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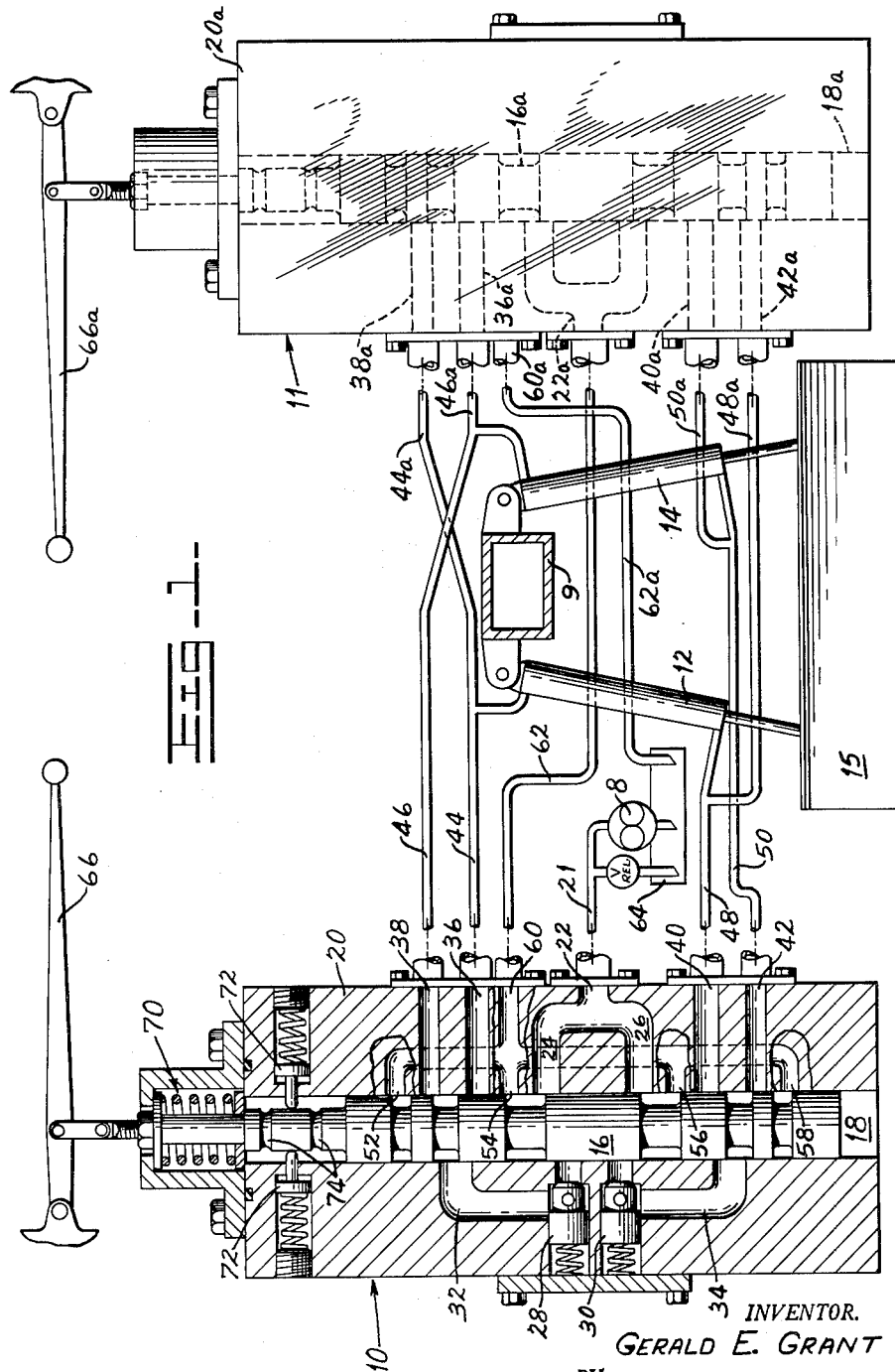
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HYDRAULIC CONTROLS FOR AN EARTHMOVING BLADE OR THE LIKE

Filed Oct. 12, 1959

2 Sheets-Sheet 1



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FIG. 2.

