

May 29, 1945.

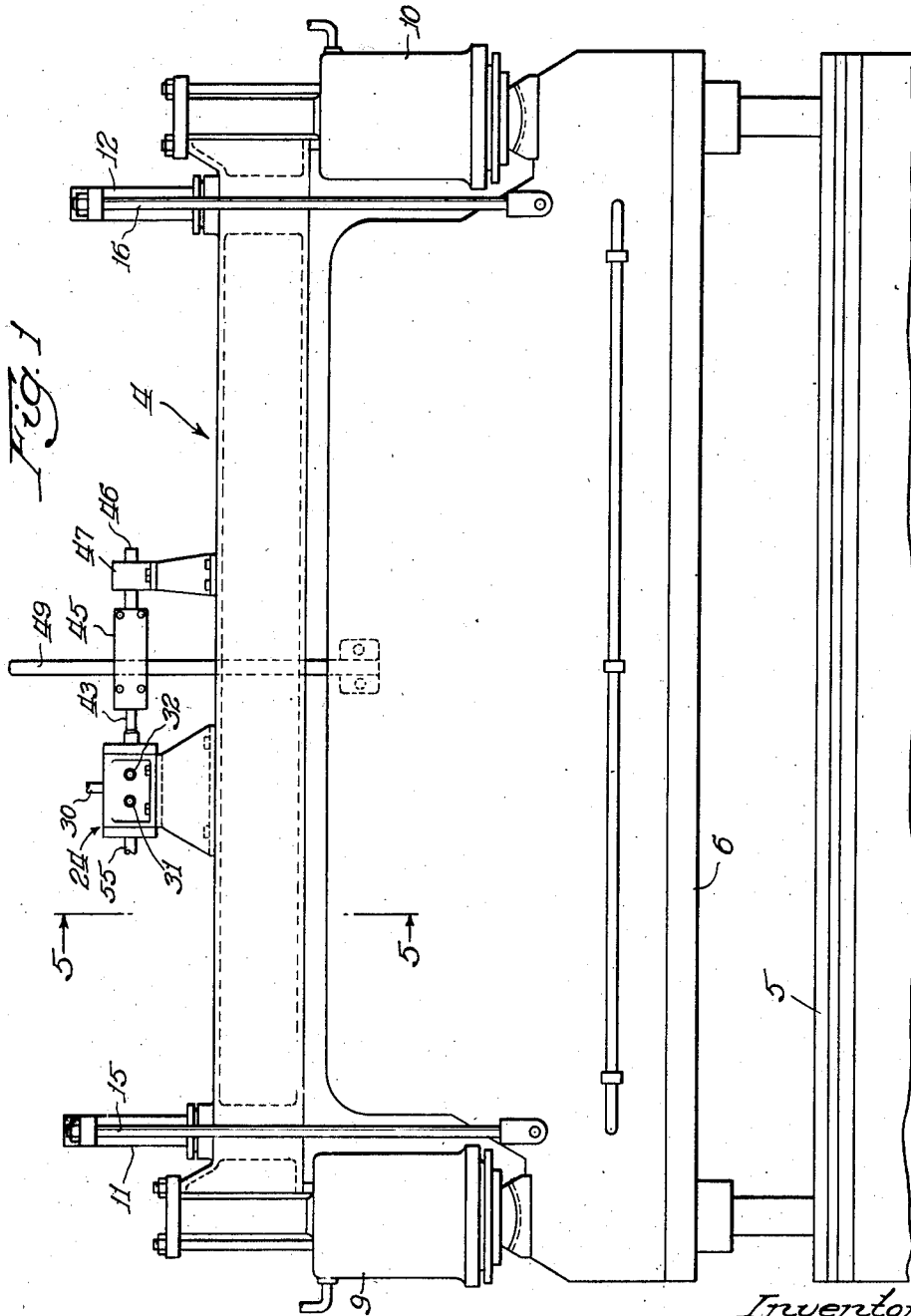
R. J. HESS

2,377,007

EQUALIZING HYDRAULIC RAM TRAVEL

Filed Sept. 29, 1941

3 Sheets-Sheet 1



