

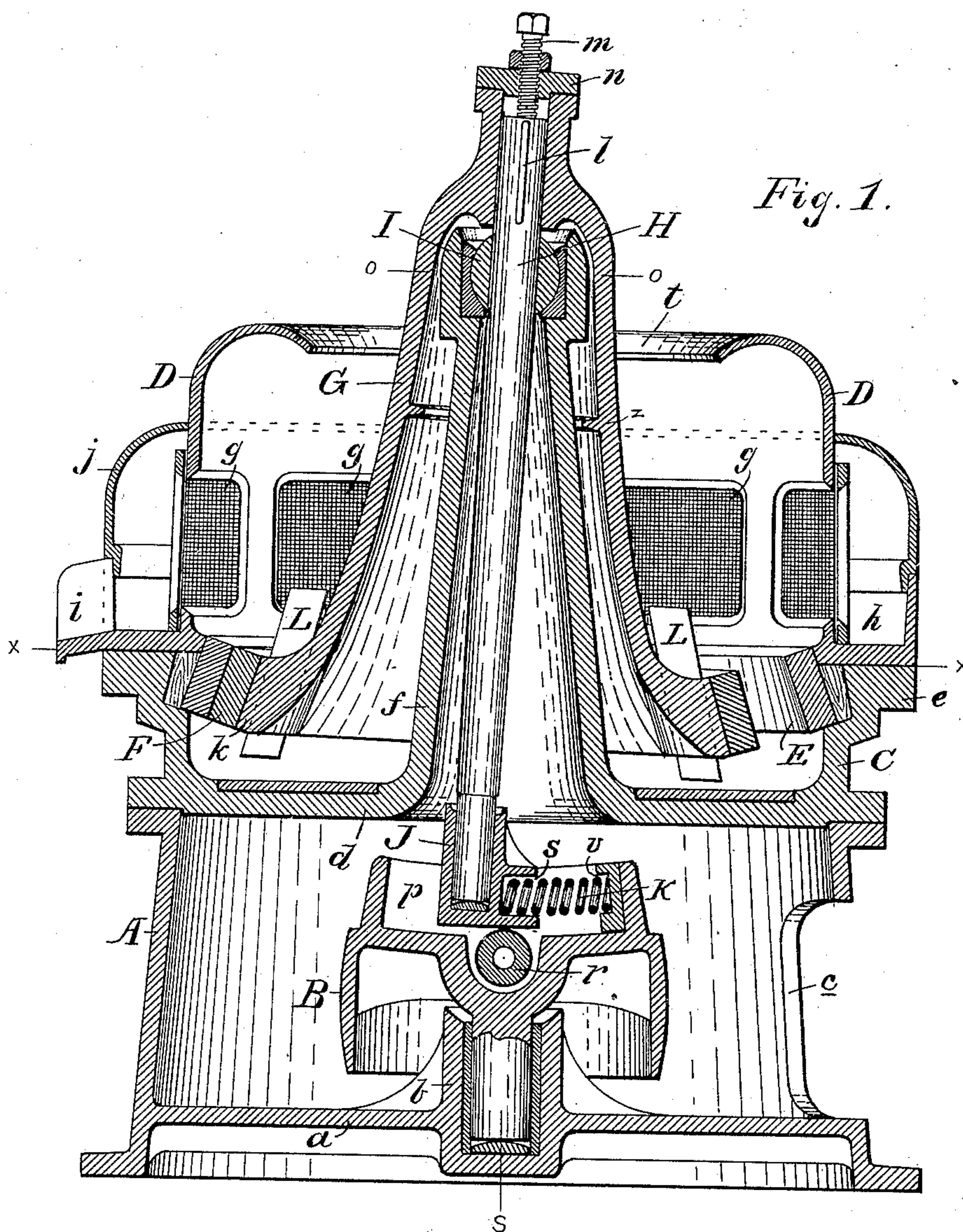
(No Model.)

3 Sheets—Sheet 1.

E. I. NICHOLS.
PULVERIZING MILL.

No. 466,864.

Patented Jan. 12, 1892.



