

No. 608,423.

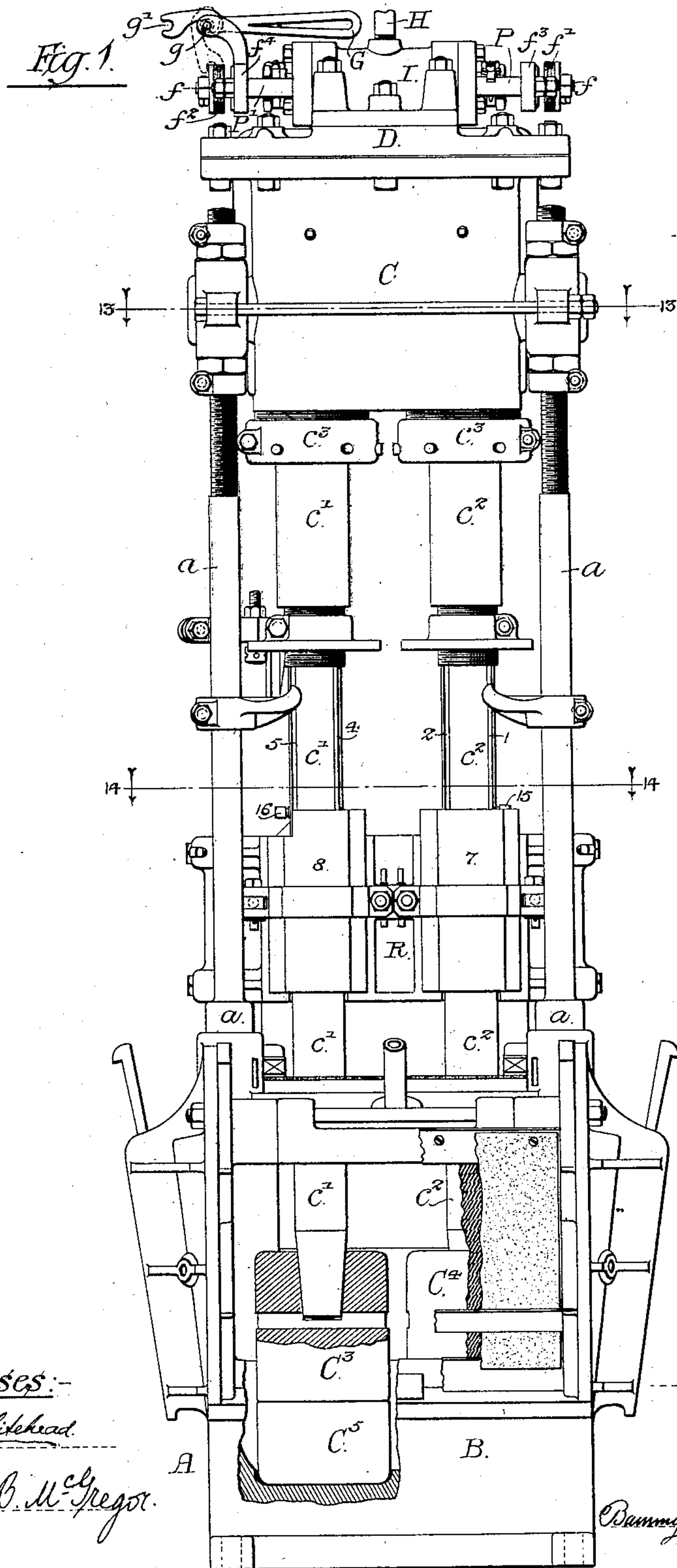
Patented Aug. 2, 1898.

D. COLE.  
STEAM ORE STAMP.

(Application filed May 3, 1897.)

(No Model.)

6 Sheets—Sheet 1.



*Witnesses:-*

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*Thomas B. McGregor.*

*Inventor:-*

*DAVID COLE.-*

*by:-*

*Bammy & Bammy, Attorneys.*

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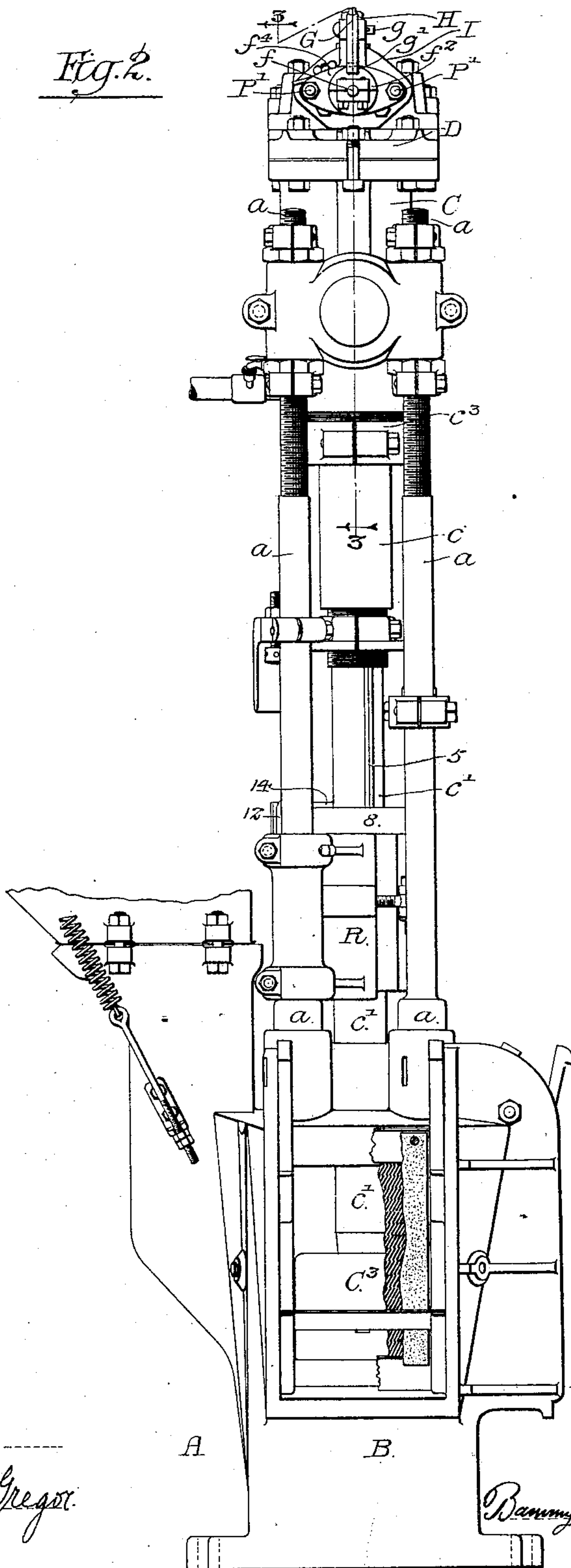
D. COLE.  
STEAM ORE STAMP.

(Application filed May 8, 1897.)

(No Model.)

