

(No Model.)

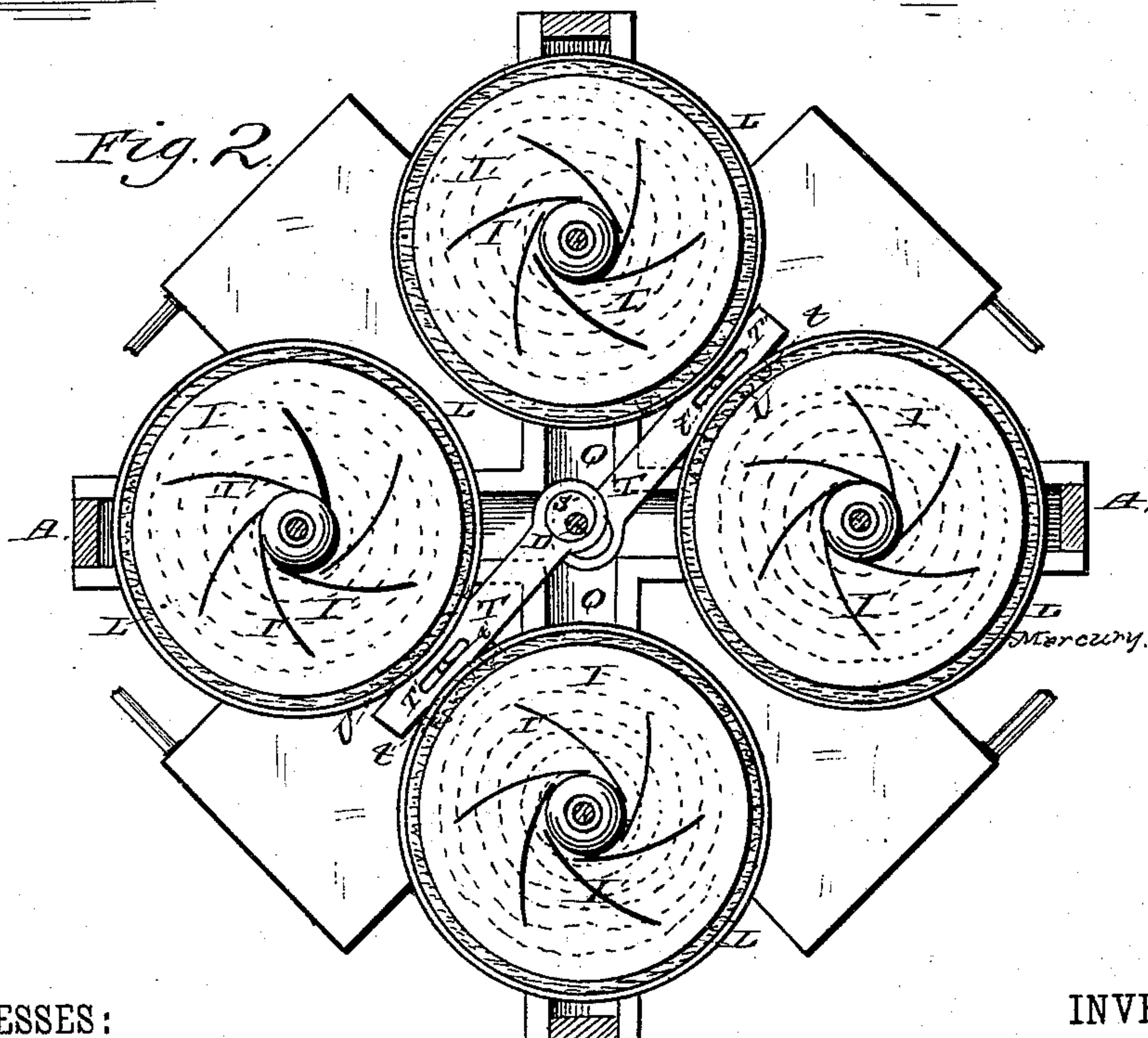
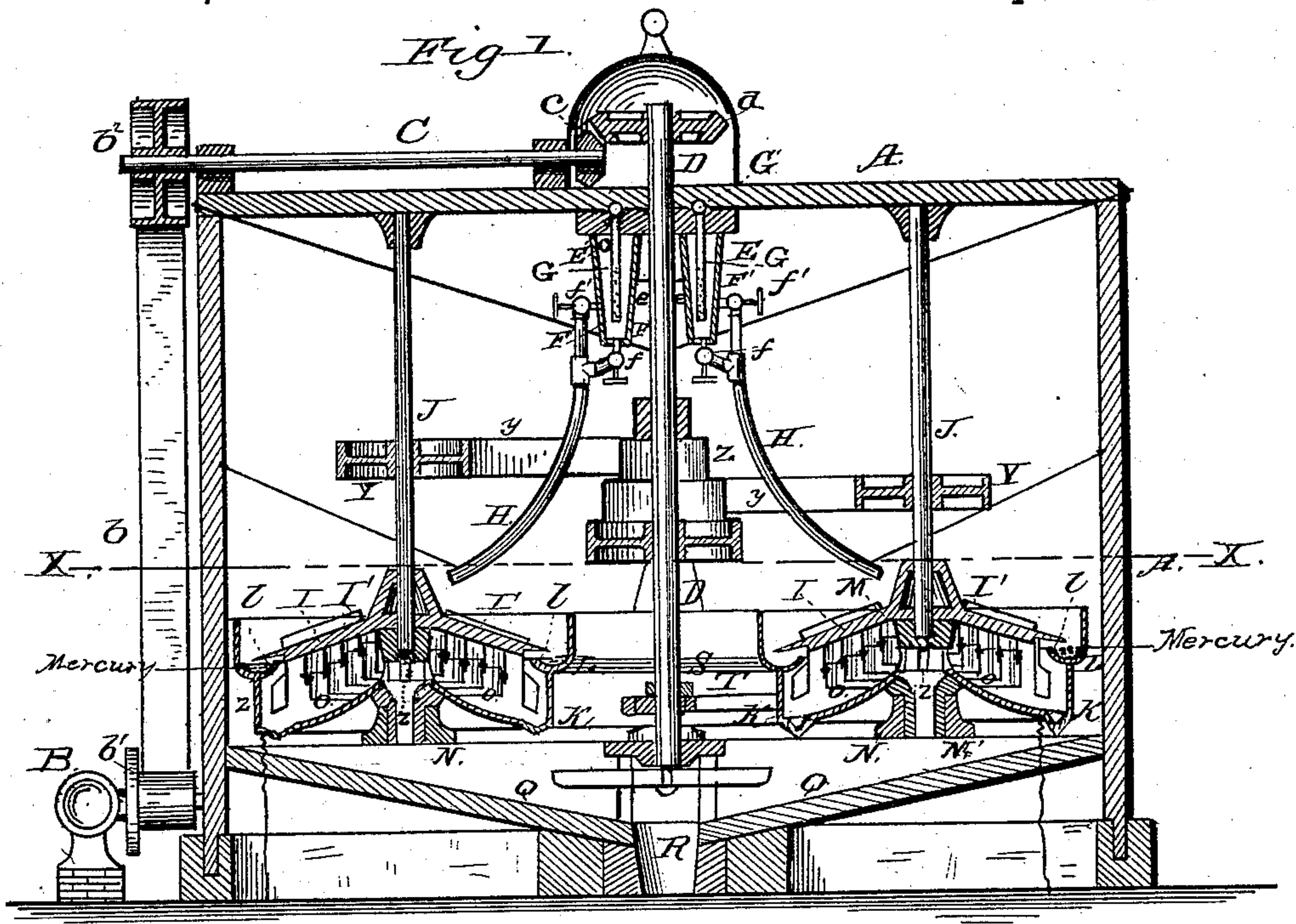
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F. R. BROWN.

