(No Model.)

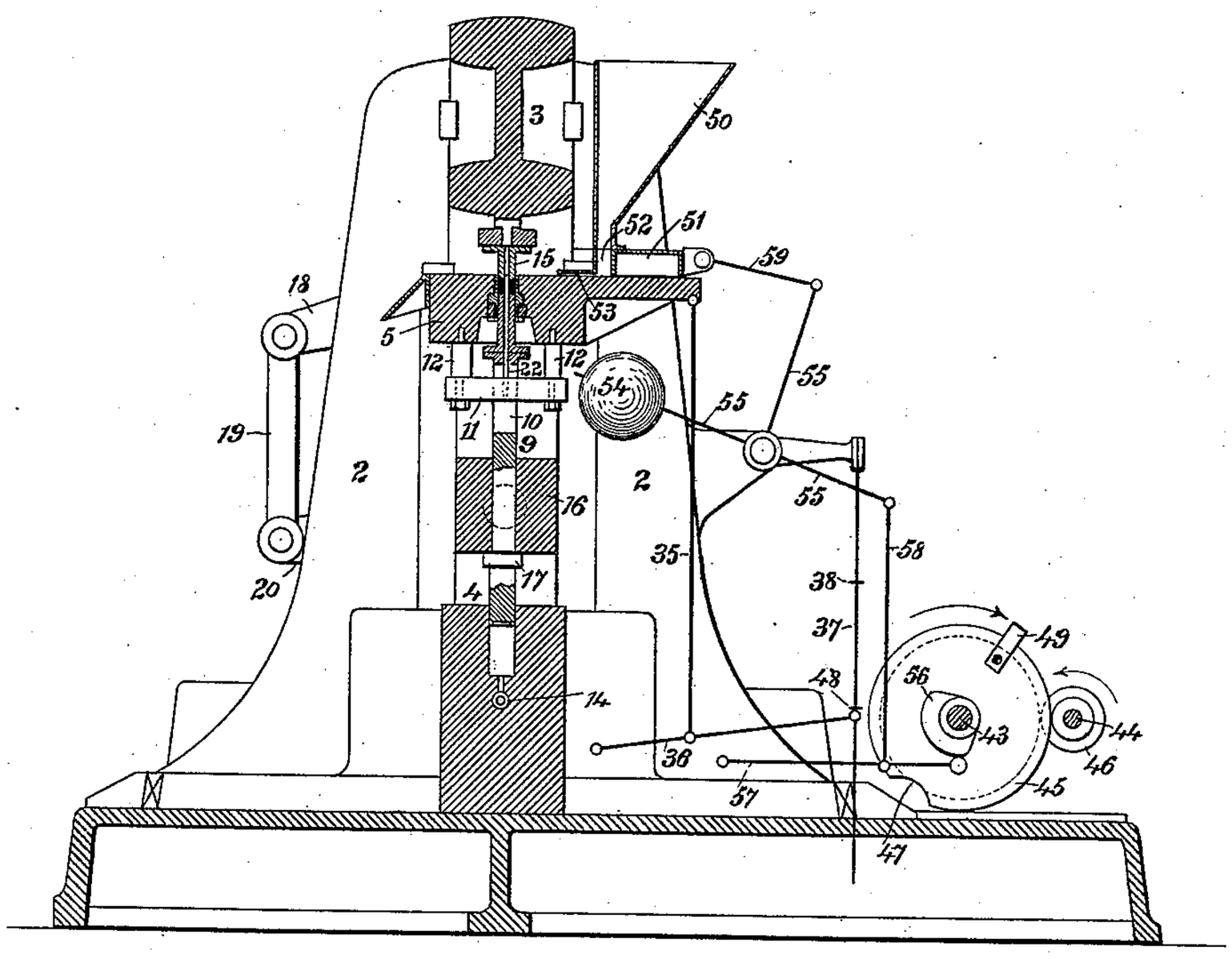
3 Sheets—Sheet 1.

H. GRUSON.

HYDRAULIC PRESS.

No. 357,125. Patented Feb. 1, 1887.

FIG. 1.



Attest:

Geo. T. Smallwood.

C. W. Hopkins

Inventor

Hermann Gruson,

By Knight Bros.

Attys.

(No Model.) 3 Sheets—Sheet 2.

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FIG. II.

