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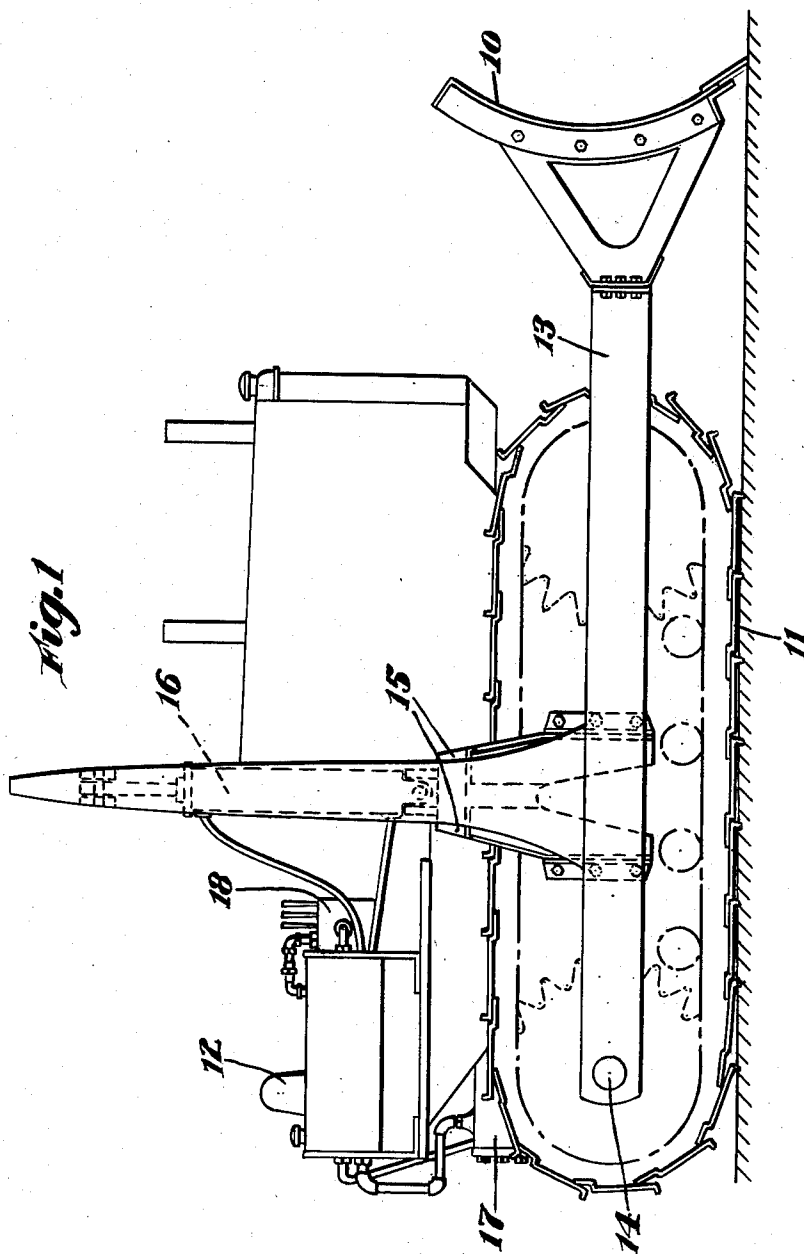
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2,103,530

