No. 735,943. PATENTED AUG. 11, 1903.

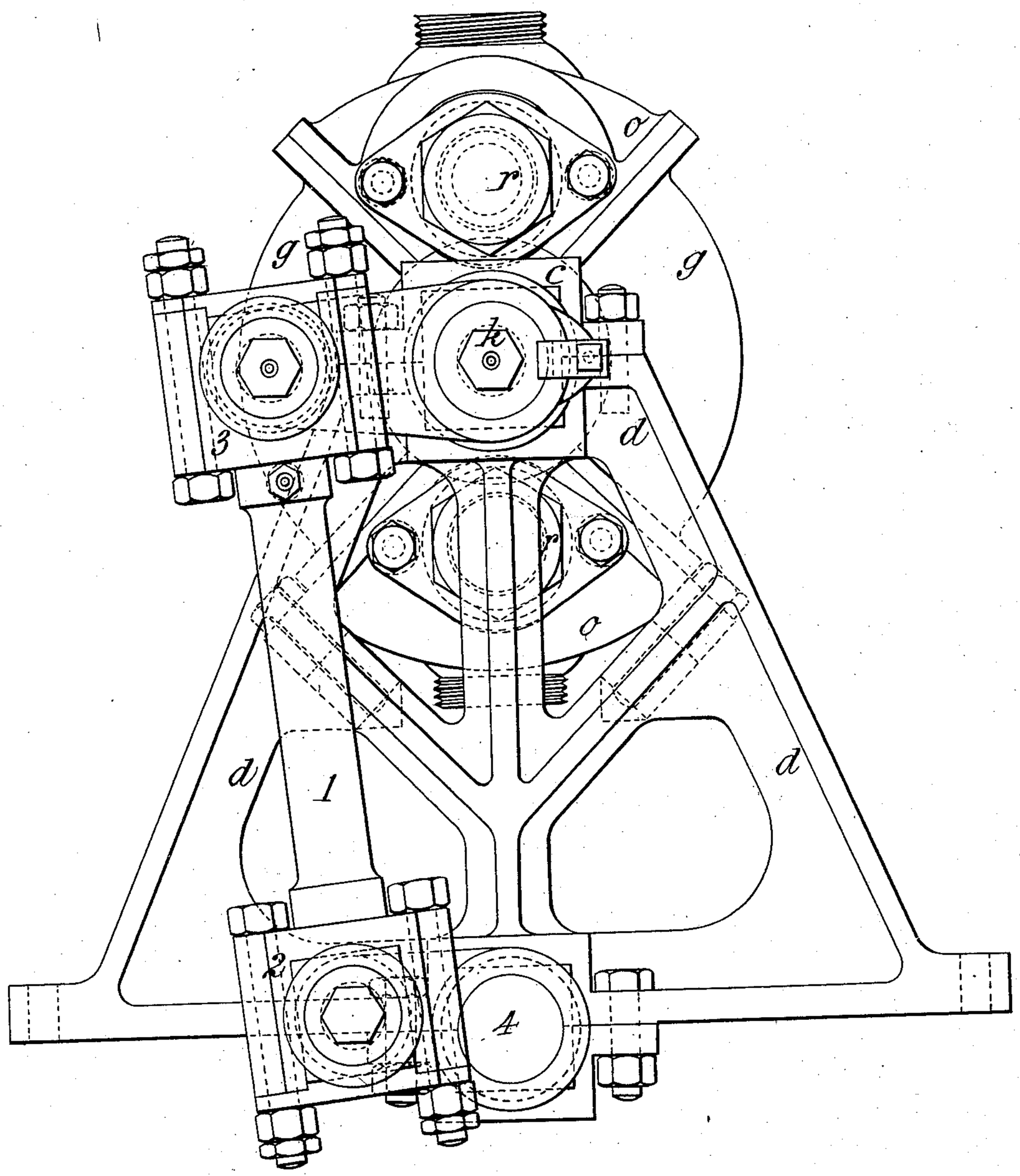
H. DE CHARDONNET.

