Jan. 10, 1967 V. E. REZABEK ETAL 3,296,716

HYDRAULIC CIRCUIT FOR ACTUATING ELEVATOR LIFT AND EJECTION MECHANISM FOR SELF-LOADING SCRAPER

Filed Aug. 29, 1963 2 Sheets-Sheet 1

Fig. 1.

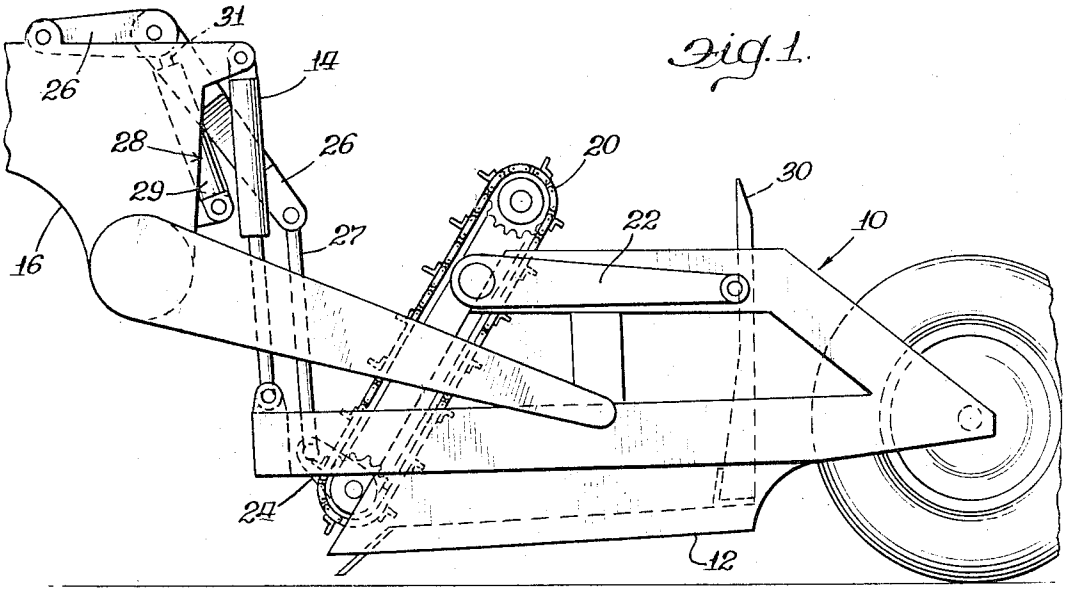
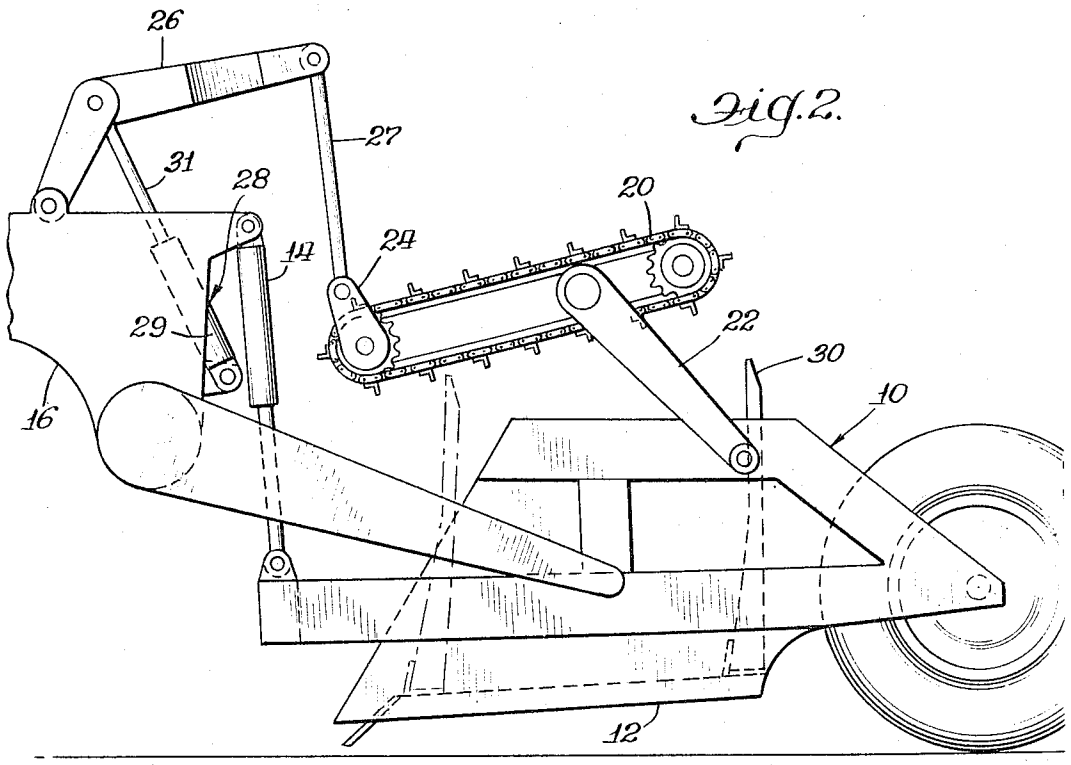


