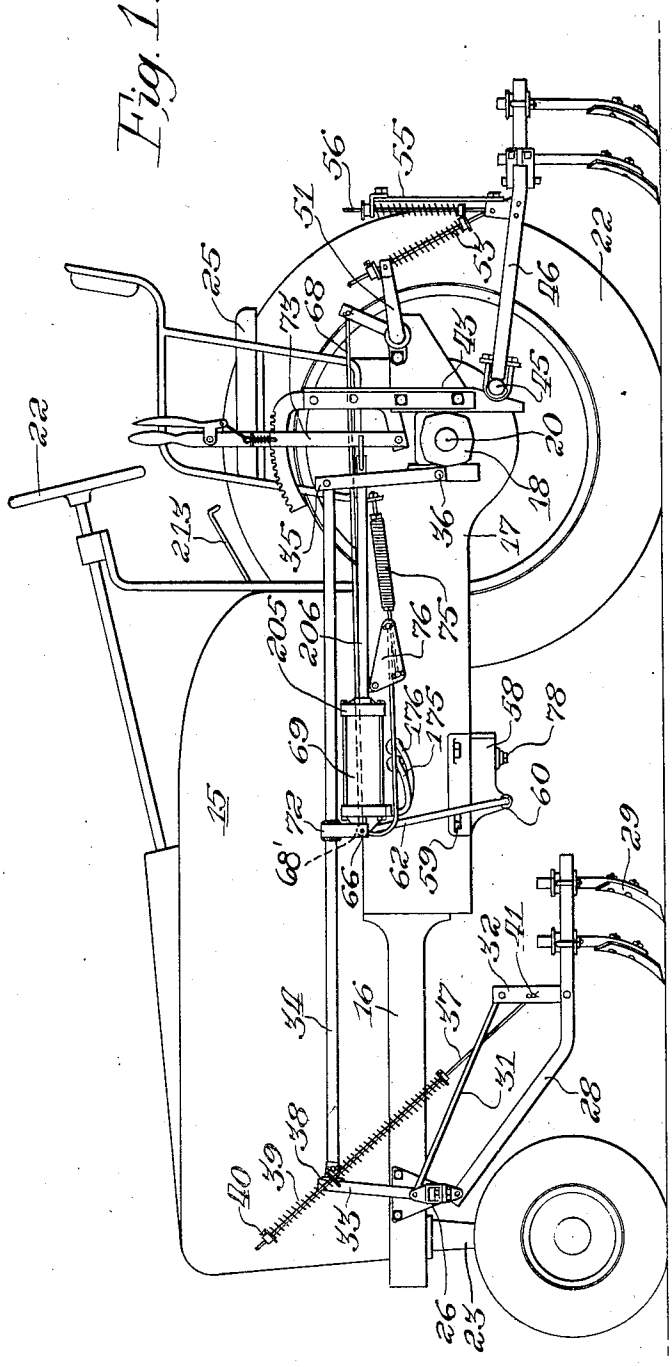
July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 1

Fig. 1.



Inventor
Carl W. Mott
By Paul O. Pippel
Atty.

July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 2

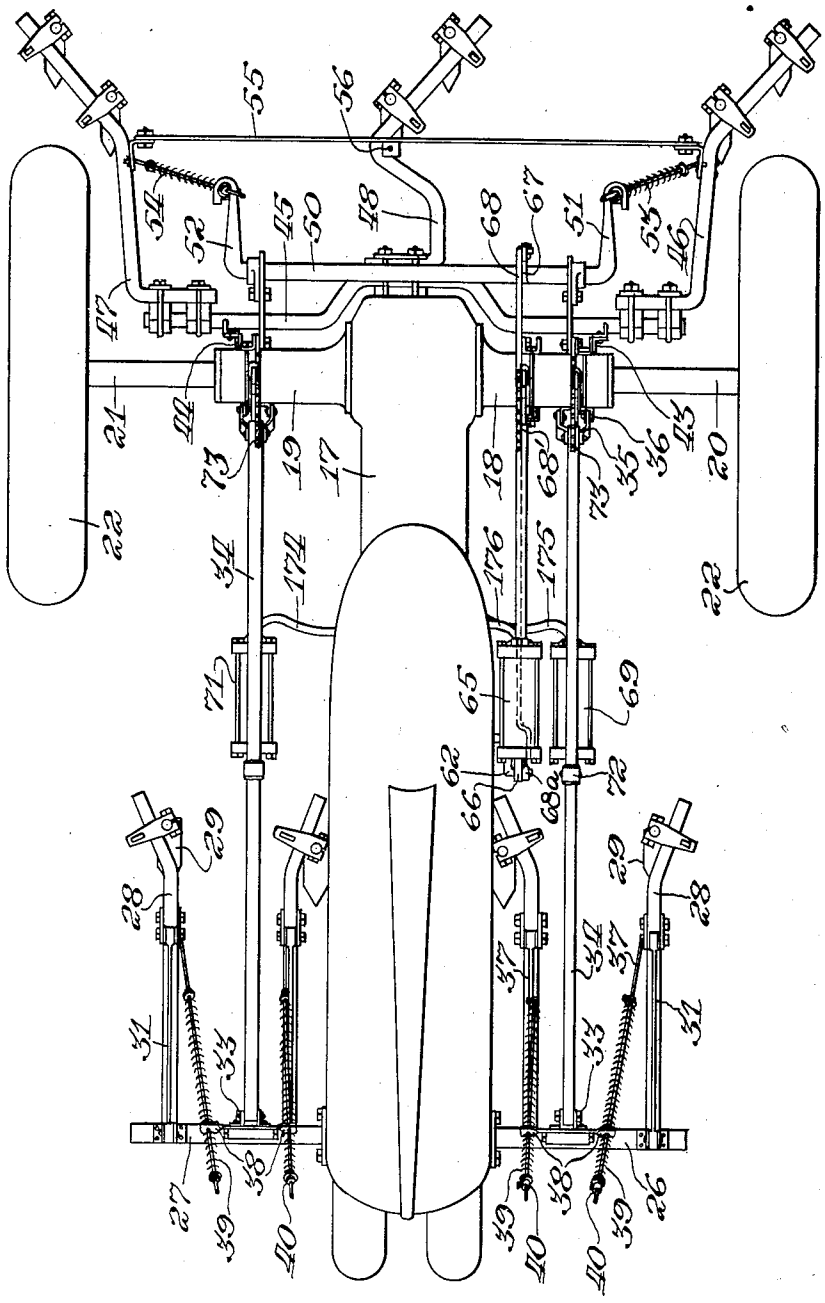


Fig. 2.

