No. 631,789. Patented Aug. 29, 1899.

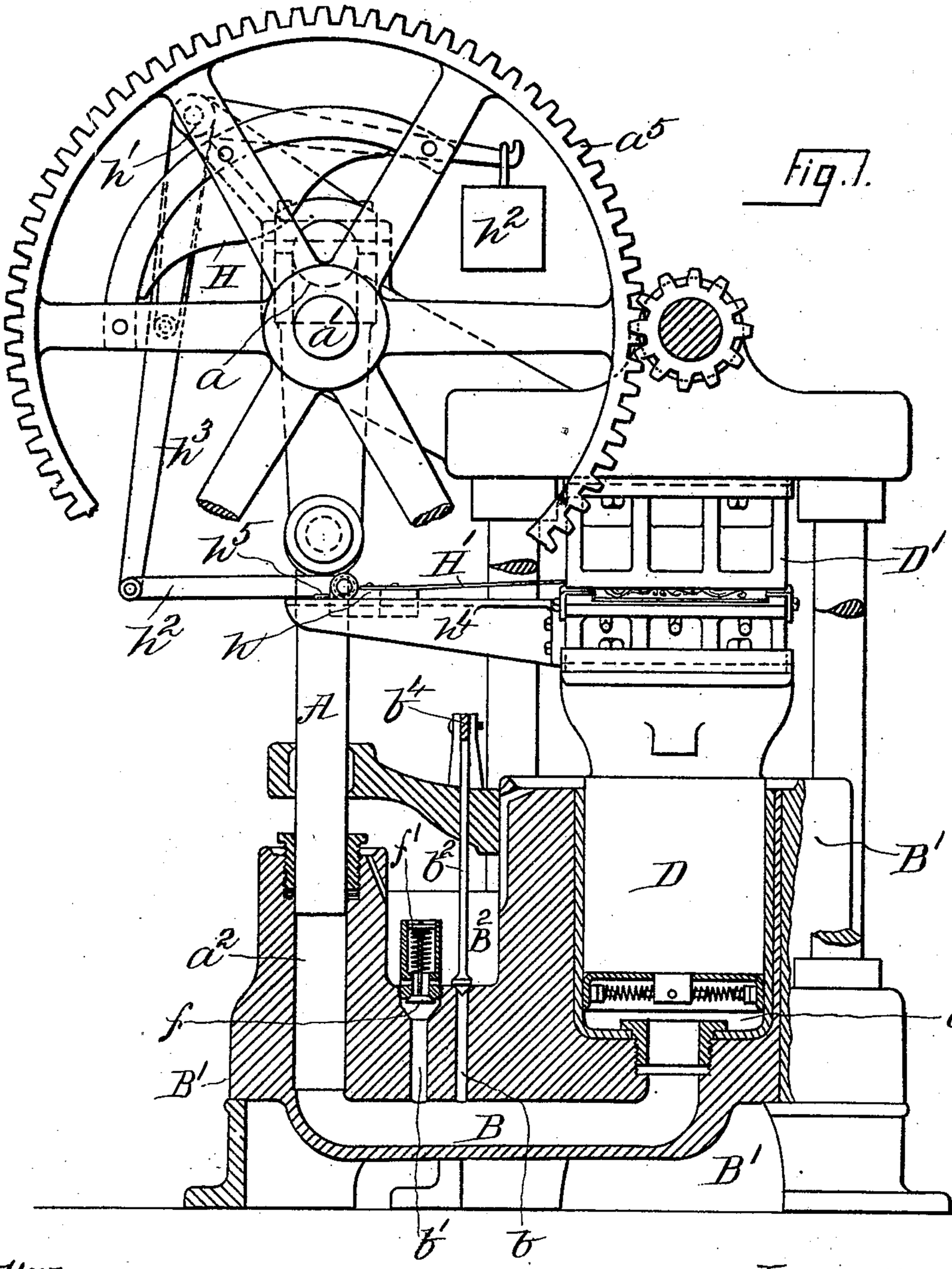
C. W. & M. J. GREENWOOD.

RECIPROCATING HYDRAULIC PRESS.