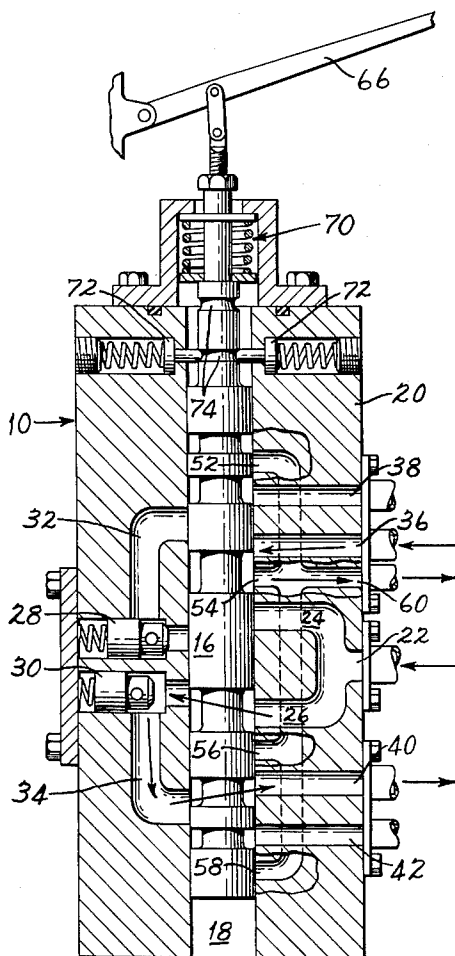
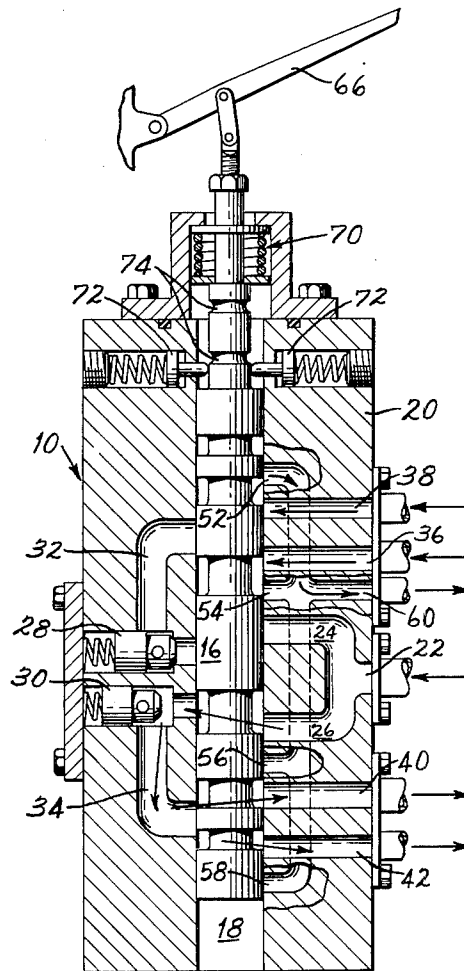


FIG. 3.



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2 Claims. (Cl. 60-97)

This invention relates to hydraulic control means and particularly to means employed for effecting operation of either one of two hydraulic motors separately or of both motors in unison.

The invention is applicable to the control of various types of apparatus but is particularly useful for the control of the earthmoving blade of a motor grader or the like and is, therefore, described herein in connection with such use, as an example, for the purpose of illustrating the manner in which it functions.

A motor grader blade is ordinarily supported for vertical movement relative to the machine upon which it is mounted to adjust the depth of cut which it makes. It is also supported for vertical movement of either of its ends relative to the other to enable tilting of its cutting edge for forming banks, ditch walls or other sloping surfaces. This ordinarily requires at least two controls, there being one for each end of the blade and it being necessary, therefore, to actuate both controls simultaneously to raise or lower the blade without tilting it or changing its angular setting. This makes it impossible for the operator to adjust other controls manually or even to steer the machine while the blade is being adjusted giving rise to difficult and sometimes dangerous operating conditions.

