Sept. 15, 1942. W. R. TUCKER 2,296,072

HYDRAULIC PRESS

Filed Nov. 20, 1939 7 Sheets-Sheet 1

FIG. 1

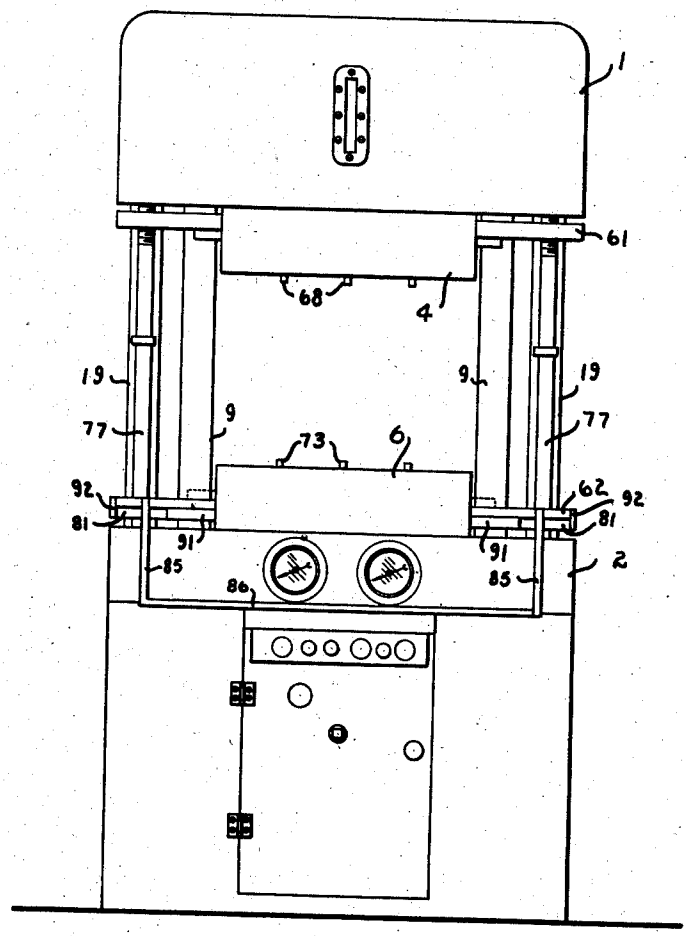

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FIG. 2

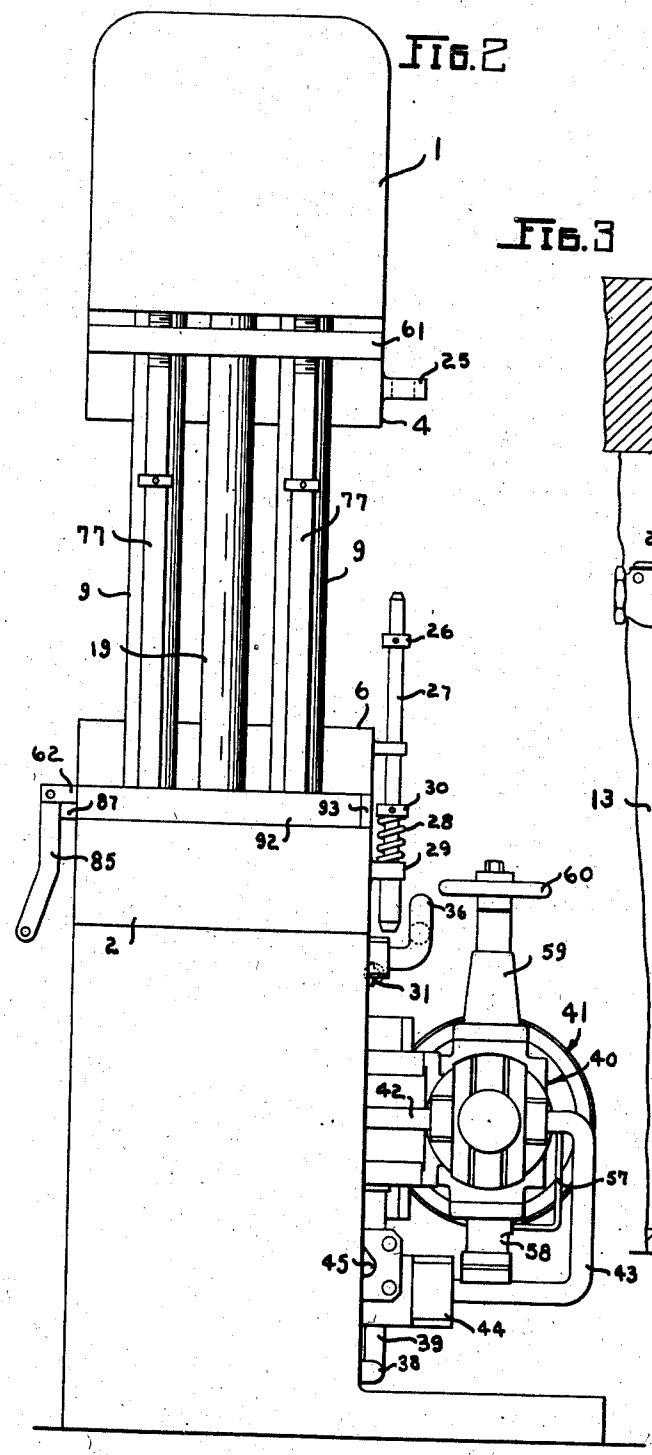

