Aug. 4, 1942. D. L. CLEVELAND 2,292,054

TRIPLE-ACTING PRESS

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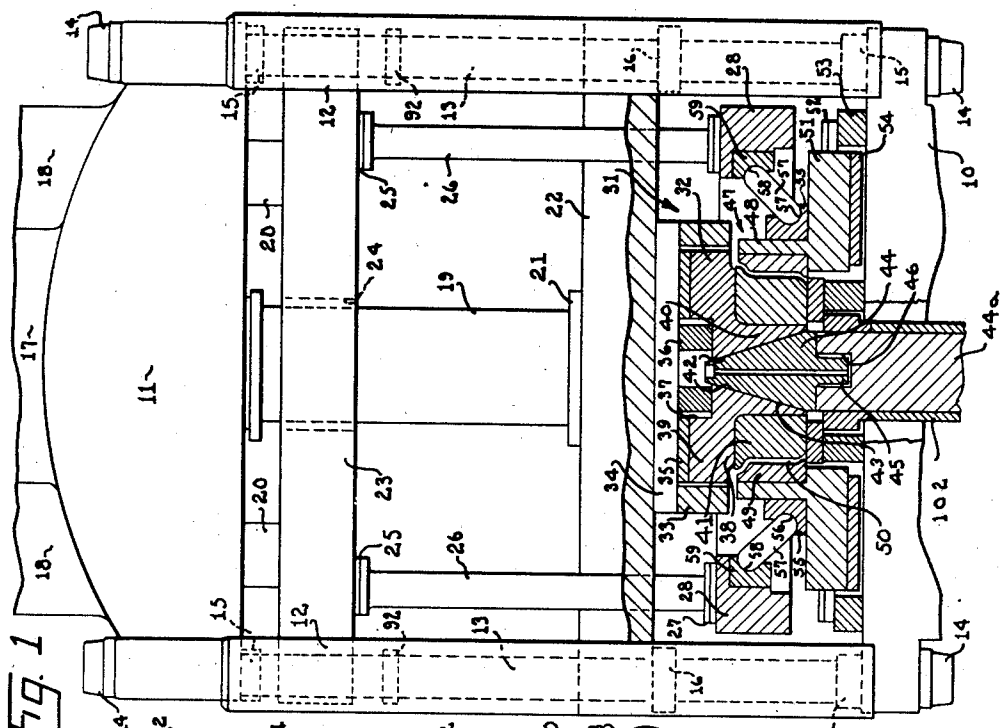


