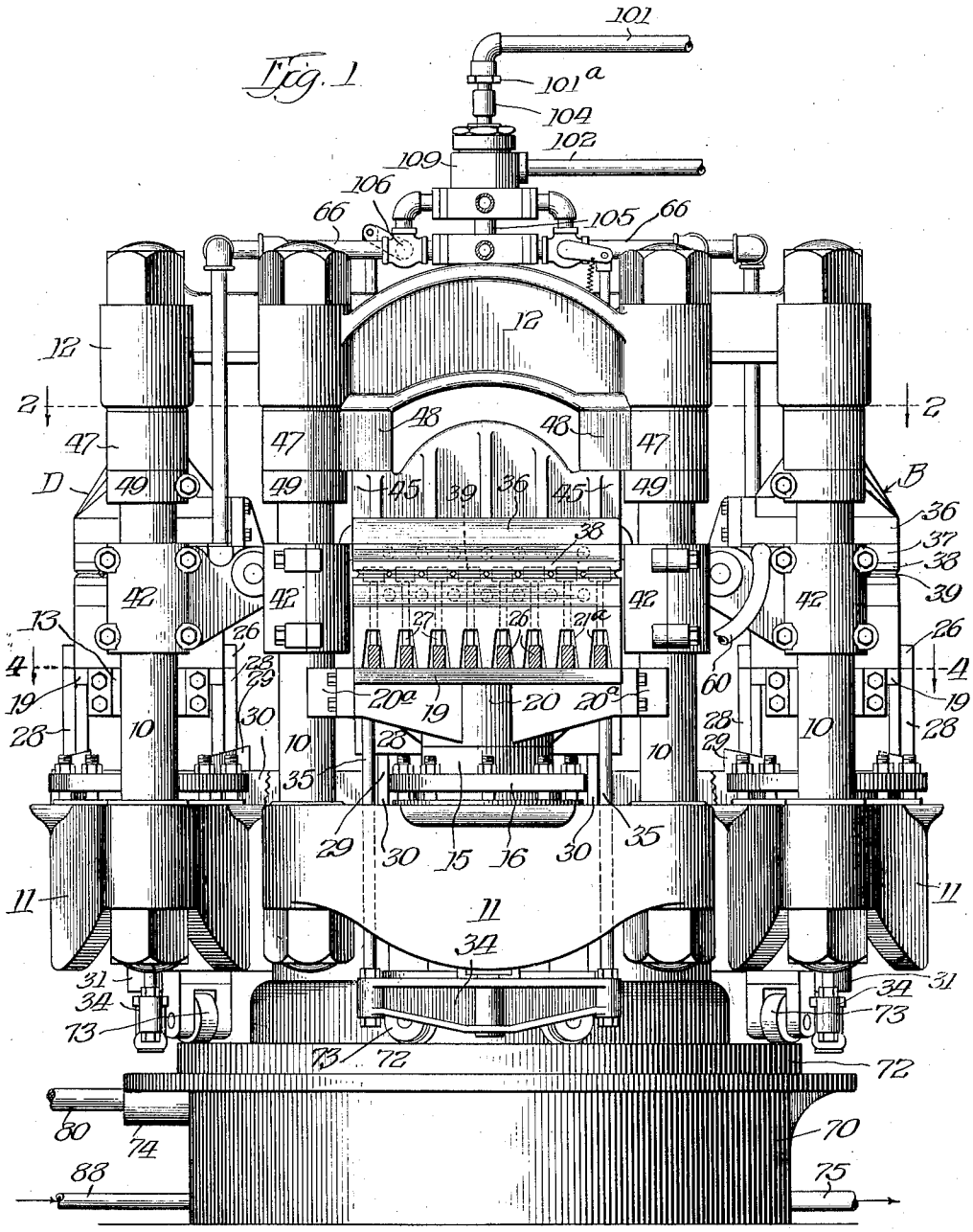
Nov. 24, 1925. 1,562,573

A. J. MATTER.

ROTARY HYDRAULIC PRESS

Filed Dec. 2, 1920 6 Sheets-Sheet 1

Fig. 1



Witness:
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1,562,573

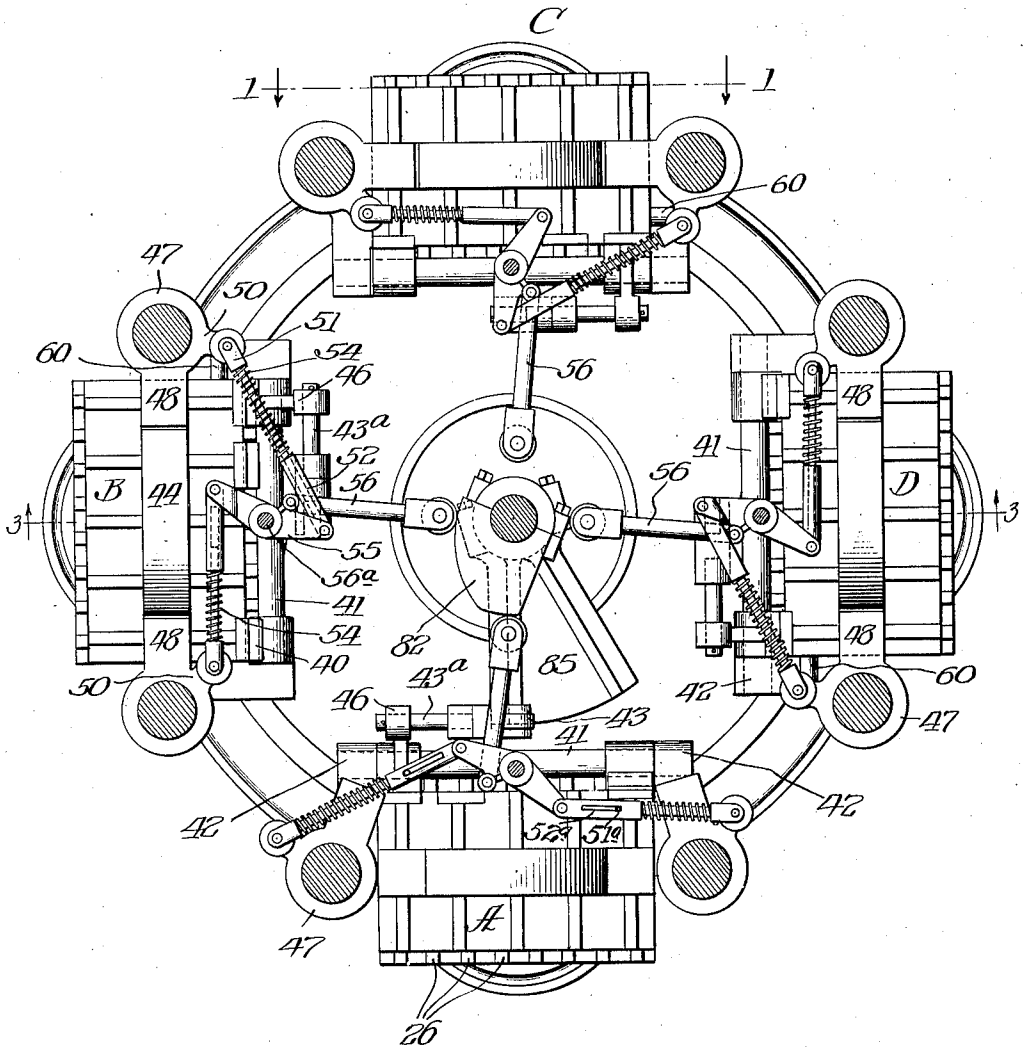
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6 Sheets-Sheet 2

