M. P. JACOMINI.

APPARATUS FOR EXERTING PRESSURES AND IMPACTS, AND METHOD OF OPERATING THE SAME.

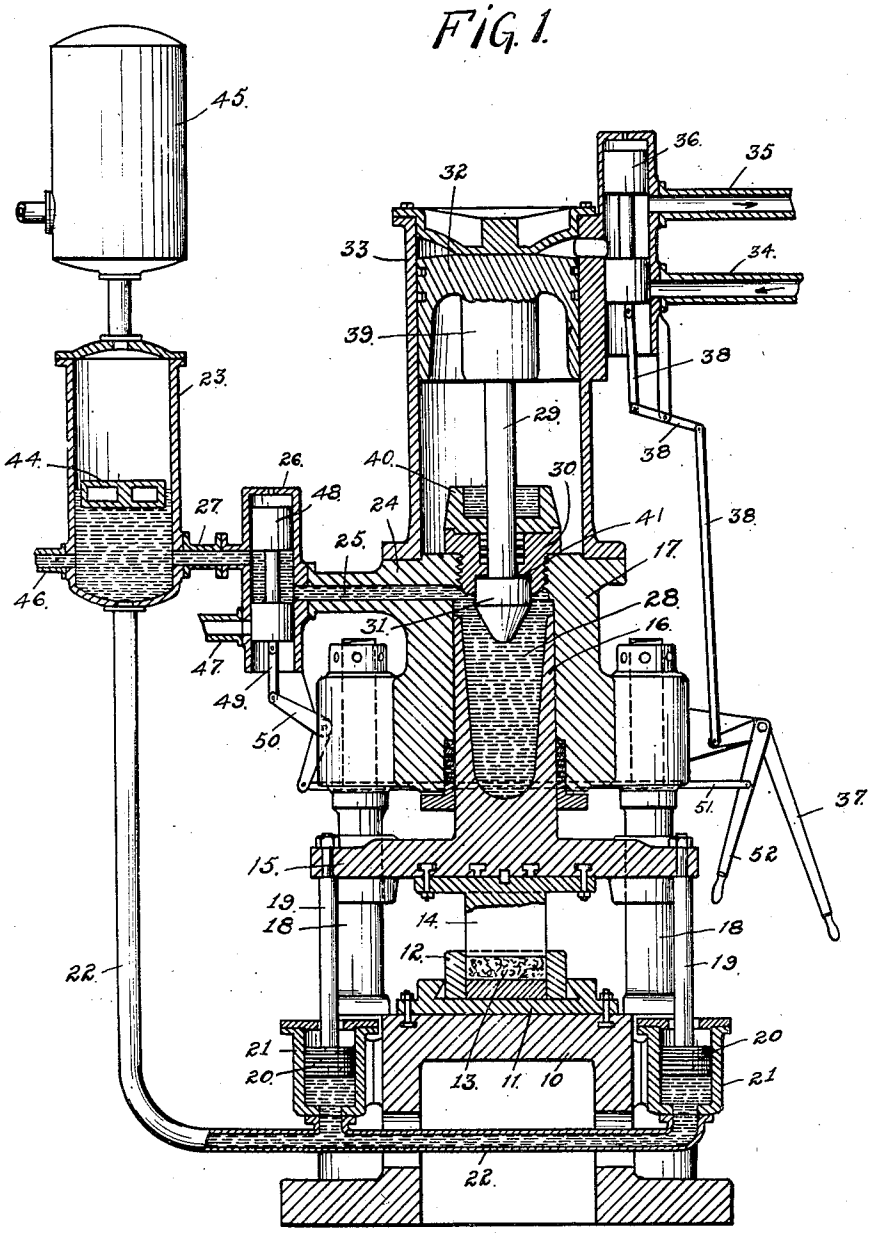
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1,230,486.

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3 SHEETS—SHEET 1.

FIG. 1.



