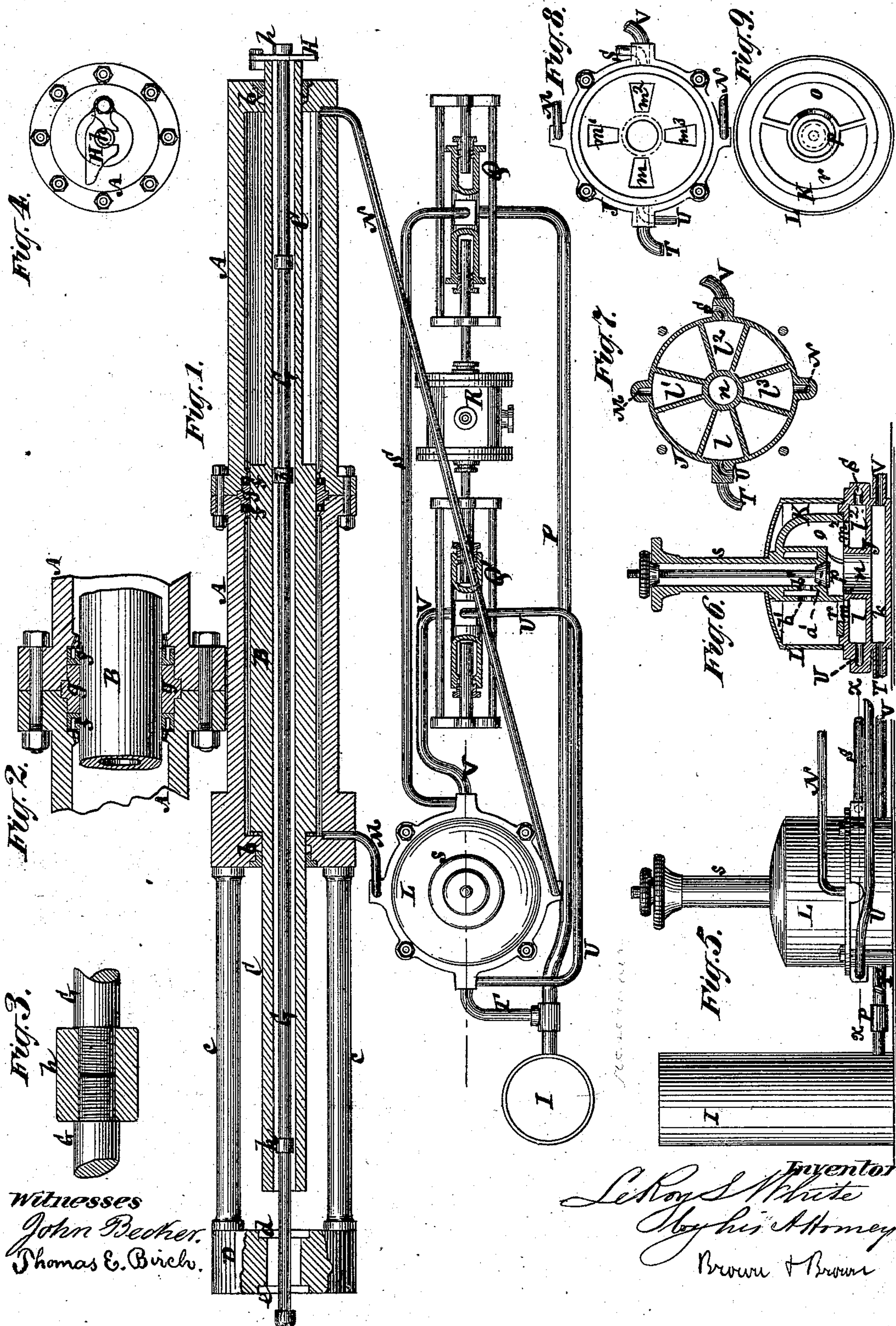


Le ROY S. WHITE.  
Machine for Forming Tubes.  
No. 225,035. Patented Mar. 2, 1880.



Witnesses  
John Becker.  
Thomas E. Birch.

Inventor  
Le Roy S. White  
By his Attorneys  
Brown & Brown



Le ROY S. WHITE.  
Machine for Forming Tubes.  
No. 225,035. Patented Mar. 2, 1880.

Fig. 13.

