Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 1

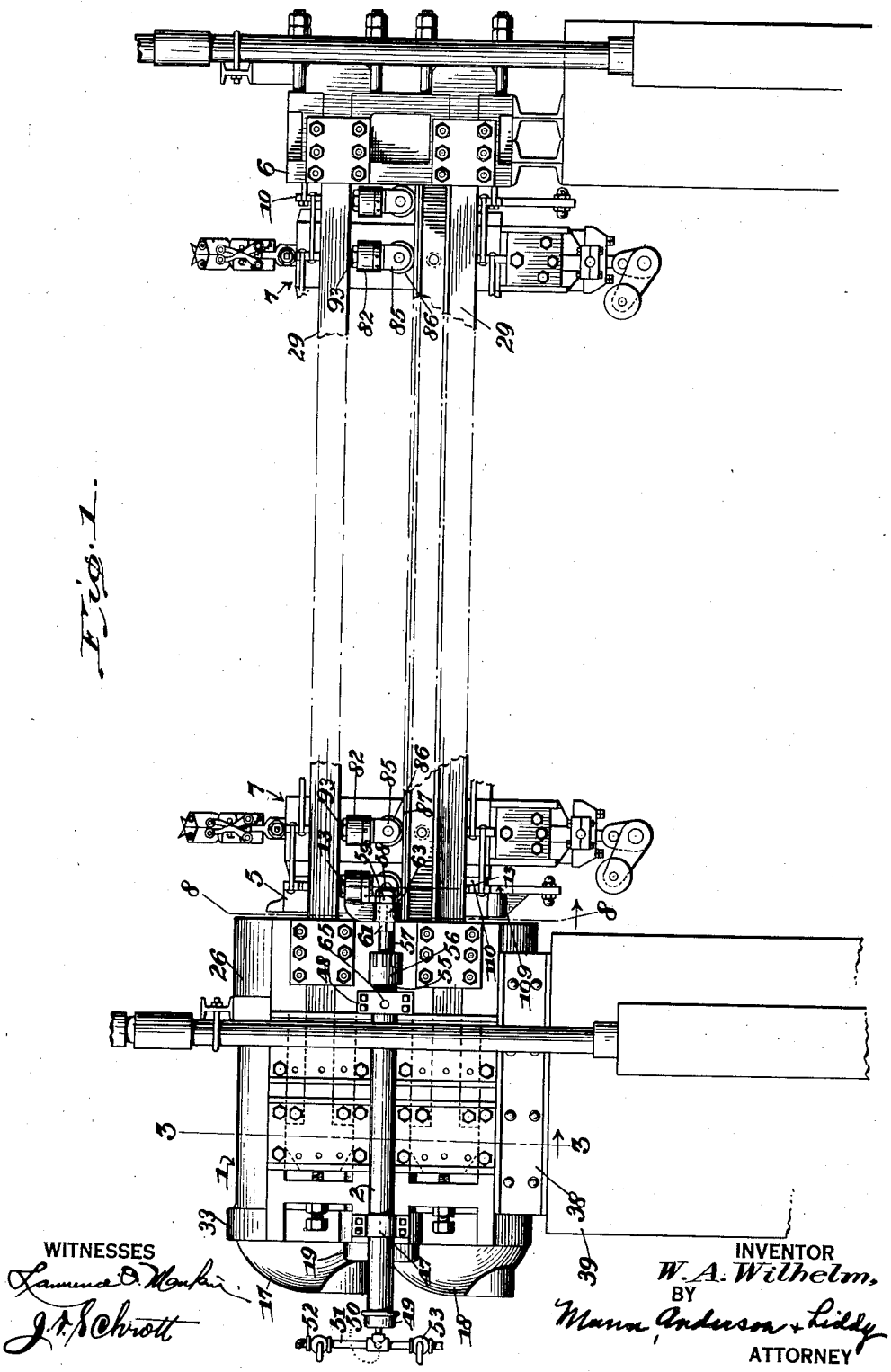


Fig. 1.

WITNESSES

Laurence A. Mahin

J. F. Schrott

INVENTOR

W. A. Wilhelm,

BY

Mann, Anderson & Liddy

ATTORNEY

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 2

Fig. 2.

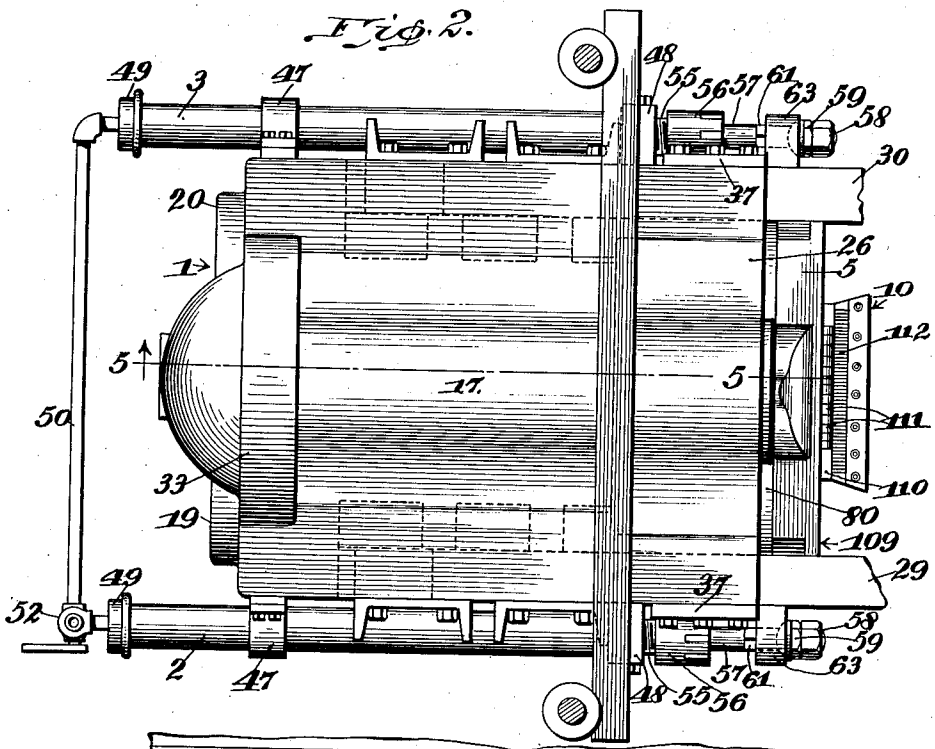
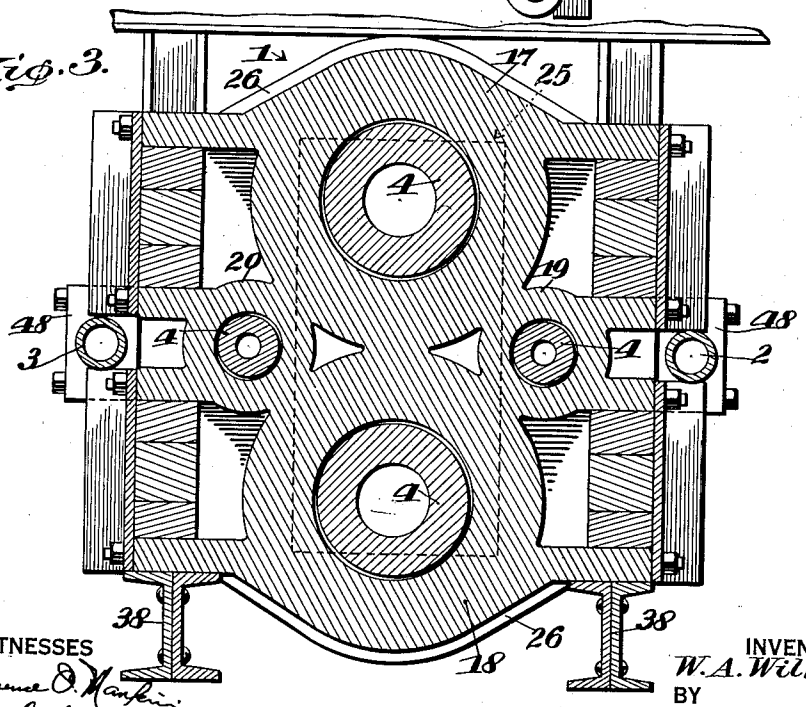


Fig. 3.



