No. 677,122. Patented June 25, 1901.

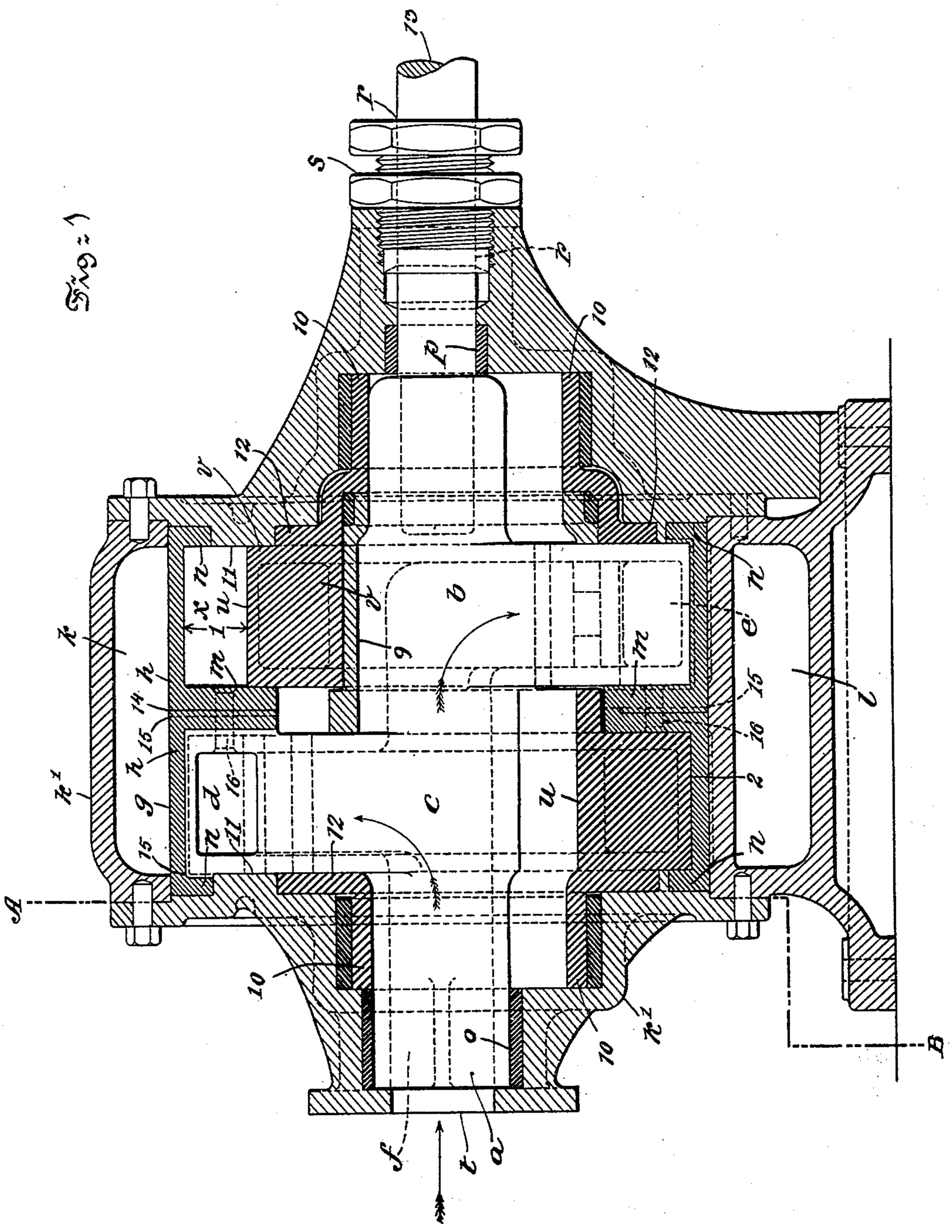
J. DOW.

ROTATING PISTON PUMP OR COMPRESSOR.