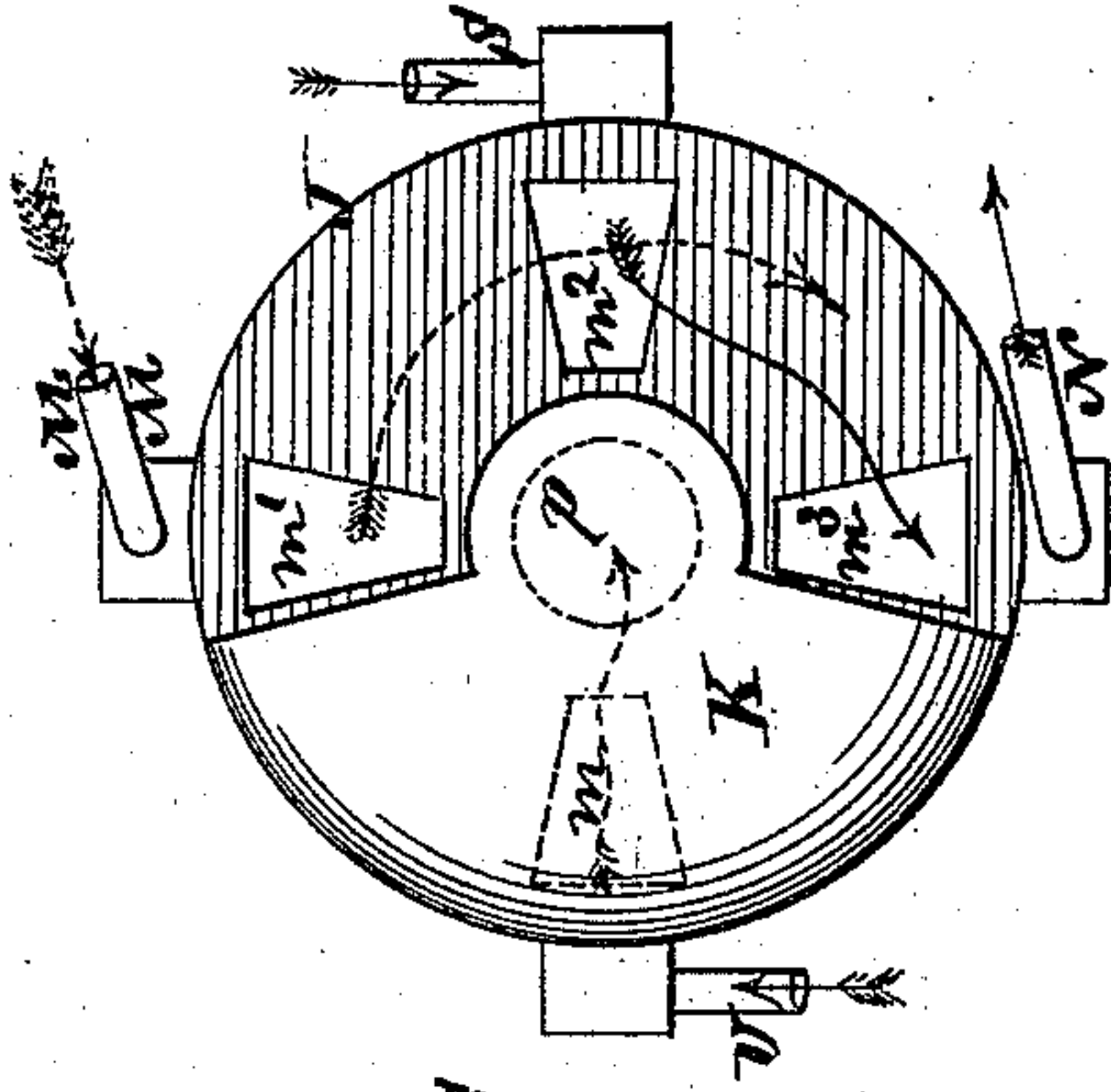


Fig. 12.

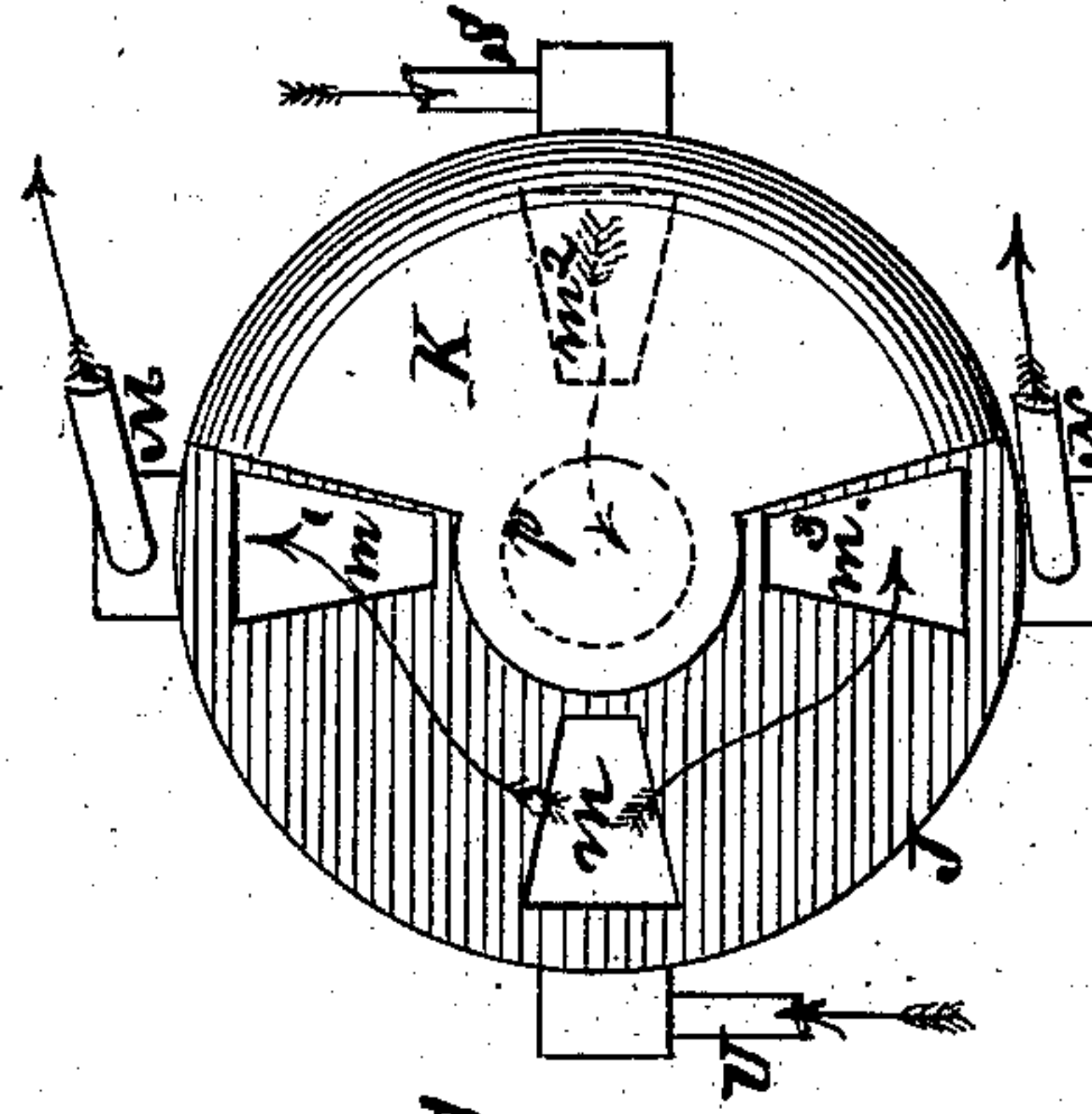


Fig. 12.