FIG. 3

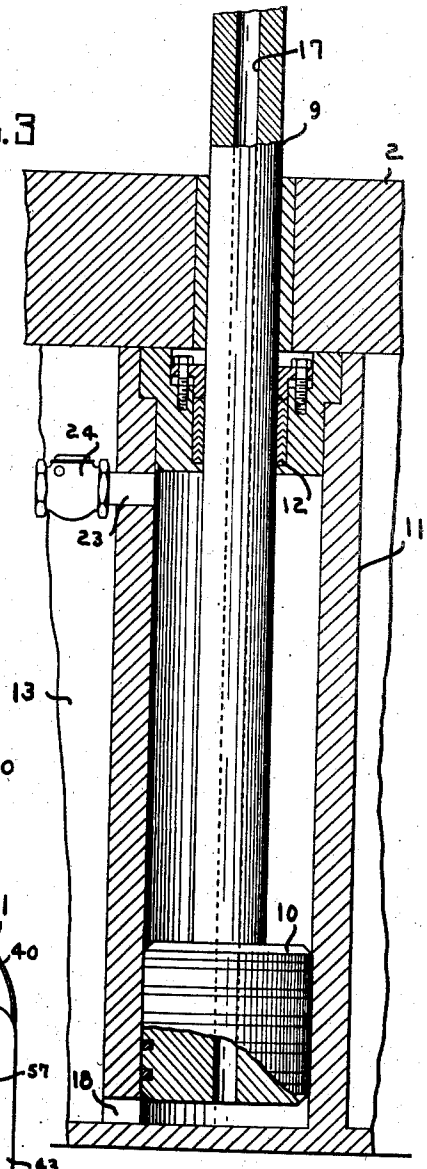

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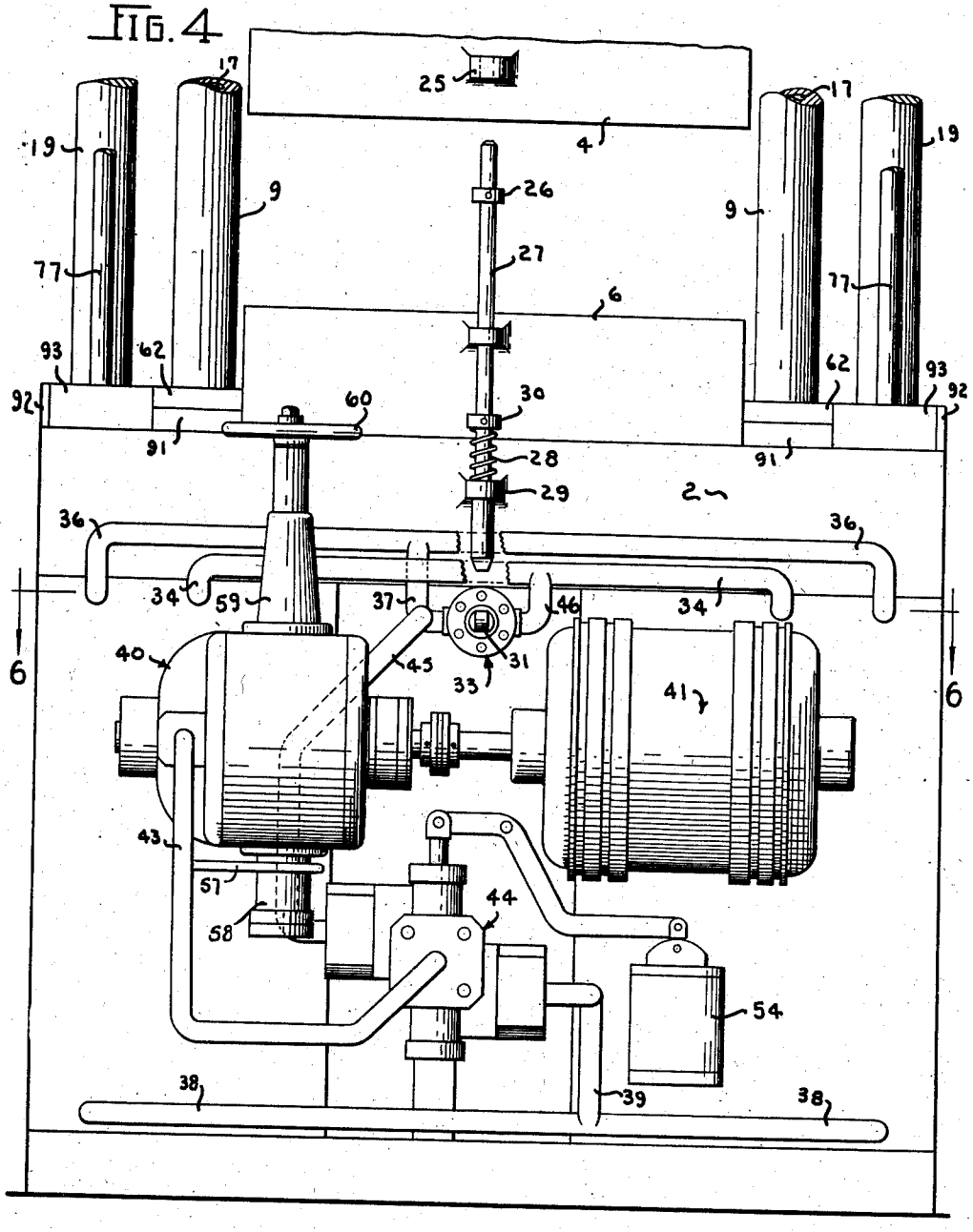
FIG. 4



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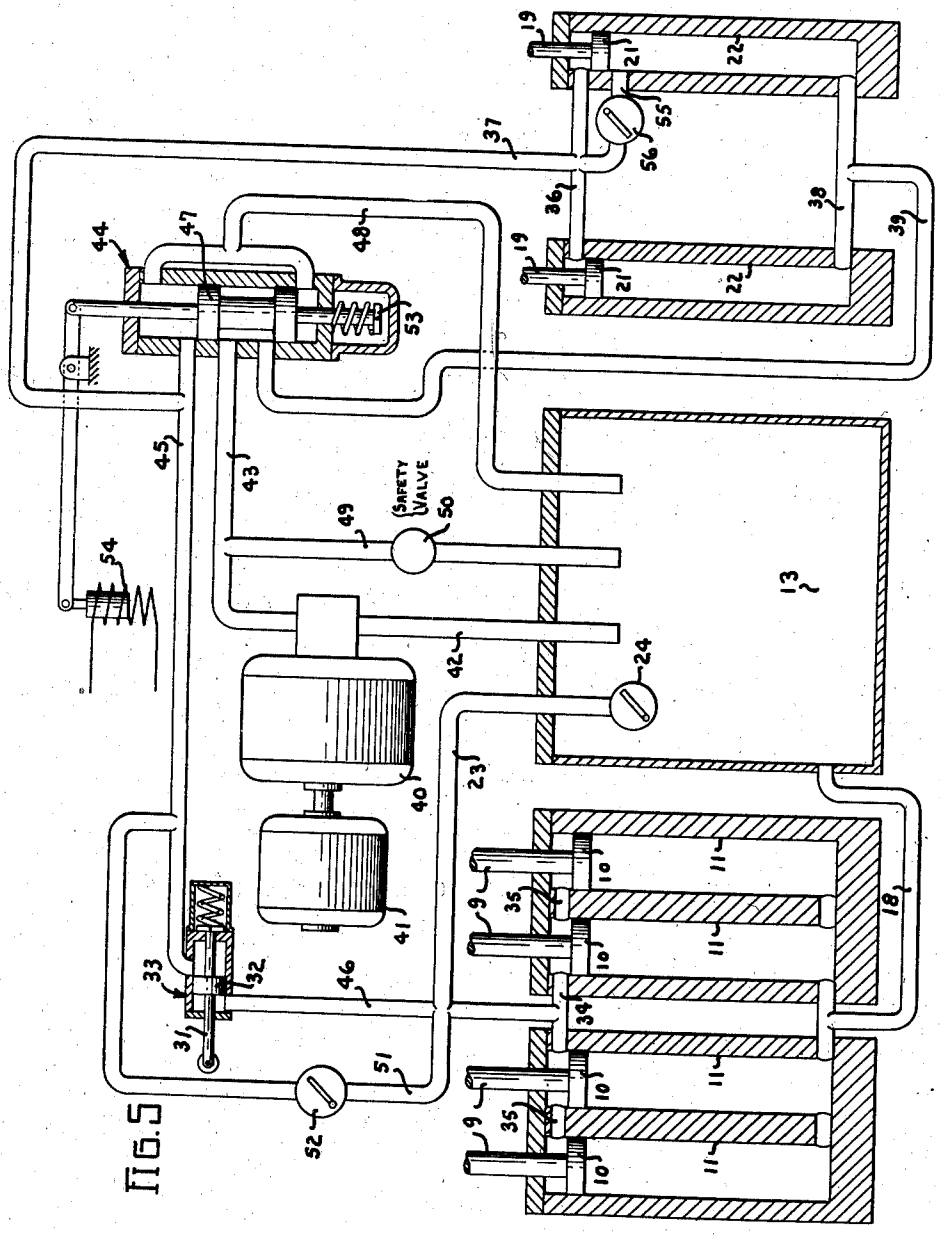