(Application filed July 7, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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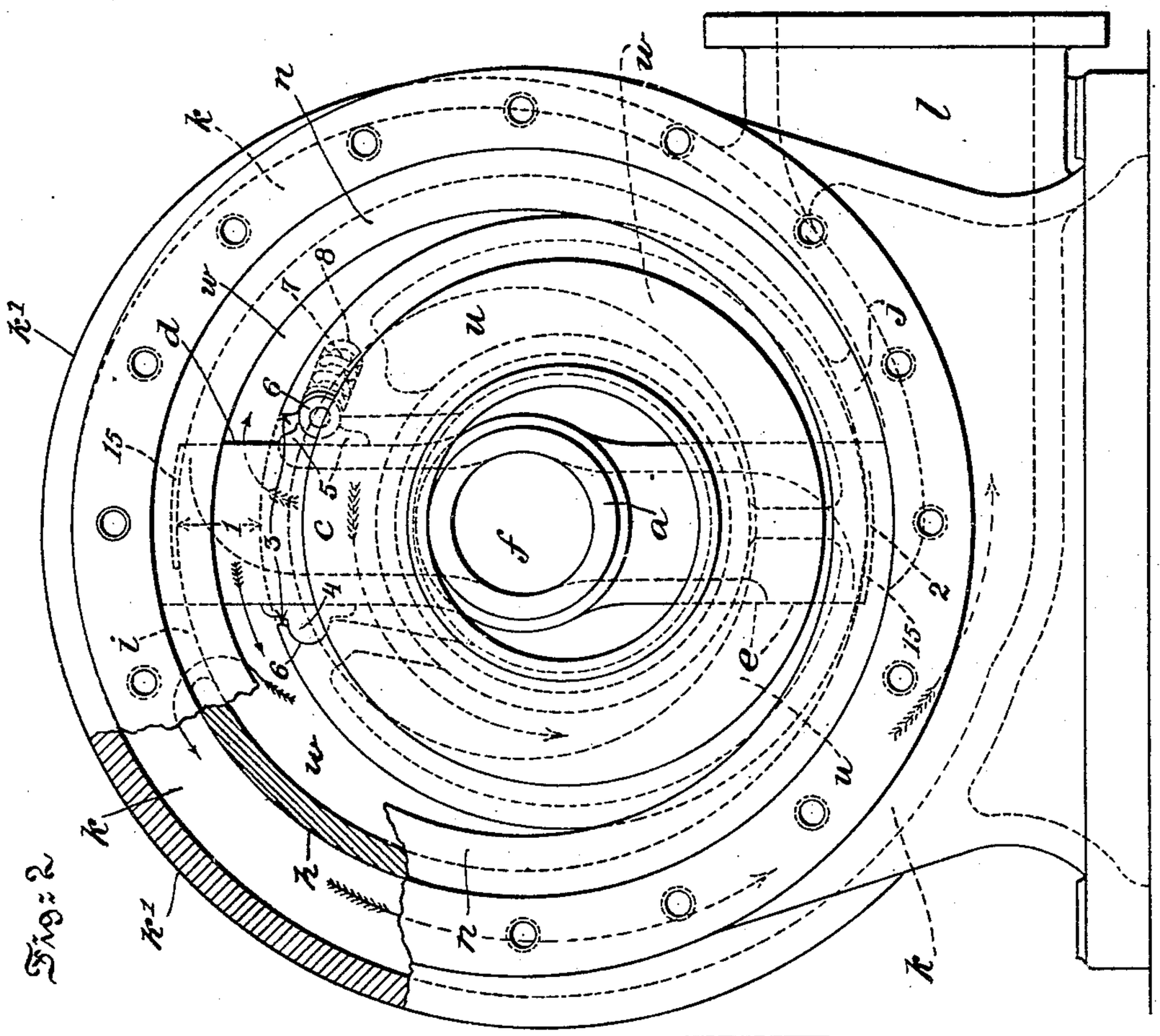