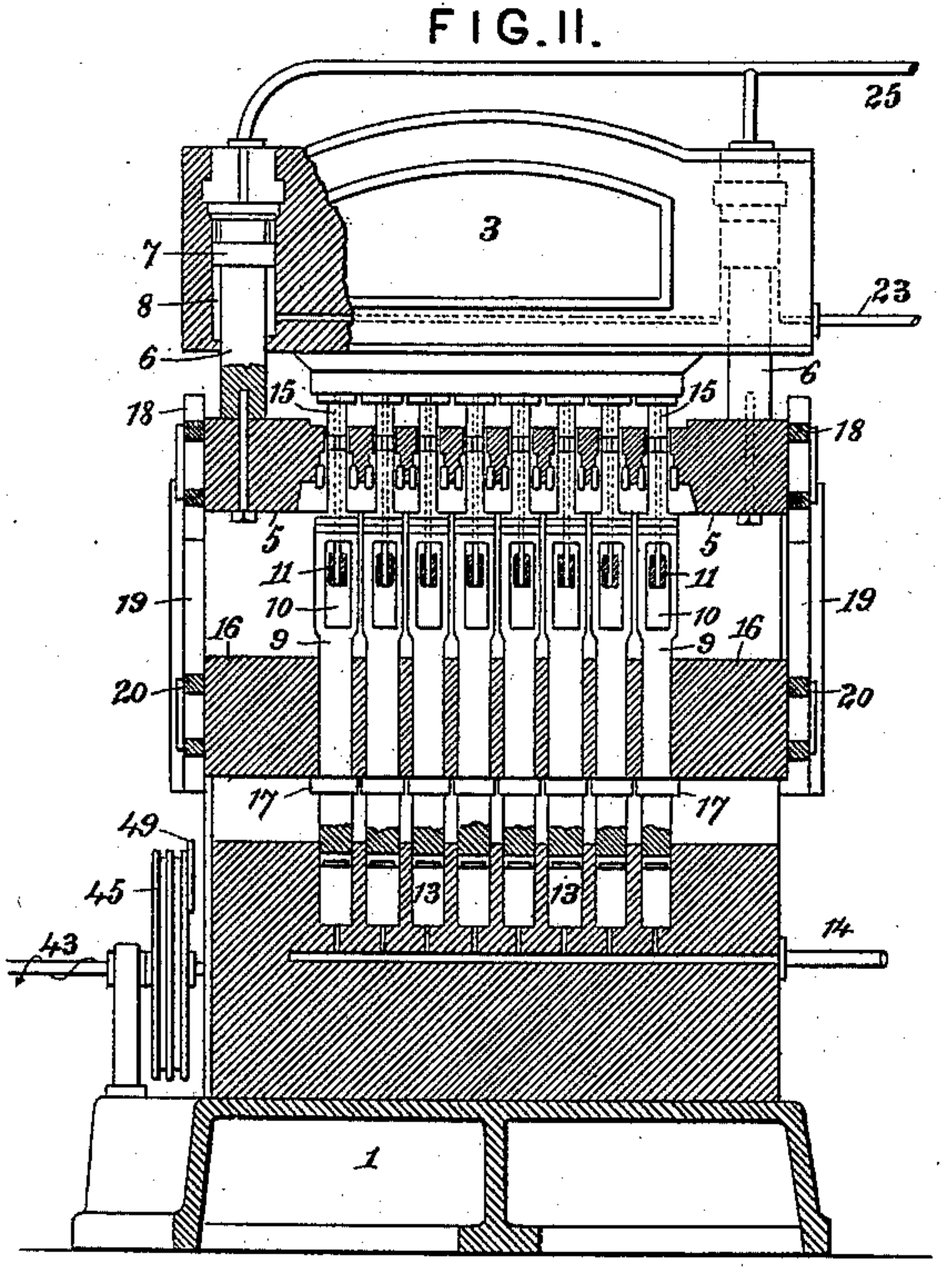


FIG. III.