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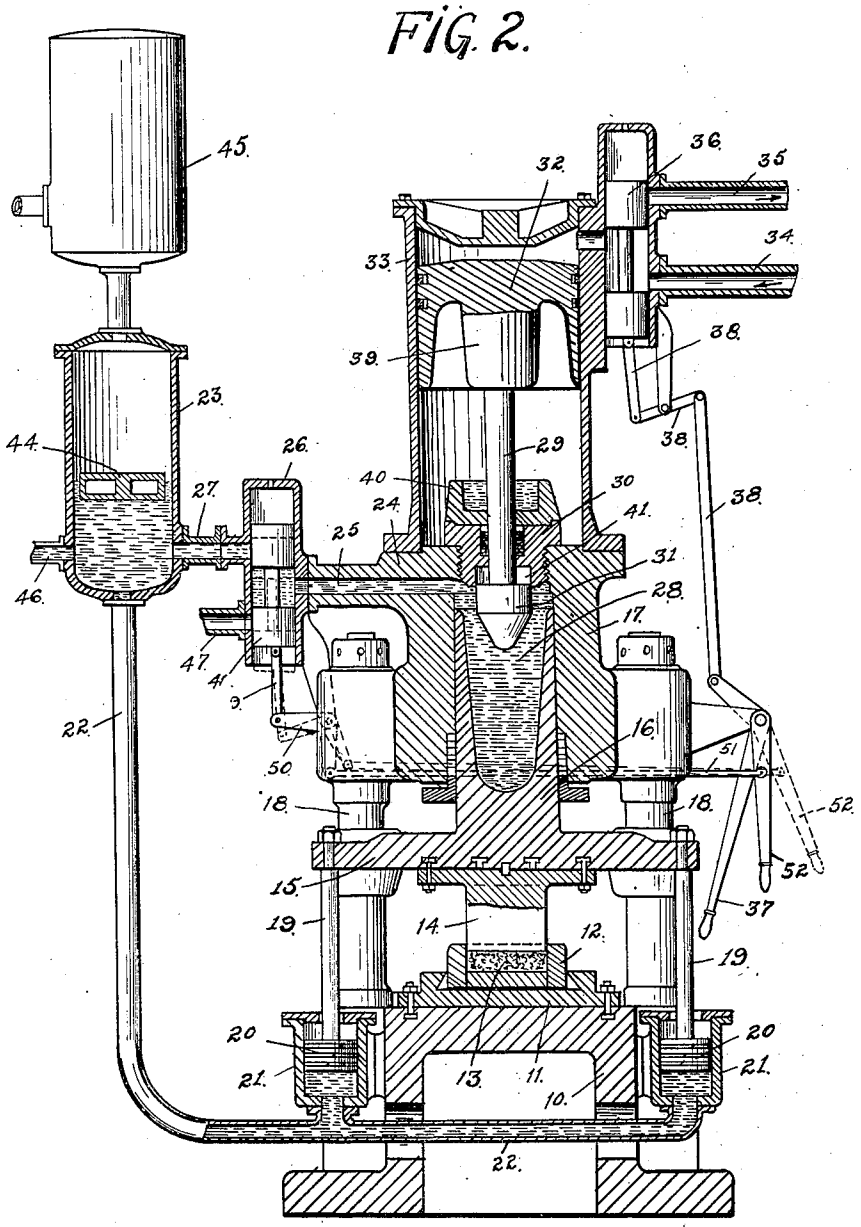
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3 SHEETS—SHEET 2.

FIG. 2.