6 Sheets—Sheet 2.

*Fig. 2.*



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**No. 608,423.**

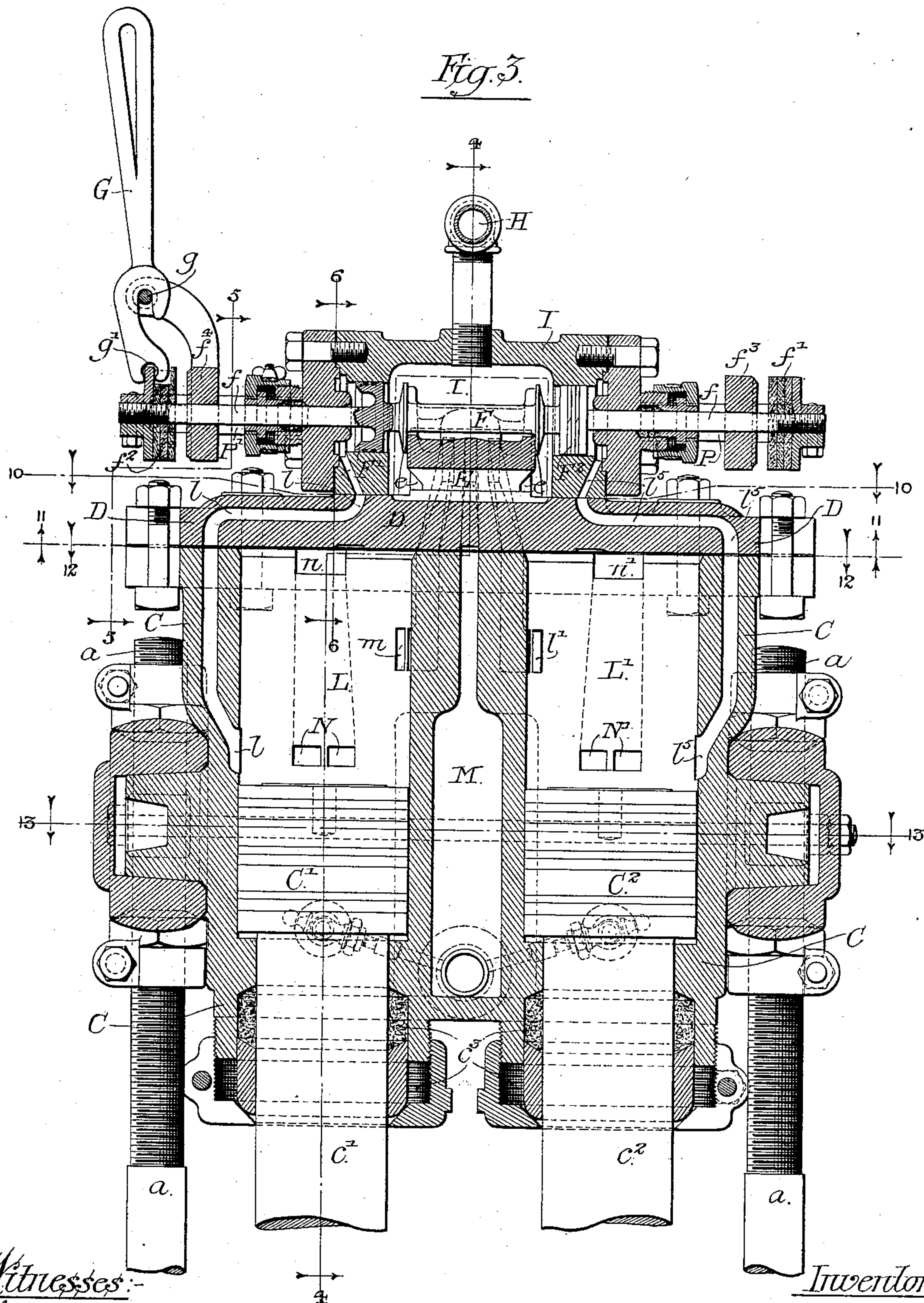
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(No Model.)

(Application filed May 3, 1897.)

6 Sheets—Sheet 3.



Witnesses:-  
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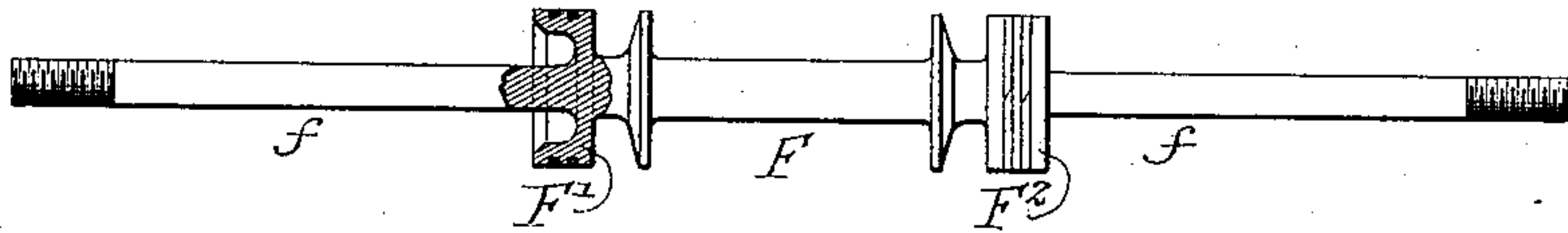
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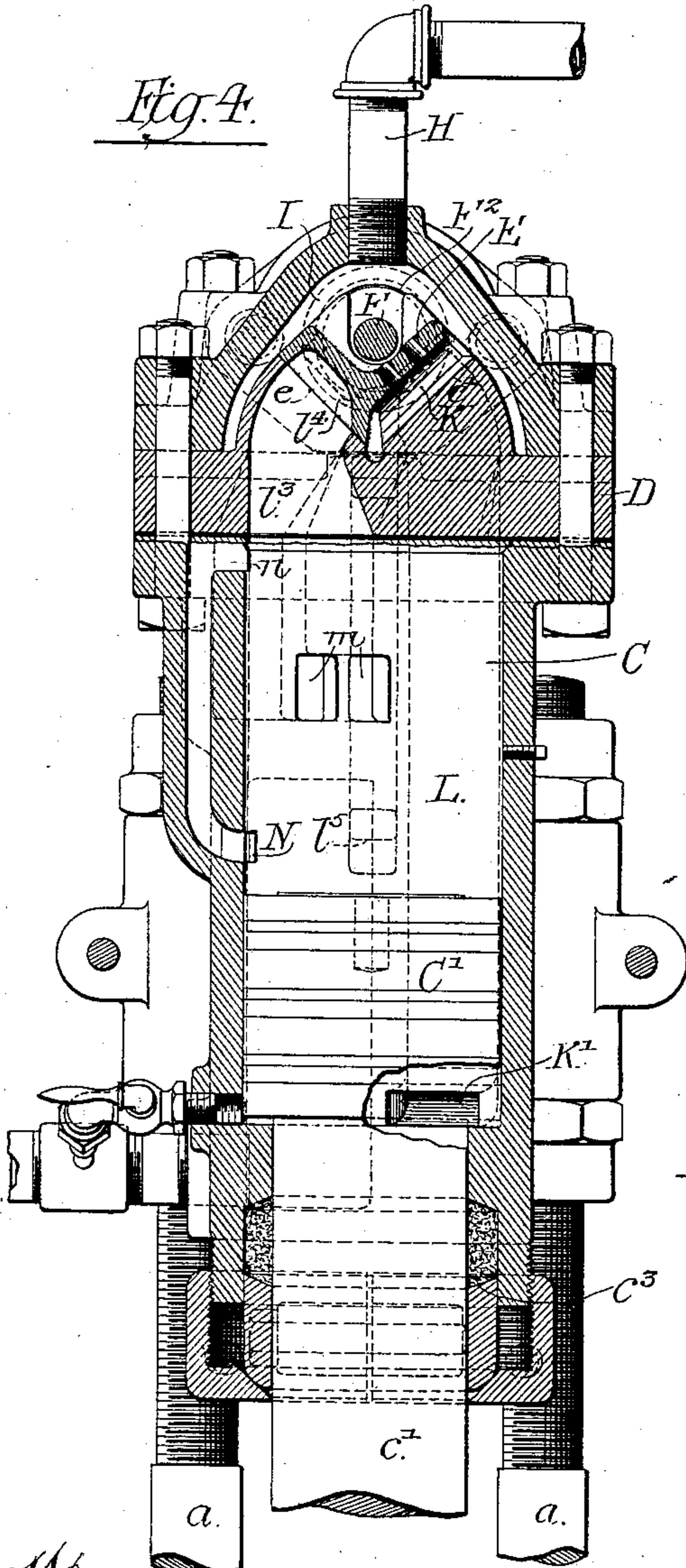
(Application filed May 3, 1897.)

