

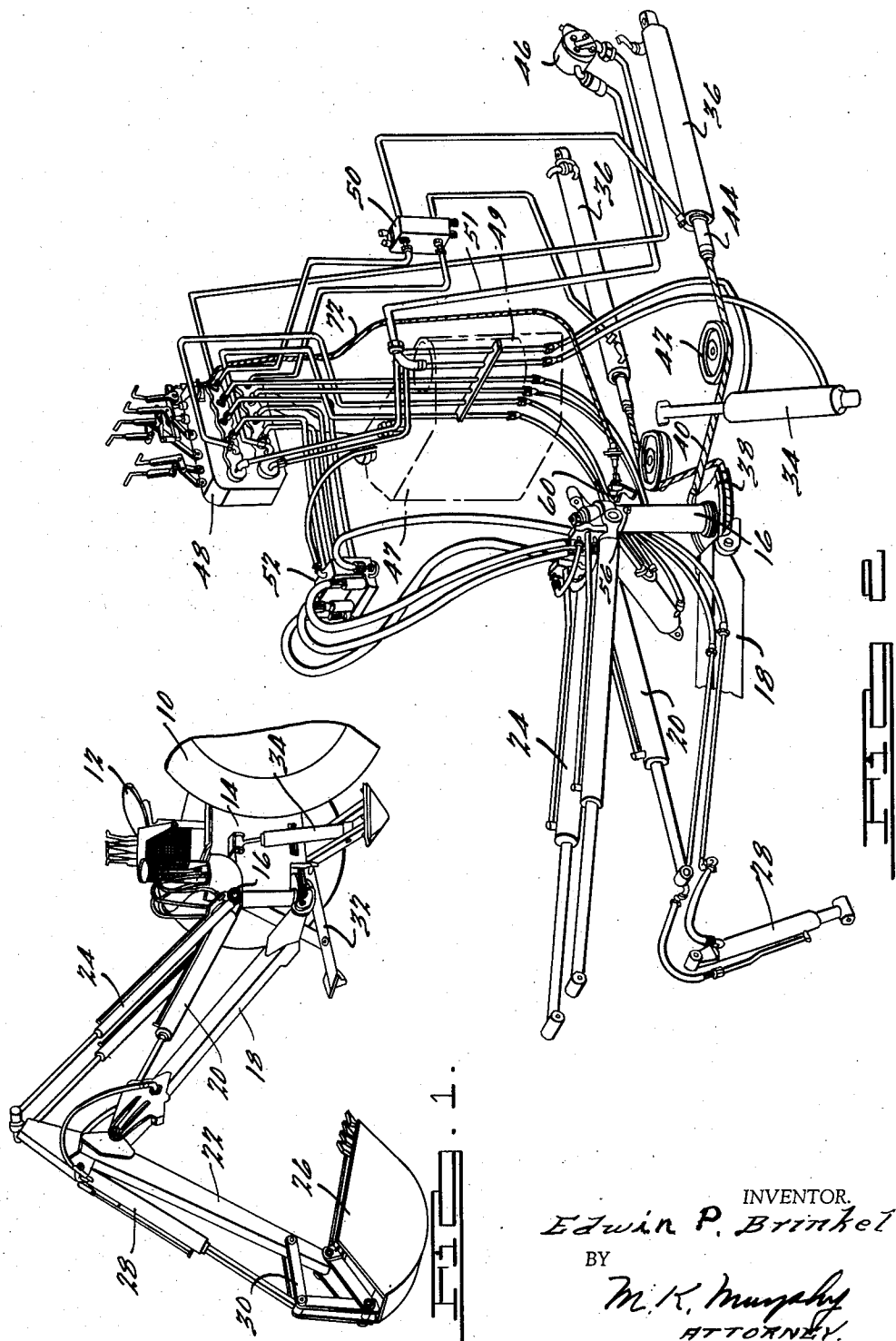
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E. P. BRINKEL
VALVE CONTROL