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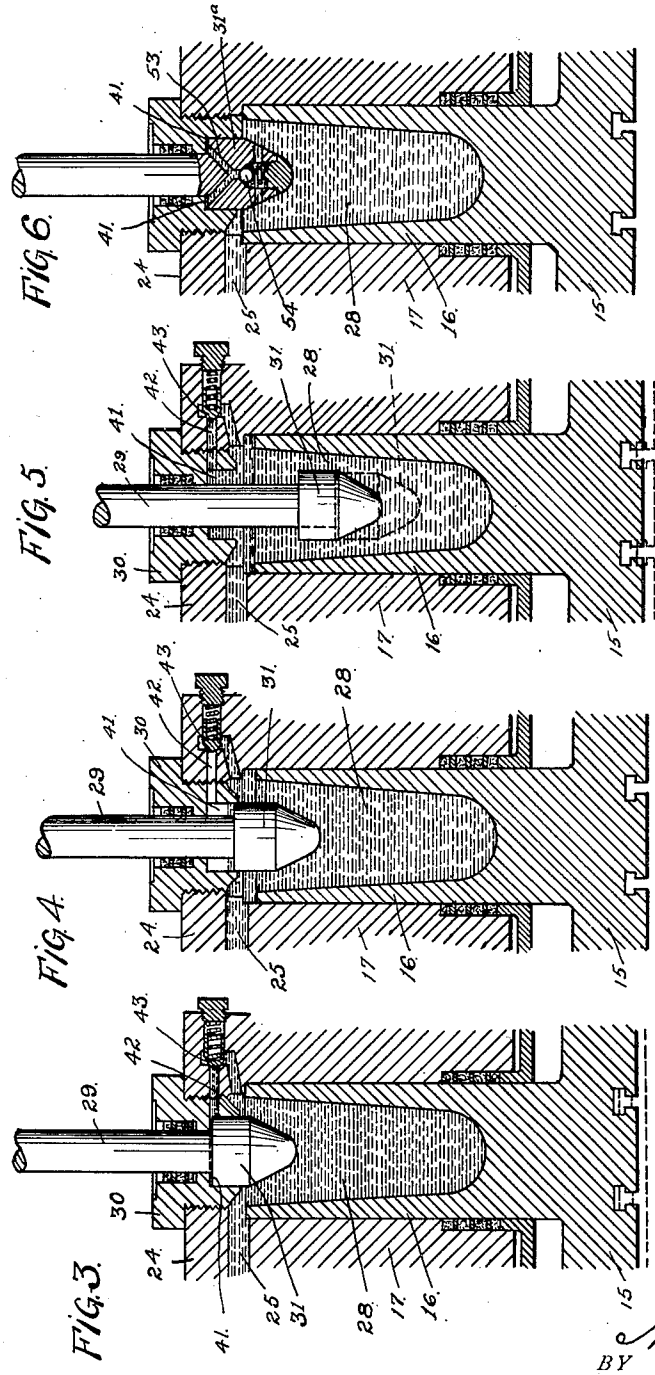
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3 SHEETS—SHEET 3.



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APPARATUS FOR EXERTING PRESSURES AND IMPACTS, AND METHOD OF OPERATING THE SAME.

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To all whom it may concern:

Be it known that I, MARIUS P. JACOMINI, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Exerting Pressures and Impacts, and Methods of Operating the Same, of which the following is a specification.

My invention relates to improvements in apparatus for intermittently exerting pressure or applying impacts to an article or material for the purpose of forging, molding, compressing, briqueting, or otherwise treating said article or material; and one of the primary objects of the invention is to provide for the accomplishment of such operations more effectively and more economically than has been possible with the apparatuses heretofore used.

The invention is illustrated as applied to the improvement of a briqueting machine operated by steam pressure in which the impulse of the steam driven element is transmitted with multiplied power to the element operating on the work through a substantially non-compressible fluid medium; and it is one of the specific objects of the invention to provide a machine for briqueting or like purposes with novel means for intensifying the power strokes, that is to say, providing an improvement for machines of this sort whereby the material will be compressed, at each stroke of the machine, by a rather gradual pressure which is intensified and magnified during the latter part of the stroke into a quick, sharp impulse of great power. The invention, in its broader phases, is not confined, however, to the improvement of machines for doing this particular kind of work as will be evident from the following specification and the claims appended thereto.

