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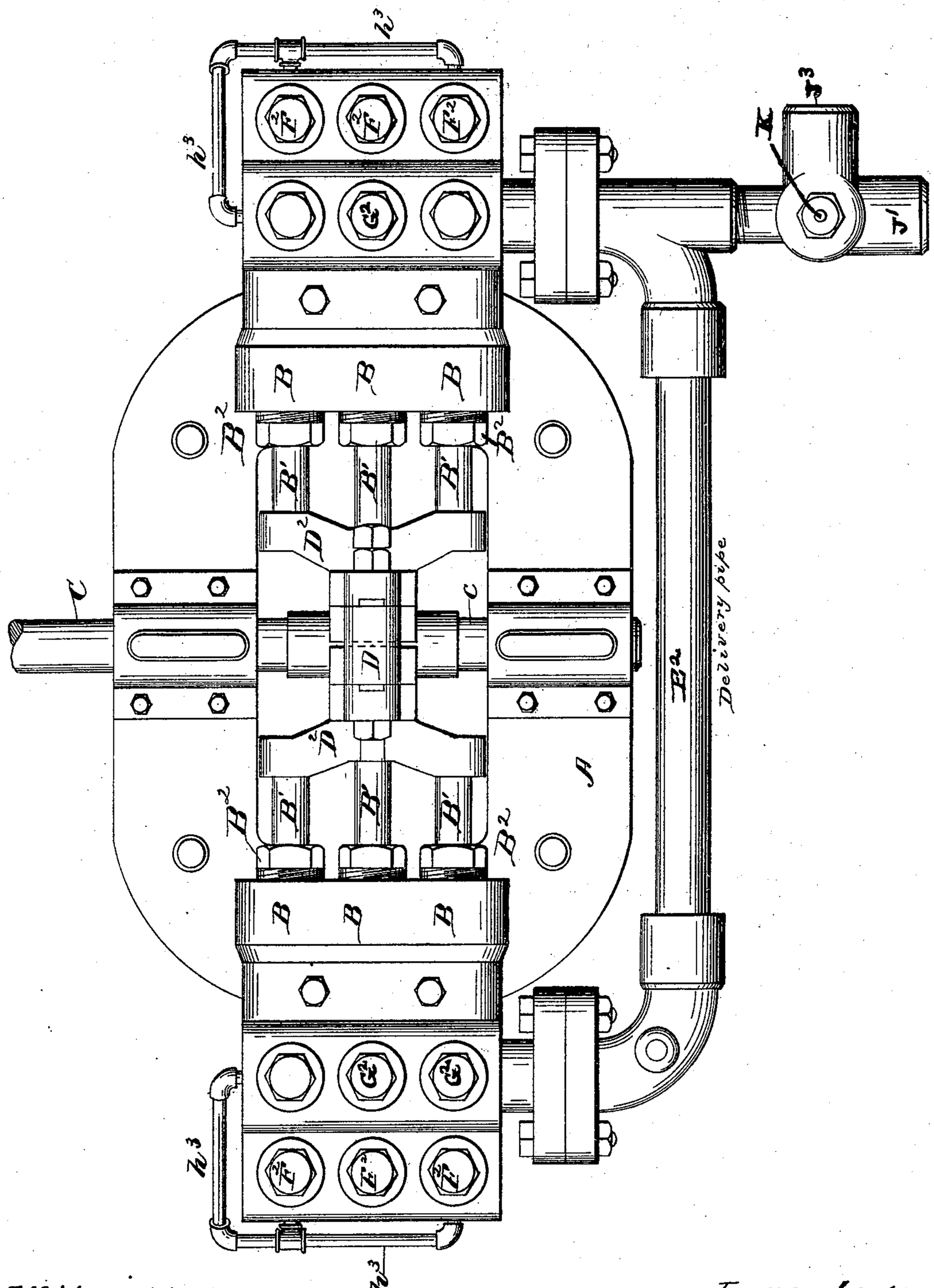
F. BLOMBERG.

HYDRAULIC PRESS.

No. 506,464. Patented Oct. 10, 1893.



