No. 753,390. PATENTED MAR. 1, 1904.

C. H. O. HAMANN.

MACHINE HAVING ROTATING PISTONS.

APPLICATION FILED DEC. 13, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

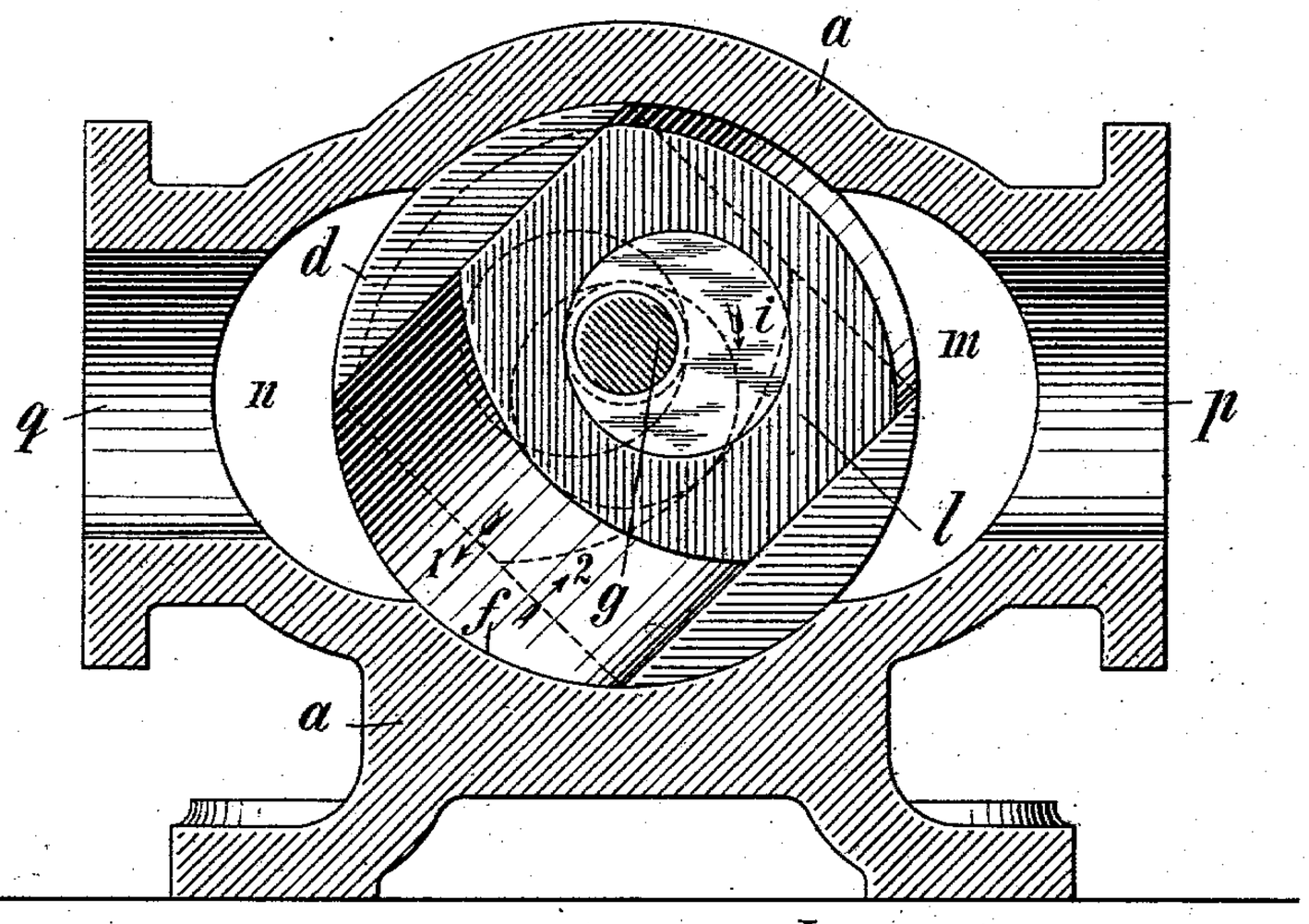
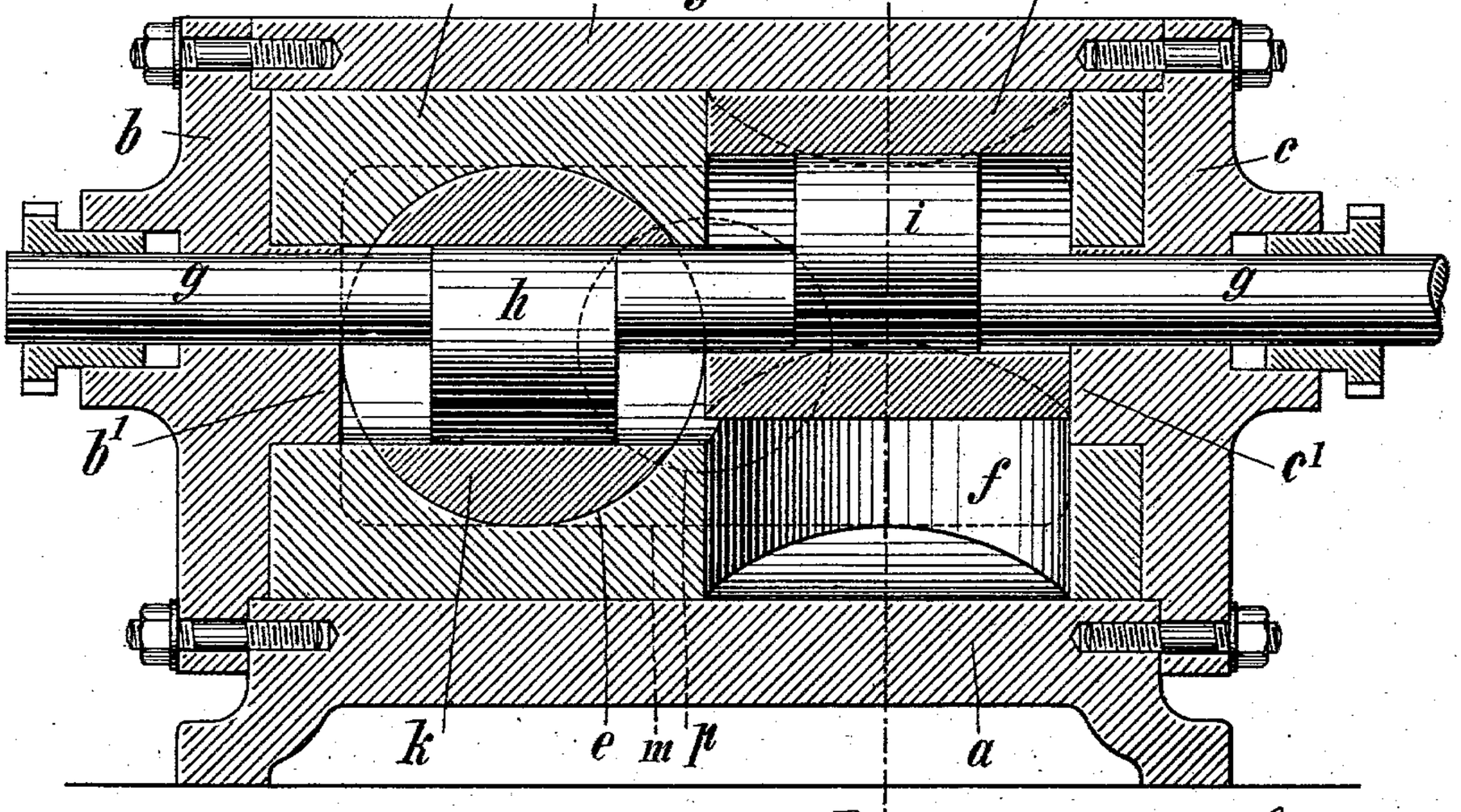


Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.

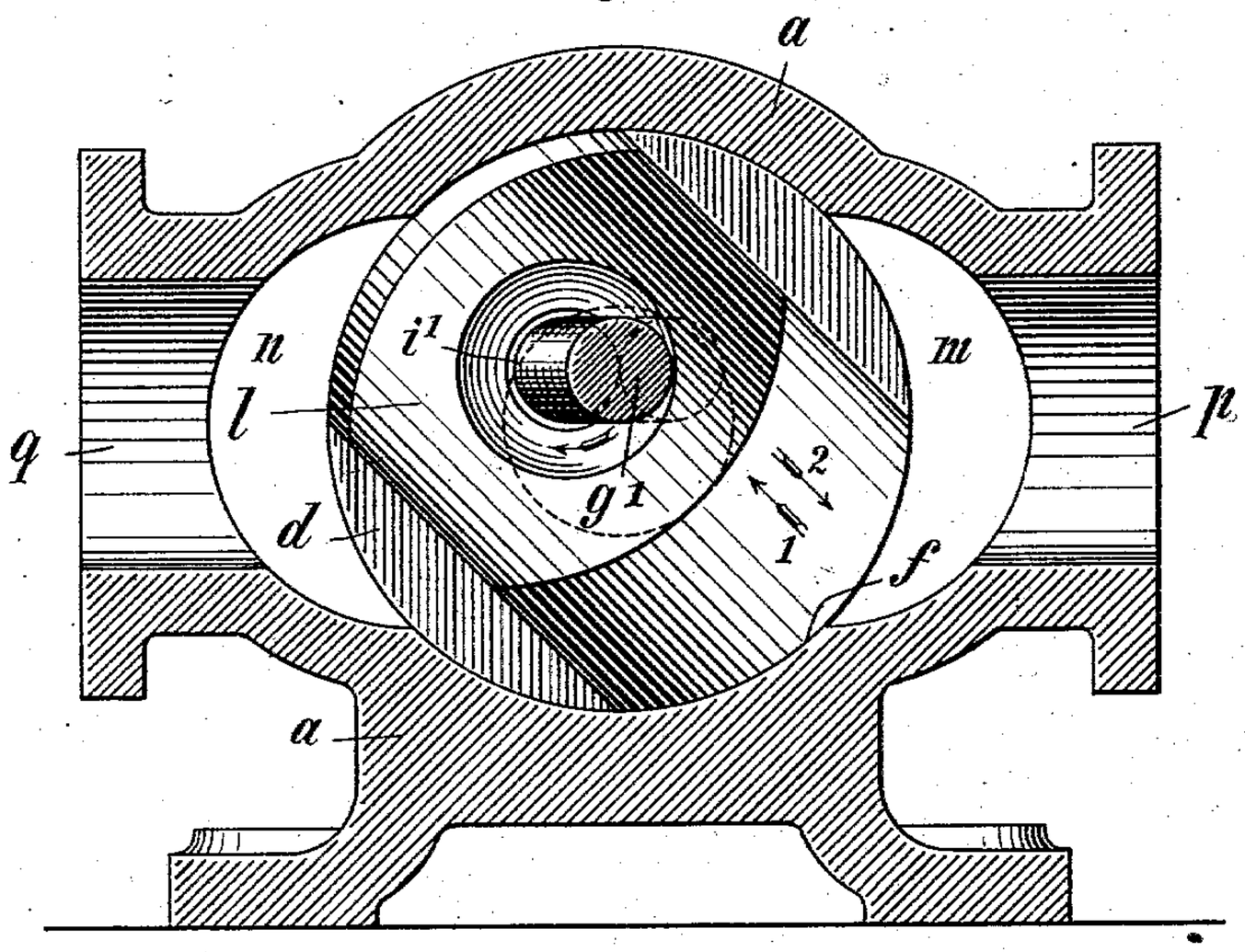
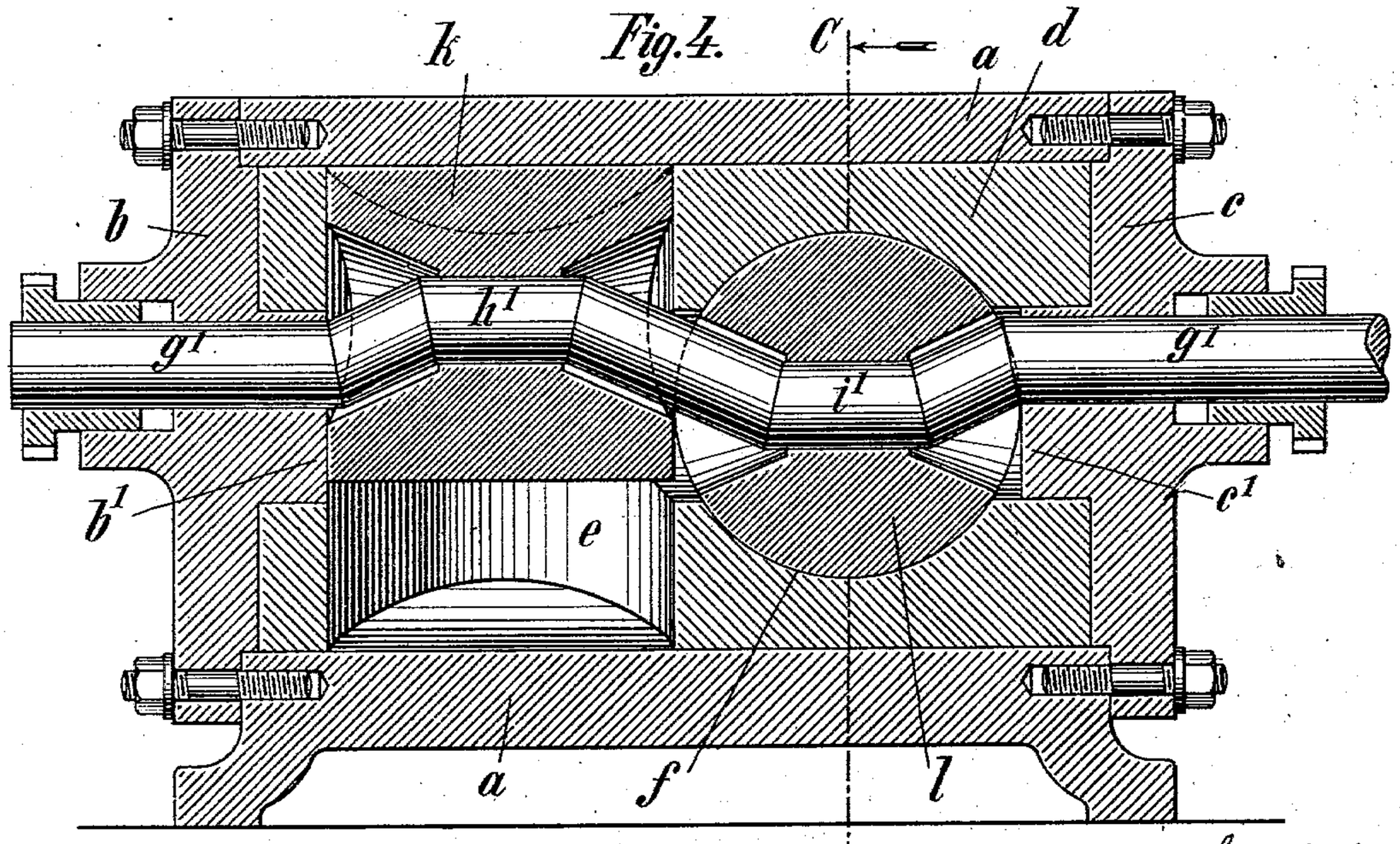