WITNESSES

Lawrence O. Mankin

J. V. Schrott

INVENTOR

W. A. Wilhelm

BY

Munn, Anderson & Liddy

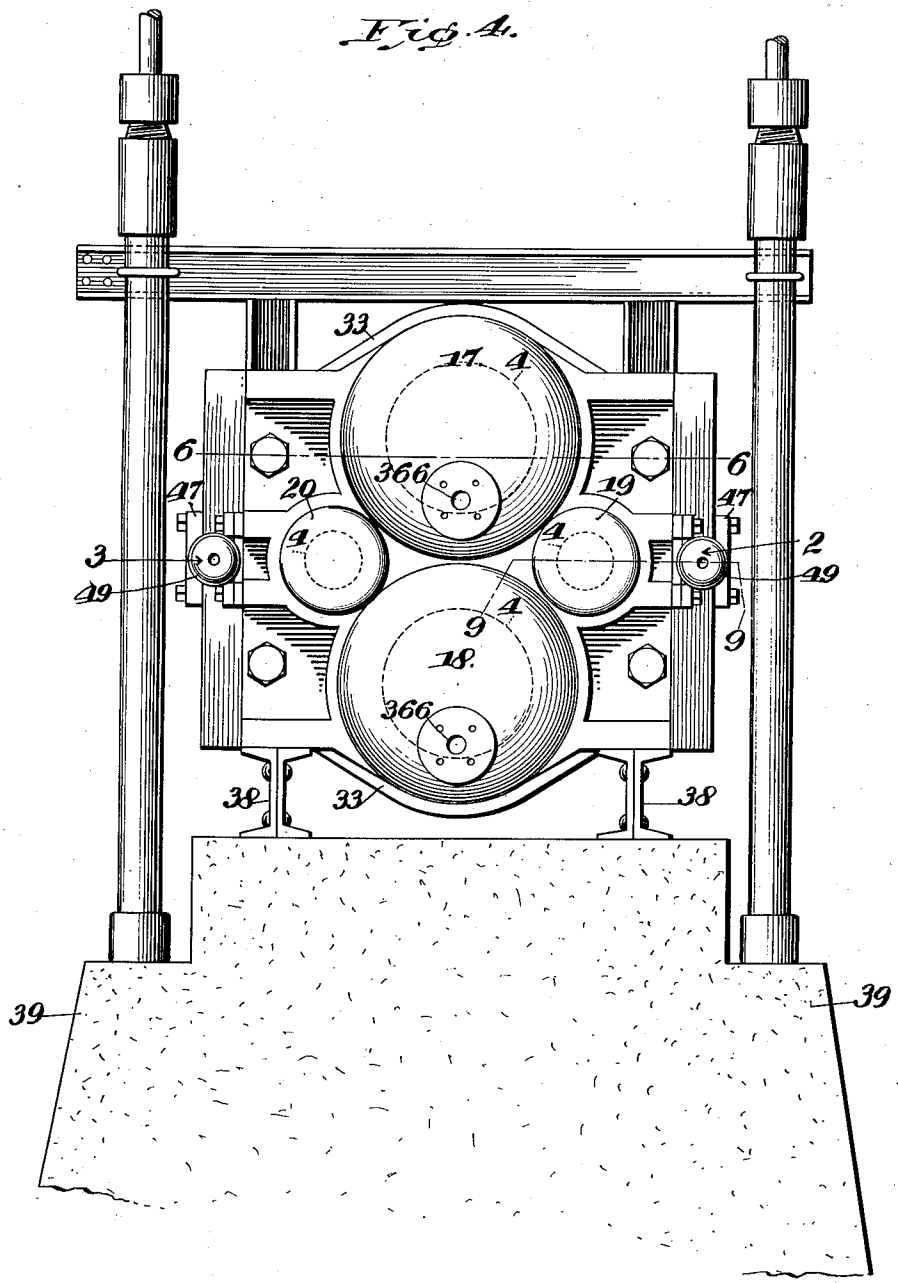
ATTORNEYS

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 3

Fig. 4.