2,903,145

Filed April 4, 1957

2 Sheets-Sheet 1



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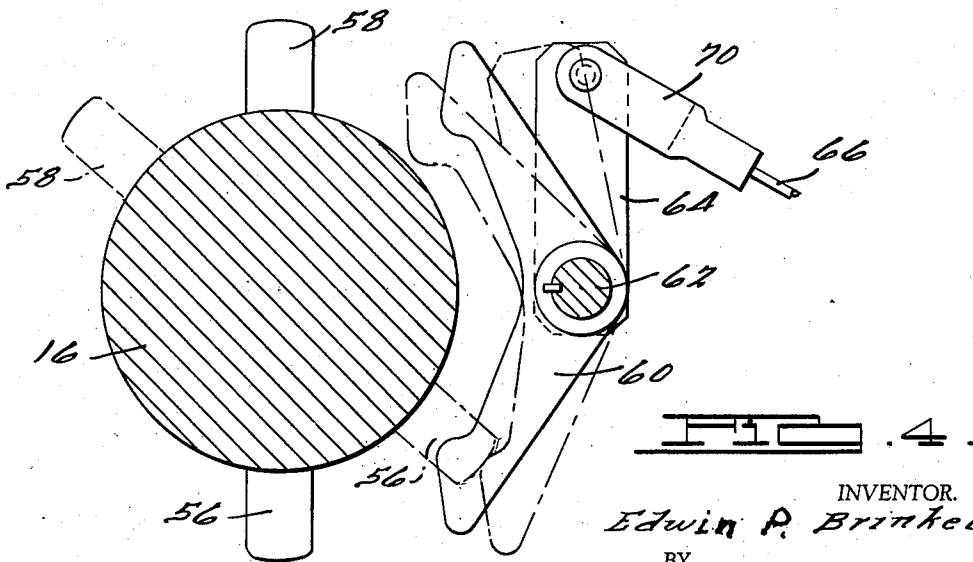
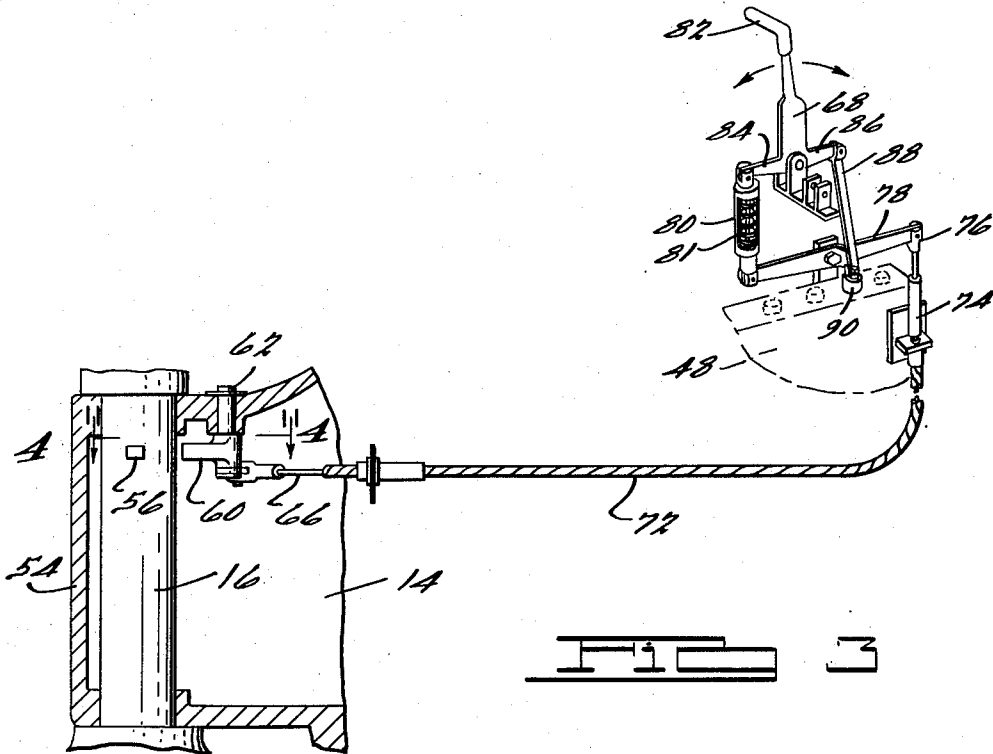
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VALVE CONTROL

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2 Claims. (Cl. 214—138)

This invention relates to improvements in tractor mounted shovels or diggers of the type commonly referred to as "back-hoes."

It relates specifically to an interlocking safety control for automatically neutralizing the swing control valve to prevent damage to the parts caused by failure of the operator to manually neutralize the valve at the end of the swinging stroke.

In diggers of this type, hydraulic power is generally used for operating the boom, dipper stick, dipper, and for swinging the digger structure about a vertical axis to deposit the load in a desired spot. The various hydraulic cylinders are controlled by a multiple valve manipulated by the operator. When a loaded dipper is swung about the vertical axis of the digger, considerable inertia forces develop and it is important that the swing be stopped before the extreme end of the stroke is reached because of possible damage to the mechanism caused by the swing frame abutting the supporting frame. The operator can prevent damage by neutralizing the swing valve in time to prevent this, but careless or inexperienced operators frequently allow the swing frame to abut the supporting frame at either end of the swing stroke with consequent shock to the mechanism.