Fig. 4.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5.

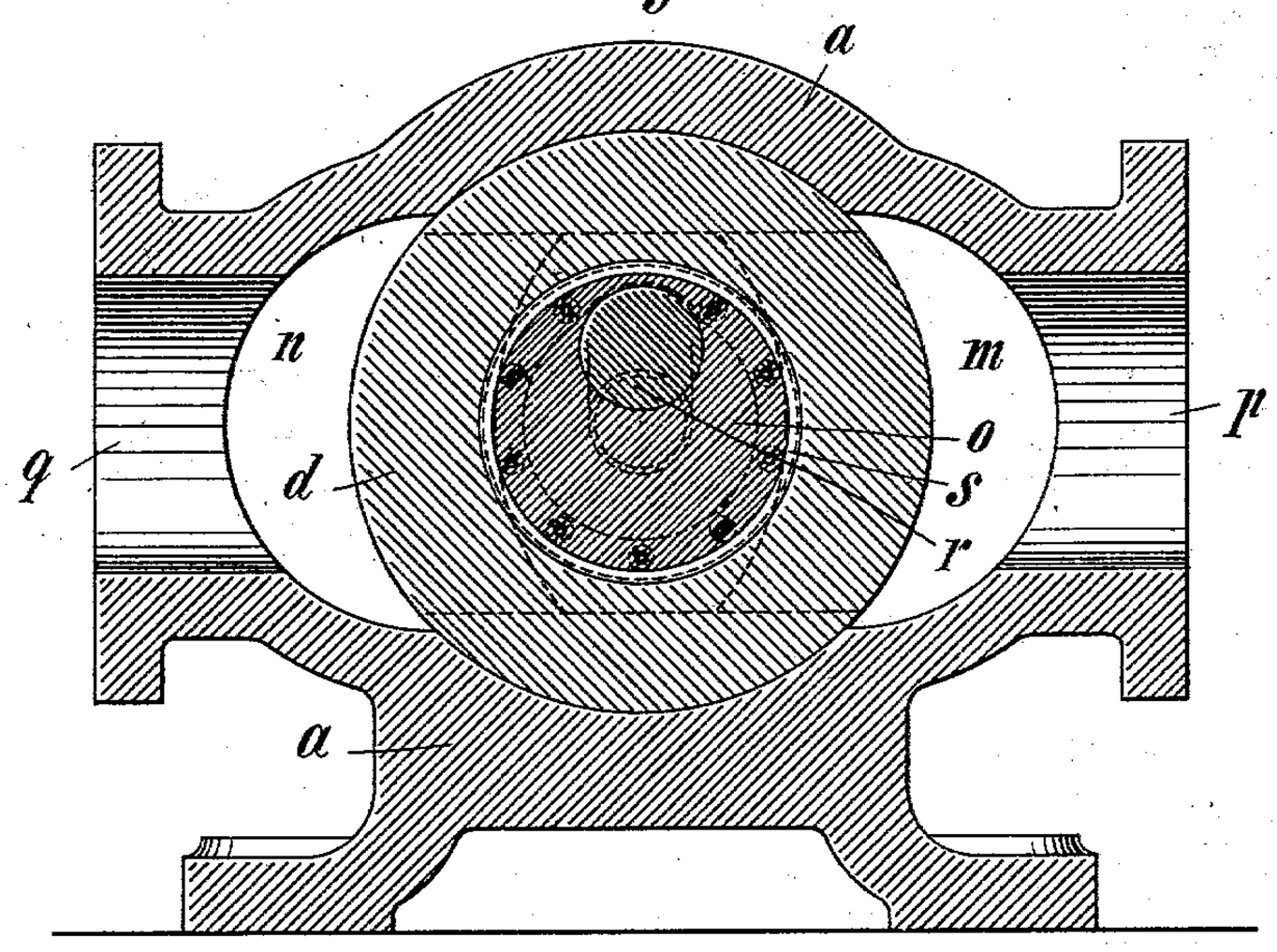
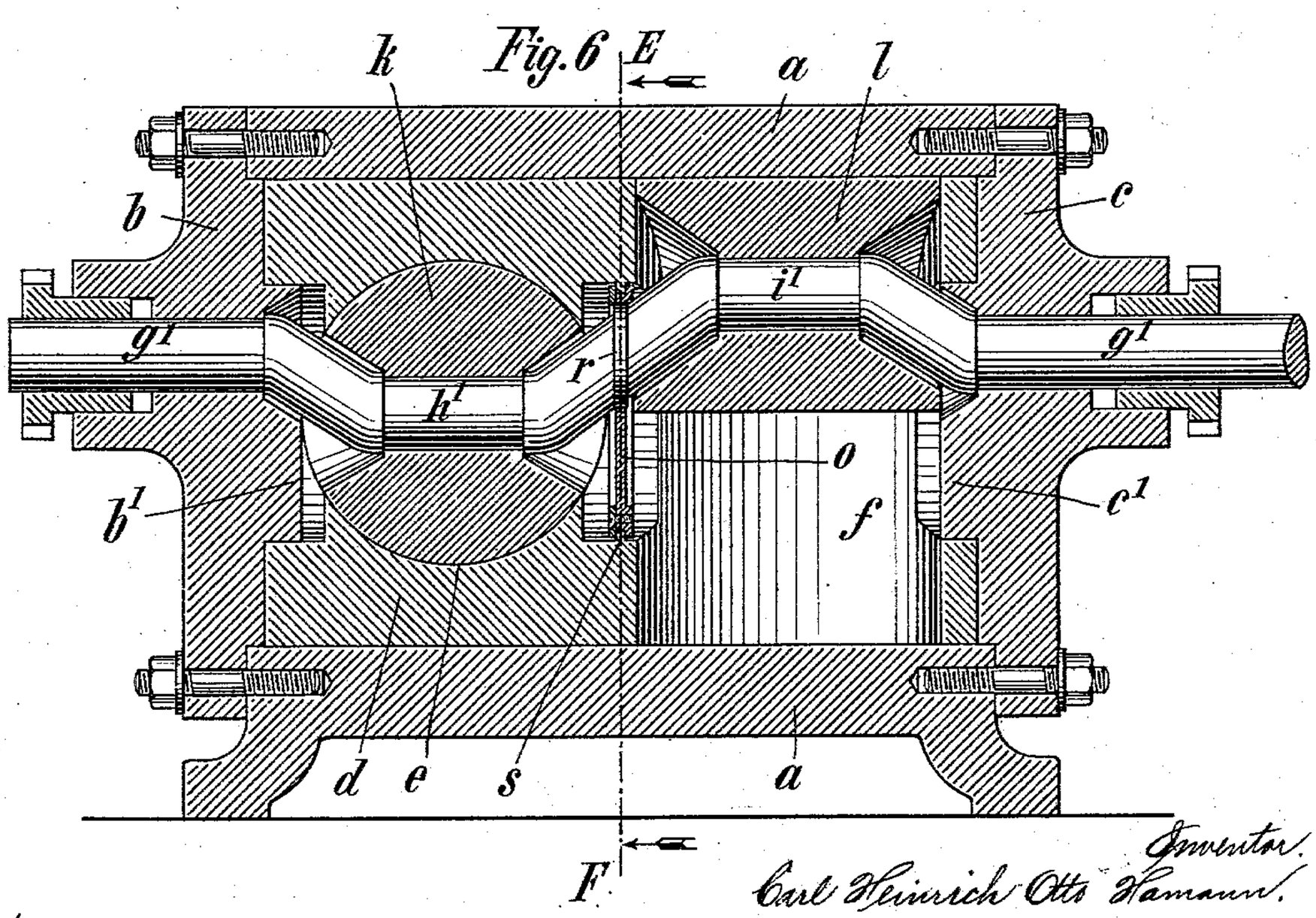