WITNESSES

Lawrence O. Mankin

J. J. Schrott

INVENTOR

W. A. Wilhelm,

BY

Munn Anderson & Liddy

ATTORNEYS

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 4

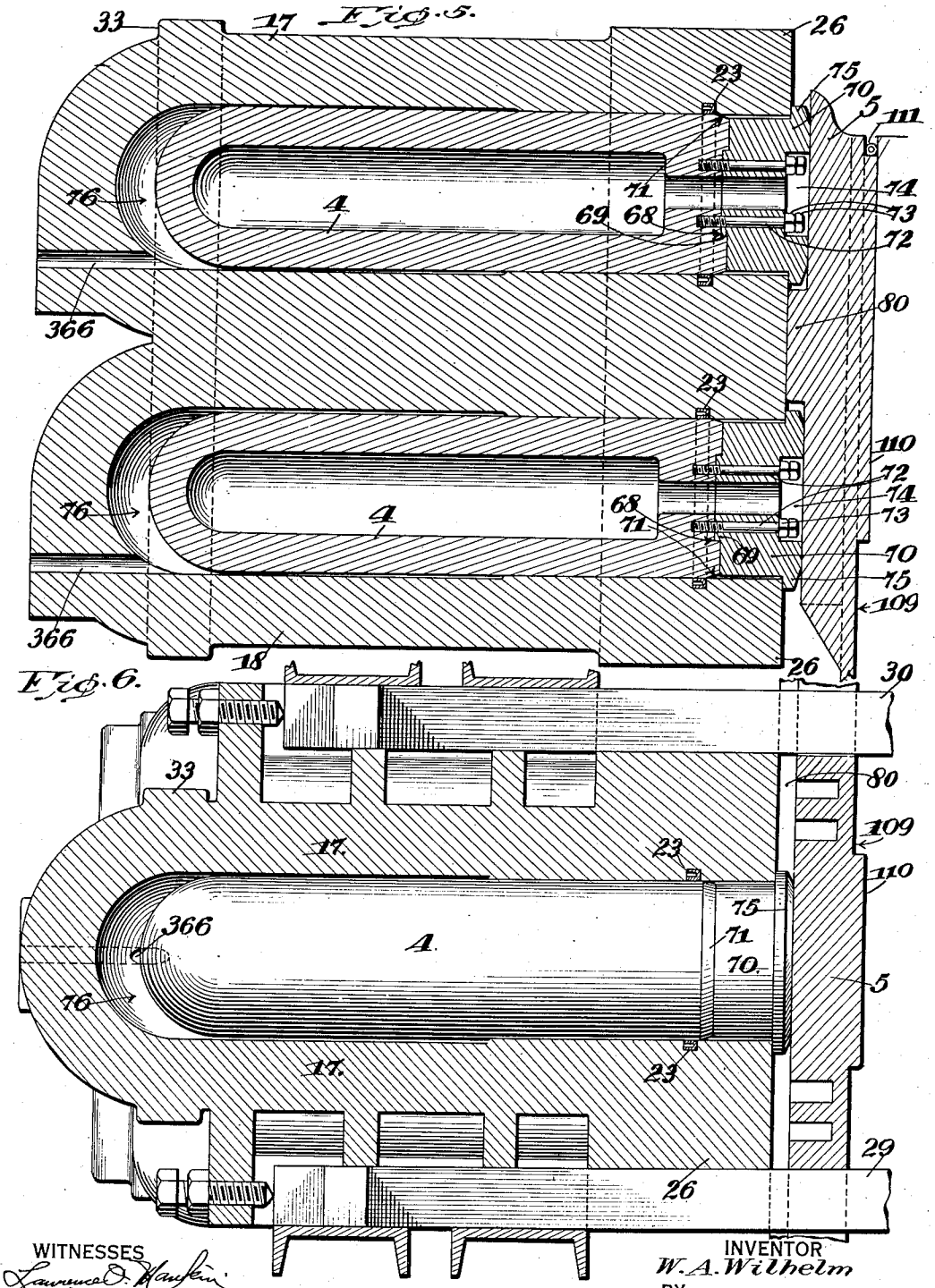


Fig. 5.

Fig. 6.

WITNESSES

Lawrence D. Hankin

J. T. Schrott

INVENTOR

W. A. Wilhelm

BY

Munn Anderson & Liddy

ATTORNEYS

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 5

Fig. 7.

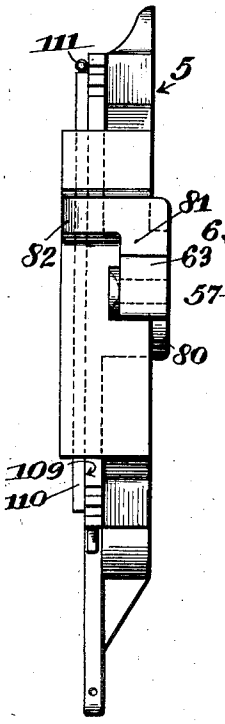


Fig. 8.

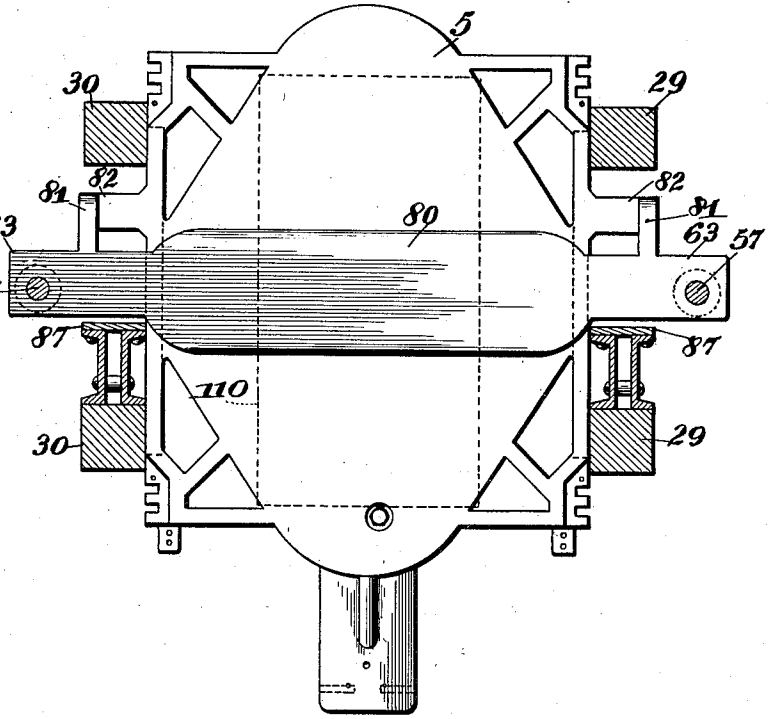
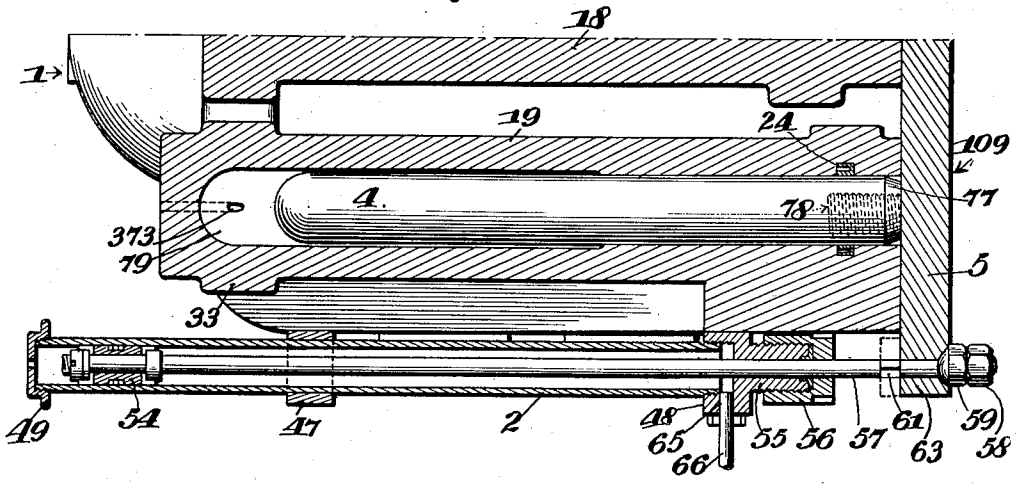


Fig. 9.



WITNESSES

Lawrence O. Hamlin

J. F. Schrott

INVENTOR

W. A. Wilhelm.

BY

Munn, Anderson & Liddy

ATTORNEYS

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 6

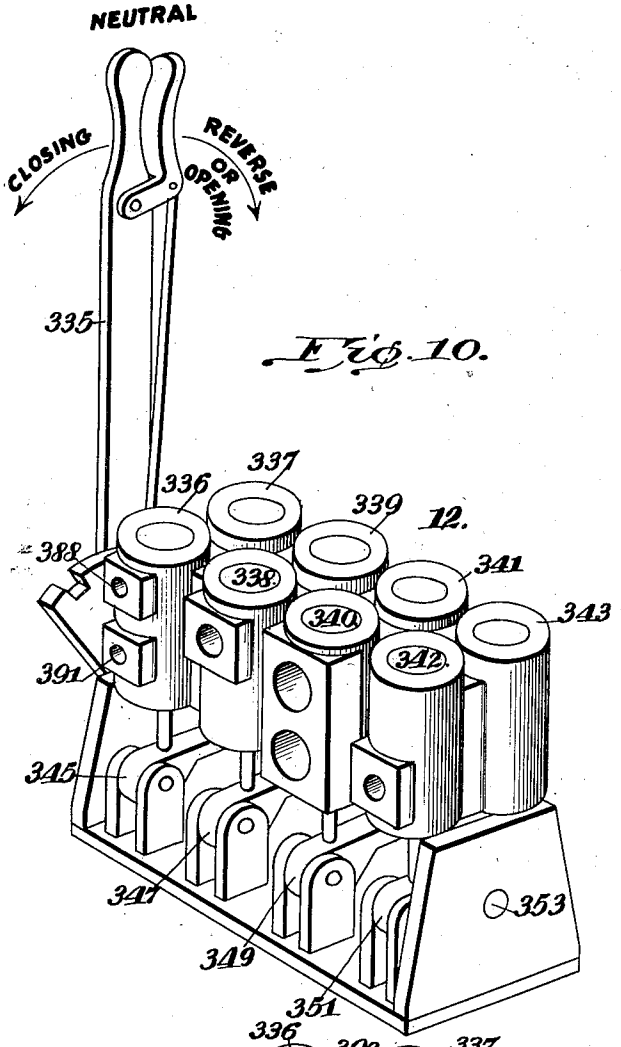


Fig. 10.