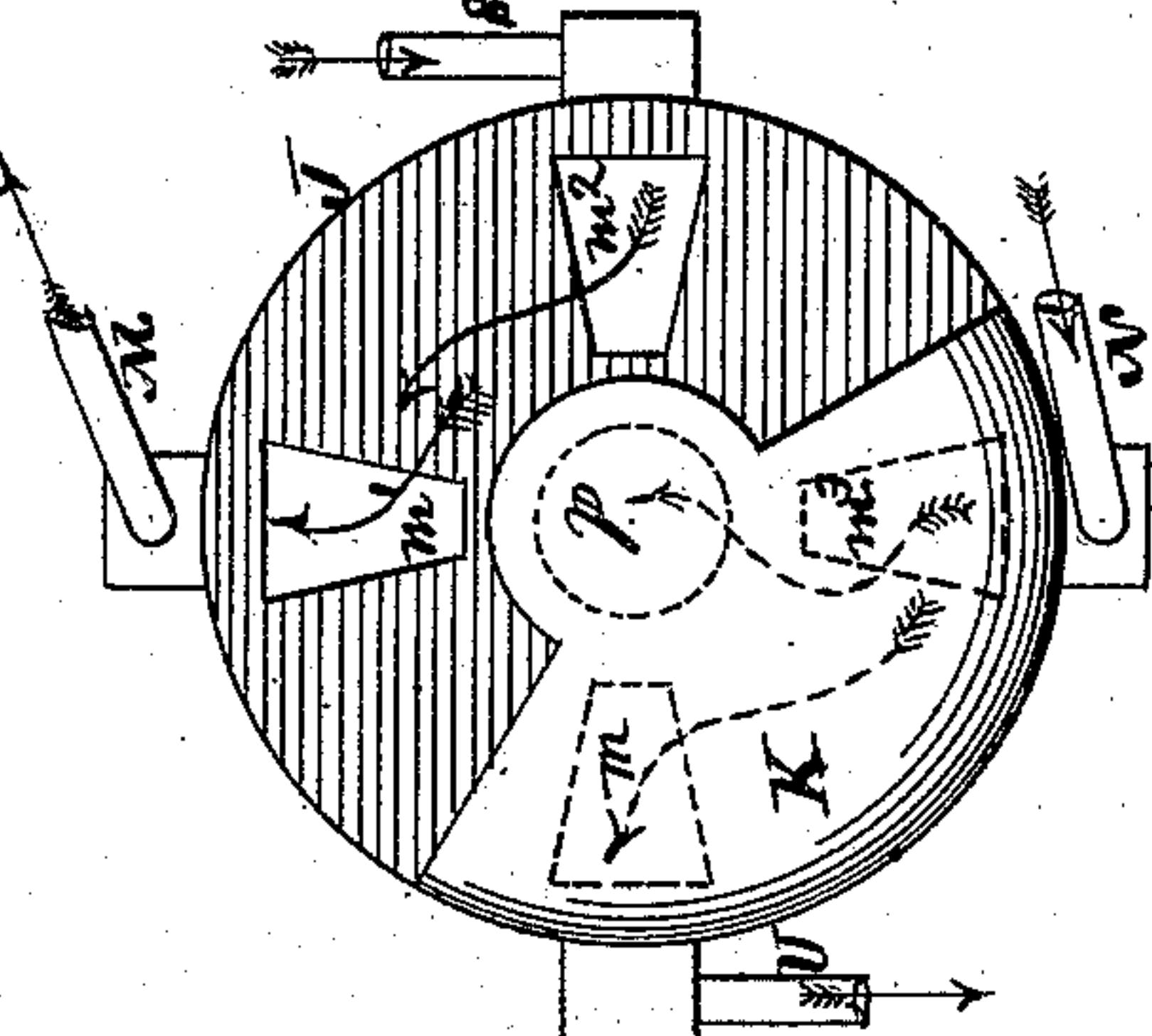


Fig. 16.