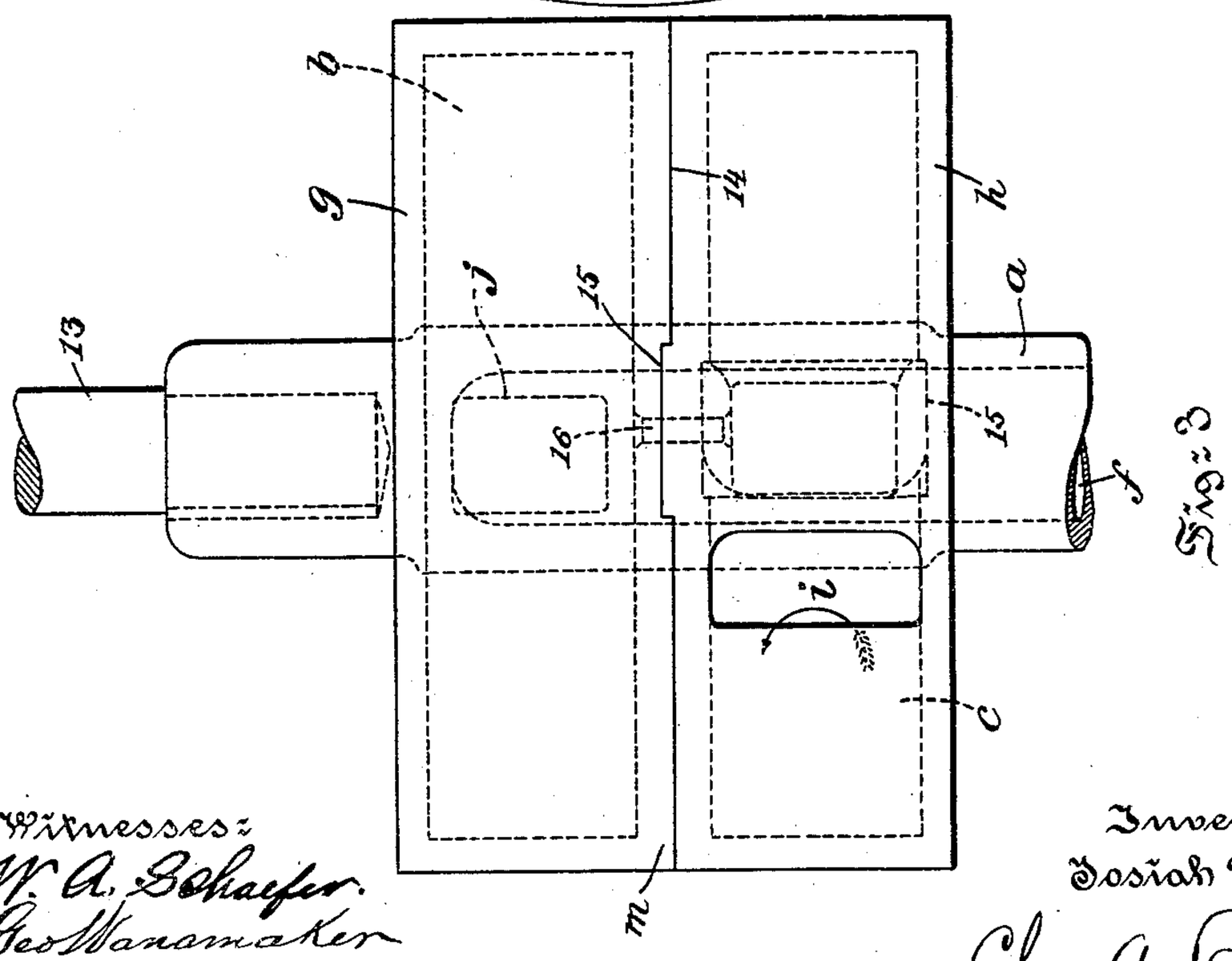

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(No Model.) 4 Sheets—Sheet 3.

Fig. 5.