FIG. 5

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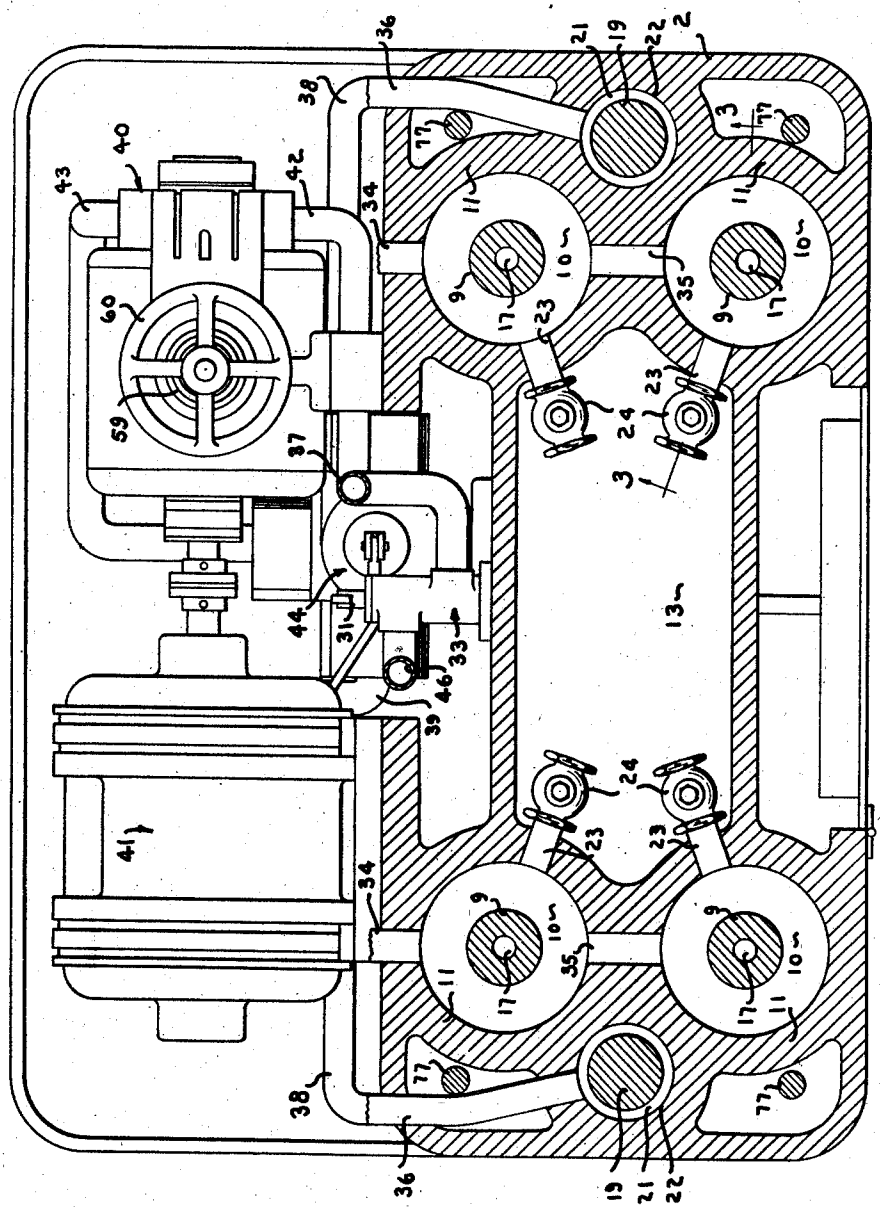