(Application filed Oct. 8, 1898.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses:
H. P. Guillo.
Wm Magnaden

Inventors:
Charles W. Greenwood
Marcus J. Greenwood
By their
Attorney. J. E. Maynadier

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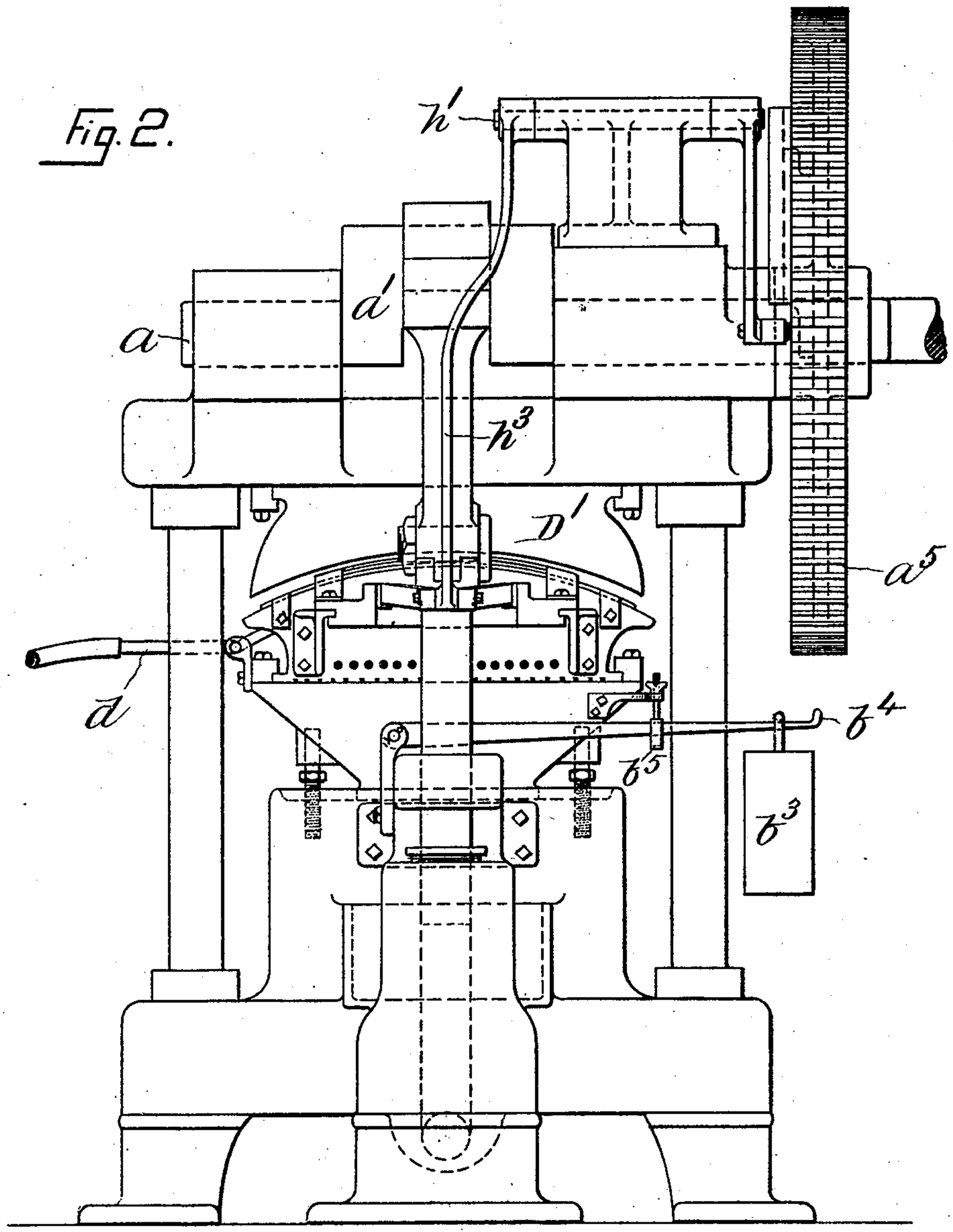
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



Witnesses:
H. P. Guillo.
Wm Magnulin

Inventor:
Charles W. Greenwood
Marcus J. Greenwood
By J. L. Magnulin their
Attorney.