# ORE SEPARATOR.

No. 305,284.

Patented Sept. 16, 1884.



WITNESSES:

J. W. Reynolds  
W. R. Haight

INVENTOR

Francis R. Brown

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ATTORNEY

(No Model.)

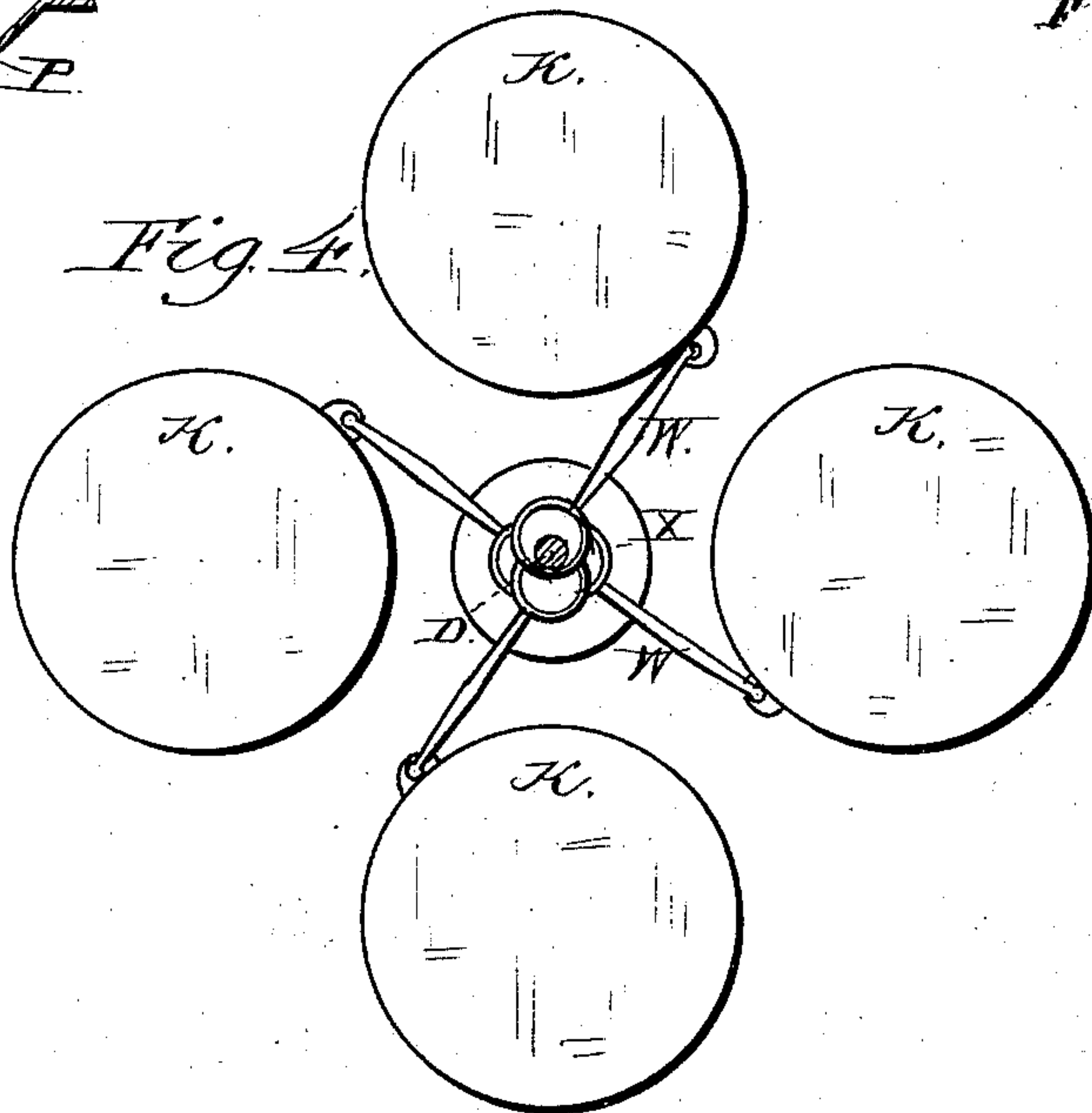
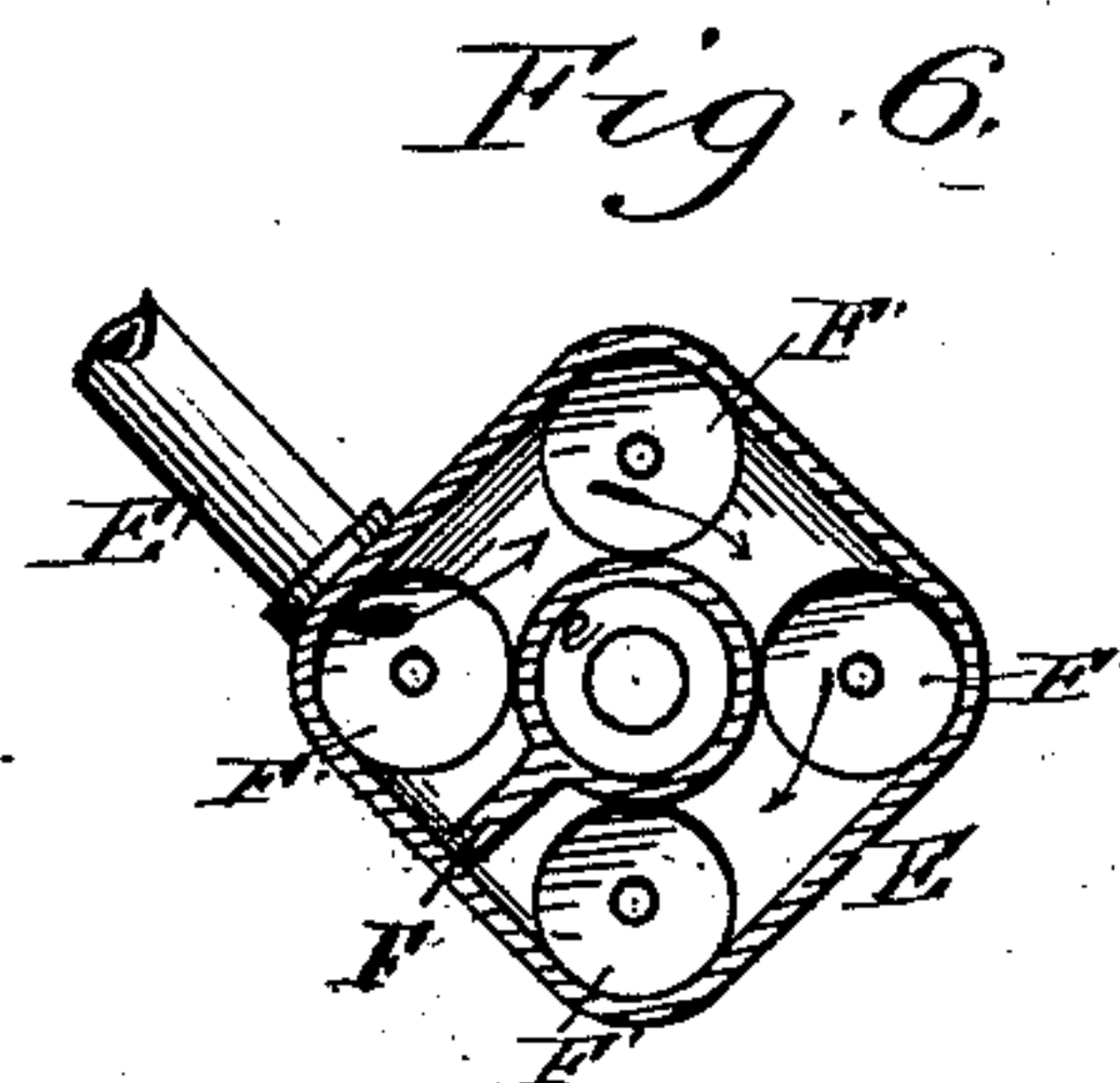
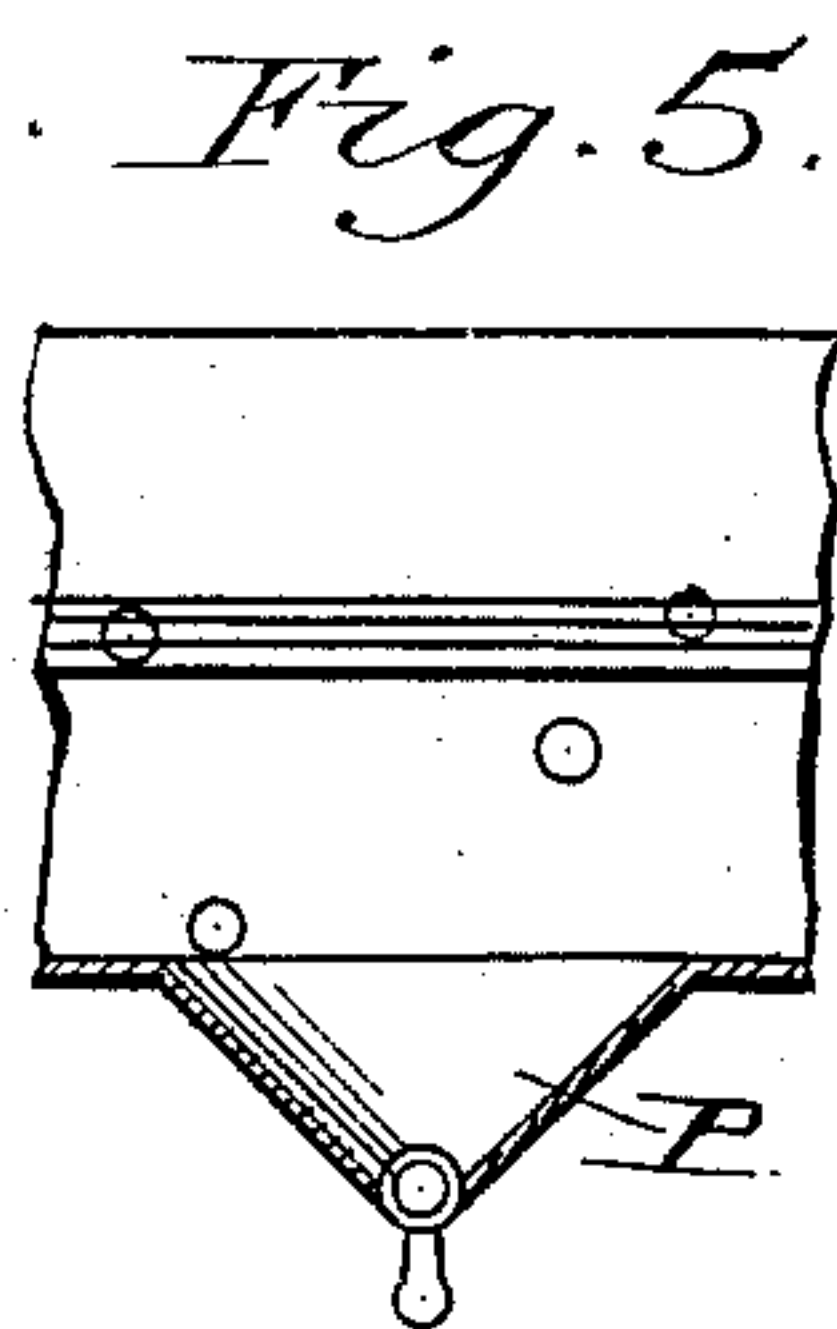
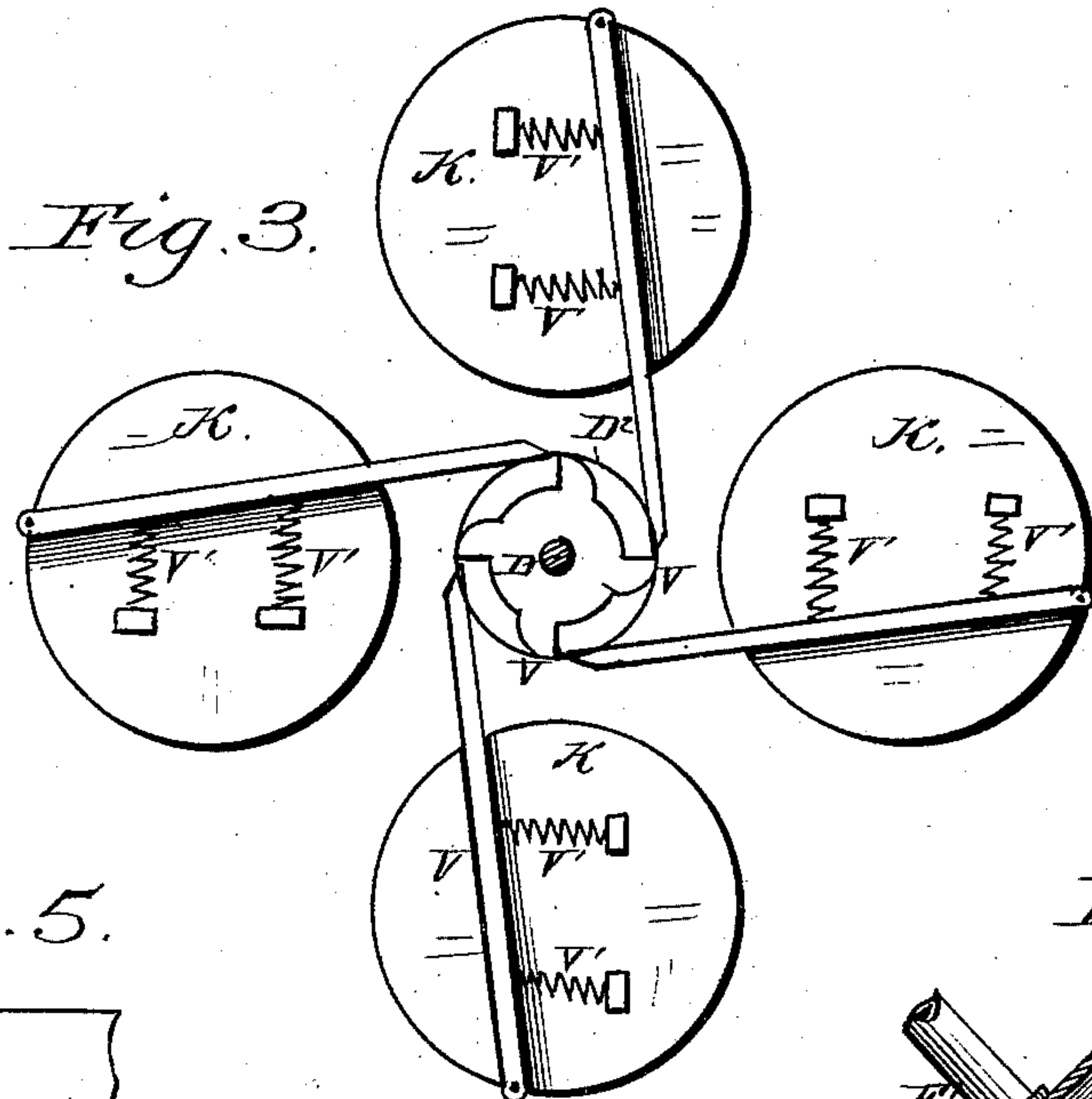
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3 Sheets—Sheet 3.