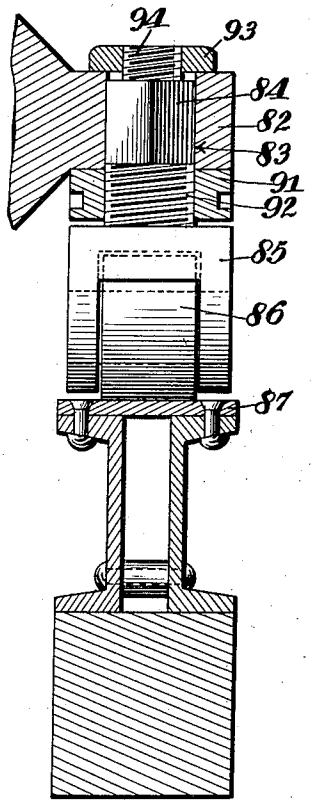


Fig. 13.

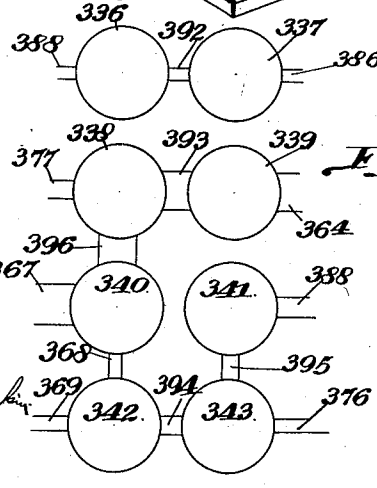


Fig. 11.

WITNESSES

Laurence O. Hawkins

J. H. Schmidt

INVENTOR

W. A. Wilhelm

BY

Munn, Anderson & Reddy

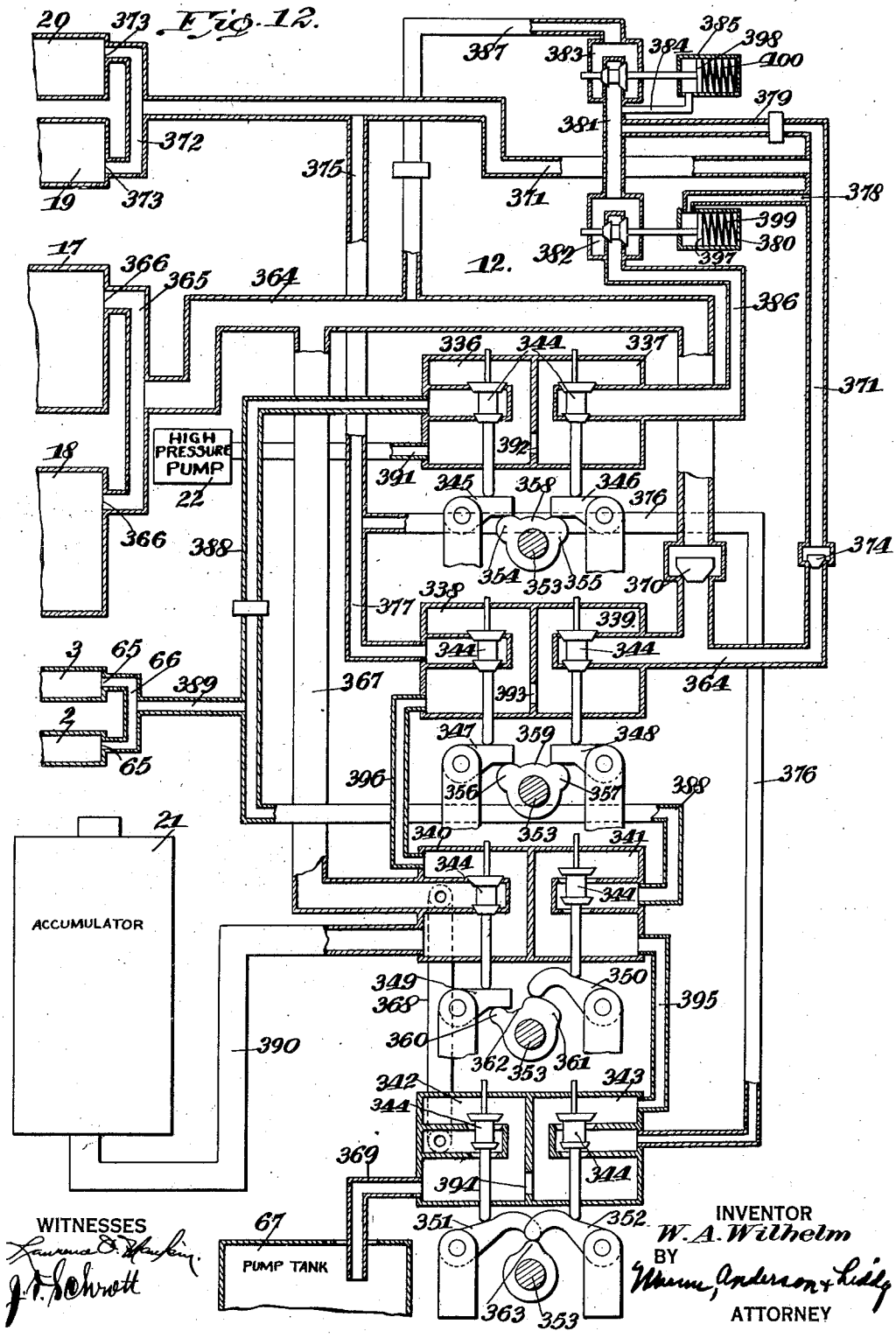
ATTORNEYS

Sept. 29, 1936. W. A. WILHELM 2,055,831

HYDRAULIC PRESS

Original Filed Aug. 11, 1930 7 Sheets-Sheet 7

Fig. 12.



Patented Sept. 29, 1936 2,055,831

UNITED STATES PATENT OFFICE

2,055,831

HYDRAULIC PRESS

Wilson A. Wilhelm, Vernon, Tex.

Original application August 11, 1930, Serial No. 474,602, now Patent No. 1,973,786, dated September 18, 1934. Divided and this application September 5, 1934, Serial No. 742,802

4 Claims. (Cl. 100—71)

This invention relates to improvements in hydraulic presses, and its objects are as follow:—

First, to provide a hydraulic motor which is especially adapted to the requirements of the press disclosed in an application for patent by Wilson A. Wilhelm, filed August 11, 1930, Serial No. 474,602 of which this application is a division, the parent application having since eventuated in Patent No. 1,973,786 of September 18, 1934.

Second, to operate the motor on a progressive power principle, in other words to start it under low fluid pressure in all of its cylinders, then continue its operation under high pressure in some of its cylinders and finally complete its operation under high pressure in all cylinders, this in order to apply a steadily increasing pressure to the ram block and so to the press.