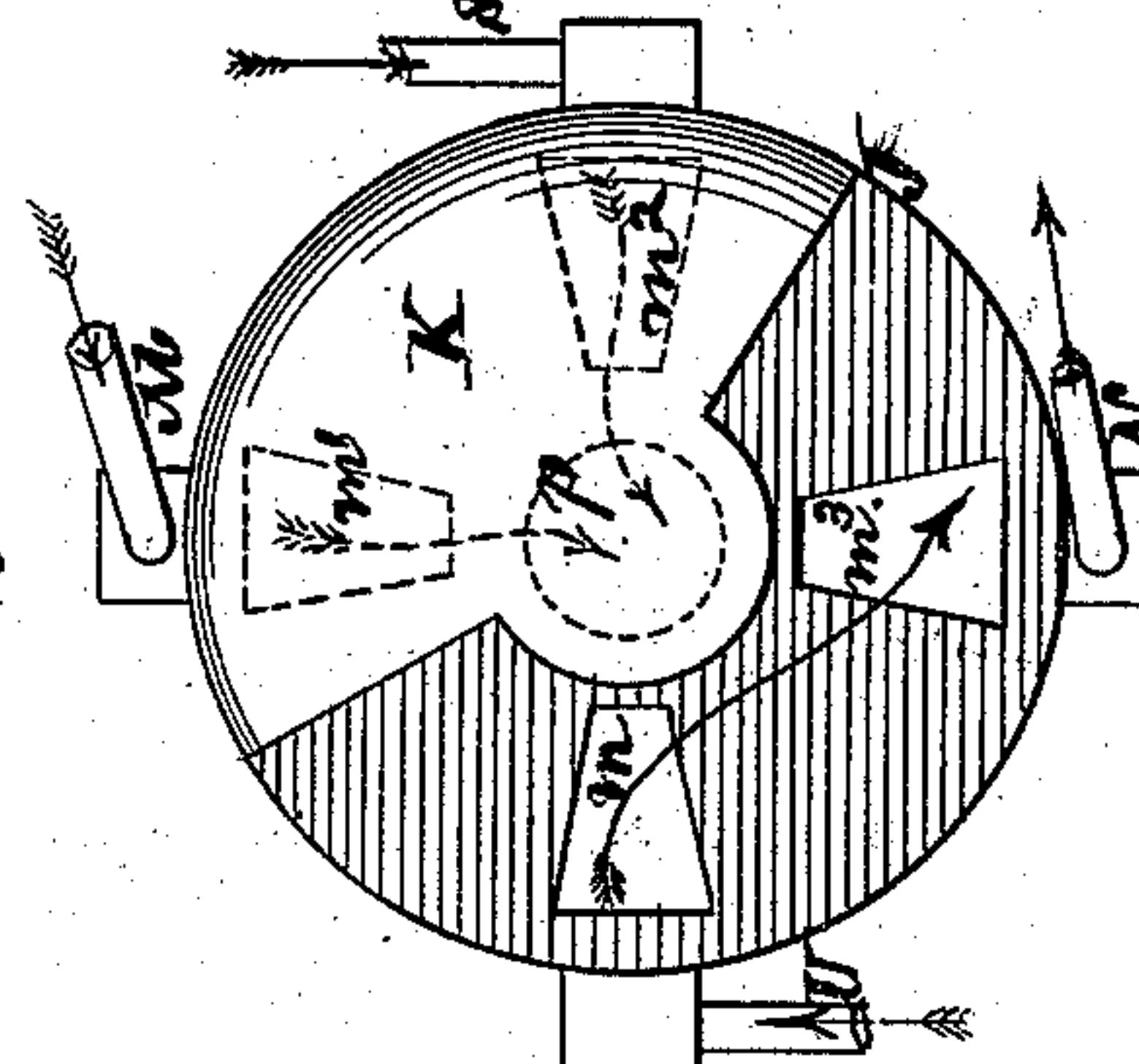


Fig. 11.

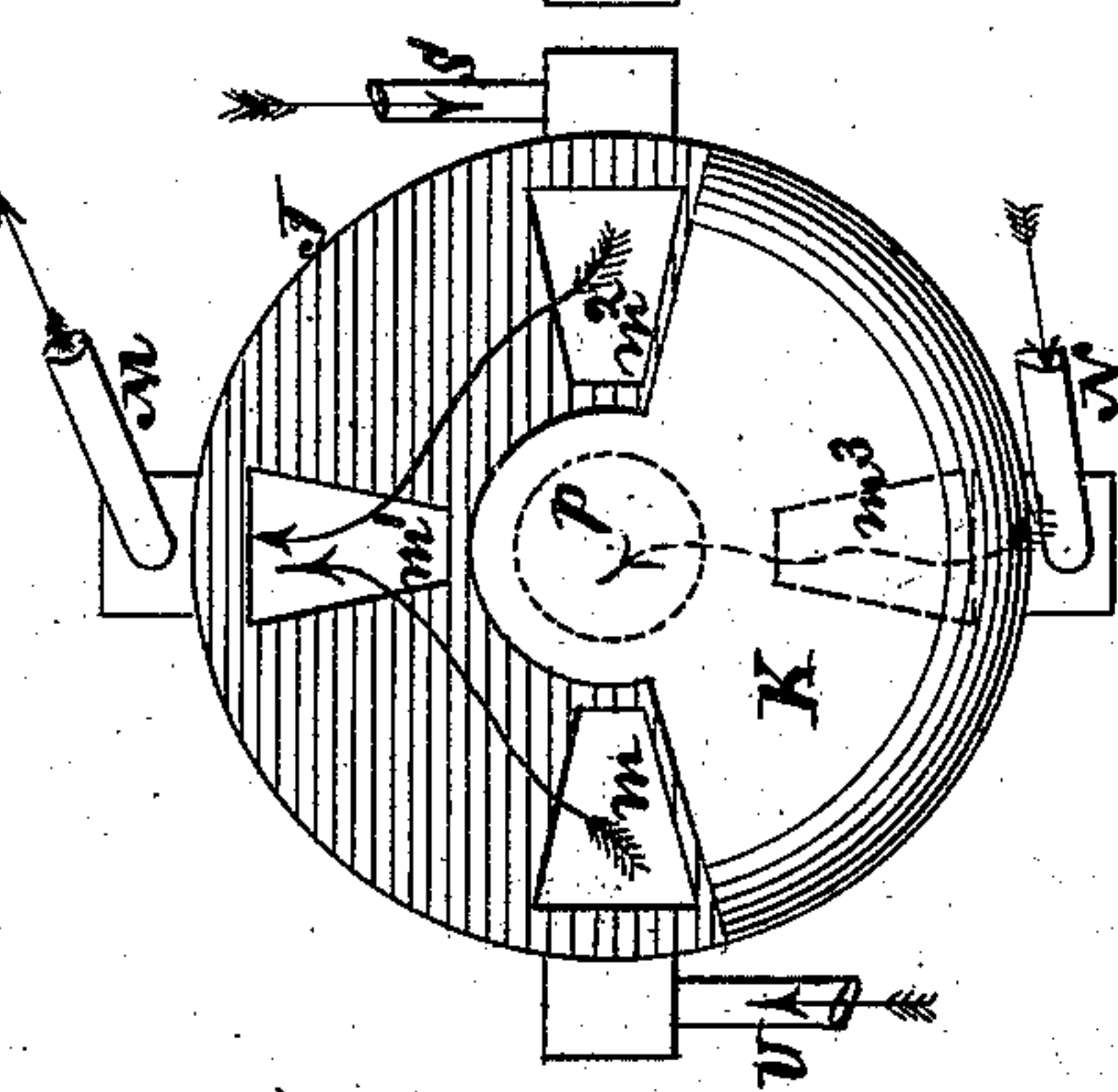


Fig. 15.