Fig. 1

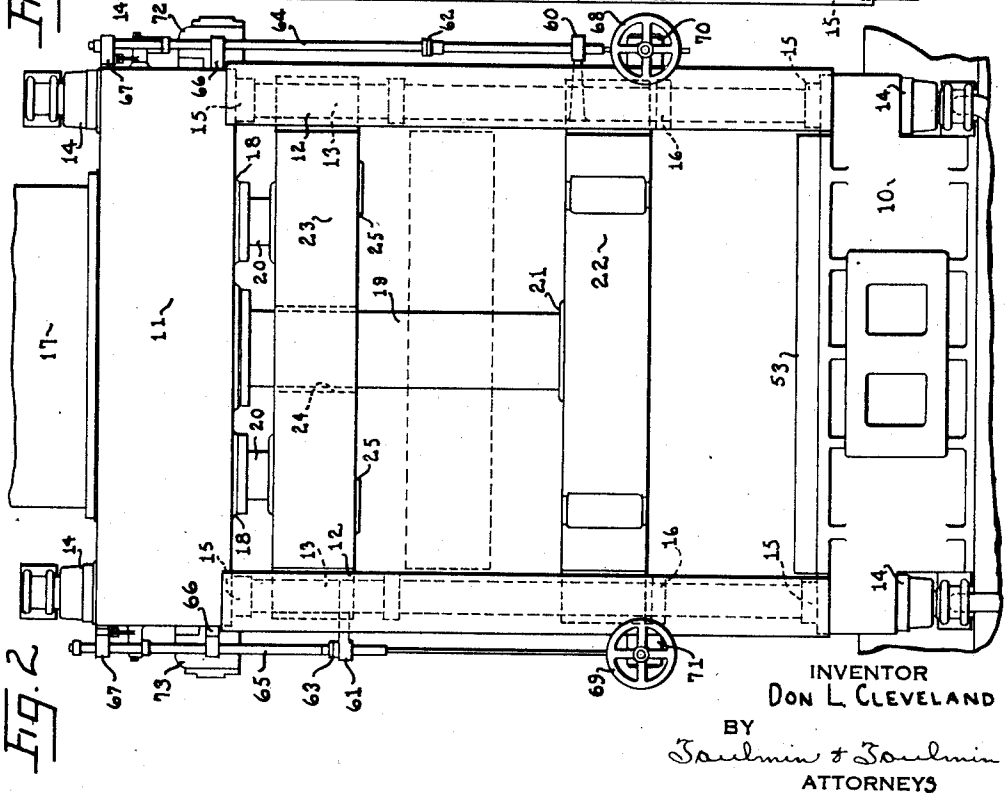


Fig. 2

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Filed Jan. 