Third, to confine the action of the low and high pressure cylinders and rams to the closing of the press for the purpose of squeezing the liquid out of liquid-bearing material, but to use the reversing cylinders and rams both for opening the press as part of the normal operation and to close the press (without liquid-bearing material being therein) so as to gain access to the low and high pressure cylinder rams.

Fourth, to provide the separate reversing cylinders and rams for opening the press and driving the press rams back into their cylinders thereby simultaneously returning the inactive fluid to the accumulator.

Fifth, to employ the rams of the reversing cylinders for the purpose of receding the ram block from the motor cylinder block, thereby closing the press boxes and exposing the ends of the press rams for removal and consequent access to their crimps.

Sixth, to provide an accumulator as the reservoir of a large volume of low-pressure fluid, from which accumulator the low-pressure fluid is initially conducted to the low-pressure cylinders of the press, the intervening action of a high-pressure pump being confined to building up a high pressure on a relatively small volume of fluid which is eventually supplied to the high-pressure cylinders and simultaneously imposed on the fluid already in the low-pressure cylinder.

Seventh, to provide a pair of valves (382 and 383) in the pressure-fluid system, each automatically operable respectively at maximum accumulator pressure during the filling of the low-pressure cylinders thereby to release the high-pressure fluid to the auxiliary or high pressure cylinders, and to release the high-pressure fluid for imposition on the fluid already in the low-pressure cylinders thus to work the various rams under a universally high pressure.

Eighth, to provide a control valve mechanism of which the foregoing valves are a part, the manual operation of said mechanism initiating the automatic action of the valves in time.

In the drawings:—

Figure 1 is a front elevation of the hydraulic motor, its specific application being to the press of the foregoing patent, the press being fragmentarily shown.

Figure 2 is a plan view of the motor cylinders, the shafts or vertical rams of a certain cake stripper with which this application is not concerned being shown in section.

Figure 3 is a cross section of the motor taken on the line 3—3 of Figure 1.

Figure 4 is a left end elevation of the motor.

Figure 5 is a vertical longitudinal section taken on the line 5—5 of Figure 2, particularly illustrating the main cylinders of the cylinder block.

Figure 6 is a horizontal section taken on the line 6—6 of Figure 4.

Figure 7 is a side elevation of the ram block, the view appearing as seen by an observer from a position opposite to that of Figure 1.

Figure 8 is a vertical cross section taken on the line 8—8 of Figure 1, particularly illustrating that face of the ram block confronting the hydraulic motor.

Figure 9 is a horizontal section taken on the line 9—9 of Figure 4, particularly illustrating one of the auxiliary and reverse cylinders.

Figure 10 is a perspective view of the valve for controlling the operation of the motor, hence the opening and closing of the press.

Figure 11 is a diagram particularly illustrating the port connections of the poppet valves.

Figure 12 is a diagram of the motor control valve and its connections with the main, auxiliary and reverse cylinders of the hydraulic motor.

Figure 13 is a detail section taken on the line 13—13 of Fig. 1.

According to the instant disclosure, the hydraulic motor is especially adapted to perform the functions of the foregoing patent. It is conceivable, however, that it may be put to other uses which require first the universal application of a low pressure, second the concentrated application of a relatively high pressure at selected points, and third the universal application of the same relatively high pressure.

It is repeated that the motor is particularly

well adapted to the purposes of the press, and this, briefly stated, is a device for the extraction of liquid from liquid-bearing substances, for example cooked cotton seed meal or meats. This press is part of a system of which a meal carriage (not shown) is charged with cotton seed meal from a distributor (not shown) which previously received the meal from a cooker (not shown), the carriage then serving to mechanically charge the press with the proper amount of meal and cut off the surplus, whereupon the press is telescoped to extract the oil. Upon a later opening of the press a stripper (not shown) is brought into position over the press to strip the cakes from the press cloths and remove the cakes from the press for subsequent disposal.

It is the instant hydraulic motor which telescopes and opens the press. Its main aspects are the cylinder block 1 (Fig. 1) with its reverse cylinders 2, 3 (Figs. 3 and 4) and its rams 4 (Fig. 5) and the ram block 5 (Figs. 1 and 8). Associated with this motor are the head block 6 (Fig. 1), the press boxes 7 and the double entering heads 10, all of the press. The respective functions of the motor are controlled by the valve mechanism 12 (Figs. 10 and 12).

The cylinder block 1 comprises a casting (Fig. 3) in which a pair of main cylinders 17, 18 is combined with auxiliary cylinders 19, 20. The act of compression which occurs by the telescoping of the entering heads 10 into the press boxes 7 is accomplished by the initial introduction of fluid at a relatively low pressure into each of the cylinders 17, 18, 19 and 20, then at a relatively high pressure into cylinders 19, 20, and finally at said relatively high pressure also into the cylinders 17, 18 so that the compressing operation is finished at the last high pressure.

There is thus a stage-application of fluid pressure. While the gradual application of the pressure is a desirable result yet the outstanding advantage of an initial high-volume low-pressure application of the fluid is an avoidance of the sudden draining and dropping in pressure of the hydraulic system. This can be better understood by considering Figure 12 which comes under the head of the control valve mechanism.

Here is an accumulator 21 in which a fluid pressure head is built up during the reversal of the press. The working low pressure arbitrarily selected is 50 lbs. per square inch, although this may be more or less in practice. If the large volume of fluid demanded of the accumulator 21 for initial introduction into the cylinders 17 to 20 (Fig. 3) were required to be applied by the high pressure pump 22, (Fig. 12) the latter by virtue of its inherent nature would be unable to build up the requisite pressure behind the large volume of fluid quickly enough to suit the requirement of speed.

So by abstracting a relatively large volume of fluid from the accumulator 21 at the beginning of compression with a consequent initial filling of the cylinders 17 to 20 (Fig. 3), the subsequent working of the pump 22 (Fig. 12) will be confined solely to the building up of the pressure and none of its strokes need be wasted in merely charging the cylinders with fluid. Toward these ends the cylinders 17, 18 (Fig. 3) are made larger in diameter than the cylinders 19, 20, the ratio being approximately 14½" to 6".

All of the cylinders 17, 18 (Fig. 5) and 19, 20 (Fig. 3) are approximately the same length, being open at the ends nearest the press boxes 7 and closed at the other ends. The cylinders are stationary while the rams 4 are movable in the horizontal direction to telescope the entering heads and press or receiving boxes 7. The main cylinders 17, 18 are of the same size and are located with their axes in the same vertical plane and on the vertical center line of the press. This has a purpose. The press boxes 7 are vertically elongated to produce a cake 25 of the shape in dotted lines in Figure 3, so by disposing the cylinders 17, 18 one above the other the greatest amount of pressure can be applied to the stock and to the cake. If the arrangement were otherwise the thrust area of the upper and lower rams 4 (Fig. 3) would overlap the extremities of the cake to a far greater extent than shown.

The auxiliary cylinders 19, 20 are also of the same size, but as previously indicated are smaller in diameter than the cylinders 17, 18. The particular grouping of the cylinders disclosed makes it possible to locate the smaller cylinders in the recesses occurring at the sides of the larger cylinders, enabling a sturdy and compact form. The symmetrical disposition of the cylinders also enables a more uniform application of the pressure, although an outstanding reason for dividing the application of pressure among four cylinders rather than among a lesser number, is to avoid the making and machining of larger masses of metal as well as to avoid the possibility of running into imperfect portions of hide from which certain crimps 23, 24 (Figs. 5 and 9) are made.