Fig. 2.



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Fig. 3.

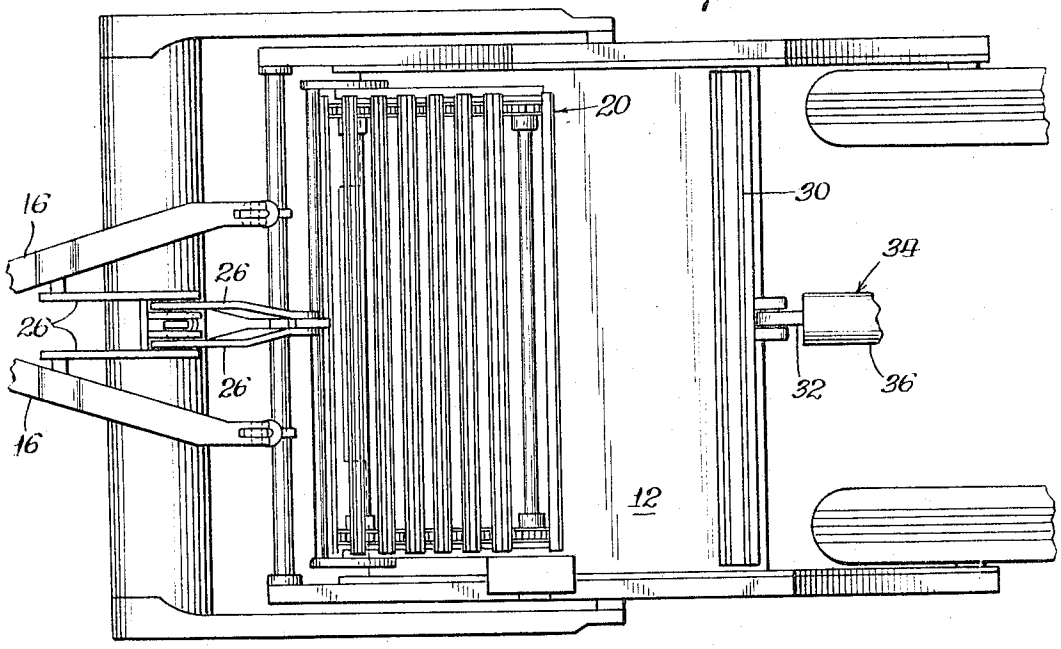
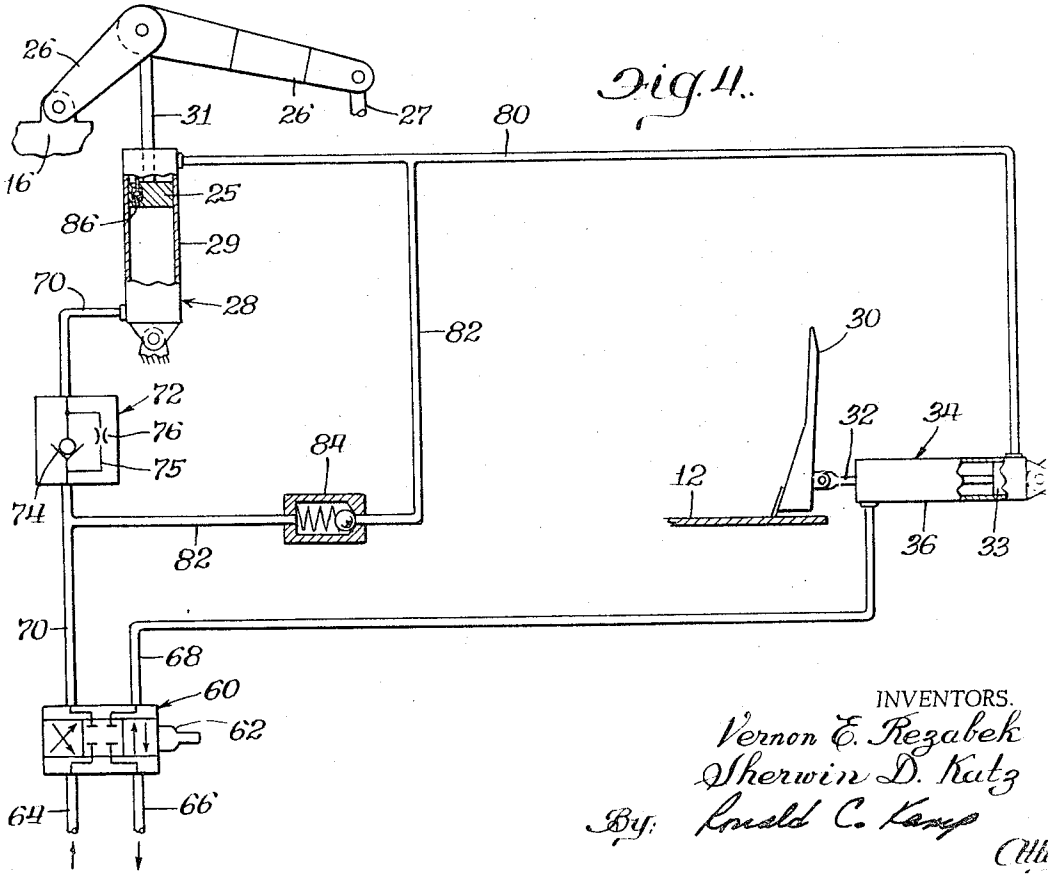