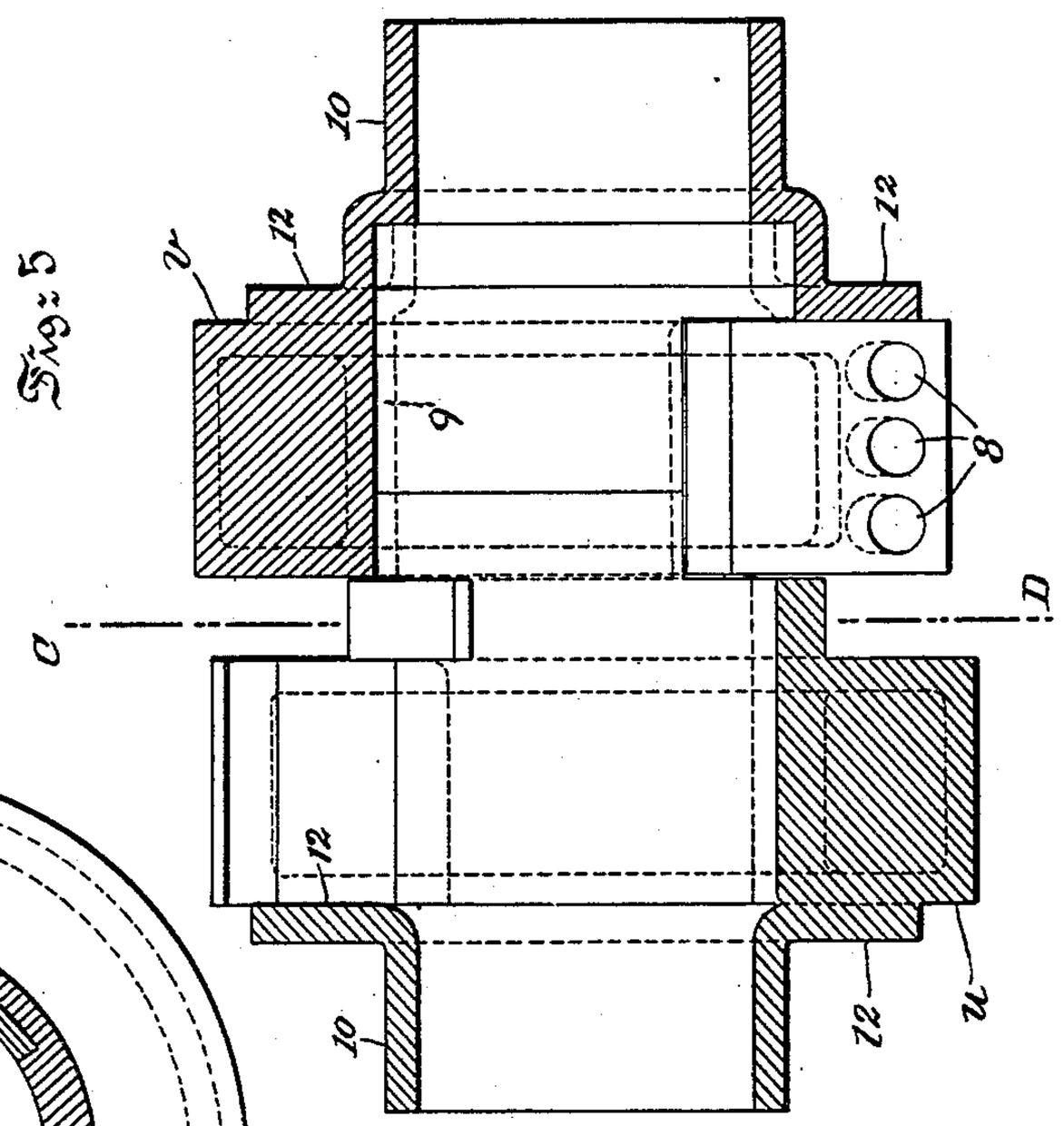

Fig. 6.

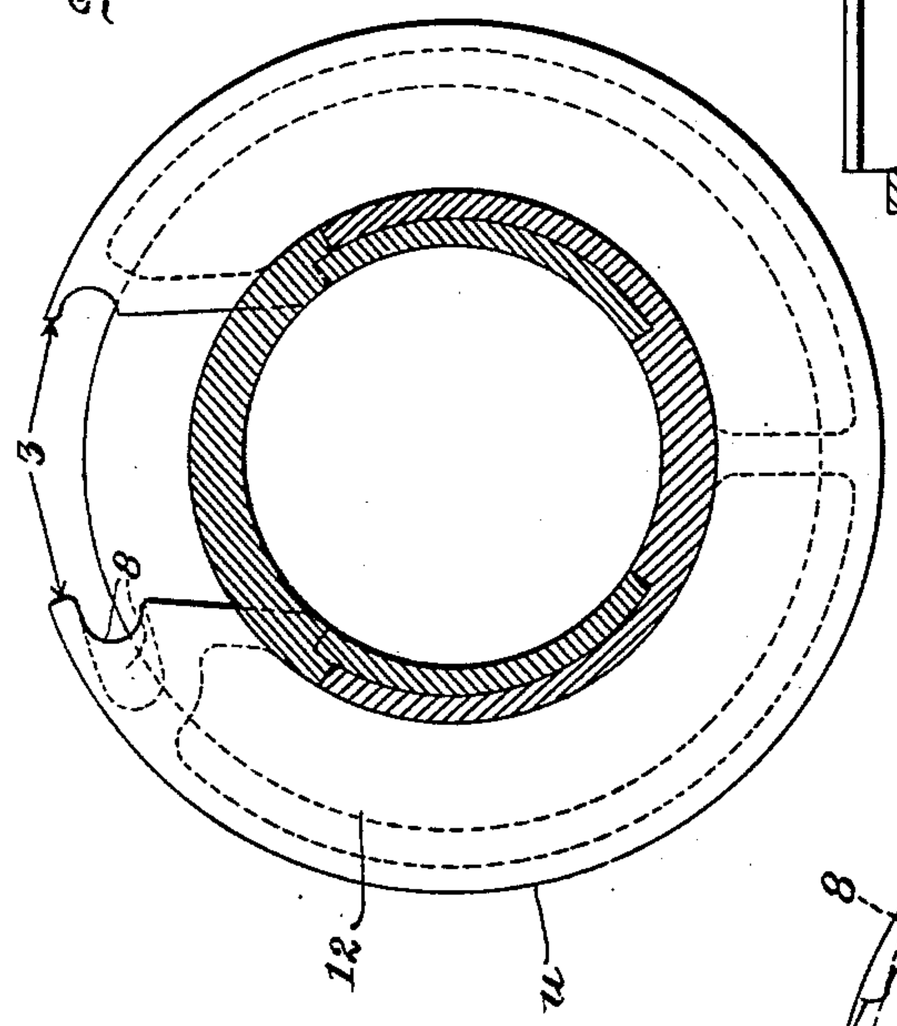

Fig. 4.