A large band or heavy flange-like projection 26 (Figs. 2 and 5) substantially encircles the open end of the cylinder block 1. Pairs of press columns 29, 30 (Figs. 1 and 8), respectively at the front and rear of the press, fixedly but adjustably connect the cylinder block (making use of the band 26) with the head block 6 according to what is known as either a short or long "hitch". The structural details of these columns and their hitches are described and claimed in Patent No. 1,973,786. A smaller band 33 is provided at the left end of the cylinder block (Figs. 2 and 9). The bands 26, 33 practically surround the whole group of cylinders 17 to 20, and their particular purpose is to strengthen and reinforce the cylinders respectively at the open end where the band 26 obviates the tendency to break out the metal should the rams 4 commence to gyrate, and to reinforce the cylinders at the points where the side walls unite with the left end wall (Fig. 5).

The reverse cylinders 2, 3 are stationed at the front and rear of the cylinder block 1 (Fig. 2), being held in place by clips 47 or their equivalents and terminal blocks 48 which are made to constitute the heads of the reverse cylinders (Fig. 9). The opposite ends of the cylinders are closed by caps 49. These are bridged by a manifold 50 (Fig. 2) respectively with inlet and exhaust valves 52 and 53 (Fig. 1). The valve 52 will be open to pressure only when it is desired to close the press in order to recede the ram block 5 (Fig. 5) from the cylinder block 1 thus to make the exposed ends of the rams 4 (Figs 3 and 5) accessible for the purpose of removing the crimps 23, 24.

In the ordinary operation of the press the sole purpose of the reverse cylinders 2, 3 is to open or separate the press box and double entering head units 7, 10. This is accomplished by introducing pressure fluid into the right ends of the cylinders 2, 3 through ports 65 which have communication with the cylinders through the terminal block 48 (Fig. 9) and are connected by

a manifold 66 (Fig. 12) for an equal supply of fluid. Pressure thus applied for the opening of the press is also applied to the right ends of the rams 4 (Figs. 5 and 9) by means of the ram block 5, thereby driving them back in their cylinders 17, 18 and 19, 20 (Fig. 3) and causing the pressure fluid to return to the accumulator 21 (Fig. 12).

The reverse cylinders are, therefore, the means for opening the press and returning the inactive or residual fluid to the accumulator. When pressure is applied to the rams 4 for the closing of the press, or the performance of the act of extraction, an escape of fluid ahead of the reverse pistons 54 (Fig. 9) occurs to an open pump tank 67 (Fig. 12) by way of the control valve mechanism 12 to be described later.

Heretofore, the rams 4 of the cylinders 17, 18, 19 and 20 (Fig. 3) have been referred to in a general way because of the collective function that they perform in acting against the ram block 5 (Figs. 5 and 9) in closing the press. However, the rams of the main cylinders 17, 18 and auxiliary 19, 20 have allied structural differences which are explained thus:—

Taking the rams 4 of the main cylinders 17, 18 first, it is to be observed (Fig. 5) that each has a recess 68 in the leading end to receive a corresponding boss 69 on an extension 70 which is diametrically reduced to match the smallest diameter of a peripheral bevel 71 on the leading edge. The purpose of this bevel is to uniformly expand the inner component of the crimp 23, immediately following the renewal of the crimp prior to which the respective ram was moved back to the limit in the main cylinder.

The extension 70 is secured to its ram by means of stud bolts 72, the nuts 73 of which are sunk in a recess 74 so that the outermost ones will at most be flush with the working surface of the flanged end 75. The flange 75 limits the inward movement of its ram 4 in respect to the main cylinder. This being the case, it is to be observed that the line of demarcation between the ram and its extension 70 is well forward of the position of the crimp 23.

There is never any possibility of the edges of the crimp 23 becoming burred by the passage of the dividing line over its inner component. In addition to the advantage which the position of the division line between the ram and its extension 70 has in respect to the crimp 23 a more important advantage follows. The specific arrangement is disclosed in Figure 5.

This has to do with the renewal of the crimp 23. Renewals are comparatively rare, but they must be made at times. Under such circumstances temporary use will be made of the reverse cylinders 2, 3 to close the press as brought out before, in order to drive the ram block 5 (Fig. 5) clear of the working faces of the extensions 70. There is now ample room for the operator to work between the extensions 70 and the ram block 5 to remove the nuts 73 (Fig. 5) and pull each extension 70 away from the ram 4.

The ram 4 is left in its respective main cylinder and is pushed all the way so that the leading end clears the crimp 23. The space 76 (Fig. 5) between the inner ends of the main cylinder and ram is provided for this purpose. Upon the replacement of the old crimp with a new one the operator will simply pull the ram 4 forwardly by taking hold of the stud bolts 72. The bevel 71 makes a smooth passage of the leading end through the new crimp 23 without injury to the edges. The extension 70 is now replaced and the nuts 73 screwed home.

In addition to matching the smallest diameter of the bevel 71 the reduction in diameter of the extension 70 from that of the ram 4 has the rather important advantage of obviating the possibility of damaging the inner edges of the extensions by virtue of contact with the right edge of the main cylinder should there be any slight misalinement of the stud bolts 72 or a possible inadvertent shifting of the extension in putting it back on the stud bolts. In other words, the diametral reduction of the extension 70 well avoids the cylinder wall so that should there be any slight portion overlapping the leading edge of the ram there will be no possibility of its hanging against the edge of the cylinder on the inner movement of the ram during an opening of the press.

There is a similarity in the rams 4 of the smaller and auxiliary cylinders 19, 20 (Fig. 9). The leading end of each of these rams is bevelled at 77 in order to pass the crimp 24 without damage under a circumstance similar to that already mentioned. This end of the ram is tapped at 78, or made with some equivalent provision, for the application of an implement by which to pull the ram outwardly after renewing the crimp. It will be understood that for such purpose the ram has to be pushed back in the space 79 so that the leading end clears the crimp 24 for access.

From this it will be understood that the rams 4 have only to be pushed back in the respective cylinders in order to renew the crimps 23, 24, bearing in mind of course that in the instance of the main ram it is first necessary to remove the extensions 70 (Fig. 5). This simple performance can be accomplished in a very short time and distinguished from the laborious and hazardous operation of renewing crimps in known presses of this type which necessitates not only the removal of the ram and ram block but the jacking up of all of the boxes and possibly the removal thereof from the press.

The ram block 5 is that element of the press through which the working thrust of the main and auxiliary rams 4 (Figs. 5 and 9) is transmitted to the stock through the successive entering heads 10 and press boxes 7 for an extraction of the oil. The ram block is shaped (Fig. 8) to provide full bearing surfaces for the right ends of the rams. The horizontal, auxiliary rams 4 which work in positions quite beyond the front and rear edges of the cake 25 (Fig. 3), exert their thrust on a reinforcing cross rib 80 (Fig. 8). All of the pressure is concentrated on the ram block 5 and transmitted thereby as already pointed out.

The ears 63 with which the reverse piston rods 57 are connected by means of a ball-faced nut 59 and a jamb nut 58 (Fig. 9) are reinforced by webs 81 (Fig. 8) which combine with brackets 82 in the square holes 83 of which the shanks 84 of roller forks 85 are secured. The square holes 83 are so placed that the corners of the shanks will point longitudinally and crosswise of the press thus taking full advantage of the greatest cross sectional dimensions for the reinforcement of the shanks. Rollers 86 journaled in these forks ride on a track which includes a cover plate 87 (Fig. 13). A nut 91 (Fig. 13), screwed on the threaded base 92 of the shank 84 enables the vertical adjustment and trans-

verse leveling of the ram block 5. A lock nut 93 on the reduced threaded end 94 of the shank secures the adjustments.

