E. L. McGARY.

FORGING PRESS.

APPLICATION FILED SEPT. 20, 1916.

1,286,687.

Patented Dec. 3, 1918.

4 SHEETS—SHEET 1.

Fig. 1.

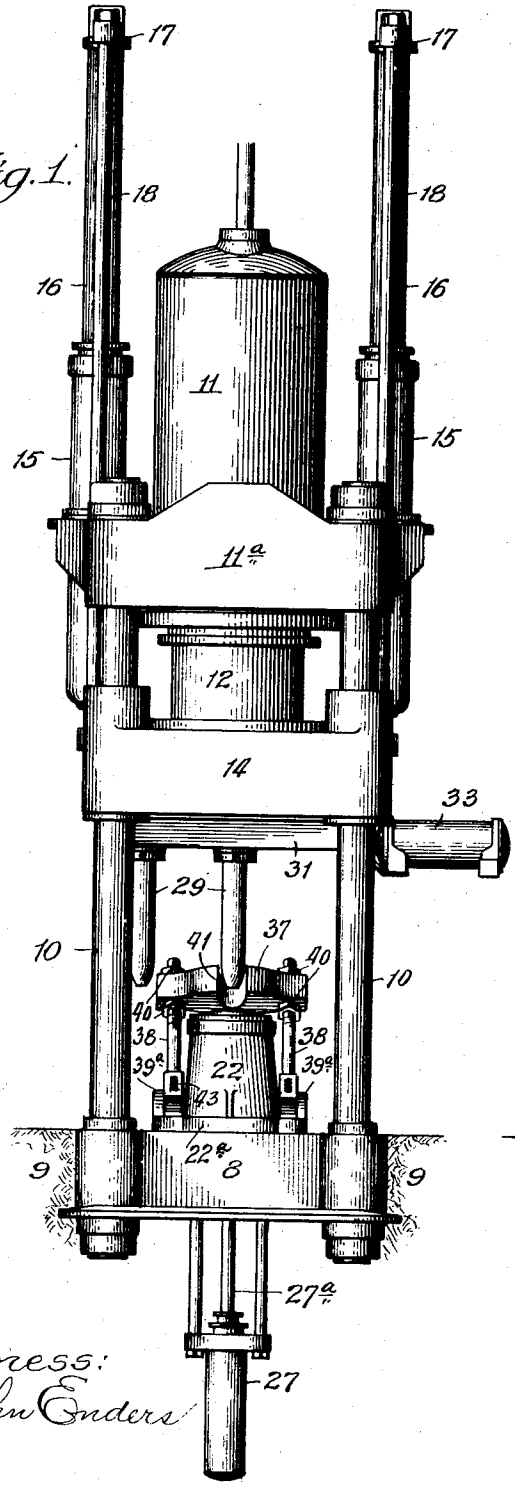
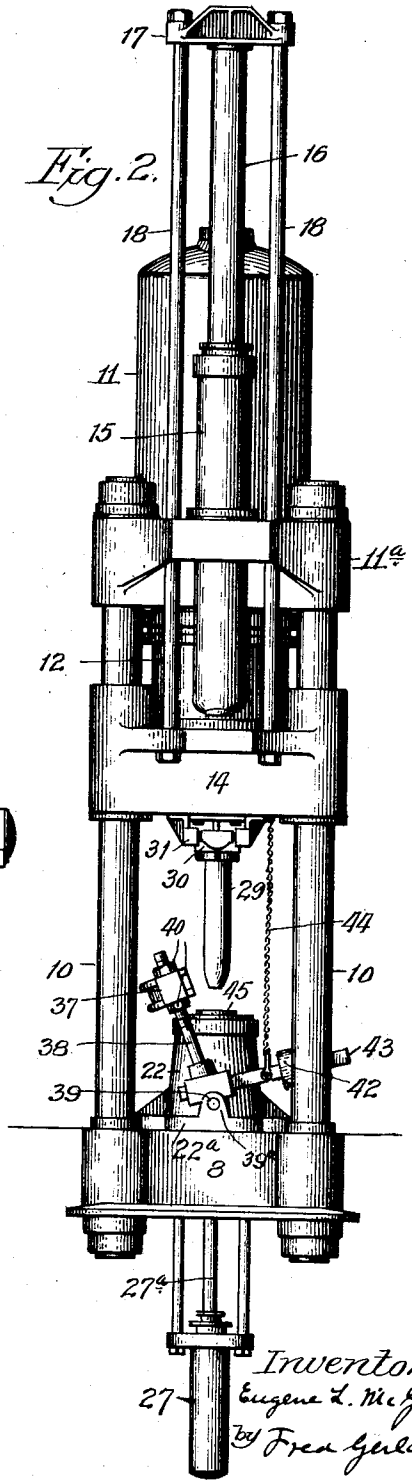


Fig. 2.