Witnesses

F. T. Carpenter.
D. A. McKinley

Inventor

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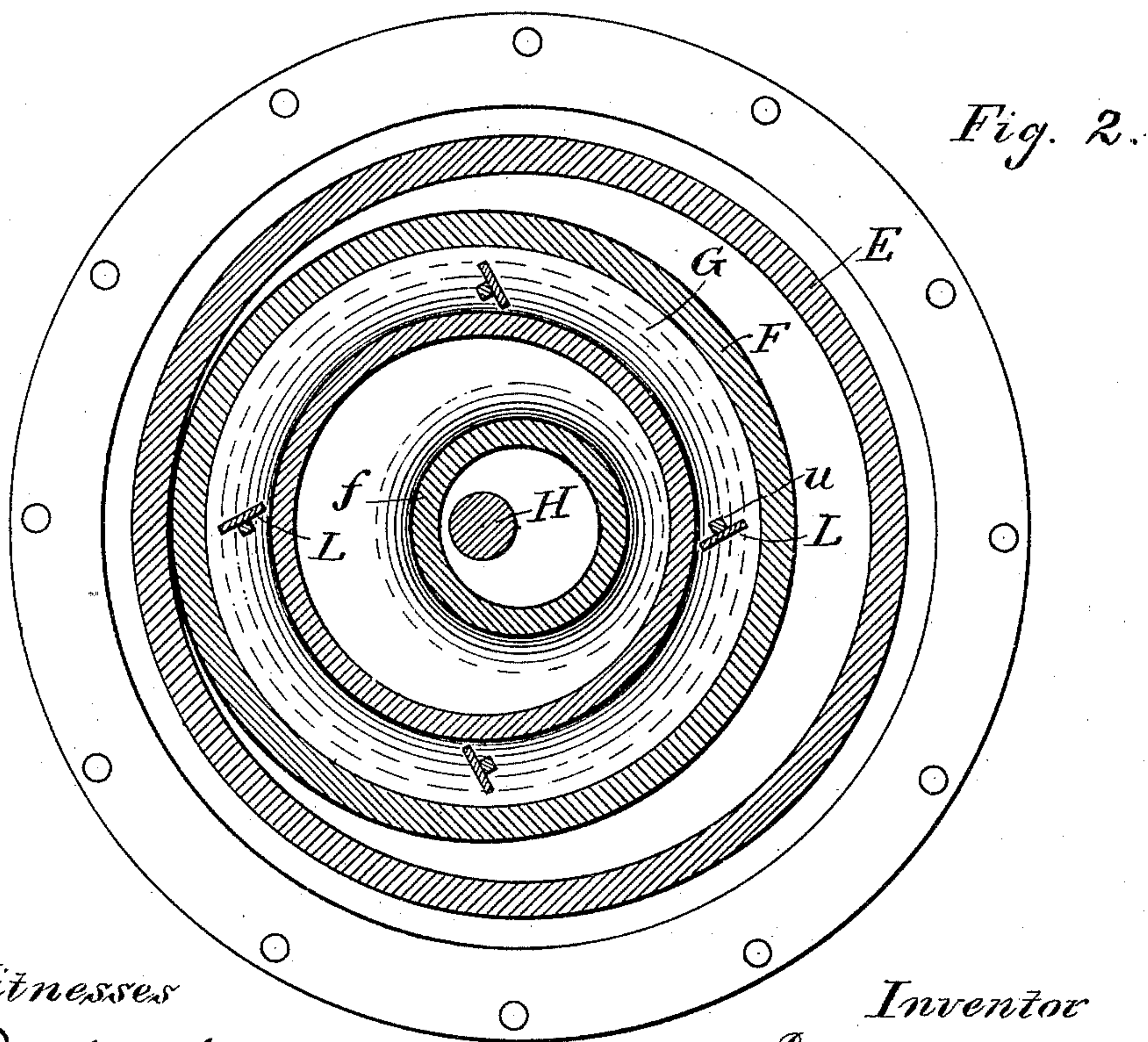