FIG. 6

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FIG. 7

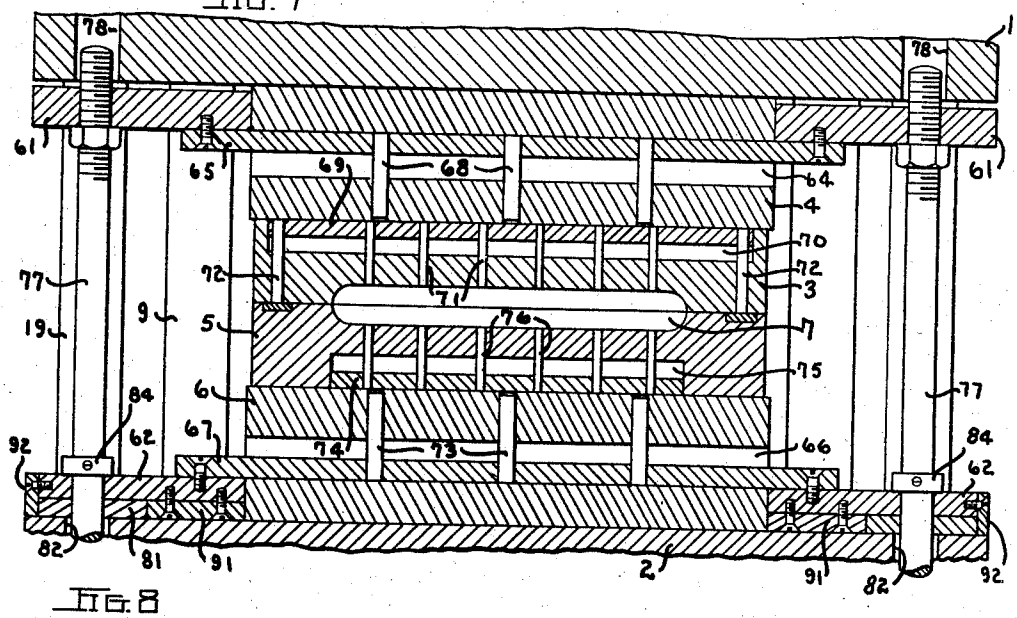

FIG. 8

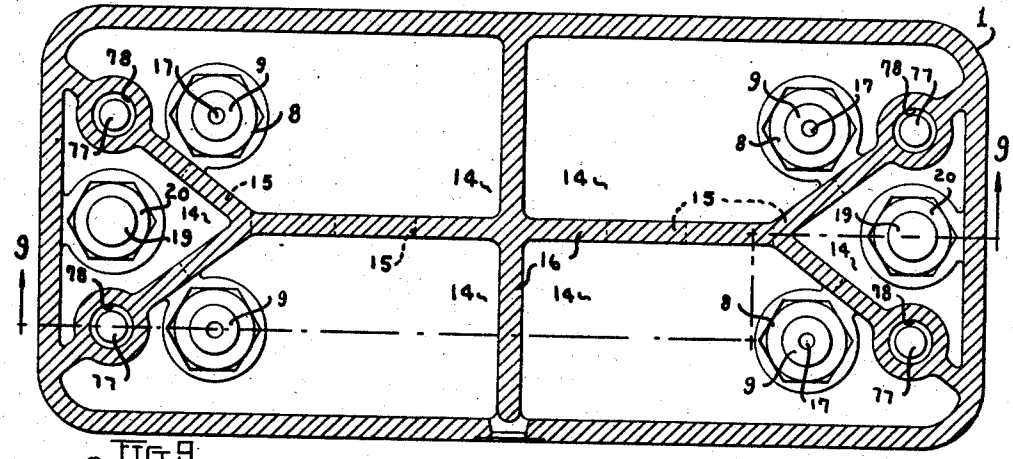

FIG. 9

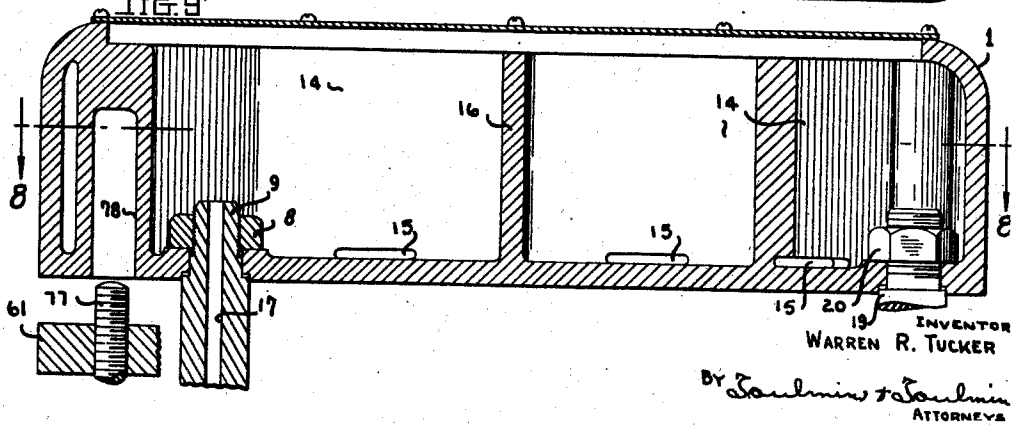

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FIG. 10

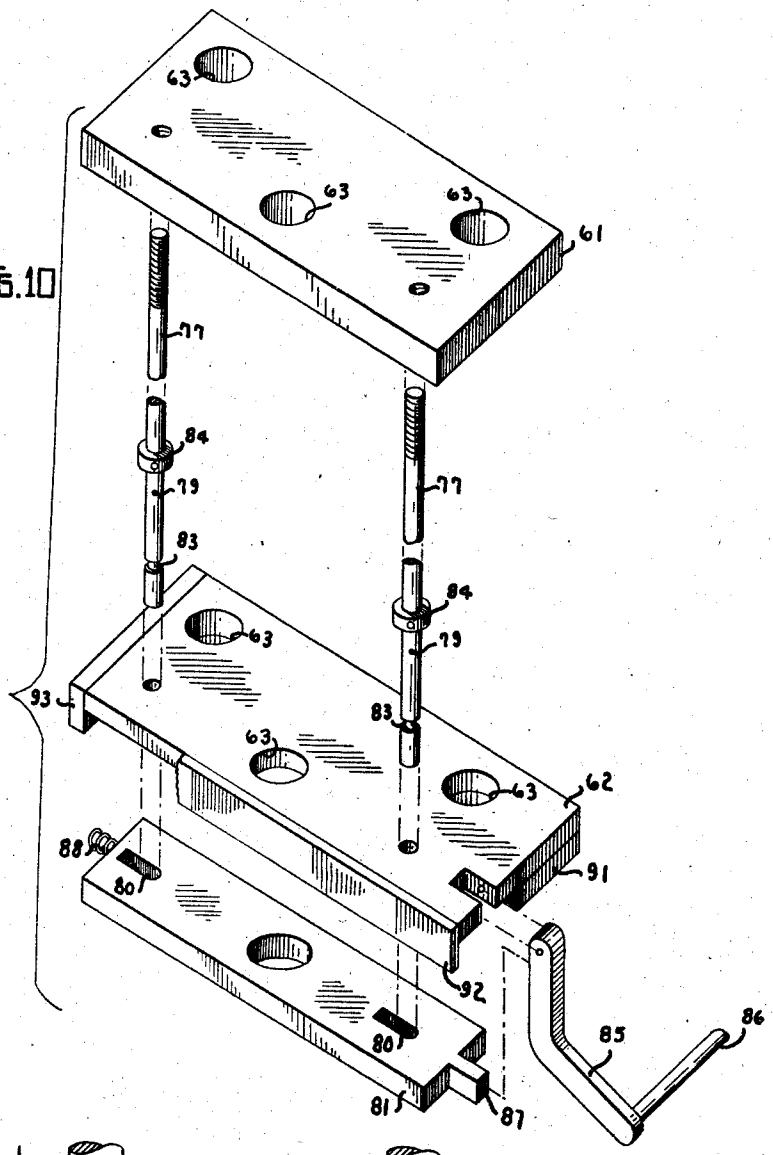


FIG. 11

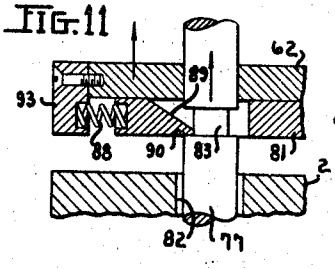


FIG. 12

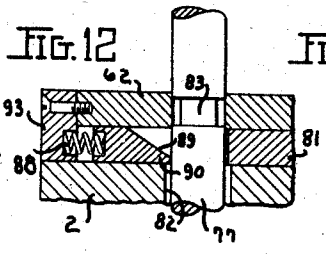
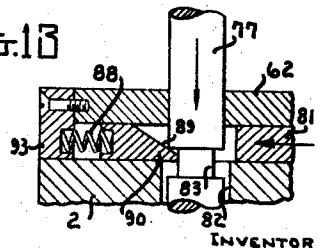


FIG. 13



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Patented Sept. 15, 1942 2,296,072

UNITED STATES PATENT OFFICE

2,296,072

HYDRAULIC PRESS

Warren R. Tucker, Dayton, Ohio, assignor to The Hydraulic Development Corp. Inc., Wilmington, Del., a corporation of Delaware

Application November 20, 1939, Serial No. 305,356

10 Claims. (Cl. 18—16)

This invention relates to a hydraulic press and more particularly to a hydraulic press in which the main ram is eliminated and the head of the press is moved as a unit towards the bed of the press by means of pistons located in the lower part of the press and operatively connected to the head of the press by rods which are employed in place of the stationary tie rods conventionally heretofore employed.

It is an object of the present invention to provide a hydraulic press of simplified construction whereby the press is less expensive to build and maintain without sacrificing the advantages of the conventional hydraulic presses heretofore available.

Another object is to accomplish the foregoing object while providing for very rapid movement of the head of the press which carries the upper pressing member towards the bed of the press until the pressing operation commences, whereupon the head of the press moves at relatively low speed but under extremely high total pressure.

Another object is to devise a press of the foregoing type which is particularly adapted to be employed in carrying out what is known as "compression" molding; in this connection the typical press to be described includes special mechanism for ejecting the molded piece after molding has been completed, this ejecting mechanism being particularly adapted to use with the compression molding press described herein.

Another object is to provide double-acting means which is separate from the main press operating means, for carrying out the operations of fast traverse and of pushing back of the press head.

Still other objects will more fully hereinafter appear.

Referring to the accompanying drawings;

Fig. 1 is a front elevation of a compression molding press embodying the principles of the present invention, with the head at the position where it is most widely separated from the base, and the knockout mechanism actuated.

Fig. 2 is a side elevation of the press.

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 6, through one of the main cylinders in the lower part of the press.

Fig. 4 is a rear elevation of the lower part of the press.

Fig. 5 is a diagrammatic view of the complete press, showing the hydraulic circuit.

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 4 through the bottom of the press.

Fig. 7 is a fragmentary vertical section showing the die halves in closed position and showing the associated mechanism including the knockout or ejecting mechanism.

