Aug. 8, 1939. J. R. SHEPPARD 2,169,113

HYDRAULIC BENDING PRESS

Filed April 29, 1938 3 Sheets-Sheet 1

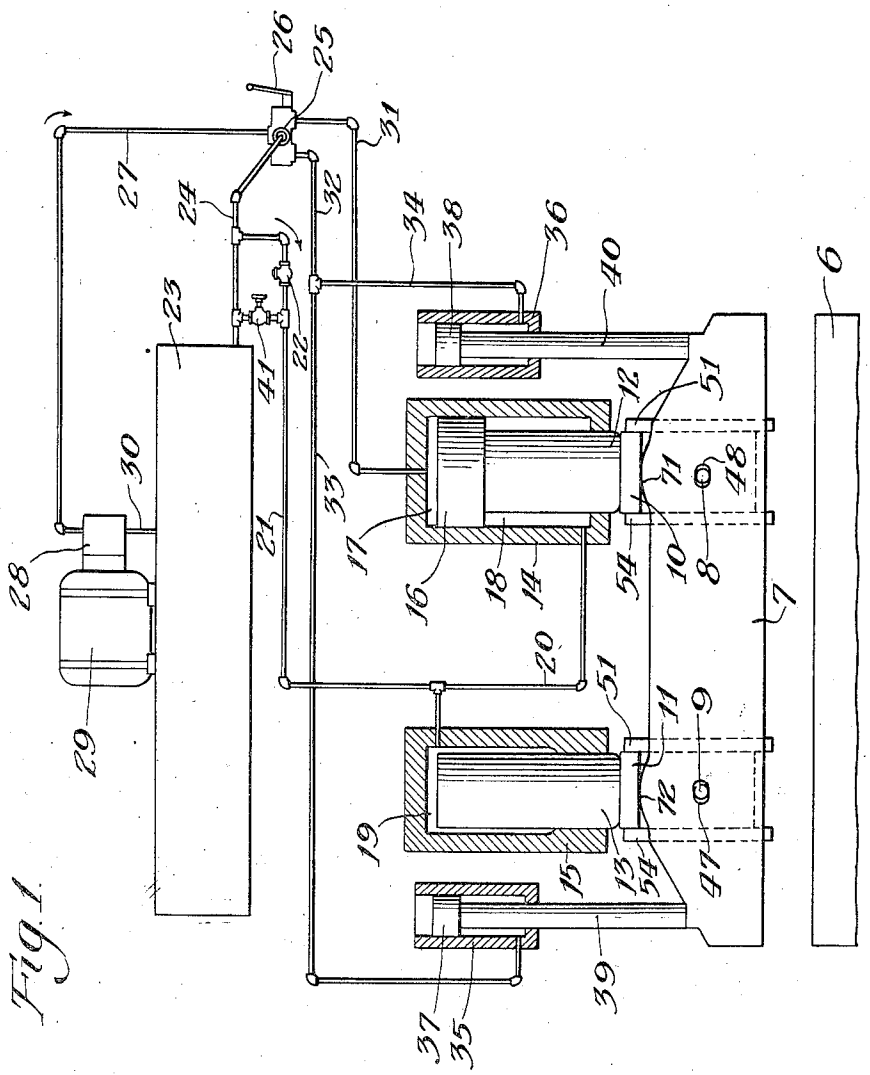


Fig. 1.