Fig. 2



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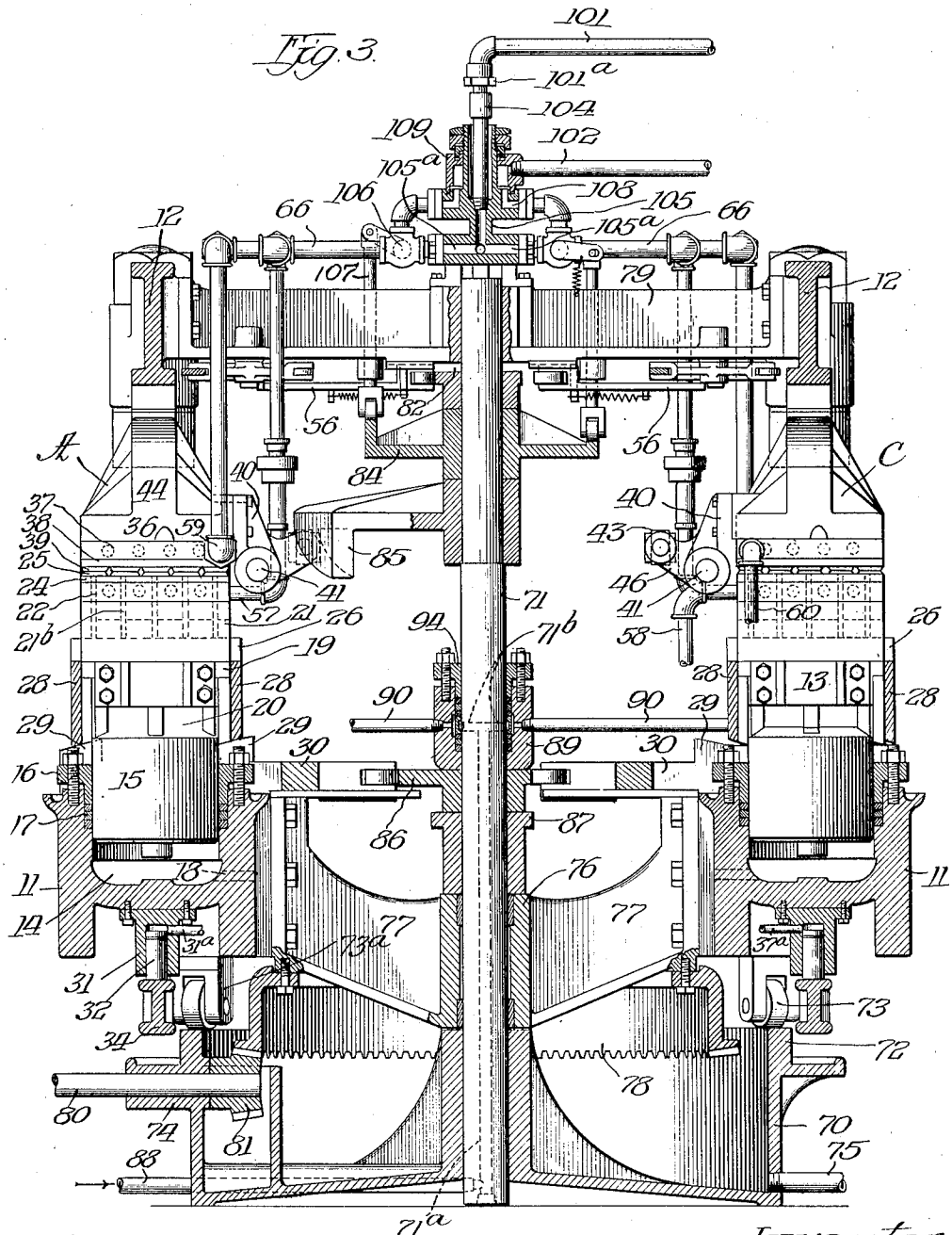
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Fig. 3.



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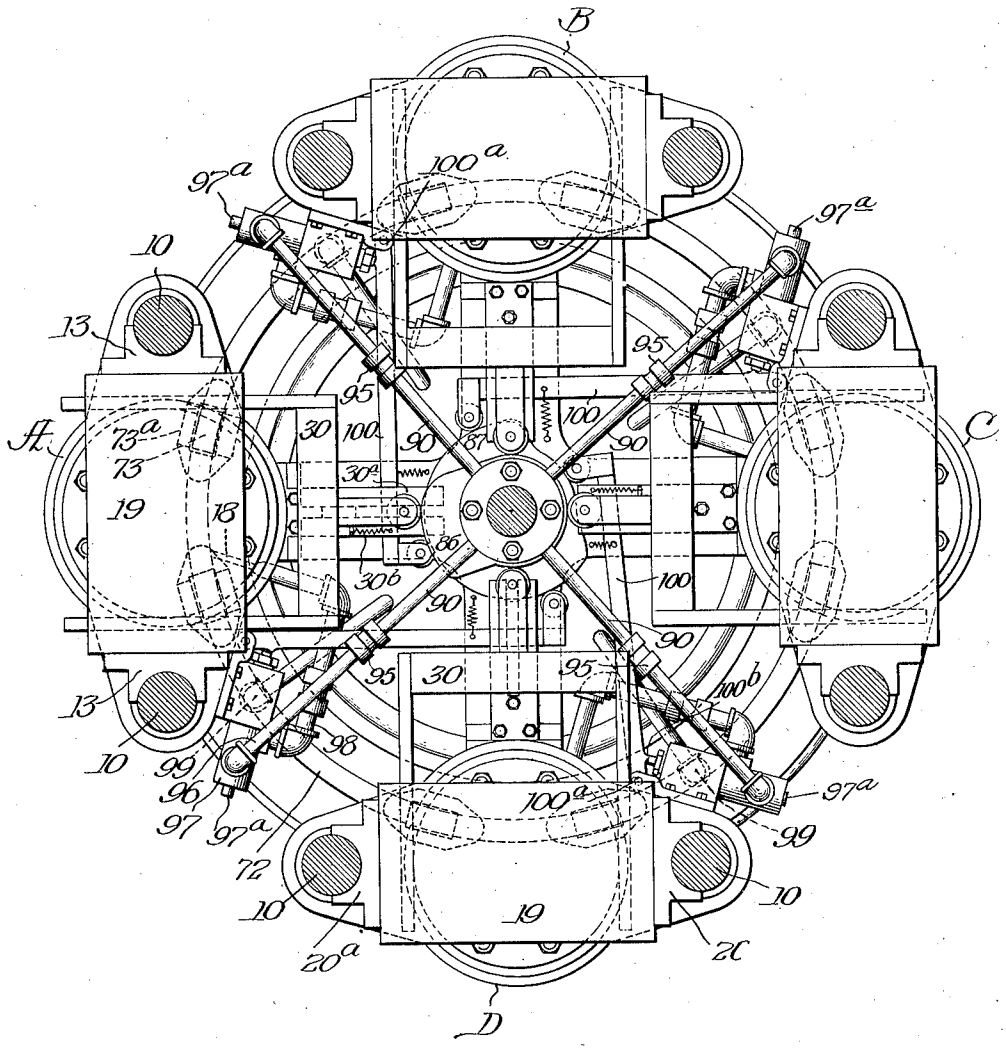
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Fig. 4