It is the primary object of my invention, therefore, to provide automatically operable means for neutralizing the swing control valve in diggers of the aforesaid type.

Reference is made to the specification and to the accompanying drawings for a description of a preferred embodiment of my invention.

In the drawings:

Fig. 1 is a perspective view of a digger mounted on a typical light tractor;

Fig. 2 is a similar view on an enlarged scale of the hydraulic system for actuating the digger;

Fig. 3 is a fragmentary view of the hydraulic system showing the swing valve neutralizer; and

Fig. 4 is a plan view on an enlarged scale of the neutralizer operating cam and follower as viewed along the line 4—4 of Fig. 3.

While the digger shown is of the back-hoe type, it should be understood that my invention is applicable to any type of digger whether its digging stroke is toward or away from the tractor, and whether it is movable or stationary. The digger illustrated is mounted on a tractor of the farm or industrial type. The tractor has rear driving wheels 10 and a seat 12 which is capable of facing to the rear, as shown, for operation of the digger, or to the front for operation of the tractor.

The power digger comprises a main frame 14 which carries the digger mechanism and is mounted on the tractor frame by means not shown. A swing frame 16 mounted on the main frame 14 carries a boom 18 which is swingable in a vertical plane under control of a double acting hydraulic cylinder 20 also mounted on the swing frame 16.

A dipper stick 22 is pivotally mounted on the outer end of the boom and is swingable about its pivotal mounting

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under control of a pair of double acting crowd cylinders 24, which are also mounted at their inner ends on the swing frame.

A dipper 26 is carried on the outer end of the dipper stick and is adapted to be swung about its pivotal connection with the dipper stick by a double acting pitch cylinder 28 through an actuating linkage 30.

The digger main frame also carries a pair of laterally extending stabilizers 32 which are adapted to be moved from transport position to a position stabilizing the tractor for digging by a pair of stabilizer cylinders 34. The swing frame 16 including the parts mounted thereon is swingable about its axis by a pair of swing cylinders 36. As may be more clearly seen in Fig. 2, the swing frame 16 has a sheave 38 fixed to its lower end. A cable 40 passes around this sheave and over a pair of idler sheaves 42 and is connected at its opposite ends to the piston rods 44 of the swing cylinders 36, which are single acting cylinders.

Fluid under pressure for actuation of the pistons in the above mentioned cylinders is supplied by a pump 46, driven by the tractor engine. A reservoir 47 having a filter 49 therein is connected to the suction side of the pump through conduit 51. A main control valve 48 having a plurality of operating levers controls flow of fluid to the various cylinders. A flow control valve 50 regulates flow to the swing cylinders 36, and a relief valve 52 is provided in the lines to the dipper operating cylinders to prevent damage from overloads.

It will be understood from the brief description above that manipulation of the various operating levers of the valve 48 will direct flow of pressure fluid from the pump 46 to the various double acting actuating cylinders to thrust the stabilizers 32 into or against the ground and to retract them, to swing the boom 18 in a vertical plane about its pivot axis on the swing frame, to swing the dipper stick 22 about its pivot axis on the boom, to swing the dipper 26 about its pivot axis on the dipper stick and finally to swing the entire digger assembly about the axis of the swing frame 16.

Referring now particularly to Figs. 3 and 4, it will be seen that the swing frame 16 is mounted in a semi-cylindrical extension 54 of the main frame 14. The member 16 has a pair of cam elements 56, 58, mounted thereon near the upper end thereof and spaced 180 degrees apart. A cam follower 60 is swingably mounted inside the frame housing 14 in such position that oppositely disposed legs thereof are adapted to be alternately engaged by the respective cam elements 56, 58, when the swing frame nears the end of its stroke in either direction.

The cam follower 60 is fixed on the lower end of a vertically disposed stub shaft 62. Also fixed to the stub shaft is an arm 64 which is operatively connected through a flexible cable 66 with the swing valve operating lever 68. A clevis 70 connects one end of the cable 66, which has a flexible sheath 72, with the arm 64 and the other end of the cable is led through a fitting 74 mounted on the valve housing 48 and to a clevis 76 which connects with a rocker arm 78. The latter is rockably mounted on the top of the valve housing 48, as shown, and the opposite end thereof is connected to the valve operating lever 68 through a lost motion device 80. The latter includes a coil spring 81 of sufficient strength to transmit motion from lever 84 to lever 78 and vice versa without being compressed or extended under normal operating conditions.