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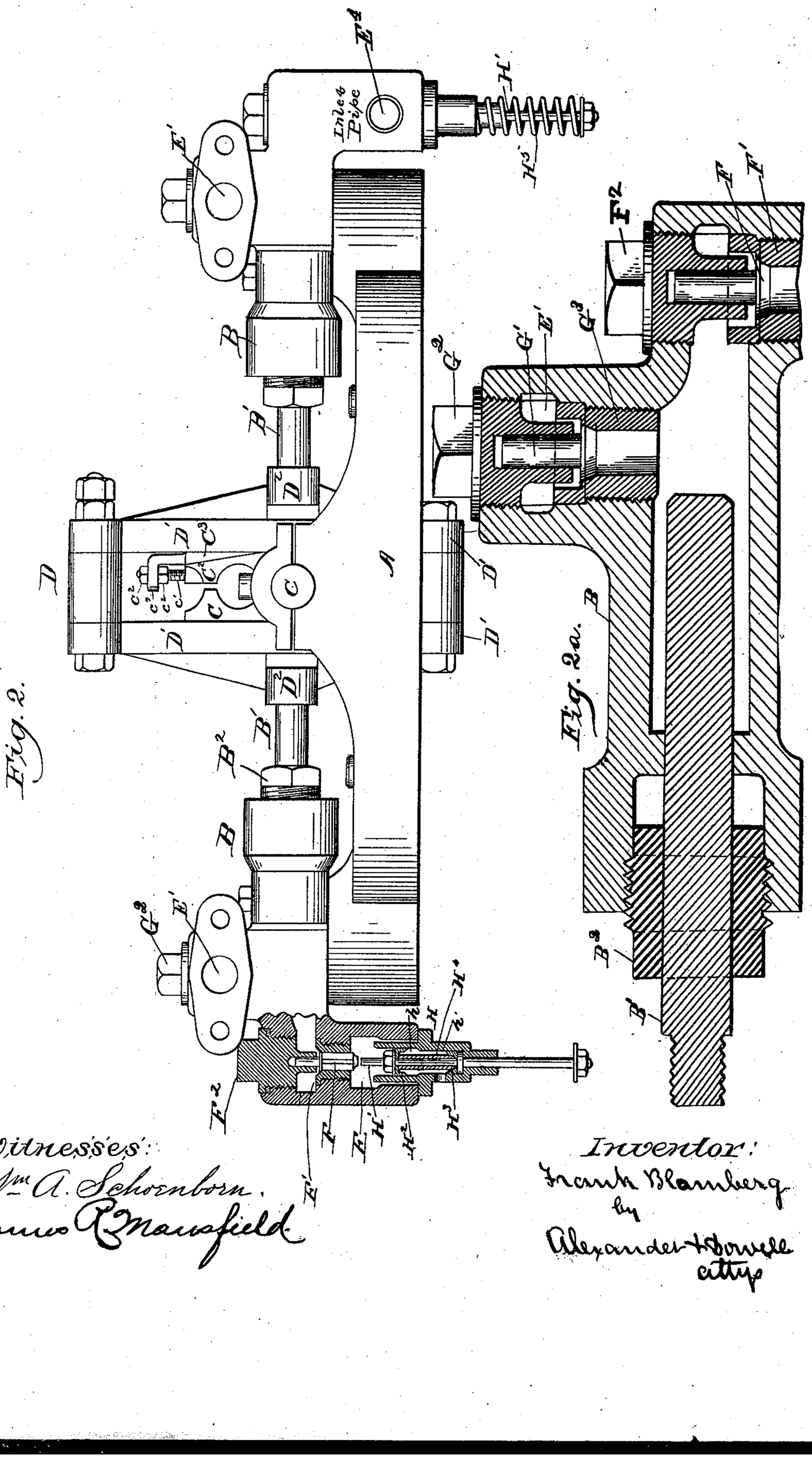

Fig. 2.

Fig. 2a.

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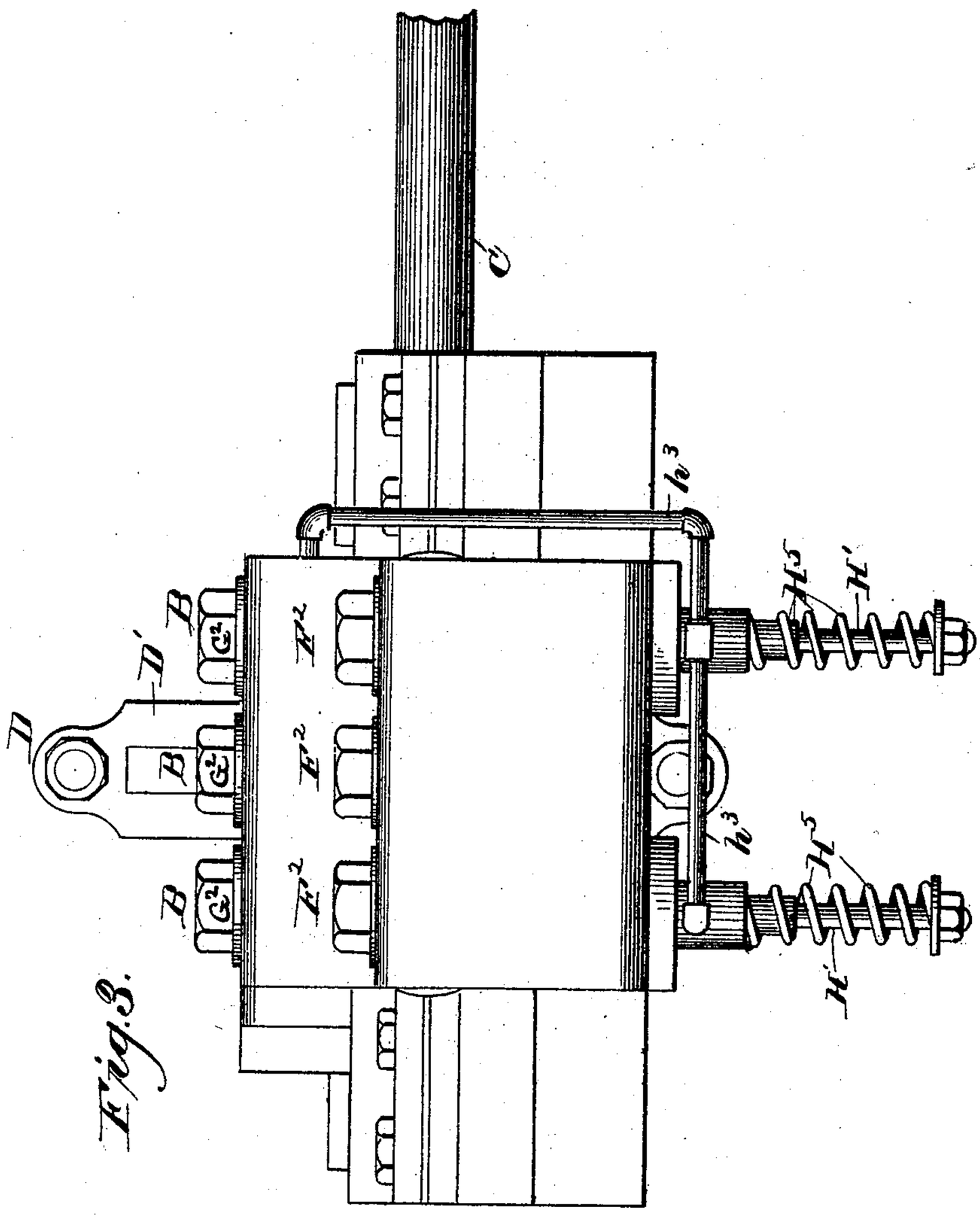