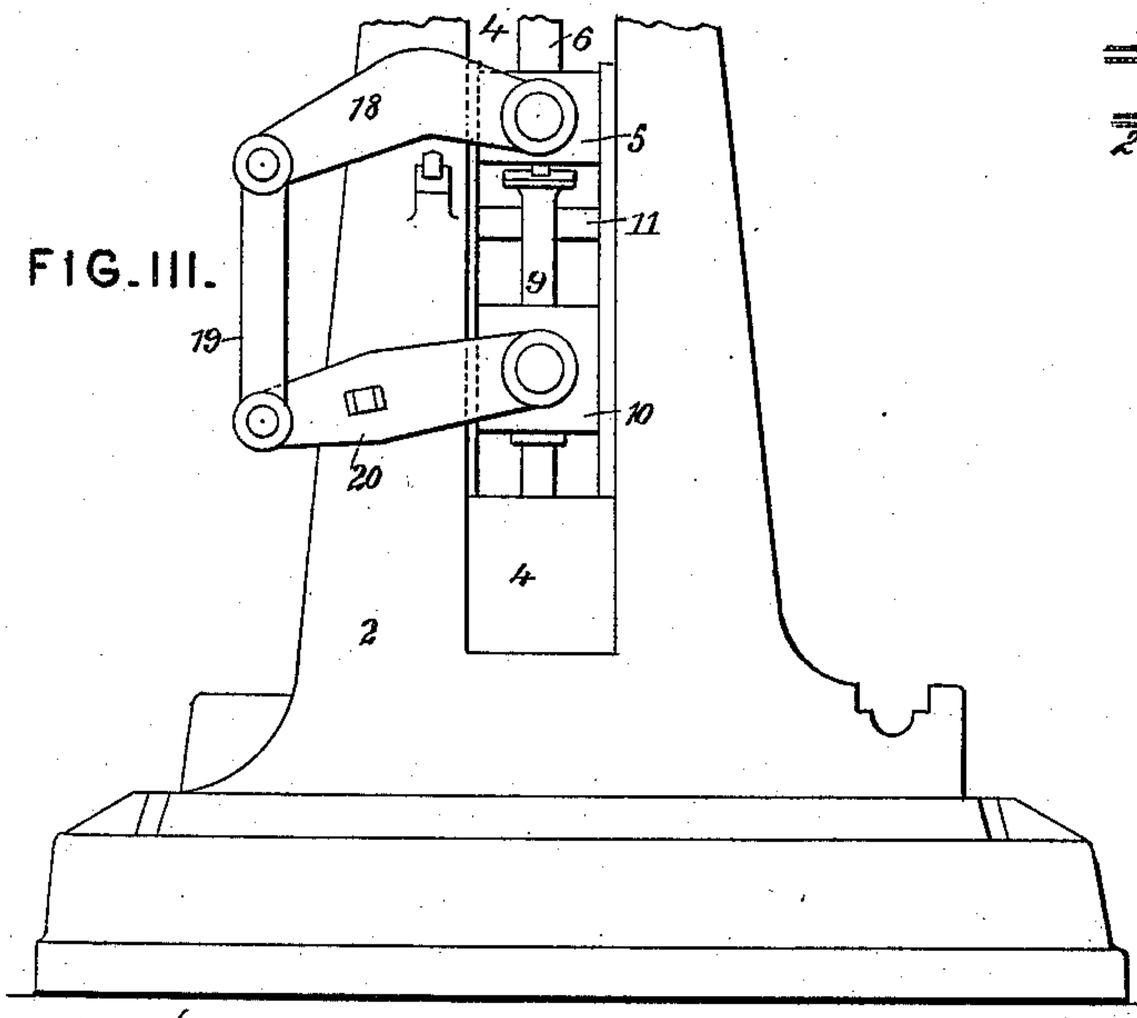


FIG. IV.

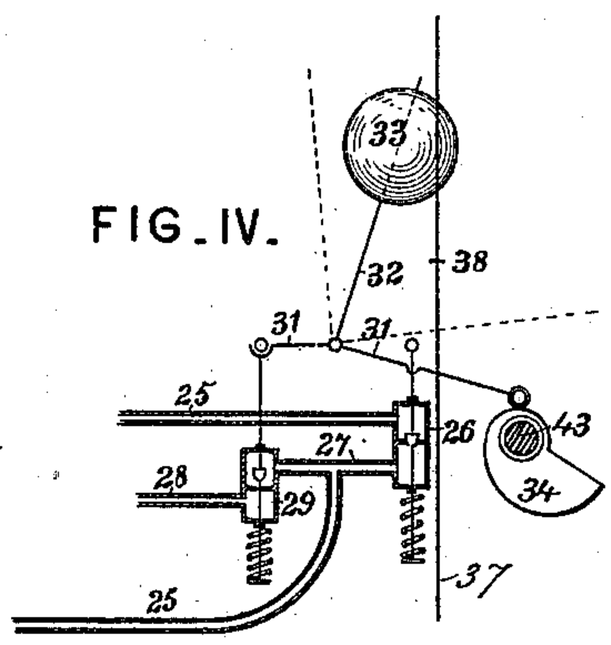


FIG. V.