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Filed April 29, 1938 3 Sheets-Sheet 2

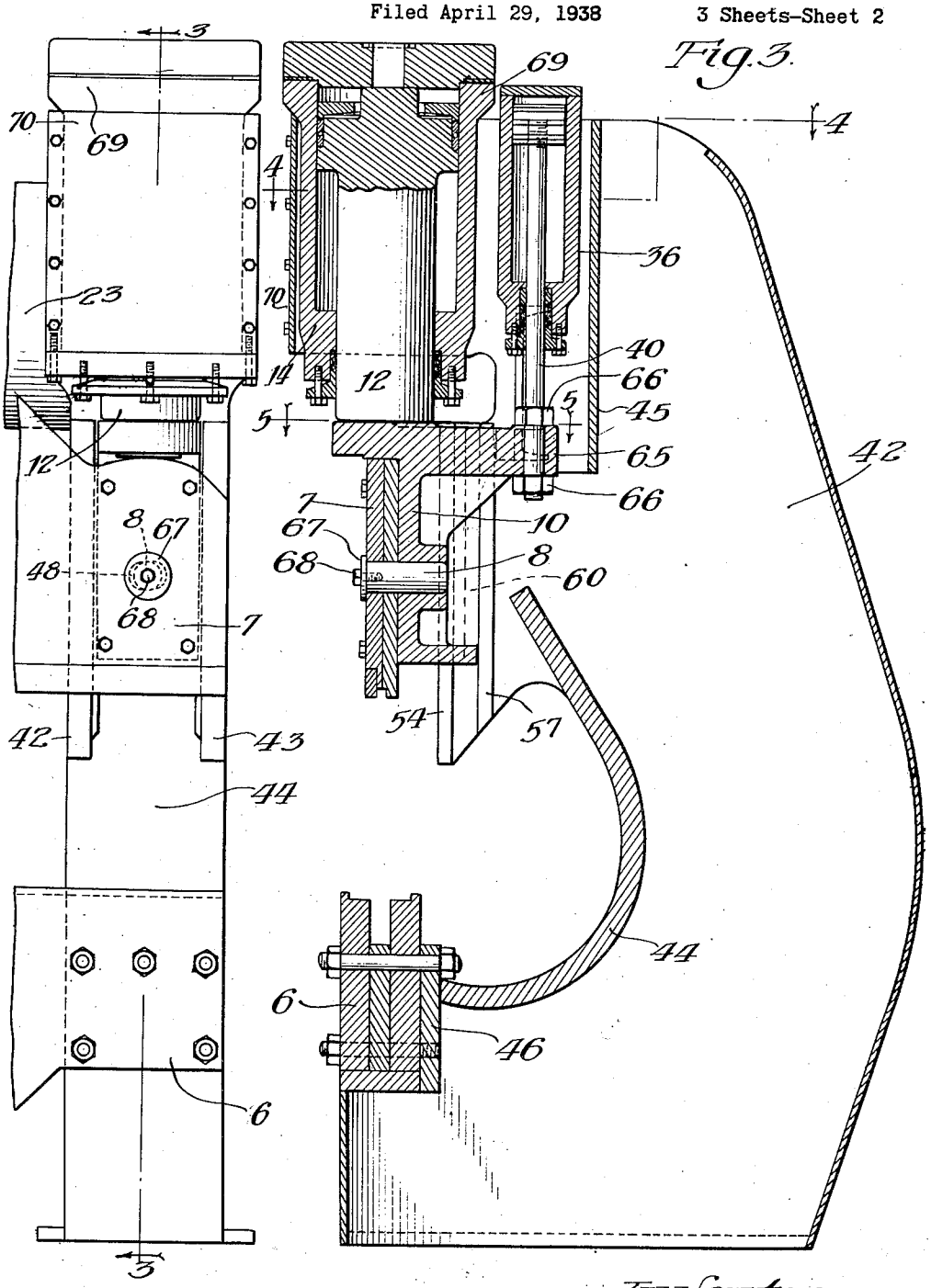


Fig. 2.

Fig. 3.

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Filed April 29, 1938 3 Sheets-Sheet 3

Fig. 4.