On the working face 109 of the ram block 5, (Fig. 2), that is to say, the face next to the first or adjacent press box 7 (Fig. 1), there is a pad 110 (Figs. 2 and 7) across the upper edge of which there is a formation of hinge knuckles 111 which support a drainage head 112 described in detail in the patent. The head block 6 occupies a position at the right extremity of the press (Fig. 1) in confronting relationship to the ram block 5. Thus far it will be understood that it is the motion of the ram block 5 to the right by action of the hydraulic motor that telescopes the press, in other words the press boxes 7 and entering heads 10, for the extraction of the oil. Of necessity the head block 6 must be stationary in order to act as an abutment for the press boxes and entering heads. To the latter end the head block 6 provides an anchorage for the right ends of the columns 29, 30. Thus the press is rigidly secured to withstand the pressure set up between the cylinder block 1 and head block 6.

The control valve mechanism 12 enables the operator to close and open the press from a safe distance. As brought out earlier in this description, the functions of the control valve mechanism are to fill both pairs of main and auxiliary cylinders 17, 18 and 19, 20 (Fig. 3) with fluid under an initial comparatively low pressure, then follow this with the application of fluid under a comparatively high pressure to the auxiliary cylinders 19, 20 while retaining the initial low pressure in the main cylinders 17, 18, finally applying said high pressure to all of the cylinders. It is also by means of this valve mechanism that pressure fluid is admitted to the reverse cylinders 2, 3 (Figs. 2 and 9) for the so-called opening of the press.

All of the foregoing changes of pressure and directions of the press are accomplished by the movement of the single control lever 335 (Fig. 10) of the main control valve generally designated 12. This control valve has eight double-ported, balanced, spring-loaded poppet valves 336, 337, 338, 339, 340, 341, 342 and 343, the valve members 344 of which are capable of being opened by the push of levers 345, 346, 347, 348, 349, 350, 351, and 352 by the action thereagainst of cams on a lay shaft 353 to which the foregoing control lever 335 is attached.

Figure 12 is in part a diagrammatic development of the control valve 12. Although the lay shaft 353 appears four times this is to be regarded as the same shaft. The cams 354, 355 are for the operation of the levers 345, 346 and are identical with cams 356, 357 for the operation of the levers 347, 348. These cams are spaced at 358, 359 so that a turn of the shaft 353 in one direction will not affect one pair of the levers for example 346, 348, while one pair of the cams, for example 354, 356 raises the companion levers 345, 347.

In the instance of the valves 340, 341 the cams 360, 361 are spaced as at 362. The cam 360 comprises a blunt-pointed lobe while the cam 361 has a relatively long face. The co-acting lever 350 of the latter has a hook end which is best adapted to maintaining the valve member 344 of the respective poppet valve 341 open while the lever 335 assumes the neutral position as well as when said lever is moved to the left (Fig. 10) or closing position of the press.

The levers 351, 352 are also of the hook-end type, these being acted on by a single cam 363 in the nature of a blunt-ended lobe. This cam is adapted to hold the valve members 344 of both poppet valves 342, 343 open when the lever 335 assumes the neutral position (Fig. 10) and to close these valve members when the lever 335 is shifted either to the left or right respectively for the closing of the press or reversal and opening thereof.

In the neutral position of the valve lever 335 (Fig. 10) all of the main 17, 18, auxiliary, 19, 20 and reverse cylinders 2, 3 are opened to the pump tank 67 (Fig. 12) by virtue of the poppet valves 341, 342 and 343 being opened. The purpose of this provision is to relieve these cylinders of pressure. The conduits by which the main and auxiliary cylinders are interconnected at times and by which each of the various cylinders is connected with the poppet valves are described as follows:—A conduit 364 (Fig. 12) joins a branch 365 that in turn has common communication with ports 366 (Fig. 5) of the main cylinders 17, 18. This conduit has a lateral 367 which terminates at the poppet valve 340 which, in turn, has a connection 368 with the poppet valve 342. That valve has a pipe 369 discharging into the pump tank 67.

The continuation of the conduit 364 embraces a check valve 370 and terminates at the poppet valve 339, there being a branch 371 from this continuation that ultimately connects with a branch 372 commonly joining the ports 373 of the auxiliary cylinders 19, 20 (Fig. 9). The branch 371 contains a back check valve 374 and has a lateral 375 communicating by way of a branch 376 with the poppet valve 343 and by way of a branch 377 with the poppet valve 338.

The branch 371 also has connections 378 and 379 respectively with a low pressure cylinder 380 and a lateral 381 which terminates at balanced valves 382, 383 and has a connection at 384 with a high pressure cylinder 385.

Branches 386, 387 connect the valves 382, 383 respectively with the poppet valve 337 and the conduit 364. A conduit 388 connects the poppet valves 336, 341 and has a branch 389 leading to the previously described manifold 66 of the reverse cylinders 2, 3.

Fluid under a comparatively low pressure is supplied to the control valve mechanism by the accumulator 21 through a conduit 390 which communicates with the poppet valve 340. The previously described high pressure pump 22 has a connection at 391 with the poppet valve 336. Ports 392, 393 and 394 connect the respective pairs of the poppet valves 336, 337; 338, 339 and 342, 343. The general arrangement is shown both in Figures 11 and 12. A connection 395 joins the valves 341, 343 while a connection 396 joins valves 338, 340.

There are only three positions of the control lever 335 (Fig. 10) namely, neutral, closing and reverse or opening. These terms have reference to the action of the press. Assume the press boxes 7 to have been filled with stock and closed. The lever 335 will be moved to the left. The corresponding turning of the lay shaft 353 to the left will cause the opening of valves 337 and 339, leaving the valve 341 open and closing valves 342, 343. These actions are accomplished by the raising movements of the cams 355, 357 against the levers 346, 348, the long face of the cam 361 and the displacement of the cam 363 from beneath both levers 351, 352.

Fluid then flows under low pressure (approximately 50 lbs.) from the accumulator 21, through conduit 390 to valve 340, (closed), thence by way of connection 396 to valve 338 (closed), through port 393 to valve 339 (open), past check valve 370 into conduit 364 to the branch or manifold 365 and from there into each of the main cylinders 17, 18. A division of the fluid flow occurs in the branch 371 past the check valve 374, reaching the connection or manifold 372 and from there flowing into the auxiliary cylinders 19, 20. Each of these cylinders is thus initially filled with fluid under an initially low pressure.

The valve members of the respective valves 382, 383 are connected with pistons 397, 398 in the cylinders 380, 385 where they are pressed against by springs 399, 400 respectively designed to yield at approximately 50 lbs. and 3800 lbs. per sq. in. on the opposite sides of the pistons. A portion of the fluid flowing to the auxiliary cylinders 19, 20 by way of the branch 371 is diverted to the cylinder 380 through the connection 378.

When the maximum low pressure is built up against the left side of the piston 397 so that the spring 399 is overcome there will be an opening of the valve 382 with a consequent admission of fluid under high pressure to the auxiliary cylinders 19, 20 by way of the connection 391, valve 336 (closed), port 392, valve 337 (open), branch 396, valve 382, lateral 381, connection 379, branch 371 to the connection or manifold 372.