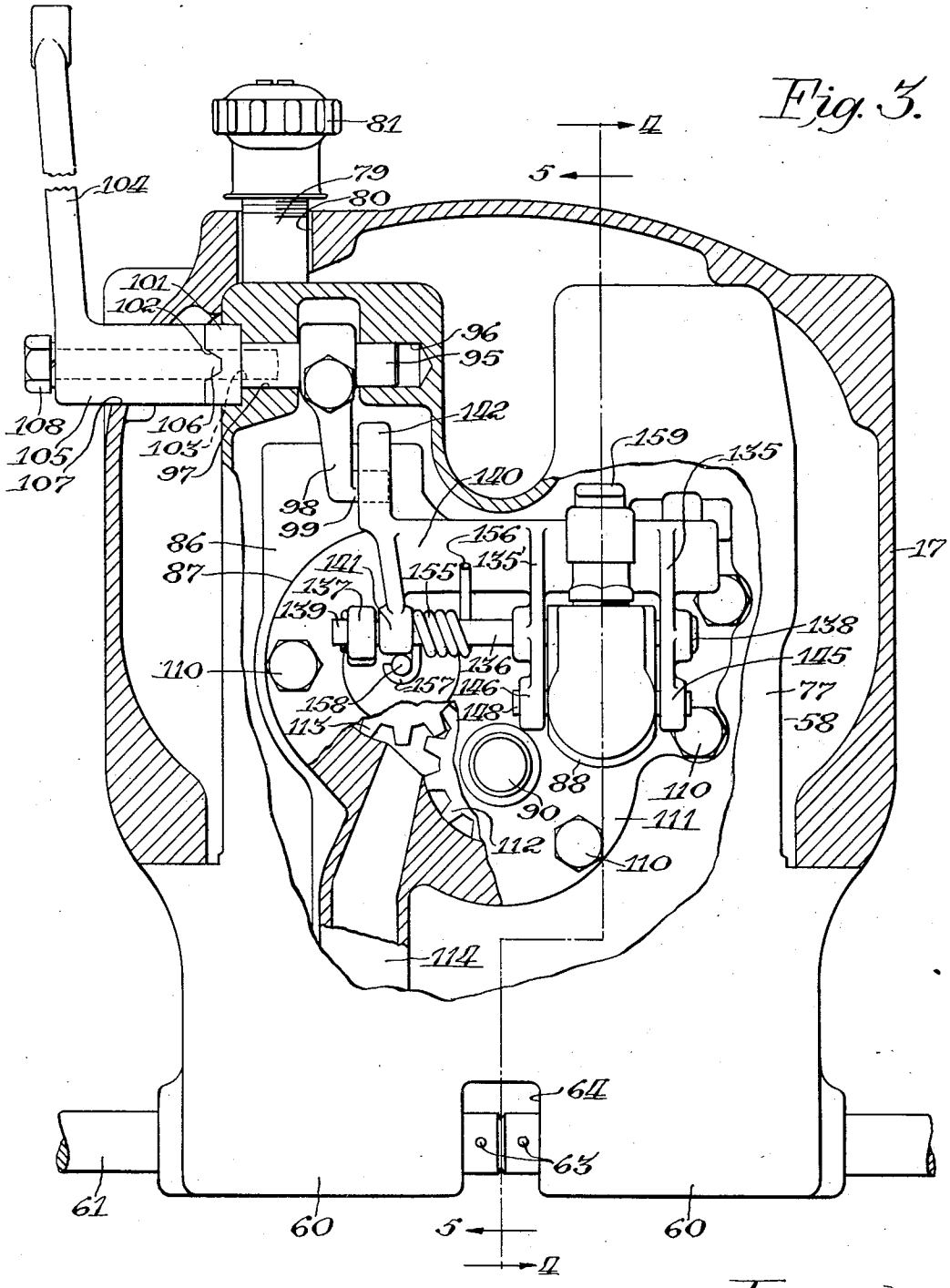
Inventor
Carl W. Mott
By Paul O. Pippel
Atty

July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 3

Fig. 3.



Inventor
Carl W. Mott
By Paul O. Pippel
Attorney

July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 4

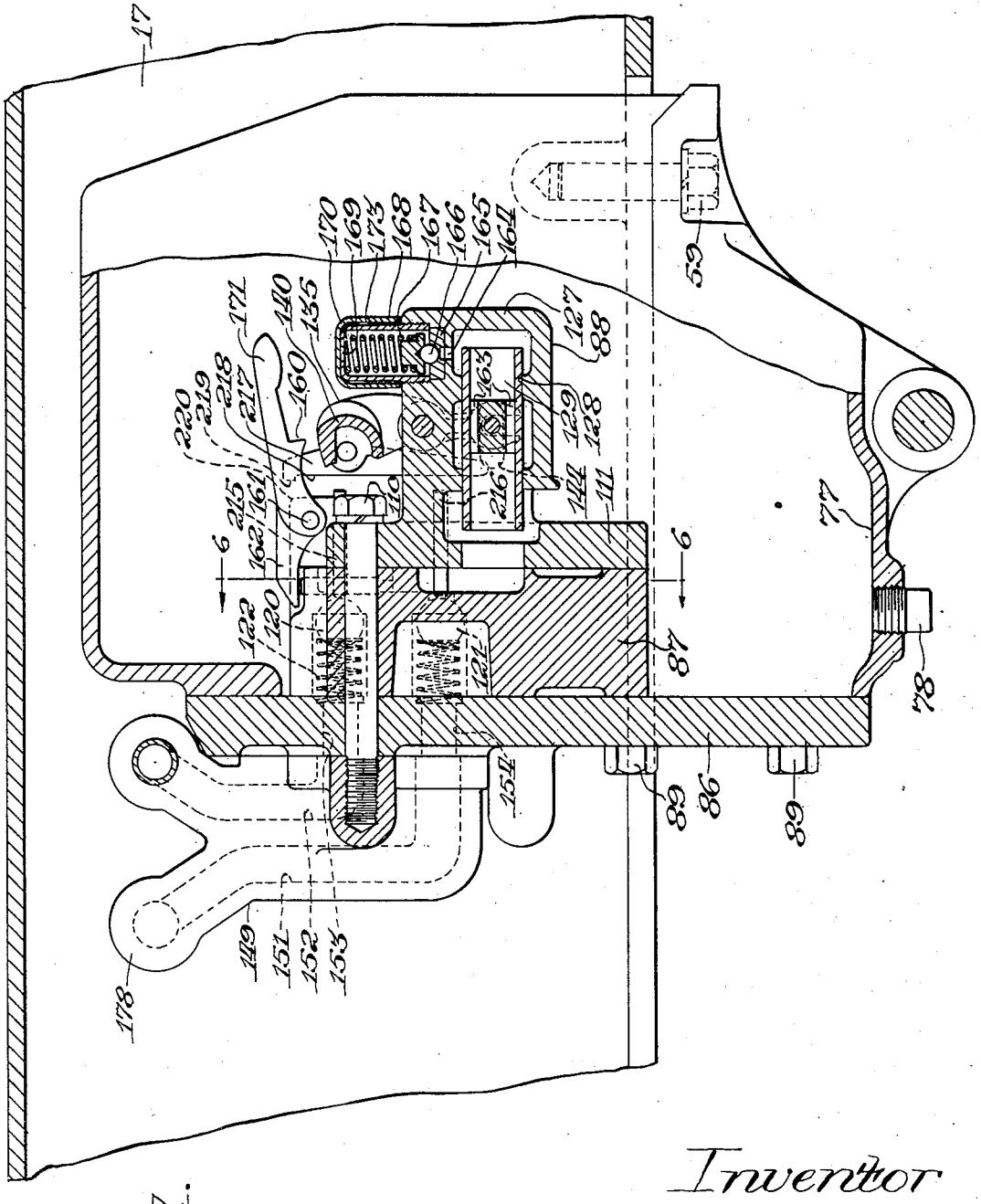


Fig. 7.

Inventor
Carl W. Mott
By Paul O. Pippel
Atty.