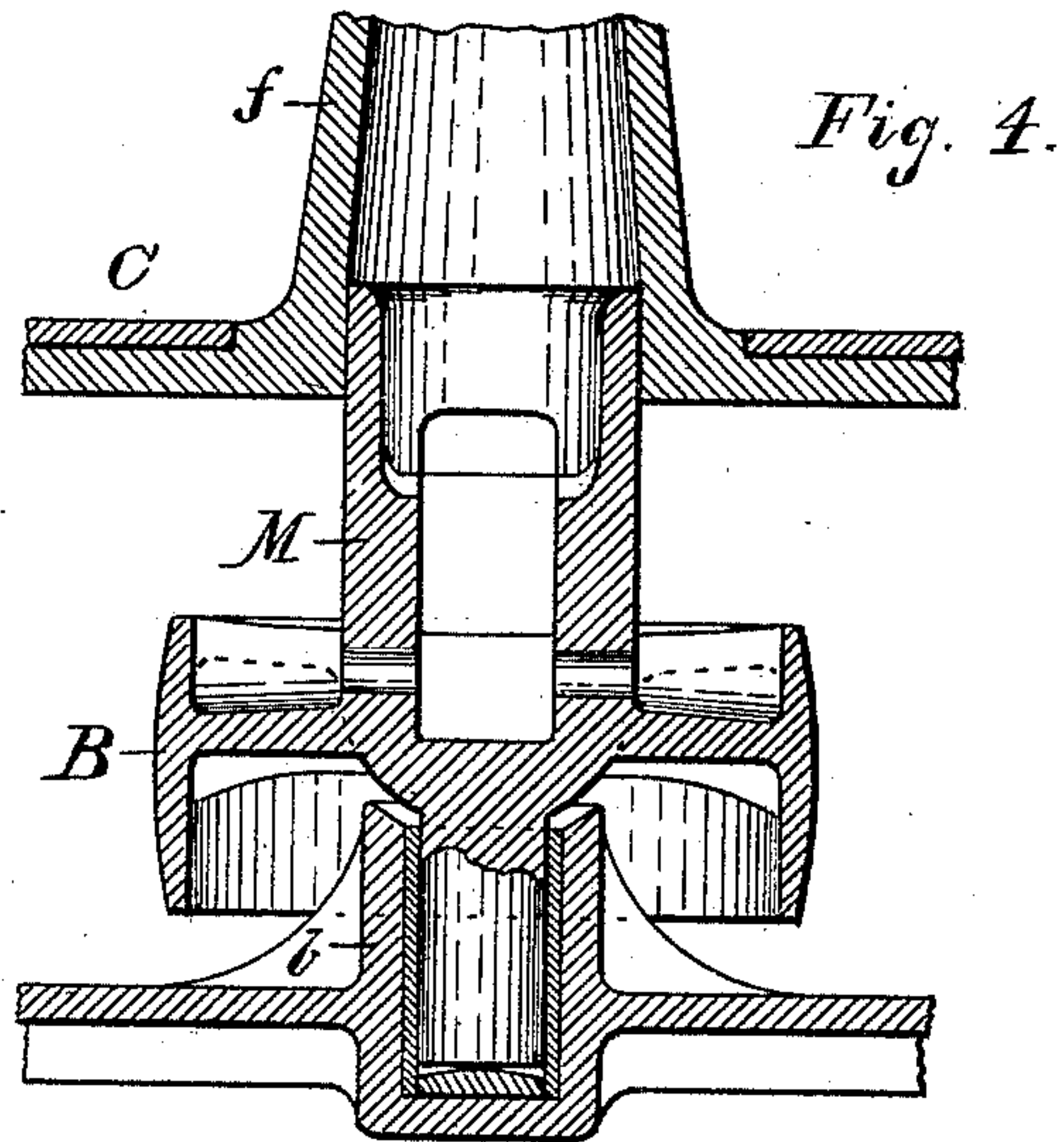
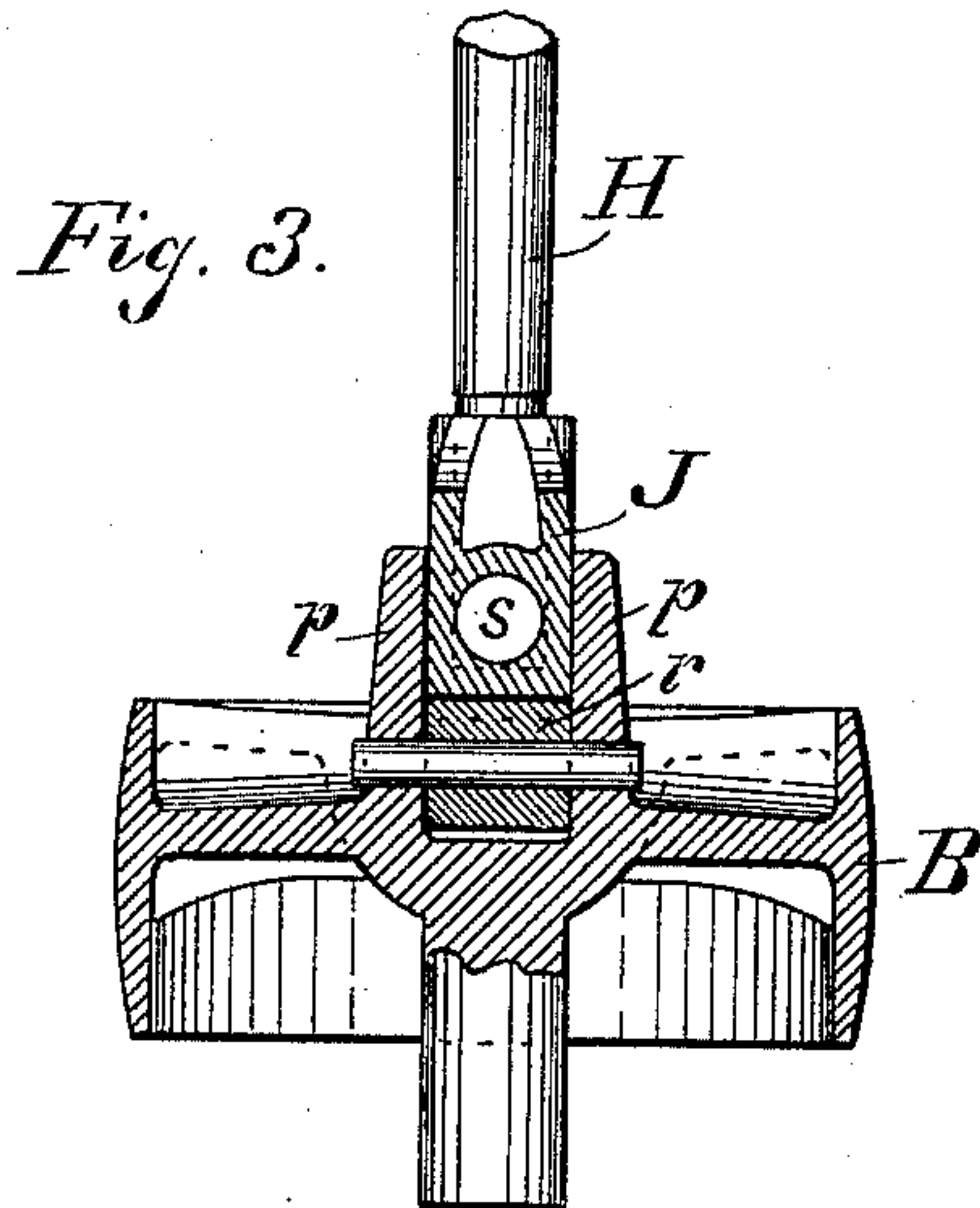
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Fig. 6.