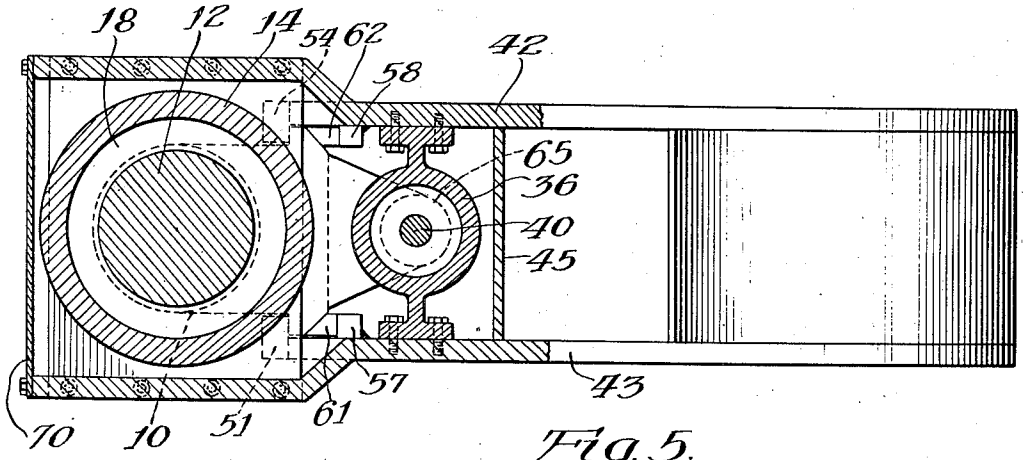
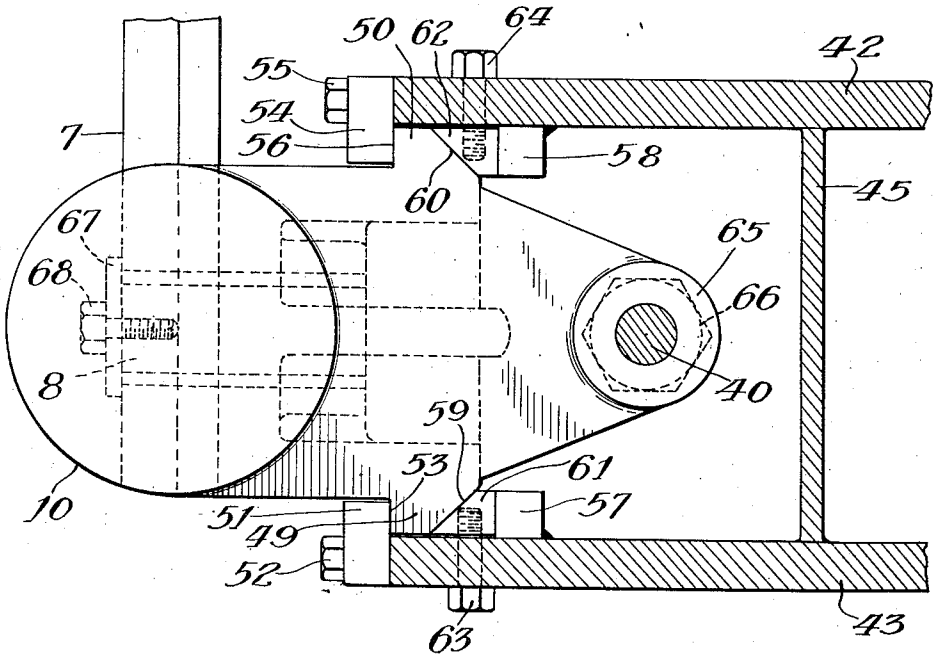


Fig. 5.



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UNITED STATES PATENT OFFICE

2,169,113

HYDRAULIC BENDING PRESS

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Application April 29, 1938, Serial No. 205,137

8 Claims. (Cl. 153—29)

The present invention relates to that type of hydraulic press in which two hydraulic cylinders of substantially equal pressure capacity and equal stroke are utilized. It is particularly applicable to that type of press having a relatively long bed, with each cylinder contained in its individual frame or housing and the frames located at the outer ends of the bed. The press embodying the present invention is so arranged as to permit clear passage of the work through the press between the cylinder frames or housings.