Fig. 6



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UNITED STATES PATENT OFFICE.

CARL HEINRICH OTTO HAMANN, OF BERGEDORF, NEAR HAMBURG, GERMANY.

MACHINE HAVING ROTATING PISTONS.

SPECIFICATION forming part of Letters Patent No. 753,390, dated March 1, 1904.

Application filed December 13, 1902. Serial No. 135,125. (No model.)

To all whom it may concern:

Be it known that I, CARL HEINRICH OTTO HAMANN, a subject of the German Emperor, and a resident of Bergedorf, near Hamburg, Germany, (whose post-office address is No. 8 Carolinenstrasse,) have invented certain new and useful Improvements in Machines Having Rotating Pistons, of which the following is a specification.

This invention relates to a machine having rotating pistons of the kind in which a cylinder mounted in such a manner as to be capable of rotation serves as a support or carrier for the driving parts, the pistons, which are displaceable in this cylinder, serving as driving parts or members, and, further, in which, whether the machine is utilized as a pump or as a motor, the respective speeds of rotation of the pistons, cylinder, and shaft of the machine stand in such a ratio one to the other that each stroke of the pistons corresponds to half a revolution of the cylinder and to a complete revolution of the shaft of the machine.

The invention relates more especially to the mounting of the shaft of the machine and of the cylinder and to the formation of the latter and of the pistons, by means of which improvements a machine which responds better to practical requirements and which is of far higher efficiency is obtained.

The defects which have been most noticeable in machines of this class have hitherto been that the shaft of the machine has been journaled or supported on one side only and also the unpractical form and unsuitable mounting of the cylinder or the cylinder-disks, so much so that with the arrangement hitherto practiced jamming and binding or in some cases even locking of the moving parts has been unavoidable, more especially when the pistons have been constructed of too great a height. The form and arrangement of the pistons further necessitated a large amount of friction and a comparatively small stroke, thus of course considerably reducing the efficiency of the machine. These defects are entirely obviated by the machine which forms the subject of this invention. With this object in view the shaft of the machine is journaled upon both sides—that is to say, it is mounted in bearings in the two ends of the stationary casing, inclosing the machine eccentrically to the longitudinal axis of this latter. The cylinder in which the pistons work is made in one piece and is also supported at both ends upon circular projections on the end walls of the machine-casing. These projections are concentric with the cylinder, but surround the shaft of the machine eccentrically. Owing to this arrangement every jamming or binding of the shaft and cylinder is avoided and a reliable guiding or mounting, and consequently a thoroughly uniform and easy running of the various parts, is insured. The pistons are of cylindrical form and move in the direction of their longitudinal axis in cylindrical transverse borings in the cylinder, in which they exactly fit. By means of this arrangement friction is reduced to a minimum, while at the same time a far better packing of the pistons is obtained than is possible with angular pistons. The height and diameter of the pistons are also selected in such a manner that a larger piston-stroke is rendered possible, thus increasing the effective capacity of the cylinder, and consequently the efficiency of the machine, whether this latter is employed as a pump or as a motor.