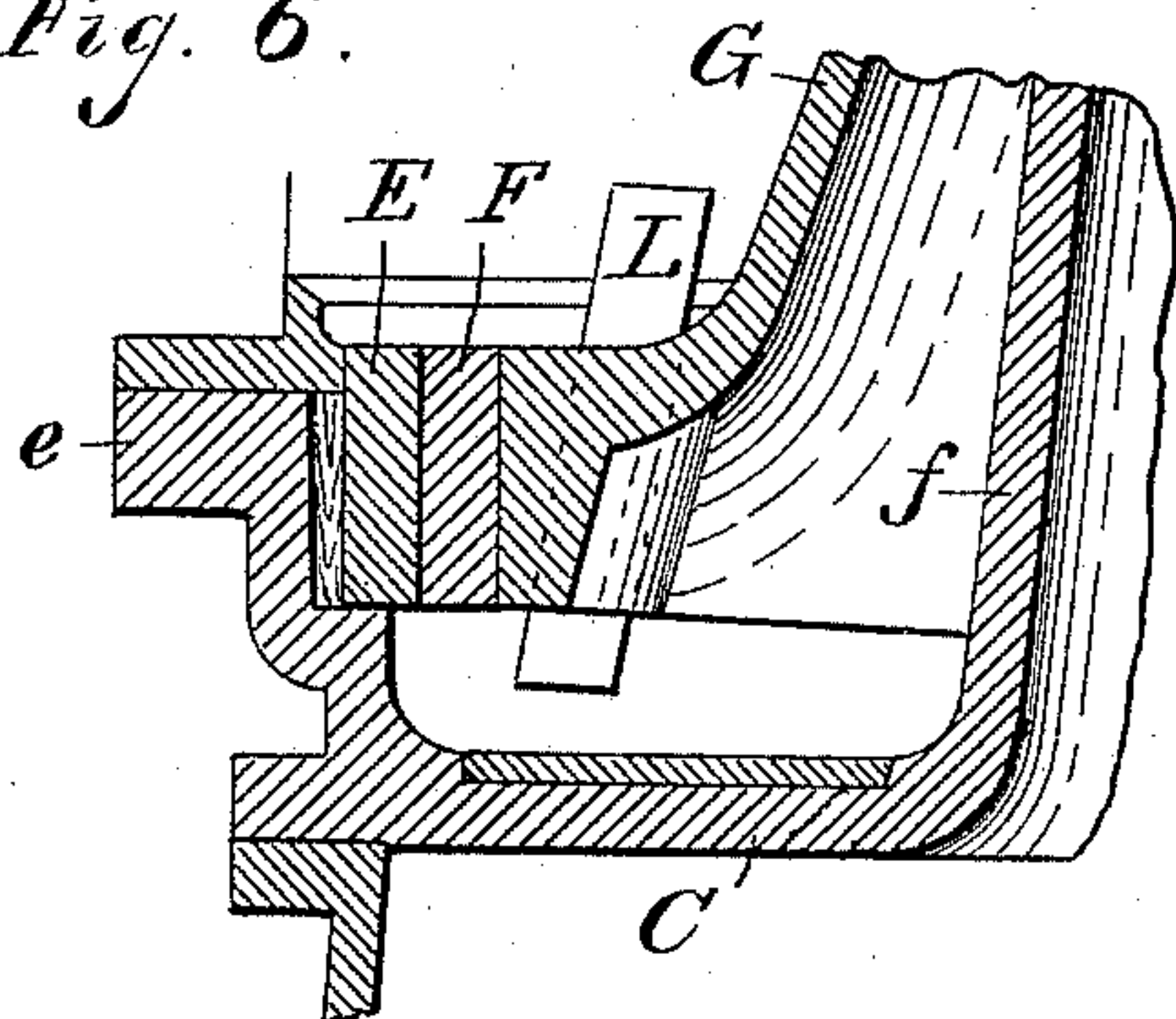


Fig. 7.