July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 5

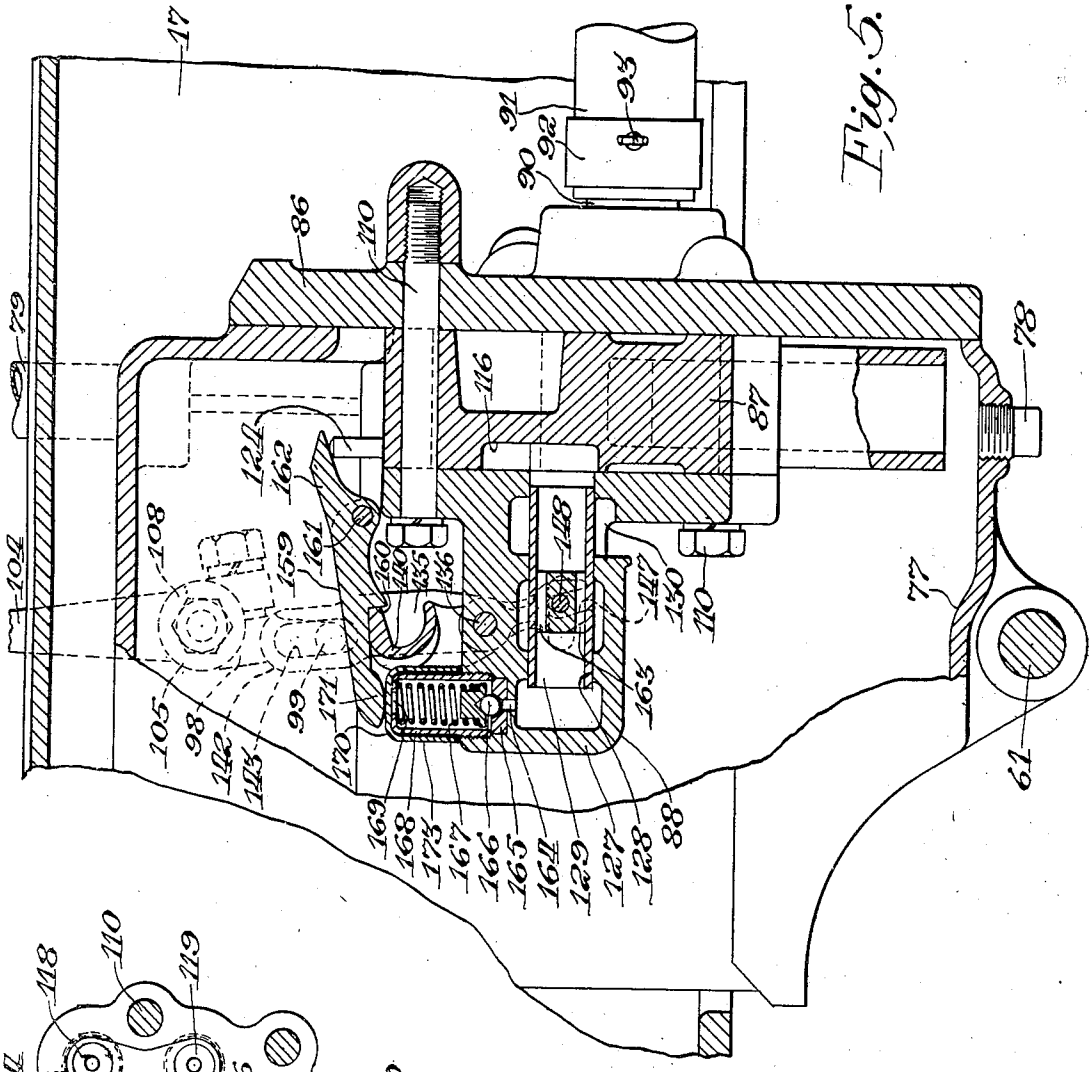


Fig. 5.

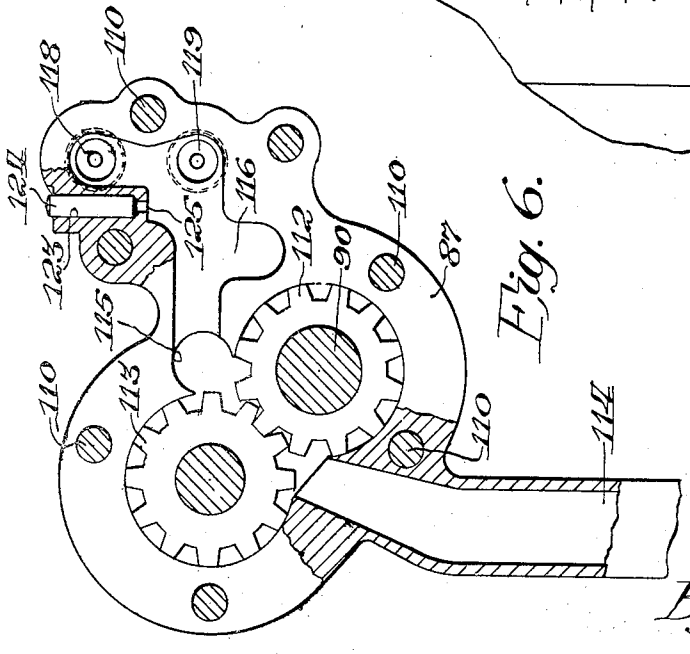


Fig. 6.

Inventor
Carl W. Mott
By Paul O. Pippel
Atty.

July 20, 1943. C. W. MOTT 2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Filed March 26, 1940 6 Sheets-Sheet 6

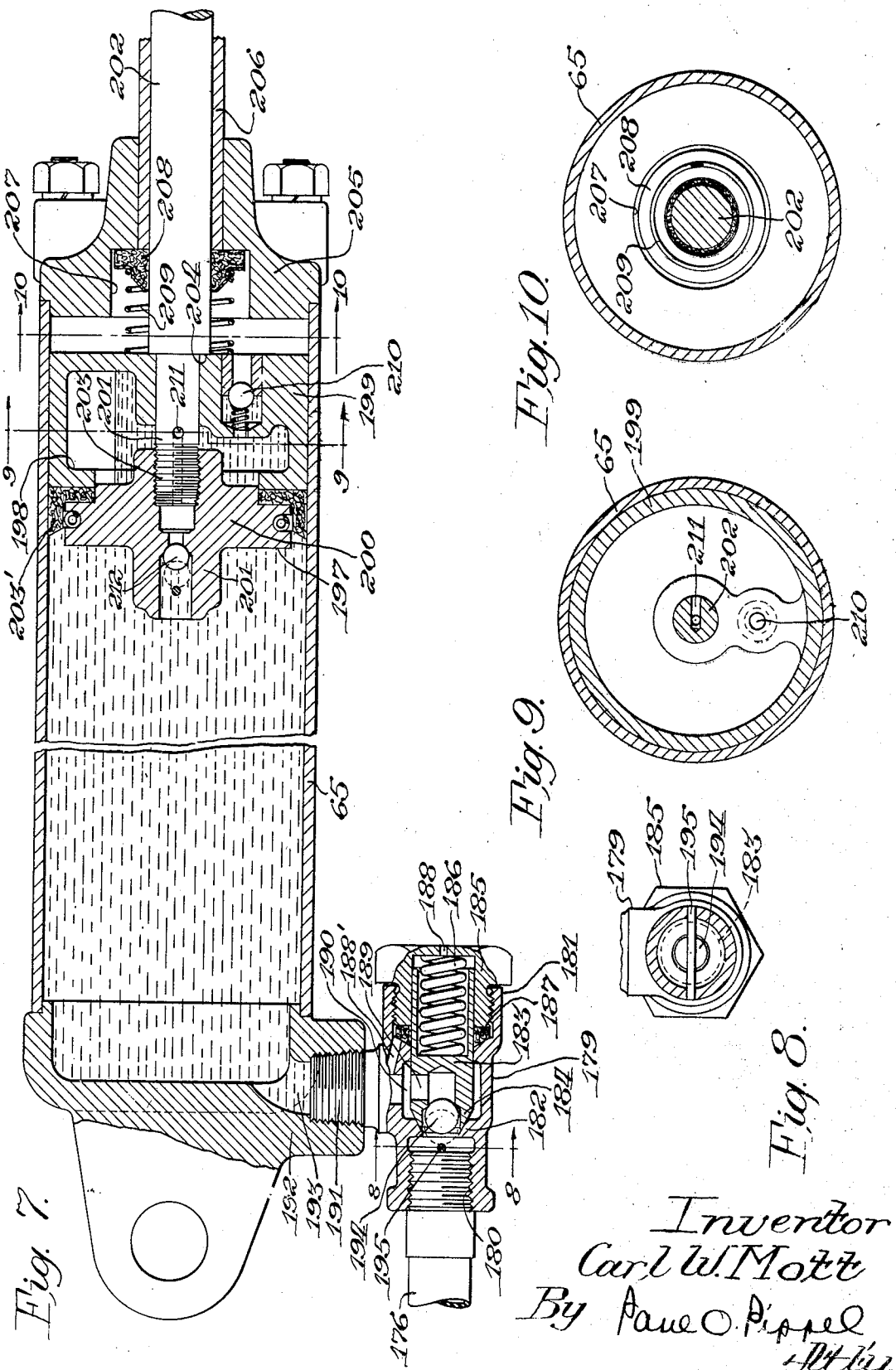


Fig. 7.