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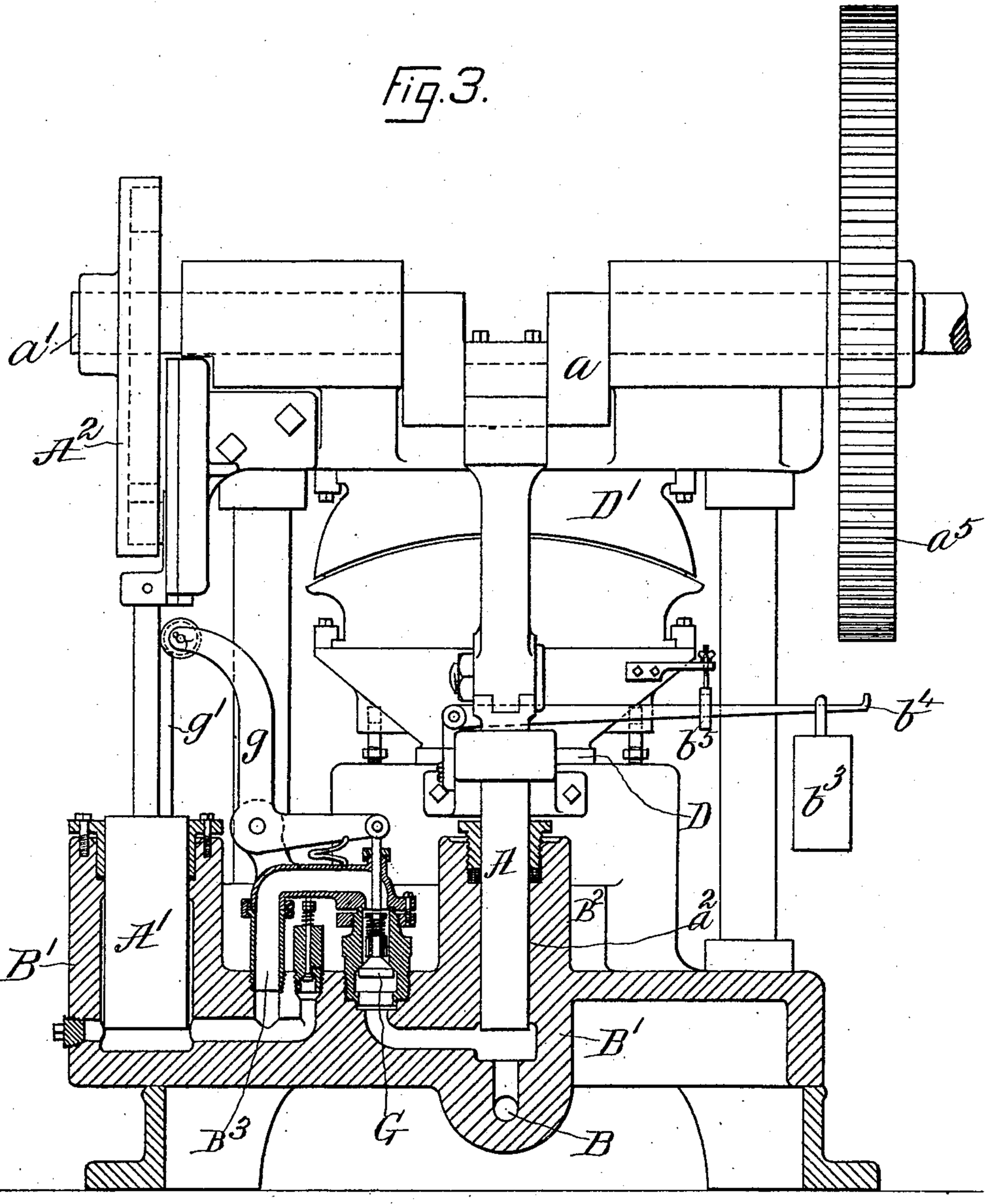
(No Model.) 4 Sheets—Sheet 3.

Fig. 3.



Witnesses;
A. P. Cuillo.
Wm Magnadier

Inventors
Charles W. Greenwood
Marcus J. Greenwood
By their attorney
J. E. Magnadier.