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Fig. 7.

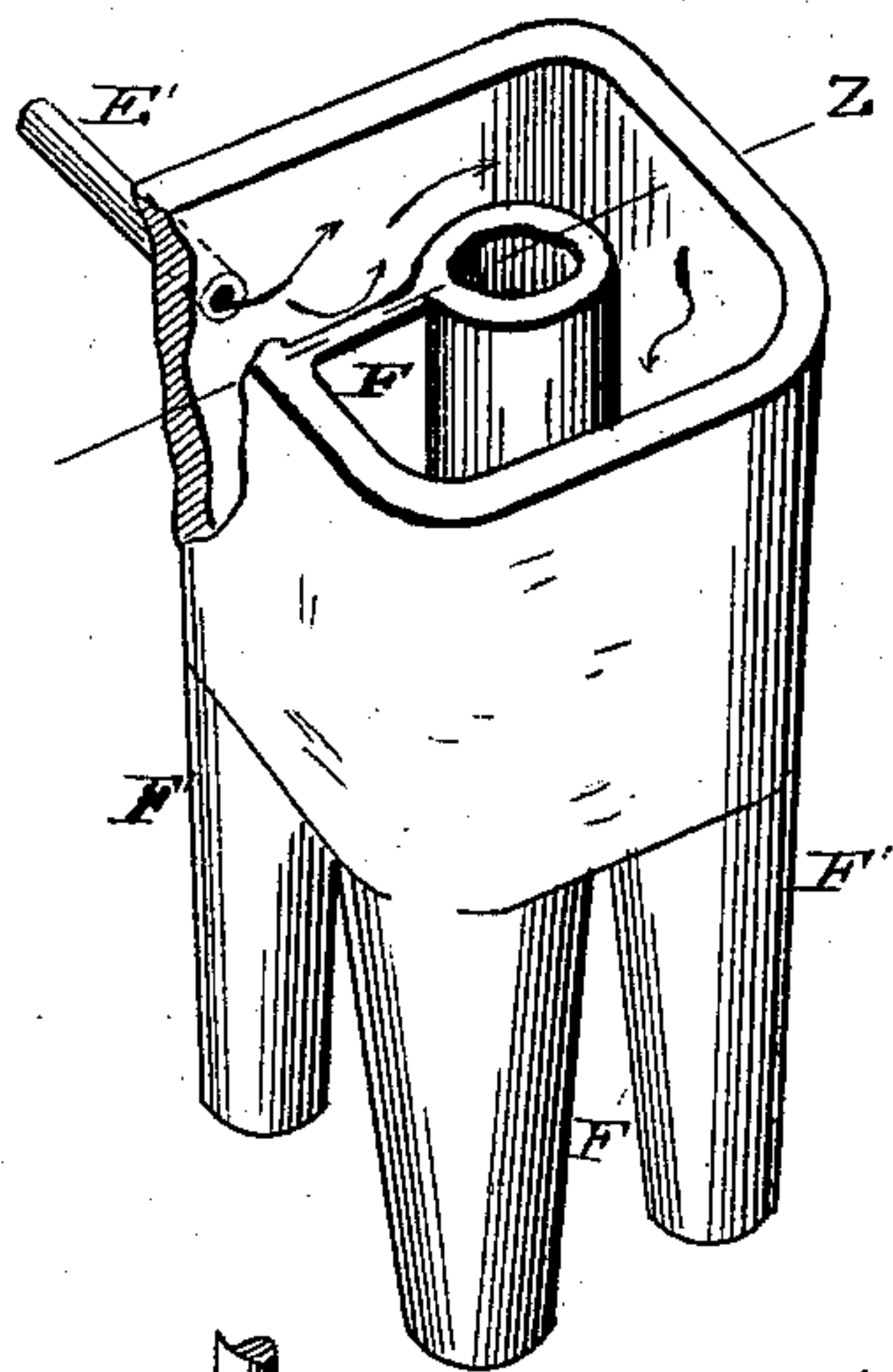


Fig. 8.