In the drawings forming part of this specification, Figure 1 is a vertical cross-section on the line A B shown in Fig. 2, and Fig. 2 a vertical longitudinal section of a machine constructed in accordance with and embodying my invention. In Fig. 1 the parts are shown in the position they occupy when the shaft has been rotated forward for ninety degrees from the position shown in Fig. 2. Fig. 3 is a vertical cross-section on the line C D shown in Fig. 4; and Fig. 4, a vertical longitudinal section of a modification of the improved machine, the shaft and eccentrics being replaced by a double crank-shaft. In Fig. 3 the parts are in the position they occupy when the crank-shaft has been rotated forward for ninety degrees from the position shown in Fig. 4. Fig. 5 is a vertical cross-section on the line E F shown in Fig. 6; and Fig. 6, a vertical longitudinal section of a modification of the im-

proved machine, the height or length of the piston and the length of its stroke being each equal to the radius of the cylinder.

Similar letters of reference refer to similar parts in the respective figures.

In accordance with the form of construction embodying my invention and represented by Figs. 1 and 2 the machine is provided with a suitable stationary casing consisting of a middle portion *a* and two lateral portions or heads *b* and *c*. The inner faces of these lateral portions are provided with circular projections *b'* and *c'*, upon which the cylinder *d* is mounted in such a manner as to be capable of rotation. This cylinder *d* presents two transverse borings *e* and *f*, running at right angles one to the other. Thrcugh a longitudinal boring in the cylinder *d* passes a shaft *g*, which is mounted eccentrically in the lateral portions *b* and *c* and in their circular projections *b'* and *c'*, and therefore also eccentrically to the longitudinal axis of the cylinder. The shaft *g* carries two eccentrics *h* and *i*, mounted at an angle of one hundred and eighty degrees one to the other, and upon these eccentrics the pistons *k* and *l* in the form of cylindrical blocks are arranged. The arrangement is such that the transverse borings *e* and *f* of the cylinder *d* form the actual cylinders for the pistons *k* and *l*. The middle portion *a* of the casing presents two half-moon-shaped recesses or chambers *m* and *n*, from which tubular sockets *p* and *q* open, one serving as inlet and the other as outlet, according to which side of the machine is connected to the suction or motor-medium-supply pipe.

The operation of the machine will best be understood by describing the operation or action of one of the pistons only. It may be assumed that the machine shall be used as a pump and the parts occupy the position shown by Fig. 1. On turning or rotating the shaft *g* and the eccentric *i* in the direction indicated by an arrow the piston *l* begins its downstroke in the boring *f*, whereby the cylinder *d* is caused to rotate in the same direction. By this displacement of the piston *l* the fluid to be pumped or conveyed is allowed to enter through the inlet *p* and the chamber *m* into the space behind the advancing piston, or, in other words, the space behind the advancing piston fills up in consequence of the sucking action of the piston with fluid. The forward stroke of the piston *l* in the direction of the arrow 1 continues until the eccentric *i* has been rotated forward through an angle of about two hundred and seventy degrees—that is to say, until the eccentric *i* is in the position shown in Fig. 2. The fluid in the boring *f* behind the piston *l* is carried around by the rotation of the cylinder *d*, the lower inner wall of the casing *a* gradually closing the boring *f*. When the eccentric *i* is in its upper position, the piston *l* has reached the end of its stroke and is also in its upper position, Fig. 2. The fluid within the boring *f* is then retained in the chamber formed by the free space of the said boring, the piston, and the casing, the further supply of fluid into and also out of the boring *f* being discontinued. On further rotation of the shaft and the eccentric *i* from the position shown in Fig. 2 into the position shown in Fig. 1 the bore *f*, containing the quantity of water taken around by the cylinder, comes in an increasing communication with the outlet-chamber *n*, while the piston reverses its stroke and moving in the direction of the arrow 2 forces out this quantity of fluid through the outlet-chamber *n* and outlet *q*. During the time the piston forces out the bulk of fluid carried around by the rotating cylinder from the inlet-chamber to the outlet-chamber fresh fluid is sucked in at the other side of the piston, and so on. The piston is therefore double-acting, the arrangement and dimensions being such that each full rotation or revolution of the shaft *g* or the eccentric *i*, respectively, effects one stroke of the piston *l* and one half-revolution of the cylinder *d*. The arrangement above described insures a long stroke for the piston, and consequently a large suction and forcing space in the boring of the cylinder, so that by each stroke a comparatively large quantity of fluid is sucked in and forced out—that is to say, the useful effect of the machine is considerable in propertion to its size. The operation of the piston *k*, actuated by the eccentric *h*, is exactly the same as that of the piston *l*. Owing to the crossed arrangement of the two pistons *k* and *l*, their operation is so regulated or distributed that they mutually coöperate, whereby a uniform flow of fluid is insured.