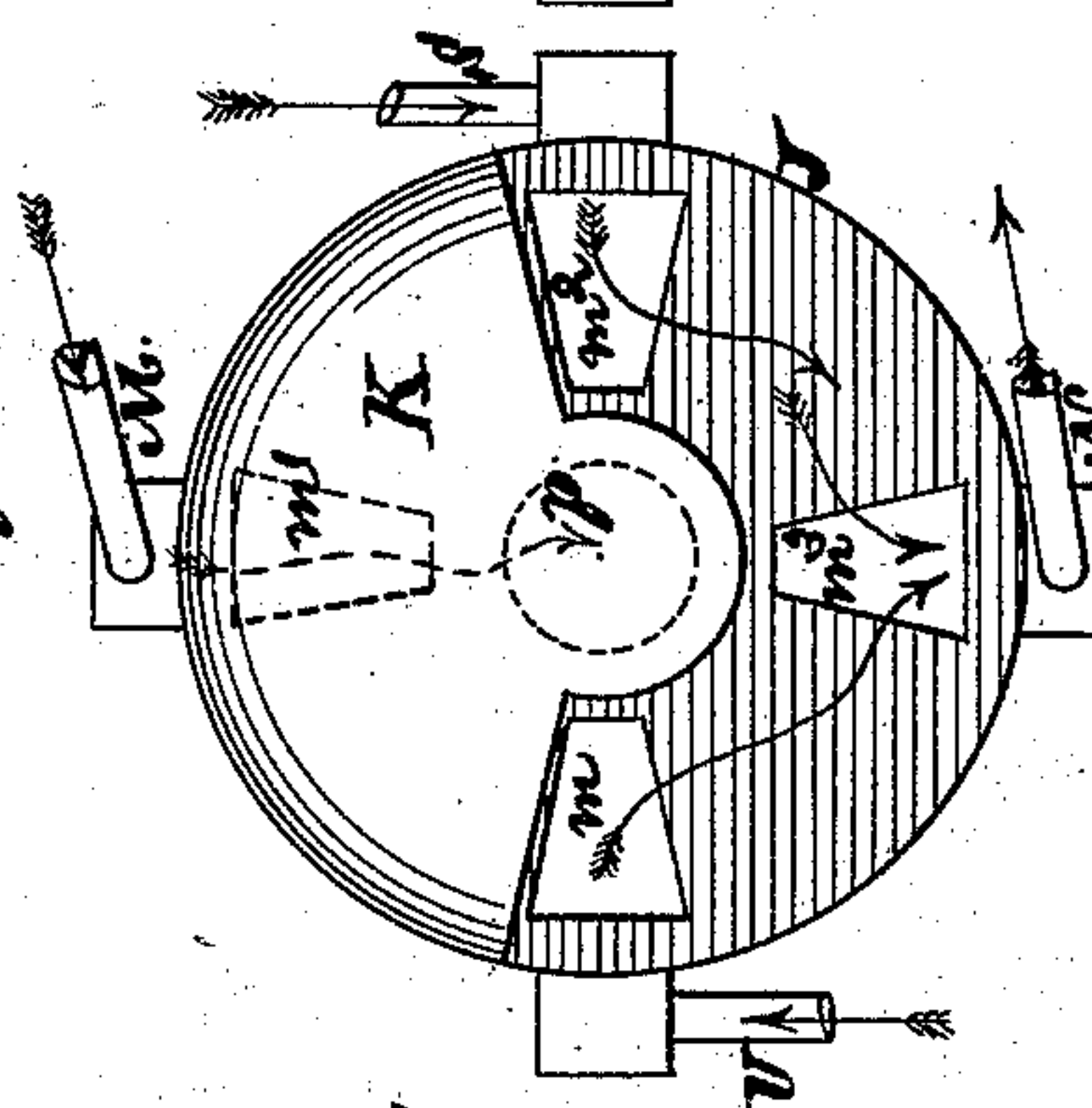


Fig. 10.