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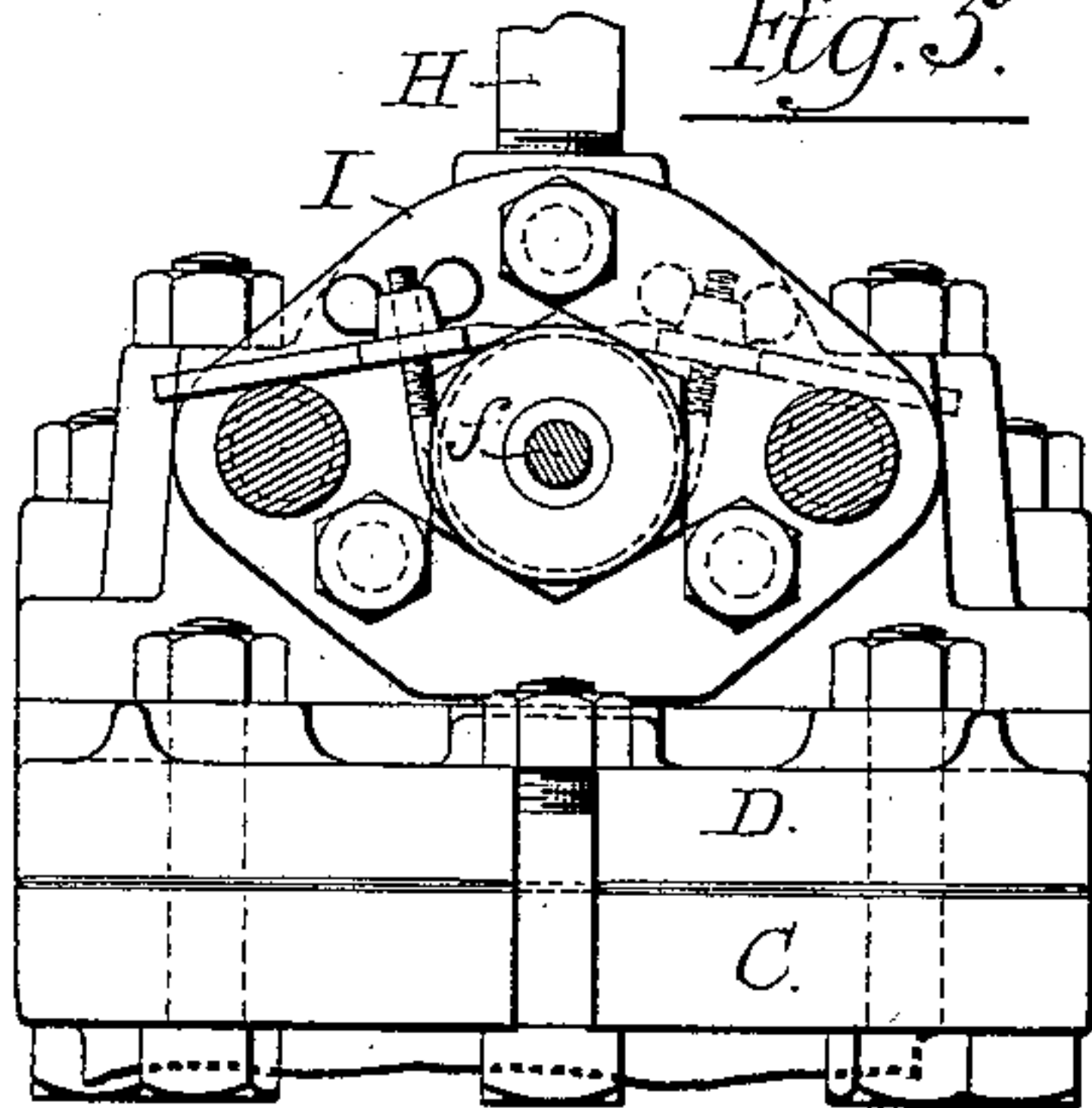
*Fig. 7.*