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Fig. 5.

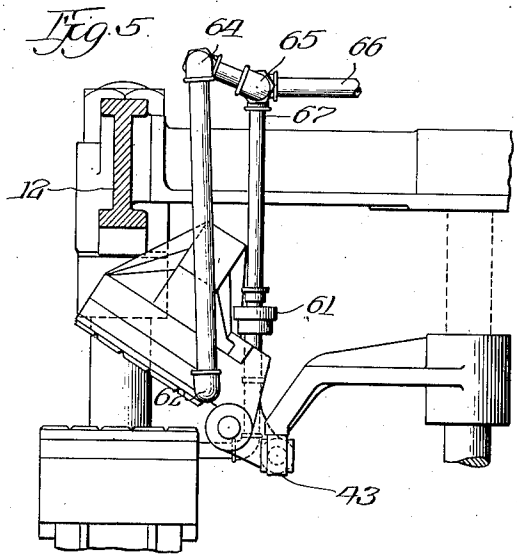


Fig. 7.

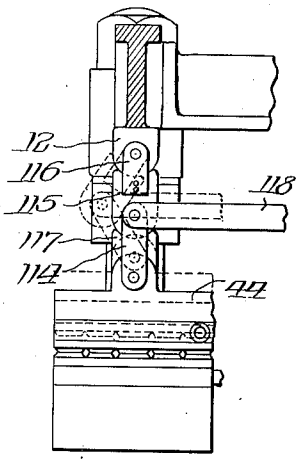


Fig. 8.

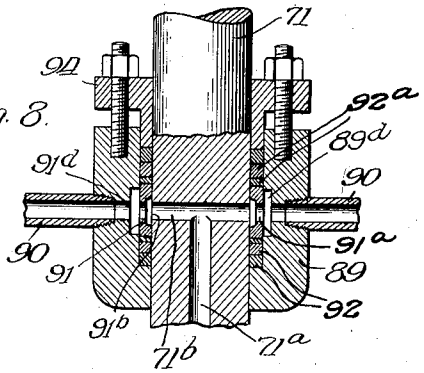


Fig. 6.

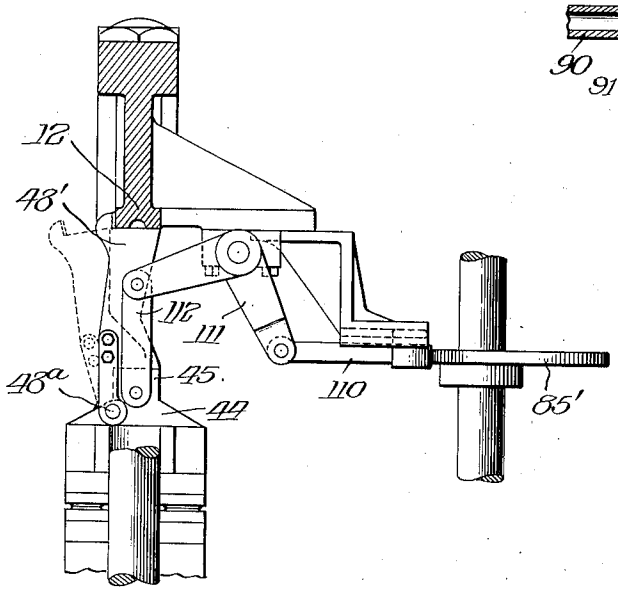
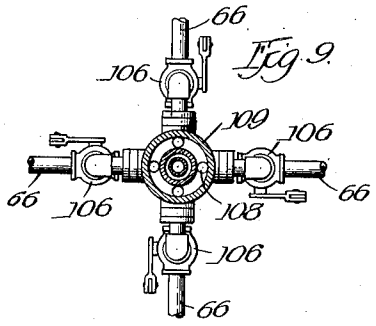


Fig. 9.



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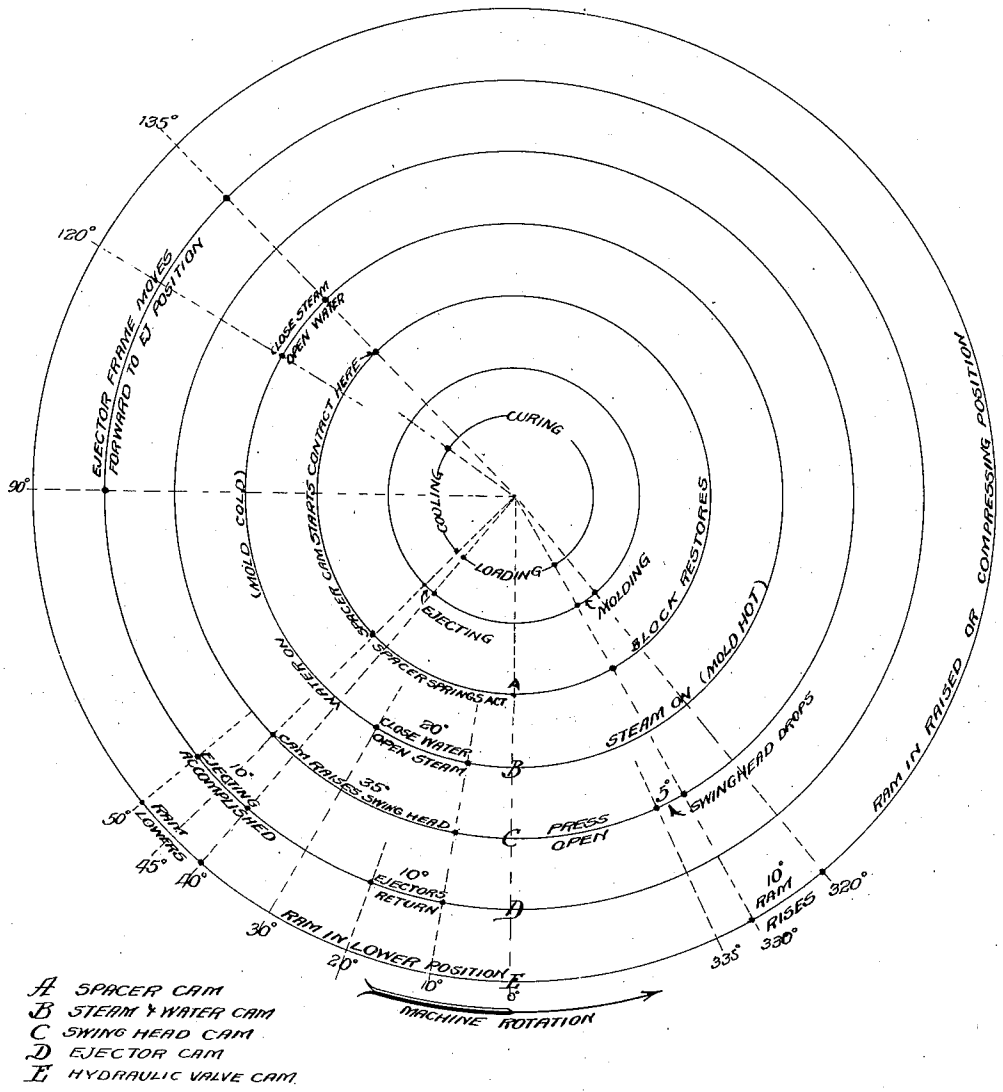
Nov. 24, 1925. 1,562,573