Fig. 3.

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(No Model.) 5 Sheets—Sheet 4.

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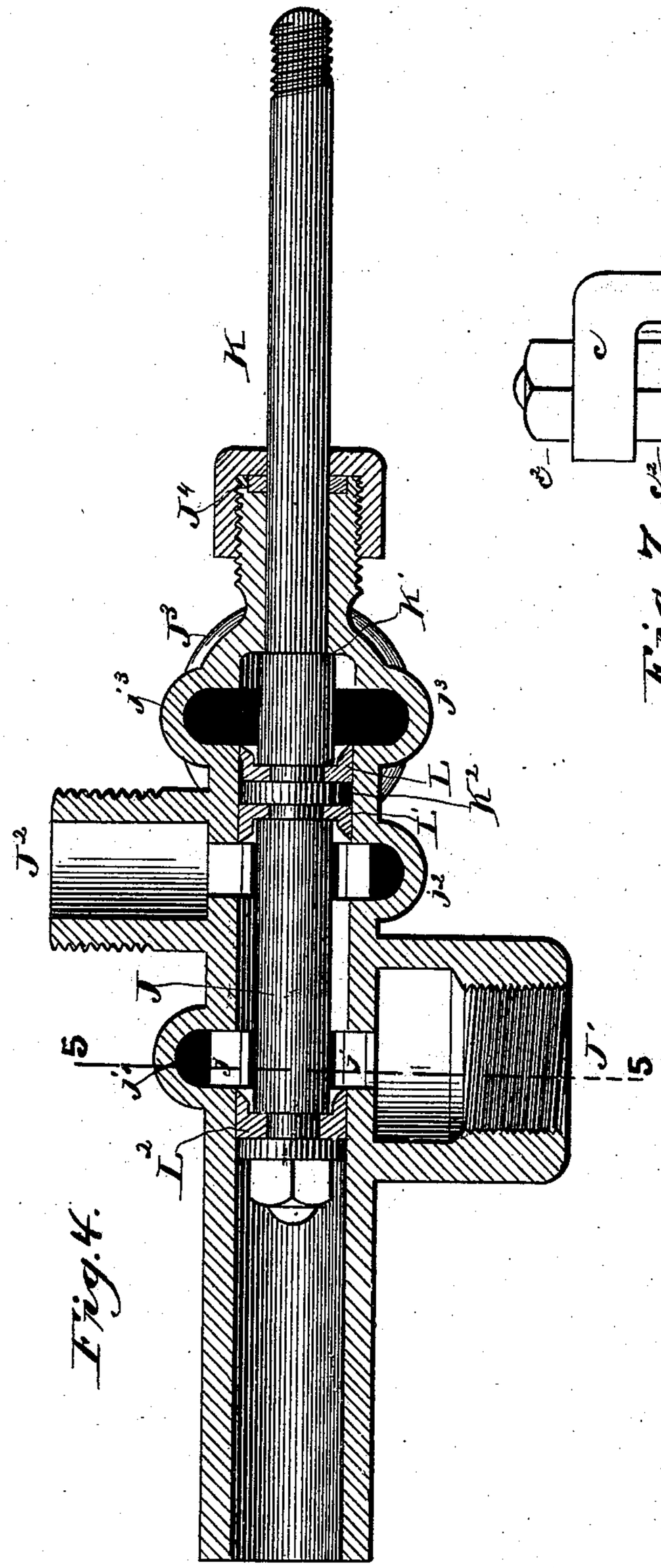

Fig. 4.