10, 1939 4 Sheets-Sheet 2

Fig. 3

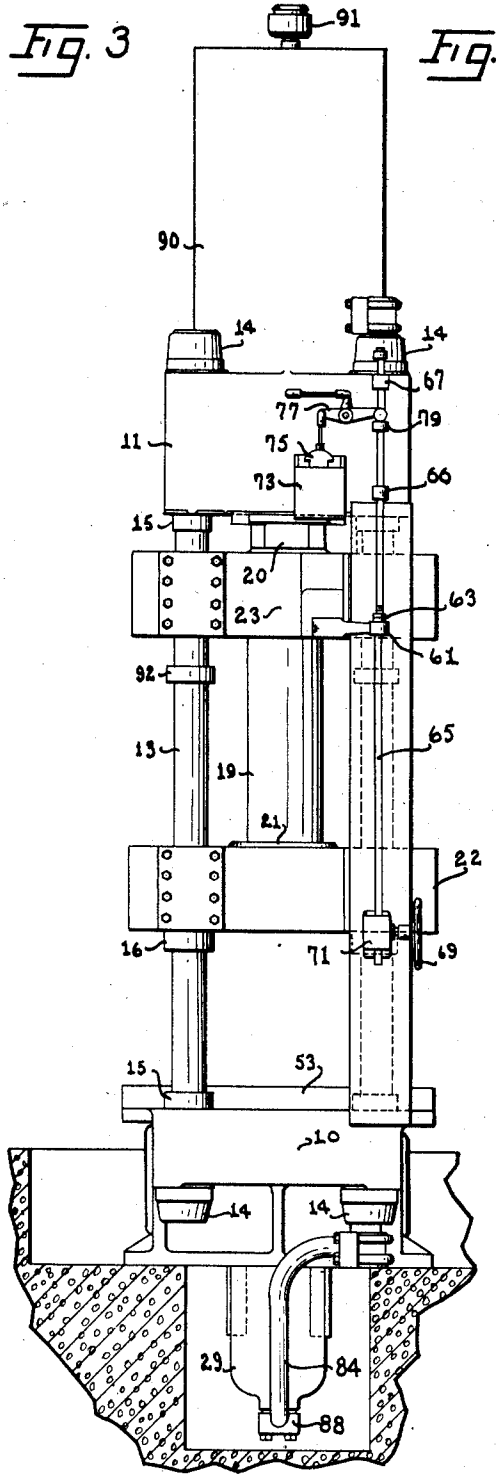
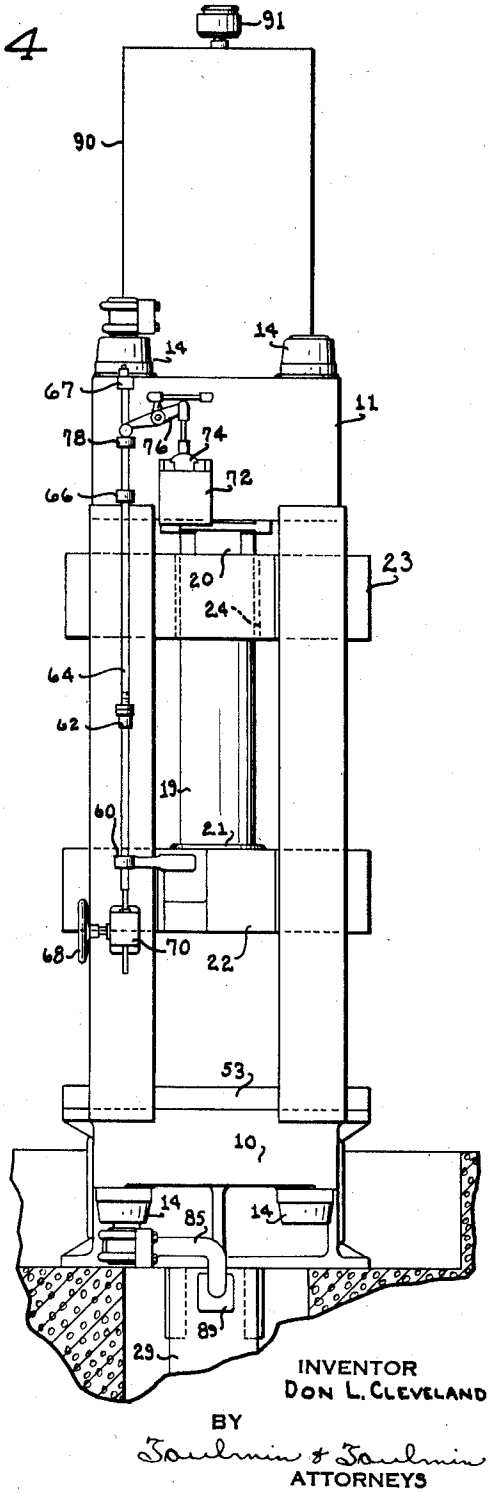