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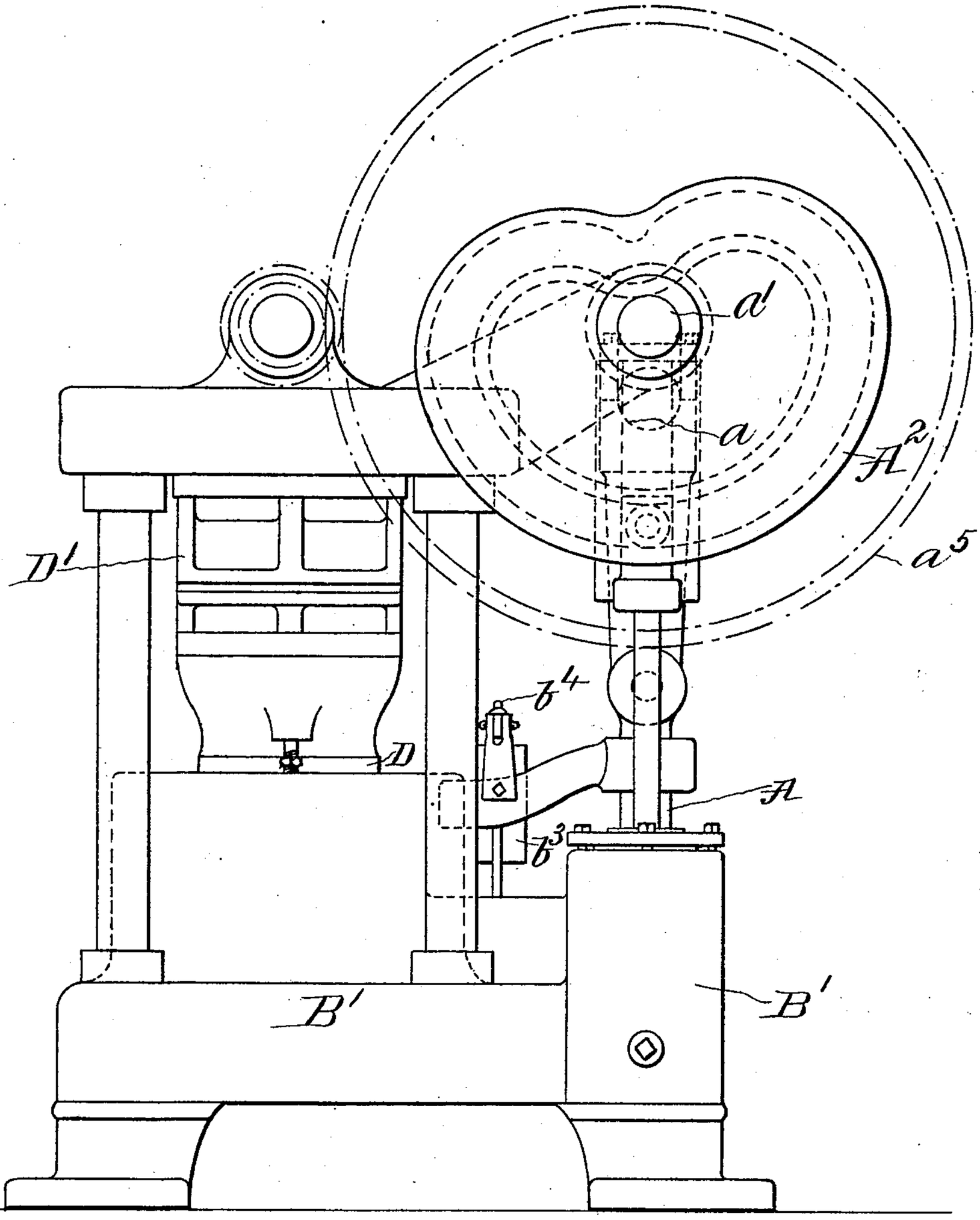

Fig. 4.

Witnesses:
H. P. Sewall.
Wm Maynadier

Inventors:
Charles W. Greenwood
Marcus J. Greenwood
By their attorney J. E. Maynadier

UNITED STATES PATENT OFFICE.

CHARLES WALTER GREENWOOD AND MARCUS JUDSON GREENWOOD, OF GARDNER, MASSACHUSETTS.

RECIPROCATING HYDRAULIC PRESS.

SPECIFICATION forming part of Letters Patent No. 631,789, dated August 29, 1899.

Application filed October 8, 1898. Serial No. 692,974. (No model.)

To all whom it may concern:

Be it known that we, CHARLES WALTER GREENWOOD and MARCUS JUDSON GREENWOOD, of Gardner, in the county of Worcester and State of Massachusetts, have invented a new and useful Reciprocating Hydraulic Press, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, and Fig. 2 is a rear elevation, of the simplest form of our press. Figs. 3 and 4 are elevations, Fig. 3 being partly in section of another form, which is the best form now known to us.

Our invention relates to that form of hydraulic press in which the ram or power-expending piston makes its outstroke while the pump-piston makes its instroke, and vice versa; and it consists in a new arrangement of these pistons and their cylinders relatively and with relation to the other parts of the press; also, in the addition of a third piston and cylinder forming a second pump with a peculiar stroke, as will be more fully described below, and also in certain other matters fully described below and particularly pointed out in the claims.