Witness:
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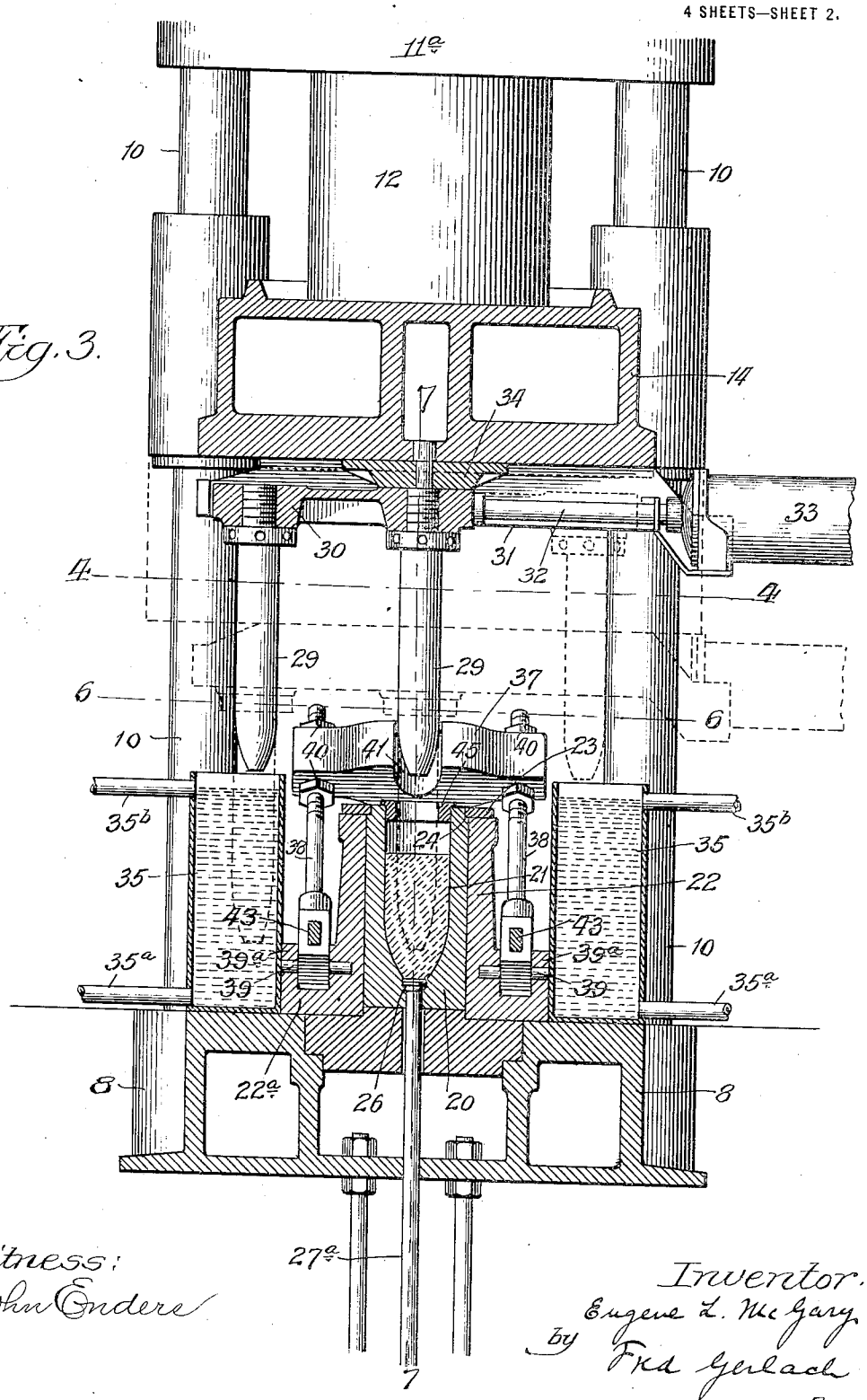
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4 SHEETS—SHEET 2.

Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

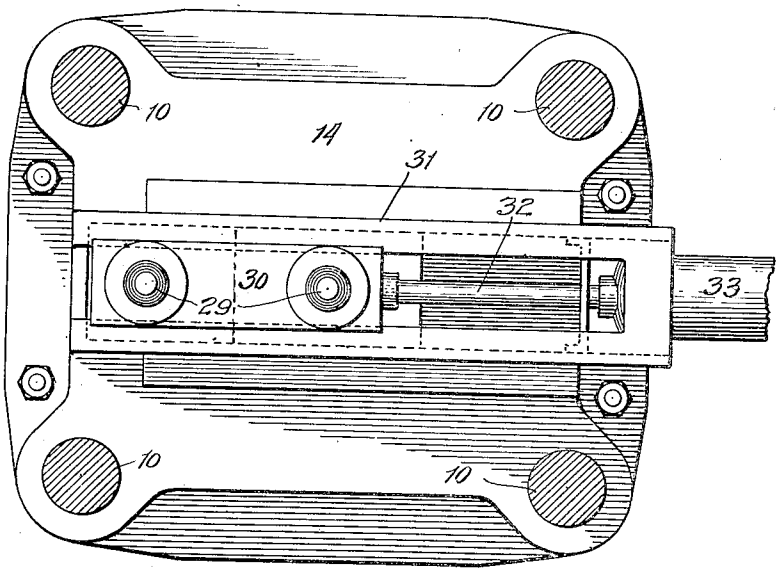
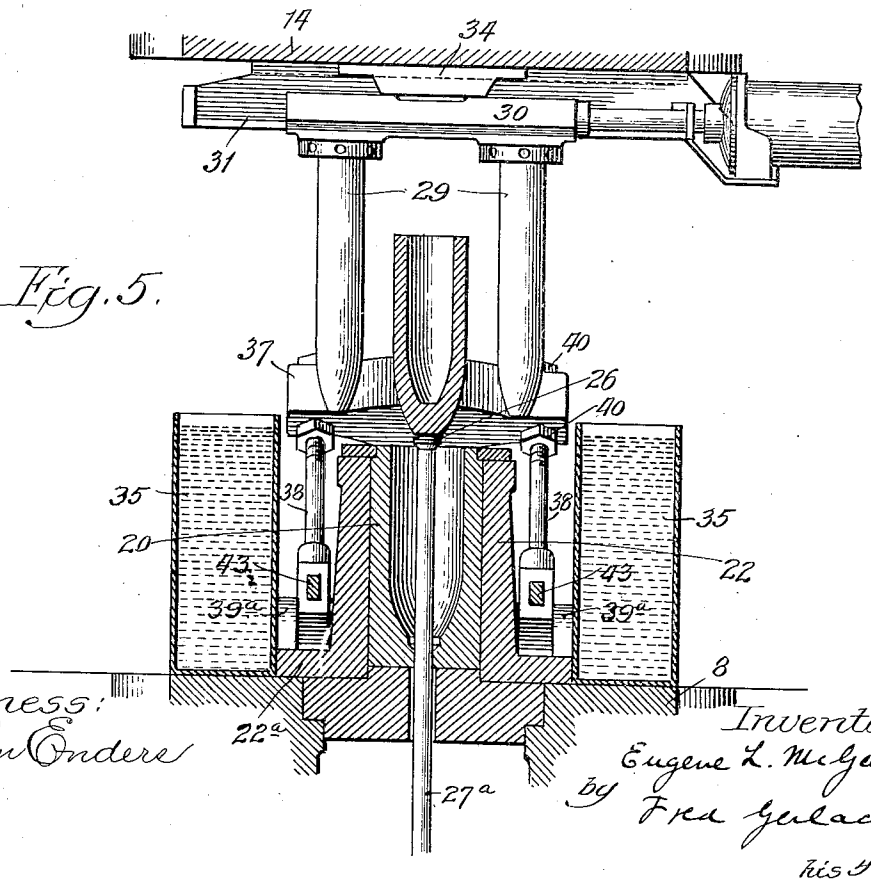