Fig. 10.

Fig. 9.

Fig. 8.

Inventor
Carl W. Mott
By Paul O. Pippel
Atty.

Patented July 20, 1943

2,324,866

UNITED STATES PATENT OFFICE

2,324,866

HYDRAULIC LIFTING ARRANGEMENT

Carl W. Mott, La Grange, Ill., assignor to International Harvester Company, a corporation of New Jersey

Application March 26, 1940, Serial No. 326,059

17 Claims. (Cl. 97—50)

This invention relates to hydraulic lifting arrangements particularly adaptable for the lifting of implements directly connected to tractors and movable with respect thereto to and from their ground-working positions.

The arrangement is similar to the arrangement covered in a copending application by A. C. Lindgren and the present inventor, Serial No. 181,778, filed December 27, 1937, now Patent No. 2,213,401, issued Sept. 3, 1940.

It is one object of the present invention to provide an improved lifting arrangement of this type which is of simple design and readily adaptable for commercial production.

It is another object of the invention to provide in a hydraulic arrangement of this type a safety means which will automatically prevent operation of the control mechanism when the tractor and the hydraulic pump are not operating.

It is still another object of the invention to provide in a hydraulic arrangement of this type an automatic valve which insures successive operation of front and rear connected implements, respectively.

It is still another object of the invention to provide in a hydraulic arrangement of this type a by-pass valve of the sleeve type which permits passage of fluid to a pressure responsive kick-out mechanism, even though the sleeve valve is moved to its closed position and thereby to cheapen the cost of construction of the arrangement by the elimination of parts.

It is a still further object of the invention to provide an improved assemblage of pump control mechanism and reservoir housing within the body of the tractor, wherein the same can be readily assembled or disassembled.

For other objects and a better understanding of an illustrative form of detail construction, reference may be had to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a view in elevation of a tractor with one of the rear wheels removed and with front and rear implements directly connected thereto and arranged for operation by the hydraulic arrangement, which is also shown;

Figure 2 is a plan view of the tractor and of the implement, showing particularly the arrangement of the lifting cylinders and their connections with respective implements;

Figure 3 is an enlarged view in elevation, showing in section the portion of the tractor into which the hydraulic reservoir and control mechanism is fitted;

Figure 4 is a view taken substantially along the line 4—4 of Figure 3, showing particularly in detail the control mechanism for the arrangement;

Figure 5 is a view taken along the same line 4—4 of Figure 3, but looking in the direction of the arrows 5—5, wherein is shown in detail the same sleeve-valve and control arrangements in the reverse direction from the showing in Figure 4;

Figure 6 is a detail showing of the pump and the plunger effective to render the latch mechanism susceptible to operation;

Figure 7 is a view in elevation and in cross-section of the fluid-operable cylinder device and delayed lift valve associated with the same;

Figure 8 is a view of the delayed lift valve taken in the direction of the arrows 8—8 of Figure 7;

Figure 9 is a cross-section of the cylinder and piston of Figure 7 and taken along the line 9—9 thereof; and,

Figure 10 is a view in section of the same cylinder shown in Figure 7 and taken in the direction of the arrows along line 10—10 thereof.

Referring now particularly to Figures 1 and 2, there is shown an implement supporting means in the form of a tractor, indicated generally at 15, having a side frame construction 16 and a transmission and differential housing 17. Extending laterally from the transmission and differential housing 17, at each side thereof, are the rear axle housings 18 and 19, respectively, in which there is connected with the differential mechanism rear drive axles 20 and 21, respectively, for the driving of the drive wheels 22, which support the rear of the tractor. The forward portion of the tractor is supported by steerable wheel construction 23 operated by the steering wheel 24 located proximate the operator's station 25.

On the side frame construction 16 there is connected, at each side of the tractor, transversely projected tool-carrying brackets 26 and 27, respectively. Since the implements at each side of the tractor are similar, only the one at one side will be described. To the bracket 26 there is connected the tool beam 28 having the tools 29 connected thereto. Immediately above the tool beam and extending parallel therewith is a link 31 connecting the transverse bracket 26 with the tool beam bracket 32. On the bracket 26 there is pivotally mounted a pivotal lever 33, the upper end of which is pivotally connected to a lifting rod 34 extending along the side of the tractor to

be supported at the rear thereof by a second pivotal lever 35 pivoted at 36 to the rear axle housing 18. Forwardly pivotal movement of these levers 33 and 35 effects lifting of the front implement by means of lifting rods 37 extending through transversely extending ears 38 on the upper end of the lever 33. As this lever 33 is pivoted forwardly, the ear 38 contacts with a spring 39 retained on a rod by a collar 40 and will thereby cause a lifting movement of the implement through the connection of the rod 37 to the bracket 32 at 41. Should the implement contact with the under portion of the tractor and to prevent breakage of any of the equipment, the spring 39 will contract sufficiently to permit forward movement of the lever 33 with respect to the lifting rod 37. The spring 39 is of sufficient tension as not normally to contract until greater force is applied to the lever than is normally necessary for the lifting of the implement.

Connected to the rear axle housings 18 and 19 by means of quick detachable bracket constructions 43 and 44, respectively, is a transversely extending implement-supporting shaft 45. To this shaft is pivotally connected outer implement beams 46 and 47, at the right and left side of the tractor respectively, and a central beam 48. Also carried by the brackets 43 and 44 is a transversely extending rock-shaft 50 having lifting arms 51 and 52 connected respectively with the implement gangs 46 and 47 by means of usual lift rods 53 and 54. In order to tie the outer members 46 and 47 together, there is provided a transversely extending jockey member 55, to the mid-portion of which is connected the central beam 48 by means of the lift rod 56, whereby lifting movement to the central beam is effected through the jockey member.

Fitted within the under portion of the transmission and differential housing 17 at a location substantially midway the length of the tractor, is a fluid pump-control valve mechanism including a number of the principal features of the present invention. This pump and control valve mechanism is housed within a reservoir housing 58 which, in turn, has a portion extending well into the housing 17. When the reservoir housing 58 including the pump and control parts is connected to the housing 17 and adequate attachments are made for the connection of the pump with a drive shaft within the housing 17, the housing 58 is thereupon retained by means of bolts 59.

The housing 58 has transversely extending sleeve portions 60, as seen more clearly in Figure 3, in which are supported the transversely extending portions 61 of the cylinder supporting links 62. These transverse portions 61 are retained in their connection with the sleeves by the cotter pins 63, inserted in their inner ends which register with a recess portion 64 of the housing 58. In the present arrangement, however, only one cylinder-supporting link 62 is being used and that is for the support of the cylinder device 65 used for the operation of the transverse rock-shaft 50 to lift the rear implements. This cylinder 65 is pivotally connected to the upper end of the link 62, as indicated at 66, and is connected to the arm 67 on the rock-shaft 50 by means of a rod 68 extending from the forward portion of the cylinder and connected at the same location 66 that the cylinder 65 is connected to the supporting link 62, as indicated at 68a. In order to provide for vertical depth adjustment of the rear implements, there is provided an adjustable stop mechanism indicated generally at 68' and taking the form of a quadrant and lever. When the lever is adjusted about the quadrant, the entire cylinder 65 with its piston is moved either fore or aft. For operation of the respectively connected implements, at each side of the tractor, there is provided cylinder devices 69 and 71. Since the arrangement for each of the front cylinders is identical on each side of the tractor, only one will here be described. The cylinder 69 is connected to the lift rod 34 at 72 and is thereby supported therefrom without the necessity of the use of a link 62. In order to effect depth regulating adjustment of the front implements, there are also provided respectively on the rear axle housing adjustable stop mechanisms 73, taking the form of a quadrant and lever similar to the adjustable stop mechanism for the rear cylinder 65. By an adjustment of the lever forming a part of the adjustable stop mechanisms 73 the cylinder 69 will be moved bodily either fore or aft, taking with it the lifting rod 34, thereby to effect depth regulating adjustment to the working tools 29.