Now there is the condition of high pressure fluid being supplied to the auxiliary cylinders 19, 20 while low pressure is still maintained in the main cylinders 17, 18. As the high pressure builds up against the left side of piston 398 the ultimate overcoming of the spring 400 will open the valve 383 so that there will be a division of the flow of the high pressure fluid into the branch 387 and conduit 364, whence it passes to the connection or manifold 365 to also fill the main cylinders 17, 18 with high pressure fluid. Thus all four cylinders are filled with high pressure fluid to impose maximum pressure on the stock in the press.

During the foregoing forward action of the press the residue of the reverse cylinders 2, 3 was discharged by the movement of the pistons 54 to the right (Fig. 9) with the ram block 5, the flow occurring through manifold 66 (Fig. 12), branch 389, conduit 388, valve 341, connection 395, around closed valve 343, through port 394 and through pipe 369 to the pump tank 67.

The foregoing pressure on the press is maintained as long as the control lever 355 remains in the left hand position. When it is shifted to the central or neutral position there will be an instant relaxation of the pressure in the main and auxiliary cylinders by virtue of the opening of the valves 341, 342 and 343 as shown in Figure 12 and as previously described. The next act is to reverse or open the press, and insofar as the retraction of the entering heads 10 from the press boxes 7 is concerned the function of the valve mechanism 12 is as follows:—

A shifting of the control lever 335 to the right will turn the lay shaft 353 to the right whereupon valves 336, 338 and 340 will open while valves 337, 339 will be permitted to remain closed, valves 341, 342 and 343 being moved to closed positions by the departure of cams 361 and 363 from beneath the ends of levers 350, 351 and 352.

The maximum 3800 lb. pressure of the pump 22 (Fig. 12) is now delivered to the right ends (Fig. 9) of the reverse cylinders 2, 3 by way of connection 391 (Fig. 12) open valve 336, conduit 388, branch 389 and manifold 66 which terminates at the ports 65. The result is a quick retraction of the entering heads 10 from the press boxes 7.

The opening pressure of the press is thus exerted against the right ends of the rams 4 both in the main and auxiliary cylinders 17, 18 and 19, 20. The fluid from the main cylinders is thus returned to the accumulator 21 by way of manifold 365, conduit 364, lateral 367, open valve 340 and conduit 390. Similarly, the fluid from the auxiliary cylinders 19, 20 is returned to the accumulator 21 by way of manifold 372, lateral 375, open valve 338, connection 396, valve 340 and conduit 390. The returning rams thus serve to charge the accumulator 21 in readiness for its next low pressure function.

The operation although heretofore described in considerable detail is now briefly reviewed here. The press of the patent includes the press box and entering head units 7, 10, these elements occurring in alternation as suggested by Figure 1. These units are capable of movement away from and toward each other with an opening and closing or telescopic action which occurs between the fixedly mounted cylinder block 1 on one hand and the head block 6 on the other hand. As already pointed out it is the function of the hydraulic motor to do the opening and closing.

Assume, first, that all of the compartments of the press have been filled with a liquid-bearing substance. After closing the boundaries of the press boxes the control lever 335 (Fig. 10) of the valve mechanism 12 is moved to the left according to the arrow marked "closing".

Comparatively low pressure fluid is simultaneously admitted to the main and auxiliary cylinders 17, 18 and 19, 20 (Figs. 3, 5 and 12). This fluid is supplied by the accumulator 21 and traverses the conduit 390, connection 396 and conduit 364, there being a division of the fluid into the branch 371. All of the rams 4 move forwardly or to the right with one accord. They act simultaneously on the ram block 5, and the action is to begin closing the entering heads 10 in all of the press boxes 7.

The material will yield a little in each of the press box compartments so that the initial compression will be made evident from one end to the other of the press. When the initial pressure has had its full effect then the fluid under comparatively high pressure is admitted to the auxiliary cylinders 19, 20 and finally to the main cylinders 17, 18 also.

This is accomplished by a building up of a maximum low pressure against the piston 397 (Fig. 12) which upon receding opens the valve 382 for an admission of high pressure fluid from the pump 22 to the branch 371. High pressure fluid is thus admitted to the auxiliary cylinders 19, 20. The low pressure fluid is maintained in the main cylinders 17, 18. When maximum high pressure is built up against the piston 398 (Fig. 12), the consequent opening of the valve 383 admits high pressure to the main cylinders 17, 18 also by way of the branch 387 and conduit 364.

Pressure is thus applied to the stock. This application is gradual and progressive. The various pressure values are applied in stages. Thus there is a gradual extraction of the oil, and as this filters through the press cloths (not shown) it runs down and out at the bottom of the press. Separation of the press box and en-

tering head units must occur in time, and this is accomplished by moving the control lever **335** (Fig. 10) to the right as indicated by the arrows designated "reverse" or "open".

Fluid is then admitted under high pressure to the right ends of the reverse cylinders **2, 3** (Figs. 3 and 9). This draws the ram block **5** back and all of the press boxes **7** and entering heads **10** with it. The pressed cakes **25** (Fig. 3) are then ready to be removed from the press. For the purpose of a convenient understanding of the control valve **12** the following schedule of the valve positions will be an aid:—

Valve position	336	338	340	341	343	342	337	339
Forward	Closed	Closed	Closed	Open	Closed	Closed	Open	Open.
Neutral	Closed	Closed	Closed	Open	Open	Open	Closed	Closed.
Reverse	Open	Open	Open	Closed	Closed	Closed	Closed	Closed.

I claim:—

1. In a press comprising press box and entering head units having an elongated cake compartment, a ram block heading the units, pressure means for closing the units including main cylinders centered well within the longitudinal confines of the cake line and auxiliary cylinders centered outside of the lateral confines of the cake line, rams in the respective cylinders acting on the ram block, and a reinforcing cross rib on the ram block receiving the thrust of the auxiliary rams.

2. For a press comprising a series of press box and entering units, separate sources of relatively low and high pressure fluid, separate means coactable to move the units toward each other and thus close the press, and fluid conduits between said separate sources and separate means; a valve mechanism for controlling the flow of fluid in the conduits comprising a plurality of valve members, a plurality of cams to operate said members, and a common lay shaft carrying the cams being movable to one position to shift the valve members for a successive introduction of low pressure fluid into all of said coactable means, then high pressure fluid into a part of said coactable means and finally high pressure fluid into all of said coactable means.

3. In a system of the character described, separate sources of relatively low and high pressure fluid, main and auxiliary cylinders each having rams against which the fluid pressure is to be expanded, and a valve mechanism for controlling the flow of fluid to said cylinders comprising valve members adapted to be opened for an initial flow of low pressure fluid to either of the cylinders, means acting upon a building up of maximum low pressure thereagainst to establish communication of the high pressure fluid with one of the cylinders, and means acting upon a building up of maximum high pressure fluid thereagainst for establishing communication of said high pressure fluid with both of the cylinders.

4. A press having connected press box and entering head units terminating in a ram block at one end, a pressure cylinder containing a ram which is projectible from the cylinder by fluid pressure to close the units, an extension on the ram and means by which it is removably attached thereto, said extension contacting the ram block for said closing, a crimp lodged in the cylinder wall to pack the ram, means ordinarily operable to open the press comprising a reversing cylinder, a piston contained by the cylinder and movable therein in one direction by fluid pressure, and a rod connecting said piston with the ram block, and means for admitting pressure fluid into the other end of the reversing cylinder to recede the ram block from the pressure cylinder, thereby exposing the extension for removal so that the ram can be pushed inwardly beyond the crimp for access to the crimp.

WILSON A. WILHELM.