SYSTEM OF EQUALIZING THE LIFTING SPEED OF DIFFERENTLY LOADED HYDRAULIC JACKS

Filed Sept. 5, 1935

4 Sheets-Sheet 1



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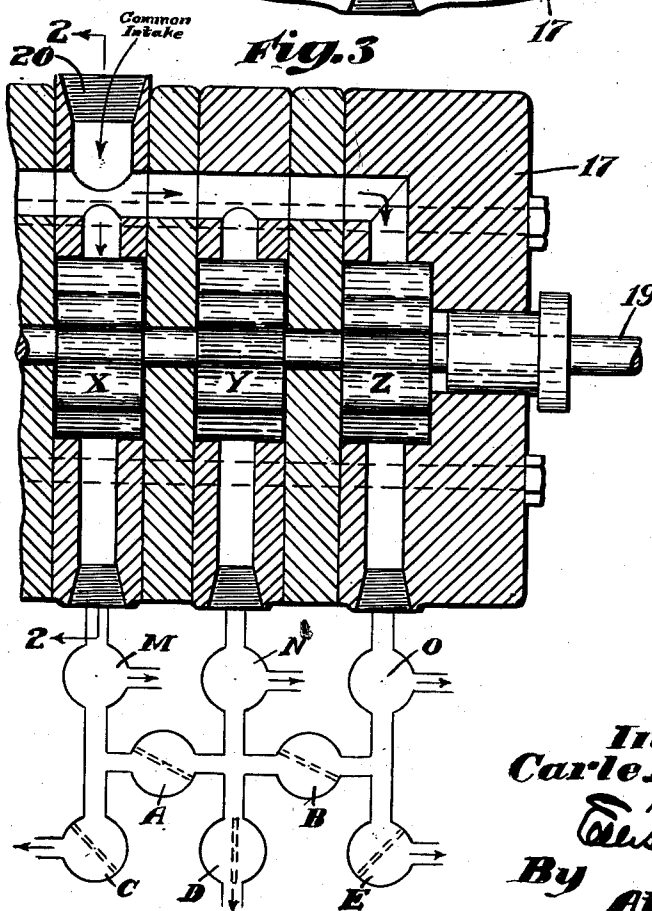
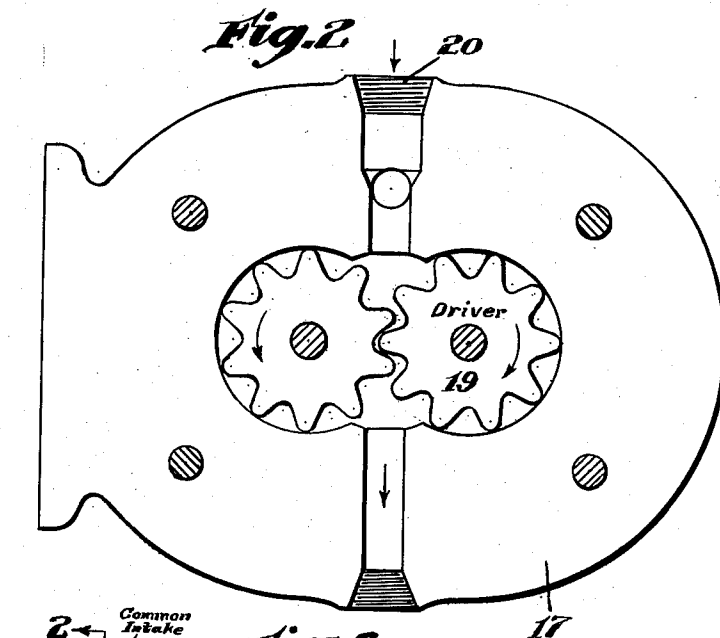
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4 Sheets-Sheet 2



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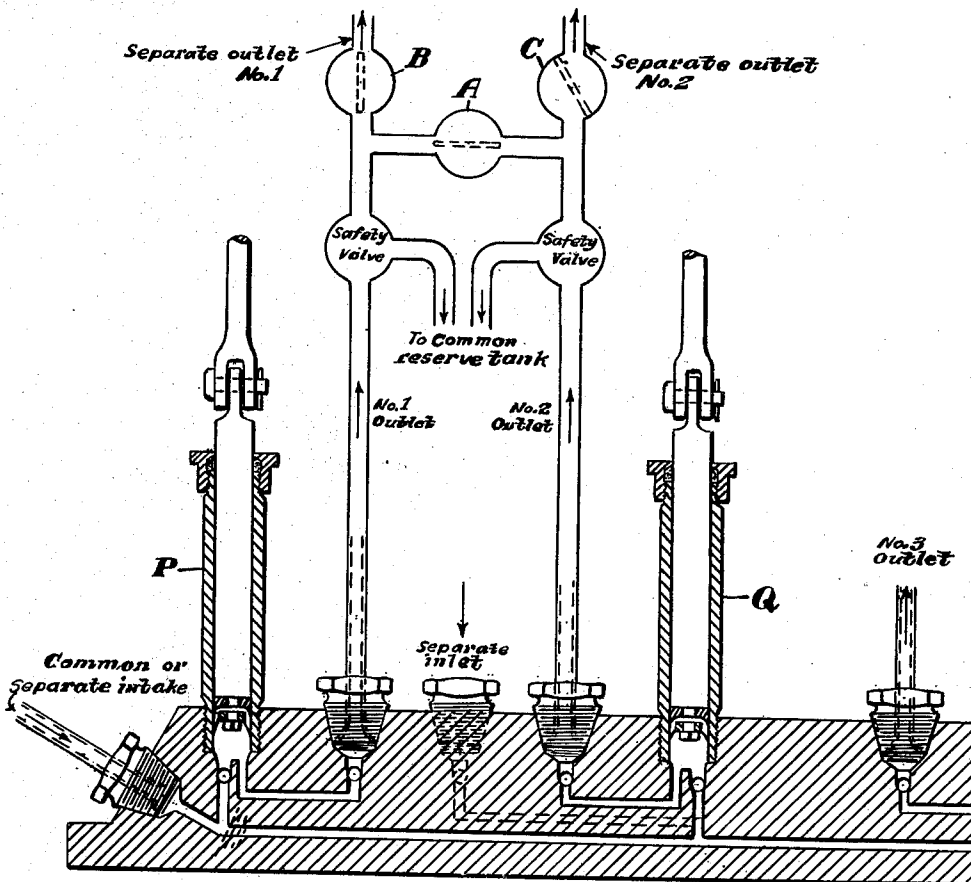
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4 Sheets-Sheet 3