Associated with each of the cylinders for both the front and rear implements, there is provided a spring arrangement 75 adapted to hold the implements in the ground. This spring arrangement includes an over-center toggle connection 76 whereby minimum effect of the springs is present when the cylinders are operated to effect lifting of the implements; thus, the cylinders do not have to work against the spring to any great degree upon lifting of the implements. Since these spring arrangements 75 form no part of the present invention, further detailed description is believed to be unnecessary.

All three of the adjusable stop mechanisms are accessible to the operator's station 25 whereby the operator may adjust independently either of the side-mounted implements or the entire rear implement arrangement. Movement of the adjusting levers effects bodily movement of the working cylinders.

Referring now particularly to Figures 3, 4, 5, and 6, there is shown in detail a pump and valve arrangement within its housing 58, and which includes the principal features of the present invention. A viewed particularly in Figure 3, there is shown a portion of the housing 58 fitted well within the transmission and differential housing 17. The portion of the housing 58 extending beneath the transmission and differential housing 17 includes the sleeve portions 60 for the connection of the cylinder supporting links 62.

This reservoir housing 58 includes a main body portion 77 adapted for the retention of the hydraulic fluid and has a drain plug 78 for the removal of the hydraulic fluid from the same. The upper portion of the housing has a pipe 79 connected thereto and adapted to extend upwardly through an opening 80 in the top part of the transmission and differential housing 17. To this pipe may be connected a cover cap 81. When this cover and breather cap 81 are removed, the hydraulic fluid may be poured into the reservoir housing 58. For the insertion of the reservoir housing 58 into the transmission and differential housing 17, the cover and breather cap 81 should be removed.

The housing 58 when fitted into the housing 17 is so arranged that the drain plug 78 is rearward of the supporting link sleeves 60 with relation to the tractor. At the rear end portion of

the reservoir housing 58, there is provided a supporting plate 86 which carries a pump housing or casing 87 and the valve control mechanism indicated generally at 88. This supporting plate 86 may be fixed to the portion 77 of the housing by means of the bolts 89. Projecting rearwardly through the supporting plates is a drive shaft 90 adapted to be connected to a driven shaft within the housing 17 by means of a connecting shaft 91 retained against vertical movement in its connection with the shaft 90 by means of a sleeve 92 surrounding the interfitted ends of the respective shafts 90 and 91. This sleeve is held against lateral displacement by a cotter pin 93 extending through the connecting shaft 91. The supporting plate 86, when removed from the reservoir housing 77, carries with it the pump and the control mechanism, leaving the reservoir housing 77 void of practically all of its working parts except a rotatable and manually operable shaft 95 carried in the upper portion of the housing 58 and rotatable in the bearing portions 96 and 97 thereof, as seen particularly in Figure 3. This rotatable shaft 95 has rigidly clamped thereto an arm 98 having a lateral projection 99. This arm will rotate upon rotation of the shaft 95.

In order to provide means for the operation of this shaft 95 adapted to extend laterally from the housing 58 and still permit connection of the shaft after the housing 58 has been inserted in the housing 17, the shaft 95 is provided with a head portion 101 having grooves 102 extending diametrically across the face of the same.

This shaft 95 also has within its head portion and extending well within the same, a threaded hole 103. With such an arrangement the housing 58 may be inserted into the housing 17 without an operable control lever 104. When the housing 58 is located in place, the control lever 104 with its laterally extending portion 105, on the forward end of which are projections 106, is adapted to be connected with the grooves 102. The portion 105 is inserted through the opening 107 of the housing 17 and made fast with the shaft 95 by means of a long bolt 108 adapted to tighten up within the hole 103 of the shaft 95.

Referring particularly to Figure 6, there is shown the pump casing 87 in end view as viewed along the line 6—6 of Figure 4. This casing is adapted to be fastened to the forward face of the supporting plate 86 by means of bolts 110 passing through a cover plate 111 for rigidly fixing the entire assembly to the supporting plate 86. This pump casing 87 has within it a drive pump gear 112 and a driven pump gear 113. The drive pump gear 112 is connected to the drive shaft 90, which extends through the supporting plate 86. Integral with the casing 87, is a downwardly extending inlet portion 114 adapted to extend within a short distance from the bottom of the housing 58 through which the hydraulic fluid is drawn into the pump. This fluid is delivered from the pump to the outlet side 115 of the pump to a channel 116 within the casing 87. Communicating with the channel 116 are the outlet ports 118 and 119. These ports are controlled by ball valves 120 and 121 respectively, and are normally retained in their closed positions by springs 122. These ball valves are maintained against their respective valve seats which are formed within the pump casing 87 as a part of the outlet ports 118 and 119; respectively.

Also in communication with the channel 116 in the casing 87 is an opening 123 in which is seated a plunger 124 adapted normally to be retained against movement into the channel 116 by shoulder portions 125 forming a part of the opening 123. When pressure is present within the channel 116, the plunger 124 is moved upwardly in the opening 123. The function of this plunger 124 will be described further in detail hereinafter in the description. It may be said for the present that this plunger forms one of the principal features of the present invention.

The cover plate 111 has a forwardly extending sleeve-valve containing portions 127 formed with a chamber opening 128 for the reception of a sleeve-valve 129. This sleeve-valve is slidable fore and aft in the opening 128 and when slid to the position shown in Figure 5 covers a by-pass opening 130. The opening 128 extends rearwardly through the cover plate 111, so that the same may have communication with the channel portion 116 of the casing 87. When the sleeve-valve 129 is in the position shown in Figure 4, the fluid entering the inlet portion 114 of the casing 87 and passing to the pressure side 115 of the pump is delivered through the by-pass opening 130, the sleeve 129 not being in position to close this opening 130. In this way, the hydraulic fluid from the pump is returned to the fluid supply within the reservoir 58. The pump is constantly driven at all times when the engine of the tractor is operating.

Pivotally connected to the forwardly extending sleeve-containing portion 127 is a lever portion 135 adapted for the operation of the sleeve 128. The pivotal connection of the lever 135 with the sleeve-containing portion 127 is by means of a pin 136 extending transversely through the containing portion 127 and through a second lever portion 135' and through a bearing 137 laterally spaced on the cover plate 111 with respect to the containing portion 127, see Figure 3. These lever portions 135 and 135' in effect straddle the containing portion 127. The pin 136 is retained against lateral movement by its head portion 138 and a cotter pin 139 on its opposite end. Extending across the upper end of the lever portions 135 and 135' is a transverse portion 140 having a portion 141 journaled on the pin 136 and also having an upwardly extending portion 142. This upwardly extending portion 142 has an elongated slot 143 in which the projection 99 of the arm 88 is disposed at the time of alining the cover plate 86 preparatory to securing it in place; see Figures 3 and 5.

The sleeve-containing portion 127 also has at each side thereof a longitudinal slot 144 with which the lower ends 145 and 146 of the lever portions 135 and 135', respectively, are alined transversely. These lower ends 145 and 146 are in the form of a fork having an open end slot 147. Through the valve sleeve 129 there is projected a pin 148, which extends into the forked ends 145 and 146. It should now be apparent that operation of the levers 135 and 135' will effect movement by means of the pin 148 to the valve sleeve 129. As the operable lever 104 is rotated to effect forward movement of the transverse portion 140 of the levers 135—135', closing of the by-pass port 130 by the sleeve-valve 129 is effected for establishment of the pumped fluid in power-transmitting relation with and for moving the implements from the working position. Upon doing this, fluid from the pressure channel 116 is delivered to the ports 118 and 119 and from there, respectively, to a casing 149 connected to the rear face of the supporting

plate 86. This casing 149 has ports 151 and 152 registering respectively with openings 153 and 154 within the supporting plate 86, which in turn register with the openings 118 and 119, respectively, in the pump casing 87.