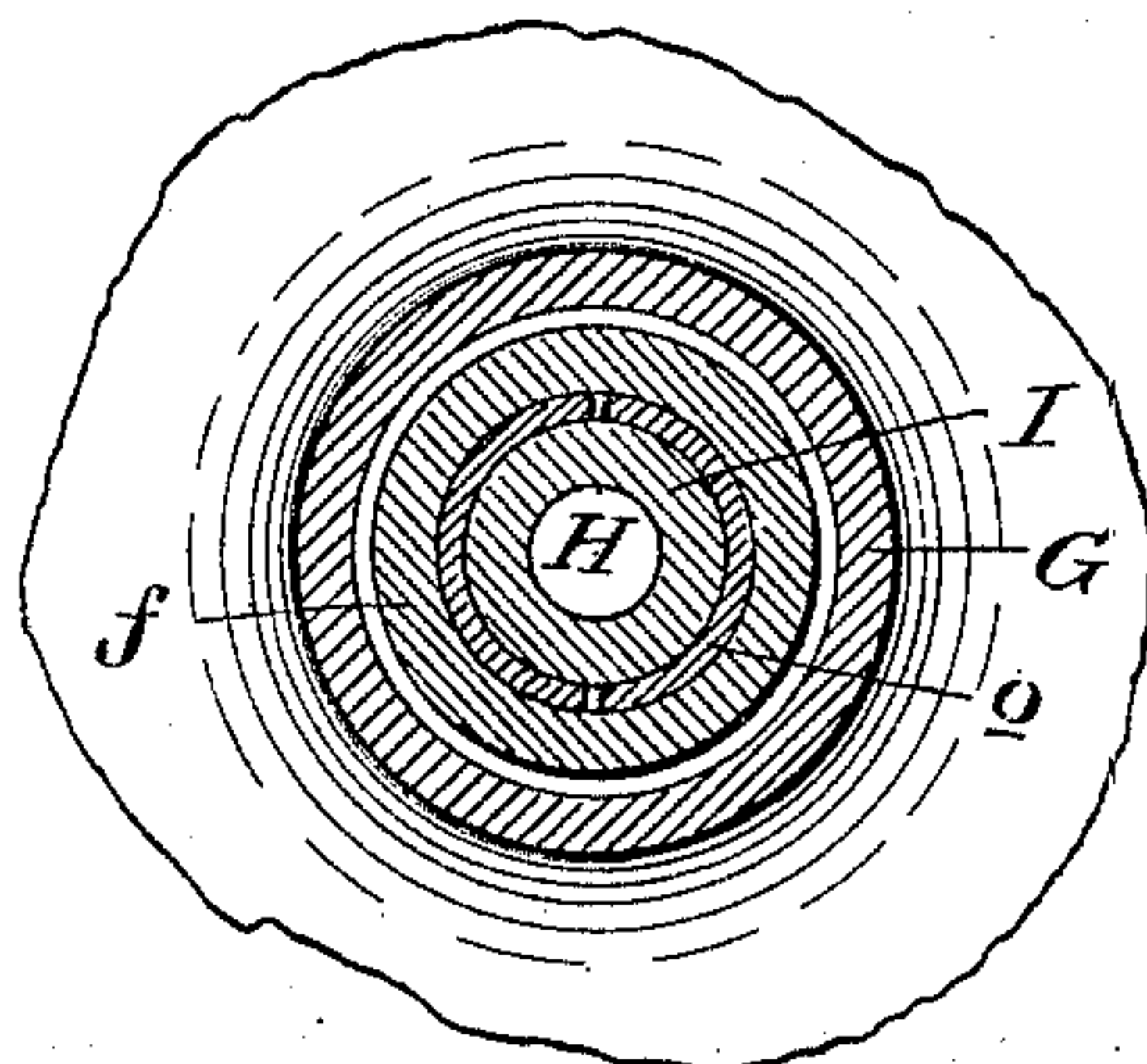