Fig. 4.



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HYDRAULIC CIRCUIT FOR ACTUATING ELEVATOR LIFT AND EJECTION MECHANISM FOR SELF-LOADING SCRAPER

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7 Claims. (Cl. 37—8)

The present invention relates to hydraulic circuits in general, and more particularly to hydraulic circuits for self-loading scrapers.

In general, scrapers are provided with a bowl, for containing the material to be handled thereby, and an ejector which is mounted within the bowl in such a manner that it may be moved forward to effect a discharge of the material from the bowl and thereby empty the same. Self-loading scrapers are also provided with an elevator which is utilized to raise the material from the ground and discharge it into the bowl, thereby filling the same. Since the elevator and the ejector would physically interfere with each other and thus damage the scraper if the ejector were positioned forwardly when the elevator is lowered or similarly if the elevator were in its lowered position when the ejector is moved forward, it is necessary to provide a means to insure that the ejector is retracted when the elevator is lowered and that the elevator is raised when the ejector is moved forward.

In addition, it is desirable to utilize a minimum number of hydraulic lines in order to reduce the cost and the complications inherent with a multiude of hydraulic lines.

It is, therefore, an object of the present invention to provide a hydraulic circuit for a self-loading scraper which will insure that the elevator is raised before the ejector attains its forward-most position and will also insure that the ejector is in its retracted position before the elevator attains its lowermost position.

It is also an object of the present invention to provide a hydraulic circuit for a self-loading scraper which will effect the complementary movement of the elevator and ejector with a fewer number of control valves and hydraulic lines than was heretofore realized in the prior art.

It is a still further object of the present invention to provide a hydraulic circuit which is low in cost and which will simultaneously operate two elements without the possibility of either interfering with the other.