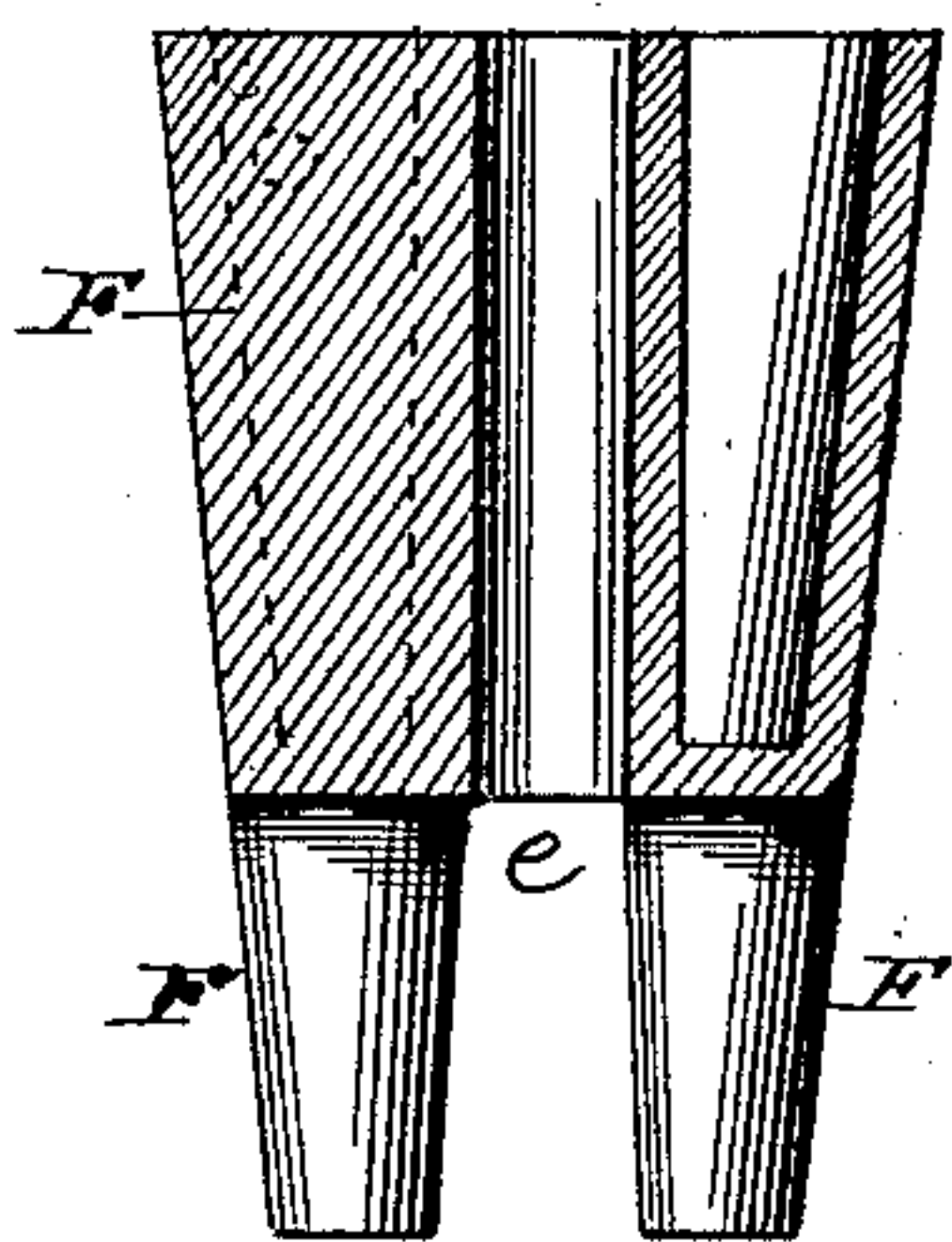


Fig. 9.