RECIPROCATING ROTARY MOTOR.

APPLICATION FILED JULY 18, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Fred Whitey

René Bruine

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.

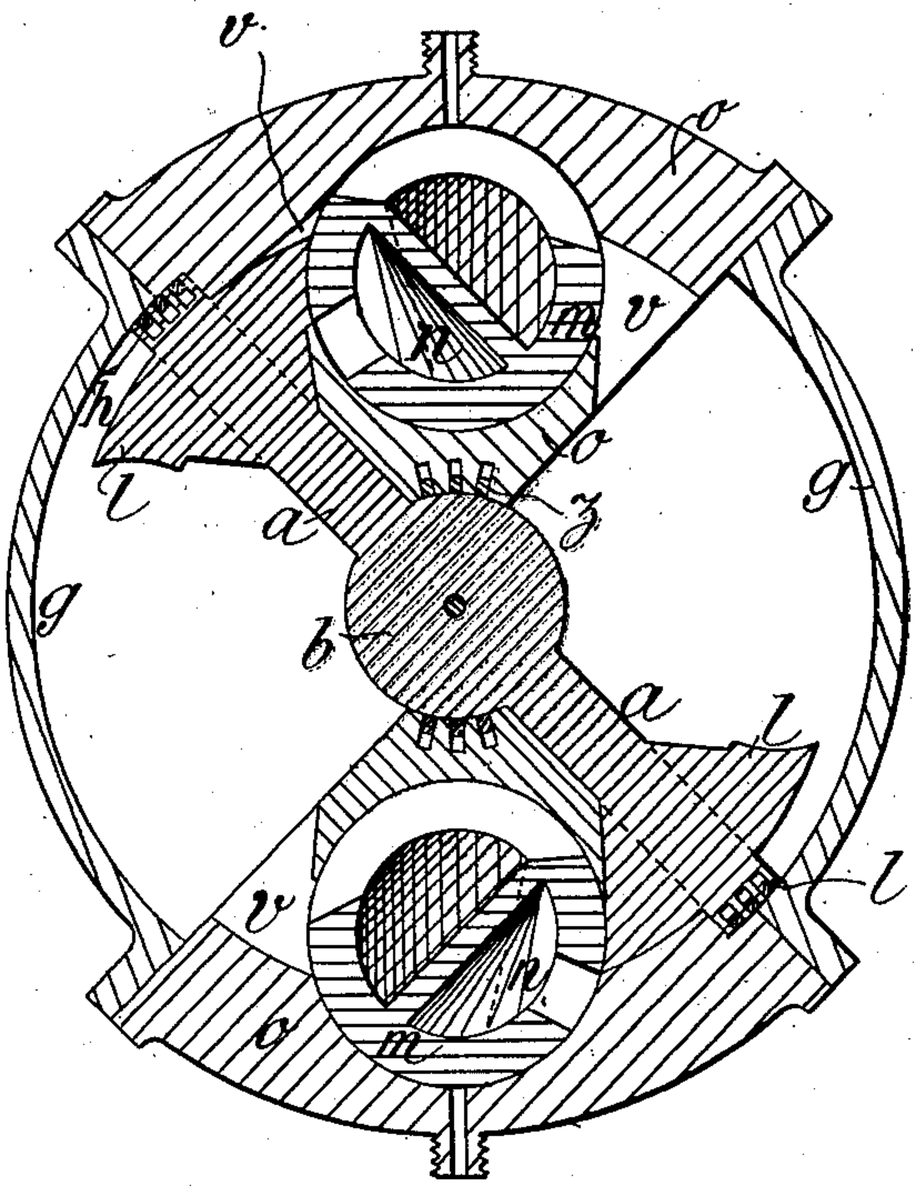


Fig. 3.