The invention contemplates transmitting the power exerted against the element, primarily moved, the steam driven element for example, which, for convenience, will be called the power member, to the pressure exerting or striking element which, for the purpose of claiming the invention generically, will be called the impact element, through a pressure transmitting connection, for example, a body of confined, substantially non-compressible liquid such as oil, the resistance of which is suddenly decreased and then brought back to normal during each power stroke, by suddenly increasing the capacity of the containing means, for instance, whereby the power member acquires a momentum, or stored energy, which is imparted to the impact element so that the pressure exerted by the latter upon the work is intensified.

The preferred form of apparatus embodying my invention contemplates maintaining for certain purposes a constant air pressure on a body of the pressure transmitting fluid contained in a storage vessel; and in this connection a subsidiary object of the invention is to provide means for preventing the compressed air or other compressible fluid used for this purpose from becoming mixed with the power transmitting fluid. The presence of air bubbles in the oil or other pressure transmitting fluid has a tendency to make the operation of the machine erratic.

The invention consists in the novel constructions, arrangements and devices to be hereinafter described and claimed, for carrying out the above stated objects and such other objects as will appear from the following specification. The invention consists further in the improved method, to be hereinafter described, of operating a press or other apparatus for producing intermittent pressures or impacts.

The invention is illustrated in the accompanying drawings wherein—

Figure 1 is a vertical sectional view of a briqueting press constructed in accordance with the principles of my invention.

Fig. 2 is a view similar to Fig. 1 showing the movable parts of the apparatus in different positions from the positions which they assume in Fig. 1.

Figs. 3, 4 and 5 are fragmentary sectional views of the ram, plunger and associated parts in the apparatus shown as a whole in Fig. 1; these figures illustrating the parts of

the machine in the different relative positions which they assume during different portions of the stroke; and

Fig. 6 is a view, similar to Fig. 3, showing a modified construction.

Like characters of reference designate like parts in the several figures of the drawings.

Referring to the drawings, 10 designates the base of a machine supporting an anvil 11 on which is arranged a die member 12 containing the material 13 which is to be operated on by the machine. If desired any suitable means may be employed for automatically placing successive batches of material in proper position to be operated upon. The movable or upper die member 14 is secured to a cross head 15 which forms part of the ram 16, the ram being in the form of a hollow piston slidably arranged in a cylinder 17 and the ram and its cross head being slidable upon pedestals 18, the upper portions of which support cylinder 17. The cross head has secured thereto the upper ends of piston rods 19 which are provided with pistons 20 operating in lifting cylinders 21 on the base of the machine. The cylinders 21 are supplied with a motive fluid, for example oil, through pipe 22 which is connected with a supply vessel 23.

The cylinder 17 has a projection 24 at one side thereof formed with a duct 25 connected through a valve casing 26 and pipe 27 with the supply vessel 23.

The hydraulic plunger or power member of the machine consists, in the form of the invention herein shown, of a stem 29 which passes through a gland 30 in the top of the cylinder 17 and is provided with an enlarged head 31, the lower end of which is preferably conical. The plunger is secured to a piston 32 arranged in a steam cylinder 33 which receives steam from steam supply pipe 34 and exhausts through pipe 35. The control of the steam supply to the cylinder 33 may be either manual or automatic and any suitable valve mechanism may be used for this purpose. I have shown a double piston valve 36 operated by a bell crank lever 37 and link mechanism 38. An emergency cushion device is provided between the steam piston 32 and the top of the hydraulic cylinder consisting of a boss 39 on the under side of the steam piston and a cylinder 40 on the gland 30 which is filled with oil. Under normal conditions the throw of the plunger is not great enough to move the boss into the cylinder 40.

The gland 30 is formed on its under side with a recess 41 of substantial depth into which the head 31 of the hydraulic plunger is adapted to fit quite accurately. 42 (Figs. 3, 4 and 5) is a by-pass leading from this recess into the pressure fluid space 28 within the ram. 43 is a check valve arranged to permit the pressure fluid to flow from the recess 41 into the space 28 but which prevents movement of the pressure fluid in the opposite direction.