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ROTARY HYDRAULIC PRESS

Filed Dec. 2, 1920 6 Sheets-Sheet 6

Fig. 10.



Witness:

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Patented Nov. 24, 1925. 1,562,573

UNITED STATES PATENT OFFICE.

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ROTARY HYDRAULIC PRESS.

Application filed December 2, 1920. Serial No. 427,674.

To all whom it may concern:

Be it known that I, ALBERT J. MATTER, 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 a Rotary Hydraulic Press, of which the following is a specification.

This invention relates generally to presses, and more particularly to improvements in construction and organization of hydraulic presses and the like, and to composite or multiple presses wherein a plurality of press units are mechanically associated and articulated for operation in a coordinated cycle.

A general purpose of the invention is the provision of a press construction adapted particularly for the utilization of extremely high pressures, and susceptible of rapid and efficient operation by such pressures, due to the fact that it both functions with a very short power stroke, and enables a very quick opening and closing of the die sections for the disposal and removal of the material operated upon.

Another particular object of the invention is the provision of a press construction for operation by extremely high pressures, and effective to accomplish curing by heat or otherwise of the material operated upon during the pressing operation, and cooling or setting of the same also during the pressing operation.

Another object of the invention is the provision of a press designed for operation under extremely high pressures and affording quickly operable means for ejecting pressed articles from the dies.

Another object of the invention is the provision of such a press which lends itself readily to interchanging of dies.

Still another and very important object of the invention is the provision of a press construction which is adapted particularly for combination with other similar presses for coordinated operation, whereby greater efficiency may be secured than in the operation of several presses independently.

A still further object of the invention is the provision of a multiple or composite press wherein a plurality of press units are operated in common by an operating and controlling mechanism effective to accomplish proper timing of the several operations of each press unit and coordination of the several operations of one press unit relative to operations of other press units.

Another object is the provision of such a press mechanism which is effective to control absolutely and automatically the timing of the different operations, such as the compressing operation, the curing operation, the setting operation, the die opening and closing operations, the product ejecting operation, and the like.

Yet another object of the invention is the provision of a multiple press mechanism which may be operated at high efficiency with a minimum of labor and attention.

Still other objects of the invention include the provision of an improved frame construction especially designed to support extremely high pressures; an improved press opening and closing mechanism; improved distributing connections for handling fluid under extremely high pressure; an improved automatic control and distributing mechanism for handling different circulating fluids in conjunction; an improved valve operating mechanism; and various other improved mechanism and operating parts and novel and advantageous features of construction in appliances of the class described, which will be pointed out hereinafter, illustrated in the accompanying drawings, indicated in the appended claims, or apparent upon an understanding of the invention.

While this specification, and the drawings forming a part thereof, are based upon an illustrative structure embodying the invention and illustrating a preferred structure of both my improved press and my improved multiple press mechanism, it is obvious that the means particularly shown do not constitute the only form or fashion in which the invention may be embodied or practiced, and, therefore, it is not my intention, in making this disclosure, to signify thereby a limitation of what I claim as my invention in any degree short of its true and most comprehensive scope. And while I refer hereinbefore and hereinafter to my invention in the singular number, it is to be understood that such designation is intended to apply to any of the several mechanisms or inventive features which I claim.

While my invention thus includes several features, I have shown them in the illustrative embodiment associated in a unitary machine, of which Fig. 1 is a front elevation of

a multiple press with certain parts in section on the line 1—1 of Fig. 2;

Fig. 2 is a cross section substantially on line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation substantially on line 3—3 of Fig. 2;

Fig. 4 is a section substantially on line 4—4 of Fig. 1;

Fig. 5 is a detail of a press in open position and illustrating the connections for circulating fluid;

Figs. 6 and 7 illustrate modified forms of press opening and closing mechanism;

Fig. 8 is a vertical section of a connection for pressure fluid distribution;

Fig. 9 is a horizontal section of the fluid circulating connections;

Fig. 10 is a diagram illustrating the cycle of operations of the machine.

By reference to these drawings, like parts in which are designated by like characters, I will describe first the construction of my improved press, forming an element of the assembly illustrated, and then describe the multiple press mechanism. In the said drawings the characters A, B, C and D designate respectively press units of similar structure and operation, each of said units includes a frame formed of lateral column members 10, a base frame member 11 and a head frame member 12, all designed to withstand the intended pressure, assembled in suitable fashion, and supported in any convenient manner. As most clearly illustrated at the left in Fig. 3, the base frame member 11 is cored to provide a pressure chamber, designated by the numeral 14, in which is slidably mounted the press ram 15 which is guided on a gland 16 also utilized to confine the pressure packing 17. The base frame is tapped to provide an inlet 18 for the pressure cylinder. Mounted on the ram, and movable thereby, is a lower press plate 19 having a flanged base 20, and guiding cooperation with columns 10 by means of end guides 13, and supported on press plate 19 is a grid or bridge member 21. Supported on the bridge member is a steam plate 22, which in turn supports the die plate 24 carrying the removable lower dies 25. The bridge member 21 is provided with transverse channels 21^a which accommodate transversely extending ejector pin supports 26 carried on the base plate 19, and said bridge member 21 is provided with series of aligned ejector pin channels 21^b communicating with the channels 21^a and affording mounting places and guides for ejector pins 27 extending through the die members severally. The steam plate 22 and die plate 24 are likewise pierced with channels arranged to register with the channels 21^b for accommodation of the ejector pins, the upper ends of which constitute parts of the lower matrix faces of the lower die members 25. The extremities of the pin supports 26 extend beyond the edges of the base plate 29 for engagement with carrying members 28 arranged in front and rear of the base plate 19 and supported so that the latter may move relative thereto upon movement of the ram 15. The elevation of the carrying members 28 is controlled by adjustable wedge members 29 carried on shifting frames 30, which slide on the base frame member 11 at opposite sides of the gland 16. Supported on the base frame 11 opposite the pressure cylinder 18 is a pull-back cylinder 31 in which operates the pull-back ram 32, pressure fluid being introduced to the cylinder through an inlet 31^a. Connected to the ram 32 is a pull-back yoke 34 which is tied to the base plate 19 by the pull-back rods 35.