As the manual control arm 104 is operated to close the sleeve-valve, it is resisted by a coil spring 155 surrounding the pin 136 and having one end engaging with the forward face of the transverse portion 140, having a portion 156 and another portion 157 circling a pin 158 serving as a reaction point for the spring. The portion 157, being circular, tends to prevent sliding of the spring 155 along the pin 136.

In order to maintain the sleeve-valve 129 momentarily closed, there is provided a latch element 159 having a latch portion 160 adapted to engage with the transverse portion 140 and pivoted on a pin 161 in the cover plate 111. This latch lever 159 also includes a rearwardly extending portion 162 arranged for engagement with the upper end of the plunger 124. This latch member 159 is so formed and arranged for its connection with the transverse portion 140 that, so long as the plunger pin 124 is not thrust outwardly by pressure in the channel 116, the latch member will not latch with the transverse portion 140. This is one of the principal features of the present invention, in that it prevents any latching of the manual lever 104 while the tractor and pump are not operating. This prevents any one from latching the sleeve-valve in its closing position at a time when the pump is not operating. This is particularly useful when the tractor is left standing with its implements in their down position, thereby eliminating the necessity for having the hydraulic arrangement going through the cycle of lifting the implement before it can be again placed in its down position. Once the pressure is on and the plunger 124 is thrust, the latch 159 will stay in its latched position in engagement with the transverse portion 140.

The sleeve-valve 129 has extending longitudinally through the same small openings 163 to permit communication of fluid through the interior of the sleeve-valve to its rear end of the chamber opening 128 of the sleeve-containing portion 127. The rear end of this opening 128 is in communication with an opening 164 having a valve seat 165 in contact with which is a ball valve 166 (see Figures 4 and 5). This ball valve 166 is retained by a spring arrangement 167 bearing at all times against the ball and enclosed within a spring arrangement housing 168 adapted to be threaded into the enlarged part of the opening 164.

This spring housing 168 is threaded into the enlarged opening 164, and the amount which it screws in determines the opening pressure at which the ball valve 166 will open. In the outer end of this spring housing 168 there is an opening 169, through which liquid passing the valve may pass to effect lifting of a cap 170. The cap 170 normally prevents fluid from passing through the opening 169 and this is particularly true when the extended projection portion 171 of the latch 159 is contacted with it. As the fluid passes through the opening 169, the cap moves upwardly a sufficient distance to cause tripping of the latch, so that the portion 160 moves out of engagement with the transverse portion 140, thereby to permit return of the lever 135—135' immediately to open the by-pass opening 130, the levers 135—135' effecting movement of sleeve 129 by means of the pin 148. It should now be seen that means has been provided responsive to pressure for automatically unlatching the latch member 159 when a predetermined pressure has been obtained within the opening 128. This unlatching takes place when the implements have been raised to their transport position. Any fluid that passes the opening 169 to move the cap 170 may pass through the downwardly relieved portion 173 of the cap and return to the fluid supply in the reservoir.

Referring back to Figures 1 and 2, there are shown hose connections 174, 175, and 176. The hose connections 174 and 175 are for the connection of the respective cylinders 71 and 69 for the operation of the front mounted implements. These two hose connections 174 and 175 are connected to the casting 149, one at each side thereof, and in communication with the opening 152 through the casting 149. The fluid which passed by the ball valve 120 passes to both of these cylinders 71 and 69 to effect the lifting of the front implements at both sides of the tractor simultaneously. The hose connection 176 for the rear cylinder device 65 is connected to the portion 178 of the casting 149 for communication with the opening 151 through the casting which receives the fluid passing by the second ball valve 121.

In order to insure delayed operation of the rear implements, there is provided, as shown in Figures 7 and 8, a delayed lift valve which does not operate until the front implements have been lifted. This valve is so constructed that it may be adjusted for any predetermined pressure. The fluid for operating the cylinder device 65 is not released until the front implements have operated. This valve consists of a main body portion 179 having a threaded portion 180 in one end thereof and a second threaded sleeve portion 181 in the opposite end thereof. Within the body portion 179 is a valve seat portion 182 with which a slidable valve 183, having a tapered seat-contacting portion 184, engages. This valve 183 is retained within the body portion 179 by an adjustable cap screw 185, which is hollowed to permit sliding engagement of the valve 183 within the same and to contain a pressure spring 186. To prevent leakage of the delayed lift valve, there is provided a packing 187. In the cap screw 185 is an air opening 188 to prevent creation of a vacuum within the cap screw 185. In the valve body portion 179, there is a passage 188' to supply fluid pressure back of the packing 187 to maintain the same against the end of the cap screw 185 for different adjusted positions of the same within the body portion 179.

The valve contacting portion 184 on the valve 183 has an opening 189 in communication with a chamber 190 of the body portion 179 which is in turn communicating through a threaded projecting portion 191 adapted to be secured into a cylinder head 192 for the communication of liquid through a passageway 193. This hollowed portion 189 contains a ball valve 194 adapted to have movement between the valve 183 and a pin 195 extending across the threaded opening 180. This movement is indicated in dotted lines, showing an alternate position of the ball valve 194. When the pressure becomes great within the delayed lift valve, the valve seat portion 184 immediately gives way to permit passage of fluid thereby into the chamber 190. The sleeve valve 183 and ball valve 194 move rearwardly against the pressure of the spring 186, and fluid immediately passes into the cylinder, the ball valve forming in effect

an integral part of the valve 183. Such a valve arrangement has an advantage over an ordinary spring pressure ball valve in that fluid does not normally have an opportunity to delay the action of the ball valve by building up in back of the same.

The valve portion in the present instance is that of the portion 183 and including the ball valve 194 when the pressure is acting to unseat the valve portion 184 from its seat portion 182. The function of the ball valve in the present invention is merely for permitting free return of fluid from the cylinder to the reservoir upon the lowering of the implements, since the valve 183 is only open when there is sufficient pressure ahead of it.

Referring now to Figures 7, 9, and 10, there is shown the rear fluid cylinder device 65. It should be understood, however, that the cylinders 69 and 71 are of the same construction. These cylinders are of the single-acting type operated to effect lifting of the implement, but return to their original position when the fluid is drained from them to release the implement. The cylinder arrangement is substantially the same as that shown in the pending application, Serial No. 222,739, filed August 3, 1938, by the present inventor. A piston, indicated generally at 197, has a hollow compression chamber 198 into which fluid, which may have leaked by the piston, passes upon movement of the piston toward the right, and, due to the air compressed therein by such fluid entering the chamber, this same fluid may be forced back to the working side of the piston upon release of the fluid from that side of the piston. The piston 197 is constructed of two parts, 199 and 200, which are fastened to a reduced end portion 201 of a piston rod 202. The projecting portion 201 has a threaded portion 203 to which the piston portion 200 is connected to retain a leather piston ring 203' against the piston portion 199, which in turn is held against a shoulder 204 of the piston rod 202.

The cylinder 65 includes a second head member 205 in which slides the piston rod 202. Immediately surrounding the piston rod 202, there is connected and forming a part of this head member a sleeve 206 extending a considerable distance outwardly from the head member 205 to keep dirt from working along the piston rod 202.

Within the head member 205, there is a recess 207 in which is contained a seal 208 adapted to fit around the piston rod 202 working through the head member 205. This seal is effective to keep fluid from being forced along the piston rod 202 during the working movement of the piston, and it fits about the piston rod 202 so snugly that it travels with the piston rod on the return movement. However, as the piston is moved to the right, no sealing takes place until the piston has traveled nearly its full distance to the right; then the seal 208 is retained against the recess 207 by means of a spring 209. Any fluid that is then within the right end of the cylinder will be forced through a valve 210 into the compression chamber 198. When the fluid is relieved from the working side of the cylinder 65 at the left, the compressed air within the chamber 198 forces the fluid through a passageway 211 in the projected portion 203 of the piston rod 202 and past a valve 212 in the portion 201 of the piston 197. Since the piston 197 and the breather seal 208 form no part of the present invention, it is believed that this description will be sufficient.