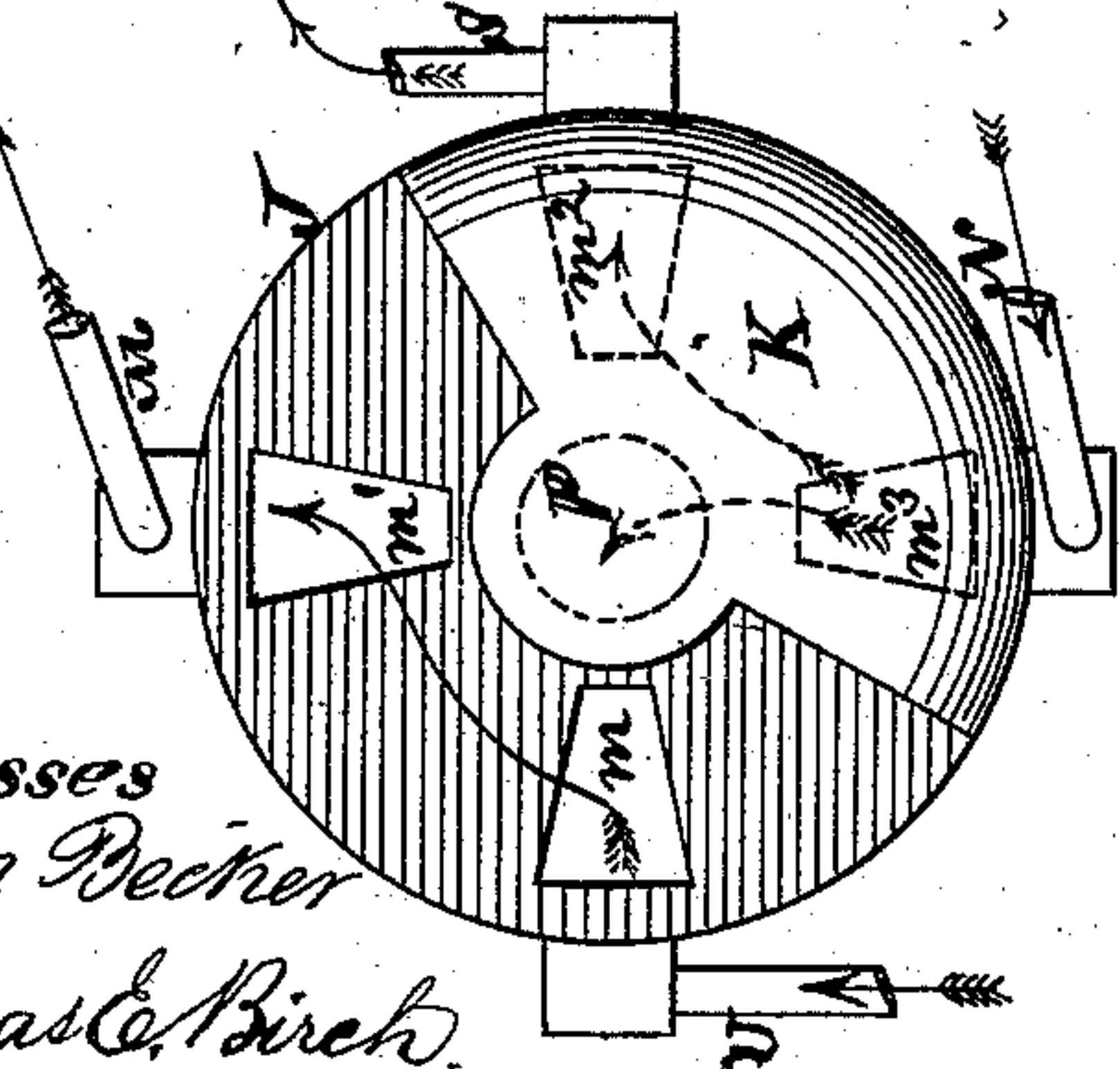
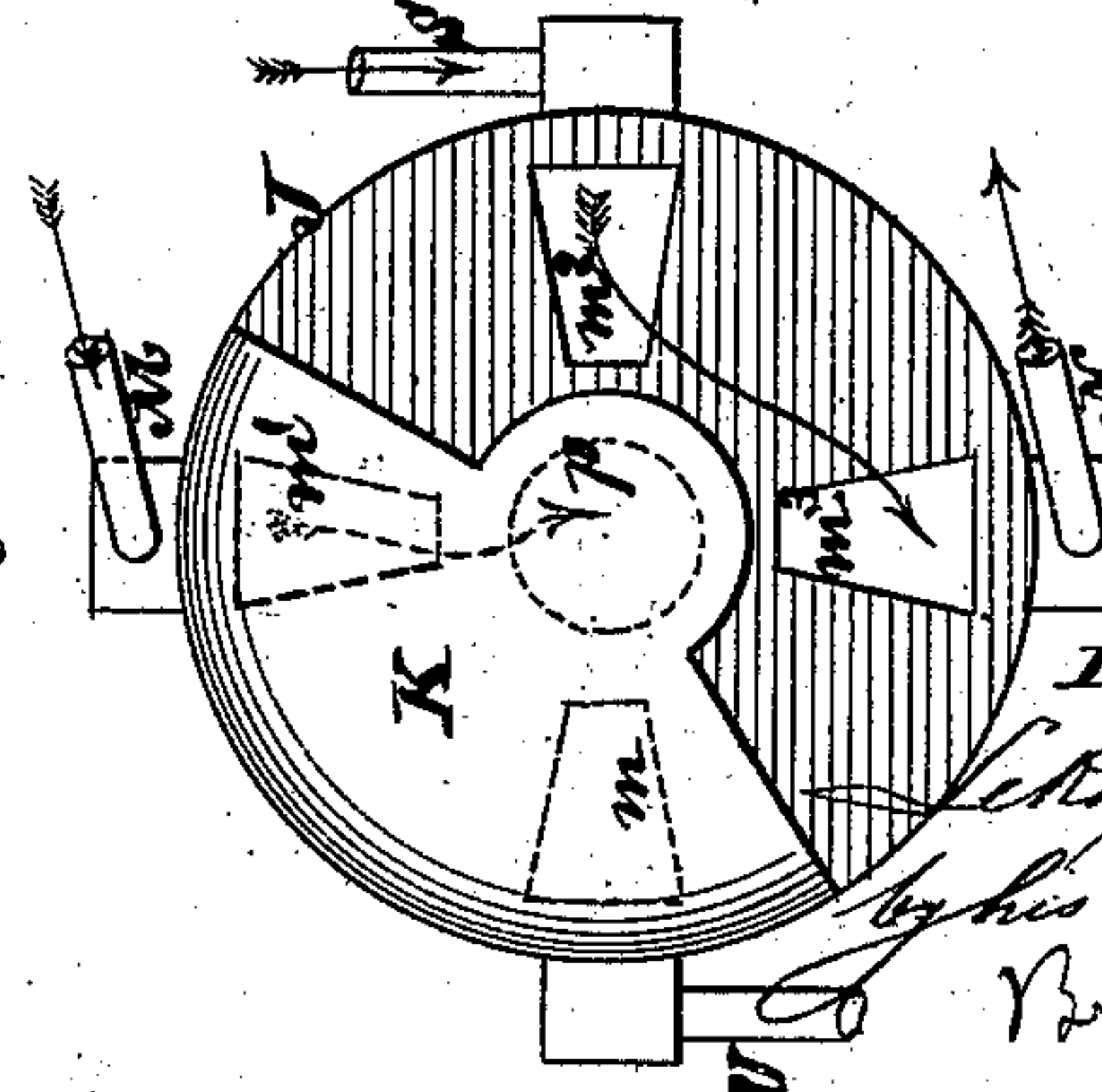


Fig. 14.



Witnesses  
John Becker  
Thomas C. Birch.

Inventor  
Le Roy S. White  
by his Attorney  
Brown & Brown



# UNITED STATES PATENT OFFICE.

LE ROY S. WHITE, OF WATERBURY, CONNECTICUT, ASSIGNOR TO BROWN & BROTHERS, OF SAME PLACE.

## MACHINE FOR FORMING TUBES.

SPECIFICATION forming part of Letters Patent No. 225,035, dated March 2, 1880.

Application filed June 17, 1879.

*To all whom it may concern:*

Be it known that I, LE ROY S. WHITE, of Waterbury, in the county of New Haven and State of Connecticut, have invented certain  
5 Improvements in Machinery for Forming Hollow Cylindrical or other Shaped Bodies, and drawing hollow cylinders, tubes, and other articles; and I do hereby declare that the following is a description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to hydraulic machinery or apparatus for the purposes above cited, and may be used either for forming seamless  
15 heads or seamless cylindrical sections for steam-boilers, or for cupping and drawing cylindrical or other shaped bodies having one closed end, such as the bodies of kitchen-boilers or other boilers drawn from a single piece of sheet  
20 metal or metal plate, or for drawing tubes or cylinders having both ends open and without restriction by the machine as to their length, thus providing for the drawing of tubes of an indefinite length.

The invention consists in a combination, with  
25 a hydraulic cylinder, of a hollow plunger or ram provided with tubular stems or rods arranged to work through both ends of said cylinder, a draw-rod, preferably of sectional construction, capable of longitudinal adjustment  
30 through said hollow ram and its stems or rods, and means for engaging and disengaging the draw-rod with and from the plunger.

The invention also consists in a combination, with a hydraulic cylinder, of a ram or  
35 plunger working therein, and to which the mandrel or draw-rod is attached, constructed to present different areas on its opposite sides or faces, a pump or two pumps, preferably of  
40 different capacity, and a valve or valves for changing the communication of the pump or pumps between opposite ends of the said cylinder, for varying the speed and action of the plunger or ram, to adapt the power of the apparatus to heavier and lighter kinds of work.

Furthermore, the invention consists in special combinations of details, including a valve of peculiar construction for operating and controlling the apparatus.