Fig. 4



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TRIPLE-ACTING PRESS

Filed Jan. 10, 1939 4 Sheets-Sheet 3

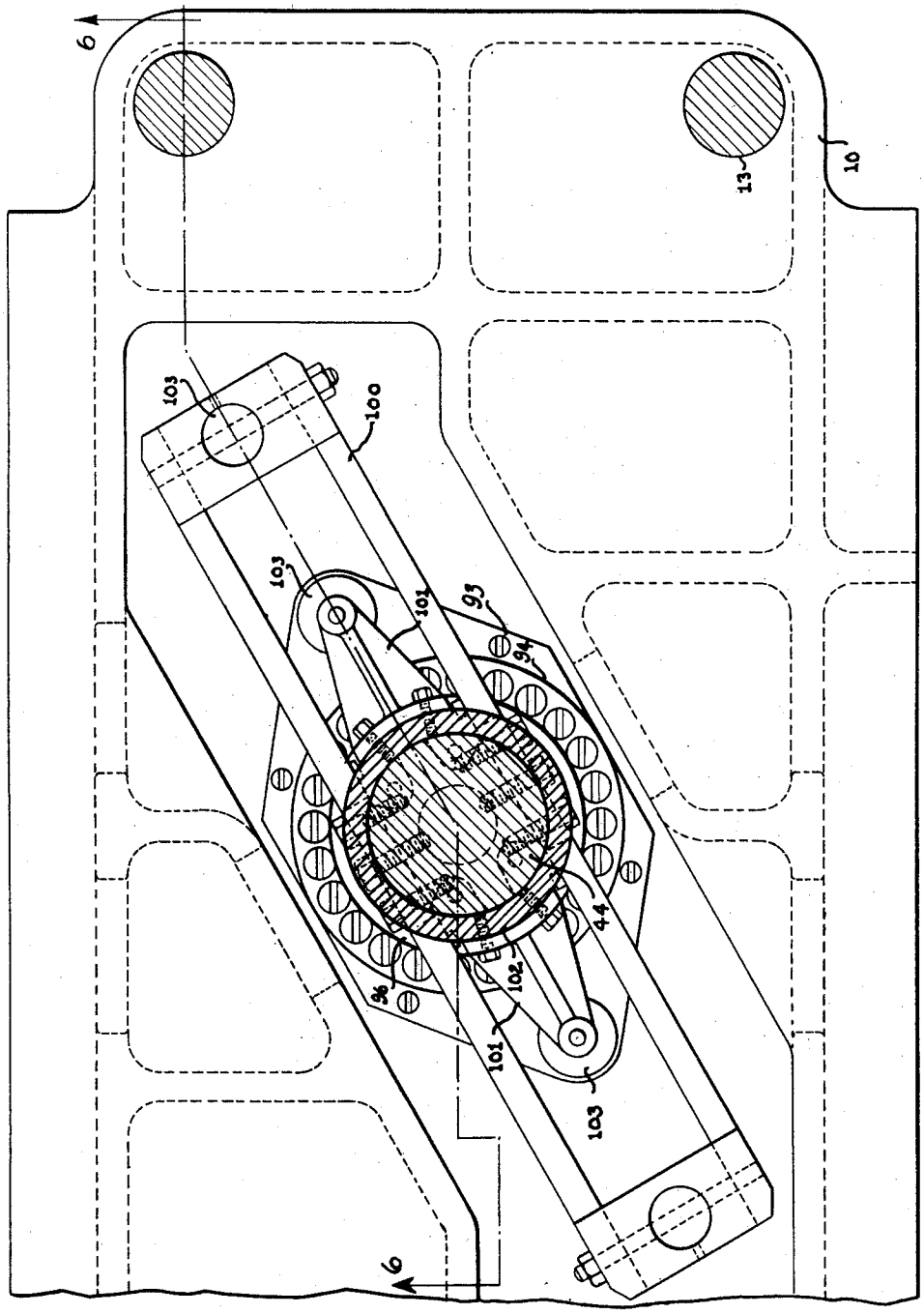


Fig. 5

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Aug. 4, 1942. D. L. CLEVELAND 2,292,054