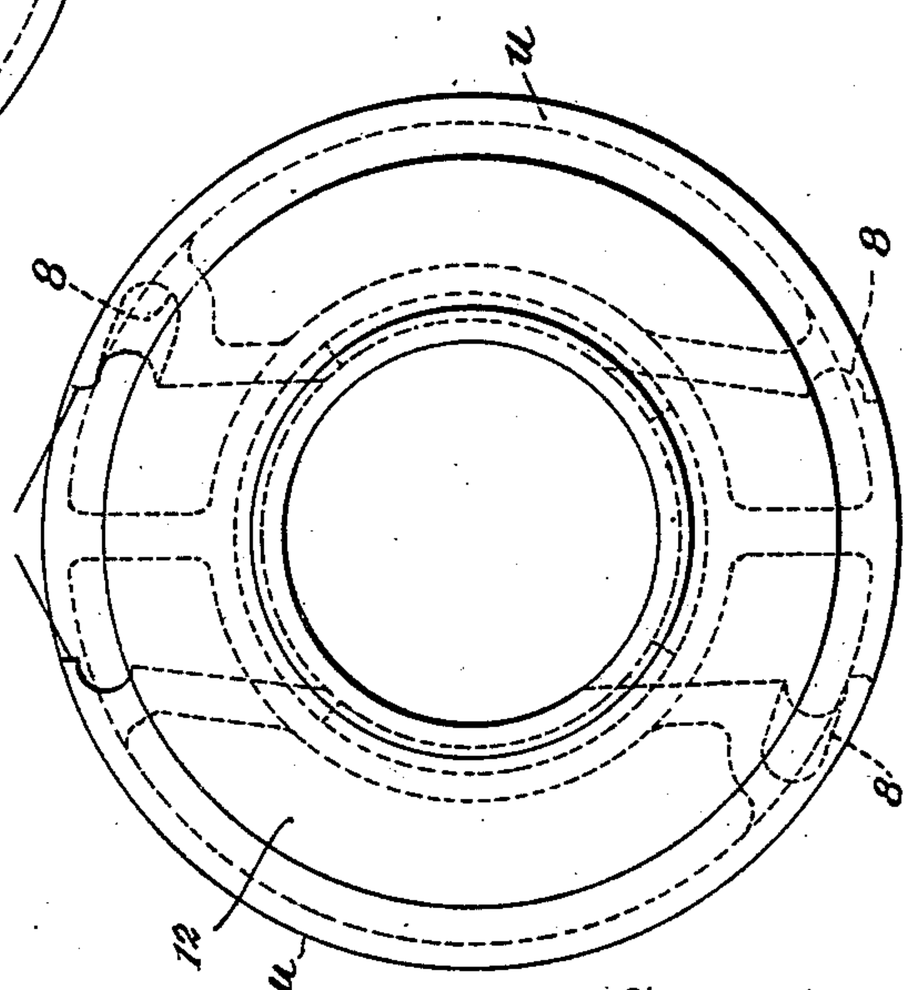

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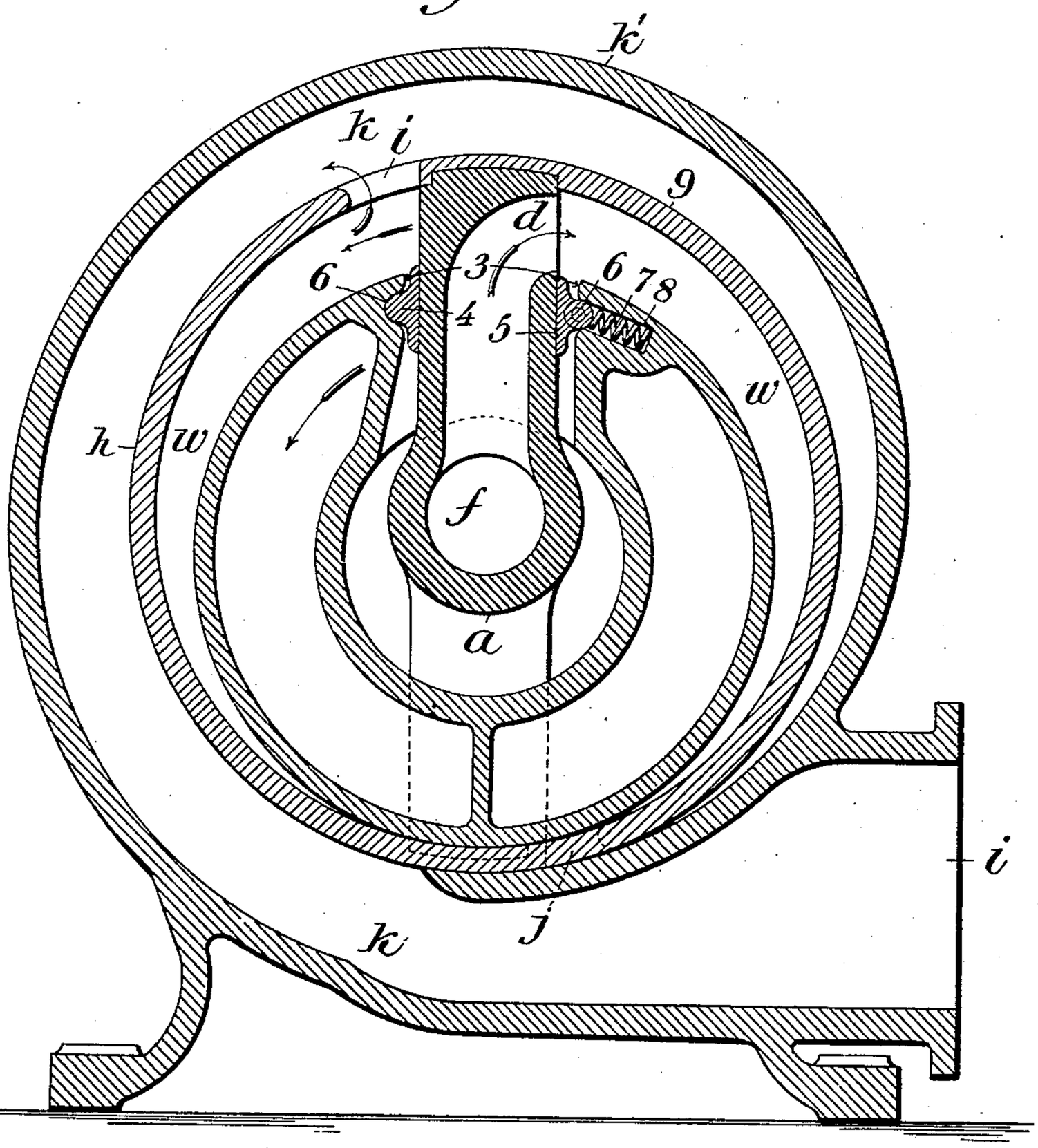
Fig. 7.



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UNITED STATES PATENT OFFICE.

JOSIAH DOW, OF PHILADELPHIA, PENNSYLVANIA.

ROTATING-PISTON PUMP OR COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 677,122, dated June 25, 1901.

Application filed July 7, 1900. Serial No. 22,784. (No model.)

To all whom it may concern:

Be it known that I, JOSIAH DOW, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Rotating-Piston Pumps or Compressors, of which the following is a specification.

My invention relates to improvements in pumps or air-compressors; and the object of my invention is to furnish a rotating-piston pump or air-compressor which will be free from the irregularity of action and shock experienced with the ordinary reciprocating pump or compressor and without the pulsations set up when the vanes of the usual forms of rotary pump pass their abutments, and the consequent loss of volume and pressure caused thereby. These objections, it is well known, are greatly augmented in both the reciprocating and rotary types of pumps or compressors by increase of velocity, which with all their natural forces in favor of the pump should be a great advantage.

In the accompanying drawings, forming part of this specification, and in which similar letters and figures of reference indicate similar parts throughout the several views, Figure 1 is a central longitudinal sectional elevation through a pump or compressor of my improved construction; Fig. 2, a front elevation of Fig. 1, the front head being removed and part of the inclosing shell being broken away; Fig. 3, a side elevation of the