Fig. 8 is a horizontal section through the top of the press on the line 8—8 of Fig. 9, looking in the direction of the arrows.

Fig. 9 is a vertical section on the line 9—9 of Fig. 8.

Fig. 10 is a perspective exploded view of the knockout mechanism on one side of the press; the knockout mechanism on the other side of the press is identical.

Fig. 11 is a detailed sectional view showing the operation of the lower knockout mechanism during an ejecting operation by which the molded piece is ejected from the mold when the die halves are about to attain their most separated position.

Fig. 12 is a similar view showing the lower knockout plate after resetting thereof by the operator.

Fig. 13 is a similar view but showing the lower knockout mechanism on the downstroke of the head of the press.

General arrangement

In the press which is illustrated in the drawings and which constitutes a typical embodiment of the present invention, the conventional stationary press head and tie rods are replaced by a vertical movable head to which is fixedly secured the upper die half or equivalent forming or pressing member, and by rods which are fixedly attached to the press head and to hydraulic pistons operating in cylinders formed by or associated with the bed of the press upon which the lower die half or the like is mounted. Thus, the rods constitute in effect very elongated plungers, and the upper die half is brought into pressing engagement with the lower die half by exerting hydraulic pressure downwardly on the plunger rods which are fixedly attached to the head. The major part of the downstroke is carried out by means of auxiliary hydraulic pistons which are effective to move the press head at very high speed until the pressing operation is about to begin, whereupon automatic adjustable mechanism causes the fluid pressure to be applied additionally to the main pistons. Thus, the auxiliary pistons exert a boosting action on the downstroke. The return of the press head upwardly is accomplished by exerting hydraulic pressure on the opposite sides of the auxiliary pistons, this being known as the "push-back" operation. Suitable

control means are provided for effecting automatically and at the proper times the application of fluid pressure to the appropriate portions of the press. The booster and push-back pistons are operatively connected to the press head by means of plunger rods which are similar to the main plunger rods and similarly extend from the pistons which are located in the base of the press into fixed attachment with the press head.

When carrying out compression molding, the press is desirably provided with knockout means for ejecting the molded article from the die half in which it is retained after the upward return of the press head is begun and preferably towards the end of the return stroke.

Referring more particularly to the accompanying drawings, 1 designates the vertically movable head of the press and 2 designates the stationary bed of the press. The head 1 of the press is in the form of a suitable casting which is hollow so as to act as a portion of the hydraulic liquid reservoir, the remainder of the hydraulic liquid being carried in the bed 2 of the press which is similarly hollowed out to form an oil reservoir. The upper mold half 3 is carried on the head 1 of the press by means of bolster plate 4 while the lower die half 5 is carried on a lower bolster plate 6 which is similarly fixedly attached to the bed 2. The mold halves 3 and 5 form the usual mold cavity 7 (Fig. 7).

Fixedly attached to the head 1 as by means of nuts 8 (see Figs. 8 and 9) and vertically dependent therefrom are four main plunger rods 9, and these plunger rods 9 integrally or fixedly carry at their lower ends main pressing pistons 10 which are reciprocably received in main pressing cylinders 11 which are fixedly carried by the bed 2 of the press (see Fig. 3). The main plungers 9 are sealed at the point where they enter the cylinders 11, as at 12 (Fig. 3). These main plungers 9 are operated directly only during the main pressing operation, as will presently appear.

The hydraulic liquid employed is carried in a reservoir which is made up of two parts, one of which is formed in the stationary bed 2 of the press and the other of which is formed in the movable head 1 of the press. The lower portion of the reservoir is formed inwardly of the main pressing cylinders 11 and is designated 13, this cavity 13 being suitably formed in the casting which constitutes the bed 2 of the press. The head of the press is formed with six oil cavities 14 (see Figs. 8 and 9), these cavities 14 being interconnected by passageways 15 suitably disposed through the partitions 16 in the head of the press. The main plunger rods 9 extend into these cavities 14 and are formed axially with bores 17 which extend to the bottom of pistons 10. The space below pistons 10 is in free communication with oil cavity 13 by means of passageways 18 (Fig. 3) in the walls of cylinders 11, and thus the oil cavities 14 are in free communication with oil cavity 13 at all times. A quantity of oil is provided such that cavity 13 is always filled regardless of the condition of the hydraulic circuit connected therewith.

Booster and pushback plungers

Fixedly attached to the head 1 and extending downwardly therefrom are a pair of auxiliary plungers 19, these plungers 19 being fixedly secured within the end compartments 14 of head 1 by means of nuts 20 (Figs. 8 and 9). Plungers 19 extend downwardly into the press bed 2 and carry on their lower ends pistons 21 which operate vertically within cylinders 22 which are formed in any suitable manner in the press bed. The plungers 19 are nearly as large in diameter as the pistons 21 mounted thereon and consequently when hydraulic pressure is applied above pistons 21 the plungers 19 are drawn downwardly at a very rapid rate, the effective area being very small. However, on the return stroke when oil under pressure is applied beneath pistons 21, the full area of pistons 21 is effective and return is not as rapid. This fast downstroke is of advantage because it enables the head 1 of the press to be brought rapidly into the position where pressing is ready to begin, thus saving time. The action of forcing plungers 19 downwardly causes main plungers 9 to be moved downwardly, and as plungers 9 so move, pistons 10 cause oil to be sucked into the space above pistons 10 through conduits 23 (Figure 6) which lead directly from the upper portion of cylinders 11 into the oil cavity 13. The conduits 23 are provided on their inward ends with check valves 24 which allow oil to be sucked outwardly but prevent its return. Thus pistons 10 are prevented from drawing a vacuum as they are pulled downwardly by the auxiliary pistons 21.

As the head of the press approaches the position where actual pressing is about to begin, the application of hydraulic pressure is automatically shifted so that hydraulic pressure is applied downwardly both upon pistons 21 and upon main pressing pistons 10. This shift is effected as follows: An ear 25 fixedly carried in any suitable manner on the head of the press, as, for example, by attachment to bolster plate 4, strikes an adjustable collar 26 (Figures 2 and 4) on a vertically movable shift rod 27 and carries rod 27 downwardly against the action of spring 28 which is disposed between an ear 29 mounted on bed 2 and an adjustable collar 30. This causes the lower cam end of rod 27 to move inwardly a rod 31 and to thereby shift a piston 32 (Fig. 5) of a two-way valve 33 so as to admit liquid under pressure to the spaces above main pistons 10 through conduits 34. As indicated in Fig. 6, the spaces above main pistons 10 at each end of the press are placed in communication with one another by passageways 35 which are suitably cored in the casting constituting the press base 2.

Liquid under pressure is admitted to the spaces above auxiliary pistons 21 during the fast traverse and during the main pressing operation by means of conduits 36 which are suitably disposed in the bed 2 of the press. These conduits 36 are connected to a common conduit 37 (Fig. 5). The spaces below auxiliary pistons 21 are connected to conduits 38, these conduits 38 merging into a common conduit 39.

For returning the head 1 after a pressing operation, the pistons 21 are employed, hydraulic pressure being applied below them by suitable operation of the controls. This causes plungers 19 to move upwardly, carrying head 1 and with it plungers 9 and pistons 10. The drawing of a suction by pistons 10 on their upward stroke is prevented by their free connection with the oil cavity 13 by means of passageways 18. One of the secondary features of the press of this invention is the simplicity of piping, the connection between reservoir 13 and cylinders 11 being merely by way of ports in the cylinder walls. Likewise, the spaces above the pistons 10 are con-

nected to the cavity 13 by similar short conduits 23 in the cylinder walls leading to the check valves 24 which are located in the cavity 13, this check valve being continually exposed to the oil in the reservoir by reason of the fact that cavity 13 is always full, being supplied with oil at all times from cavities 14 through bores 17 in plungers 9.