TRIPLE-ACTING PRESS

Filed Jan. 10, 1939 4 Sheets-Sheet 4

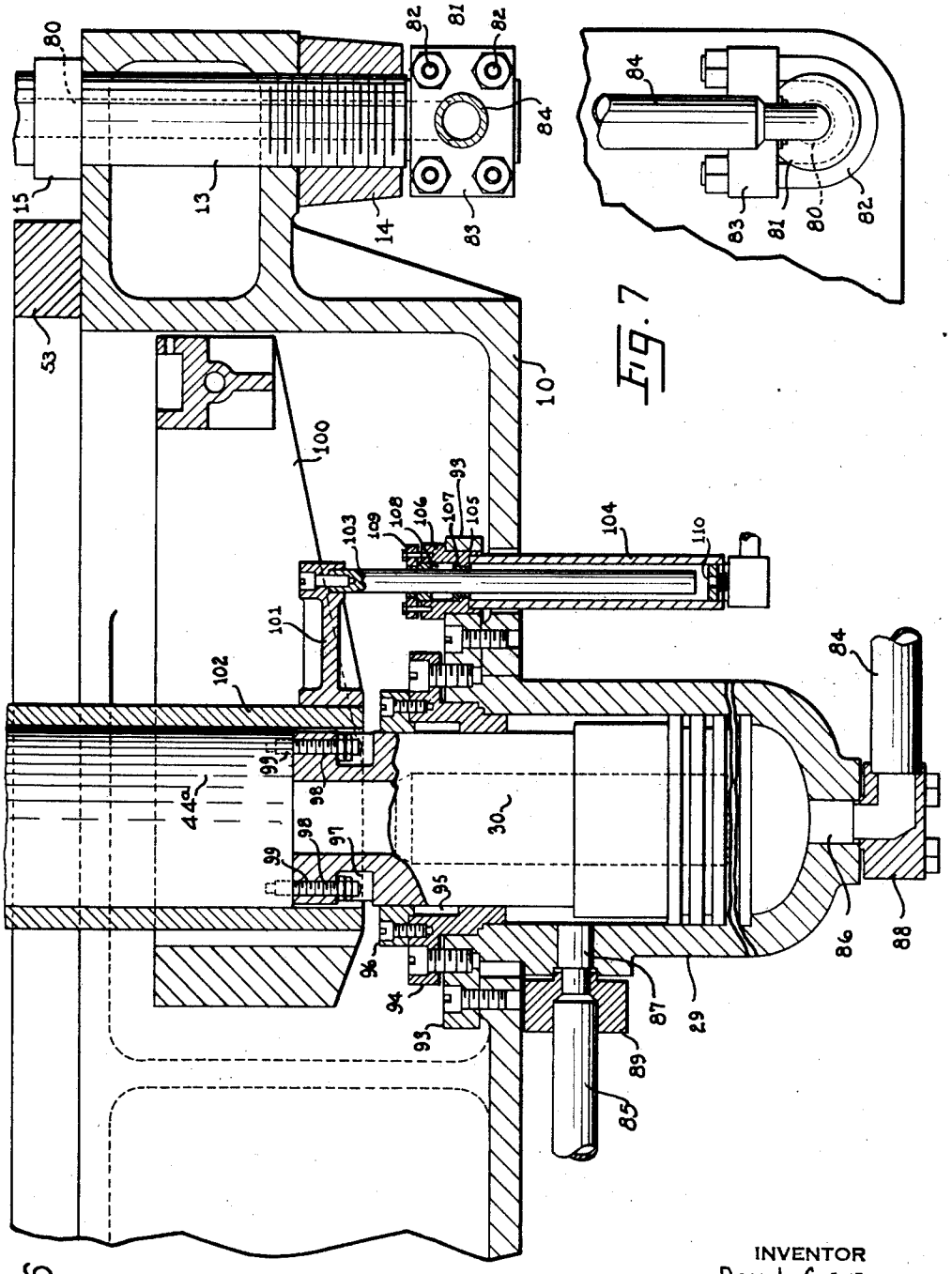


Fig. 6

Fig. 7

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UNITED STATES PATENT OFFICE

2,292,054

TRIPLE-ACTING PRESS

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Application January 10, 1939, Serial No. 250,222

24 Claims. (Cl. 153—48)

This invention relates to presses, and in particular, to hydraulic presses having a plurality of rams operating in different assemblies, such as in a triple-acting press.

One object of this invention is to provide a hydraulic press having plungers moving in opposite directions, such as to close a die assembly, and one or more additional plungers to perform further operations upon the die assembly, such as to constrict the die assembly laterally.

Another object is to provide a triple-acting hydraulic press having a main plunger cooperating with an oppositely acting auxiliary plunger to open and close a die assembly, together with at least one other plunger operative to perform further operations upon the die assembly, such as to move parts thereof in a lateral direction for giving an additional working operation upon the workpiece.

Another object is to provide a triple-acting hydraulic press, as set forth in the preceding object, wherein one or more ejector plungers are provided for ejecting the workpiece in addition to the three plungers previously mentioned.

Another object is to provide a triple-acting hydraulic press having an expansible and contractable die assembly mounted thereon, with a pair of oppositely acting plungers for opening and closing the die assembly, and for expanding the latter, together with an additional plunger for externally contracting the die assembly; and optionally an additional ejector plunger for ejecting the workpiece after the die assembly has completed its work.

In the drawings:

Figure 1 is a diagrammatic front elevation, partly in section, showing the principal parts of a triple-acting press according to the present invention.

Figure 2 is a front elevation of a commercial form of press, employing the principles illustrated diagrammatically in Figure 1, with the die assembly omitted for purposes of simplification.

Figure 3 is a left-hand side elevation of the press shown in Figure 2.

Figure 4 is a right-hand side elevation of the press shown in Figure 2.

Figure 5 is a plan view of a portion of the bed of the press illustrated in Figure 2, showing the ejector mechanism.

Figure 6 is a vertical section along the broken line 6—6 in Figure 5.

Figure 7 is a bottom plan view of the hydraulic connection to one of the hollow strain rods shown at the right-hand side of Figure 6.

In general, the triple-acting press of this invention consists of a frame with a plurality of independently acting rams for performing various related operations, such as operating a compound die assembly. The press of the present invention is illustrated as adapted to operate a die with multiple parts for truing rims for pneumatic automobile and truck tires. The press consists of a downwardly acting main plunger which closes the rim-truing die, the lower half of which is mounted upon the press bed. An upwardly acting auxiliary plunger serves to expand the die to perform the first truing operation. A third set of plungers operates mechanism for contracting the outer portion of the die so as to complete the rim-truing or squeezing operation, and a fourth set of plungers serves to expel the completed workpiece, which in the embodiment chosen for illustration, is an automobile tire rim.

Referring to the drawings in detail, Figure 1 shows diagrammatically a form of press embodying the principles of the invention. This press is provided with a bed 10, a head 11, side members 12 and strain rods 13 interconnecting the head 11 and bed 10. The opposite ends of the strain rods 13 are threaded and carry nuts 14 for holding the press frame parts together. The strain rods 13 are provided with shouldered portions 15 near their ends, cooperating with the nuts 14 to hold the press bed 10 and head 11 therebetween. Stops 16 are also provided on the strain rods 13 for holding the press platen, as hereinafter explained.