chambers inclosing the pistons and the shaft upon which the pistons are carried; Fig. 4, an end elevation of Fig. 5; Fig. 5, a longitudinal central sectional elevation of the rotating abutment-cylinders; Fig. 6, a section of Fig. 5 on line C D; Fig. 7, a section of Fig. 1 on line A B.

a is a hollow shaft having cast or immovably fitted upon it two or more pistons or "buckets" *b c*, arranged in pairs in position diametrically opposed to one another. These pistons *b c* are furnished with suction-passages *d e*, one end of said passages connecting with the suction-passage *f* in shaft *a* and the other end opening out at the backs of the outer ends of the pistons and forming ports for the discharge of the fluid. The outer ends of pistons *b c* are cast with or fitted into a hollow cylinder or shell *g h*, having its axis identical with that of shaft *a*. The cylinder or shell *g h* is continuous and completely closed, except for the discharge-ports *i j*, and the outer periphery of this cylinder forms the inner wall of the discharge-passage *k*, the outer wall of which is formed by the outer shell or case *k'*. The discharge-passage *k* is formed so that it increases in sectional area from the beginning of the stroke of the piston to its end at the final discharge *l*. *m*, Fig. 1, is an annular partition carried by and projecting inward between and separating the chambers in the cylinder *h*. The pistons *b c* are separated by the partition *m* and are firmly secured to it. *n* represents flanges on the outer ends of cylinders *g h*. All these parts—*i. e.*, the hollow shaft, the pistons, and the cylinder *g h*—may be cast in one piece, but for convenience in handling and shop-work the divided construction shown is preferred.