Other objects and many of the attendant advantages of the present invention will become more readily apparent when considered in connection with the following description and the accompanying drawings, wherein:

FIGURE 1 is a side elevation of a self-loading scraper with the ejector retracted and the elevator in its lowered position;

FIGURE 2 is a view, similar to FIGURE 1, showing the elevator in its raised position and the ejector in its forward position;

FIGURE 3 is a top plan view of a self-loading scraper with the elevator in its lower position and the ejector retracted; and

FIGURE 4 is a schematic view of the hydraulic circuit.

Referring now to the drawings, there is shown in FIGURE 1 a self-loading scraper, indicated generally as **10**, of the type commonly known in the art. The scraper **10** is provided with a bowl **12**, which serves as receptacle for the material to be handled, an elevator **20**, and an ejector **30**. The bowl **12** is raised and lowered by means of a pair of hydraulic cylinders **14** in a manner well known in the art.

The elevator **20** is pivotally attached near its rearward end to a pair of links **22**, which are pivotally mounted on the sides of the bowl **12**. A lug **24** is rigidly secured

to the forward portion of the elevator **20** and is pivotally attached to a connecting link **27**, which in turn is pivotally attached to one end of a rigid L-shaped link **26**. The other end of the L-shaped link **26** is pivotally secured to the A-frame **16** of the scraper **10**. A hydraulic ram **28** has its rod end **31** pivotally attached to the L-shaped link **26** at the juncture of its two legs and has its cylinder end **29** pivotally secured to the A-frame **16**. When the ram **28** is in its retracted position, the elevator **20** will be lowered and operative to load the bowl **12**, as shown in FIGURE 1. When the ram **28** is in its extended position, the elevator **20** will be raised to clear the ejector **30** as it moves forward to empty the bowl **12**, as shown in FIGURE 2.

The ejector **30** is slidably mounted in the bowl **12** and is pivotally attached to the rod **32** of the ejector ram **34**. The cylinder **36** of the ram **34** is pivotally secured to the axle rear portion of the body of the scraper, not shown. The ejector ram **34** of necessity has a stroke sufficiently long enough to move the ejector **30** substantially the length of the bowl **12**. It, therefore, has a larger displacement than the elevator ram **28**, which moves through a shorter distance, and may be either of the simple cylinder and piston type or of the telescopic type.

Referring now to the schematic representation of FIGURE 4, there is shown a control valve **60** having a plunger or spool **62** which is movable to either of two positions from a center neutral position by means of a control lever and appropriate linkage, not shown. A conduit **64** is connected to the control valve **60** and provides fluid from a pressure source, not shown, and another conduit **66** is connected to the control valve and provides a means for return of the fluid to a reservoir or tank, also not shown. The rod end of the ejector cylinder **36** is connected to the control valve **60** by means of a conduit **68** and the piston end of the elevator cylinder **29** is connected to the control valve **60** by means of a conduit **70**. The control valve **60**, in its central neutral position, returns the fluid entering the valve **60** from the conduit **64** directly to the tank through the conduit **66**. When the spool **62** is moved to the left, as viewed in FIGURE 4, fluid pressure is directed from the conduit **64** to the conduit **70** and the conduit **68** communicates with the conduit **66** for return of fluid to the reservoir. When the spool **62** is moved to the right, as viewed in FIGURE 4, the fluid under pressure is directed to the conduit **68** and the conduit **70** is ported to the tank through conduit **66**. A conduit **80** is connected between the rod end of the elevator cylinder **29** and the piston end of the ejector cylinder **36**. A valve unit **72** is positioned in the conduit **70** and is provided with a one-way check valve **74** and a restricted orifice or metering valve **76**. The check valve **74** permits fluid flow through conduit **70** only from the control valve **60** toward the piston end of the elevator cylinder **29**. The metering valve **76** is connected in parallel with the check valve **74** by being located in a by-pass port **75** which communicates with the conduit **70** on each side of the check valve **74**. Another conduit **82** is connected between the conduit **80** and that portion of the conduit **70** which extends from the control valve **60** to the valve unit **72**. A spring-loaded check valve **84** is positioned in the conduit **82** and permits fluid flow therethrough only from the conduit **80** to the conduit **70**. The elevator ram **28** has a piston **25** attached to the rod **31** and slidably retained within the cylinder **29**. A poppet valve **86**, which comprises a ball having a rod-like extension thereon, is retained within a bore extending axially through the piston **25**. The bore is provided with an enlarged portion which forms with the bore itself a pair of seats, which the ball may engage to seal or close off the bore. The rod-like extension protrudes from the face of the piston **25** to which the rod **31** is attached. As the elevator ram nears the end of its extension stroke,