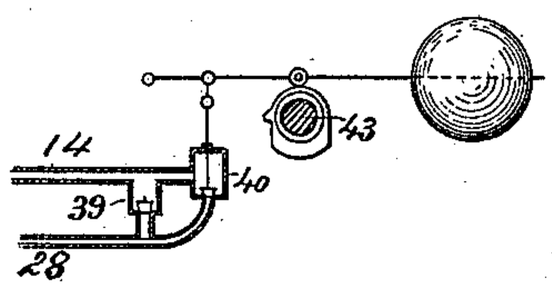
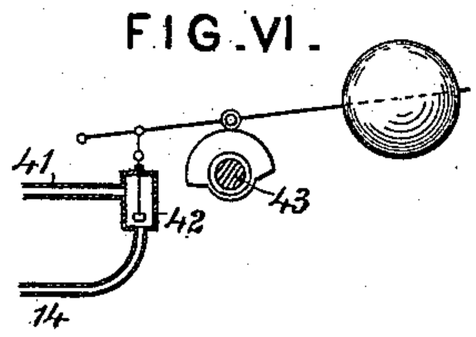


FIG. VI.



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(No Model.) 3 Sheets—Sheet 3.

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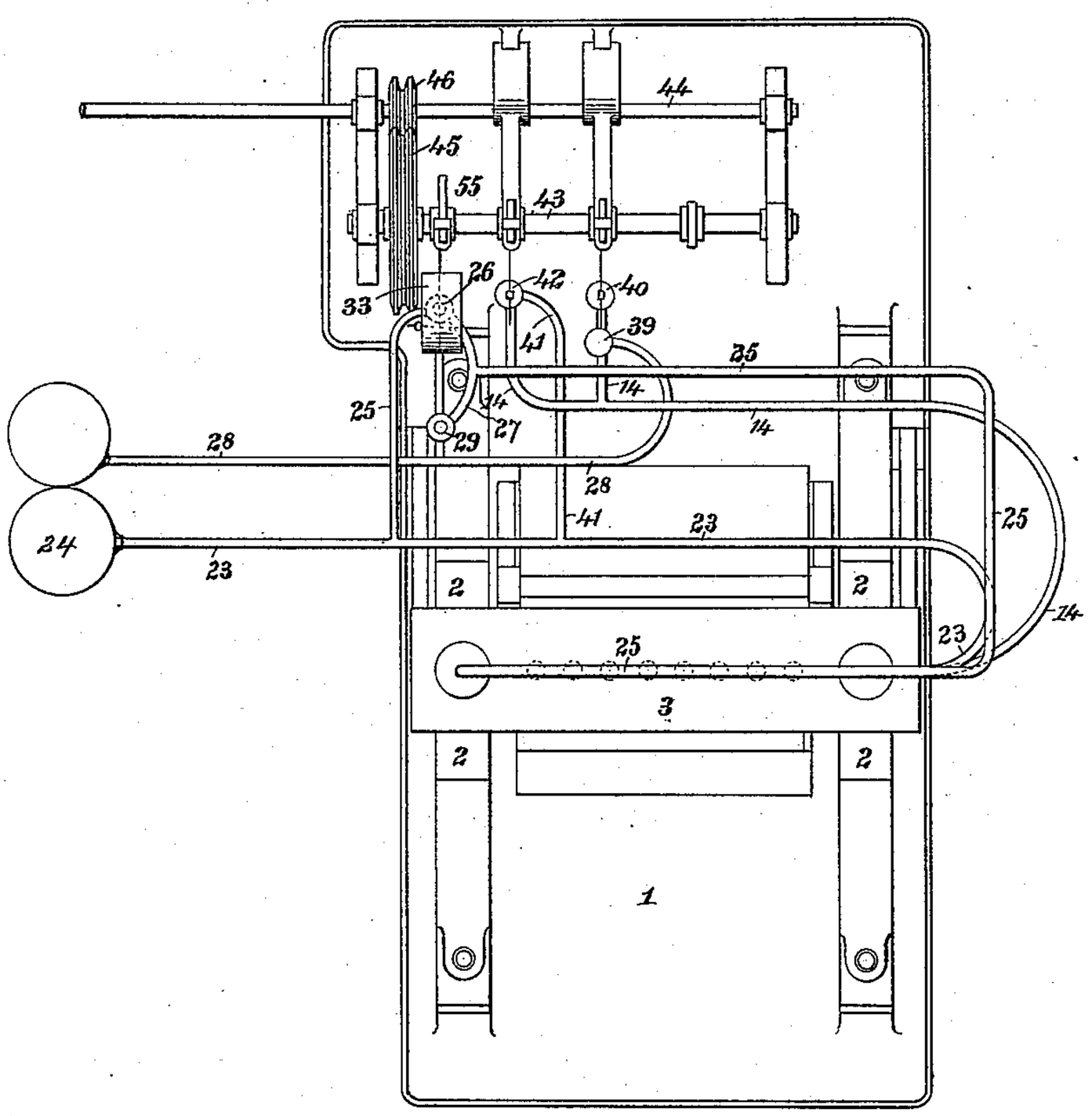
FIG. VII.