The foregoing constitute the pressure delivery and the ejecting mechanism, the operation of which is as follows:

Upon introduction of pressure fluid into the cylinder 14, the cylinder is raised to the position illustrated in Fig. 3, which lifts the base plate 19 and parts carried thereby so that the die members 25 are pressed against cooperating die members supported as hereinafter described. When the ram and base plate 19 are in this position, which I will term the compressing position, shifting frame 30 is moved to elevate carrying members 28. At the end of the compression period, pressure is relieved from cylinder 18 and is introduced into pull-back cylinder 31, where it is effective to move the pull-back ram 32 downwardly, which, through the connection of the yoke 34 and rods 35 with base plate 19, draws the latter downward so that the parts carried thereby, including lower die members 25, are moved out of cooperation with the upper press portions. The carriers 28 being maintained in their elevated positions by wedges 29, however, they will engage the projecting ends of ejector pin supports 26, and serve to hold the ejector pins 27 elevated while the press portions and die members move downwardly, said pins sliding longitudinally in the slots 21^b and ejecting the pressed articles from the lower die members 25. Shifting frame 30 and wedges 29 then being retracted, pin supports 26 are lowered to base plate 19, effecting the retraction of ejector pins 27 to permit insertion of new charges into the dies.

The foregoing constitute the lower press assembly. The upper press assembly includes a head plate 36 upon which is mounted a steam plate 37 above a die plate 38 carrying upper removable die members 39. Said members are conjointly supported for swinging movement relative to the frame by hinge brackets 40 hinged at 41 on collar brackets 42 mounted on the columns 10. The upper press plate 36 carries a flanged arch

portion 44 and lateral abutments 45, which clear the head frame 12 and columns 10 sufficiently to permit the upper press assembly to swing rearwardly away from the lower press assembly to provide a liberal work space between the upper and lower die plates. Any suitable means may be provided for swinging the head plate 36 and its carried parts, which operating mechanism may include a lever arm 46 forming a mounting for a rotatable spindle carrying a roller 43. Rotatably mounted on columns 10 by means of collars 47 are spacer blocks 48 movable into abutting relationship with the head frame member 12 and the abutments 45 of the upper press plate. The collars 47 have a limited amount of play longitudinally of the columns 10, and are retained by stop collars 49, so that spacer blocks 48 will not bind between head frame 12 and abutments 45 when the latter are not under upward pressure. Spacing blocks 48 are adapted to be swung rearwardly from between the abutments 45 and the head frame 12 by suitable mechanism best illustrated in Fig. 2, wherein it will be seen that the collars 47 are provided with bell crank arms 50 affording pivotal mountings for thrust rods 51, which are guided in sleeve members 52. Coiled springs 54 are mounted on the rods 51 so as to be compressed between the ends of sleeves 52 and shoulders on said rods. Sleeves 52 are pivotally connected with the arms of a toggle lever 55 rotatably mounted on a bearing 56[a] and affording eccentric pivotal mounting for operating rod 56. Outward movement of rod 56 will swing the toggle lever 55, placing springs 54 under compression which is exerted against arms 50 in a direction intending to rotate collars 47. So long as spacer blocks 48 are held under compression by the abutments 45 and head frame 12, collars 47 will be restrained against rotation, but as soon as pressure upon press plate 36 is relieved, spacer blocks 48 will be released and the energy of springs 54 will be rendered effective to swing them rearwardly to give the necessary clearance between the abutments 45 and head frame 12 to permit the upper press assembly to be swung into the position illustrated in Fig. 5. Steam plates 22 and 37 are formed with suitable interior channels or bores for permitting circulation of fluid within them, which is led to lower steam plate through an inlet 57 and from said steam plate by outlet 58, and fluid is likewise led to upper steam plate 37 through an inlet 59, and therefrom through an outlet 60. In order to accommodate the movement of said steam plates in the pressing operation and the opening and closing of the press, the inlet pipes of the lower steam plate are provided with extension couplings 61, and the inlet and outlet pipes for the upper steam pipes with swivel connections 62, 64 and 65, all of which permit the necessary movement of the steam plates relative to the supply lines 66 and 67. The outlets may be arranged to discharge into any suitable receptacles, or as hereinafter described.

The foregoing constitutes a description of a press unit, and applies equally to any of the presses A, B, C or D. The cycle of operations is as follows:

Starting with the press in open position, as illustrated in Fig. 5, and when the ram 15 is in its lower position, the material to be compressed is placed in the lower die members 25. Upper press plate 36 is then swung to its horizontal position, and spacer block 48 interposed between its abutments 45 and and head frame 12. Admission of pressure fluid to cylinder 14 meanwhile having been started, ram 15 will be raised to elevate the lower press assembly and bring lower die members 25 into cooperation with upper die members 39 to effect the desired compression operation upon the material therein. In the event it is desired to cure the material in the press, admission of heating fluid into steam plates 22 and 27 through inlets 57 and 59 is permitted for the proper time, after which a cooling fluid may be similarly admitted to said steam plates in the same fashion for a desired period to cool or set the material. Upon completion of the cooling or setting period, pressure is relieved from cylinder 14 and introduced in pull-back cylinder 31, positioning wedges 29 meanwhile having been moved to raise the carriers 28, and compression having been induced in springs 54 of the spacer block operating mechanism. The pressure in pull-back cylinder 31 being effective to depress yoke 34 and retract press plate 19, lower die members 25 will be moved away from upper die members 39, thereby relieving pressure on the upper assembly, and permitting spacer blocks 48 to be swung rearwardly by the activity of springs 54. As the downward movement of base plate 19 continues, pin supports 26 being retained in raised position by carriers 28, ejector pins 27 will be rendered effective to eject the moulded articles from die members 25. Inasmuch as head plate 36 may be swung rearwardly immediately the spacer blocks 48 are removed, it is obvious that the press is quickly opened to permit working therein even before the finish of the relief stroke of ram 15. As a result a much more rapid and efficient operation of the press is secured, a much shorter power stroke may be used, resulting in the exhaustion of a much smaller volume of pressure fluid, and a much more liberal working space between the cooperating die members.