the rod-like extension will contact the end of the cylinder 29 and move the ball away from its seat thereby permitting the fluid to flow through the bore in the piston 25 from the piston end of the cylinder to the rod end of the cylinder. Depending upon the rate of flow desired, the bore size may be varied or the number of poppet valves may be increased.

When it is desired to fill the bowl of the scraper, the spool 62 is moved to the right, as viewed in FIGURE 4, admitting fluid under pressure through the conduit 68 to the rod end of the ejector cylinder 36. The fluid pressure acting on the piston 33 retracts the rod 32 and moves the ejector 30 to the rear of the bowl 12. As the ejector ram 34 is retracted, fluid is forced from the piston end of the ejector cylinder 36, through the conduit 80 to the rod end of the elevator cylinder 29. The fluid acting on the piston 25 will cause the elevator to move downwardly. This downward movement will be at a slow rate because the fluid expelled from the elevator cylinder can pass through only the restricted orifice 76 in the by-pass port 75 of the valve unit 72, the check valve 74 being seated to seal off the main conduit 70. The remainder of the fluid displaced by the retraction of the ejector ram 34 will pass through the conduit 82, since the check valve 84 will be unseated by the resulting pressure increase, to the conduit 70. The aforementioned movement of the spool 62 to the right having connected the conduit 70 to the conduit 66, the fluid flowing into the conduit 70 will be returned to the reservoir.

When desired, the bowl may be emptied by moving the spool 62 to the left, as viewed in FIGURE 4, from its center neutral position. Fluid under pressure will thereby be admitted to the conduit 70 and will pass through both the main conduit 70 in valve unit 72, the check valve 74 being unseated, and the orifice 76 in the by-pass port 75 to the piston end of the elevator cylinder 29. The poppet valve 86 will be forced against its upper seat within the piston 25 and the fluid pressure will move the piston upward raising the elevator. The fluid displaced by the movement of the piston 25 will flow through the conduit 80 to the piston end of the ejector cylinder 36 and cause the ejector ram 34 to be extended. The conduit 82 will remain closed because the spring force and pressure force acting to seat the valve will be greater than the pressure force acting to unseat the valve. As the elevator ram 28 reaches the end of its extension stroke, the poppet valve 86 will be unseated permitting fluid to flow through the piston 25. Since the displacement of the elevator cylinder 29 is less than the displacement of the ejector cylinder 36, the additional fluid required to complete the extension stroke of the ejector ram 34 will be supplied thereto by fluid flowing through the piston 25 and the conduit 80.

Thus, it can be seen the present invention provides a hydraulic circuit for a self-loading scraper which will insure that the elevator is raised and clear of the ejector as it is brought forward and that the ejector will be moved rearwardly before the elevator is lowered, thereby preventing interference of each with other.

It will be understood that various changes in the details, materials and arrangements of the parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

We claim:

1. A hydraulic circuit for a self-loading scraper having an ejector and an elevator comprising, a double acting elevator cylinder for raising and lowering said elevator, a double acting ejector cylinder having a displacement larger than said elevator cylinder for moving said ejector forward and backward, a first conduit connected to one end of said ejector cylinder, a second conduit connected to the other end of said ejector cylinder and to one end of said elevator cylinder, a third conduit connected to the other end of said elevator cylinder, a fourth conduit connected to each of said second and third conduits and a metering valve including a fixed orifice having a restricted two-directional flow; interposed in said third conduit between said elevator cylinder and the connection of said third and fourth conduits for controlling the egress of fluid from said elevator cylinder whereby fluid under pressure in said first conduit will cause said ejector cylinder to move said ejector backward and said elevator cylinder to slowly lower said elevator.