Fig.4



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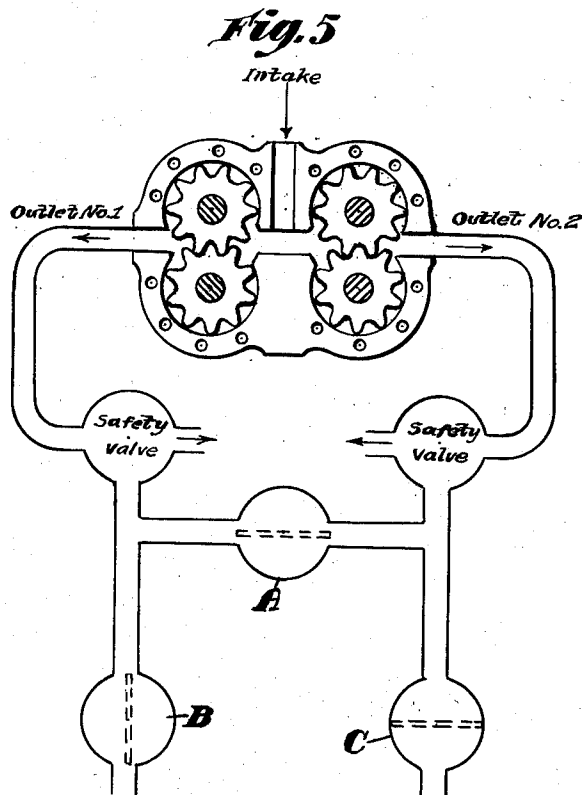
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SYSTEM OF EQUALIZING THE LIFTING SPEED OF DIFFERENTLY LOADED HYDRAULIC JACKS

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4 Sheets-Sheet 4



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SYSTEM OF EQUALIZING THE LIFTING
SPEED OF DIFFERENTLY LOADED HY-
DRAULIC JACKSCarle D. Henry, South Portland, Maine, assignor
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Application September 5, 1935, Serial No. 39,274

11 Claims. (Cl. 37-144)

This invention relates to material handling equipment intended especially for use on track laying or crawler tractors and has for its general object to provide a means of attaining an equalized lifting speed in two or more separate hydraulic jacks carrying different loads at the same time when only a single source of power is available to operate the pumping mechanism.

The crawler tractor is so designed that each of its two tracks may move up and down or "oscillate" independently of each other except at one point which is usually at or near the center of the rear drive sprocket. The two tracks tend to pivot around this common point and because this is the only point along the track frames where one track remains permanently in the same relationship to the other track it is the point from which accessory material handling equipment is ordinarily pushed.

Accepting this point as the conventional push point, the problem is to lift or adjust the accessory equipment in a vertical plane while it is being pushed by and ahead of the tractor.

The point or points from which the lifting power is applied must obviously be ahead of the pivot and push point previously referred to and because it is ahead of this point it is equally obvious that the lifting is done from points which do not stay in the same relative positions with each other and that therefore a single lift is impractical and there must be a separate lift or hydraulic jack on each side of the tractor.

Both lifting jacks are commonly operated by means of hydraulic pressure generated by a pump connected with the power take-off of the tractor. The difficulty with the conventional type of lift is that when one side of the equipment to be lifted is loaded with snow or dirt and the other side is not so loaded, any attempt to operate the two jack lifts results in lifting the light side to the limit of its stroke before the loaded side starts up, because in accordance with the well known principle of hydraulics, oil pressure originating from a single source, with two possible outlets, will flow through the outlet having the least load until the resistance in that outlet is built up to equal the pressure necessary to lift the load on the other outlet.

Hence when the operator of a bulldozer, or a trail-builder, or a snow plow, or a snow plow wing, opens his lifting valve, first one end of the equipment comes up and then the other end, and only an analysis of the load which happens to be on the equipment at that particular minute will fore-warn the operator as to which end will lift

first, or how far it will lift before the other end starts after it.