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Fig. 2

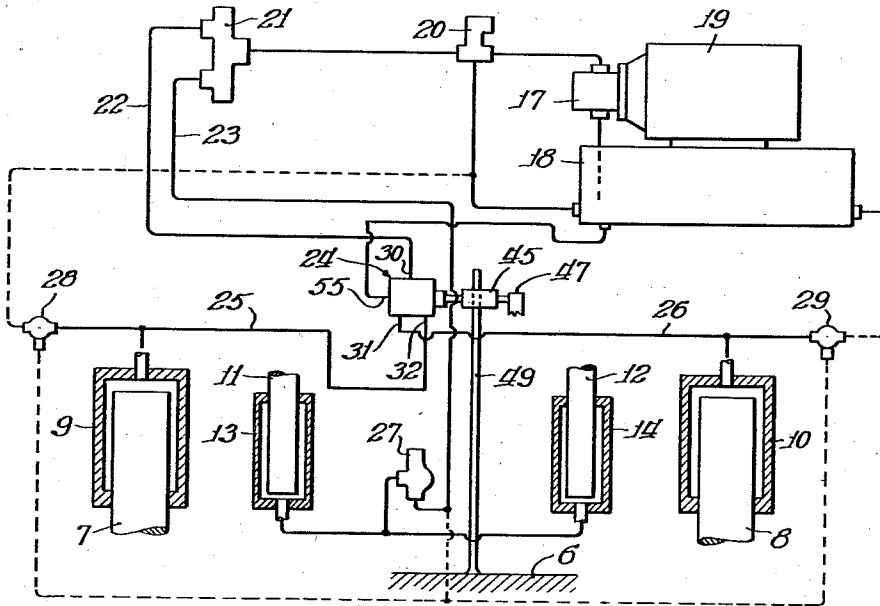


Fig. 4

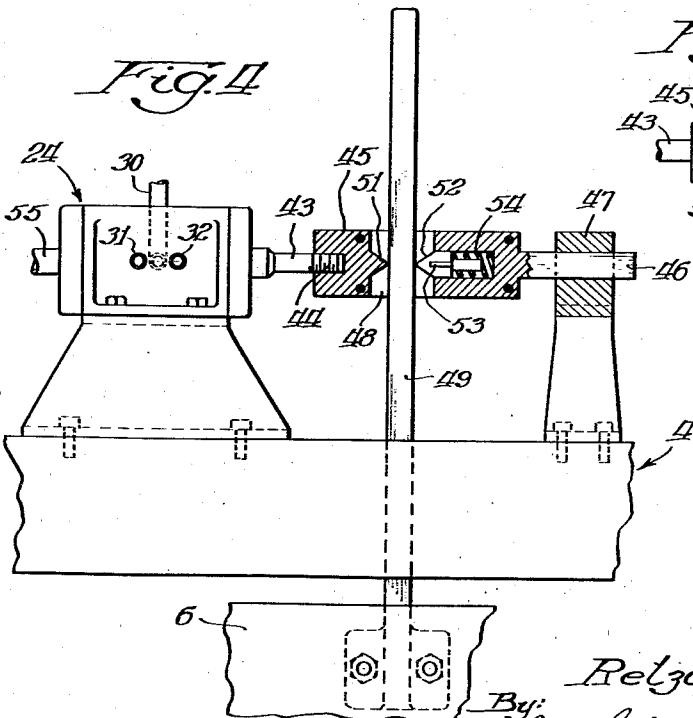
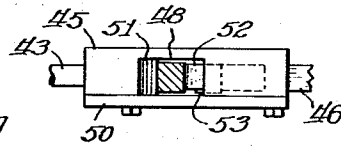