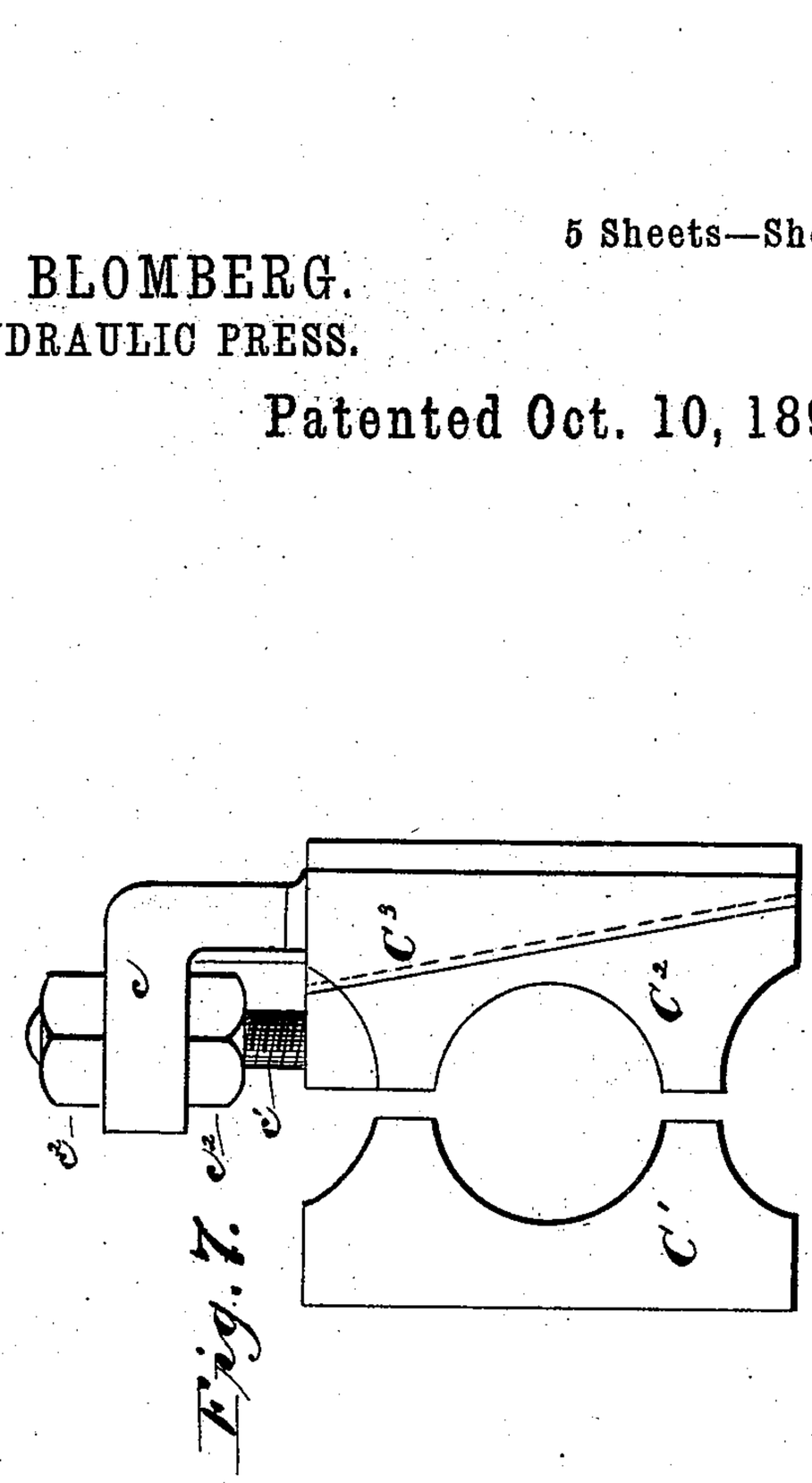

Fig. 2.

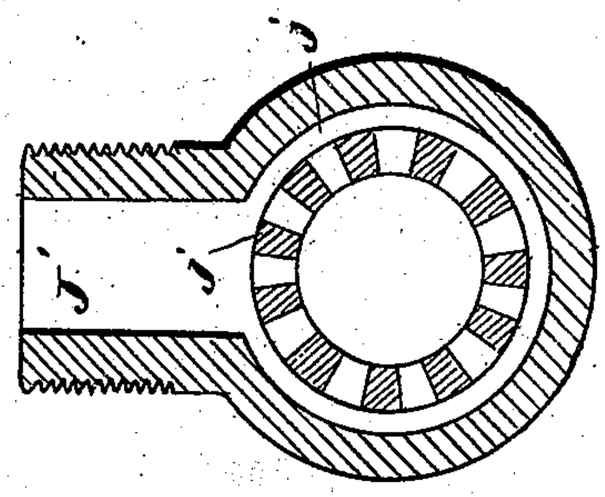

Fig. 5.