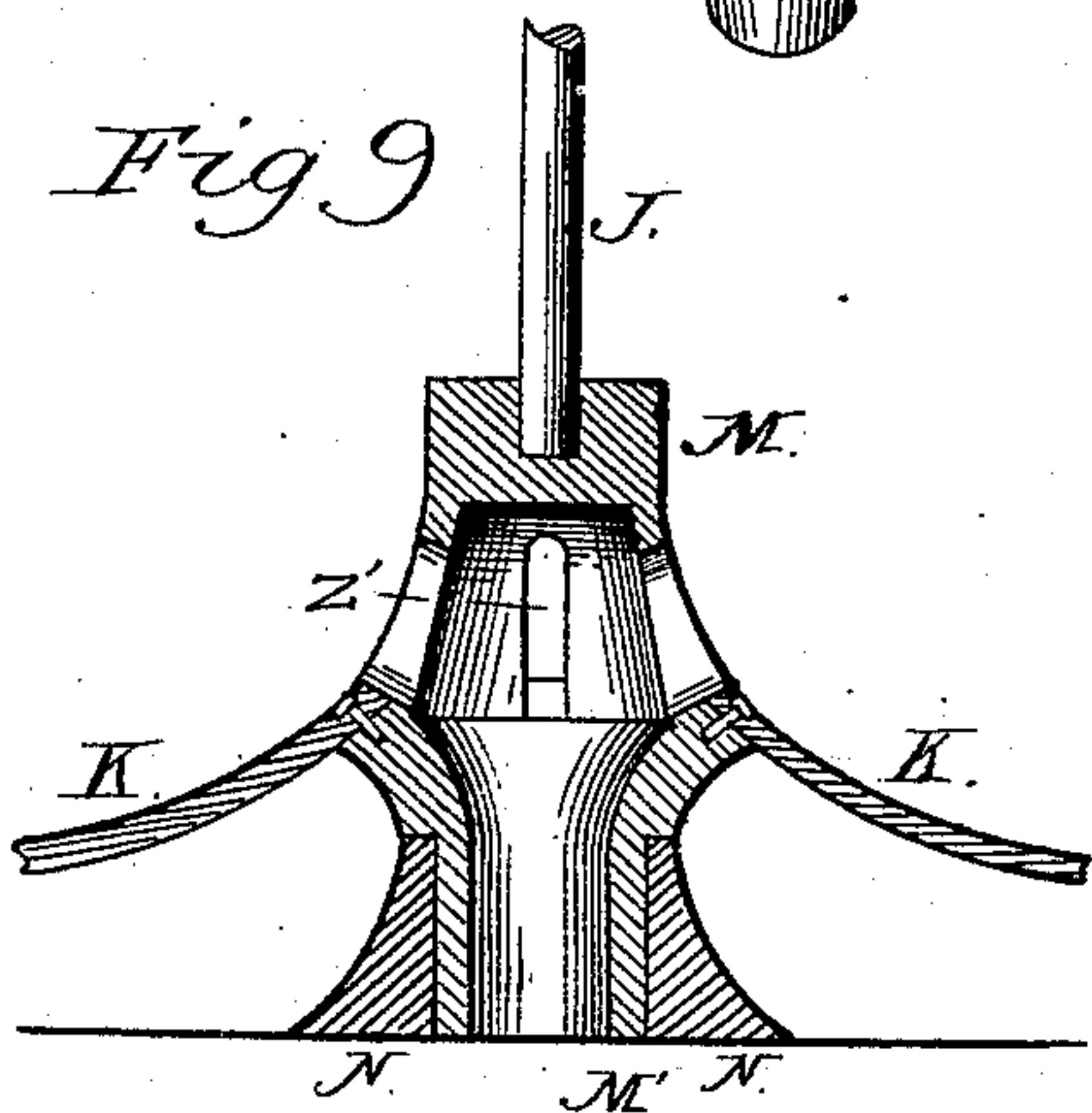
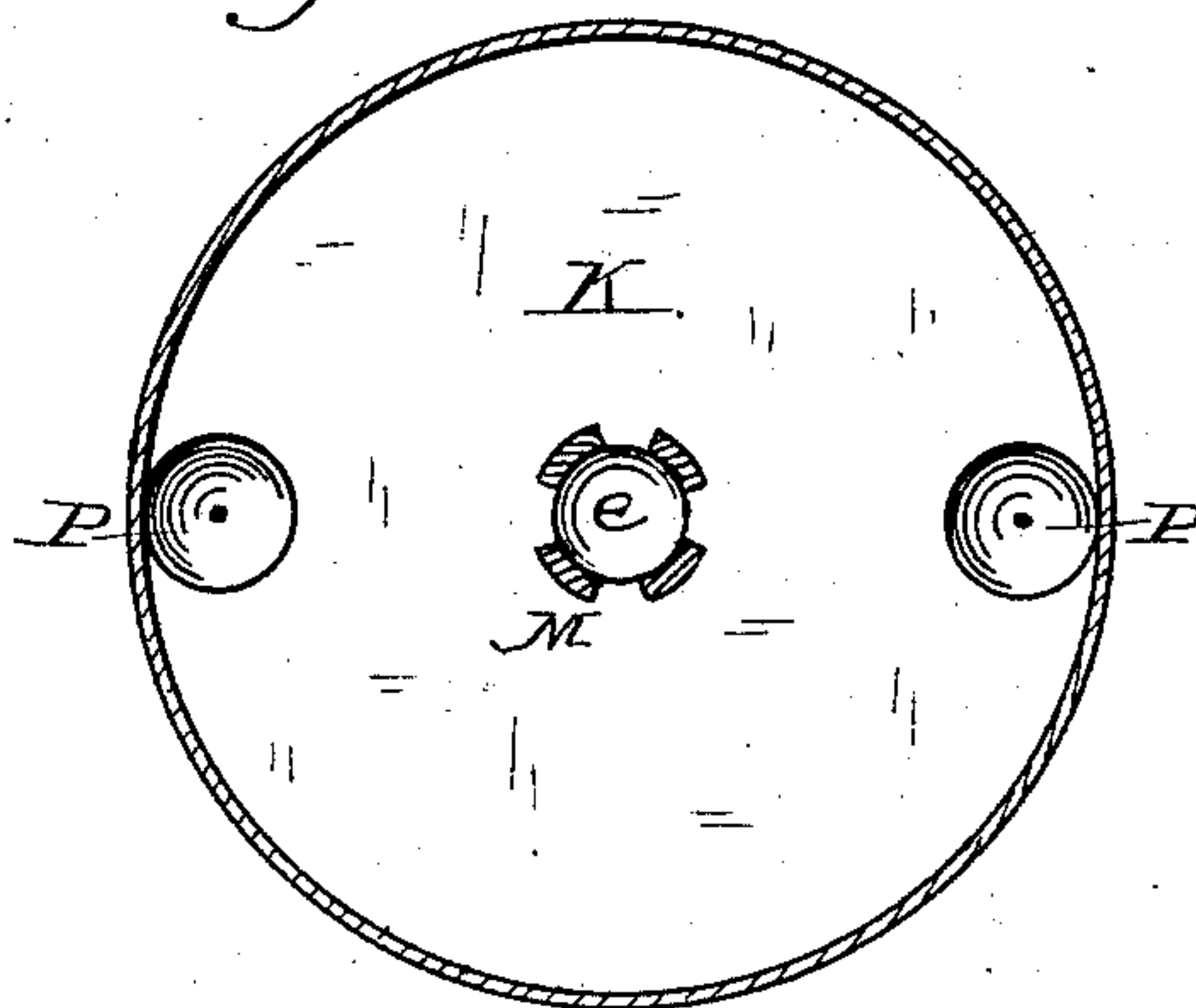