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

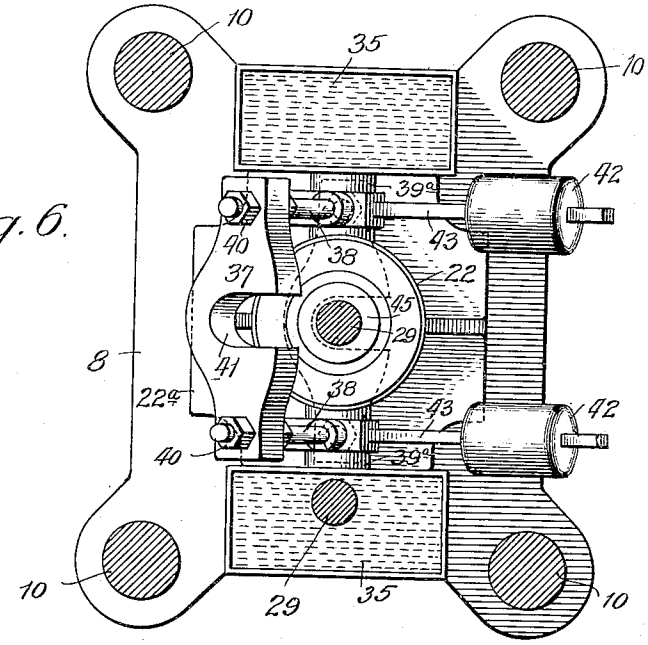
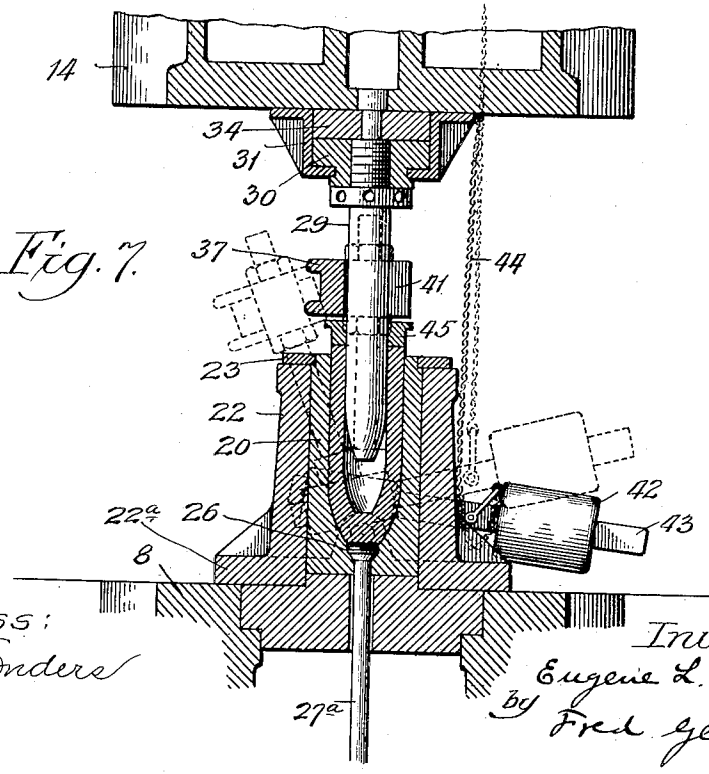


Fig. 7.



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UNITED STATES PATENT OFFICE.

EUGENE L. McGARY, OF CHICAGO, ILLINOIS.

FORGING-PRESS.

1,286,687. Specification of Letters Patent. Patented Dec. 3, 1918.

Application filed September 20, 1916. Serial No. 121,107.

To all whom it may concern:

Be it known that I, EUGENE L. McGARY, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Forging-Presses, of which the following is a full, clear, and exact description.

The invention relates to forging presses. It is now common practice to form ammunition shells by forcing a tool or piercing die operated by a hydraulic ram into a pot containing a charge of ductile metal to form the usual chamber in and form the shell. In this operation, the metal is subjected to very high pressure, *e. g.* 1200 tons—to sufficiently densify the metal for use as an ammunition shell. According to present practice, the forging tool is operated by a ram which is operated by fluid under pressure and the organization of the parts is such that the stroke of the piercing tool is more than double the length of its penetration in the pot to provide the necessary clearance between the pot and the forging or piercing tool for removal of the forged shell and recharging of the pot.