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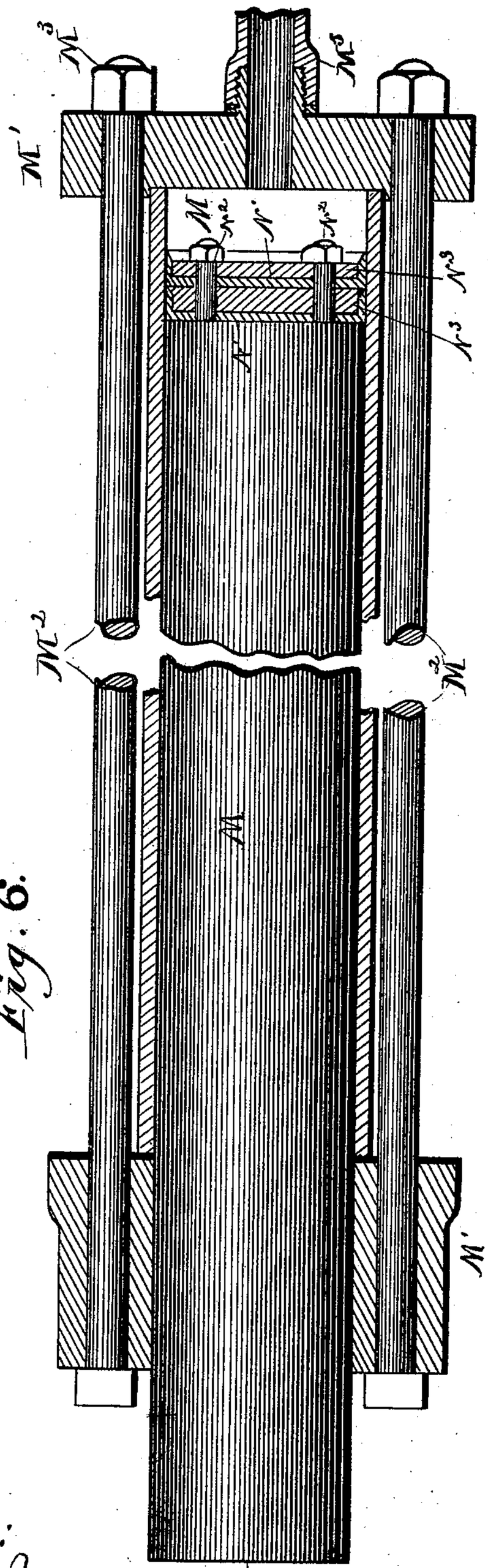

Fig. 6.

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UNITED STATES PATENT OFFICE.

FRANK BLOMBERG, OF MEMPHIS, TENNESSEE.

HYDRAULIC PRESS.

SPECIFICATION forming part of Letters Patent No. 506,464, dated October 10, 1893.

Application filed April 11, 1892. Serial No. 428,583. (No model.)

To all whom it may concern:

Be it known that I, FRANK BLOMBERG, of Memphis, in the county of Shelby and State of Tennessee, have invented certain new and useful Improvements in Hydraulic Presses; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification, in which—

Figure 1 is a plan view of the pump and connections. Fig. 2 is a side elevation partly broken away and Fig. 2ª is an enlarged longitudinal vertical section through one of the pump cylinders, pistons and automatic valves. Fig. 3 is an end elevation. Fig. 4 is an enlarged vertical sectional view through the main valve. Fig. 5 is a transverse section of the valve on line 5—5, Fig. 4. Fig. 6 is a longitudinal sectional view of the ram. Fig. 7 is a detail view of the crank-pin box.

This invention is an improvement in hydraulic press mechanisms and its object is to provide a rapidly operating, evenly running hydraulic press which can be worked at little expense with small power.

To make a perfect and satisfactory press for cotton, wool and other compressible substances wherein the material is greatly reduced in bulk under compression and wherein the resistance of the material to compression increases at first but slowly, it is desirable to have a mechanism whereby the ram will be moved forward steadily and rapidly at first, and then gradually slower and more powerfully. In the ordinary form of hydraulic presses the ram has been worked by means of a single or double acting pump which at each stroke ejects the same amount of water into the ram cylinder. This necessarily, as the resistance of the material under compression increases, causes the pump to slow up and puts more and more strain on the working parts and valves thereof. Where the cylinder of such pumps is of small capacity the movement of the ram has been slow, and where it has been large the power required to drive the pump to compress the material to the desired degree has to be proportionaly increased, so that while hydraulic presses are considered the best, yet they have been heretofore either too slow in operation, or too expensive to operate to be of general utility.

My present invention is designed to combine the good points, and avoid the defects of the heretofore known styles of hydraulic presses by making the pumps with a number of pump cylinders, communicating with a common supply and exhaust pipe, and providing automatic mechanism whereby as the pressure in the ram cylinder increases, several of the pump cylinders will be successively "cut out" or stopped from pumping thereby decreasing the resistance to be overcome by the driving power, and enabling the pump to be run steadily and continuously during the entire operation of compressing, with much less driving power required to work it than has heretofore been required; and I also cause the ram to work rapidly by first pumping into the ram cylinder from a series of pump cylinders, until the pressure in the cylinder caused by the resistance of material being compressed, reaches a predetermined point. Then by "cutting out" one or more cylinders the resistance to the driving power is decreased and the remaining cylinders are rapidly operated, until the pressure in the ram cylinder reaches a still higher point, when one or more other cylinders are automatically cut out and so on until the desired compression on the material is attained. In brief, as the pressure in the ram cylinder increases, the total working surfaces of the pumping pistons are proportionally decreased, so that the same driving power will operate the pump when the pressure in the ram cylinder is greatest that operated it when the pressure was least without injurious strains on the pump.