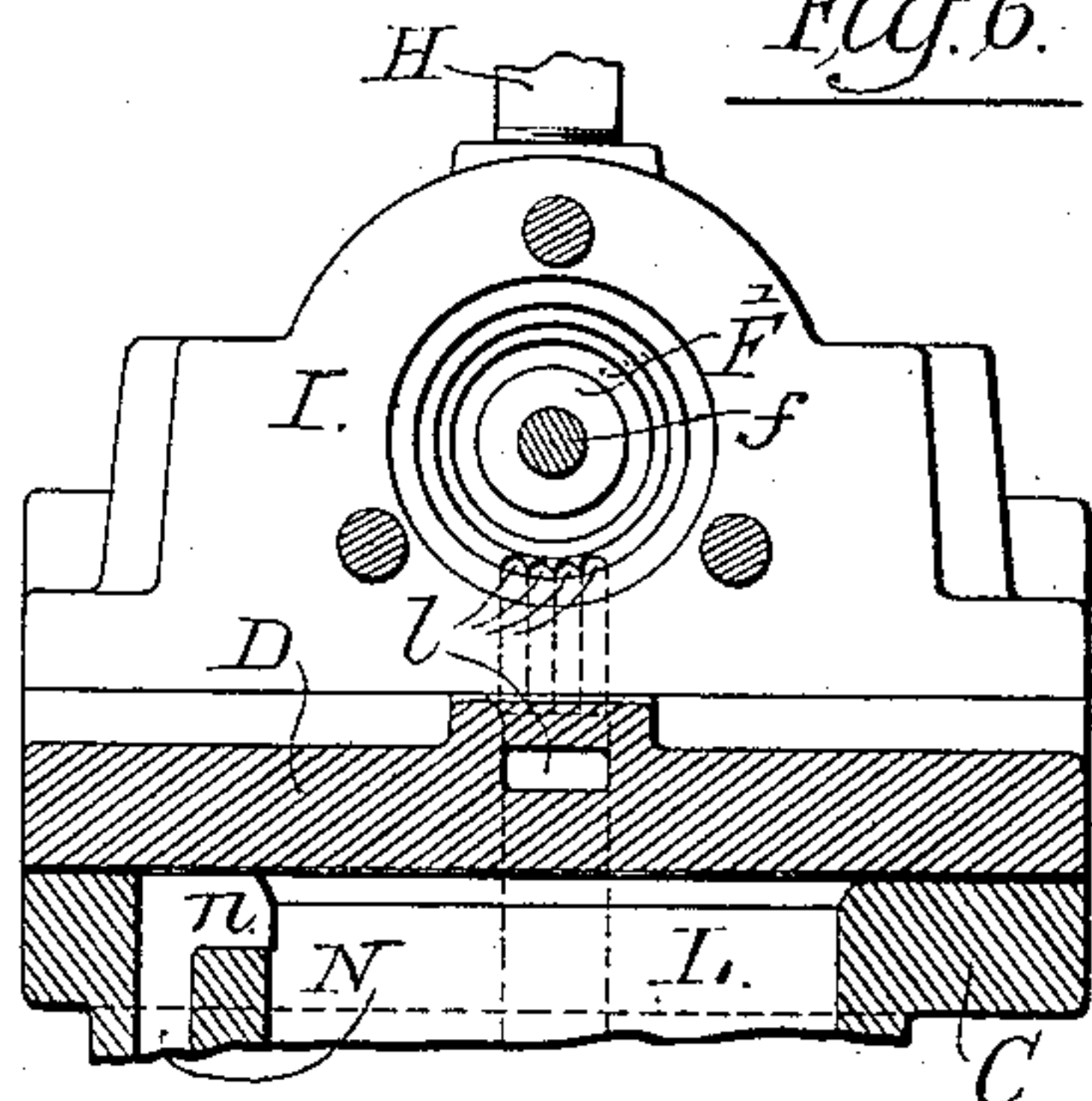
*Fig. 4.*



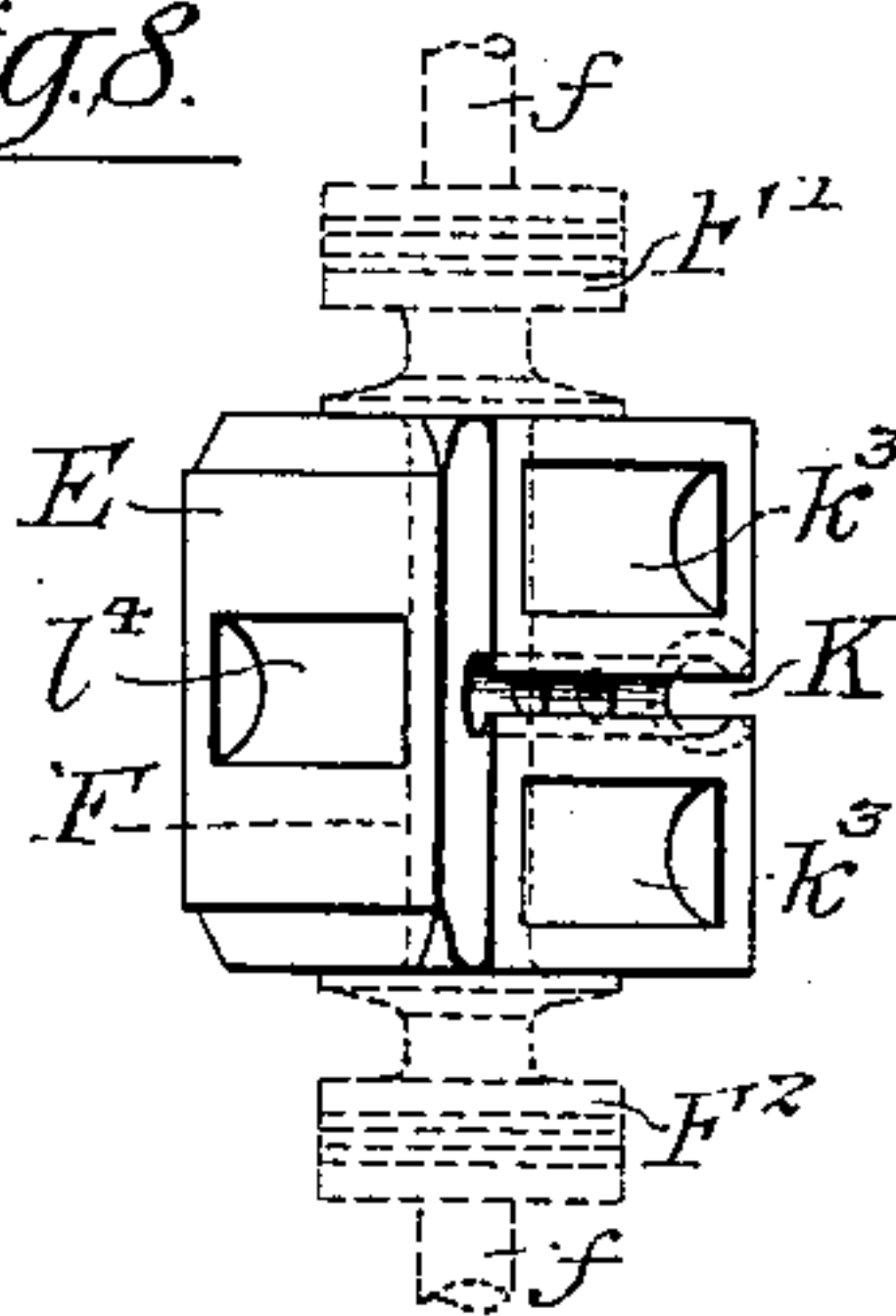
*Fig. 5.*



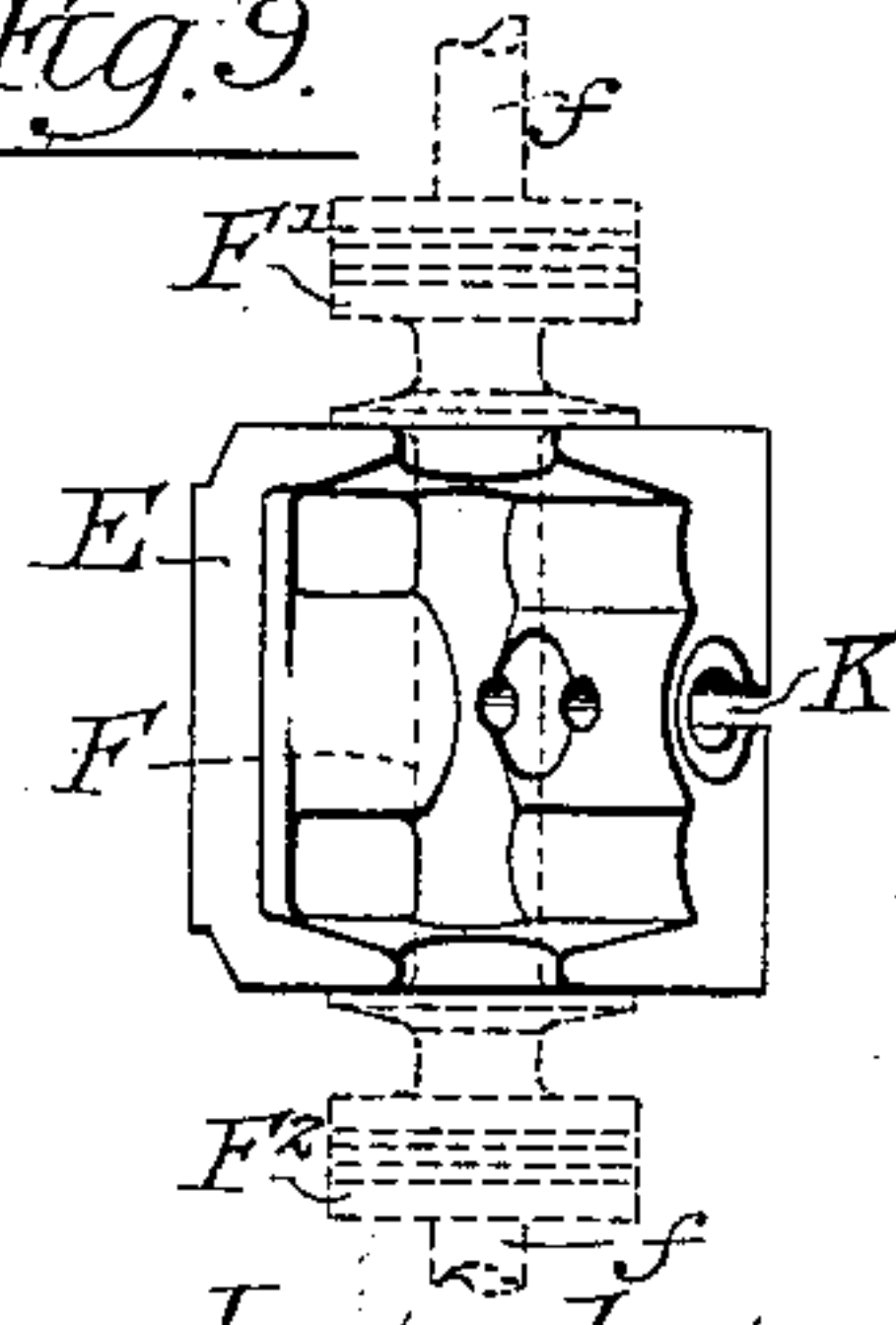
*Fig. 6.*



*Fig. 8.*



*Fig. 9.*



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D. COLE.  
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6 Sheets—Sheet 5.

Fig. 10.