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Geo. P. Smallwood.
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Inventor
Hermann Gruson
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Attys:

UNITED STATES PATENT OFFICE.

HERMANN GRUSON, OF BUCKAU, NEAR MAGDEBURG, PRUSSIA, GERMANY.

HYDRAULIC PRESS.

SPECIFICATION forming part of Letters Patent No. 357,125, dated February 1, 1887.

Application filed April 26, 1886. Serial No. 200,193. (No model.) Patented in Germany March 26, 1884, No. 31,047; in France April 23, 1884, No. 161,685; in England May 1, 1884, No. 7,108; in Belgium May 5, 1884, No. 65,046; in Italy June 30, 1884, XXXIII, 309, and in Austria-Hungary September 2, 1884, No. 17,600 and No. 39,647.

To all whom it may concern:

Be it known that I, HERMANN GRUSON, of Buckau, near Magdeburg, Prussia, German Empire, have invented certain new and useful Improvements in Hydraulic Presses, (for which I have obtained Letters Patent of Germany March 26, 1884, No. 31,047; of France, No. 161,685, dated April 23, 1884; of England May 1, 1884, No. 7,108; of Belgium, No. 65,046, dated May 5, 1884; of Italy, No. 309, dated June 30, 1884, Vol. XXXIII, and of Austria-Hungary, No. 17,600 and 39,647, dated September 2, 1884,) of which the following is a full, clear, and exact description.

The subject-matter of my present invention is fully shown in my pending application, Serial No. 144,466, which was filed on the 1st of October, 1884, but is not therein specifically claimed, but only generically as a modification of a press involving similar principles.

My invention consists in certain features of novelty which are hereinafter fully described, and more particularly set forth in the claims; and in order that it may be fully understood I will proceed to describe it with reference to the accompanying drawings, which form a part of this specification, and in which—

Figure I is a vertical section of a hydraulic powder-press embodying my invention, the section being taken on the line I I, Fig. II. Fig. II is a similar section of the same on the line II II, Fig. I. Fig. III is an elevation of details, hereinafter more particularly referred to. Figs. IV, V, and VI are sectional elevations showing in detail the several valves and their operating mechanism. Fig. VII is a plan view on a smaller scale, showing the press and the complete system and arrangement of pipes, valves, and other accessories.

1 represents the base of the press, from which rises a pair of standards, 2 2, which are connected at top by a fixed cross-head, 3. Each of these standards is slotted, as at 4, so as to form guides for the moving parts of the press, hereinafter fully described.

5 represents the matrix block or table, in which may be formed any desirable number of matrices. This matrix block or table is connected at or near its respective ends to the lower extremities of a pair of piston-rods, 6, each of which is provided with an enlarged head, 7, fitting and working in a cylindrical chamber, 8, formed in or affixed to the cross-head 3, to which fluid under pressure is admitted, as hereinafter described, for raising and lowering the matrix-block.

9 represents plungers corresponding in number with the matrices in the block 5. Each of these plungers 9 has near its upper end an elongated slot or eye, 10, through which is passed a horizontal cross-head, 11, suspended from the under side of the matrix-block by means of bolts or rods 12, which cross-heads and bolts will be hereinafter referred to collectively as "hangers." The lower extremities of these plungers form pistons, each of which works in a cylinder, 13, formed in or annexed to the base of the press, the several cylinders having connection by means of a pipe, 14, with the fluid-pressure apparatus. Thus far it may be seen that when the matrix-block 5 is elevated it will carry with it (through the medium of the hangers 11 12) the plungers 9, and that after said matrix-block has reached the limit of its upward movement (in which position the fixed plungers 15, secured to the under side of the cross-head 3, project slightly into the matrices) said plungers may, by reason of the slots or eyes 10, be moved still higher by the admission of pressure-fluid to the cylinders 13, and also that, while the said plungers are held in their elevated position, by confining the fluid within the cylinders 13 the matrix-block 5 may, by reason of the slots 10, be lowered independently, these independent movements being limited by the length of the slots. The plungers 9 are also passed through a follower-block, 16, which rests upon them through the medium of shoulders, collars, or nuts 17, the said follower-block and the matrix-block 5 being connected at their ends through the medium of differential connections made up of floating levers 18, links 19, and fulcrumed levers 20. Each of the floating levers 18 is pivotally connected at its respective extremities to one extremity of the matrix-block 5 and one extremity of one of the links 19, whose other extremity is connected to one extremity of one of the fulcrumed levers 20, which lever is in turn fulcrumed at an intermediate point to one of the standards 2, and connected at its other extremity to the follower-block 16.