I will now proceed with the description of the articulated and automatic multiple

press assembly constituting one of the features of my invention.

A suitable base member 70 provides a mounting for an upright center column 71, a circular track 72 and a driving shaft bearing 74. Said base also preferably is shaped to form a pan or receptacle drained through outlet 75. Rotatably mounted upon the center column is a lower spider member 76 having the radial arms 77 adapted to form attaching places and supports for a bevel gear 78 and for the base frame members 11 of a plurality of presses, which may be of the type above described. Rotatably mounted at the upper portion of the center column is an upper spider member including arms 79 extending radially and adapted to provide supports for upper frame members 12. In this arrangement it will be obvious that upper spider arms 79 are conjoined with lower spider arms 77 through the heavy frame connections formed by the members 11 and 12 and the columns 10. Each press assembly is additionally supported on the track by wheels 73, journaled in mountings 73^a on the base frame. A driving shaft 80 journaled in the bearing 74 carries a pinion 81 adapted to drive the gear 78 to contribute rotary movement to the spider members and parts carried thereby, whereby the presses are carried in an orbit about the column 71. Upon the column in fixed positions are mounted a number of controlling cams including spacer block cam 82, fluid control cam 84, press opening cam 85, ejector cam 86 and pressure fluid controlling cam 87. Each cam is adapted to cooperate with all of the presses and to establish the timing, duration, sequence, and extend of their several operations, thus coordinating not only the operations of each press, but also the operations of each press relative to the operations of all the other presses.

The center column 71 provides part of the conduit for the supply of operating pressure fluid to the presses, and to this purpose is formed with a central longitudinal channel 71^a which leads to a plurality of lateral outlet channels 71^b. Pressure fluid is supplied to the channel 71^a by way of an inlet pipe 88. Inasmuch as a press of this type is designed for operation by extremely high pressures, very tight and very strong packing of pressure joints is necessary. In order to accommodate the distribution of pressure fluid to the presses in the course of their orbital movement about center column 71, I provide an outlet box or cylinder 89 rotatably mounted on the column 71 over the outlet ports 71^b, and connected on different sides with the pressure cylinder inlets 18 and 31^a by means of distribution pipes 90. The details of this outlet box are best illustrated in Fig. 8. Here it will be seen that it is chambered to provide an annular space between its inner wall and the column 71, which annular space is of enlarged diameter in a zone 89^d overlying the outlet ports 71^b. This zone is spanned by an annular spacer 91 which has a number of apertures 91^a through it and is formed with an interior circumferential channel portion 91^b, thereby affording communication from the outlet ports 71^b through the spacer 91, into distributing chamber 89^d and thence to the distribution pipes 90. Spacer 91 has bearing engagement against the sides of the chamber about and below the portion 89^d, and below it packing 92 is compressed in the chamber of the member 89 against the surface of the column 71, and packing 92^a is similarly disposed above the spacer 91. By means of a gland 94 the proper compression is placed on the packing, the upper packing being maintained in position by the spacer 91 and the compression being transmitted through the spacer to the lower packing 92. In this fashion a tight joint is secured which prevents the escape of pressure fluid yet gives uninterrupted communication between the supply conduit 71^a and the distribution pipes 90. Through connections 95 pressure fluid is conducted to the inlets of the pull-back cylinders 31 through suitable piping; and by pipes 96 pressure fluid is conducted from the distribution pipes 90 to controlling valves 97 which control its admission to the inlets 18 of the press cylinders. Said valves 97 may be of the type illustrated in patent to Harvey Slater, #1,143,236, granted June 15, 1915, or may be of other construction suitable to withstand the high pressures and to control inlet and discharge of the pressure fluid. In the drawings a valve of the type illustrated in the aforementioned patent is shown, its operation being effected by a plunger 97^a movable to positions to admit pressure fluid from connection 96 to connection 98 which leads it to the press cylinder, or to close such communication and open communication between connection 98 and connection 99, which is a discharge pipe through which pressure fluid may be exhausted from the press cylinder into the receptacle formed by the base frame 70. The effective pressure area of press cylinder 14 being much greater than that of pull-back cylinder 31, so long as pressure is maintained in the former the pressure on the pull-back ram 32 will be ineffective. As soon as pressure is relieved from press cylinder 14, the pressure which is maintained on the pull-back cylinder will assert itself, operating the pull-back mechanism as above described.

The controlling mechanism for the controlling valves 97 is illustrated in Fig. 4. Cooperating with valve control cam 87 is a plurality of valve operating levers 100,

one associated with each press, and pivoted on the press base frame at 100[a] adjacent to the fulcrum point. The lever is provided with a valve engaging shoulder 100[b] adapted to make contact with the end of the plunger 97[a] and move it from one position to another, depending upon the extent to which the lever 100 is swung by the cam 87. Each lever carries a roller at its inner end which rides upon the margin of the cam during movement of the press thereabout. As shown in Fig. 4, the lever of the press "D" is in the dwell of the cam, so that communication is open between the press cylinder and the discharge connection 99, whereas, in presses "A", "B" and "C", as illustrated in said figure, the levers 100 are swung to outward position, which is effective to position the plungers 97[a] to open communication between the pipes 96 and 98, and maintain pressure in the pressure cylinders. The operation of the valves 97, therefore, and the supply and discharge of pressure fluid from the press cylinders is automatically controlled and positively coordinated incident to the revolution of the presses, so that, during a given portion of their orbital travel the presses will be closed while during the other periods they will be open or in the process of opening or closing.

The means for controlling the swinging of the upper press assemblies to opened and closed positions is illustrated best in Figs. 3 and 5. Here it will be seen that the rollers 43, which are carried on trunnions 43[a] rotatably mounted in the arms 46, are adapted to ride under and upon the face of the cam 85 during a certain part of the orbital movement of the press. The positioning of the effective portion of the cam 85 relative to the spacer block actuating cam 82 and pressure controlling cam 87 is such that release and retraction of the spacer blocks 48 is accomplished just prior to the engagement of a roller 43 with the cam 85. The upper press assembly being thus rendered free for swinging movement, the travel of the supported roller 43 under cam 85 will be effective to rock arm 46 downwardly and swing the upper press assembly upwardly, to open the press and permit ejection, removal and replacement of the material operated upon. The closing movement of the upper press will be accomplished by gravity when the roller 43 rides off of the cam 85. Thus it will be seen that, in addition to the application and relief of the press operating pressure, the opening and closing of the presses, the ejection of the pressed articles, and the positioning and removal of the spacer blocks which support the pressures, are all accomplished automatically incident to the rotation of the press, and all of these operations properly coordinated in each press and as between the several presses. The supply of heating and cooling fluid for the curing and setting of the material in the presses is likewise automatically controlled, as will presently appear in connection with the description of the fluid circulating mechanism.