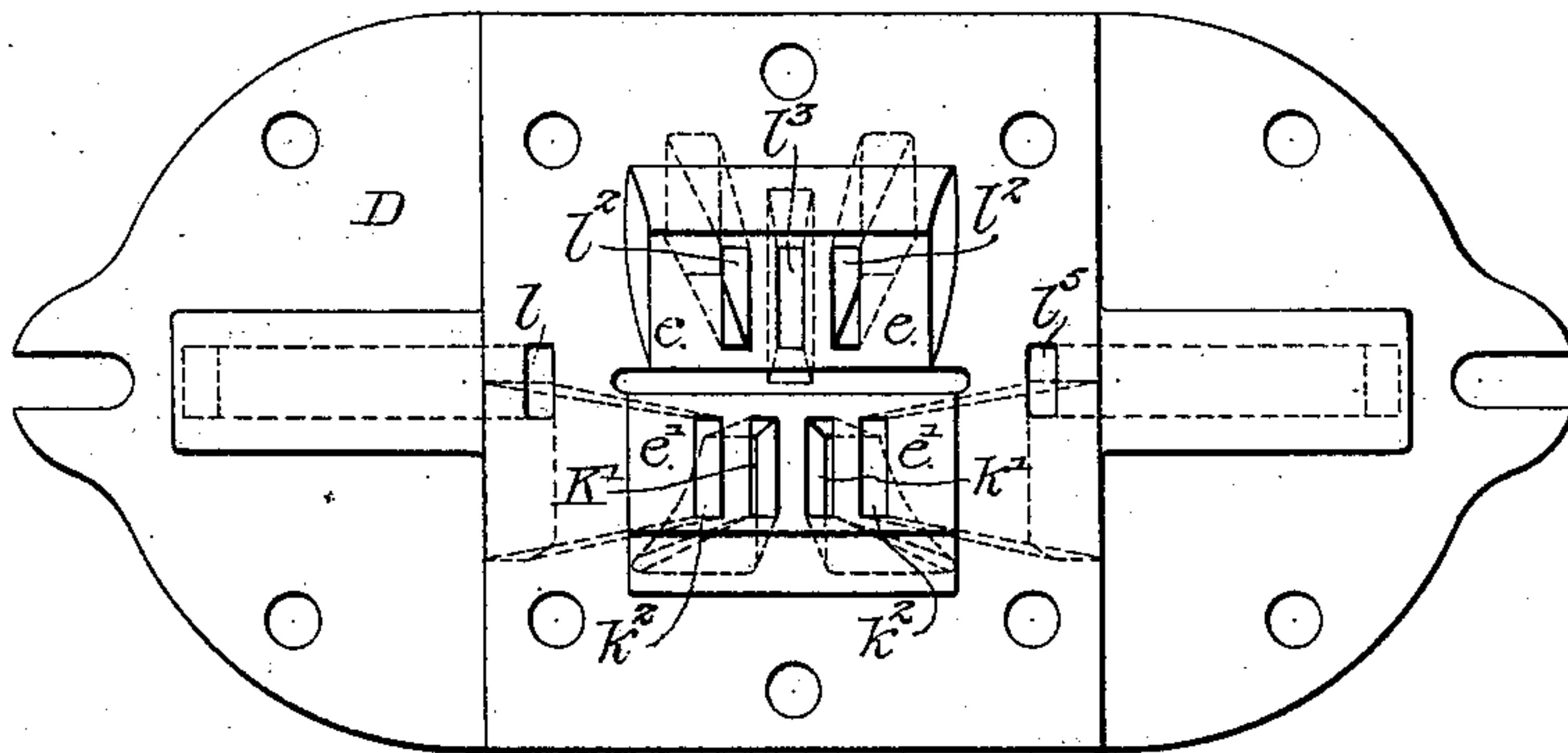


Fig. 11.

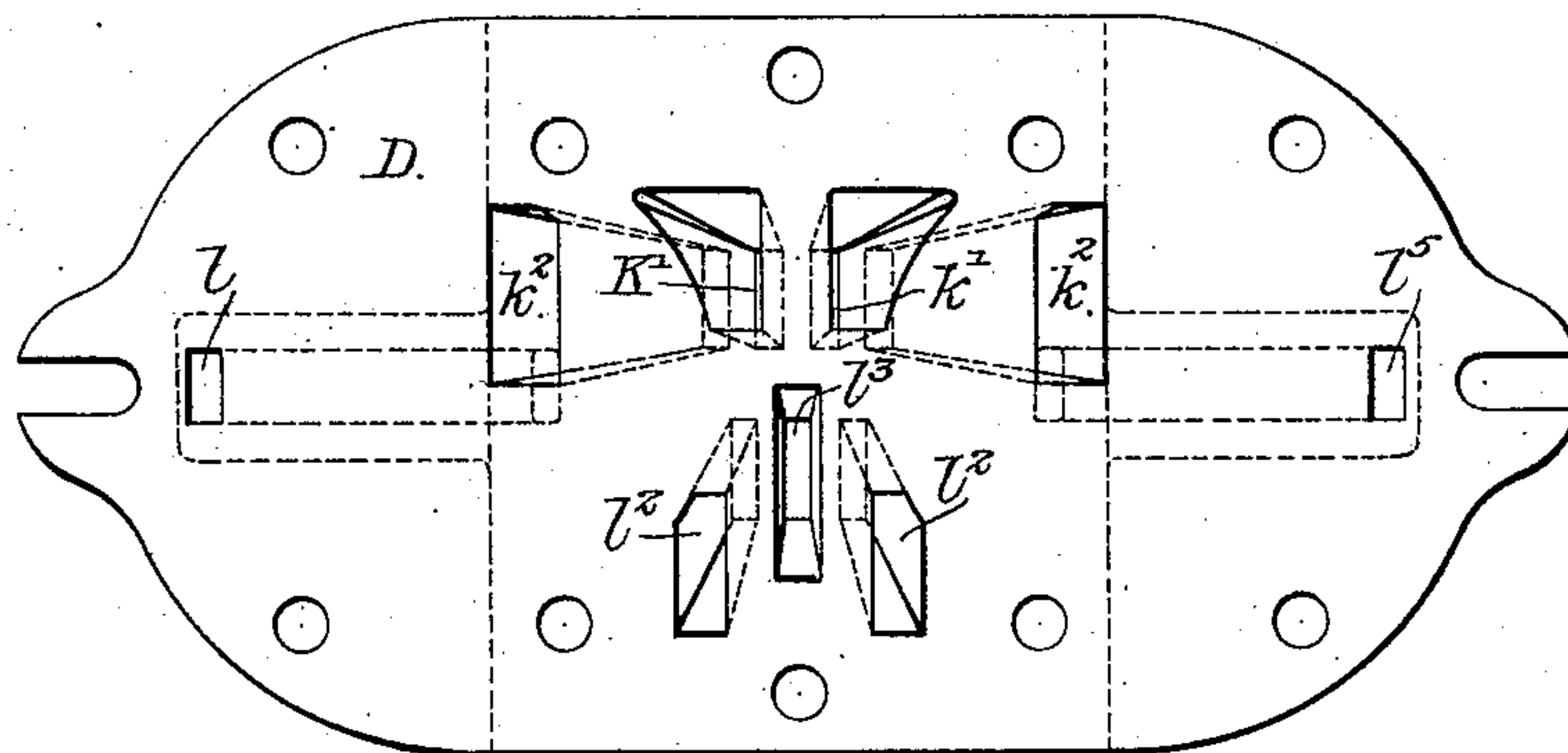
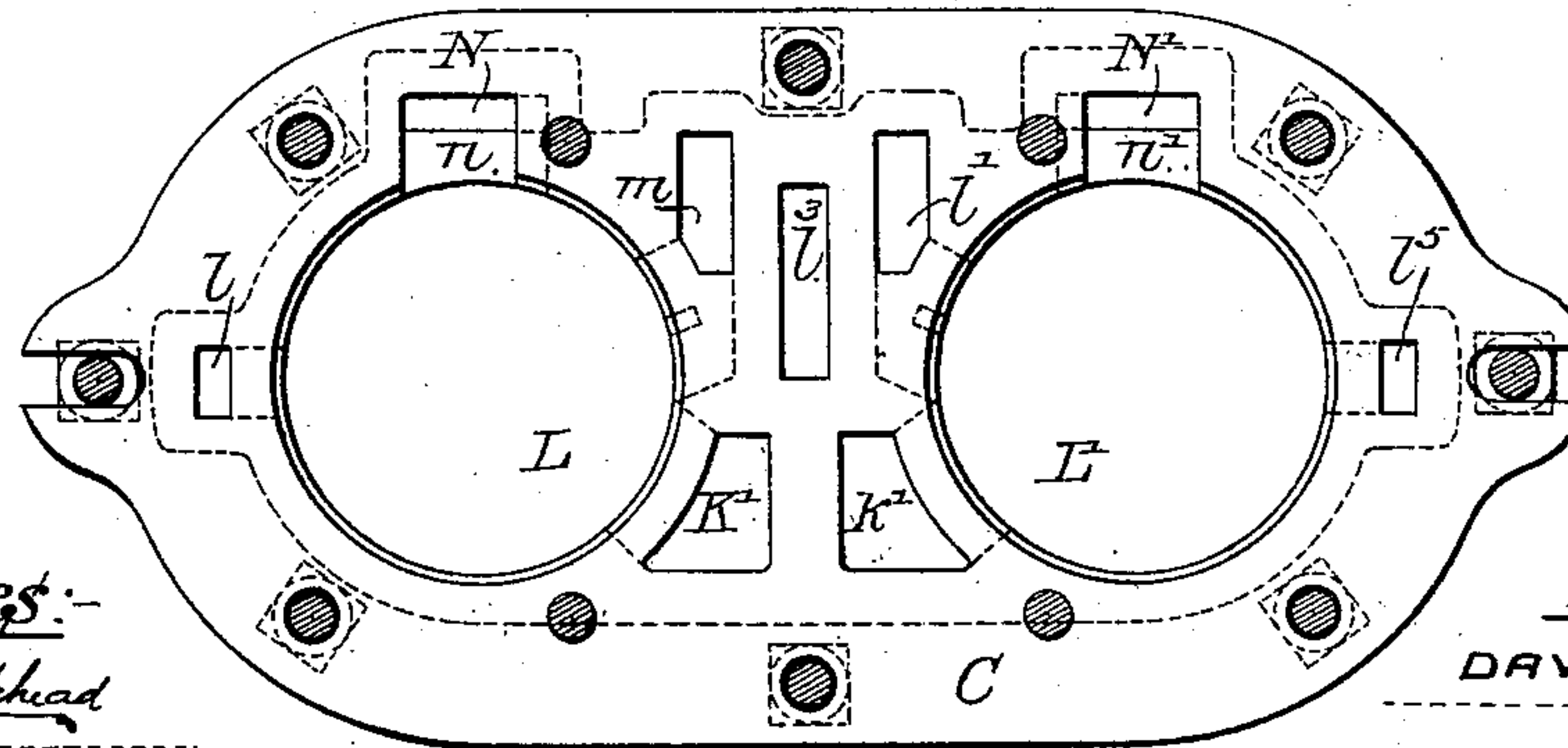


Fig. 12.