Fig. 10.



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# UNITED STATES PATENT OFFICE.

FRANCIS R. BROWN, OF BOULDER, COLORADO.

## ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 305,284, dated September 16, 1884.

Application filed April 19, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS R. BROWN, a citizen of the United States, residing at Boulder, in the county of Boulder and State of Colorado, have invented certain new and useful Improvements in Ore-Separators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to ore-concentrators; and it consists partly in certain improvements in a hydraulic separator, which first receives the comminuted ore or stock; partly in the combination of this hydraulic separator with a series of amalgamating-diaphragms, each of which is fed directly therefrom; partly in certain improvements in the pan and its hub, to which the ore passes from each diaphragm, and partly in the general construction and combination of the parts constituting the machine as a whole, and to divers details, all as hereinafter more particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a vertical section through the machine as a whole. Fig. 2 represents a horizontal section on the line *x x* of Fig. 1. Fig. 3 represents a plan view of a modification of the pan-shaking devices. Fig. 4 represents a plan view of another modification of the same. Fig. 5 represents a detail sectional view of one of the mineral-pockets of the pans. Fig. 6 represents a horizontal section through the hydraulic separator. Fig. 7 represents an enlarged perspective detail view of the hydraulic separator. Fig. 8 represents an enlarged vertical section through the same on the line *Z*, passing through the partition and the center of said separator. Fig. 9 represents an enlarged detail vertical section of the hub of one of the concentrator-pans. Fig. 10 represents an enlarged horizontal section through one of said pans on a plane a little below the diaphragm.

In said drawings, A designates the frame of the machine, provided with necessary sills, uprights, and cross-bars, which need not be more particularly described.

B designates the motor which drives said machine by means of a belt running to a horizontal shaft, C, which is connected by bevel-

gearing to a vertical shaft, D, both of said shafts being journaled in the said frame. The belt above referred to is lettered *b*, its pulleys or belt-wheels are lettered *b'* *b''*, and the meshing bevel-wheels on said shafts are lettered *c d*.