44 is a float separator arranged in the supply vessel 23. Compressed air, steam or other fluid under pressure is introduced into the upper end of vessel 23 from a vessel 45. It is the intention that this fluid exert a relatively constant pressure upon the upper side of piston float 44 and upon the body of pressure transmitting fluid, oil, for example, below the float. 46 is a pipe conveying oil under pressure from a pump (not shown) to the vessel 23. 47 is an oil outlet pipe leading from valve casing 26, and 48 a double piston valve in casing 26 which controls the flow through pipes 25, 27 and 47. In the drawings the valve is connected by a link 49 to a bell crank 50 which in turn is connected by link 51 with a lever 52. It would obviously be quite possible to control the valve 48 and also valve 36 automatically instead of manually as shown. In fact all of the control valves of the machine might be mechanically operated in synchronism with each other.

Operation: Fig. 1 shows the parts of the apparatus in the positions which they assume at the beginning of the power stroke of the machine. The steam cylinder 33 is open to the exhaust pipe 35. The supply pipe 34 is closed by valve 36. The operator has already, by manipulation of lever 52, moved the valve 48 so that the pressure fluid in the vessel 23 has been forced by the pump (not shown) which is connected with pipe 46 through pipe 27, valve casing 26 and duct 25 into the space 28 within the ram, with the result that the ram has been forced downwardly, bringing the die 14 in contact with the work 13. The initial position of the ram, that is, the position which it takes before it is moved against the work as just described, is shown in the full lines in Fig. 3. The dotted lines in Fig. 3 show the position of the ram when moved against the work. The introduction of fluid under pressure into the cylinder and ram also serve to raise the plunger 31 and steam piston to the initial position shown in Fig. 1.

After the ram has been given its initial movement the operator shifts valve 48 to the position shown in Fig. 2, in which the inlet pipe 27 and also the exhaust pipe 47 are closed, and by manipulation of lever 37 moves valve 36 to the Fig. 2 position putting the steam cylinder 33 in communication with the steam supply pipe 34 and closing the exhaust pipe 35. The steam enters the cylinder 33 and forces the plunger 31 into the confined body of pressure transmitting fluid in the ram and cylinder. The ram is thereby caused to exert further pressure against the work. This pressure steadily increases until the head 31 of the cylinder clears the

chamber 41. When this occurs the capacity of the containing means for the pressure transmitting fluid is suddenly increased so that the resistance of the fluid to the plunger is momentarily reduced, practically destroyed, with the result that the plunger makes a sudden jump forward, say to the full line position shown in Fig. 5. By the time the plunger has reached this position it has displaced a volume of the pressure transmitting fluid equal to the volumetric contents of chamber 41 so that the pressure in the confined space is reëstablished. By a further movement of the plunger, say to the dotted line position of Fig. 5, which movement is relatively quick, the energy stored in the plunger due to its acquired velocity during the time that the pressure against it was released, is imparted to the ram which transmits the same in the form of a sharp, quick impulse to the work. This intensification of the stroke of the ram gives the machine very much increased efficiency.

At the end of the down stroke the operator moves the lever 52 to the dotted line position of Fig. 2. This shifts valve 48 so as to open the oil exhaust pipe 47 without uncovering the oil inlet 27. Pressure above the ram being relieved in this manner, the ram is raised to its initial position by the lifting pistons 20. The combined area of these pistons is less than the area of the portion of the ram subjected to the pressure transmitting fluid so that on the down stroke the lifting pressure is overcome.

On the return stroke of the ram the fluid trapped in recess 41 is forced back into the space within the ram through by-pass 42.

In Fig. 6 the general arrangement is the same as that shown in the previous figure except that the by-pass 53 and check valve 54 are in the head 31^a of the plunger instead of being arranged in the cylinder. The check valve, in each case, prevents the pressure transmitting fluid from being forced into the chamber 41 through the by-pass on the power stroke of the machine.