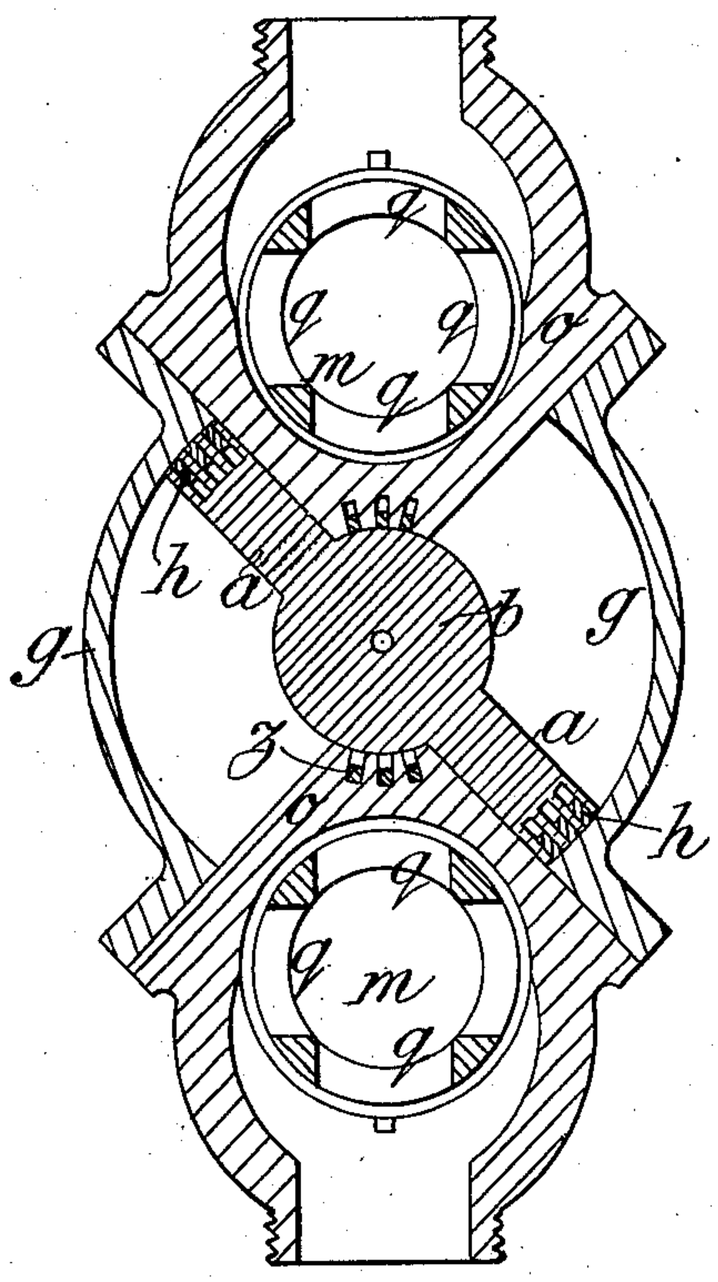