The feature of having two oil reservoirs which are in continuous communication with one another and one of which is in the base and the other in the pressing head, serves the purpose of utilizing the spaces which occur in these parts and of providing a head of pressure for filling the main cylinders 11 during the upward movement and the first part of the downward movement of the pressing head 1.

Hydraulic circuit

While the hydraulic circuit has been referred to to some extent above, it is desirable to describe it in detail with reference particularly to Fig. 5. Oil under pressure is constantly supplied by a one-way variable delivery pump 40 driven by motor 41 and withdrawing oil through conduit 42 from tank 13 and passing it under pressure through conduit 43 to a four-way valve 44. Leading from four-way valve 44 is a conduit 45 which leads to the normally spring-closed two-way valve 33 which is in communication with the inlet conduits 34, leading to the spaces above main pistons 10, by a conduit 46. Thus fluid pressure transmitted to conduit 45 is prevented from being admitted to the spaces above pistons 10 except when ear 25 has actuated spring-urged rod 31 so as to open the two-way valve 33, this taking place only when the pressing operation is about to begin and when it is desired to have a very great force applied to the pressing elements, namely mold halves 3 and 5.

Conduit 39 is connected to four-way valve 44 and is adapted to lead pressure fluid to the spaces below auxiliary pistons 21 when it is desired to return the pressing head to its upward position. Four-way valve 44 contains a shifting member 47 which is adapted to connect the pressure liquid from conduit 43 to either conduit 45 or to conduit 39. The four-way valve 44 is also provided with a common return conduit 48 which connects both ends of valve 44 back to the tank 13 and which is thus adapted to convey fluid returned either by conduit 45 or by conduit 39 back to the tank 13.

Conduit 43 is connected back to the tank by a conduit 49 in which is disposed a safety valve 50 which is adapted to open only under emergency to allow the output of pump 40 to be returned to the tank.

The valve member 47 is normally held in the position shown in Fig. 5 in which it is adapted to convey the pressure liquid to the spaces below auxiliary pistons 21, and to return the liquid from above main pistons 10 through a by-passing conduit 51 connected to conduit 46, leading around the two-way valve 33, and connecting therebeyond with conduit 45. A check-valve 52 is disposed in this conduit 51 for preventing liquid under pressure in conduit 45 from reaching the spaces above pistons 10 except by way of two-way valve 33.

A spring 53 normally holds valve member 47 in the position shown in Fig. 5. In order to shift valve member 47 at the desired time so as to admit pressure liquid to conduit 45 and thence through conduit 37 which connects conduit 45 to the spaces above pistons 21, for causing the rapid traverse, and subsequently for aiding in the pressing operation after two-way valve 33 is opened, solenoid 54 is provided. When this solenoid 54 is energized by any suitable means under the control of the operator, valve member 47 is shifted upwardly of Fig. 5, causing the application of pressure liquid to the spaces above auxiliary pistons 21 and the simultaneous return of liquid from below pistons 21 by way of conduits 39 and 48 to the reservoir 13.

In order to limit the upward movement of pushback or auxiliary pistons 21 and thereby to limit the upward return of press head 1, in order to hold press head 1 in this upward position, and in order to by-pass the output of pump 40 while so holding the head 1, the following means is provided. A conduit 55 is disposed in the wall of one of the cylinders 22 at a point just below the desired upward position of piston 21 in that cylinder and this conduit 55 is connected to conduits 36 and 37. A check valve 56 is disposed in this conduit 55 in such manner that it allows liquid to pass outwardly from the space in cylinder 22 to the conduit 37 and thence by way of conduit 48 back to the reservoir 13, but prevents the flow of pressure liquid from conduit 37 through conduit 55 into cylinder 22. Thus, during the pushback operation, when piston 21 is below the point of connection of conduit 55, the liquid above piston 21 is adapted to flow outwardly either through conduit 55 or through conduit 36. However, when piston 21 moves upwardly of the connection of conduit 55 to cylinder 22, the pressure liquid admitted from conduit 39 to the interior of cylinders 22 is freely passed outwardly through check valve 56 into conduit 37 and thence back to the tank 13. Should pistons 21 and head 1 drop slightly so as to cover up the port of conduit 55, the pressure liquid would immediately force them upwardly until the port of conduit 55 was uncovered. In this way, the pistons 21 and with them the head 1 and main pistons 10 are held in their uppermost position, this uppermost position is predetermined, and as they are so held, the output of pump 40 is by-passed. As will be obvious, it is generally desired to place the port of conduit 55 on the booster side of the cylinder 22, adjacent the port of conduit 36, whereby the pistons 21 are located and held near the top of cylinders 22. However, if desired, the port of conduit 55 may be located at any point on the cylinder wall 22.

Operation of press

While the operation of the press proper will be in large part obvious from the foregoing description, it may be reiterated as follows. Motor 41 is first started, causing pump 40 to deliver liquid. Four-way valve 44 is in the position of Fig. 5 while the press is at rest and consequently the pressure output from conduit 43 will be delivered through conduit 39 to the spaces below auxiliary pistons 21, causing them to rise in cylinders 22, thereby elevating the head 1 of the press to its uppermost position if it is not already at said position. As the pistons 21 rise, the pressure liquid above them will be forced outwardly through conduits 36 and 37 and thence through the upper portion of four-way valve 44 to the return conduit 48 which leads back to the reservoir 13. As the head 1 approaches its uppermost position, the port of conduit 55 will be uncovered and the liquid will be by-passed

through check valve 56 to the tank 13 in the manner just described above.

As the auxiliary pistons 21 are elevated, the main pistons 10 will be correspondingly elevated in their cylinders 11 by reason of their connection to head 1 by plungers 9, causing the liquid above pistons 10 to return to the tank 13 by way of conduits 34, conduit 51 and check valve 52, conduit 45, the upper portion of four-way valve 44, and return conduit 48 to the reservoir 13.

Assume now that it is desired to effect downward travel of the head 1 in a pressing operation. Solenoid 54 will be first energized by any suitable means under the control of the operator, causing valve member 47 in four-way valve 44 to shift upwardly of Fig. 5, thereby causing the pressure liquid from conduit 43 to be connected to conduit 45. The liquid from conduit 45 cannot flow at this time into the spaces above main pistons 10 because two-way valve 33 is still closed and check valve 52 prevents movement of the liquid from conduit 45 into conduits 34. Accordingly, the liquid is directed from conduit 45 into conduit 37 and thence into the spaces above pistons 21, it being prevented from going into the spaces below pistons 21 by the action of check valve 56 until the piston 21 has traversed the port of conduit 55. Pistons 21 now exert a traversing action upon the head 1, bringing it downwardly. As head 1 is thus traversed at high speed downwardly, the liquid beneath pistons 21 is caused to be returned to the tank 13 by way of conduits 39 and 48 which are now in connection by reason of the positioning of valve member 47. Simultaneously, the liquid below main pistons 10 is forced downwardly and into tank 13 by way of passageways 18, and liquid from tank 13 is sucked upwardly through check valve 24 and conduit 23 into the spaces above pistons 10.