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D. COLE.  
STEAM ORE STAMP.

(Application filed May 3, 1897.)

(No Model.)

6 Sheets—Sheet 6.

Fig. 13.

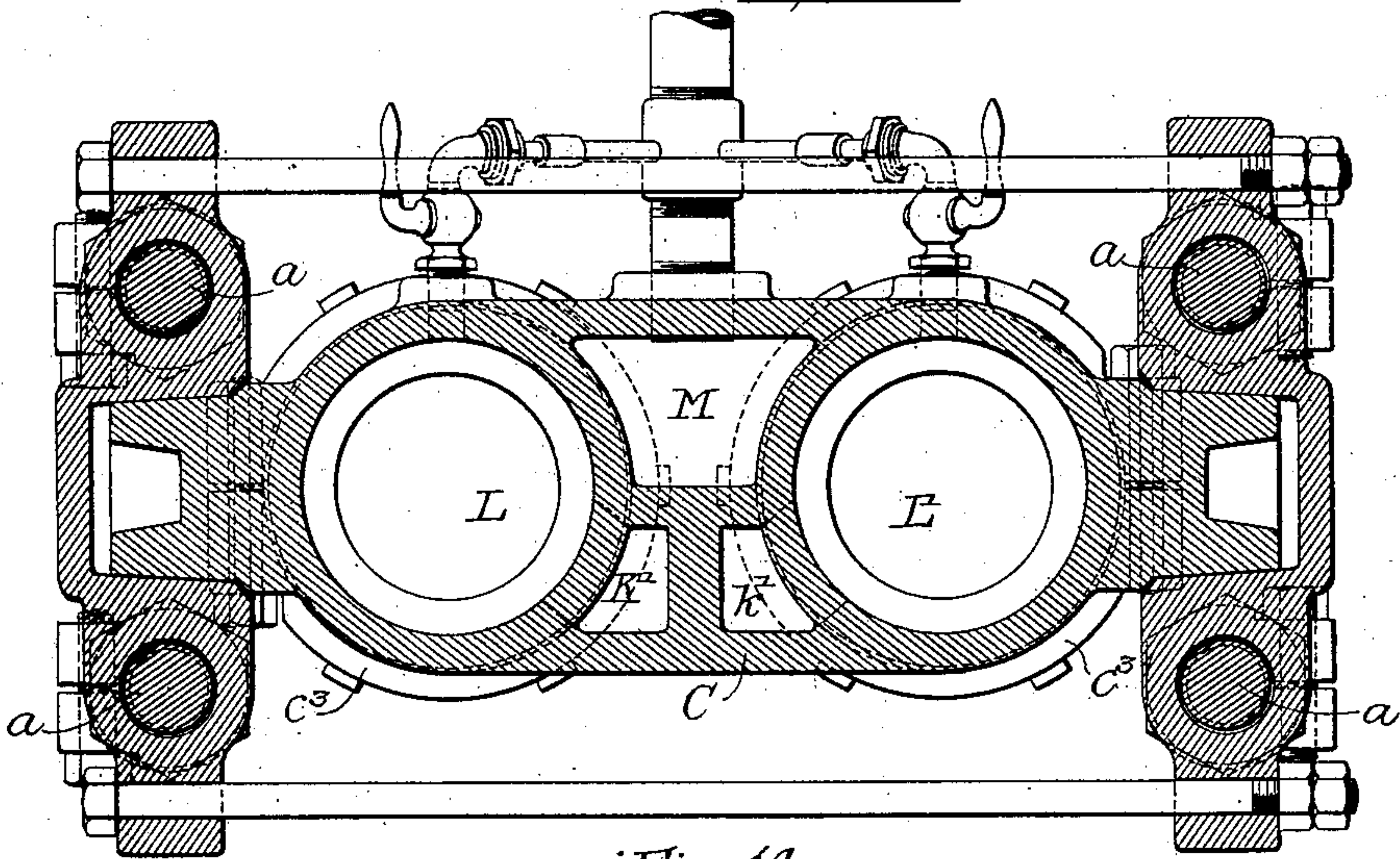


Fig. 14.