Mounted in the press head 11 is a main cylinder 17 and auxiliary cylinders 18, reciprocably receiving the main plunger 19 and auxiliary plungers 20. The main plunger 19 is connected, as at 21, to the main platen 22, which reciprocates vertically with its ends guided in the frame side members 12. At its lower extent of reciprocation the main platen 22 engages the stops 16 on the strain rods 13. The auxiliary plungers 20 are connected to an auxiliary platen 23, which reciprocates independently of the main platen 22 and which is provided with an aperture 24 for accommodating the main plunger 19. Connected to the auxiliary platen 23, as at 25, are vertically depending posts 26 connected, as at 27, to a connecting member 28 which serves to interconnect the lower ends of the posts 26. Mounted in the bed 10 of the press is a cylinder 29 containing an upwardly acting plunger 30 (Figure 6). Bolted to the latter is a plunger 44a

carrying the conical die expander 44. Not shown in Figure 1 but shown in Figures 5 and 6 are ejector plungers, subsequently to be described, for ejecting the workpieces, such as tire rims. Thus, the press contains four different plunger assemblies, the main plunger and platen assembly 19, 22, the auxiliary plunger and platen assembly 20, 23, 26, 28, the upwardly acting plunger assembly 29, 30, 44a and the ejector plunger assembly subsequently to be described.

Returning to Figure 1, the die assembly, generally designated 31, consists of an annular central portion, generally designated 32, secured within an encircling portion 33 and connected to a plate 34 mounted upon the lower side of the main platen 22. Spacing elements 35 and 36 are provided between the central annular portion 32 and the mounting plate 34, the element 36 being mounted in a recess 37. The central annular member 32 of the die assembly 31 consists of a plurality of segments 38 having enlarged upper portions 39 and lower reduced diameter portions 40. The portions 40 are provided with wear plates 41, secured thereto and serving to engage the workpiece. The segments 38 are provided with tapered internal surfaces 42, forming in assembly a conical recess which is engaged by the conical outer surface 43 of the conical die expander 44, the lower portion 45 of which is of reduced diameter and is mounted within the bore 46 of the plunger 44a connected to the upwardly acting plunger 30. The segments 38 and wear plates 41 are forced outward to expand the die assembly when the plungers 30 and 44a and the conical expander 44 rise.

The die assembly 31 is also provided with a split outer unit, generally designated 47, including a split ring portion 48 and wear plates 49 disposed in opposition to the wear plates 41, and providing an annular space 50 for the reception of the workpiece, such as the tire rim. The portion 48 is provided with an annular base portion 51, secured as at 52, to the supports 53 mounted upon the press bed 10. Secured to the under sides of the base portions 51 are the members 54. Engaged by the portions 48 are the thrust members 55 having recesses 56 receiving the ends of links 57, the opposite ends of which engage recesses 58 within the members 59 mounted inside the connecting member 28.

In the operation of the press shown diagrammatically in Figure 1, let it be assumed that the main platen 22 and auxiliary platen 23 are raised to their uppermost positions, and that the plunger 30 is in its lowermost position. The upper and lower portions of the die assembly 31 are therefore separated so as to permit the placing of a workpiece therein. A tire rim, or other workpiece, is then inserted in the lower portion of the die, within the hollow inclosed by the wear plates 49. Pressure is then admitted to the upper and lower cylinders 17 and 29, whereupon the main plunger 19 and lower plunger 30 move toward one another. As the main plunger 19 and main platen 22 are assisted by gravity in their downward movement, and preferably aided by a surge valve in admitting fluid to the upper portion of the main cylinder 17 to permit this rapid gravitational descent, the main platen 19 reaches its lowermost postion first and comes to rest against the stops 16 on the strain rods 13, thereby lowering the upper portion of the die assembly 31 into the lower portion thereof, with the wear plates 41 within the workpiece or tire rim which is to be trued. This clamps the upper and lower portions of the die assembly 31 together.

Meanwhile, the lower plunger 30 rises more slowly, since it is unassisted by gravity, and pushes the conical expander 44 into the conical recess 42, thereby forcing the segments 38 outwardly in radial directions and causing the wear plates 41 to engage the inner portions of the workpiece. At the end of a pressure dwell of predetermined length, the hydraulic circuit is reversed so that the main plunger 19 and lower plunger 30 are retracted by pressure fluid directed to them in the opposite direction from that employed in causing them to perform their forward or working strokes. As the lower plunger 30, however, is now assisted by gravity in its retraction stroke, it reaches its return position before the main plunger 19 and main platen 22, which are opposed by gravity.