Assume now that the traversing operation has been completed or substantially so and that the actual pressing is about to begin. The adjustable collar 26 on rod 27 will have been so adjusted that ear 25 will engage collar 26 in such manner as to cause opening of two-way valve 33 at this point. The pressure liquid in conduit 45 will now be directed through valve 33 into conduit 46 and thence into the spaces above main pistons 10 which are already filled with liquid under atmospheric pressure from tank 13. The pressing operation is now commenced and is carried out by the exertion of pressure downwardly on main pistons 10 and simultaneously the downward exertion of pressure upon auxiliary pistons 21, which now exert a booster action. This pressing condition continues until the pressing operation is completed whereupon solenoid 54 is deenergized either manually or automatically so as to cause valve member 47 to move downwardly of Fig. 5, causing liquid under pressure to be again transmitted through conduit 39 to the spaces below auxiliary pistons 21 which now again exert their push-back function. As the pistons 21 move upwardly, they carry head 1 and pistons 10 upwardly, the liquid above pistons 10 discharging through conduit 51 and check valve 52 to conduit 45 and thence through conduit 48 back to the tank.

When carrying out compression molding, it is desirable to hold the mold halves closed under pressure at the end of the pressing operation. Moreover, the speed of downward travel of the head 1 will decrease considerably during the pressing. In order to take care of the decreased amount of pressure liquid thus allowed to be admitted to the spaces above pistons 10 and 21 and in order to prevent damage to the pump 40, means is provided for shifting the pump 40 to compensate for these effects. This means is well known in the art and is not described specifically but takes the form of a conduit 57 (Figs. 2 and 4) which communicates the pressure in conduit 43 to a cylinder 58 on one side of the pump 40 and causes movement of a piston in the cylinder 58 against the action of a spring (not shown) mounted in a chamber 59 on the opposite side of the pump 40 and adjusted by hand wheel 60 to effect shifting of the shift ring in pump 40 so as to reduce the delivery of the pump 40 to the required extent. If it is desired merely to hold the head down under pressure, the output of pump 40 is reduced to a point where only sufficient liquid is delivered to compensate for leakages which may occur past pistons 10 and 21. In this way, the head 1 is forced downwardly until a maximum pressure is exerted, whereupon this pressure is maintained for the desired time.

Ejecting mechanism

The mechanism for ejecting the molded article from the mold is shown more particularly in Figs. 7 and 10 to 13. The knock-out or ejecting mechanism is employed to remove the molded article from the mold half to which it adheres as the mold halves approach their point of most complete separation. The ejecting mechanism shown in the drawings comprises a pair of upper knockout plates 61, one at each side of the press, and a pair of lower knockout plates 62 disposed one directly below each upper plate 61. Plates 61 and 62 are provided with bores 63 which slidably receive the plungers 9 and 19. The upper bolster 4 is formed with an elongated recess 64 into which is received a flat plate 65 which is fixedly attached at its ends to the knockout plates 61 and which is substantially thinner than the depth of recess 64. The lower bolster 6 is similarly provided with a recess 66 in which is disposed a plate 67 which corresponds to plate 65 and which is similarly attached to knockout plates 62.

Fixedly carried on plate 65 are a plurality of pins 68 which are adapted to engage the upper face of a plate 69 which is vertically slidably carried in a recess 70 and which carries a plurality of knockout pins 71 and a pair of positioning pins 72 which are adapted to engage the upper surface of the lower mold half 5 and thus to push plate 69 upwardly so that pins 71 are flush with the interior of the mold half 3.

The lower plate 67 carries a plurality of upwardly extending pins 73 which are adapted to engage a plate 74 vertically reciprocably mounted in a recess 75 in the lower mold half 5. Plate 74 fixedly carries a plurality of knockout pins 76 which are slidably received in the lower half and which are flush with the inner surface of mold half 5 when plate 74 is resting upon bolster 6.

As a result of the construction so far described, it will be apparent that when knockout plates 61 are moved relatively to bolster 4, knockout pins 71 will be actuated, projecting into the mold cavity when plate 65 approaches the bottom side of recess 64. Correspondingly, when knockout plates 62 move relatively to bolster 6, the knockout pins 76 will correspondingly move relative to the mold half 5, being fully projected thereinto

when plate 67 is in contact with the upper surface of recess 66.

Threaded in the upper knockout plates 61 are a pair of vertical rods 77, the head 1 being cored out at 78 to receive the projecting ends of these rods. Rods 77 are provided with a depression 79 to receive a spanner wrench for adjusting them with respect to plates 61. These rods extend slidably through the lower knockout plates 62, and thence through recesses 80 in a latch plate 81 into bores 82 in base 2. Latch plate 81 is slidably carried on the under surface of lower knockout plate 62, being retained by a guide plate 91 fixedly carried by knockout plate 62 and by side guide 92 and rear guide 93. As latch plate 81 is lifted, it lifts knockout plate 62 with it, and knockout plate 62 is carried downwardly by its own weight. The rods 77 are provided with an annular groove 83 located at an appropriate point thereon, and with a collar 84 which is adjustably disposed between groove 83 and the upper knockout plate 61. Latch plate 81 is slidable fore and aft with respect to the press by means of a pair of arms 85 pivoted on the lower knockout plate 62 and adapted to be operated simultaneously by a handle 86 so as to abut against an abutment 87 to thereby move the latch plate 81 rearwardly against the action of spring 88 which bears against rear guide 93 and which normally urges the latch plate 81 forwardly.

As a result of the foregoing construction, as pressing head 1 is moved toward the base 2 of the press, the collars 84 will engage the lower knockout plates 62 just as the mold halves 3 and 5 are about to come together and will cause the upper knockout plate 61 to remain stationary and plate 65 to traverse the recess 64 into the position of Fig. 7, thereby fully retracting the pins 68. The resting of pins 72 upon the upper surface of mold half 5 will cause the knockout pin carrying plate 69 to be fully retracted upwardly of its slot 70 and cause knockout pins 71 to be withdrawn to the flush position. Meanwhile, gravity will hold the lower plates 62, 67 and 74 in the downward position, thereby causing knockout pins 76 to be retracted to a point flush with the mold cavity.

As head 1 moves downwardly until collars 84 rest upon knockout plate 62, the lower portion of rod 77 is received downwardly in the bores 82 in the base 2, the notch 83 sliding past the inclined surface 89 of locking projection 90 which is integral with latch plate 81, causing latch plate 81 to move leftwardly of Fig. 13 (rearwardly), to a position past that shown in Fig. 13. This prepares the assembly for the opening of the mold. It will be understood that the knockout pins 71 and 76 have been retracted in order to allow filling of the mold without marking of the article to be molded.

Subsequently, after molding has been completed, the controls will be manipulated to cause head 1 to be returned upwardly. As this occurs, rod 77 will be carried upwardly and as recess 83 passes latch 90, latch 90 will be spring-pressed forwardly into latched relationship with rod 77, causing knockout plate 62 to be lifted by the upward movement of rod 77. This is indicated in Fig. 11. This action takes place near the end of the return stroke of the head 1 and causes the elevating of pins 73 relative to stationary bolster 6 and thereby the projection of knockout pins 76 into the mold cavity, causing the molded article to be freed therefrom.