In the modified form of my invention (represented by Figs. 3 and 4) I employ a cranked shaft *g' h' i'* instead of an eccentric shaft *g h i*, as above described. While in Fig. 1 the piston *l* is represented as beginning a forcing and sucking stroke, Fig. 3 shows the said piston as approaching the end of this stroke.

The forms of machines described above and shown in Figs. 1 to 4 are especially adapted for use as pumps. If it is desired to employ such machines as motors, this may be effected by simple reversal, the driving medium being allowed to act upon the pistons, the stroke of which is transmitted to the shaft and the cylinder as rotary movement in such a manner that for each stroke of the piston the shaft of the machine completes a revolution, while the cylinder effects or performs half a revolution only.

In Figs. 5 and 6 I have shown a further constructional form which is especially adapted for use as a motor. The height of the pistons only amounts to half the diameter of the cylinder *d*. The stroke is therefore equal to the radius of said cylinder. The charge-chambers of the transverse borings or piston-channels *e* and *f* are as large as possible, so that the pistons

effect as large a stroke as possible, whereby the machine is rendered highly efficient. As in this arrangement the pistons cannot shut off their borings *e* and *f* against each other, it is necessary to provide a partition *o* between the two pistons *k* and *l* in the cylinder *d*, this partition being mounted on a collar *r* on the shaft *g'*, while its outer edge makes a joint on or against a rib or feather *s* on the cylinder. The fitting or packing of the two pistons one against the other or the separation or shutting off of the two borings, respectively, may, however, be effected in any other convenient manner, the only essential point being that a tight joint shall be made.

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

1. The combination with a casing having inlet and exhaust ports, of a cylinder therein mounted to rotate and having a transverse bore, a piston in said bore and means to reciprocate said piston and thereby rotate said cylinder, substantially as described.

2. The combination with a cylindrical casing having inlet and outlet ports therein, of a cylinder mounted to rotate in said casing and having a transverse bore, a piston in said bore and means eccentric to the cylinder to reciprocate the pistons and simultaneously rotate the cylinder, substantially as described.

3. The combination with a cylindrical casing having oppositely-situated ports, of a cylinder axially mounted therein, transverse bores in said cylinder in symmetrical angular relation to one another, pistons in the bores and rotating means eccentric to the cylinder to reciprocate the pistons and rotate the cylinder, substantially as described.

4. The combination with a cylindrical casing having oppositely-situated ports, of a cylinder axially mounted in the casing and having two bores therethrough at right angles to each other, a shaft passing longitudinally through the cylinder and eccentric thereto and means on the shaft to reciprocate the pistons and thereby rotate the cylinder, substantially as described.

5. The combination with a cylindrical casing having oppositely-situated ports and heads having central bosses, of a cylinder axially mounted in the casing on said bosses and having bores therethrough at right angles to each other, pistons in said bores, a shaft passing eccentrically through the cylinder and also through the pistons, and eccentrics on the shaft to engage the pistons to reciprocate them and thereby rotate the cylinder, substantially as described.

6. The combination with a cylindrical casing having ports, of a cylinder mounted to rotate in said casing and having transverse bores, a shaft passing longitudinally through the cylinder and eccentric thereto, pistons in the bores, means on the shaft to reciprocate the pistons and thereby rotate the cylinder and a partition mounted on the shaft between the bores, substantially as described.

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