In presses of this type it is believed desirable to have both hydraulic cylinders of equal power effect, in order to distribute the pressure uniformly along the press bed. There are several factors, however, which may cause one press ram to move somewhat faster than the other. Such factors may be variations in flow of pressure liquid to the actuating cylinders, friction of the different packings in the press rams, and certain types of pressing conditions. If one press ram moves faster than the other, there is undesirable angular travel of the pressing or moving platen, with consequent binding or twisting effect in the guide members which are usually provided between the pressing platen and the press housings.

It is the principal object of this invention to provide a two-cylinder hydraulic press in which the two pressing rams will be assured a uniform rate of travel. The invention contemplates also an arrangement of guide members to accommodate any adjustment of ram travel, whether the two rams move together or one moves in advance of the other.

The present invention contemplates a press construction in which, by suitable pre-charging of one of the cylinders, the movable platen can be made to advance to its work with its pressing surface at an angle to the stationary platen. The common operation would, of course, be with the pressing surfaces of the movable and stationary platens held parallel to each other. If the press is used as a shearing machine, instead of the normal plate bending purpose, then it may be advantageous to have one end of the moving platen closer to the stationary platen than the other.

The present guide construction is such that no distortion or twisting effect will result from having the pressing surface of the movable platen set at an angle to the stationary platen.

It should be understood that the press as shown in the drawings may be operated from any customary supply of hydraulic pressure, such as an individual pumping unit or an accumulator system. The features and advantages of the invention will appear more fully as the description proceeds in connection with 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 considered as limiting the invention except insofar as it is limited by the claims.

In the drawings, Fig. 1 is a somewhat diagrammatic view illustrating the arrangement of the hydraulic cylinders and the hydraulic fluid circuit employed therewith;

Fig. 2 is a front view of one end housing of the press;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3, and

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 3.

Referring now to the drawings, and particularly to Fig. 1, the press is shown as having a stationary platen 6 and a movable platen 7. The movable platen 7 is connected by pins 8 and 9 to two guides 10 and 11. The guides 10 and 11 are adapted to be engaged by press rams 12 and 13. The press rams 12 and 13 are mounted in cylinders 14 and 15.

It will be noted that the cylinder 14 accommodates a differential ram in which the ram 12 has an enlarged end 16 which is twice the area in cross section as that of the main ram portion 12. The enlarged end 16 is desirably in the form of a pressure tight piston so that no leakage can take place from the space 17 in the cylinder 14 to the space 18.

The press cylinder 15 accommodates the ram 13 which has the same area as the ram 12, space 19 being provided in the cylinder 15 so that the pressure fluid may be introduced above the ram 13.

The space 18 of cylinder 14 is connected to the space 19 of the cylinder 15 by suitable piping 20. This piping is connected by a pipe 21 through a check valve 22 to a reservoir 23. The check valve 22 is so disposed as to permit flow of fluid from the reservoir 23 to the spaces 18 and 19. However, the position of the check valve 22 is such as to prevent flow from the cylinders back into the reservoir 23. The reservoir 23 is connected by a pipe 24 to a suitable control valve 25 which is adapted to be actuated by a control lever 26. The valve 25 has an inlet pipe 27 leading from a pump 28 which is driven by a motor 29. The pump 28 is connected by a pipe 30 to the reservoir

23. The valve 25 is of the usual construction in which, by adjustment of the lever 26, fluid under pressure from the pipe 27 may be directed through the valve to either one of three outlet pipes 31, 32 or the pipe 24. This valve structure is a well-known structure in the art, and it is believed that further description thereof is unnecesary.

The pipe 32 has two branches 33 and 34 which communicate with two pull-back cylinders 35 and 36. The cylinders 35 and 36 have pistons 37 and 38, respectively, connected to the movable platen 7 by stems 39 and 40.