At the same time that plunger 30 starts its return or retraction stroke, fluid is admitted to the auxiliary cylinder 18, causing the auxiliary plungers 20 and auxiliary platen 23 to move downward, carrying with them the posts 26 and connecting member 28. By this motion the links 57 are caused to push the split ring portion 48 and wear plates 49 inwardly, thereby giving the final truing squeeze to the outside of the tire rim, or other workpieces. After this operation has been performed the flow of pressure fluid to the auxiliary cylinders 18 is reversed so that the auxiliary plungers 20 and auxiliary platen 23 move upward, carrying with them the posts 26 and outer member 28, and causing the split ring 48 to expand outwardly by reason of the releasing of the force upon the links 57. When the main platen 22 reaches its retracted position, the upper and lower portions of the die assembly 31 are separated and the die is opened. The ejector plungers, subsequently to be described, are then operated to move the rim, or other workpiece, upward out of the hollow within the die and into a position facilitating its removal from the press.

The commercial form of press shown in Figures 2 to 6 is similar in principle and general construction to that shown diagrammatically in Figure 1, and similar parts are similarly designated. In this press the hydraulically operated platens 22 and 23 are provided with laterally extending valve actuating arms 60 and 61 for controlling the flow of hydraulic fluid to and from the cylinders 17 and 18. The valve actuating arms 60 and 61 are adapted to engage collars 62 and 63 upon vertically movable control rods 64 and 65, respectively, to move the same. The control rods 64 and 65 are also guided at their upper ends in the arms 66 and 67 extending laterally from the press head 11, and are movable manually up or down by the hand wheels 68 and 69, operating rack and pinion gearing units 70 and 71. The control rods 64 and 65 are likewise movable electrically by means of solenoids 72 and 73 (Figures 3 and 4) through their armatures 74 and 75 and rock arms 76 and 77, the outer ends of which engage collars 78 and 79 upon the control rods 64 and 65, respectively. The control system employed with the presses shown in Figures 2, 3 and 4 forms no part of the present invention.

In order to facilitate the transfer of fluid between the upper and lower portions of the press, certain of the strain rods 13 are provided with longitudinal bores 80 (Figures 6 and 7), to the ends of which connection is made by the cou-

plings 81 secured thereto by the U-bolts 82 and clamping plate 83. Pipes 84 and 85 lead respectively from the bored strain rods to the ports 86 and 87 in the upper and lower ends of the lower cylinder 29 (Figure 6), connection being made thereto by the couplings 88 and 89 (Figures 3, 4 and 6). Mounted on the press head 11, above the main cylinder 17, is a surge tank 90 for containing the working fluid, this tank being surmounted by an air filter 91. The strain rods 13 are provided with upper stops 92, corresponding to the lower stops 16, but serving to engage the auxiliary platen 23 at the lower limit of its travel. The lower cylinder 29 is bolted to the press bed 10 by a flanged portion 93 thereof, and provided with a packing retainer 94 of annular form and containing an annular recess 95 for receiving a packing which is compressed by the gland 96, bolted thereto. The upper end of the lower plunger 30 (Figure 6) is provided with recesses 97 communicating with bolt holes 98 serving to receive the bolts 99, by which the plunger 44a is connected thereto.

The ejector mechanism by which the tire rims, or other workpieces, are placed in a position for removal consists (Figures 5 and 6) of a rectangular carriage, generally designated 100 having brackets 101 bolted thereto (Figure 5) by way of the cylindrical portion 102. Bolted to the outer ends of the brackets 101 are ejector plungers 103 which reciprocate in the ejector cylinders 104, mounted in the bores 105 extending through the flanged portion 93 of the lower cylinder 29. The ejector cylinders 104 are closed by cylinder heads 106 containing an annular packing retainer 107 and a packing recess 108 for receiving a packing, the latter being compressible by the gland 109.

The operation of the commercial form of press shown in Figures 2 to 7 is the same as that described in connection with the diagrammatic or simplified form shown in Figure 1. The ejector cylinders, however, are provided with lower ports 110, through which fluid is admitted when it is desired to raise the ejector plungers 103 and carriage 100 so as to lift the tire rim, or other workpiece, out of the lower die portion. The ejector plungers 103 return by gravity to their retracted positions when the port 110 is connected to the discharge or exhaust circuit of the press.