Because of the high fluid pressures involved in forging these shells, the operation of the ram is costly and any reduction of the length of the stroke of the high pressure ram and the length of the stroke of the forging tool relatively to the pot effects a very substantial saving in power and cost of operation and production of the shells. The primary object of the present invention is to provide a forging press which may be economically operated as a result of organizing it structurally so as to reduce to the practical minimum the clearance portion of the stroke of the forging tool without affecting the facility with which the shell can be removed and the pot recharged. This object is attained primarily by providing a plurality of forging tools or dies and moving them laterally away from the top of the pot to leave clearance between the tools for convenient removal of the forged shells in lieu of operating one tool longitudinally away from the pot to provide the necessary clearance for the withdrawal of the forged shell from the pot.

In these forging machines, excessively rapid operation of the tools causes breakage and deformation owing to the high temperature of the ductile metal in which the tools operate and as a result, the speed of production is correspondingly limited. A still further object of the invention is to provide an improved forging press having an increased output or capable of more rapid operation than is possible when the single forging tool is employed. This object is attained by providing a plurality of forging tools or piercing dies and alternately operating the tools in the ductile metal and in a cooling liquid. It has been found that cooling these dies between the forging operation is conducive to their longevity.

A further object of the invention is to provide improved stripper mechanism for the shells which is operable in conjunction with a forging tool to which a short stroke is imparted.

Lastly, the invention is designed to provide a forging press which may be economically operated and has a great capacity.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure 1 is a front elevation of a forging press embodying the invention. Fig. 2 is a side elevation. Fig. 3 is a vertical section, the forging dies being shown in position assumed at the commencement of a forging stroke. Fig. 4 is a section taken on line 4—4 of Fig. 3. Fig. 5 is a section similar to Fig. 3, showing the forging tools in position assumed when a forged shell has been ejected from the pot. Fig. 6 is a horizontal section taken on line 6—6 of Fig. 3. Fig. 7 is a section taken on line 7—7 of Fig. 3, showing the parts in position assumed after a shell has been forged and during the withdrawal of the forging tool, the stripper being shown in operative position.

The press comprises a base 8 suitably supported upon a solid bed 9, standards 10 on the upper portions of which is rigidly mounted a hydraulic ram comprising a cylinder 11 provided with a head 11^a, and a piston 12 working in the cylinder and for operating the forging tools or dies. This ram is provided to impart the working stroke to the forging tool and is adapted to be operated by fluid under high pressure to forge the shell. A head 14 on the piston 12 is suitably guided on the standards 10. Mechanism for imparting the idle stroke to the piston-head 14 and piston 12 comprises

a pair of cylinders 15 mounted on cylinder-head 11ª, pistons 16 working in said cylinders respectively, cross-heads 17 secured to the upper ends of the pistons 16 and rods 18 connecting the cross-heads 17 and the piston head 14. It will be understood that the usual connections for supplying fluids under the necessary pressures to the operating and retracting cylinders and for exhausting such fluids, and controlling valves therefor are provided, as well understood in the art.

The forging mechanism comprises a pot 20 which receives the billet or metal in ductile condition and is provided with a chamber 21 conforming to the outer periphery of the forging to be made. The pot 20 is contained within a holder 22 having a flange 22ª which is secured to the base 8 and a ring 23 is fixed to the holder and overlies a shoulder 24 on the pot 20 to replaceably hold the latter in the bed. An ejector 26 extends through the bottom of the pot 20 and is operated by fluid in a cylinder 27 containing a piston having a stem 27ª which is operatively connected to the ejector. The function of this ejector is to lift the forged shell out of the pot and into position indicated in Fig. 5.