The valve operating lever 68 is of T-shape and embodies a handle 82, a forwardly extending arm portion 84 connected to the lost motion device 80 and a rearwardly extending arm portion 86 connected through a link 88 with the swing valve plunger 90. The parts are illustrated schematically and it will be understood that the mounting thereof is such that the fitting 74, the rocker

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arm 78, etc., are mounted on the valve housing such that no interference with the valve operating mechanism for the other hydraulic cylinders exists.

The device operates as follows:

Swinging of the lever 68 forwardly and rearwardly by the operator will actuate the valve plunger 90 to cause swinging of the entire digger structure through substantially 180° of movement in accordance with the pressure fluid admitted to the swing cylinders 36. If the valve operating lever 68 is thrust forwardly, the plunger 90 will be moved to such position that fluid is admitted to one of the cylinders 36 and the swing frame 16 together with the entire movable digger assembly will be swung to the left. At the same time, the cam follower 60 will be moved, through intermediary of the rocker arm 78 and the flexible cable 66, to the full line position shown in Fig. 4, such that the cam element 56 will engage the follower 60 and neutralize the valve plunger 90 before the swing frame has moved full 90° from central position. Because of the inertia of the swing frame and the load in the dipper 26, the frame will swing a short distance after neutralization of the valve plunger 90, but will be brought to a stop before it has swung the full 90°. The fluid in the cylinders 36 regulated by the flow control valve 50 cushions the stop and prevents shock to the mechanism.

If the range of swing is not sufficient and the operator wishes to swing the frame further to substantially 90° from central position, he can thrust the lever 68 forwardly with sufficient force to compress the coil spring 81 whereupon the valve plunger 90 will be operated regardless of the position of the neutralizing lever 78.

Swinging of the digger toward the right is accomplished in a similar manner by thrusting the lever 68 rearwardly. In this instance, swinging of the swing frame beyond its normal stop position as determined by the neutralizing lever 78 is done by thrusting the lever 68 without sufficient force to extend the coil spring 81.

It will thus be seen that I have provided a simple and easily constructed safety device for diggers of the type described which prevents damage that might be caused by careless or inexperienced handling and which speeds up operation of the digger by relieving the operator of the necessity of manipulating the swing valve lever to neutralize the swing valve at the proper time to prevent possible damage.

I claim:

1. A control mechanism for power operated material handling apparatus comprising, a main frame, a swing frame pivotally mounted on the main frame, material handling elements carried by said swing frame, hydraulic actuated means for pivoting said swing frame with respect to said main frame, a valve controlling said hydraulic actuated means, a manually operable lever for shifting said valve to an operative position whereby the swing frame is pivoted relative to the main frame, a cam element

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carried by said swing frame, a cam follower mounted for movement on said main frame adjacent said swing frame, means interconnecting said lever with said cam follower shifting the cam follower to a position in the path of movement of said cam element when the manually operable lever is moved to shift said valve to the operative position, said cam follower upon movement in response to engagement by said cam element shifting said valve to an inoperative position rendering said hydraulic actuated means inactive, and a lost motion device forming part of said interconnecting means whereby said manually operable lever may be actuated to return said valve to the operative position after it has been shifted to the inoperative position.

2. A control mechanism for power operated material handling apparatus comprising, a main frame, a swing frame pivotally mounted on the main frame, material handling equipment carried by said swing frame, hydraulic actuated means for pivoting said swing frame with respect to said main frame, a valve having a neutral inoperative position and a first operative position and a second operative position activating said hydraulic actuated means whereby pivoting and the direction of movement of the swing frame relative to the main frame is controlled by said valve, a manually operable lever for shifting said valve to either of said operative positions from said neutral position, a first cam element carried by said swing frame, a second cam element carried by said swing frame spaced from the first cam element, a cam follower pivotally mounted intermediate its ends on said main frame adjacent said swing frame, means interconnecting said lever with said cam follower for shifting a first end of the cam follower to a position in the path of movement of the first cam element when the manually operable lever is moved from the neutral position to shift the valve to the first operative position, said cam follower upon movement in response to engagement by said first cam element shifting said valve to said neutral position rendering said hydraulic actuated means inactive, said interconnecting means shifting the second end of said cam follower to a position in the path of movement of said second cam element when the manually operable lever is moved from said neutral position to shift said valve to the second operative position, and said cam follower upon movement in response to engagement by said second cam element shifting said valve to said neutral position rendering said hydraulic actuated means inactive.

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