The operation of the fluid cycle is as follows: When both rams 12 and 13 are in the "up" position as shown in the drawings, the lower space 18 of the cylinder 14 and the space 19 of the cylinder 15, together with the interconnecting pipes 20 and 21, are kept completely filled with liquid entering through the check valve 22. If the valve 25 is operated to admit liquid to the space 17, then the piston 16 will be forced downward, and in consequence will force liquid from the space 18 over into the space 19 of the cylinder 15. As hereinbefore stated, the rams 12 and 13 are of the same area in cross section. Furthermore, the piston 16 is twice the area of the ram 12. Since the combined areas of pistons 12 and 13 are equal to the area of the piston 16, both the rams 12 and 13 will be caused to travel at an equal speed and for an equal distance. As pressure is applied to the top of the piston 16, each ram will exert one-half of the total pressure applied on the top of the piston 16. On the reverse stroke the valve 25 is, of course, set to direct fluid under pressure beneath the pull-back pistons 37 and 38. At the same time, the pipe 31 is by-passed by the valve 25 into communication with the pipe 24 so as to permit liquid to return to the reservoir 23 from the space 17 over the piston 16.

In order to produce movement of one end of the platen 7 ahead of the other, a valve 41 connecting pipe 21 with pipe 20 may be used, precharging the pipe 20 and the spaces 18 and 19 so that the ram 13 is advanced below the ram 12. The valve 41 may then be closed and, when the operation hereinabove described takes place, the same relative positions of the rams 12 and 13 will be maintained throughout the structure. The ram 13 will advance at the same speed as the ram 12, but will be started at a lower level, thus causing the platen 7 to assume an angular position with respect to the stationary platen 6.

Referring now to the construction of the press, this is best shown in Figs. 2—5. It is to be understood, of course, that Fig. 2 illustrates one end of the press and that the other end, shown at the left in Fig. 1, is substantially a duplicate thereof except for the different cylinder 15 and ram 13.

The end housing of the press comprises two side plates 42 and 43 which are connected together by cross tie members 44 and 45, preferably welded to the side plates 42 and 43. The lower platen 6 is bolted directly to a plate 46 which is welded to the side plates 42 and 43. The upper platen 7 has elongated openings 47 and 48 to receive the pins such as pin 8 on the guide 10. The guide 10 has portions 49 and 50 projecting from the opposite side edges thereof and adapted to be guided in suitable guideways provided on the plates 42 and 43. To form the guideways plate 42 has a vertically running bar 51 at the front edge thereof, secured in place by bolts 52 and adapted to engage a shoulder 53 on the portion 49. The plate 42 has a bar 54 bolted thereto by bolts 55. The bar 54 engages a shoulder 56 on the portion 50. A bar 57 is welded to the plate 43 to the rear of the projection 49 and the bar 58 is welded to the plate 42 to the rear of the projection 50. The rear edges of the projections 49 and 50 are bevelled, as shown at 59 and 60. In order to hold the projections 49 and 50 up against the bars 51 and 54, I provide adjustable gibs 61 and 62 between the bars 57 and 58 and the bevelled faces 59 and 60. These adjustable gibs have bevelled faces engaging the faces 59 and 60. Screw bolts 63 and 64 are utilized to clamp the members 61 and 62 in place. It is believed to be clear that any wear can be taken up by moving the adjustable gibs 61 and 62 inward and putting shims behind them.

The pull-back cylinder 36 is mounted to the side plates 42 and 43, and the stem 40 is passed through a rearwardly extending portion 65 of the guide 10. It is secured to the guide 10 by lock nuts 66. The moving platen 7 is held on the pin 8 by a washer 67 and a screw bolt 68.

The side frames 42 and 43 also mount the cylinder 14. The cylinder is provided with a flanged end 69 beneath which the side plates 42 and 43 engage. A front plate 70 is bolted to the front edges of the side plates 42 and 43.