In the accompanying drawings, Figure 1 represents a plan view, partly in section, of an  
50 apparatus constructed in accordance with the invention; Fig. 2, a longitudinal section, upon a larger scale, through a central jointed portion of the ram-cylinder, in illustration of a  
55 packing applied to said cylinder to keep the ram tight. Fig. 3 is a longitudinal section, upon a larger scale, of one of the couplings of the sectionally-constructed draw-rod; and Fig.  
60 4, a rear-end view of the ram-cylinder, in illustration of a catch applied to the rod of the ram and to the sectionally-constructed draw-rod, to effect the necessary engagement and disengagement of said rods. Fig. 5 is an elevation  
65 of the valve-chest and reservoir used in working the ram, and Fig. 6 a vertical section of the valve and valve-chest. Fig. 7 is a horizontal section through the valve-chest on the line *xx* in Fig. 5; and Figs. 8 and 9, a top view  
70 of the valve-seat and under view of the valve, respectively. The remaining figures, from 10 to 17, inclusive, represent plan views of the valve in different working positions to produce different actions and speeds of the apparatus.

A indicates the cylinder of a hydraulic motor  
75 or apparatus fitted with an elongated plunger or ram, B, which latter is hollow throughout its length, and is provided at its opposite ends with hollow or tubular stems or rods C C,  
80 arranged to project through stuffing-boxes *b b* in the ends of the ram-cylinder. These tubular stems or rods C C are of different diameters, whereby the ram B is made to present  
85 different working areas on its opposite ends or faces, and whereby a differential action of the apparatus is provided for. The one of said stems C which occupies a forward position—that is, the one which is nearest to the  
90 work-die holder D of the apparatus—is here represented as being the largest of the two stems, thus giving the greatest working area to the back end of the ram B.

The work-die holder D may be connected  
95 with the working-cylinder A by side rods, *c c*, and may be arranged at any suitable distance from the front end of said cylinder not less than the stroke of the ram. It is preferred to



construct said die-holder with die-seats *d e* on its opposite sides or faces, the inner one, *d*, of which serves to hold a die for cupping cylindrical or other shaped bodies, while the other  
5 or outer seat, *e*, may be used to hold a die for purely drawing purposes.

The ram or plunger B is fitted to work freely or loosely in the cylinder A, and is packed against leakage intermediately of the length  
10 of its stroke by a double annular packing, *f*, of leather or other suitable flexible material, applied to the interior of the cylinder A, intermediately of its length, on opposite sides of a joint-closing metal ring, *g*, inserted within  
15 the cylinder A intermediately of the length of the latter. Said cylinder is constructed of two independent lengths or sections bolted together to receive and hold the joint-closing ring *g* between and within them. Said ring  
20 *g* may also serve to form an intermediate bearing for the ram B, which is of such a length in relation to the entire cylinder A that in the course of its extreme stroke in reverse directions it never wholly clears or passes be-  
25 yond the double packing *f*.

Arranged to pass freely or loosely within and through the tubular or hollow elongated plunger or ram B and its stems C C is a draw-rod, G, which is constructed of a series of sec-  
30 tions of any desired length joined together by screw-couplings *h*. These sections may be added to or reduced in number, as required, according to the length of tube to be drawn or of the work to be done. Said draw-rod G is  
35 arranged to engage with and disengage from the ram B, for the purpose of causing it to be moved in one direction by said ram, or of being slid or adjusted longitudinally through the ram. To this end the rear stem C of the ram  
40 has hinged to or otherwise suitably connected with it, outside of the working-cylinder A, a catch or coupling device, H, of any suitable construction to engage with or against one of the screw-couplings *h* of the rod G.

45 When it is required to cup a cylindrical or other shaped body, or, in other words, to draw said body, leaving one closed end, the necessary die is inserted in the seat *d* of the die-holder D, and a suitable cupping tool or mandrel fitted or screwed on or into the front end  
50 of the forward stem C of the ram, so that the latter, in its advance stroke, will project the cupping-mandrel into the metal and cup the latter as required. This action is repeated for  
55 any number of times in succession, the cupping-mandrel on the end of the advance rod C of the ram and the die in the seat *d* of the die-holder being changed as required, and the cupped article or body, if necessary, being  
60 amended prior to each succeeding cupping operation.

To draw a tube or hollow article open at both ends the cupping-die is removed from the seat *d* in the die-holder D and a suitable die  
65 inserted in the seat *e* thereof. The tube to be drawn is then clamped in any suitable manner

to the advance or work end of the rod G, or between the front end of the latter and a mandrel over which the tube is drawn, so that in the back stroke of the ram B the tube will be  
70 drawn through the die in the die-holder D by the engagement of the rod G with the ram, after which the ram makes its advance stroke, leaving the rod G behind it, for a succeeding drawing operation on the tube by engaging the ram,  
75 through the coupling device H, with a succeeding rod-coupling, *h*, and so on for any number of operations of the ram to follow up the work, the tube as it is drawn passing through the hollow ram and its stems and being annealed,  
80 and the die or die and mandrel being changed, if necessary, at or before each succeeding drawing operation. In this way or by these means the length of the tube capable of being drawn is not restricted by the length of the stroke of  
85 the ram.

I will now proceed to describe the mechanism by which the ram B is reciprocated and provision is made for varying its speed and action to adapt the power of the apparatus to  
90 heavier and lighter kinds of work.

I is a reservoir containing water or other fluid for operating the ram B, and J is a hollow valve-seat composed of a lower chamber, *k*, and a series of upper chambers, *l l' l'' l'''*,  
95 which upper chambers have ports *m m' m'' m'''* in their tops, over which and a central exhaust-port, *n*, a circularly-adjustable valve, K, of a D-like construction, is arranged, said valve being formed with a cavity, *o*, on one side of  
100 its axis, a central cavity, *p*, arranged over the port *n* and in communication with the cavity *o*, and a through-opening, *r*, on the opposite side of its axis. This circularly-adjustable valve K is arranged for operation within a  
105 valve-chest, L, mounted on the valve-seat, and is capable of being turned by a stem, *s*, to control the ports *m m' m'' m'''*.

M is a pipe connecting the advance end of the ram-cylinder A with the chamber *l'* in the  
110 valve-seat, and N is a pipe connecting the rear end of said cylinder with the chamber *l''* in the valve-seat.