Fig. 6



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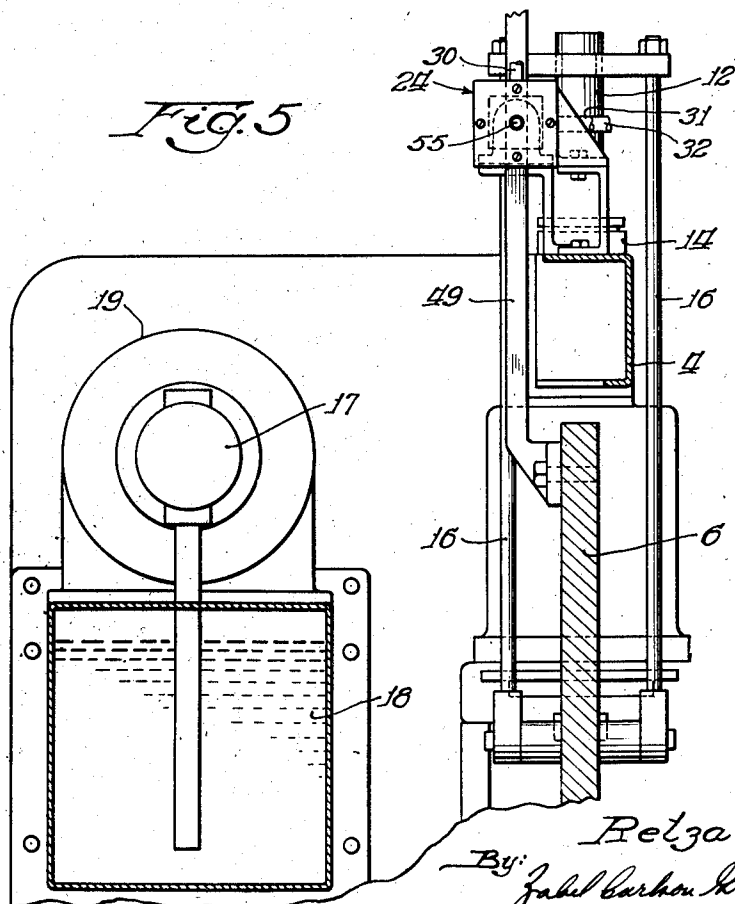
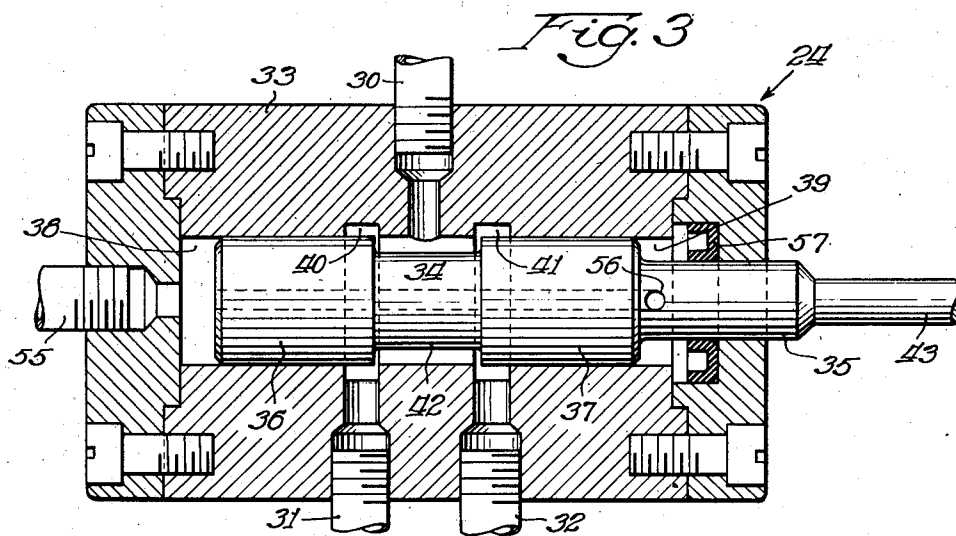
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EQUALIZING HYDRAULIC RAM TRAVEL

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3 Sheets-Sheet 3



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Att. 11

UNITED STATES PATENT OFFICE

2,377,007

EQUALIZING HYDRAULIC RAM TRAVEL

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Application September 29, 1941, Serial No. 412,819

4 Claims. (Cl. 100—71)

The present invention relates to hydraulic presses and particularly to means for controlling and equalizing the travel of two or more spaced rams that may be applied to advance the platen of the press.

The problem of causing equal advance of spaced portions of a platen driven by spaced rams under hydraulic pressure has caused many difficulties in the past. Many methods of operation and mechanisms of many types have been tried as a means of solving this problem. The various solutions of which I am aware are not practical in all instances. In some cases it is because of lack of accuracy. In other cases too many delicate parts are necessary while in most cases the solution of the problem requires complicated and expensive mechanisms where wear of the parts soon makes them incapable of performing the desired function.

The present invention contemplates means for equalizing the travel of two spaced rams, which means embodies a simple valve and control lever arrangement whereby fluid from a source under pressure is so fed to the spaced rams that any tendency of one ram to get ahead of the other is immediately and directly offset by a corresponding reduction in the quantity of fluid directed toward that ram. Moreover the present invention contemplates a means of this character wherein the change in the proportion of fluid directed to the two rams is accomplished without effecting any change whatsoever in the capacity of the valve. In accordance with the present invention it is also contemplated that the control of the advance of one ram ahead of the other is increasingly sensitive and effective as the rams approach their final advanced position.

Other and more specific objects and advantages of the present invention will appear from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is shown. It is to be understood however that the drawings and description are illustrative only and are not to be taken as limiting the invention except insofar as it is limited by the claims.

In the drawings:

Fig. 1 is a view in side elevation of a press to which the present invention has been applied;

Fig. 2 is a diagrammatic view illustrating the fluid connections by which operation of the press is accomplished;

Fig. 3 is an enlarged view of the control valve, this view being a section taken longitudinally through the valve;

Fig. 4 is an enlarged detailed view illustrating the control mechanism and its connection to the valve;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1; and

Fig. 6 is a fragmentary plan view of part of the mechanism shown in Fig. 4.