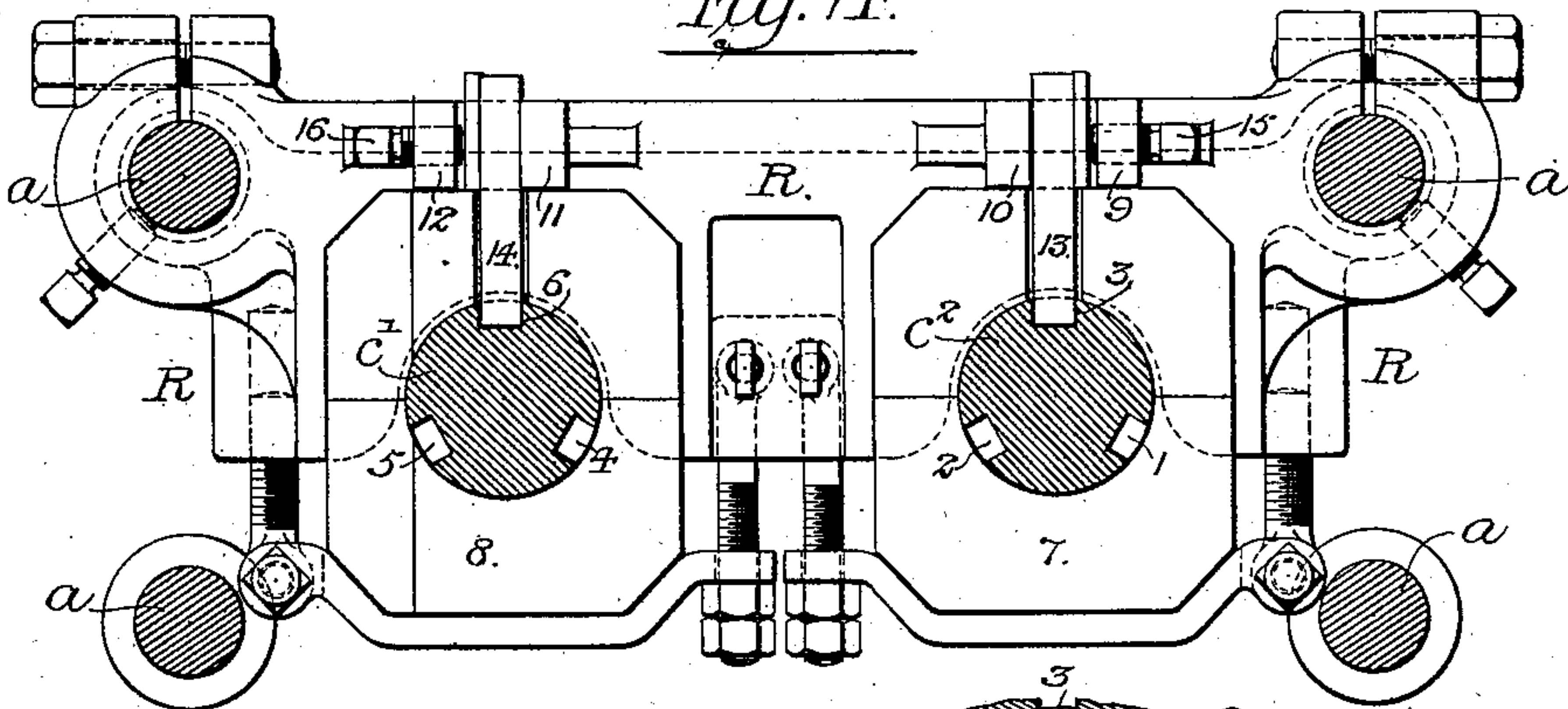
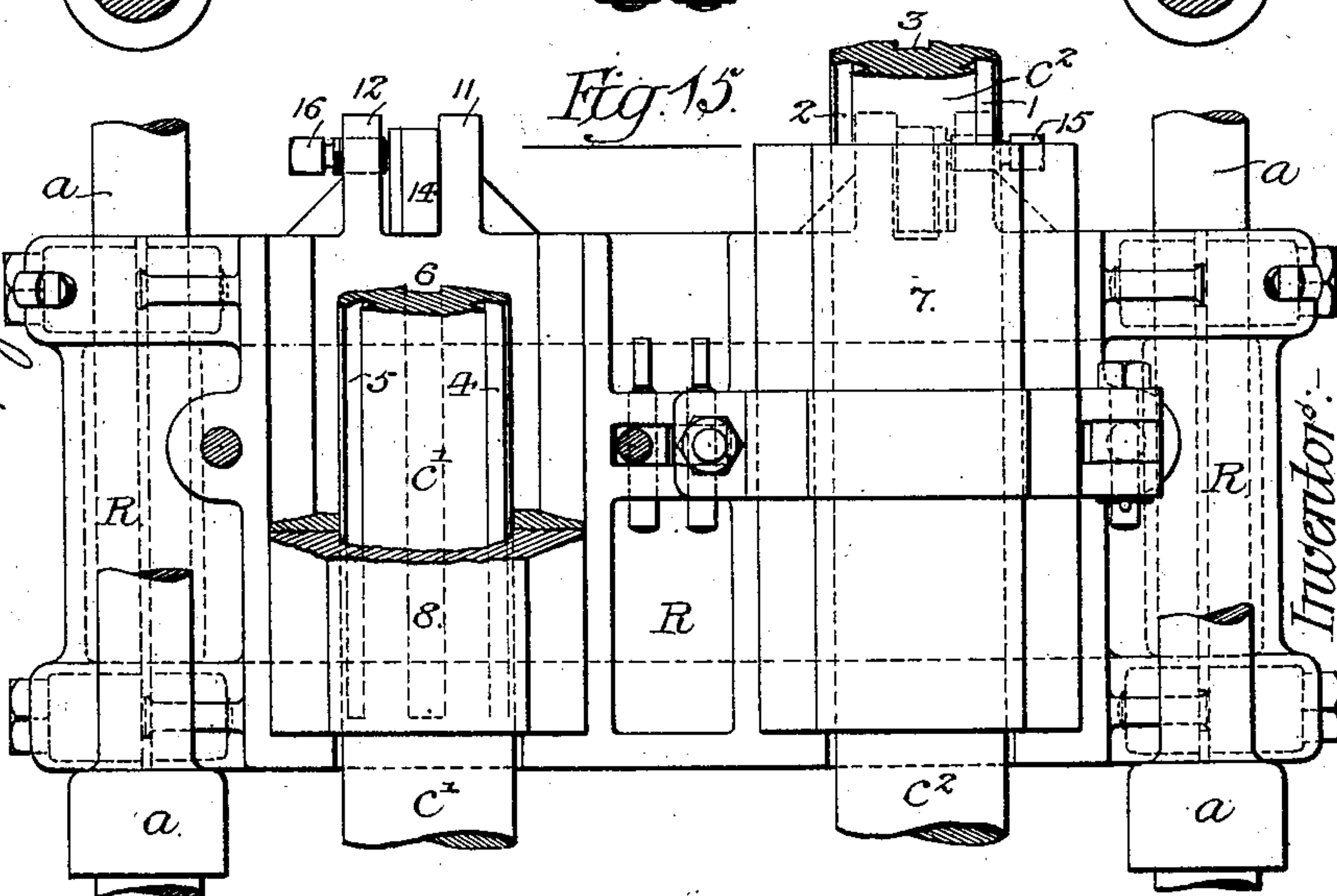


Fig. 15.



Witnesses:  
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By *James H. Blum* Attorney.



# UNITED STATES PATENT OFFICE.

DAVID COLE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GATES IRON WORKS, OF ILLINOIS.

## STEAM ORE-STAMP.

SPECIFICATION forming part of Letters Patent No. 608,423, dated August 2, 1898.

Application filed May 3, 1897. Serial No. 634,874. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID COLE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have  
5 invented certain new and useful Improvements in Steam Ore-Stamps, of which the following is a specification.

The object of my invention is to provide the valve mechanism with efficient cushion-stops  
10 arranged outside the valve-chest.

A further object is to provide mechanism for adjusting the lateral position of the stamps, so as to equalize the wear caused by the crushing of ore between the die and the shoe  
15 which is attached to the stems; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is  
20 a front elevation of a steam ore-stamp constructed in accordance with my improvements, part of the mortar being broken away, so as to show the shoe attached to the same and other parts; Fig. 2, a side elevation of  
25 the same with a portion of the mortar broken away; Fig. 3, a cross-sectional view of the cylinders and valve-chest, taken on line 3 3 of Fig. 2, looking in the direction of the arrow; Fig. 4, a longitudinal sectional view of  
30 one of the cylinders and valve-chest, taken on the irregular line 4 4 of Fig. 3; Fig. 5, a side elevation of the valve-chest, shown partly in section, taken on line 5 of Fig. 3, looking  
35 in the direction of the arrow; Fig. 6 is a section taken through line 6 6 of Fig. 3; Fig. 7, a side elevation of the valve-rod, partly in section; Fig. 8, a plan view of the under side of the controlling slide-valve, with the piston  
40 for moving the same shown in dotted outline; Fig. 9, a plan view of the top of the slide-valve, with the piston for moving the same shown in dotted outline; Fig. 10, a plan view of the top of the valve-plate, looking at it  
45 from line 10 10 of Fig. 3; Fig. 11, a plan view of the bottom side of the valve-plate, looking at it from line 11 11 of Fig. 3; Fig. 12, a plan view of the top of the cylinders to which the valve-plate is attached, looking at it from  
50 line 12 12 of Fig. 3; Fig. 13, a cross-sectional view taken on line 13 13 of Fig. 3; Fig. 14, a cross-sectional view taken on line 14 14 of

Fig. 1, and Fig. 15 a front elevation of the guide-block and other parts shown particularly in Fig. 14.

In constructing a steam-stamp in accordance with my improvements I make a frame  
55 portion of the desired size, shape, and strength, adapted to hold and sustain the movable and other parts in operative position, and which comprises a base portion A, which contains  
60 the mortar B, four pillars or posts  $a$ , on which the cylinders C are mounted at the upper end thereof. The cylinders are provided with movable stamp-pistons  $C'$   $C^2$ , having stem portions  $c'$   $c^2$  projecting downwardly therefrom  
65 and carrying the shoes  $C^3$  and  $C^4$ , between which and the dies  $C^5$  the material is crushed or pulverized during the reciprocations of the pistons. The lower part of the cylinders is provided with stuffing-boxes  $c^5$  and the up-  
70 per part with a head D, which forms a valve-plate on which the controlling-valve operates. To permit the admission and exhaust of the steam from both of such cylinders, I provide the valve-plate with a number of inlet and  
75 exhaust openings or parts, which connect with inlet and exhaust passages in the cylinder, the operation of which is controlled largely by the reciprocations of the controlling-valve  
80 E, which is moved back and forth upon its seat by means of a valve-rod F. This valve-rod has stem portions  $f$ , projecting out of each side of the valve-casing, and which are provided with cushion-stops or buffers  $f'$   $f^2$ ,  
85 that are arranged to contact with stops  $f^3$   $f^4$  on some fixed portion of the cylinder or valve-casing. In the drawings I have preferred to show them as fixed to the heads of the valve-casing.

In order to set the valve, and thereby con-  
90 trol the operation of the pistons and other parts, or to move the valve from one position to another, I provide what I term a "starting-lever" G and removably pivot it at  $g$  to a fixed portion of the valve-casing. This lever  
95 is provided with a bifurcation  $g'$ , that straddles a portion of one of the cushion-stops, so that the slide-valve may be moved by manual force from one extreme to the other or to any point intermediate the same. This lever is  
100 used merely for the purpose of starting the mechanism and is then removed.