P is a pipe connecting the reservoir I with a small pump, Q, of a pumping-engine, R, and  
115 S is a pipe connecting said small pump with the chamber *l''* in the valve-seat. A branch pipe, T, also connects the pipe P with the lower chamber, *k*, in the valve-seat.

Q' is a pump of larger dimensions or work-  
120 ing than the pump Q, and worked by the engine R. This pump is connected by a pipe, U, with the chamber *l* in the valve-seat, and by a pipe, V, with the lower chamber, *k*, in said seat.

125 When the valve K is turned to the position represented in Fig. 10 of the drawings, the large pump Q' pumps, by the pipe U from the reservoir, through the chamber *l*, ports *m* and *m'*, and pipe M, to the front end of the ram B,  
130 and the water from the rear of said ram is discharged, by the pipe N from the rear of the



ram, and under the valve K, by the port  $m^3$  and passages  $p n$ , to the reservoir I, and by the port  $m^2$  and pipe S to the smaller pump Q, all as shown by arrows in said figure. This gives a certain velocity and force to the ram, suitable for a heavy class of work.

When the valve K is turned to the position represented in Fig. 11 of the drawings, both the large and small pumps Q Q' discharge through the ports  $m m^2$  and by the port  $m$  and pipe M to the front end of the ram-cylinder A, while the water from the rear end of said cylinder is discharged by the pipe N under the valve K to the reservoir I, as shown by the arrows in said figure. This gives a quick action to the ram in a backward direction, and is more especially intended for returning it after it has done its work by movement in a forward direction.

When the valve K is in the position represented in Fig. 12 of the drawings, the small pump Q alone supplies water, by the pipe S, ports  $m' m^2$ , and pipe M, to the forward end of the ram, while the water is discharged from the rear end of the ram to the reservoir, as in Fig. 11, as shown by arrows. This gives a slow backward motion to the ram and the most powerful operation of which it is capable in a forward direction.

When the valve K is turned to the position represented in Fig. 13, then the small pump Q alone, by its pipe S, pumps water, by the ports  $m^2 m^3$  and pipe N, to the rear of the ram, which then moves with a quick speed forward, the water discharging from the front end of the ram, which is of smaller area, through the valve-chest, and by the port  $m^3$  and pipe N to the rear of the ram, as shown by arrow, the differential construction of the ram providing for this circulation of the water.

When the valve is turned to the position represented in Fig. 14 of the drawings, then the small pump Q, by the pipe S, pumps the water up through the port  $m^2$  into the valve-chest, and from thence, by the port  $m^3$  and pipe N, to the back of the ram, while the water is discharged from the front of the ram by the pipe M, and under the valve to the reservoir I, as shown by arrows. This gives a slow but powerful action to the ram.

When the valve is in the position represented in Fig. 15, both pumps operate, by the pipes U S, ports  $m, m^2$ , and  $m^3$ , to pass the water, as shown by arrow, by the pipe N, to the rear of the ram, the water from the front of the latter being discharged as when the valve is situated as represented in Fig. 14. This gives a medium speed to the ram.

When the valve is adjusted as shown in Fig. 16, the large pump Q', by its pipe U, ports  $m m^3$ , and pipe N, discharges into the cylinder A, in rear of the ram. This gives a moderately slow and powerful speed. When the valve is turned to the position represented in Fig. 17, then the large pump discharges wa-

ter by its pipe U, ports  $m m' m^3$ , and pipes M N, as shown by arrows, both in front and in rear of the ram, while the small pump, by its pipe S, port  $m^2$ , valve passage or cavity  $p$ , and connections, returns water to the reservoir I. This gives a very quick speed to the ram, and is generally used for returning the ram after drawing by aid of the rod G.

By means of the pumps, the valve controlling the circulation of the water through the apparatus, and the differential ram, as described, a most complete provision is made for varying the speed and power of the apparatus to adapt the latter to heavier and lighter kinds of work. In some cases, where a less variety of power is required for the ram, then a single pump may be used in place of the two pumps, as described.

To facilitate the turning of the valve K, its stem  $s$  may be fitted with a valve,  $a'$ , adjustable from above, and whereby, when open, water may be circulated through the valve by apertures  $b'$ , to relieve the valve of pressure.

I claim—

1. In hydraulic machinery for forming or drawing tubes, cylinders, and other hollow articles, the combination, with a hydraulic cylinder, of a hollow plunger or ram provided with hollow or tubular stems or rods arranged to work through both ends of said cylinder, a draw-rod capable of longitudinal adjustment through said hollow ram and its tubular stems or rods, and means for engaging and disengaging the latter with and from the plunger, substantially as specified.

2. In hydraulic machinery for forming and drawing tubes or other hollow articles, the combination, with a hydraulic cylinder containing a ram or plunger to which the mandrel or draw-rod is attached and the faces of which present different areas, of one or more pumps and a valve or valves for changing the communication of the pump or pumps between opposite ends of the said cylinder, substantially as specified.

3. The combination, with the hydraulic cylinder and a ram or plunger constructed to present different areas on its opposite sides or faces, of two pumps of different working capacity and a valve for changing the communications of said pumps from one end of said cylinder to the other, for varying the speed and action of the plunger in either or both directions of its travel, essentially as and for the purpose herein set forth.

4. The sectionally-constructed draw-rod, in combination with the hollow hydraulic ram or plunger having tubular stems or rods, and means for engaging and disengaging said draw-rod at different points in its length with the ram or plunger, essentially as specified.

5. The combination of the cylinder A, its hollow plunger or ram B, having hollow rods or stems C C, the sectional draw-rod G, and means of attaching the same to the plunger,



the two pumps Q Q', the valve K, water-reservoir I, and pipes M N P T U V, all substantially as herein described.

6. The circular valve K, constructed with an opening, *r*, and cavity *o*, and the valve-seat J, constructed with a central port, *n*, and lower chamber, *k*, and with surrounding ports *m m'* *m<sup>2</sup> m<sup>3</sup>*, and upper chambers, *l l' l<sup>2</sup> l<sup>3</sup>*, in com-

bination with the two pumps Q Q', the ram-cylinder A, and reservoir I, substantially as herein described.

LE ROY S. WHITE.

Witnesses:

WM. S. FEARING,  
HIRAM VAN DUSEN.