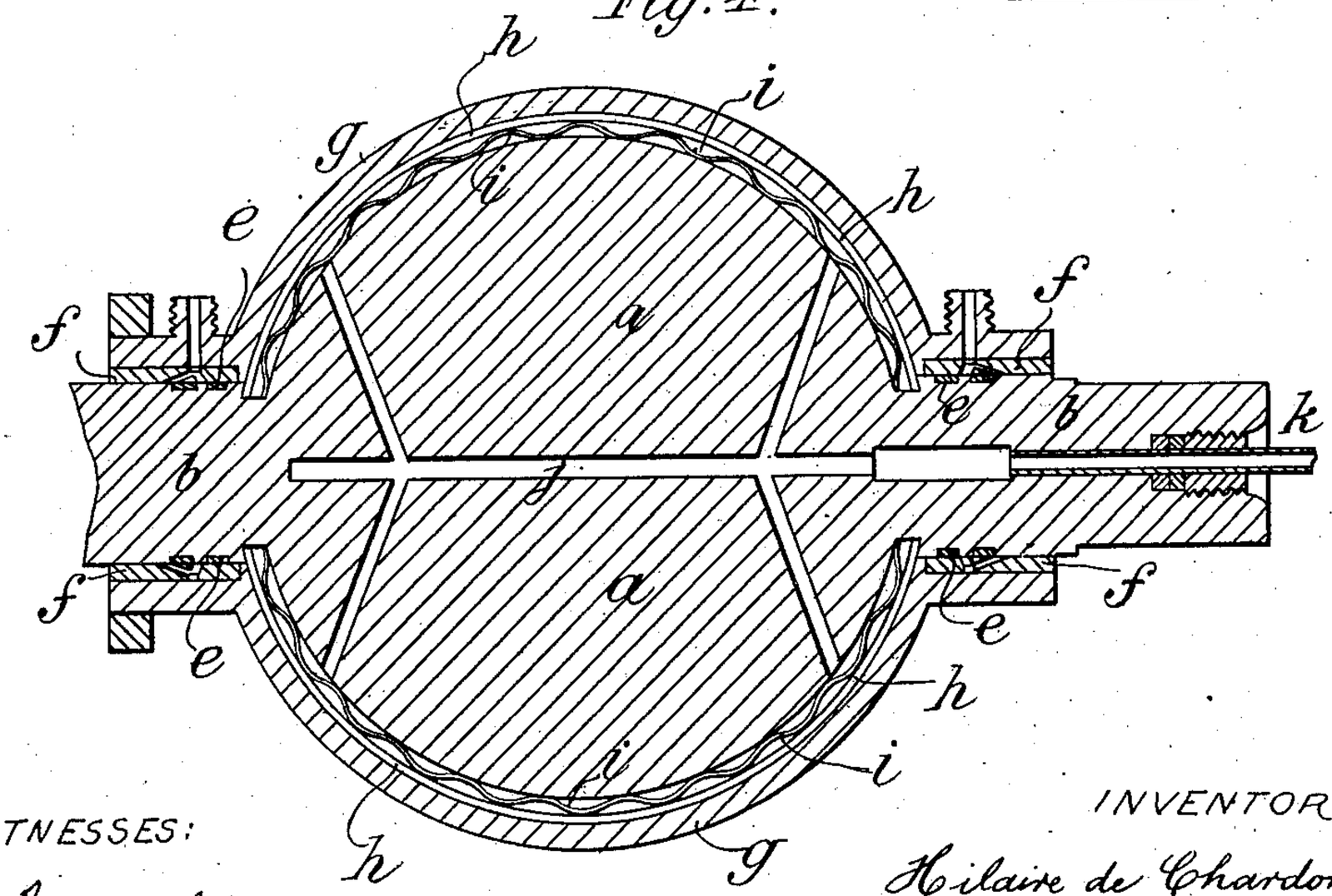