Referring now in detail to the drawings, the present invention is shown in Fig. 1 as embodied in a press such as a bending or shearing press 4, the bed plate of which is indicated at 5 and the moving platen of which is indicated at 6. The moving platen 6 is movable vertically downward by means of two hydraulic rams 7 and 8 housed in cylinders 9 and 10. The moving platen 6 is lifted by means of pull-back rams 11 and 12 housed in cylinders 13 and 14, these rams being connected by rods 15 and 16 to the platen. The rams are actuated by fluid under pressure which is pumped by means of a pump 17 from a tank 18, the pump 17 being driven by a motor 19. The pressure liquid is fed through a relief valve 20 to a 4-way control valve 21 which may be controlled by any suitable means, manual or automatic, alternatively to direct fluid under pressure to one of two supply pipes 22 and 23. The supply pipe 22 directs the liquid under pressure through a control unit 24 to the cylinders 9 and 10 to thus advance the rams 7 and 8. The supply pipe 23 directs the liquid under pressure through a holding valve 27 to the cylinders 13 and 14 so as to lift the rams 11 and 12 for withdrawing the movable platen 6.

As illustrated the control unit 24 is connected by pipes 25 and 26 to the cylinders 9 and 10, respectively. Suitable quick exhaust valves 28 and 29 are provided in the pipes 25 and 26, these valves being adapted to provide an exhaust outlet back to the tank 18 to exhaust the fluid from the cylinders 9 and 10 when the platen 6 is being raised after an advance stroke. The valves 28 and 29 as shown are connected to the supply pipe 23 so as to be actuated by fluid from the pipe 23.

The control unit 24 is illustrated more completely in Fig. 3. This is adapted to direct fluid from an inlet 30 to one of two outlets 31, 32. The outlet 31 leads to the pipe 26 while the outlet 32 leads to the pipe 25. The unit 24 is a balanced valve construction comprising a casing 33 having a chamber therein in which a reciprocating valve 35 is arranged to travel. The chamber has a central reduced portion 34. The valve 35 has two cylindrical portions 36 and 37, which portions are closely fitted in cylindrical bores 38 and 39 provided in the casing 33. The cylindrical portions

36 and 37 extend into enlarged outlet portions 40 and 41 of the chamber. The valve 35 has a reduced portion 42 between the cylindrical portions 36 and 37. The portions 36 and 37 and the reduced portion 42 of the chamber are machined to give an accurate fit. Also, the portions 36 and 37 are in normal position when the two ends of the platen 6 are even. In their normal position the portions 36 and 37 are equally spaced from the adjacent edges of the reduced portion 42.

The portions 36 and 37 are so spaced apart that when the valve is moved to the right or left the total opening provided is substantially the same from the point where one of the enlarged portions 37 completely cuts off its outlet to the point where the other enlarged portion 36 completely cuts off its outlet. I make use of this characteristic of the valve construction to obtain a smoothly operating correction of any tendency of one ram to advance faster than the other. Mechanism is provided to move the valve 35 instantly and in proportion to any advance of one ram ahead of the other. Thus if one ram gets slightly ahead of the other for any reason, the moving platen tips slightly and this tipping is translated into a direct movement of the valve 35 in a direction to increase the size of the outlet to the cylinder for the ram that is lagging behind. Immediately the available flow of liquid is diverted more to the cylinder of the lagging ram and less to the cylinder of the leading ram until the tipping is corrected. Furthermore, with the mechanism provided the correction in the size of outlet opening becomes increasingly or decreasingly sensitive as the movable platen approaches the limits of its travel.

The particular mechanism for controlling the movement of the valve 35 in response to tipping of the moving platen comprises a stem 43 on the valve having threads 44 on the end thereof. The stem 43 is threaded into a slotted block 45. The other end of the block 45 is provided with a reduced extension 46 sliding in a bearing 47. The block 45 is slotted at 48 to receive a bar 49 that is fixed to the moving platen 6. A cover plate 50 (Fig. 6) holds the bar 49 in the slot 48. Within the slot 48 two knife edge bearings 51 and 52 are provided for the bar 49. The bearing 52 is a spring pressed pin having a key 53 thereon to prevent it from turning. A spring 54 holds the bearing 51 snugly against the bar with sufficient force to cause the block 45 to move endwise in response to any angular movement of the bar 49. The bar 49 however may slide vertically in the block 45 between the bearings 51 and 52. The parts are machined accurately to eliminate any lost motion between the bar 49 and the block 45. As the moving platen is lowered the valve stem 43 is caused to move further for a given angular movement of the moving platen because of the increase in effective length of the bar 49.