Obviously the momentary diminution or release of pressure exerted upon and transmitted by the pressure transmitting fluid might be accomplished in other ways than those shown and described. For example, the pressure might be released by allowing a certain amount of the fluid to exhaust from the cylinder at the proper moment during the stroke of the plunger.

The piston float device 44 prevents the mixing of the air or other compressible gas in the upper part of vessel 23 with the pressure transmitting fluid in the lower part of the vessel. In machinery of this type air bubbles in the pressure transmitting fluid make the operation erratic and unreliable so that it is quite important that there should be no splashing of the power transmitting fluid which would result in trapping air bubbles therein.

While I have described my invention in certain preferred embodiments, it will be apparent, as suggested in the foregoing description, that other means might be employed for accomplishing the results which my invention seeks to accomplish. While the invention is shown in connection with a power press, specifically a briqueting machine, the same principles of operation might be utilized in connection with other types of machinery for producing intermittent pressures or striking impulses upon material or articles of one sort or another. A manual control of the apparatus has been shown for the purpose of simplifying the drawings and description as much as possible. My invention contemplates the possibility of using any of the well known means employed in apparatus of this general type for an automatic and synchronized control of the various working parts of the apparatus. For these and other similar reasons I do not wish to be understood as limiting the invention to the particular constructions, arrangements and devices shown and described except so far as certain of the claims are specifically so limited.

I claim:

1. The method of intensifying the power stroke of an apparatus for exerting pressures or producing striking impulses which consists in providing a pressure transmitting connection between the power member and the impact member of such apparatus and momentarily diminishing the resistance of said connection so that the power member acquires energy which is imparted to the impact member.

2. The method of intensifying the power stroke of apparatus for exerting pressures or producing striking impulses which consists in providing a confined body of pressure transmitting fluid between the power member and the impact member of such apparatus and momentarily reducing the pressure of said fluid against the impact member during the stroke of the power member so that the latter acquires energy which is subsequently imparted to the former.

3. The method of intensifying the power stroke of apparatus for exerting pressures or producing striking impulses which consists in providing a confined body of pressure transmitting fluid between the power member and the impact member of said apparatus and suddenly increasing the capacity of the confining means for the pressure transmitting fluid so that the power member will acquire energy which is subsequently transmitted to the impact member.

4. The method of intensifying the latter portion of the power stroke of a hydraulic

press which consists in increasing the capacity of the confining means for the pressure transmitting fluid after pressure has been exerted against the work so that the power member of the press acquires energy which with its further movement into the pressure transmitting fluid is imparted to the pressing member of the press.

5. In apparatus of the character described, the combination of an impact member, a power member and a pressure transmitting connection between the same provided with means for substantially reducing the resistance of said connection during a portion of the power stroke of the apparatus.

6. In apparatus of the character described, the combination of an impact member, a power member and a pressure transmitting connection between the same provided with means for substantially reducing the resistance of said connection during the power stroke of said power member and after the impact member has been caused to exert a pressure against the work.

7. In apparatus of the character described, the combination of an impact member, a power member and a pressure transmitting connection between the same provided with automatically operating means for substantially reducing the resistance of said connection during a portion of the power stroke of the apparatus.

8. In apparatus of the character described, the combination of an impact member, a power member and a pressure transmitting connection between the same provided with automatically operated means for substantially reducing the resistance of said connection during the power stroke of said power member and after the impact member has been caused to exert a pressure against the work.

9. In apparatus of the character described, the combination of a reciprocating impact member, a reciprocating power member and a pressure transmitting connection between the same provided with means for substantially reducing the resistance of said connection during a portion of the power stroke of the apparatus.

10. In apparatus of the character described, the combination of a reciprocating impact member, a reciprocating power member and a pressure transmitting connection between the same provided with means for substantially reducing the resistance of said connection during the power stroke of said power member and after the impact member has been caused to exert a pressure against the work.