To eliminate this uncertainty and to secure an equal lifting speed on each side regardless of different loading my invention includes a hydraulic pump which may be of gear, plunger, or other hydraulic type and which is of multiple construction so that two or more separate streams of oil are pumped to the different jacks.

With such multiple-stream pump may be included a valve assembly by which the oil or other fluid under pressure from all of the multiple pumping units may be combined as a single stream to a single jack thereby to obtain the maximum lifting speed and additional valve adjustments enabling the several jacks to be lifted simultaneously with a uniform flow of oil to each regardless of variation in their respective loads.

By means of my multiple pump and valve assembly the blade of a trail-builder, for example, can be tipped up and set at an angle with the maximum speed by combining all the oil flow to the jack on one end, and thereafter by using the valve assembly to separate the flow to the jacks on either side, it can be lifted and lowered as a whole and still retain the tipped position arrived at by using the combined flow to the single jack.

Or considering a snow plow wing with a jack on either end where the load on one end is much heavier than the load on the other end, such wing may be lifted in a level position with the divided flow, or speedily tilted to any angle by the combined flow, and such angle having been once attained, the wing can be lifted as a whole by the divided flow and while being lifted can maintain its tilt even when one end is loaded to capacity and the other end is light.

The same principle can be used to adjust the angle of a trail-builder blade in a horizontal plane, and in fact is generally applicable to use in connection with all equipment mounted on tractors or other types of motive equipment which needs to be quickly and positively adjusted during its use and operation.

In the accompanying drawings I show an embodiment of my invention which has been found highly satisfactory under actual service conditions. In the drawings:—

Fig. 1 is a side elevation of a conventional tractor equipped with means for equalizing the lifting speed of the hydraulic jacks commonly employed for raising the material-handling implement, here shown as the moldboard of a bulldozer, trail-builder, or the like.

Fig. 2 is a section on the line 2—2 of Fig. 3 through a multiple gear pump such as contemplated by my present invention.

Fig. 3 is a fragmentary plan section of such pump.

Fig. 4 is a diagrammatic view of the hydraulic system as used in my invention but showing pumps of the plunger type rather than the multiple gear type as shown in Figs. 2 and 3, and

Fig. 5 is a diagrammatic view of a variation of the hook up wherein two gear pumps are placed side by side and driven from a common shaft.

Referring to Fig. 1 I have indicated at 10 the moldboard of a bulldozer or trail-bulldozer. For this however can be substituted a snow plow or any other implement of the material handling type requiring upward or downward or angular adjustment and which is made for use with a tractor or other type of motive equipment.

I have indicated at 11 the tracks of a tractor 12 of conventional type, and at 13 the push members which push the moldboard, plow or other equipment mounted on the tractor. The push members 13 are pivoted at or near the center of the rear drive sprocket 14.

I have indicated at 15 a pair of upright supporting structures attached to the track frames at either side thereof, and at 16 a pair of hydraulic jacks mounted on the supports, 15 and by means of which jacks one or the other, or both, of the push members may be lifted.

I have indicated generally at 17 a multiple hydraulic pump preferably driven by the power take off of the tractor and at 18 a valve assembly conveniently located in the cab by means of which the operator may divert the oil or other fluid under pressure to the different jacks as he desires to manipulate his machine.

Referring to Figs. 2 and 3 I have shown the multiple pump 17 as a pump of the gear type driven from a common shaft 19 having three separate outlets under different conditions. Two outlets may be adequate or a greater number may be required. The three pumps X, Y, and Z draw oil or other fluid under pressure from a common reserve tank (not shown), through the common intake 20. Each pump is provided with a separate safety valve M, N, and O which in case of overload release the oil back to the common reserve tank from which the three pumps are fed. Valves A and B are designed to separate or combine the flow from the three pumps X, Y, and Z. Valves C and D and E govern the separate outlets so that when valves A and B are opened and the three pumps are working with a common outlet, these valves C, D and E can divert the common stream to one, two or three different jacks.

When valves A and B are closed, the output of the pumps go individually to their respective cylinders. When only A is closed, the cylinder on the output of valve C is the only one operating individually. Valve B operates identically. When both valves A and B are open the output of the pumps go to the cylinders in combination. By leaving valves A and B open and closing any one or two of C, D or E, the output of the pumps may be directed to any one or two cylinders. The valves A, B, C, D, and E may be of any type, as rotary plugged plunger, poppet, needle, or any combination thereof.

In Fig. 4 I have shown the same system with plunger type pumps such as P and Q which accomplish the same purpose as the multiple gear pump shown in Figs. 2 and 3 and, governed by a

valve assembly of similar principle, may be used with either a common or a divided flow.