It is the object of the present invention to provide an improved control system for motor grader blades or other devices which may be actuated by hydraulic motors and wherein it is necessary to operate selectively either one or both motors. Another object of the invention is to provide control means for actuating either one or both of a pair of hydraulic motors by a single lever to enable an operator simultaneously to operate other controls.

Further and more specific objects and advantages of the invention reside in the construction and arrangement of its various components and will become apparent upon an understanding of the following specification wherein reference is made to the accompanying drawings.

In the drawings:

FIG. 1 is a schematic view of a control system embodying the present invention, and showing the relationship in a circuit of two control valves with the hydraulic adjusting mechanism of an earthmoving blade;

FIG. 2 is a schematic view of one of the valves shown in FIG. 1 illustrating another position of adjustment thereof; and

FIG. 3 is a similar view of the same valve adjusted to a third position.

The system illustrated in FIG. 1 includes a hydraulic pump 8 for directing fluid under pressure through either one of two manually operated valves generally indicated at 10 and 11 for actuating either one or both of a pair of hydraulic motors herein illustrated as double acting hydraulic jacks 12 and 14 which adjustably support a blade 15 of a motor grader or the like, the jacks being pivotally suspended from the main frame of the machine, a portion of which is illustrated at 9.

The control valves 10 and 11 are identical in construction and each comprises, as illustrated in the valve 10, a valve spool 16 reciprocally mounted in the bore 18 of a valve body 20. Fluid under pressure from the pump may be introduced to the bore of the valve through a conduit 21, an inlet passage 22 and either of a pair of passages 24 and 26 which communicate between the in-

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let passage 22 and the bore. A pair of spring loaded check valves 28 and 30 normally close passages 32 and 34 to permit flow of fluid under pressure from the pump to the jacks through circuits which are opened upon manipulation of the valve spool in a manner presently to be described and to prevent reverse flow in the event of failure of the pump to operate. Two ports 36 and 38 communicating with the bore of the valve form communication with the head ends of the jacks 12 and 14, respectively, through a pair of conduits 44 and 46. Similar ports 40 and 42 form communication with the rod ends of the jacks 12 and 14 through conduits 48 and 50. A plurality of ports 52, 54, 56, and 58 which communicate with the bore of the valve body are connected by a common passage with an outlet port 60 which communicates with the inlet passage 22a of the valve 11, which corresponds to the inlet 22 in the valve 10, through a conduit shown at 62.

The reference characters employed on the valve 10 are used for identification of identical parts in the valve 11 but followed by the character (a) and the valve 11 is connected in the same manner as the valve 10 with the jacks 12 and 14 through the ports 36a, 38a, 40a and 42a through conduits 46a, 44a, 50a and 48a, respectively, corresponding to the similarly numbered conduits which lead to the jacks 12 and 14 from the valve 10. The drain port 60a of the valve 11 connects with a conduit 62a which returns to the sump or supply tank indicated at 64 from which the pump 8 withdraws the operating fluid.

Each of valves 10 and 11 employs a centering spring assembly generally indicated at 70 of conventional construction, the function of which is to hold the valve spool in a centered position which is the position illustrated in FIG. 1. One or more spring loaded detents, two of which are illustrated at 72 in FIG. 1, are urged into engagement with the sides of the spool for cooperation with circumscribing grooves 74 therein to indicate to an operator when the spool has attained certain positions and also to retain the spool in predetermined positions of adjustment. The spools are adjustable as by a pair of operator's control levers illustrated at 66 and 66a.

In order to actuate the jack 12 to raise the left end of the blade 15 as viewed in FIG. 1, the spool 16 of the valve 10 is adjusted to the position of FIG. 2 until the detents 72 enter one of the grooves 74, this being the lower groove as viewed. In this position, fluid under pressure from the pump is directed to the rod end of the jack 12 by way of the conduit 21, port 26 and through check valve 30 and passage 34 and the valve bore to the port 40 and conduit 48 which communicates with the jack 12.