The shaft *a* has its outer bearings at *o p r*, formed in the heads of the outer case and in a gland *s*.

t is an opening in the head k^2, to which a pipe may be attached for conducting the fluid to be operated on to the interior of shaft *a*.

u v, Figs. 1, 2, 4, 5, and 6, are internal abutments which form the inner bounds of the separated chambers *w x*, in which the pistons *b c* have their action. These abutments have their axis of revolution eccentric with that of shaft *a* to the degree necessary to form the crescent-shaped chambers *w x*, the outer periphery of the abutments forming the inner limit of these chambers from their full opening, 1, Figs. 1 and 2, to that of their closing, 2, with the inner surface of the inclosing cylinders *g h*. The pistons pass through the internal abutment-cylinders at 3, Figs. 2, 4, and 6, and in consequence of the eccentricity of the abutments these latter are during the rotating of the pump, at the point where the pistons pass through them, moved in and out along the pistons, the pistons being fully protruded at the middle of their stroke and fully retracted at its end and beginning. 4 is a sliding piece before and 5 a sliding piece behind the pistons, both pieces being carried by the abutment, which through the movements of the abutment in or out upon the pistons maintain perfect contact between them and

prevent any passage of the contained fluid through or to the inside of the abutments. These packing-pieces are provided on one side with a socketed bearing 6, having a hinge movement in the abutment, and upon the other side with a broad sliding contact which bears against the pistons. The contact-piece 5 on the rear of the pistons is provided with springs 7, which hold it in place during the time that it is not acted upon by the fluid-pressure. The springs 7 fit in seats 8 on the outer periphery of the abutments. The internal abutments are constructed separately not only for convenience of assembling, but because their tangential differentiation is not synchronous. Therefore one, as *u*, has a bearing 9, which extends through the other one, *v*. The abutments are thus free to turn upon the same axis independently of one another, and each has an ample bearing 10, surrounding the shaft and carried by the outside case. The abutments are rotated by pressure from the pistons and are so arranged that when the pistons are doing the fullest work upon the fluid they are doing the least work in rotating the abutments, and vice versa. The abutments are made hollow and the space inside them necessary for their centers to pass in eccentricity about the shaft is shut off completely from all other parts. The packing-pieces 4 5 shut off the piston-chambers *w x* from any communication with the interior of the abutments *u v*. The outer ends of the pistons and their inner sides being firmly attached to the cylinder *g h* and the partition *m*, no possible leak can occur at these parts. The outer end of the other side is partly closed by the flange *n*, and the balance of these outer sides have ample sliding contact at 11 with the heads of the inclosing case and with a deep flange 12 upon the abutments to prevent any leak at these sides. The contact 11 at the sides of the pistons does not need to be frictional to effect a perfect closing. A tight joint, however, may be made by any high-pressure packing-strip or by means of a capillary packing. The hollow bearings 10 at the outside ends of the united abutments *u v* and the bearings for the shaft are formed for convenience in assembling in the heads, which are firmly bolted to the outer case.

13, Figs. 1 and 3, is a smaller continuation of shaft *a*, passing outward through a gland 5. The shaft 13 is connected with and is driven by any suitable source of power.

The inclosing cylinder upon and surrounding the pistons, which rotate in firm connection together, is for convenience of assembling made in two pieces parted upon the line 14. The end openings through the outer flange *n* of each piece has internal diameter sufficient to pass over the hollow shaft and its attached piston, each half toward the center from either end, after which each piece is pressed inward radially over its piston by the grooves 15 provided, as shown in Figs. 1, 2, and 3, and on reaching complete seats the whole becomes interlocked and is held in place by rivets 16.

The operation is as follows: The shaft *a* being revolved, the pistons *b c* rotate through their crescent-shaped chambers *w x*, and the fluid contents of these chambers are expelled by displacement through the openings *i j*. At the same time the suction side of the pistons draws the fluid by displacement, aided by centrifugal force, in through the hollow shaft *a*, filling the spaces behind the pistons, which are emptied at their next stroke. As the pistons each in relation to the other increase and diminish their work upon the fluid in reverse proportion, the flow through the suction-openings and outward through the final discharge *l* is continuously equal and any desirable speed may be maintained without pulsation or reaction, while the suction being axial and centrifugal force aiding the whole work with the discharge tangential the ordinary difficulties and loss of energy arising from an opposed inertia are entirely avoided and a great saving of power and smoothly continuous flow are effected. A principle involved in the action of this pump affords efficient aid to this saving—*i. e.*, the flow through the pump can be propelled with much greater velocity than that through the pipes without difficulty, and hence a smaller pump can be used to obtain a given flow than has heretofore been possible.