The steam is admitted to the valve-chest by means of a supply-pipe II and by means of the slide-valve is admitted into the various ports and passages to control the operations of the stamp-pistons. The valve-rod is provided with two pistons  $F'$  and  $F^2$ , and live steam acting between such pistons balances the opposing forces and, as high and low pressures alternate on the opposite sides of such piston, acts to unbalance such piston and force the valve-rod, with the slide-valve, in the direction of the low pressure.

To illustrate the action of the machine, it will be supposed that the valve has been moved by means of the starting-lever, so that the cushion-stop or buffer  $f'$  (see Fig. 3) is in contact with the buffer-plate  $f^3$ . The steam or fluid pressure entering the valve-chest I will pass into the steam-port K of the slide-valve (shown in Figs. 4, 8, and 9) and into the inlet-port K' of the valve-plate (shown in Figs. 10 and 11) and out of its lower end into the corresponding port of the cylinder-casing, (shown in Fig. 12,) entering the piston-chamber L under the stamp-piston  $C'$  (see Fig. 4) and causing the piston to rise. The upper portion of this cylinder is connected by the valve to the exhaust-chamber M through the exhaust-port  $m$ , as shown in Figs. 3 and 4, so that such piston meets with no resistance during its upward movement. In its movement toward the top of the cylinder the lower side of the piston I passes by the opening of the piston  $l$ , so that fluid-pressure which follows the piston passes to the left of the valve-piston  $F'$  and moves such piston, with the slide-valve, to the opposite limit of motion, so that the buffer  $f^2$  will contact against the buffer-plate  $f^1$ . This action of the valve cuts off the flow of pressure to the under side of the piston  $C'$  by shifting the live-steam port K of the slide-valve, so that it coincides with the passage  $l'$  (shown in Fig. 10) and admits pressure by way of such port and a passage corresponding to the passage K' of Fig. 4 underneath the stamp-piston  $C^2$ . The valve in its new position also connects the top and bottom of the cylinder L together above and below the stamp-piston, by way of the passages K' and  $l^2$ , (shown in Figs. 4, 10, and 11,) passing through the recess  $l^3$  in the slide-valve. (Shown particularly in Fig. 8.) It also connects the upper part of the cylinder L' with the exhaust-chamber M by means of the passages  $l'$ ,  $l^2$ , and  $l^3$  (shown in Figs. 10, 11, and 12) through the recess  $l^4$  in the slide-valve, thus allowing the steam which has been expanded in the upward movement of the piston  $C^2$  to escape freely to the atmosphere. The high pressure being in contact with the lower side of the piston  $C^2$  causes the same to rise, while at the same instant the steam which has filled the cylinder L underneath the piston  $C'$  is expanding by way of the passage  $l'$ , Fig. 4, K', Figs. 10, 11, and 12, through the recess  $l^3$  in the slide-valve and the passages  $l^2$  in Figs. 10 and 11 into

the top of the cylinder L and above the piston, which on account of acting on the larger area of the piston  $C'$  furnishes the required force for striking the necessary blow on the die  $C^5$ , as shown in Fig. 1. It will be evident from an inspection of the drawings that as soon as the piston  $C^2$  in its cylinder passes the port  $l^5$  high pressure will pass to the end of the valve-piston  $F^2$ , shifting the controlling slide-valve to the position first described, thus completing a cycle in a double action of the pistons.

It will be evident that if no means were provided for checking or overrunning the momentum acquired by the stamp-piston due to the high pressure acting against the lower surface of the same it would drive it against the valve-plate with sufficient force to injure the parts. To obviate this objection, a by-pass N N' is provided in each of the cylinders, so that as the pistons uncover the lower opening the high fluid-pressure will rush in and come out at the openings  $n$  and  $n'$  at the upper part thereof, thereby acting against the largest superficial area of the pistons to overcome and arrest this upward tendency.

It will be seen from the foregoing description that the movement of the stamp-pistons is used as the means for actuating and shifting the valve, while the valve is used for alternating the movements of the stamp-pistons, such actions continuing in successive cycles until the supply of fluid-pressure is shut off.

The slide-valve is provided with two faces and the valve-seats  $e$  and  $e'$  situated parallel to each other, but with their faces at right angles, as shown in Fig. 4. One of these valve-seat faces is provided with proper means to carry the side of the slide-valve which operates to admit high pressure to the bottom of the cylinders below the pistons and for it to return and work expansively on the top of the pistons, the other valve-seat face containing the exhaust-ports only and carrying the side of the slide-valve which operates to exhaust the fluid-pressure, as has been above described particularly in connection with Figs. 8, 9, and 10.

The machine in operation has one stamp-piston rising while the other is falling. Therefore when one piston has passed its valve-shifting port going up it admits high pressure to that port at the same time the other stamp-piston has dropped to a point in its travel such as to uncover its valve-shifting port to the expanding pressure that is pushing it down. In the cylinder in which the piston is falling, before the stamp-piston commences to drop, it will be seen that the pressure will be expanded in the amount represented by the cubical contents of the piston-rod expelled by said action of dropping and that the pressure will be correspondingly reduced in this cylinder. The action of the high pressure in the opposite cylinder, in which the piston is rising, will admit said high pressure upon the end of the valve-piston with which it has con-



nection, thereby causing the said valve-rod, pistons, and controlling-valve to travel to their opposite limit of motion. This operation is such as to connect the various ports necessary to alternate the action of the stamp-pistons. In this mechanism there is no provision made for exhausting the pressure from either end of the valve-pistons except through the same port used for admitting the high pressure and by way of the regular exhaust operated by the controlling-valve itself. The movement of the valve-piston and valve is accomplished by the difference of the high and low pressures on opposite ends of the valve-rod caused by the expansion and consequent lowering of the pressure in the cylinder in which one of the stamp-pistons is descending.

To regulate the amount of travel of the valve-rod and its attached parts and overcome the shock incident to such movement, as well as to provide means for taking up the wear, the cushion-stops or buffers above described are provided, and attached to the steam-chest are the stops above described, which are held in position by means of studs P P'. These studs are adjusted at equal distances from the steam-chest to receive the stops, which are held in place by means of nuts on the ends of said studs. The ends of the valve stem or rod are threaded, so that the cushion-stops may be adjusted thereon and regulate the travel of the valve, as well as compensate for the wear on the buffers.

In the use of mills of this kind it is found that some point or points of the face of the shoe or die, or both, wears faster than other portions, making it desirable and necessary to shift the position of a given point on the faces of such parts and to hold it in such position until the uneven wear is compensated for. In order to accomplish this result, I provide the piston-stem with keyways or slides, as indicated at 1, 2, 3, 4, 5, and 6 in Fig. 14. These keyways are of such length as to allow for the reciprocations of the stamp and for the lowering of the cylinder to compensate for the wear upon the shoes and dies. A

frame R is provided which carries the guide-blocks 7 and 8 and is provided with two pair of bosses 9 and 10 and 11 and 12, between which is removably held the keys 13 and 14, which enter the desired slots or keyways in the stamp-stems, such keys being held in the same adjustably by means of the set-screws 15 and 16. When it is ascertained that uneven wear is taking place on the shoe or die, or both, the key of the stem carrying such shoe or die may be withdrawn and the stem, with its shoe and die, rotated to a point that will tend to overcome this condition, the key reinserted, and the parts secured in position. The holding of the stem while the parts are operated in this manner will tend to equalize the wear and is a decided advantage over the rotation of the parts in a step-by-step automatic manner.

I claim—

1. In a steam ore-stamp, the combination of a cylinder, provided with a reciprocating piston, a reciprocating controlling-valve for admitting and exhausting steam into and out of the cylinder to operate the piston, and provided with a valve-stem projecting out of the valve-casing at each end, a cushion buffer-collar on each end of the valve-rod, and stop mechanism arranged on a rigid portion of the machine between the valve-casing and the cushion-collars, substantially as described.

2. In a steam ore-stamp, the combination of a cylinder provided with a reciprocating stamp-piston provided with a plurality of longitudinal slots or grooves arranged in alignment and parallel with the motions of the piston, a key removably secured to a rigid or immovable portion of the machine and adapted to enter one slot at a time, the whole so arranged that the lateral position of the stamp-stem with its top parts may be changed by shifting the same and engaging the key with another groove, substantially as described.

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Witnesses:

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