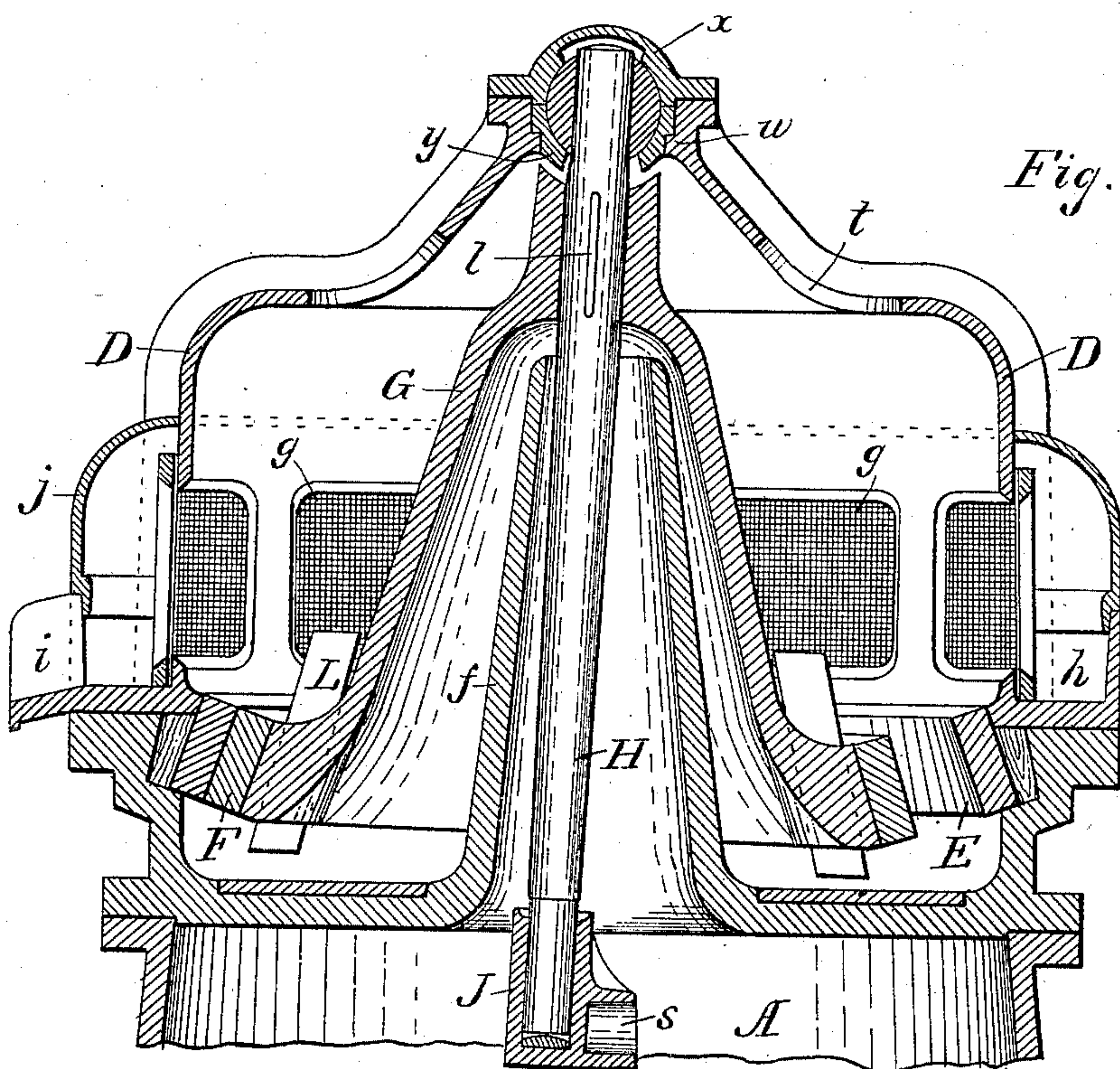