When valve A is closed outputs of pumps go individually to their respective cylinders. When valve A is open output of the pumps go to the cylinders in combination. By closing valve A or B output of pumps may be directed to any one cylinder.

In Fig. 5 I have shown a variant of the multiple gear pump wherein the gears are arranged side by side instead of on a common shaft, all principles being the same as in the other drawings, the difference being only in the mechanics of housing and hanging gears.

Various other arrangements will suggest themselves to those skilled in the art and all such as come within the purview of my invention as defined by the appended claims are to be regarded as covered thereby.

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

1. In material handling equipment, the combination with a propulsion vehicle and a material moving element propelled thereby, of a pair of hydraulic lifting jacks mounted on the propulsion vehicle and operatively connected with the material moving element, a multiple unit pump for supplying plural streams of fluid under pressure to said jacks, a single source of power for operating said pump, and control means dominant upon said pump and manipulatable to maintain predetermined lifting speeds on both jacks regardless of loads on either jack varying from zero to capacity and also manipulatable to combine all of the fluid streams and send them to a single jack to cause said jack to operate at maximum lifting speed.

2. In material handling equipment, the combination with a propulsion vehicle and a material moving element propelled thereby, of a hydraulic lifting jack mounted on the propulsion vehicle at either side thereof and operatively connected with the material moving element, a multiple unit pump for supplying plural streams of fluid under pressure to said jacks, a single source of power for operating said pump, and a valve assembly dominant upon said pump and manipulatable to combine all of the fluid streams and send them to a single jack to cause said jack to operate at maximum lifting speed or to divide the streams uniformly and send the divided streams to both jacks to cause both jacks to operate at equalized lifting speed on occasions when both jacks are differently loaded at the same time.

3. The combination of claim 1 wherein all of the pumping units are driven from a common drive shaft.

4. The combination of claim 1 wherein the pump is a multiple gear pump.

5. The combination of claim 1 wherein the pump is a multiple plunger pump.

6. The combination of claim 1 wherein a pair of multiple stream pumps are placed in juxtaposition to each other and driven from a common shaft.

7. In material handling equipment, the combination with a tractor, a material moving element propelled thereby, and push members pivoted at their rear ends at or near the rear drive sprocket of the tractor and fastened at their forward ends to said material moving element, of separate supports mounted on the track frames of the tractor at each side thereof, separate hydraulic jacks carried by said supports and operatively connected with said push members, a multiple unit pump for

supplying plural streams of fluid under pressure to said jacks and driven from the power take-off of the tractor, and a valve assembly located within convenient reach of the operator of the tractor and dominant upon said pump and manipulatable either to combine all of the fluid streams and send them to a single jack to cause said jack to operate at maximum lifting speed, or to divide the fluid streams uniformly and send the divided streams to both jacks to cause both jacks to operate at equalized lifting speed on occasions when both jacks are differently loaded at the same time.

8. In material handling equipment, the combination with a propulsion vehicle and a material moving element propelled thereby, of a separate hydraulic lifting jack mounted at each side of the propulsion vehicle and operatively connected with the material moving element, a multiple unit pump mounted on the propulsion vehicle, a single source of power for driving said pump, said pumping units having a common intake and also having separate outlets under different conditions, and a valve assembly mounted on the propulsion vehicle and controlling the supply of fluid from said pump to said jacks and including a pair of valves adapted either to separate or combine the flow of fluid from the several pumping units to said jacks, and a plurality of other valves separately governing the separate outlets of the several pumping units and effective when said pair of valves is open and the several pumping units are operating with a common outlet to divert the common stream to one or both of the jacks.

9. The combination of claim 8 wherein separate safety valves are provided for all of said pumping units.

10. In material handling equipment, the combination with a propulsion vehicle and a material moving element propelled thereby, of a separate hydraulic lifting jack mounted on each side of the propulsion vehicle and operatively connected with the material moving element, a multiple unit pump mounted on the propulsion vehicle, a single source of power for driving said pump, said pumping units having a common intake and also having separate outlets under different conditions, and a valve assembly controlling the supply of fluid from said pump to said jacks and manipulatable either to separate or combine the flow of fluid from the several pumping units to said jacks.

11. In material handling equipment, the combination with a propulsion vehicle and a material moving element propelled thereby, of a pair of separate lifting members mounted on the propulsion vehicle and operatively connected with the material moving element, a prime mover for said lifting members, a single source of power for driving said prime mover, and control means dominant upon said prime mover for causing a single jack to operate at maximum lifting speed or for causing both jacks to operate at equalized lifting speed on occasions when both jacks are differently loaded at the same time.

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