This is best illustrated in Fig. 3 showing a vertical section thereof and Fig. 9 showing a horizontal section. The numeral 101 designates the steam supply pipe and the numeral 102 the water supply pipe. It will be understood that each is connected with a suitable source for supplying the desired circulating fluid. The steam supply pipe has a swivel connection at 101[a] with an inlet pipe 104 which is an axial conduit connected into a distributing T, 105. This is mounted upon the spider member for rotation therewith, and has lateral discharge channels 105[a] each connected with one of the fluid inlet pipes 66 associated with the respective presses. Communication from distribution T 105 to each inlet pipe 66 is controlled by a three-way valve 106, the position of which is determined by fluid control cam 84, which is rendered effective upon valve rods 107 carrying rollers riding upon said cam, and connected at their upper ends to the valve levers. The distributing T 105 has a series of radial discharge channels forming water outlets 108 each one communicating with one of the three-way valves 106 and having its communication with its associated distribution pipe 66 controlled by such valve. Water is distributed to the outlets 108 from the water supply pipe 102 through a water hood 109 affording an internal annular chamber having communication with the outlets 108. This water hood is maintained stationary with the water supply pipe, and has proper water tight movable connections with the rotating distribution T 105, after the fashion illustrated in Fig. 9. Steam being constantly maintained in the steam outlets 105[a] and water in the water outlets 108, the admission of steam or water into any one of the inlet pipes 66 is determined by the adjustment of the associated valve 106. Inasmuch as this valve is a three-way valve, it is controlled by the cam 84 which is effected to control admission of both water and steam to the movable connections 67 and 62 and the circulating tubes of the upper and lower steam plates 37 and 22.

Thus, the curing and setting operations are automatically controlled incident to the operation of the press, and such operations in one press are positively coordinated with its other operations and with the operations of the associated presses.

The operation of the spacer block swinging mechanism has been described above, and will not be here repeated excepting to call attention to the fact that the springs 54, which actually swing the spacer blocks

out of position, are placed under tension prior to the time when the valve operating cam 87 is rendered effective to relieve pressure in the press cylinder. Consequently, upon the release of such pressure the spacer blocks 48 are rendered free to swing under the pressure of the springs 54. Likewise, after the falling of the upper press assembly has been permitted by cam 85, the spacer blocks 48 are swung into position over abutments 45, by retraction of the rods 56, so that, when pressure is again admitted to the press cylinder, they will be in position to sustain the upper press assembly against the action of the ram. The operation of the wedges 29 by the shifting frames 30 for control of the ejecting operation, is similarly coordinated and articulated with other operations by the action of ejector cam 86 upon the contact rollers 30[a] carried on the shifting frames 30. The arrangement of cam 86 is such that the carriers 28 are raised after movement of the ram to compression position, and are maintained in elevated position during the movement of the ram to its lower position. Retraction of the shifting frame 30 is accomplished by suitable springs 30[b].

In Fig. 10 is a diagram illustrating the cycle of operation of the press above described. The center circle is sub-divided to show the various operations to which each press is subjected, viz, loading, moulding, curing, cooling and ejecting. The circle designated by A illustrates the effectiveness of the spacer block control cam 82 during this cycle of operations, while the circle B designates the effectiveness of the steam and water control cam 84, the circle C that of the press opening on head swinging cam 85, D that of the ejector cam 86, and E that of the pressure fluid control cam 87. This represents the sequence of operations of each press, and by placing four of these diagrams in an angular relationship of 90 degrees about their center, the coordinated relationship of the operations of the four presses in the assembly illustrated may be graphically portrayed.

Inasmuch as the several operations of the various parts have been described in detail above, I will attempt here nothing more than an outline description of the operation. Continuous motion being transmitted to the driving shaft 80, rotary motion is transmitted to the press frame through the circular rack 78, the speed of operation depending, of course, upon the nature of the material, the size of the press, and other considerations. For a large press a period of from five to eight minutes may be consumed in a complete cycle. A handling station being provided at the zone where the presses are open, as determined by the positions of cams 87 and 85, an operator may be stationed at such platform and supplied with the intended material for charging into the open dies. This he accomplishes while the upper press assembly is in swung back position. The progressive or revolving movement of the press frame being continuous, the press is carried on during the filling operation until the roller 43 rides off of the cam 85, permitting the upper press assembly to drop to horizontal position. Meanwhile cam 84 has become effective to operate valve 106 to admit steam to the plates 37 and 22. The spacer blocks are then swung in over the abutments 45 and valve control lever 100 is rendered effective to admit pressure fluid to the press cylinder, whereupon the ram is raised to effect the compression operation. The dies meanwhile becoming heated by the circulation of steam in plates 27 and 22, the temperature gradually rises while the pressure is maintained on the ram, thus being effective to cure the pressed articles in the dies, which operation, as will be observed from the diagram, continues during somewhat over one-half the period of the entire cycle. Upon travel of the press to the proper point in its orbit, cam 84 becomes effective upon valve 106 to shut off the steam, and to admit cooling fluid to the plates 37 and 22. At about the same time, the ram being in elevated position, the shifting frame 30 is moved outwardly by cam 86 to raise the supports 28. The circulation of cooling water in the plates 37 and 22 proceeds to cool the dies and the pressed articles therein, thereby causing the latter to set in their pressed form. At about the same time that the cooling operation is started, spacer cam 82 becomes effective to tension the springs 54 of its block operating mechanism, placing the blocks under tension, but they are prevented from swinging by the pressure maintained upon them from the ram through the lower and upper press assemblies and against the head frame 12. Meanwhile the cooling operation continues until the point where cam 87 becomes effective upon the valve lever 100 to cut off supply of operating pressure fluid from the cylinder, and prevent pressure therefrom. Thereupon the ram moves downwardly under the pressure maintained in the pull-back cylinder 31[a], lowering the entire lower press assembly with the exception of the ejector pins, which are maintained in elevated position on the supports 26 and carriers 28 by the wedges 29. Shortly after the lowering of the ram has started, the spacer blocks are released thereby and swing back sharply under the pressure of springs 54, and immediately thereafter cam 85 becomes effective upon roller 43 to induce the upward swinging movement of the upper press assembly. The circulation of cooling water meanwhile having continued, the dies are sufficiently cool for the operator to remove the pressed

articles. While the press is thus open, the inward movement of the shifting frame 30 is accomplished, retracting the wedges 29 and lowering the carriers 28, supports 26 and ejector pins 27. At about the same time the cam 84 has accomplished the cutting off of the cooling water and the opening of the steam connections to the plates 37 and 22, so that the press begins to warm up. After the removal of the pressed articles the operator is free to dispose unpressed material in the dies. This completes the cycle of operations which is identical for each press, both as to sequence and as to periodicity.

