagable selectively to mechanically connect said drum and said motor, for powering said drum, and to disconnect said motor and said drum for free wheeling of said drum in at least one direction, a brake motor for actuating said brake means, a valve having a pressure port connected to said source, exhaust porting, first and second motor ports, and a movable part having first, second, and third passaging, said third passaging being less restrictive than said first and second passaging, ducts connecting said motor ports individually with said motor connections and said first motor port also with said brake motor, and an element for shifting said valve part selectively to first and second positions in which said first and second passaging, alternately, connects said pressure port and exhaust porting to said motor connections for reversed powering of said winch motor and said drum, and to a third position in which said third passaging connects said pressure port with said first motor port, the fluid pressure from said pressure source being insufficient to actuate said brake motor in said first and second positions of said element and being sufficient in said third position of said element to actuate said brake motor and thereby cause free wheeling of said drum.

2. The combination described in claim **1** in which said valve actuating element is moved in the same direction to said second and third positions for operating said winch motor and drum in the direction for successive paying out of said cable and free wheeling of said drum.

3. The combination described in claim **1** in which said valve part has additional passaging and said element has a fourth position in which said additional passaging directly connects said pressure and said exhaust porting.

4. The combination described in claim **1** further including a restriction in one of said motor ducts and a check-controlled bypass therearound for cooperating with said valve to influence actuation of said brake motor.

5. The combination described in claim **1** further including pressure limiting means in one of said ducts for limiting the powering of said drum in the lifting direction.

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