21 are studs, one projecting from each of

the standards 2, so as to cross the path of the floating lever 18, serving as a fulcrum, upon which said lever oscillates after it has come in contact therewith during the descent of the matrix-block. When the valves hereinafter described are so manipulated as to cause the matrix-block 5 to rise, the follower-block 10 will, by reason of its connection with the plungers 9, and in turn their connection with the matrix-block, rise the same distance. Let it be here observed that if each of the levers 18 and 20 fulcrumed at its mid-length the movement of one would be neutralized or complemented by the other; or, in other words, they would merely be rocked upon their fulcrums by the synchronous movement of the matrix-block and follower-block, and would therefore remain at all times parallel. This would of course render it impossible for the follower-block to ascend (upon the introduction of pressure-fluid into the chambers 13) or the matrix-block to descend, as hereinafter described, independently of each other. These independent movements being absolutely essential, the levers must be so fulcrumed and arranged that the upward movement of the follower-block shall not neutralize the effect which a corresponding movement of the matrix-block produces upon the connections between them; and, furthermore, that the downward movement of the matrix-block shall be multiplied when the floating lever 18 comes to its fulcrum, so as to impart a more rapid movement to the follower-block 10. To accomplish these results, the fulcrum of each lever is situated to one side of the center, that of the lever 18 being nearer the end connected to the matrix-block and that of the lever 20 being nearer the end remote from the follower-block. Thus it will be seen that during the synchronous upward movement of the matrix-block and follower-block the floating lever will be lifted above its fulcrum-block to such a distance that even the subsequent independent ascent of the follower-block 10 shall not (acting through the lever 20 and link 19) draw it down into contact therewith, but that even after this independent ascent of the follower-block there shall still be such a distance between the lever 18 and its fulcrum 21 as to enable the matrix-block to descend independently of the follower-block and plungers until its upper surface comes flush with the ends of the plungers, to permit the bricks or cakes to be removed, as hereinafter described. Then, the blocks or cakes having been removed, the fluid is released from the chambers 13, and the differential connections described so multiply the balance of the movement of the matrix-block that the follower-block shall be carried to its lowermost position.

As described in the application above referred to, each of the plungers is provided with a central perforation, through which extends a needle, 22, affixed at its lower end to the hanger 11 12, and extending upwardly to the surface of the matrix-block 5, serving to form a perforation through each block or cake of powder.

The pistons 7 divide the cylinders 8 into two compartments, and by reason of the presence of the piston-rod in the lower compartment the latter is reduced to an annular chamber of considerably less superficial area than the upper.

23 is a pipe without valves, which connects with the lower chambers of the respective cylinders 8 at one end and with the high-pressure reservoir 24 at the other, thereby maintaining a constant pressure in said lower chambers.

25 is a branch of the pipe 23, communicating with upper larger chambers of the cylinders 8, said branch being provided with a valve, 26, for regulating the admission of the pressure-fluid to said chambers. This branch is itself provided with a branch, 27, which connects with the outlet or low-pressure pipe 28, the branch 27 being provided with a valve, 29, so seated that when high pressure is being exerted it will press upon the top of the valve and hold it firmly to its seat. As before stated, the lower chambers of the pistons 8 are in constant communication with the high-pressure reservoir, and the parts are so proportioned that when the pistons reach the limit of their downward movement they will not quite touch the bottoms of their respective cylinders, thereby leaving an annular space which is always filled with fluid. The pipe 23 communicates with the cylinders 8 a little above their bottoms, so that after the pistons have passed beyond the mouths of said pipe there will be no means for the escape of the fluid from the annular spaces; hence when an elastic fluid is employed it constitutes a packing for preventing jar. The fluid in this annular space being somewhat compressed will by its expansion impart the preliminary movement to the pistons when the inlet-valve 26 is closed and the outlet-valve 29 is opened. As soon as the cylinders rise far enough to uncover the ends of the pipe 23 pressure-fluid will flow into the lower chambers and elevate the pistons. When the plungers are to be lowered after the high pressure has been exerted on the powder in the matrices, as hereinbefore described, the outlet-valve 29 is closed and the inlet-valve 26 opened, thereby placing the upper chambers of the cylinders 8 in communication with the high-pressure reservoir.