Fig. 4.



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NO MODEL. 4 SHEETS—SHEET 3.

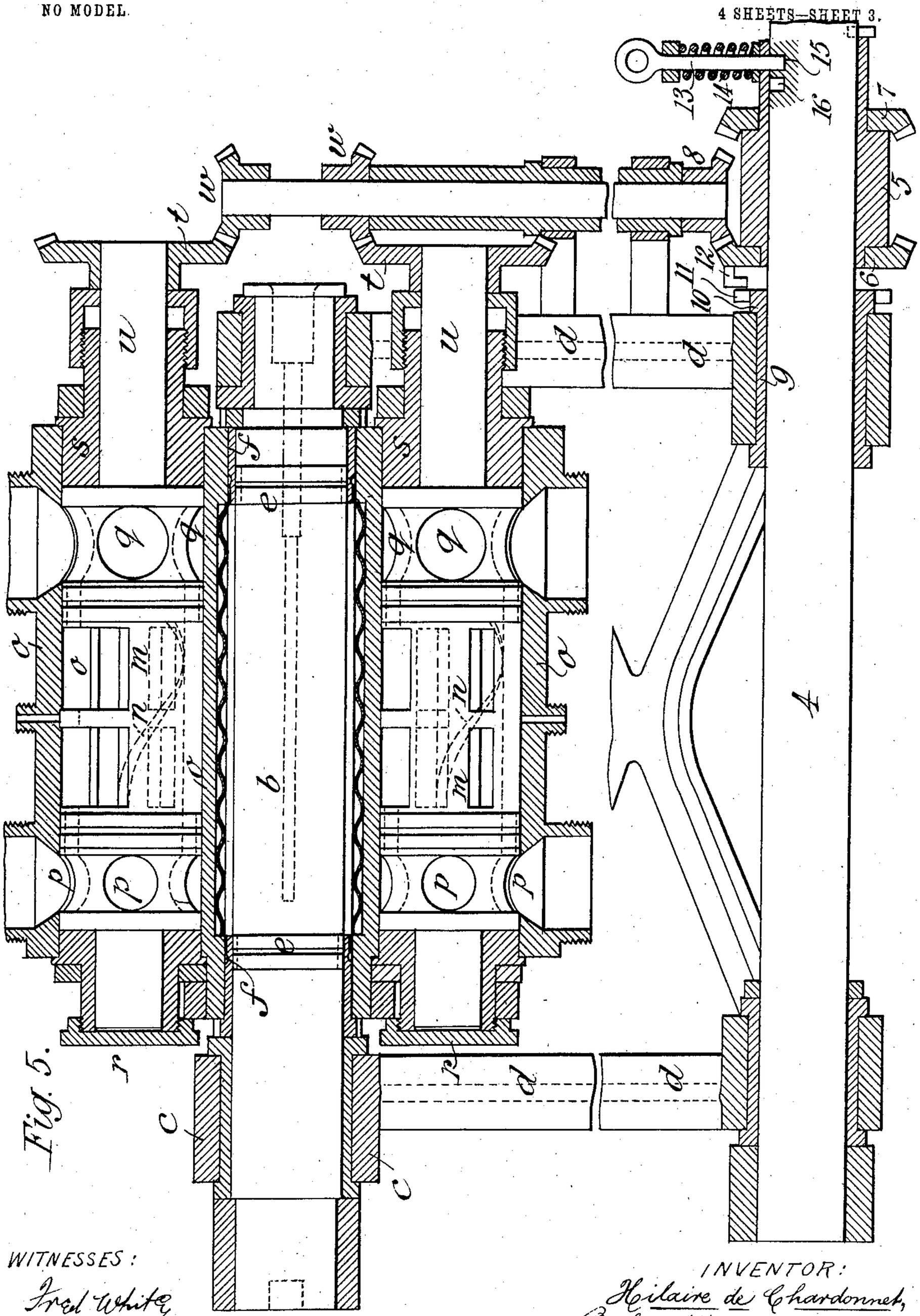

Fig. 5.

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RECIPROCATING ROTARY MOTOR.

APPLICATION FILED JULY 18, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 6.

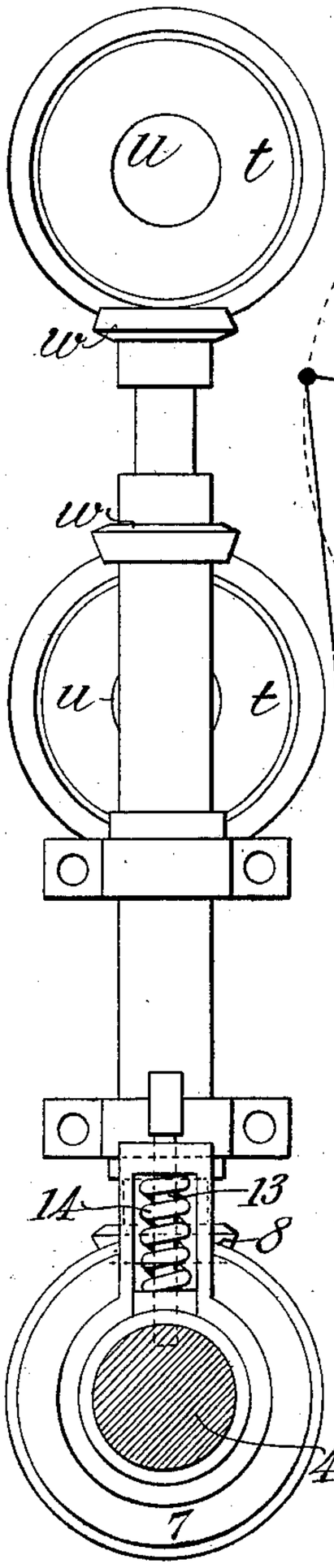

Fig. 7.