In Figs. 6 and 7 are illustrated modified arrangements of operative mountings for the spacer blocks and upper press assembly. In the form illustrated in Fig. 6, the block 48′ is hinged at 48ª upon the upper press head 44 in such fashion as to permit its being swung in between the abutment 45 and the head frame 12, and outwardly from between said portions in such position as to clear the face of the latter, as shown in the dotted line position. In this figure the numeral 85′ designates the press opening cam which is effective to shift a sliding bar 110 longitudinally to swing a lever 111, which is pivoted on the frame and connected by a link 112 with the head of the upper press assembly. Such operation of the lever 111 will be effective to raise the upper press assembly quickly away from the lower press assembly, thus accomplishing the quick opening of the press for discharging and recharging. The movement of the upper press assembly in this instance, obviously, is rectilinear, as distinguished from the pivoted movement in the arrangement before described. Any suitable means may be employed for swinging the spacer block 48′.

In the forms shown in Fig. 7, the head 44 of the upper press assembly is hung on a pair of links 114, which are pivoted on a toggle block 115, pivotally suspended from the upper frame 12, by ears 116. The toggle block 115, cooperates with a second toggle block 117, to form a continuous spacer between the upper press assembly and the frame 12, when the toggle is straightened, thus providing a thrust supporting member between said portions. By means of the longitudinally shifted bar 118, connected with the toggle block 115, the toggle may be broken and the parts moved to the position shown in dotted lines in Fig. 7. This, obviously, moves the spacer blocks out from between the upper press assembly and the frame, and also accomplishes a quick lifting of the upper press assembly for a considerable distance, for the purposes above described.

From the foregoing it will be observed that this press construction accomplishes distinct advantages which are of particular value in presses utilizing pressure fluid under extremely high pressure. The arrangement of spacer blocks with the swinging upper press assembly supports very high pressures, yet permits a quick opening of the press, while the utilization of the swinging upper press assembly minimizes the extent of compression stroke requisite for the ram, thus necessitating the exhaustion of a minimum amount of pressure fluid at each operation thereof. The quick opening and closing action of the press minimizes the labor costs for operation, as it enables a single operator to handle the charging and discharging of all of the presses in the assembly. It will be observed that with the time arrangement illustrated in Fig. 10, the loading operation covers something less than a quarter of the entire cycle, so that one press is ready for the attention of the operator very shortly after the preceding press has been charged. In this fashion all of the operator's time is utilized in productive work, and he is not required to stand idle awaiting the completion of certain operations of the machine. The construction also permits a great variation in the timing of the respective operations, which, obviously, may be accomplished by substitution of control cams, but the arrangement maintains under all conditions a proper coordination of the several operations and proper timing of them. The construction is such that none of the movable mountings are subjected to any of the pressures induced by the compression operation, the entire reaction being supported by the closed frame formed by the base and head frame members 11 and 12 and columns 10.

It is to be understood that the term "stressing" as used herein is to be given a general interpretation to indicate the placing of an element under pressure or stress, and that the term "oscillatory" is likewise to be given a general interpretation indicative of movement about a point. Features disclosed herein but not claimed are claimed in my co-pending application Serial No. 480,324, filed June 25, 1921 as a continuation in part of this application.

I claim:

1. In apparatus of the class described, a combination comprising a frame, an actuated press member mounted thereon, a cooperating press member, a movable spacer cooperating with said cooperating press member and frame to support pressure from the actuated press member, and means for inducing a tension upon said spacer while under pressure from the actuated press member, said means being effective by said tension to move the spacer when it is relieved from such pressure.

2. In apparatus of the class described, a

combination including a progressively movable frame, a swinging press member mounted thereon, a reciprocating press member mounted on the frame for cooperation with the swinging press member, a spacer movably mounted on the frame for cooperation with the swinging press member, means for moving the frame progressively, and means rendered effective by progressive movement of the frame for accomplishing relative movement of the press members and spacer.

3. In apparatus of the class described, a combination including a progressively movable frame, a swinging press member mounted thereon, a reciprocating press member associated therewith, a spacer movably mounted on the frame for cooperation with the swinging press member, means for controlling relative movement of the spacer and press members, and means for moving the frame progressively to position it for cooperation with said means.

4. In apparatus of the class described, a combination including a frame, means for moving said frame progressively, cooperating press members mounted on the frame, one of said press members having swinging movement relative to the other, a spacer cooperating with the frame and said swinging press member, and means rendered effective by progressive movement of the frame for accomplishing movement of the spacer and swinging operation of said press member in sequence.

5. In apparatus of the class described, a combination comprising a movably supported frame, means for moving said frame progressively, cooperating press members mounted on said frame, means for reciprocating one of said press members relative to the other, a spacer cooperating with the other press member and the frame and means rendered effective by progressive movement of the frame for controlling relative movement of the spacer and said reciprocating press member.

6. In apparatus of the class described, a combination comprising a movably supported frame, cooperating press members mounted on said frame, a spacer adapted to transmit pressures from said press members to the frame, means for reciprocating one of said press members relative to the other, control means for controlling movement of the spacer and reciprocation of said press member, and means for moving said frame progressively to position it for cooperation with said control means.

7. In apparatus of the class described, a combination comprising a movably supported frame, means for moving said frame progressively, cooperating press members mounted on said frame for relative movement, cooperating die portions carried by said press members, ejector members carried by one of said press members and having movement thereon relative to the die portions, and means rendered effective by progressive movement of the frame for accomplishing relative movement of said ejector members and the press member on which they are carried.

8. In apparatus of the class described, a combination comprising a movably supported frame, cooperating press members mounted on said frame for relative movement, cooperating die portions carried by said press members, ejector members carried by one of said press members and having movement thereon relative to the die portions, control means for controlling relative movement of said ejector members and the press member on which they are carried, and means for moving said frame progressively to position said press member for cooperation with said control means.

9. In apparatus of the class described, the combination comprising a movably supported frame, means for moving the frame progressively, cooperating press members mounted for relative movement on the frame, means for applying pressure to one of said press members to move it toward the other, a spacer member cooperating with said other press member and the frame to support pressure from the pressure actuated press members, and means rendered effective by progressive movement of the frame for moving said spacer.

10. In apparatus of the class described, a combination comprising a movably mounted frame, means for moving said frame progressively, cooperating press members mounted for relative movement on said frame, a spacer movably supported for cooperation with one of said press members and the frame to transmit pressure from the former to the latter, elastic means effective to move said spacer to inoperative position, and means rendered effective by progressive movement of the frame for inducing compression in said elastic means.

11. In apparatus of the class described, the combination of a stationary conduit having a lateral outlet, a housing encompassing said conduit and affording an annular distribution channel, an operated device movable about the conduit, a connection affording communication between said device and said channel, a spacer bridging the channel about the conduit, packing between said housing and conduit on opposite sides of said spacer, and means for compressing said packing.

In testimony whereof I have hereunto signed my name.

ALBERT J. MATTER.