Although the pressure in both compartments of the cylinders 8 is the same per square inch, yet by reason of the greater superficial area of the pistons which is exposed to the action of the pressure-fluid in the upper chambers they will be forced down and the fluid expelled from the lower chambers when the valves are placed in the positions last described. The inlet and outlet valves 26 and 29 are shown in detail and on a larger scale in Fig. IV. They are both held down upon their seats automatically by springs, and are engaged for being lifted therefrom by the re-

spective horizontal arms 31 of a double bell-crank lever, 31 32, whose vertical arm 32 is provided with a weight, 33, whereby the said lever is held to any position in which it is set. This bell-crank lever is moved into the position indicated by dotted lines in Fig. IV for opening the valve 26 (and closing the valve 29) by means of a cam, 34, secured to an operating-shaft. As has been before described, while this valve 26 is open the matrix-block descends.

Connected with the matrix-block through the medium of a vertical rod, 35, and a lever, 36, fulcrumed at one end to the standard or other fixed part of the press, is a rod, 37, so mounted as to partake of the movement of the matrix-block, said rod being provided with a lug or finger, 38, so situated as to project over one of the horizontal arms of the bell-crank 31 32, and, when the matrix-table has nearly completed its descent, to come into contact with said arm 31, and thereby rock the lever from the position shown by the dotted line to that shown by full lines, whereby the valve 26 is permitted to close and the valve 29 open, whereupon the matrix-block commences its upward movement.

The pipe 28, which communicates with the low-pressure reservoir, (and also with the upper chambers, 8, through the pipes 25 and 27,) also communicates with the lower cylinders, 13, in which the plungers 9 work, through the medium of a branch pipe, 14, under control of a suction-valve, 39, and outlet-valve 40. As the plungers 9 are being raised by the mechanism just above described fluid is sucked into the cylinders 13 from the low-pressure reservoir through the suction-valve 39. The high-pressure pipe 23 also communicates with the chambers 13 through a branch, 41, and the same pipe 14 under control of a valve, 42, the suction-valve 39, and also the outlet-valve 40, being so located as to be held tightly to their seats when the high-pressure valve is open. After the upward movement of the matrix-block ceases the valve 42 is opened and the pressure-fluid flows into the cylinders 13 and produces the final maximum pressure.

The valves 39, 40, and 42 are shown in detail and on a larger scale in Figs. V and VI, respectively. These valves may all be worked by any desired arrangement of cams and weights or springs, the cams being preferably all carried by the operating-shaft 43, which is driven from a power-shaft, 44, through the medium of friction-wheels 45 46, secured to them respectively. The friction-wheel 45 is mutilated, or provided on its periphery with a notch, 47, which will cause an interruption or arrest in its rotation as soon as it reaches the wheel 46. This interruption takes place just before the matrix-block reaches the limit of its downward movement, and continues until the said matrix-block commences its upward movement, whereupon a projection, 48, from the vertically-reciprocating rod 37, which is moved by the said matrix-block, as already explained, comes in contact with a nose, 49, projecting from the periphery of the friction-wheel 45, and sets it in motion. This momentary arrest in the rotation of the operating-shaft 43 is for the purpose of giving all of the parts time to complete their movements at each operation, for it is evident that as the moving parts of the press depend entirely upon the fluid-pressure the regularity of their movements will vary more or less, according to the condition of the fluid or other circumstances. If therefore all the valves were put under the control of the regularly-moving shaft 43, the one for causing the matrix-block to rise might be opened before said matrix-block had quite completed its descent; hence the valve for producing the initial movement of each operation of the press—*i. e.*, the ascent of the matrix-block—is so placed as to be operated by the final movement of the subsequent operation. To this end the matrix-block is so connected with the valve, which must be opened in order to permit its ascent, that said valve will be opened as soon as the said matrix-block has completed its descent. The table thereupon rises, and by means of the projection 48, before mentioned, puts the wheel 45 in motion.

50 represents the feed-hopper, which is mounted upon and carried with the matrix-block 5. Between the bottom or discharge aperture of the hopper and the upper surface of the matrix-block is placed a reciprocating feeder, 51, made sufficiently long to serve all the matrices, and sufficiently wide to cover the mouth of the hopper, to prevent the escape of the material when it is projected for charging the matrices. It is provided near its forward edge with a series of vertical apertures, 52, which, when it is retracted, receive the material from the hopper 50, and when projected coincide with the matrices 52 and permit the material to fall thereinto.

53 is a finger projecting from the forward edge of the feeder 51, which pushes away the blocks or cakes of powder formed by the previous operation of the press. This feeder is moved forward at the proper time (*i. e.*, when the matrix-block has partially descended and its surface is flush with the ends of the plungers 9) by means of a weight, 54, secured to one of the horizontal arms of a double bell-crank lever, 55, said feeder being held normally in a retracted position by a cam, 56, secured to the operating-shaft 43 and acting upon the other of said horizontal arms of the double bell-crank lever in opposition to the weight 54, through the medium of a fulcrumed lever, 57, and a link or rod, 58.