I also provide improved means whereby the admission of water into the ram cylinder from the pumps can be regulated, so that, without stopping the pump and by a single valve the water can be turned into the ram cylinder, or into the tank from the pump, or from both pump and ram cylinder into the tank. Finally I provide an improved ram cylinder and ram, by which all the water admitted into the ram cylinder acts directly against the ram.

The entire machine;—to wit—the pump,

valves, ram and ram cylinder, are essential to make a complete rapidly working press and have been specially designed and adapted to co-operate with each other in producing my perfected hydraulic press for cotton, wool, &c.

My invention therefore consists, first, in the novel construction of the multiplex piston pump; and valves for automatically cutting out of working operation one or more of the pump cylinders successively; second, in a novel valve for regulating the passage of water from the pump to the ram cylinder or tank and from the ram cylinder to tank; and finally in certain other novel details of construction and combination of parts hereinafter described and claimed.

Referring to the drawings by letters;—A designates the bed plate of the pump which is bolted to the sills of the press, or other suitable support.

B, B, B, designate three pump cylinders which as shown are formed in one casting, two sets of cylinders being used, secured respectively to the opposite ends of the bed plate directly opposite each other as indicated in Fig. 1.

C is a crank shaft lying transversely of the bed plate and journaled in proper bearings thereon; and D is the cross head having central guides D′ D′ between which fit the boxes on the crank of shaft C so that as the crank revolves, the cross head is reciprocated back and forth. The box on the crank of shaft C is formed of three pieces C′, C², C³. Parts C′ and C² are provided with half recesses or journals to fit the crank of the shaft, and part C′ has its outer edge also tongued or grooved to fit the guides D′ on the cross head. The outer edge of part C² is beveled vertically as shown and fitted by tongues and grooves to the oppositely beveled edge of part C³, the outer edge of part C³ being tongued or grooved to fit the guides on the cross head as shown. Part C³ has a bent arm *c* on its upper end which overlies the upper end of part C² and is vertically slotted for the passage of an upstanding threaded bolt *c′* rigidly affixed to the upper end of part C² and *c²*, *c²*, are adjusting nuts on this bolt above and below arm *c* for adjusting the parts C², C³, in relation to each other and holding them so adjusted. By this means I am able to take up wear on the crank journal boxes easily without disabling or dismantling the engine, so that there shall be no knocking of the boxes against the cross head. The cross head is provided at its sides with horizontal pieces D² to which are connected the outer ends of plungers or pistons B′ B′ which work in the respective cylinders B, B, B, as shown. The pistons B′ pass through adjustable stuffing glands or heads B² screwed into or otherwise attached to the inner ends of cylinders B and closing the bores of the cylinders. The outer end of each cylinder B in a set communicates with a common inlet chamber E below and with a common outlet chamber E′ above. A check valve F is interposed between the chamber E and each cylinder which valve is seated in a removable seat F′ screwed into an opening between the cylinder and chamber E and being guided by its stem which enters a bore in a removable cap F² screwed into an opening in a casting above the valve as shown in Fig. 2. By this construction each inlet valve can be separately and quickly removed for repairs or cleaning. Each cylinder communicates with the chamber E′ at its rear end through an opening closed by a check valve G′ as shown in Fig. 2ª which valves are seated in removable seats G³ and to which access can be had by removing screw caps G². The chambers E′ communicate with each other and with a common pipe E³ so that the water pumped thereinto from the cylinders will be conducted to a common outlet and the pressure in the two chambers E′ be equalized. The chambers E, E, are supplied with water from a tank by pipes attached at E⁴.

The automatic devices for "cutting out" one or more cylinders is as follows:—In the pump shown, having six cylinders, three on a side, I have only provided means for "cutting out" two cylinders on each side. All the "cut out" devices are alike in construction and operation. Each consists of a short tube H which is bolted to the bottom of chamber E below the valve F of the cylinder to be controlled, and through this tube plays a longitudinally movable rod H′ which projects into chamber E in such position that if sufficiently elevated its inner end will strike and lift valve F and hold it raised. The upper portion *h* of the bore of the tube is of greater diameter than its lower portion *h′*, and on the rod H′ are fixed two pistons H², H³, respectively occupying and working in the larger and smaller parts *h*, *h′* of the bore of the tube. These pistons are preferably cup leather pistons facing each other the lower one being confined on the rod by a collar H³ (which also prevents the rod falling out of the tube) and a superimposed tube H⁴ on the rod, the upper piston resting on the upper end of the sleeve and confined by a washer and nut on the threaded upper or inner end of the rod. The two pistons are thus held rigidly in relation to each other. The chamber in the tube between said pistons H², H³, communicates by a small pipe *h³* with the chamber E′ or the common pipe E² so that the pressure in the tubes H is equal to that in said chambers or pipe. Now, owing to the upper part *h* of the tube, and the upper piston H² being larger than the lower part *h′* and piston H³, it is obvious that the pressure on the two pistons will be unequal. Consequently the pressure on the larger piston will overcome the pressure on the smaller piston and the rod H will be lifted, thereby causing its inner end to unseat the opposed valve F. The movement of the rod however is controlled by means of a spring H⁵ placed on the outer end of rod between the tube and a washer on the end of rod, the tension of