The forging tools or dies 29 operated by the head 14 are adapted to enter the ductile charge of metal in the pot and to forge and form the metal into a shell. A plurality of dies or tools 29 are provided and both of these dies have their upper ends screw-threaded to and secured in a cross head 30 which is slidably mounted in a guide 31 secured to the lower face of the movable head 14 of the ram. Cross-head 30 is connected to the rod 32 of a piston in a cylinder 33 which is adapted to be operated by fluid under pressure to reciprocate the cross-head 30 laterally to alternately bring the forging dies or tools into coaxial position with the pot 20. The stroke of the cross-head 30 is limited so that it will be arrested in correct position for the entry of the tools 29 in proper position in the pot 20. A bearing plate 34 is provided on the underside of head 14 to engage the cross head immediately above the active forging tool or dies so that the latter will be solidly backed for operation by the movable head 14. The lateral space or clearance between the piercing tools is sufficient to permit removal of the shell between them so that the necessity of elevating the forging tools or dies for sufficient vertical clearance between them and the pot to permit removal of the shells, will be avoided.

By providing a plurality of forging tools or dies which are alternately operated to forge a shell, it becomes possible to cool the tool or die during its non-working stroke and for this purpose, cooling tanks 35 are mounted on the base 8 laterally of the pot 20 and are so disposed that each tool 29 during its non-working stroke and between its working strokes will be immersed in the cooling liquid to reduce its temperature. As a result, the invention is particularly adapted for presses in which high temperatures are involved. Pipes 35ª supply cooling liquid to said tanks and pipes 35ᵇ conduct the hot water from the tanks so that water will be constantly circulated through these tanks.

Mechanism for stripping the shell from the forging tools comprises a bar 37 mounted on the upper ends of arms 38 which are pivoted, as at 39, to lugs 39ª on the base flange of the pot-retainer 22. Stripper bar 37 is adjustably connected to arms 38 by nuts 40 to adapt the stripper for shells of different lengths or pots of different heights. Bar 37 has a recess 41 therein so that the bar can straddle or pass around the active forging tool or die and pass into position to restrain the upward movement of the shell while the forging tool is being retracted. Weights 42 on arms 43, which are connected to arms 38, serve to normally swing the stripper-bar 37 into operative position above the pot 20. A chain 44 connected to one of the arms 43 and to the piston head 14 of the die-operating ram swings the stripper laterally to release the shell near the end of the retractile stroke of the forging tool, so that when the tool has been completely withdrawn from the pot, the stripper will have moved into position to permit removal of the shell. A ring 45 fits in the upper end of the pot 20 to guide the forging tool and this ring is usually forced away from the pot as the metal is forged into shell form, as shown in Fig. 7.

The operation of the improved press will be as follows: Assuming the tools to be in position shown in full lines in Fig. 5, a charge of ductile metal is put into the pot. The forging tools 29 are then disposed laterally of the upper end of the pot so that the latter will be accessible for charging purposes. Next, ring 45 will be placed in the pot. Fluid under pressure will then be admitted to cylinder 33 to shift the piston therein to one end of its stroke which will bring one of the forging tools or dies 29 into position for entry into the charge of metal in pot 20. Fluid under pressure will then be admitted to cylinder 11 to cause head 14 to force the forging die or tool 29 into the metal in the pot and to forge the metal into shell-form, as well understood in the art.

When the forging operation has been completed, fluid under pressure will be admitted to cylinders 15 to raise head 14 and retract piston 12. During retraction of the forging tool, the stripper bar 40 will be in operative position to release the shell from the tool. Near the end of the withdrawal stroke of the tool, chain 44 will be operated to swing the stripper bar toward the rear of

the pot so that the shell will be free to be lifted by the ejector and removed manually. Next, fluid under pressure will be admitted to cylinder 33 to bring the cross-head 30 into position to hold the forging tools 29 substantially in position shown in full lines in Fig. 5. This disposition of the tools will leave the space above the pot clear and accessible for removal of the shell. Fluid under pressure will then be admitted to cylinder 27 to operate the ejector 26, which will lift the shell into position indicated in Fig. 5. From this position, the operator can readily remove the shell from between the tools. In some instances, the operator can remove the shells while the tools are moving laterally so that they need not be arrested at the intermediate position shown in Fig. 5. After recharging the pot, fluid under pressure will be admitted to cylinder 33 to bring the tool 29, which has been inactive during the last operation, into position to forge a shell in pot 20. The operation of the head 14 will then be repeated as before. During each forging operation, the idle forging die will pas into one of the tanks 35 containing cooling fluid and will be cooled thereby. After each operation of the forging tools, the cross-member 30 will be operated laterally to clear the space above the pot for the purpose already set forth, and to bring them alternately into position for a forging operation.