The third or vertical arm of the bell-crank lever 55 is connected with the feeder by a link, 59.

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

1. In a press, the combination, with the plungers, of a movable matrix-block, pistons to which said matrix-block is connected, cyl-

inders in which said pistons work, a source of pressure, and valved pipes for conveying said pressure to said cylinders, substantially as and for the purposes set forth.

2. In a press, the combination, with the plungers, the cylinders in which said plungers fit, a source of fluid-pressure, and valved pipes for conveying said pressure to said cylinders, of a movable matrix-block, pistons to which it is connected, cylinders in which said pistons work, and a second set of valved pipes for conveying the fluid-pressure to said cylinders, substantially as set forth.

3. The combination, with the movable matrix-block, the piston to which it is connected, and the fluid-pressure cylinder in which said piston works, of a plunger, and connection between said matrix-block and plunger, whereby the latter is moved by the movement of the former and at the same time each is capable of a limited movement independently of each other, substantially as set forth.

4. The combination of the movable matrix-block, the plunger having an elongated slot or eye, the hanger connecting said matrix-block and follower, fluid-pressure devices for moving said matrix-block, and separate pressure-cylinders for moving said followers, as explained.

5. The combination, with the matrix-block and fluid-pressure devices for raising and lowering it, as described, of the plunger and follower-block connected to said matrix-block, so as to partake of its upward movement, while being capable of a further movement independently thereof, a pressure-cylinder for continuing the upward movement of said plunger, and differential or multiplying levers connecting said matrix-block and follower-block, as and for the purpose set forth.

6. In a press, the combination, with a piston, a cylinder in which it works, a source of pressure-fluid, pipes for conveying said pressure-fluid to said cylinder, and valves for controlling the movement of said piston, of an intermittently-rotating shaft, a cam carried thereby for shifting the valves to effect a movement of the piston in one direction, and connections between said piston, valves, and shaft, whereby the valves are shifted to effect a return movement of the piston automatically by the piston as it completes its stroke, and the shaft again set in motion, substantially as set forth.

7. In a hydraulic press, the combination, with the piston and the cylinder in which it works, of a pipe communicating with said cylinder and having two branches, one communicating with the pressure apparatus and the other serving as an outlet, a spring-seated valve located in each of said branches, an oscillating lever having two horizontal arms, each adapted to engage one of said valves as it approaches each extremity of its permitted movement and lift it from its seat, and a third arm substantially perpendicular to the others, having a weight for maintaining said lever in the position in which it is set, a cam for moving said lever in one direction, and a moving part of the press having means for engaging said lever to move it in the other direction, substantially as set forth.

8. In a press, the combination, with the fluid-pipes and the valves, of a connection between one of the moving parts of the press and one of the valves, an intermittently-rotating shaft, a connection between one of the moving parts of the press and said shaft, and cams carried by said shaft for actuating the other valves in succession until its rotation ceases, substantially as set forth.

9. In a press, the combination, with the pressure-cylinder and piston, pipes for conveying the fluid to and from said cylinder, valves for controlling the passage of fluid through said pipes, and a rotary shaft having cams, for the purpose set forth, of means for arresting the rotation of said shaft to give the parts time to complete their movements, connections between the piston and one of the valves, whereby the latter is actuated automatically by said piston as it completes its stroke for effecting the return-stroke, and connections between said piston and the cam-shaft, whereby the latter is again put in motion, substantially as set forth.

10. In a press, the combination, with the matrix-block, the pistons connected thereto, the chambers of unequal superficial area located upon the respective sides of each of said pistons, a source of pressure, a valveless pipe connecting the smaller chambers with the source of pressure, a pipe connecting the larger chambers with said source of pressure, a valve for controlling the passage through said pipe, and a valve for permitting the escape of fluid from said larger chambers, and a plunger connected with said matrix-block, so as to be partially elevated thereby, but capable of further elevation independently thereof, a cylinder in which the piston of said plunger fits, a reservoir containing fluid under low or atmospheric pressure, a pipe connecting said cylinder and reservoir, a suction-valve in said pipe, a pipe connecting said last-named cylinder with the pressure apparatus, a valve for controlling the passage through said pipe, and an outet-valve for permitting the escape of fluid from said cylinder, of a rotating shaft, cams for shifting said valves, means for arresting the rotation of said shaft, connections between the matrix-block and one of the valves, whereby said valve is shifted by the matrix-block as it completes its descent and fluid admitted to again raise the matrix-table, and connections between the matrix-block and shaft, whereby the latter is again put in motion as the matrix-block ascends, substantially as set forth.

HERMANN GRUSON.

Witnesses:
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M. W. MOORE.