which spring can be adjusted by nuts as indicated in the drawings. Consequently the valve stem will not be raised until the pressure on the upper piston is more than the combined resistance of the spring and the pressure on the lower piston; and knowing this the operator can readily regulate the tension of the spring so that the rod will not rise and unseat the valve until the pressure in the chambers E′ has reached a certain limit. By employing the two pistons on the stem, as described, a very light spring can be made to regulate a high pressure in the pump chambers and cylinders, but I do not intend to confine myself to the described construction as the lower piston might be omitted by increasing the power and tension of the spring sufficiently to hold down the rod against the pressure on the upper piston to the desired point. And obviously instead of springs, weighted pivoted arms might be used as in ordinary safety valves. As shown one of these controlling devices is applied to two of the cylinders on each side; and they should be adjusted to operate at different pressures so that their corresponding cylinders will be "cut out" successively as the pressure in chambers E′ increases, instead of all together.

By "cutting off" a cylinder I mean that it ceases to pump water into chamber E′, because so long as a valve F is raised, the water will be simply drawn back and forth through said valve between the cylinder and chamber E. Therefore so long as a rod H is raised and unseats a valve F, just so long will the corresponding cylinder and piston fail to inject water into chamber E′.

J represents the main valve for regulating the pressing operation and the passage of water from pump to ram cylinder, &c. This valve consists of a tube having its lower end open, and three branches or joint openings J′ J^2, J^3, one above the other as indicated in the drawings, and made in opposite sides of the tube so that there will be no difficulty in connecting piping thereto. Preferably, the tube is laterally bulged or chambered opposite each opening J′ J^2, J^3, as at j' j^2, j^3, the ends of the chambers communicating with the respective openings, and a radially slotted annulus j is placed in each chamber j' j^2, to guide the reciprocating valves. K designates a valve stem in said tube, its upper end extending through a stuffing box J^4 on the upper end of the tube, which is thus closed. The stem is shouldered as at K′ to prevent its being drawn too far upward, and below this shoulder is a collar K^2 on the rod fitting neatly the bore of tube J, and above and below this collar and properly secured to the stem are two oppositely facing cup shaped (preferably leather) valves L, L′, which when the stem is raised stand between openings J^2, J^3 and cut off communication therebetween. L^2 is a similar valve fixed to the lower end of stem K below the opening J′. The lower end of the tube is left open so that leakage may be detected, and the stem and valves easily removed from the tube. The upper end of the stem K is connected by rods or other means with a lever, &c., so that it can be readily operated by the pressman. Opening J^2 is connected to pipe E^2; J′ to pipes leading to the ram-cylinder; and J^3 to pipes leading to the water tank or waste.

When the pump is working and it is desired to operate the ram, the valve stem K is raised until packing or valves L, L′ stand above opening J^2, the water from the pumps then enters tube J and passing downward is arrested by valve L^2 and escapes through passage J′ to the ram-cylinder. The pressure on valve L^2 is equalized by the pressure on valve L′. When the ram is raised and the pressing complete the pressman shifts stem K downward until pistons or valves L, L′ pass below opening J^2, the water from the pumps escapes through opening J^3 and the water in the ram cylinder is shut therein. Then when the bale is tied the pump can be stopped, and stem K still further depressed until valves L, L′ stand below opening J^2, when the water from the ram will move back up through tube J and escape through opening J^3 to the tank or waste. By this valve all danger from sudden shutting off of communication between pump and ram-cylinder while the pump is running, is obviated; and by a single duplex valve I control the water communication between the pump, ram-cylinder and waste or tank. Preferably I employ the ram and ram-cylinder shown in Fig. 7. The cylinder is formed of a metallic tube M the ends of which are seated in recesses in metallic heads M′ M′ which are united by tie rods M^2, M^2, exterior to the tube, and securely bound to the heads by nuts M^3. The ram or piston is formed of a shaft or pipe N of a diameter to fit closely in the tube, and having on its head or inner end two disks N^3, N^3, set in cup-shaped or dished washers preferably leather N′ N′ one above the other secured to the end of ram by bolts N^2. Water is admitted into the cylinder M through pipes M^5 connected with opening J′ of the valve J below washers N′ and spreads the washers, making a close joint between the ram head and the cylinder. This construction of cylinder enables it to be repaired by an inexperienced party, and it can be repaired if fractured by hooping it externally.