A is the driven piston, driven by crank a on shaft a', which is revolved by gear a^5 meshing with a pinion, (see Fig. 1,) through which power is effected to drive the press.

The cylinders a^2 and a^3—the first for the pump-piston A and the second for the ram D—are in one casting B′, cored out to form conduit B, which connects cylinders a^2 and a^3 and is itself connected by conduits b and b' with tank B^2, and these parts are so arranged that any liquid (oil is preferred) which escapes from cylinders a^2 and a^3 will flow into tank B^2, and any tendency to a vacuum in either cylinder a^2 or a^3 will result in a flow of liquid from tank B^2 into conduit B through check-valve f, which covers conduit b', opens inward, and is held in position by spring f'. In case ram D and platen D′ should be accidentally prevented from making the full stroke (which is of not infrequent occurrence in wood-embossing presses) the excessive pressure will cause liquid in conduit b to lift safety-valve b^2, held on its seat by weight b^3 in lever b^4, and enough of the liquid will escape through conduit b into tank B^2 to prevent the breaking of the machine. This arrangement of the cylinders a^2 a^3, the tank B^2, and the supply and relief valves so that the leakage is into the tank and the supply from the tank is an important feature of our invention, as it is practically impossible to make a press on this principle so that liquid will not escape about the pistons, which makes the supply-valve essential, and it is also essential as a practical matter to provide a relief-valve which may be used not only as a safety-valve in case of accident, but also as a regulator for the outstroke of the platen, as more fully explained below.

In this simple form of our machine the instroke of piston A causes the piston D to make its outstroke and press against the substance (in this case a strip of wood) which is backed up by the abutment D′ of the piston D, and the outstroke of piston A causes the piston D to make its instroke and carry its platen away from the abutment D′, allowing another strip of wood to be fed.

When used for wood-embossing, the platen carried by piston D must be heated, and this is done by means of the gas or naphtha pipes d.

In certain classes of work it is very desirable to move piston D quite rapidly during that part of its outstroke when it has little work to do, but to compel it to exert an exceedingly heavy pressure during the working part of its outstroke, and for this reason in the rapid running of our press we use an additional piston A′, reciprocated by a cam A^2, as fully shown in Figs. 3 and 4.

By properly proportioning the additional piston A′ and piston A a given motion of piston A′ will give the desired motion of piston D, and when pistons A and A′ are both moving the motion of piston D will depend upon the total displacement of pistons A and A′; but as piston D does little work, except near the end of its outstroke, a rapid motion can be given to piston A′, thus moving piston D and the platen it carries rapidly toward the bed or abutment D′, and thereby clamping the strip of wood between the platen and the

bed. Piston A′ then dwells, but piston A continues its instroke, and thereby causes piston D to exert an exceedingly heavy pressure, so that the strip of wood thus clamped between the platen and bed receives the enormous pressure desired—that is, the piston D is first moved rapidly by piston A′ to clamp the work between the bed and platen and then slowly by piston A to exert its full pressure—and this is the main feature of this form of our invention, for although piston A will move piston D very slowly as the crank *a* passes its dead-center and more rapidly when crank *a* is acting to give the maximum speed to piston A, yet additional piston A′ is requisite to cause piston D to make its rapid clamping stroke, and this feature of our invention is the combination of the three pistons—namely, the platen-piston D, the high-pressure piston A, and the low-pressure piston A′. For the best results the low-pressure piston A′ should make its full instroke in about one-quarter of a revolution of the shaft *a′*, then dwell for about half a revolution of that shaft, and make its outstroke during the remainder, as will be plain from Fig. 4 of the drawings, which show the throw of the cam A^2, by which piston A′ is reciprocated.

In order to prevent excessive strain on the cam or other mechanism for actuating piston A′, we use a check-valve G to prevent the backflow of liquid through conduit B^3, which connects the cylinder of pistons A′ and D. This is a matter of extreme importance when great pressure under piston D is required, for the pressure per square inch under piston A′ must be the same as that under piston D if a check-valve, such as valve G, be not used to close the conduit B^3 against backflow of the liquid between the pistons A′ and D, and it is practically highly objectionable to make the driving mechanism of piston A′ strong enough to stand the strain that would come upon it if the pressure under piston A′ were as great as it is often required to be under piston D. The result of the use of the check-valve G is that the mechanism for reciprocating piston A does not require to be made heavy enough to stand any greater pressure under piston A′ than the comparatively easy low pressure requisite to move piston D and cause it to act as a work-clamp. This feature of my invention is the combination of the three pistons with a check-valve to cut off the low-pressure high-speed piston from the severe pressure caused by the latter portion of the instroke of the high-pressure low-speed piston, and although this feature of our invention may seem to be practically merged in the broader combination of the three pistons, yet it is as a matter of fact the vital feature in all presses required to exert an extremely heavy pressure on the work as the high-pressure piston A nears the end of its instroke, for without this check-valve feature such a press could not be commercially operative for the reason that the mechanism used to actuate the low-pressure piston A′ could not as a practical matter be made to stand the excessive strains to which it would be subjected.