The invention exemplifies a forging press which comprises a plurality of forging elements which are movable laterally between the forging operations to provide clearance and space for removal of the shell and charging the pot and with such a construction the working stroke of the forging tools is reduced so that it is not necessary to leave vertical clearance approximately equal to the length of the shell between the pot and the forging tool. In fact, the stroke will be approximately no greater than the distance necessary to move the tool into the shell and a slight clearance between the shell and the tool. The importance of this feature may be realized from the circumstances that in some instances where heretofore the stroke of the arm has been 78 inches, the stroke has been reduced to approximately 27 inches and this reduction in the stroke effects a very substantial saving in power required for the operation of the press. The invention further exemplifies a press in which the forging tools or dies are alternately cooled and worked and this alternate cooling avoids deformation which frequently results when a die is worked in too rapid succession.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

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

1. In a forging press, the combination of a pot for holding a charge of metal, a forming tool adapted to enter the top of the pot and forge the metal therein, fluid pressure operated mechanism for operating the tool longitudinally into and out of the pot, mechanism for shifting the tool transversely to alternately bring it into position for a working stroke and to clear the space above the pot for removal of the forging, an ejector normally positioned in the bottom of the pot and mechanism to operate the ejector from the bottom of the pot into position above the pot and for removal above the pot.

2. In a forging press, the combination of a pot for holding a charge of metal, a forming tool adapted to enter the top of the pot and forge the metal therein, fluid pressure operated mechanism for operating the tool longitudinally into and out of the pot, mechanism for shifting the tool transversely to alternately bring it into position for a working stroke and to clear the space above the pot for removal of the forging, an ejector normally positioned in the bottom of the pot, mechanism to operate the ejector from the bottom of the pot into position above the pot and for removal above the pot, a stripper for the tool and mechanism for operating the stripper to an inoperative position during the operative stroke of the ejector.

3. In a forging press, the combination of a pot adapted to receive and hold a charge of ductile metal, a plurality of tools each adapted to forge the metal in the pot into the same shape, fluid-pressure operated mechanism for operating the tools longitudinally to forge the metal, said tools being transversely movable, mechanism for shifting the tools transversely to alternately bring them into position for a working stroke, and means for lifting the forging out of the pot after each operation of one of the tools.

4. In a forging press, the combination of a pot adapted to receive and hold a charge of ductile metal, a plurality of tools each adapted to forge the metal in the pot into the same shape, fluid-pressure operated mechanism for operating the tools longitudinally to forge the metal, said tools being transversely movable, mechanism for shifting the tools transversely to alternately bring them into position for a working stroke, means for lifting the forging out of the pot after each operation of one of the tools, means for stripping the forging from the tools during the retractile stroke of the press, and means for shifting the stripping means into inoperative position to permit the ejector to lift the forging out of the pot.

5. In a forging press, the combination of a pot adapted to hold a charge of ductile

metal, a tool for forging the metal in the pot, fluid pressure operated mechanism for operating the tool longitudinally, a stripper for separating the forging from the tool, means for holding the stripper normally in operative position around the tool, and means operated by said mechanism for operating the stripper to an inoperative position.

6. In a forging press, the combination of a pot adapted to hold a charge of ductile metal, a tool for forging the metal in the pot, fluid pressure operated mechanism for operating the tool longitudinally, a stripper for separating the forging from the tool comprising a notched bar, and an arm to which the bar is adjustably connected, means for holding the stripper normally in operative position, and means operated by said mechanism for operating the stripper to an inoperative position.

7. In a forging press, the combination of a pot adapted to hold a charge of ductile metal, a tool for forging the metal in the pot, fluid pressure operated mechanism for operating the tool longitudinally, a stripper for separating the forging from the tool, a weight for holding the stripper normally in operative position, and means operated by said mechanism for operating the stripper to an inoperative position.

8. In a forging press, the combination of a pot adapted to hold a charge of ductile metal, a tool for forging the metal in the pot, fluid pressure operated mechanism for operating the tool longitudinally, a stripper for separating the forging from the tool, a weight for holding the stripper in operative position, and a flexible connection operated by said pressure mechanism for operating the stripper to an inoperative position.

EUGENE L. McGARY.