Fig. 5.



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UNITED STATES PATENT OFFICE.

EMORY I. NICHOLS, OF SAN FRANCISCO, CALIFORNIA.

PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 466,864, dated January 12, 1892.

Application filed April 27, 1891. Serial No. 390,532. (No model.)

To all whom it may concern:

Be it known that I, EMORY I. NICHOLS, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Pulverizing-Mills; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to improvements in that class of pulverizing-mills in which a pulverizing-roller mounted upon a gyrating shaft rolls in a pan or bed in contact with an annular die, pulverizing the material between itself and said die.

My mill may be briefly described as consisting of a pan or bed having a central hollow standard, through which passes the shaft which transmits motion to the pulverizing-roll. The pulverizing-roll is also hollow and surrounds the central standard and is mounted upon the shaft, so as to rotate or gyrate with it in contact with a die secured to the pan. Means are provided for giving the shaft the required inclination to secure its gyratory motion, which means also cause and maintain the contact between the pulverizing-roll and the annular stationary die.

This in brief is a general description of the construction I employ; but my mill also contains numerous novel features of construction which need not be specifically alluded to here, but which are fully hereinafter described, as well as shown in the accompanying drawings.

In the drawings, Figure 1 is a vertical cross-section showing the general construction of the mill. Fig. 2 is a horizontal section on the line $x x$ of Fig. 1. Fig. 3 is a section of pulley and driving mechanism on line $s s$, Fig. 1. Fig. 4 is a similar section, but showing a modified construction. Fig. 5 is a section similar to Fig. 1, but showing a modified arrangement of the universal bearing for the roller-shaft. Fig. 6 is a section showing a slightly-modified position for the rings or dies. Fig. 7 is a horizontal section through the universal bearing on the line $o o$, Fig. 1.

A represents the supporting frame or bed of the mill, preferably cast in one piece and of sufficient strength and solidity to sustain the entire weight of the mill. The exact con-

struction of this bed-frame and the material of which it is composed are not essential; but I prefer to make it in the form of an open-topped hollow cylinder, as shown. Secured to or formed with the bottom plate a is a step-bearing b for the driving-pulley B, and an opening c is formed in the side of the bed-frame to admit the driving-belt. The driving-pulley is of peculiar construction and will be described more fully hereinafter.

C represents the pan, formed of a single casting composed of a base-plate d , having an upturned rim e and a central hollow standard f of conical shape. The pan rests upon the top of the bed-frame and may be provided with suitable amalgamating-surfaces surrounding the central standard. Above and resting upon the pan is the pan-top D, and g are the screens through which the pulverized material is discharged into the external trough h , by which it is carried to the discharge-spout i . The external trough is provided with a covering-frame j .

E represents the annular stationary die secured to the inner wall of the pan at a proper distance above its bottom. The die is shown in Fig. 1 with the top inclined toward the center; but it may be set perpendicularly, if preferred, as shown in Fig. 6.

The die F, which rolls upon the inner periphery of the die E, is carried by or forms a part of the pulverizing-roll G. The latter is shown as a hollow bell-shaped casting having at the lower edge a seat k , to which the die F, if made separately, is secured firmly. It surrounds the central standard and is secured to the shaft H, upon which it is fixed by keys or feathers l , or in any other suitable manner. It may, however, be adjusted vertically upon the shaft by means of a screw m , passing through the top cap n and bearing upon the end of the shaft. The shaft H is journaled in the central standard by a universal bearing I, shown here as a ball working in a spherical chamber in the standard and provided with a two-part wear-resisting bushing o , Fig. 7. The shaft H extends down through the standard, and at its lower end is stepped in a box J, sliding in a chamber formed by the upturned flange or vertical guides p , connected to the driving-pulley, or

formed with it, as shown, Fig. 3. The bottom of this box bears upon a roller *r*, which sustains the weight of the shaft and roller and is journaled horizontally in the driving-pulley B. A pressure-spring K contained in the recesses *s* *v*, formed, respectively, in box J and the driving-pulley, forces the box and shaft to one side. This movement of the shaft throws the pulverizing-roll over and brings the die F against the ring-die E, where it is held by the constant pressure of the spring. When power is applied to the pulley, its rotation, transmitted through the box J to the shaft, produces a gyratory movement of said shaft and pulverizing-roll and causes the die F to travel around in constant contact with the die E, pulverizing the material between the dies. The material may be fed into the mill from a suitable hopper (not shown) or through an opening, as *t*, in the pan-top adjacent to the pulverizing-roll.

The operations of amalgamating, when amalgamation is practiced, and of discharging the pulverized material, are well understood by all skilled in the art, and need not be here particularly described. I, however, provide adjustable scrapers or stirrers L, secured by wedges *u* or otherwise in slots formed in the pulverizing-roll extending above and below the roller. The lower parts of these stir the material in the bottom of the pan and the upper parts throw the pulverized material against the screen.

I have shown in Fig. 4 a modified construction of the driving-pulley, the purpose of which is to give it an upper bearing, and thus relieve the strain or thrust upon the single step-bearing shown in Fig. 1. A cylindrical journal M is formed with the driving-pulley, which extends up and has a bearing in the lower part of the central standard, which is made cylindrical to receive it. The journal M is made hollow to permit the shaft to pass through and gyrate within it, and it is provided with bearings for the friction-roller and with a chamber for the sliding box J to work in.

In Fig. 5 I have shown a modified construction of mill differing from that before described in the manner of forming the upper shaft-bearings. The pan-top extends inward above the pulverizing-roll, being made sufficiently heavy and provided with strengthening-ribs, as shown. In the open circular top of the pan-top and supported by a shoulder *w* thereof is the universal bearing, to which the shaft is connected. The bearing is shown as formed by a hemispherical top cap *x* and a similar lower bearing *y*. The pulverizing-rod is secured to the shaft below the ball-joint. In other respects the construction and operation are the same as previously described.

It will be observed that in my mill there are no bearing-points exposed to wear by reason of dust or grit entering between them. The driving-pulley and the lower bearings for the shaft are entirely separated from the pan,

while the universal bearing is placed so far above as to be practically out of reach of dust and grit, which could enter from the bottom of the pan inside the pulverizing-roll. It is also protected by the central standard, which incloses it, and is completely covered by the surrounding pulverizing-roll, rendering it impossible for any of the material in the upper part of the pan to gain access to it. To more effectually guard against the admission of dust to the upper bearing, I provide the interior of the pulverizing-roll with a guard-rib *z*, Fig. 1.