11. In apparatus of the character described, the combination of a ram, a plunger, containing means for a pressure transmitting fluid interposed between said plunger and ram, the capacity of which is enlarged during the power stroke of the apparatus.

12. In apparatus of the character described, the combination of an impact member, a power member, containing means for a pressure transmitting fluid interposed between said power member and impact member, the capacity of which is enlarged during the power stroke of said apparatus.

13. In apparatus of the character described, the combination of a ram, a plunger and containing means for a pressure transmitting fluid interposed between said plunger and ram, the capacity of which is enlarged during the power stroke of the plunger and after the ram has been caused to exert a pressure upon the work being operated upon.

14. In apparatus of the character described, the combination of an impact member, a power member and containing means for a pressure transmitting fluid interposed between said power member and impact member, the capacity of which is enlarged during the power stroke of said power member and after the impact member has been caused to exert a pressure against the work operated upon.

15. In apparatus of the character described, the combination of a ram, a power driven plunger, containing means for a pressure transmitting fluid interposed between the plunger and the ram, a supplemental chamber, and means for putting said supplemental chamber in communication with said containing means during the power stroke of the apparatus.

16. In apparatus of the character described, the combination of a ram, a power driven plunger, containing means for a pressure transmitting fluid interposed between the plunger and the ram, a supplemental chamber, and means operated by the movement of said plunger for putting said supplemental chamber in communication with said containing means during the power stroke of the apparatus.

17. In apparatus of the character described, the combination of an impact member, a power member, and containing means for a pressure transmitting fluid interposed between said power member and impact member; said apparatus comprising means for suddenly reducing and thereafter reestablishing the pressure of the fluid on said power member during the working stroke of the apparatus.

18. In apparatus of the character described, the combination of an impact member, a power member and containing means for a pressure transmitting fluid interposed between said power member and impact member; said apparatus comprising means for suddenly reducing and thereafter reestablishing the pressure of the fluid on said

power member during the power stroke of the power member and after the impact member has been caused to exert a pressure against the work.

19. In apparatus of the character described, the combination of a ram, a power driven plunger provided with an enlarged head, and a hydraulic cylinder containing pressure transmitting fluid interposed between the plunger and ram and formed with a recess in which the enlarged head of the plunger fits when the plunger is in its initial position.

20. In apparatus of the character described, the combination of a ram, a power driven plunger provided with an enlarged head, a hydraulic cylinder containing pressure transmitting fluid interposed between the plunger and ram and formed with a recess in which the enlarged head of the plunger fits when the plunger is in its initial position, and means constituting a by-pass between the recess and the space within the body of the cylinder which is provided with a check valve adapted to permit the outflow of fluid from the recess while preventing movement of the fluid in the opposite direction.

21. In apparatus of the character described, the combination of a ram, a power driven plunger provided with an enlarged head, a hydraulic cylinder containing pressure transmitting fluid interposed between the plunger and ram and formed with a recess in which the enlarged head of the plunger fits when the plunger is in its initial position, and means for permitting the flow of fluid from the recess into the main portion of the cylinder when the enlargement on the plunger enters the recess on the back stroke while preventing a reverse movement of the fluid on the working stroke of the plunger.

22. In apparatus of the character described, the combination of alined hydraulic and steam cylinders, a ram in said hydraulic cylinder, a plunger which operates in said hydraulic cylinder, a piston in said steam cylinder, a rod connecting said piston and plunger, means for exerting pressure against said ram to normally hold the same away from the work, and means constituting a supplemental chamber which is put into communication with the hydraulic cylinder during the power stroke of said plunger and ram.

23. In apparatus of the character described, the combination of a power member, an impact member and a pressure transmitting connection between the same comprising means whereby the velocity of the power member is momentarily accelerated so that it acquires energy which is subsequently imparted to the impact member.

24. In apparatus of the character described, the combination of a power member, an impact member and a pressure transmitting connection between the same comprising a pressure transmitting fluid, and means whereby the pressure against the fluid is momentarily released and thereafter reëstablished during the power stroke of the power member.

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