2. A hydraulic circuit for a self-loading scraper having an ejector and an elevator comprising, a double acting elevator cylinder for raising and lowering said elevator, a double acting ejector cylinder having a displacement larger than said elevator cylinder for moving said ejector forward and backward, a first conduit connected to one end of said ejector cylinder, a second conduit connected to the other end of said ejector cylinder and to one end of said elevator cylinder, a third conduit connected to the other end of said elevator cylinder, a fourth conduit connected to each of said second and third conduits, a metering valve interposed in said third conduit between said elevator cylinder and the connection of said third and fourth conduits for controlling the egress of fluid from said elevator cylinder whereby fluid under pressure in said first conduit will cause said ejector cylinder to move said ejector backward and said elevator cylinder to slowly lower said elevator, a first check valve positioned in said fourth conduit and permitting fluid flow only from said second conduit to said third conduit, a second check valve connected into said third conduit in parallel with said metering valve and permitting flow therethrough only toward said elevator cylinder and poppet valve means attached to said elevator cylinder for permitting fluid flow through said elevator cylinder from said third conduit to said second conduit in response to said elevator being raised to its upper limit whereby when fluid under pressure is admitted to said third conduit said elevator will be raised to its limit, said poppet valve will be unseated and fluid will flow through said elevator cylinder to complete the extension of said ejector cylinder.

3. A hydraulic circuit according to claim 2 and further comprising a selector valve connected to said first and third conduits for selectively and alternately supplying fluid under pressure to one of said first and third conduits while porting the other of said first and third conduits to tank.

4. A hydraulic circuit for a self-loading scraper having an ejector and an elevator comprising, a double-acting elevator cylinder having a piston slidable therein for raising and lowering said elevator, said piston having a poppet valve therein for permitting fluid flow through said elevator cylinder in response to said elevator attaining its raised position, a double acting ejector cylinder having a displacement greater than said elevator cylinder for moving said ejector forward and returning the same, a first conduit connected to one end of said ejector cylinder and capable of receiving fluid under pressure for effecting movement of said ejector cylinder and the return of said ejector, a second conduit connected to the other end of said ejector cylinder and to one end of said elevator cylinder, a third conduit connected to the other end of said elevator cylinder, a fourth conduit connected at each end to said second and third conduits, a first check valve positioned in said fourth conduit and permitting fluid flow therethrough only from said second conduit to said third conduit, a valve unit having a metering valve and a second check valve in parallel interposed in said third conduit between said elevator cylinder and the connection of said third and fourth conduits, said second check valve permitting fluid flow therethrough only toward said elevator cylinder, and means for alternately and selectively admitting fluid under pressure to either of said first and third conduits.

5. A hydraulic circuit for a self-loading scraper having an elevator and an ejector comprising an elevator

cylinder having a piston slidable therein for raising and lowering said elevator, an ejector cylinder having a displacement greater than said elevator cylinder for moving said ejector forward and backward, a first conduit connected to the rod end of said ejector cylinder, a second conduit connected to the piston end of said ejector cylinder and to the rod end of said elevator cylinder, a third conduit connected to the piston end of said elevator cylinder, a fourth conduit connected to each of said second and third conduits, and a metering valve interposed in said third conduit between said elevator cylinder and the connection of said third and fourth conduits for controlling the rate of fluid flow from said piston end of said elevator cylinder whereby when said first conduit is subjected to fluid under pressure said ejector will be fully retracted and said elevator will thereby be lowered at a controlled rate.

6. A hydraulic circuit according to claim 5 and further comprising a first check valve interposed in said fourth conduit for permitting fluid flow therethrough only from said second conduit to said third conduit, a second check valve connected into said third conduit in parallel with said metering valve, and poppet valve means connected to said elevator cylinder for permitting fluid flow therethrough only in response to complete extension of

said elevator cylinder whereby when said third conduit is subjected to fluid under pressure said elevator cylinder will be fully extended and said poppet valve means will be opened allowing said ejector cylinder to be fully extended.

7. A hydraulic circuit according to claim 6 and further comprising a selector valve connected to said first and third conduits for alternately and selectively connecting one of said first and third conduits to a source of fluid under pressure and porting the other of said first and third conduits to tank.

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