A control rod 213, Figure 1, having a back end portion disposed accessibly to the operator's station 25 is employed for manipulating the control arm 104, Figure 3, of the fluid pressure developing apparatus. This control rod is axially slidable within an opening (not shown) in the tractor casing 17 into which a forward portion (not shown) of said rod extends into connection with the upper end of said control arm 104. Fore and aft movement of the control rod, therefore, causes corresponding pivotal adjustment of the arm 104 with the above explained results for raising and lowering the ground-working tools.

The rod is pulled rearwardly thereby to effect latching of the transverse portion 140 by the latch member 159. This can be effected providing the plunger 124 is thrust outwardly into contact with the projection 162 of the latch 159. With the pump operating, this can be readily effected and the mechanism is ready to effect the lifting operation. Fluid then passes the ball valve 120 to the cylinders 69 and 71, whereby lifting of the front implements is immediately effected. Because of the delayed lift valve 179, fluid is prevented from passing to the cylinder 65 until lifting of the forward implements has been completed and until sufficient pressure can be built up to operate the valve 183 within the same against the spring 186 of the delayed lift valve shown in Figures 7 and 8. Once the valve 183 is operated, the cylinder 65 will be filled and the rear implements will be subsequently lifted. Upon completion of the lifting of all implements, a greater pressure is then built up in the arrangement to effect operation of the valve 166 for permitting actuation of the cap 170 which in turn effects unlatching of the latch member 159 from the transverse portion 140 of the levers 135—135', thereby to effect opening of the port 130 to continue the interchange of fluid between the pump and the fluid reservoir.

Once the implements have lifted, the fluid is retained in the cylinders by the ball trap valves 120 and 121. To effect lowering of the implements, these ball valve 120 and 121 must be opened. As means for effecting opening of these valves, there are provided within the pump cover plate 111 two plungers 215 and 216 adapted to contact respectively the ball valves 120 and 121 (see Figure 4). Pivoted to the transverse portion 140 of the control levers 135—135' is a plunger-operating device 217 having a face portion 218 adapted to contact the ends of the plungers 215 and 216. Once the latch mechanism is operated, the hand control returns to a neutral position under the force of the spring 155, Figure 3, as the latter imparts retrograde pivotal movement to said transverse member 40. Thereafter, at any selected time, additional retrograde pivotal movement is impartable to the transverse member 140 by manually pushing the control rod 213 an additional distance forwardly to first effect engagement of the face 218 with the plunger 215 to operate the same, thereby permitting lowering of the front implements. Further manual movement of the operating control rod 213 forwardly effects operation of the plunger 216, thereby to lower the rear implements. To insure the most satisfactory operation of this plunger-operating device 217, there is a projection 219 which contacts with a raised portion 220 on the cover plate 111. Inasmuch as the weight of the implements effects great fluid pressure on the ball valves 120 and 121, a very definite effort is necessary to effect operation of the control rod 213 forwardly to lower the implements. The feel of this pressure to the

operator is very much the same as in the operation of a transmission gear shift of an automobile. The return of the fluid from the cylinder 65 through the delayed lift valve 179 is permitted past the ball valve 194, since the ball valve is normally biased to an open position with respect to the chamber 189 also in communication with the cylinder 65.

It should now be apparent that there has been provided by the present invention a hydraulic arrangement particularly adaptable for the operation of front and rear implements directly connected to a tractor; that in the arrangement the front and rear implements are raised successively after having initiated the operation by the mere closing of the by-pass opening 130; and, that lowering of the implements may be readily effected by the operator upon giving to the control rod 213 a reverse movement from a neutral position, and may effect lifting of the implements, and that the timing of the lowering operation is effected manually by the operator, thereby to obtain successive lowering of the implements. It should be further apparent that automatic pressure-operating means has been provided for unlatching the control mechanism when a predetermined pressure has been obtained, and further that latching of the implement can only be done at a time when the arrangement is prepared for operation to lift the implements.

While various changes may be made in the specific construction of the present arrangement, it shall be understood that such changes shall be made within the spirit and scope of the present invention as defined in the appended claims.

What is claimed is:

1. In combination, a tractor, an implement connected to the tractor for movement thereon, a hydraulic arrangement for moving the implement comprising a fluid reservoir, a fluid operable device connected to the implement, a fluid pump for delivering fluid to the device, manual control means for controlling the delivery of fluid from the pump to the device, means for retaining said control means in a position to effect the movement of the implement, and means for making said retaining means dependent upon the operation of the fluid pump in order to retain the control means.

2. In combination, a tractor, an implement connected to the tractor for movement thereon, a hydraulic arrangement for moving the implement comprising a fluid reservoir, a fluid operable device, a fluid pump for delivering fluid to the fluid operable device, manual control means for controlling the delivery of fluid under pressure from the pump to the device, latch means adapted to retain the control means in a position to effect movement of the implement, and means for making the retaining means dependent upon the operation of the fluid pump in order to retain the control means.

3. In combinaiton, a motor-propelled vehicle and an implement connected to said vehicle for movement with respect thereto, a fluid operable cylinder, a fluid supply reservoir connected with the implement to move the same, a fluid pump adapted to be driven by the motor, inlet passageway means connecting the pump with the reservoir, passage means for directing fluid from the pump to the cylinder, by-pass means for effecting normal interchange of fluid between the pump and the reservoir, a valve biased to open position for controlling the by-pass means to direct the fluid to the cylinder, means effective upon the closing of said valve for retaining said valve in its closed position, and means for making the retaining means dependent upon the operation of the fluid pump in order for it to retain the biased valve in its closed position.

4. In combination, a motor-propelled vehicle and implement connected to said vehicle for movement with respect thereto, a fluid-operable cylinder, a fluid supply reservoir connected with the implement to move the same, a fluid pump adapted to be driven by the motor, inlet passageway means connecting the pump with the reservoir, passage means for directing fluid from the pump to the cylinder, by-pass means for effecting normal interchange of fluid between the pump and the reservoir, a valve biased to open position for controlling the by-pass means to direct the fluid to the cylinder, means effective upon the closing of said valve for retaining said valve in its closed position, and means for making the retaining means dependent upon fluid pressure in the passage means from the pump in order for it to retain the biased valve in its closed position.

5. In combination, a motor-propelled vehicle, an implement connected to said vehicle for movement with respect thereto, a fluid supply reservoir, a fluid driven motor connected with the implement to move the same, a fluid pump adapted to be driven by the vehicle motor, inlet passage means connecting the pump with the reservoir, passage means for directing fluid from the pump to the cylinder, by-pass passage means for effecting a normal delivery of fluid from the pump to reservoir, a manually operable valve in control of said by-pass passage and normally biased to an open position to provide such normal delivery to the reservoir but closable to divert the fluid to said motor, a latch means for retaining said valve in its closed position, and means for making said latch means dependent upon the operation of the fluid pump in order to retain the valve in its closed position.

6. In combination, a tractor having a power plant, an implement connected to the tractor and having parts adapted to be moved, a fluid reservoir, a fluid operable device connected to the implement parts to move the same, a fluid pump for delivering fluid from the reservoir to the fluid operable device and adapted to be driven by the tractor power plant, by-pass means for permitting flow of fluid to return to the reservoir when fluid is not being delivered to the fluid operable device, a sleeve-valve for closing the by-pass means to divert the flow of fluid to the fluid operable device, manual control means for operating the sleeve-valve, said sleeve-valve constructed to permit the passage of fluid axially through the same while at the same time closing the by-pass means, means for retaining the sleeve-valve in its by-pass closing position only when the pump is operating, and pressure responsive means receiving fluid pressure from the fluid passing axially through the sleeve-valve for releasing the retaining means.