The platen 7 has curved upper ram-engaging faces 71 and 72 (see Figs. 1 and 2). The surfaces 71 and 72 are so curved as to take care of any angular disposition of the movable platen 7 as may be desired. The rams 12 and 13 fit into the guides 10 and 11 as shown best in Figs. 2 and 3 so as to directly engage the surfaces 71 and 72.

From the above description it is believed that the construction and operation of this device will be readily apparent to those skilled in this art. Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a hydraulic press of the character described, comprising a stationary platen, a moving platen, guide means for said moving platen, spaced rams operable to apply pressure to the moving platen and force it toward the stationary platen, cylinders for said rams and means for causing the rams to be advanced the same distance at the same speed under all conditions, said last named means comprising a piston on one of the rams having an area equal to the sum of the areas of said rams, the cylinder for said last named ram having a space beneath the piston equal in cross section to the area of the other ram, said space beneath the piston being connected with the hydraulic liquid space in the cylinder for the other ram.

2. In a hydraulic press of the character described, comprising a stationary platen, a moving platen, guide means for said moving platen, spaced rams operable to apply pressure to the moving platen and force it toward the stationary platen, cylinders for said rams and means for causing the rams to be advanced the same distance at the same speed under all conditions, said last named means comprising a piston on one of the rams having an area equal to the sum of the areas of said rams, the cylinder for said last named ram having a space beneath the piston equal in cross section to the area of the other ram, said space beneath the piston being connected with the hydraulic liquid space in the cylinder for the other ram, a supply conduit for filling said spaces and the connection between

them with liquid, a check valve in said conduit to prevent return of fluid from said spaces, and a valved by-pass around said check valve whereby to supply liquid to and remove liquid from said spaces.

3. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a piston in one cylinder having a cross-sectional area equal to the sum of the cross-sectional areas of said rams, means including said cylinders providing a sealed liquid chamber including the spaces around said rams, and means to apply pressure to the piston whereby to cause equal advancements of both rams at the same speed.

4. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a piston in one cylinder having a cross-sectional area equal to the sum of the cross-sectional areas of said rams, means including said cylinders providing a sealed liquid chamber including the spaces around said rams, means to apply pressure to the piston whereby to cause equal advancements of both rams at the same speed, and means to vary the relative positions of said rams comprising means to vary the amount of liquid in said sealed chamber.

5. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a piston in one cylinder having a cross-sectional area equal to the sum of the cross-sectional areas of said rams, means including said cylinders providing a sealed liquid chamber including the spaces around said rams, means to apply pressure to the piston whereby to cause equal advancements of both rams at the same speed, and means to vary the relative positions of said rams comprising means to vary the amount of liquid in said sealed chamber, said last named means comprising a liquid supply conduit having a check valve and a valved by-pass around the check valve.

6. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a piston in one cylinder having a cross-sectional area equal to the sum of the cross-sectional areas of said rams, means including said cylinders providing a sealed liquid chamber including the spaces around said rams, means to apply pressure to the piston whereby to cause equal advancements of both rams at the same speed, a movable platen adapted to be advanced by said rams, a guide associated with each ram and slidably mounted in said frame, and means pivotally mounting said platen on each of the guide means, said mounting means comprising a pin and elongated slot connection.

7. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a movable platen adapted to be advanced by said rams, a guide associated with each ram and slidably mounted in said frame, and means pivotally mounting said platen on each of the guide means, said mounting means comprising a pin and elongated slot connection.

8. In a hydraulic press of the character described, a frame, a pair of cylinders thereon, rams in said cylinders, a movable platen adapted to be advanced by said rams, a guide associated with each ram and slidably mounted in said frame, and means pivotally mounting said platen on each of the guide means, said mounting means comprising a pin and elongated slot connection, said platen having convex bearing portions adapted to receive the pressure from said rams.

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