By using a spring to positively force the pulverizing-roll against the stationary die the machine is made self-compensating, so far as frictional wear between the dies is concerned. The limit of motion allowed the sliding box J is more than sufficient to permit the roll to be forced into contact with the die, no matter how the dies have been reduced by wear. The spring also permits the roll to yield to a refractory piece of material, and then throws it immediately into contact.

The mill is adapted to the pulverizing of many different kinds of material and either for wet or dry crushing, as will be readily understood.

Having described my invention, what I claim is—

1. In a pulverizing-mill, the combination of a pan having a central hollow standard, a pulverizing-roller surrounding and gyrating about said standard, and a shaft secured to said roller and having a movable bearing in a rotary driver, substantially as set forth.

2. In a pulverizing-mill, the combination of a bed plate or frame, a power-pulley journaled therein and having vertical guides, a box having a horizontal movement in said guides, a shaft journaled in said box, and a pulverizing-roller secured to said shaft and having a gyratory motion in contact with a stationary die, substantially as set forth.

3. A pulverizing-mill consisting of a pan having an annular die, a hollow central standard, and a pulverizing-roll surrounding said standard and adapted to be gyrated in the pan and in contact with said die, substantially as set forth.

4. The combination of the hollow central standard, a universal bearing therein, a shaft carrying a pulverizing-roll, and a driving pulley or gear having a guide to permit the lower end of said shaft to slide independently and at the same time to rotate with said pulley or gear, substantially as set forth.

5. The combination of the hollow central standard, a universal bearing therein, a shaft carrying a pulverizing-roll, and a driving pulley or gear having a roller-bearing for the bottom of the said shaft and a guide to permit said shaft to slide and at the same time to rotate, substantially as set forth.

6. A pulverizing-mill consisting of a pan carrying an annular die and having a central

hollow standard, a gyratory shaft having a universal bearing, a pulverizing roller and die connected to said shaft and surrounding the standard, and a spring connected to said shaft for producing a constant contact between the dies, substantially as set forth.

7. The combination, in a pulverizing-mill, of a shaft having an upper universal bearing and carrying a pulverizing-roller, a driving pulley or gearing having guides, a box sliding in said guide and connected to the lower end of the shaft, and a pressure-spring bearing upon said box, substantially as set forth.

8. The combination, in a pulverizing-mill, of a vertical standard having a universal bearing for the shaft of the pulverizing-roll and a pulverizing-roll mounted on said shaft above said bearing and surrounding and inclosing the central standard, substantially as set forth.

9. The combination, in a pulverizing-mill, of a vertical hollow standard, a shaft having a bearing in said standard and carrying a pulverizing-roll surrounding said standard, and a guard-rib between said standard and roll to prevent the introduction of dust, &c., to the upper bearing, substantially as described.

10. In a pulverizing-mill, the combination, with the pan, of a pulverizing-roll and adjustable scrapers secured in said roll and extending above and below the same, substantially as described and shown.

11. The combination, in a pulverizing-mill, of a shaft having an upper universal bearing, a lower bearing within a driving pulley or gear and movable toward and from the center thereof, and a pulverizing-roll mounted upon said shaft, substantially as described.

12. In a pulverizing-mill, a hollow roller surrounding a central standard in a pan, an annular die secured to said roller, and scrap-

ers secured and projecting above and below the bottom rim of said roller, substantially as set forth.

13. In a pulverizing-mill, the combination of a pan carrying an annular die and having a central hollow standard, a roller surrounding and gyrating about said standard, and a shaft secured to said roller and having a universal bearing above, and a bearing having a horizontal movement at the lower end of said shaft, substantially as described.

14. In a pulverizing-mill consisting of a pan having an annular die, a pulverizing-roller surrounding a central standard in said pan, a gyrating shaft secured in said roller, and means for gyrating said shaft around a center, substantially as described.

15. In a pulverizing-mill, the combination of a pan carrying an annular die and having a central standard, a roller surrounding said standard, a shaft secured to said roller and having a universal bearing above and a horizontally-moving bearing below, and a revolvable driver carrying said roller and shaft and gyrating the same, substantially as described.

16. In a pulverizing-mill, the pan carrying an annular die, in combination with a revolvable driver suitably supported, a bearing therein carrying a shaft and roller, and means to throw the bottom of shaft to one side of the center and gyrate the shaft and roller within the pan, and thus keep the roller in constant contact with the die of the pan, substantially as described and shown.

In testimony whereof I have hereunto set my hand this 10th day of April, 1891.

EMORY I. NICHOLS.

Witnesses:

L. W. SEELY,
J. W. ALBRIGHT.