In order to reset the knockout plate 62 after the ejection operation, the operator presses bar 86 inwardly, causing unlatching of the latch plate 81 from rods 77 and causing the knockout plate 62 and the associated parts to lower into the position of Figure 12 where they rest upon the base 2 of the press and where they are ready for a subsequent pressing operation.

The foregoing description relates especially to the case where the molded article adheres to the lower mold half. If the molding conditions are such that the article adheres to the upper mold half, the upper knockout pins 71 eject it as follows. As the press opens, the lower knockout plate 62 is carried upwardly by the latched engagement of latch plate 81 with rod 77. This continues as described above until the plate 67 strikes the top of its recess 66. When this happens, the whole knockout mechanism, both top and bottom, is arrested while the press head 1 and the mold half 3 continue in their movement. This causes the upper plate 65 to traverse its slot 64 in the bolster 4 and to thereby compel relative movement of knockout pins 71 through the upper mold half 3, causing ejection of the article.

As will be apparent from the foregoing, when the lower knockout plate 62 is reset by means of handle 86, the upper plate 65 is in its lowermost position against the bottom of recess 64, so that knockout pins 71 are projected into the mold cavity while the lower knockout pins 76 are flush with their cavity by reason of the action of gravity upon knockout plate 62 and the plates 67 and 74 associated therewith. As the press head 1 moves downwardly, the collars 84 serve to reset the upper plate 65 and the engagement of pins 72 with the upper surface of mold 5 causes the resetting upwardly of the knockout pins 71.

It will be seen from the foregoing that the knockout mechanism provides for the projection of knockout pins into either mold half upon a single movement of the mold halves, namely upon their separating movement towards the end thereof.

In operation, the operator will first reset the lower knockout plate 62 by pushing handle 86 inwardly and will then energize solenoid 54 to cause the press head 1 to come downwardly. After the molding operation, the operator will deenergize solenoid 54 whereupon the press will open and ejection will automatically occur towards the end of the opening stroke regardless of to which mold half the molded article adheres. The operator will then reset the plate 62 and the cycle will be again repeated.

I wish it to be understood that I intend to include as within my invention such modifications as may be necessary to adapt it to varying conditions and uses and as fall within the terms or spirit of the appended claims.

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

1. A hydraulic press comprising a stationary bed, a head movable toward said bed for a pressing operation and away from said bed after a pressing operation, a first group of hydraulic cylinders provided at one side of said bed, a second group of hydraulic cylinders at the opposite side of said bed, hydraulic plungers reciprocably disposed in said cylinders and connected to said head for reciprocating the latter, means associated with said bed for receiving a first mold portion intermediate said plungers, means associated with said head for receiving a second mold portion in alignment with said first mold portion for cooperation therewith, and fluid reser-

voirs carried by said head and said bed respectively and communicating with each other through at least some of said plungers.

2. A molding press comprising a stationary press bed, a movable press head, hydraulic motor means including a cylinder-piston-assembly with one element thereof connected to said press head and a cooperating element of said cylinder-piston-assembly connected with said press bed, said cylinder-piston-assembly being operable selectively to move said head toward said bed or away therefrom, cooperating mold halves carried by said bed and said head, knockout pins associated with each of said mold halves, and one pair of rods each of which rods is connected to all of said knockout pins, said rods being movable by said press head and operable in response to the movement of said press head to advance and retract the knockout pins associated with said mold halves in a predetermined sequence.

3. A hydraulic press comprising a bed, a head movable towards said bed, a plurality of main hydraulic cylinders carried by said bed adjacent the side faces thereof, main pistons in said cylinders, connecting means connecting said pistons and said head for motion together, auxiliary hydraulic cylinders carried by said bed and arranged adjacent the side faces thereof, auxiliary pistons in said auxiliary cylinders, the means connecting said auxiliary pistons and said head for motion together, means for hydraulically actuating said auxiliary pistons for traversing said head towards said bed, means for hydraulically actuating said main pistons for continuing the movement of said head towards said bed under higher pressure after said traversing, and fluid reservoirs in said head and bed respectively and commuincating with each other through passageways in said connecting means and said main pistons.

4. A hydraulic press comprising a bed, a head movable towards and away from said bed, tie means fixedly attached to said head adjacent the side faces thereof so as to allow insertion of a mold between said tie means, hydraulic plunger means in said bed operatively connected to said tie means for moving said head through the intermediary of said tie means, a fluid reservoir in said head, and a fluid reservoir in said bed, said fluid reservoirs being in constant communication with each other through passageways in said tie means and said plunger means.

5. In a hydraulic press, a stationary bed, a movable head thereabove, a reservoir for hydraulic liquid in said bed, a reservoir for hydraulic liquid in said head, and hydraulically operable plunger means movable in said bed and rigidly connected to said head, said plunger means being provided with a passageway therethrough communicating with both of said reservoirs for establishing constant free liquid communication between said reservoirs regardless of the position of said head.

6. In a hydraulic press, a bed, a head thereabove which is movable towards and away from said bed, means forming a hydraulic cylinder in said bed, a piston movable in said cylinder in a direction parallel to the motion of said head, a plunger fixedly attached to and extending from said piston into fixed engagement with said head whereby said head is moved with said piston, a reservoir for hydraulic liquid in said bed, means establishing constant free communication between said reservoir and the lower portion of said cylinder, a reservoir in said head, and a bore lengthwise of said plunger and said piston for establishing free liquid communication between the reservoir in said head and the lower portion of said cylinder and for thereby establishing constant communication between said reservoirs regardless of the position of said head.

7. A molding press comprising a bed, a head which is movable towards and away from said bed, a mold half carried by said bed, a mold half carried by said head and adapted to cooperate with said first-named mold half, a rod carried by said head, a knockout plate carried with lost motion by said bed and being operable by said rod, a plurality of knockout pins associated with said first-named mold half and actuatable by said knockout plate, and means associated with said knockout plate for allowing said rod to move freely by said knockout plate as said head moves towards said bed and for locking said knockout plate to said rod as said head moves away from said bed.

8. A molding press comprising a bed, a head which is movable towards and away from said bed, a mold half carried by said bed, a mold half carried by said head and adapted to cooperate with said first-named mold half, a rod carried by said head, a knockout plate carried with lost motion by said bed and being movable parallel to itself in the direction of said rod, a plurality of knockout pins associated with said first-named mold half and actuatable by said knockout plate, means associated with said knockout plate for allowing said rod to move freely by said knockout plate as said head moves towards said bed and for locking said knockout plate to said rod as said head moves away from said bed, and means for unlocking said knockout plate from said rod for thereby allowing resetting of said knockout plate.

9. A molding press comprising a bed, a head movable towards and away from said bed, a first mold half carried by said bed, a second mold half carried by said head and adapted to cooperate with said first mold half, a knockout plate carried with lost motion by said head, knockout pins associated with said second mold half and adapted to be projected by said knockout plate into said second mold half, a rod fixedly carried by said knockout plate and extending towards said bed, and means on said rod for holding said knockout plate stationary while said head moves towards said bed to retract said knockout pins from said second mold half.

10. A molding press comprising a bed, a head movable towards and away from said bed, cooperating mold halves carries by said bed and said head, a plurality of knockout pins associated with each of said mold halves, and means comprising a pair of members each of which is connected to all of said knockout pins, said members being operatively connected with said movable head and operable in response to the movement of said head away from said bed to project first the knockout pins pertaining to one mold half into the latter and subsequently to move the knockout pins pertaining to the other mold half into knockout position.

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