It will be observed that check-valve G is closed only when piston A′ is at the end of its instroke—that is, when lever *g* is free from action of cam *g′*, which cam reciprocates with piston A′. The result of this arrangement is that as soon as piston A′ begins its outstroke check-valve G is opened and the liquid can flow back freely through the conduits connecting the cylinders. This is a detail of construction shown to explain the best mode which we have contemplated applying the principle of this feature of our invention, which is preventing the backflow of the liquid from the cylinder of the platen-piston to the cylinder of the low-pressure piston while the high-pressure piston is increasing the pressure to the maximum.

The operation is as follows: When the platen-piston D is at the end of its instroke, the work is inserted between the platen and the bed D′ and the shaft *a′* is started, thereby compelling the high-pressure piston A and also the low-pressure piston A′ to begin their instrokes. The low-pressure piston A′ completes its instroke in about a quarter of a revolution of shaft *a′* and forces the platen on piston D so close to bed D′ as to clamp the work firmly between the bed and the platen, and at the end of the instroke of low-pressure piston A′ the check-valve G prevents backflow of the liquid to the cylinder of low-pressure piston A′, as above explained. High-pressure piston A then completes its instroke and causes platen-piston D to exert its full pressure against the work as crank *a* passes its lower dead-center. In practice for many kinds of work it is highly desirable to limit the outstroke of platen-piston D by automatically opening the safety-valve b^2 by means of an adjustable connection carried by platen-piston D and acting to unseat valve b^2 when the platen-piston is about to complete its outstroke, this connection being clearly shown at b^5, Figs. 2 and 3. The high-pressure piston A then begins its outstroke, and as piston A makes its outstroke platen-piston D makes its instroke, being greatly accelerated by the rapid outstroke of low-pressure piston A′, for when piston A′ begins its outstroke it unseats check-valve G, and this admits of backflow of the liquid from the cylinder of piston B to the cylinder of piston A′, and any vacuum under either of the pistons is prevented by the supply-valve *f*, which is unseated as soon as any appreciable vacuum is formed under either of the pistons and liquid flows past supply-valve *f* into conduit B. The cam H, carried by gear a^5, operates on one arm of rock-shaft *h′*, and thereby lifts the weight h^2 on another arm of rock-shaft *h′* and causes a third arm h^3 of rock-shaft *h′* to slide gage H′ on table h^4 in a direction to remove the work from between the bed and platen. Weight h^2 brings

the gage H′ back to place ready for the operator to put in a new strip of wood or other work.

What we claim as our invention is—

1. The improved reciprocating hydraulic press above described, comprising two pistons and two cylinders; a conduit connecting the two cylinders; a tank arranged to receive leakage from both cylinders; conduits connecting that tank with the conduit which connects the two cylinders, and supply and relief valves for those conduits; all arranged to operate substantially as described.

2. In combination three pistons and three cylinders of different cross-sectional areas; conduits connecting the cylinder of smallest area, and the cylinder of intermediate area with the cylinder of largest area; mechanism for reciprocating the piston of intermediate area; and the piston of smallest area, an equal number of strokes per second, but which causes the piston of intermediate area, to dwell at the end of its instroke longer than the piston of smallest area; substantially as described.

3. In combination three pistons and three cylinders of different cross-sectional areas; conduits connecting the cylinder of smallest area and the cylinder of intermediate area with the cylinder of the largest area; mechanism for reciprocating the piston of intermediate area, and the piston of smallest area; a check-valve in the conduit which connects the cylinder of intermediate area with the cylinder of largest area; and mechanism to hold that check-valve open except when the piston of intermediate area is at the end of its instroke; all substantially as described.

CHARLES WALTER GREENWOOD.
MARCUS JUDSON GREENWOOD.

Witnesses:
THATCHER B. DUNN,
EDWARD A. DUNN.