Both of the jacks 12 and 14 may be retracted simultaneously to raise the blade 15 without tilting it or changing its angular position, whatever it may be, by actuation of the same valve to move its spool beyond the position of FIG. 2 and to that shown in FIG. 3 wherein the output of the pump is delivered through the valve bore and to both of the outlets 40 and 42 for communication with both of the rod ends 12 and 14. This is the extreme movement of the valve spool to the position where it is limited by the solid height of the spring in the centering assembly 70.

As the lands on opposite ends of the valve spool are bi-symmetric in size and spacing from the central portion thereof, and the outlet ports 36 and 38 are bi-symmetrically disposed with respect to the outlets 40 and 42, it is apparent that operation of the control lever 66 in the opposite direction will effect direction of fluid under pressure to either one or both jacks 12 and 14 to extend them and lower the blade 15, either at one end, upon partial movement of the control lever, or at both ends, upon

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full movement thereof. Thus the valve 10 may be actuated to raise or lower one end of the blade 15 or to raise or lower both ends simultaneously. Since the valves are identical in construction, it is apparent from the foregoing description that the valve 11 may be actuated to raise or lower the opposite end of the blade 15 as well as to raise or lower the entire blade. It is possible, therefore, by operation of only one control lever at a time, to obtain any desired adjustment of the blade which is possible through actuation of the jacks 12 and 14.

If the machine is at rest, or if for any other reason it is safe for the operator to employ both hands, more rapid adjustment of the blade can be accomplished by simultaneously operating both of the control valves 10 and 11. For example if the valve spool 16 and 16a are moved in opposite directions to their blade tilting positions, one jack will be advanced while the other is retracted and a rapid adjustment of the tilt angle is accomplished. The full output of the pump may also be employed for vertical adjustment of the blade as for example to raise it quickly by moving both valve spools to the position shown in FIG. 2. In this position, the fluid from the pump 8 is directed to the rod end of jack 12 in the manner previously described and the return flow from the head end of the jack 12 passes through conduit 44 and ports 36 into the valve bore and thence through passage 54 into conduit 62 and to inlet port 22a of valve 11 which is positioned to communicate pressure to the rod end of jack 14 through passage 40a and conduit 50a. In this manner, both jacks are retracted simultaneously and rapidly because the full output of fluid under pressure from the pump is utilized.

I claim:

1. For combination with a vehicle having an operated element such as an earthmoving blade and means supporting said element including a double acting hydraulic jack adjacent each end thereof, and means to supply fluid pressure to said jacks comprising a valve in the fluid circuit; a control member on said valve movable in one direction to first supply fluid to a first of said jacks to raise one end of the operated element and upon further movement to supply fluid to both jacks simultaneously to raise the entire element, said same control member being

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movable in the opposite direction to first supply fluid to the opposite end of said first jack to lower one end of the operated element and upon further movement to the opposite end of both jacks simultaneously to lower the entire element, and a second similar valve and control member operable like the first to effect independent operation of the second of said jacks and simultaneous operation of both jacks, and means directing return flow from one jack operated by one valve through the other valve whereby the entire output of fluid under pressure is available to raise or lower said operated element upon actuation of both control members.

2. For combination with a vehicle having an operated element such as an earthmoving blade and means supporting said element including a double acting hydraulic jack adjacent each end thereof, and means to supply fluid pressure to said jacks comprising a valve in the fluid circuit; a control member on said valve movable in one direction to first supply fluid to a first of said jacks to raise one end of the operated element and upon further movement to supply fluid to both jacks simultaneously to raise the entire element, said same control member being movable in the opposite direction to first supply fluid to the opposite end of said first jack to lower one end of the operated element and upon further movement to the opposite end of both jacks simultaneously to lower the entire element, and a second similar valve and control member operable like the first to effect independent operation of the second of said jacks and simultaneous operation of both jacks, said valves being connected in series in the fluid circuit to enable their simultaneous operation to raise one end of the operated element and lower the other end thereof.

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