7. In combination, a motor-propelled vehicle, an implement connected to the vehicle and having parts adapted to be moved, a fluid reservoir, a fluid-operable device adapted to move the implement parts, a fluid pump adapted to be operated by the motor of the vehicle for delivering fluid from the reservoir to the fluid-operable device, by-pass means for the return of fluid to the reservoir, a sleeve-valve for closing the by-pass means biased to an open position and having a passageway for permitting the flow of fluid

therethrough while at the same time closing the by-pass means, means for operating said sleeve-valve, means for retaining the sleeve-valve and its operating means when moved to a position for closing of said by-pass means, and pressure responsive means arranged to be operated from fluid passing through the sleeve-valve for releasing the retaining means when a predetermined pressure has been reached in the arrangement.

8. In combination, a motor-propelled vehicle, an implement connected to the vehicle and having parts adapted to be moved, a fluid reservoir, a fluid-operable device for moving the implement parts, a fluid pump adapted to be operated by the motor of the vehicle for delivering fluid from the reservoir to the fluid-operable device, a control mechanism for governing the flow of fluid from the pump, means for supporting said mechanism within said reservoir, said mechanism comprising a projected chamber portion on said supporting means having a fluid communication with the pump and having by-pass means for normally permitting flow of fluid between the pump and reservoir, a sleeve-valve operable in said chamber for controlling the flow of fluid through the by-pass means, whereby fluid will be diverted to the fluid-operable device, a lever carried by the projected chamber portion for operating said sleeve-valve and biased to normally maintain the valve in its open position, a latch member associated with said lever to retain said sleeve-valve in its closed position, and pressure responsive means operable from pressure within the same for operating on said latch to release said lever to discontinue the flow of fluid to said fluid-operable device.

9. In combination, a motor-propelled vehicle, an implement connected to the vehicle and having parts adapted to be moved, a fluid reservoir, a fluid-operable device for moving the implement parts, a fluid pump for delivering fluid from the reservoir to the fluid-operable device, means on the vehicle for operating the fluid pump, a control mechanism for governing the flow of fluid from the pump, means for supporting said mechanism within said reservoir, said mechanism comprising a projected chamber portion on said supporting means having a fluid communication with the pump and having by-pass means for normally permitting flow of fluid between the pump and reservoir, a sleeve-valve operable in said chamber for controlling the flow of fluid through the by-pass means whereby fluid will be diverted to the fluid-operable device, a lever carried by the projected chamber portion for operating said sleeve-valve and biased normally to maintain the valve in its open position, a latch member associated with said lever to retain said sleeve-valve in its closed position, said sleeve-valve having a passageway for permitting the flow of fluid therethrough to a part of the chamber projecting portion while at the same time closing the by-pass means, and pressure responsive means operable from pressure of fluid passing through the sleeve-valve for operating on said latch to release said lever to discontinue the flow of fluid to said fluid-operable device.

10. In combination, a draft vehicle, an implement connected to the vehicle and having parts adapted to be moved, a fluid-operable device for moving the implement parts, a fluid reservoir housing having a main body portion and a closing plate, fluid pressure supply means for delivering fluid from the reservoir to the fluid-operable device, a control mechanism connected to said plate and adapted to extend into said housing when the plate is connected to the main body portion, a shaft separately supported in the body portion and adapted to be operated by means externally of the housing, and means for effecting engagement of the control mechanism with the shaft to be operated by the same upon fitting the control mechanism within the housing to assemble the arrangement.

11. In combination, a draft vehicle, an implement connected to the vehicle and having parts adapted to be moved, a fluid-operable device for moving the implement parts, a fluid reservoir housing having a main body portion and a closing plate, fluid pressure supply means for delivering fluid from the reservoir housing to the fluid-operable device, a control mechanism connected to said plate and adapted to extend into said housing when the plate is connected to the main body portion, a shaft separately supported in the body portion and adapted to be operated by means externally of the housing, and means for effecting engagement of the control mechanism with the shaft to be operated by the same upon fitting the control mechanism within the housing to assemble the arrangement, said engaging means comprising a lever forming a part of the control mechanism and having an elongated slot therein, and an arm fixed to the shaft and having a laterally extending engaging projection on the end thereof adapted to fit within the slot in said lever.

12. In combination, implement-supporting means, an implement mounted at one location on the implement-supporting means for movement thereof, a hydraulic mechanism including mounted at another location on the implement-supporting means for movement with respect thereto, a fluid-operable device for each implement and connected to the same to effect movement thereof, a hydraulic mchanism including fluid communication with each of the fluid devices, means for effecting operation of the hydraulic mechanism to move the implements, and a delaying valve in the communication to one of the devices whereby successive movement of the respective implements will be effected upon actuation of the hydraulic mechanism.

13. In combination, a tractor having forward and rearward portions, an implement mounted on the forward portion of the tractor for vertical movement to and from its ground-working position, a second implement mounted on the rearward portion of the tractor for vertical movement to and from its ground-working position, a hydraulic lifting arrangement comprising a fluid-operable device connected to each implement respectively to move the same, a hydraulic supply source having fluid communications with the respective fluid devices, and a delaying valve in the communication to the fluid operable device which operates the implement on the rearward portion of the tractor whereby successive lifting movement of the forward and rearward implements will be effected upon actuation of the hydraulic lifting arrangement.

14. In combination, a tractor having forward and rearward portions, a set of implements mounted for movement on the forward portion and respectively at each side of the tractor, a set of implements mounted for movement on the rearward portion of the tractor, a hydraulic lifting arrangement comprising a fluid-operable

device for each set of implements on the forward portion of the tractor, a third fluid-operable device for the set of implements on the rearward portion of the tractor, a hydraulic supply source having fluid communications with the respective fluid devices, and a delaying valve in the communication to the fluid-operable device which operates the implement set on the rearward portion of the tractor, whereby successive lifting movement of the forward and rearward sets will be effected upon actuation of the hydraulic lifting arrangement.

15. In combination, implement-supporting means, an implement mounted at one location on the implement-supporting means for movement with respect thereto, a second implement mounted at another location on the implement-supporting means for movement with respect thereto, a single-acting fluid-operable device for each implement and connected to the same to effect working movement thereof, a hydraulic mechanism including fluid communications with each of the fluid devices, control means for effecting operation of the hydraulic mechanism to cause fluid to flow through the communication toward the devices, and a delaying valve in the communication to one of the devices to effect successive movement of the respective implements, said control mechanism being effective to retain the fluid within the devices at the completion of movement, said delaying valve including structure to permit return of fluid from the fluid devices upon release of the fluid retained in the devices by the control mechanism.

16. In combination, a tractor having a hollow body portion, an implement connected to the tractor for movement with respect thereto, and a hydraulic arrangement for moving the implement including a reservoir housing adapted to be fitted within the hollow body portion of the tractor, said housing including a supporting plate and a main body portion, and pump and control mechanism supported entirely on the supporting plate and being removable therewith from the main body portion of the reservoir upon removal of the reservoir housing from the hollow body portion of the tractor.

17. In combination, a tractor, an implement mounted on the tractor for movement with respect to the same to and from a working position, a fluid pump for supplying fluid under pressure for establishment in power-transmitting relation with and for moving the implement from the working position, a manually manipulatable valve in control of the fluid supplied by said pump and manipulatable to an active position for so establishing such fluid in power-transmitting relation between the pump and the implement, retaining means settable for retaining the valve control means in said active position, and means responsive to the pressure of the pumped fluid for so setting said retaining means.

CARL W. MOTT.

CERTIFICATE OF CORRECTION.

Patent No. 2,324,866. July 20, 1943.

CARL W. MOTT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, second column, line 38, claim 12, strike out the words "thereof, a hydraulic mechanism including" and insert instead --with respect thereto, a second implement--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of November, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.