To briefly summarize the operation of the apparatus; supposing that the parts are properly connected to each other and a suitable press, and it is desired to exert a pressure on the material of, say, six hundred pounds per square inch, and the driving power for rotating shaft C is equal to the task of driving said shaft, with one pair of pistons only at such pressure; there being three pairs of pistons and cylinders however, obviously the pump could not be operated economically unless either additional power be obtained, or the number of cylinders be diminished. Therefore the "cut outs" are adjusted so that when

the pressure in chambers E′ reaches two hundred pounds per square inch of piston surface in the cylinders B, two of the cylinders will be cut out, and when the pressure in the chambers E′ reaches three hundred pounds per square inch on the working cylinders pistons two more cylinders will be cut out, leaving but two cylinders pumping, which can be run up to six hundred pounds pressure easily. When the pump is started, therefore, all six cylinders are working and consequently the water is rapidly forced into the ram cylinder. Then when the pressure reaches two hundred pounds per square inch on six pistons equal to six hundred pounds per square inch on two pistons two cylinders are cut out; this immediately relieves the pressure and the pump works rapidly up until the pressure reaches three hundred pounds per square inch on four pistons (equal to six hundred pounds on two pistons) and then two more cylinders are cut out, pressure being relieved and the pump rapidly operates until the six hundred pounds pressure on the two cylinders is reached, which insures six hundred pounds pressure in the ram-cylinder. By this arrangement most water is supplied to the ram cylinder when there is least pressure, and the water gradually cut off as the resistance of the material increases, and when the necessary movement of ram is less.

I do not confine myself to any particular number of pistons and cylinders operating thus, and it is obvious that instead of cutting out two or more cylinders at a time, they may be arranged so that they may be successively cut out one at a time, and if desired the cylinders may be of different diameters, and the pumps may be of various constructions and kinds.

Having described my invention, what I claim as new, and desire to secure by Letters Patent thereon, is—

1. The combination of the tube having three differently facing openings, and enlargements opposite each opening and open at its lower end, a reciprocating valve stem in said tube having a shoulder K′ and a collar k^2, the washers L, L′ L^2 attached to said stem, and the radially slotted rings in the enlargements past which said valves work, substantially as specified.

2. The combination with the ram cylinder, with a ram therein corresponding in diameter with the bore of the cylinder, having two cup-shaped washers N^3 placed one over the other and confined in its end by disks and bolts, the disks filling the washers, substantially as described.

3. The herein described pump consisting of a base, two sets of pump cylinders, each set formed in one casting secured to opposite ends of the base, a single crank shaft, a single cross head D, yokes D^2 on opposite sides thereof, and the pump piston rods in each set respectively attached to the yokes D^2, substantially as described.

4. The combination with the cylinder and its inlet valve, of a tube below said valve, a rod playing through said tube adapted to strike and unseat the inlet valve when lifted, a piston on said rod within the tube, a water inlet below the piston, and an adjustable spring on the lower end of said rod below the tube, all constructed and arranged to operate substantially as and for the purpose described.

5. The combination of the cylinders, the common inlet and outlet chambers, the inlet and outlet valves, and the tubes H below the inlet valves communicating with the outlet chamber, the rods H′ playing through said tubes, and the unequal sized pistons on said rods respectively above and below water inlet to the tube whereby they are caused to rise by pressure of water and unseat the inlet valves directly above, substantially as described.

6. The combination of two or more cylinders and pistons, a common water supply chamber, and a common outlet chamber and receiver, and inlet and outlet valves between the cylinders and the supply, and outlet chamber with a rod adapted to strike and unseat the inlet valve having a pair of pistons working in a chamber of unequal diameters below the inlet valve and communicating with the receiver at a point between the pistons adapted to holding the inlet valve of a cylinder open when the pressure in the receiver passes a certain point, substantially as described.

7. The combination of a pump cylinder, an inlet chamber and valve and a receiver communicating with the cylinder with a detachable tube located at the inlet side of the inlet valve, a rod in said tube, a pair of unequal sized pistons on said rod and a pipe connection between said tube and the receiver between the pistons on the rod whereby the rod is raised in the inlet chamber by fluid pressure from the receiver and at a certain pressure and the inlet valve kept open, substantially as described.

8. The combination of the cylinder and piston, the supply chamber and receiver, and inlet and outlet valves, with the detachable tube located opposite the inlet valve having unequal chambers in its bore, a rod playing through said tube and supply chamber and adapted to unseat the inlet valve, pistons on said rod in the chambers of the tube, and a fluid inlet between the pistons valves from the receiver for controlling the movement of the rod, substantially as set forth.

9. The combination with the cylinder and its inlet valve and removable valve seat, of a removable tube below said valve, a rod playing through said tube adapted to strike and unseat the inlet valve when lifted, a piston on said rod within the tube, a water inlet below the piston, a second smaller piston

on the rod below the water inlet, and a spring on the lower end of the rod below the tube, and means for adjusting the tension of said spring, substantially as and for the purpose described.

10. The combination of a set of cylinders, and a set of synchronously operating pistons, the common inlet and outlet chambers and valves therein, and removable tubes below several of the inlet valves each having a portion of its bore enlarged, a rod extending through each tube and through the inlet chamber with its upper end just below the inlet valve, unequal sized pistons on said rod within the tube, a water inlet to the tube from the outlet chamber between said pistons, and means for normally holding said rod down, substantially as and for the purpose set forth.

11. The combination of the pump, the ram cylinder, and a valve tube interposed between the pump and cylinder having three outlets one above the other, the lowest communicating with the cylinder, the central opening with the pump, and the upper opening with a waste pipe or tank, and a vertically movable valve stem in said tube having collar k^2, double washers L, L′ and single washer L^2, all arranged to operate substantially as and for the purpose described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

FRANK BLOMBERG.

Witnesses:
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J. M. WOODS.