It will be understand that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

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

1. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, and a die-expanding ram connected to said die expander.

2. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, a die-expanding ram connected to said die expander, a workpiece ejector, and an ejector ram operatively connected to said workpiece ejector.

3. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, and a die-expanding ram connected to said die expander, said auxiliary ram being movable in the same direction as said main ram upon the working stroke thereof.

4. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, and a die-expanding ram connected to said die expander, said die-expanding ram being movable in the opposite direction from said main ram upon the working stroke thereof.

5. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, and a die-expanding ram connected to said die expander, said auxiliary ram being movable in the same direction as said main ram upon the working stroke thereof, said die-expanding ram being movable in the opposite direction from said main ram upon the working stroke thereof.

6. In a hydraulic press, a frame, a die assembly having an expansible portion and a contractable portion, a main ram operatively connected to one of said portions for opening and closing said die assembly, an auxiliary ram operatively connected to said contractable portion, a die expander, a die-expanding ram connected to said die expander, a workpiece ejector, and an ejector ram operatively connected to said workpiece ejector, said ejector ram being movable in the same direction as said die-expanding ram upon the working stroke thereof.

7. In a method of truing hollow workpieces in a multi-part die, inserting the workpiece in the space between the outer and inner parts of the die, exerting hydraulic pressure for closing the die, hydraulically expanding the inner part of the die outward against the inner wall of the workpiece, squeezing the outer part of the die against the outer wall of the workpiece while gradually relieving the expanding pressure, hydraulically retracting the die parts, and removing the trued workpiece.

8. In a method of truing hollow work pieces, inserting the work piece in a multi-part die, closing the die, expanding the inner die surface outwardly against the inner wall of the work piece to expand the same, squeezing the outer die surface inwardly against the outer wall of the work piece while slightly releasing said expanding pressure to contract the same, separating the die parts, and removing the work piece from the die.

9. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same

direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion.

10. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, said main ram and said die-actuating ram operating in opposite directions.

11. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejector ram adapted to expel the work piece from the die.

12. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejector ram adapted to expel the work piece from the die, said main ram and said die-actuating ram operating in opposite directions.

13. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejector ram adapted to expel the work piece from the die, said ejector ram and said die-actuating ram being mounted adjacent each other in said press.

14. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion.

15. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, said auxiliary ram being mounted beside said main ram and movable in the same direction upon the working stroke thereof.

16. In a hydraulic press, a frame, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, said die-actuating ram being mounted at the opposite end of said frame from said main ram and being movable in the opposite direction upon the working stroke thereof.

17. In a hydraulic press, a frame, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, said auxiliary ram being mounted beside said main ram and movable in the same direction upon the working stroke thereof, said die-actuating ram being mounted at the opposite end of said frame from said main ram and movable in the opposite direction upon the working stroke thereof.

18. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected

to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejector ram adapted to eject the work piece from the die.

19. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejector ram adapted to eject the work piece from the die, said auxiliary ram being mounted beside said main ram and movable in the same direction upon the working stroke thereof.

20. In a hydraulic press, a frame, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, said die-actuating ram being mounted at the opposite end of said frame from said main ram and movable in the opposite direction upon the working stroke thereof.

21. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, and an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, an ejector ram, said ejector ram being mounted adjacent said die-actuating ram.

22. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram, a main platen connected to said main ram and adapted to carry said first die portion into cooperating relationship with the second die portion, an auxiliary ram, and an auxiliary platen connected to said auxiliary ram, said auxiliary ram and platen operating in the same direction as said main ram, and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion, and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, an ejector ram, said ejector ram being mounted adjacent said die-actuating ram, and movable in the same direction upon the working stroke thereof.

23. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejection plunger carried by said ram and surrounding said die-actuating ram.

24. In a hydraulic press, a first die portion and a second die portion arranged to act on opposite sides of a work piece, a reciprocable main ram adapted to carry the first die portion into cooperating relationship with the second die portion, an auxiliary ram operating in the same direction and adapted to move said second die portion angularly with respect to the direction of movement of the first die portion and in a direction to approach the second die portion, and a die-actuating ram adapted to move said first die portion in a direction toward said second die portion, and an ejection plunger carried by said ram reciprocably journaled on said die-actuating ram.

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