It will be understood that the pump may be so modified that the fluid to be acted upon may instead of being carried through a hollow shaft be introduced around the shaft through the hollow bearings of the abutments, and thence outward behind the pistons to the piston-chambers.

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

1. A rotating-piston pump or compressor comprising, in combination, an inclosing shell or case, a central shaft, pistons firmly attached to said shaft, a cylindrical shell surrounding and secured to said pistons and furnished with a fluid-outlet, abutments eccentric within said shell through which said pistons pass and which engage said shell at one point, and a central suction-passage through which the fluid to be operated on may be conducted to the piston-chambers at the back of the pistons.

2. The combination in a rotating-piston pump or compressor of an inclosing shell or case, a hollow shaft, one or more pairs of radially opposed and balanced hollow pistons carried firmly by said shaft the openings in said pistons forming a passage from the opening in said shaft to the rear upper faces of said pistons, a hollow cylinder surrounding and secured to said pistons and shaft and divided into separate piston-chambers, each of which is furnished with a peripheral discharge-opening, and abutment-cylinders within said piston-chambers eccentrically carried in relation to said shaft and hollow cylinder

through which said pistons protrude, the outer periphery of said hollow cylinder and the inner periphery of said inclosing shell or case forming between them a discharge-passage for the fluid operated upon.

3. The combination in a rotating-piston pump or compressor of an inclosing shell or case, a hollow shaft, radially opposed and balanced hollow pistons carried firmly by said shaft, the openings in said pistons forming a passage from the hollow shaft to the rear upper faces of the pistons, a hollow cylinder surrounding and secured to said shaft and pistons and divided into separate piston-chambers each of which is furnished with a discharge-opening, and means for closing said piston-chambers at one point so as to prevent circulation of fluid through them.

4. A rotating-piston pump or compressor comprising in combination, an inclosing shell or case, a hollow shaft, hollow pistons as described firmly connected to said shaft, a hollow cylinder carried by said shaft and pistons divided into separate annular piston-chambers furnished with discharge-openings, and cylindrical abutments carried in said chambers eccentrically through which said pistons pass and which serve to divide the piston-chambers into two increasing and decreasing parts.

5. The combination with the inclosing shell or case, the hollow shaft and pistons as described, and a hollow cylinder, divided into separate piston-chambers, secured to said pistons and furnished with peripheral discharge-openings, of cylindrical abutments eccentric to said shaft and cylinder through which said pistons pass adapted during the rotation of said pistons to engage and travel around in contact with the inner peripheries of the piston-chambers, forming in connection with said chambers, crescent-shaped fluid-chambers of increasing and decreasing capacity.

6. In a rotating-piston pump or compressor, in combination, an inclosing shell or case, a shaft carried by said shell or case, pistons as described carried by said shaft, a hollow cylinder concentric with said shaft, secured to said pistons and divided into separate chambers, one for each piston, which are furnished with discharge-openings and which form with said shell or case a discharge-outlet for the fluid, and cylindrical abutments within and eccentric to said piston-chambers through which said pistons pass and which engage the inner periphery of said piston-inclosing cylinder at points opposite to the outer ends of said pistons.

7. The combination with the hollow shaft and pistons, the cylinder inclosing and secured to said pistons, divided into separate annular piston-chambers furnished with fluid-outlets, of cylindrical abutments through which said pistons pass, said abutments being placed eccentrically to and adapted to engage the inner peripheries of said piston-chambers and being so connected that one can be moved upon its axis independently of the others.

8. The combination with the shaft and pistons, the hollow cylinder inclosing and secured to said pistons, and the abutment-cylinders through which said pistons pass, of sliding packings carried by said abutments and engaging said pistons substantially as and for the purposes set forth.

9. The combination with the shaft and pistons, the hollow cylinder inclosing and secured to said pistons, and the abutment-cylinders through which said pistons pass, of packings carried in sockets in the advancing sides of openings in said abutments adapted to engage advancing sides of said pistons, and spring-actuated packings carried in sockets carried by the following side of said abutments adapted to engage the following sides of said pistons.

10. The described rotating abutments the outer ends of which are furnished with hollow shoulders adapted to run in bearings surrounding the main shaft and the inner end of one being furnished with a bearing passing through and engaging the other, substantially as and for the purposes set forth.

11. The combination with the rotating shaft and pistons, the inclosing shell secured to said pistons, and the abutments all arranged and operating substantially as described, of an inclosing shell furnished with bearings in which said shaft and abutments are carried and forming in connection with said piston and abutment inclosing shell a helical discharge-passage of constantly-increasing sectional area.

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