With the apparatus hereinbefore described a positive and accurate equalization of the travel of two spaced rams is obtained. Provision is made in the connection of the stem 43 to the block 45 for adjustment of the valve position with respect to the platen position. This is done by threading the stem into the block 45. The construction is such that the valve openings between the inner ends of the portions 36 and 37 and the adjacent edges of the portion 42 can be made equal when the platen is level to a very accurate degree. The valve 35 is balanced in all positions. The end of the bore 38 is open through a port 55 to the tank 18. A passage 56 connects the bore 39 with the

bore 38. A seal 57 is provided to prevent leakage around the stem 43.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a hydraulic press wherein there is provided a platen and a ram disposed at each side of the center of the platen to which pressure fluid is applied for causing the platen to travel, a source of fluid under pressure for supplying pressure fluid to said rams, and valve means responsive to uneven travel of said platen to change the proportion of valve opening for fluid to the rams, said valve means comprising a valve casing having a chamber comprising an inlet chamber, two outlet chambers, each connected to one of said rams, a balanced valve in said chamber having two valve portions each controlling flow from the inlet chamber to one of said outlet chambers, said portions being movable together to restrict one outlet as much as the other outlet is opened, and valve moving means, operable upon advance of one ram ahead of the other, to shift said valve in a direction to restrict the outlet to the leading ram and increase the outlet to the trailing ram, said valve moving means comprising a block having a slot, said block being slidably mounted on the press and presenting within said slot an integral knife-edge bearing, a spring pressed pin mounted in said slot and presenting a knife-edge bearing spaced from the first-mentioned bearing, a connection between said block and said valve, and a bar fixed to said platen and extending between said bearings for slidable engagement therewith, said bar having a lever arm increasing in effective length as said platen is advanced by said rams.

2. In an hydraulic press comprising a platen and a plurality of rams disposed at opposite sides of the center of said platen, to which rams pressure fluid is applied for advancing said platen, a source of fluid under pressure for supplying pressure fluid to said rams, valve means responsive to uneven travel of said platen to change the proportion of valve opening for said fluid to said rams, and valve actuating means comprising a member on the press having a slot therethrough, a block having at one end thereof a portion slidably fitted in said slot, said block having an opening therethrough and presenting within said opening an integral bearing, a spring-pressed pin mounted in said block and presenting a bearing spaced from and aligned within the first-mentioned bearing, a connection between said valve means and the opposite end of said block, and a bar carried by the platen and extending between said bearings in line contact therewith, said bar having a lever arm increasing in effective length as said platen is advanced by said rams.

3. In a hydraulic press comprising a platen and a plurality of rams disposed at opposite sides of the center of the platen, to which rams pressure fluid is applied for advancing said platen, a source of fluid under pressure for supplying pressure fluid to said rams, valve means responsive to uneven travel of said platen to change the proportion of valve opening for said fluid to said rams, and valve actuating means comprising a block having a slot, said block being slidably mounted on the press and presenting within said slot an integral knife-edge bearing, a spring-pressed pin mounted in said slot and presenting a knife-edge bearing spaced from the first-mentioned bearing, an operative connection between said block and said valve means, and a bar fixed to said platen

and extending between said bearings for slidable engagement therewith, said bar having a lever arm increasing in effective length as said platen is advanced by said rams.

4. In an hydraulic press wherein there is provided a platen and a ram disposed at each side of the center thereof to which pressure fluid is applied for causing the platen to travel, a source of fluid under pressure for supplying pressure fluid to said rams, and valve means responsive to uneven travel of said platen to change the proportion of valve opening for fluid to the rams, said valve means comprising a valve casing having a chamber comprising an inlet chamber, two outlet chambers each connected to one of said rams, a balanced valve in said chamber having two valve portions each controlling flow from the inlet chamber to one of said outlet chambers, said portions being movable together to restrict one

5 outlet as much as the other outlet is opened, and valve moving means operable upon advance of one ram ahead of the other to shift said valve in a direction to restrict the outlet to the leading ram and increase the outlet to the trailing ram, said valve moving means comprising a block having a slot, said block being slidably mounted at one end thereof on the press and presenting within said slot an integral knife-edge bearing, a 10 spring-pressed pin mounted in said slot and presenting a knife-edge bearing spaced from the first-mentioned bearing, a connection between the opposite end of said block and said valve, and rigid means fixed to said platen and having a 15 lever arm extending between said bearings for slidable engagement therewith, said lever arm increasing in effective length as said platen is advanced by said rams.

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