E designates a hydraulic separator (see Figs. 1, 6, 7, and 8) attached to and supported by the upper part of frame A, and provided with an outer and an inner wall arranged concentrically around shaft D, which passes through an opening in the bottom *e* thereof. Below this bottom extend tapering thimbles *F'*, which open at top into the bottom of the annular space between the walls of the separator, so that the said thimbles may receive stock therefrom. This annular space is divided by a vertical partition, F, which extends across it and from the top of the separator to said bottom *e*. The stock is supplied through a pipe, *E'*, which discharges against the side of said partition, as shown in Fig. 7. The stream of stock is deflected by this partition and caused to circle around the separator, following the course of the arrows in Fig. 7, and passing over the thimbles as it does so. When the stream reaches the opposite side of the partition, it again turns upon itself. Water is supplied by pipes *G'*, arranged above the separator, and perforated discharge-pipes *G*, extending vertically downward from said pipes *G'* into said thimbles *F'*, respectively. The water thus supplied circulates around the interior of each thimble, thoroughly washing it, and stirring the stock therein, and then passes upward into the remainder of the separator. The heavier parts of the stock thus stirred gradually settle to the bottoms of the thimbles and the lighter parts take their place above them. Each thimble is provided with a cock, *f*, in its bottom, for allowing the former to escape, and another cock, *f'*, at a point in the side, which will allow the lighter parts to be drawn off at will. By the above contrivances the ores of different gravity are separated, and either the lighter or the heavier may be drawn off at will. Both of said cocks open communication through their respective branch pipes with a pipe, H, which feeds one of the four amalgamating-diaphragms I. Each thimble *F'* supplies one of said diaphragms



through one of said pipes H. Each diaphragm is mounted on and rotates with a vertical shaft, J, and under each is an oscillating pan, K. On each pan is mounted a circular feeding-wall, L, which surrounds the lower edge of the diaphragm I, and has an inner flange, *l*, turned up to receive and temporarily sustain the stock before it descends therefrom to the pan. As the diaphragm rotates while the pan K and wall L oscillate, the stock will be shaken and stirred about in passing from the one to the other. This facilitates the process of amalgamation. The shaft J has its lower bearing in a hub, M, formed with said pan, or attached thereto, as shown in Fig. 9, and the said hub is extended downward below said pan, forming the journal of said pan. This journal turns in a bearing formed in a base plate or support, N, attached to the frame.

The diaphragm I is provided on its upper face with copper ribs I', which are coated with quicksilver, and as the feed-tube H discharges stock at or near the center of the diaphragm the distribution of it over said ribs is very thorough and complete. After this amalgamation the stock passes to the annular receptacle or trough formed by the feeding-wall L and its flange *l*, and there undergoes further amalgamation with the mercury in the bottom of said trough. The stock passes from this trough over the flange or inner rim, *l*, thereof down to the concentrating-pan K. In this pan it is acted on by a spiral copper flange, O, which is secured to the under side of the convex diaphragm I. As both the diaphragm and spiral flange are fully described in my Patent No. 291,872, they need not be further dwelt upon here. The bottom of the pan is also convex, and is provided on opposite sides with pockets P, (see Figs. 5 and 10,) in which the heavier portions of the ores gradually settle. The lighter portions are worked by the action of said spiral flange to the center of the pan, and enter the interior of the lower part, M', of the hub M, said lower part, M', being made tubular in order that it may serve as a discharge-outlet as well as a journal. This hollow part of the hub has openings *z*' in its sides, whereby it receives stock from the pan, and its lower end is open to allow the stock to pass therefrom. This outlet discharges on an incline, Q, which conducts the material thus delivered to a waste-pipe, R. There is one of these inclines under each concentrating-pan, and they all converge to said waste-pipe.

The oscillating motion of the concentrating-pans K is preferably produced, as in Fig. 2, by two bars, T, which are actuated by cams S on vertical shaft D. These bars have racks *t* formed on their sides, and each one of these racks engages a toothed segment, U, attached to one of said concentrating-pans. In consequence each bar oscillates two of the pans simultaneously, though in opposite directions. Each bar is provided with a longitudinal slot, T', which receives a guide-pin, *t*,

fixed to the frame A. This construction of the oscillating apparatus insures a violent shake or jar, which is needed for the treatment of some ores. For other ores a gentler oscillation is required.

In Fig. 3 I have shown as a substitute a series of rods or arms, V, which are loosely connected to the concentrating-pans K and arranged to be struck by cams or tappets *v* on a pulley or wheel, D<sup>2</sup>, carried by shaft D. Each arm V is provided with retracting-springs *v*', which restores it and the concentrating-pan to their former position as soon as said arm is freed from the tappet.

In Fig. 4 no retracting-springs are shown; but I employ connecting-rods W, which are hinged to the concentrating-pans, respectively, and are connected by encircling rings to cams X on shaft D.

The rotary motion of the shafts J is derived from belts *y*, extending from pulleys Y on said shafts to pulleys Z on shaft D, respectively.

The rotation of the diaphragm, the oscillation of the concentrating-pan, the complicated motions of the stock and water, and the numerous obstacles they meet with, all combine to cause a very great amount of friction, and electricity is generated thereby to such a degree as to be practically serviceable in aiding the separation of the different ores from one another by magnetization, due to the action of currents of electricity generated in the metallic parts of the separator by the friction of the stock against them. At times, however, the electricity seems to be in excess, and certain improper and injurious accumulations of ore are attributed to it. To remedy this I connect ground-wires *z* to the pans, and thus lead off the superfluous electricity.

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

1. The combination of a hydraulic ore-separator provided with a series of thimbles or tubes with a series of diaphragms and concentrating-pans corresponding in number to said thimbles, and the feed-pipes connecting said thimbles with said pans, substantially as set forth.

2. A hydraulic ore-separator having an annular interior, formed as one apartment or passage, and provided with a single partition extending across it at one point from side to side and from top to bottom of said space, substantially as set forth.

3. A hydraulic ore-separator having a continuous annular interior space, and provided with a partition extending across the said space in proximity to the inlet for stock, in combination with devices for discharging water into the lower part of said compartment, the stock being directed against one side of said partition, and compelled thereby to make the circuit of the annular space to



the other side of said partition, substantially as set forth.

4. A hydraulic ore-separator having an annular interior space provided with a downwardly-extending series of thimbles or tubes  
5 in combination with perforated water-tubes, which extend down into these thimbles, respectively, and discharge the water therein.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS R. BROWN.

Witnesses:

F. E. STOREY,

W. A. FARNSWORTH.