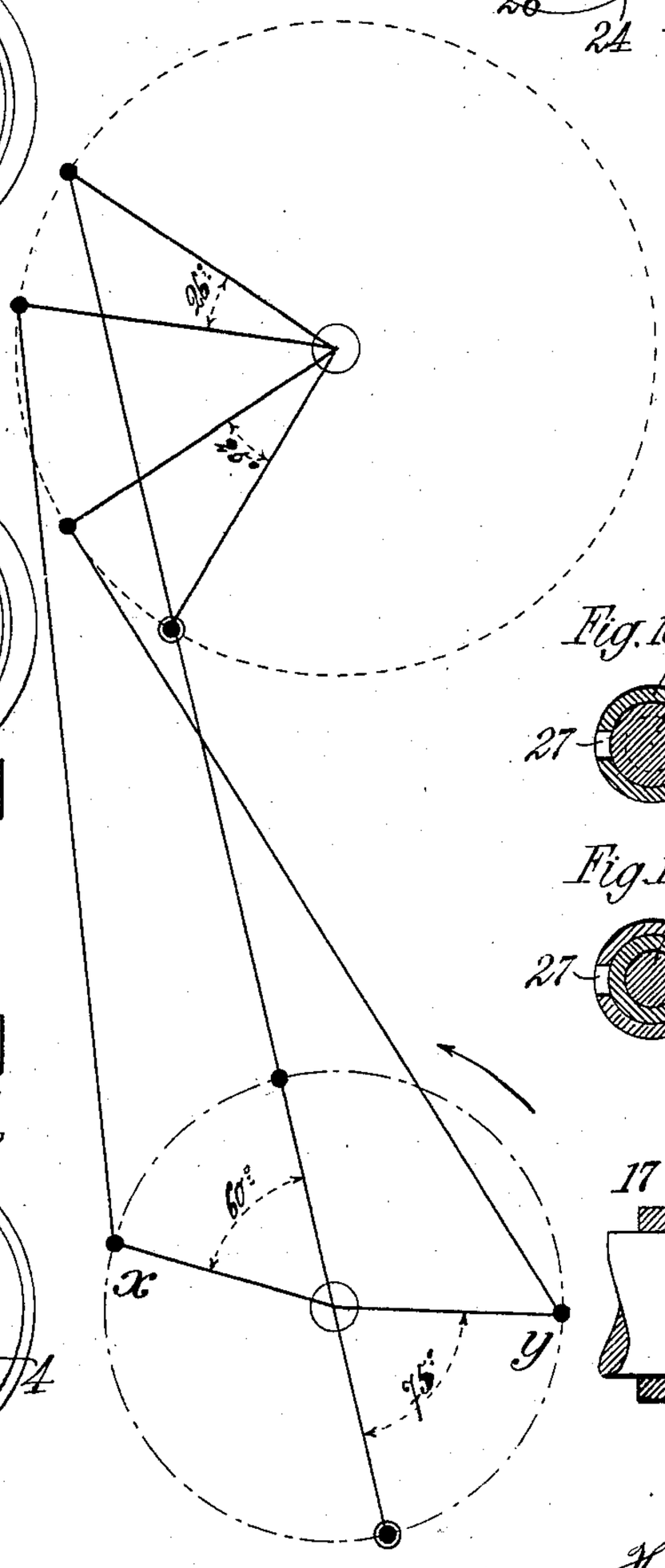

Fig. 8.

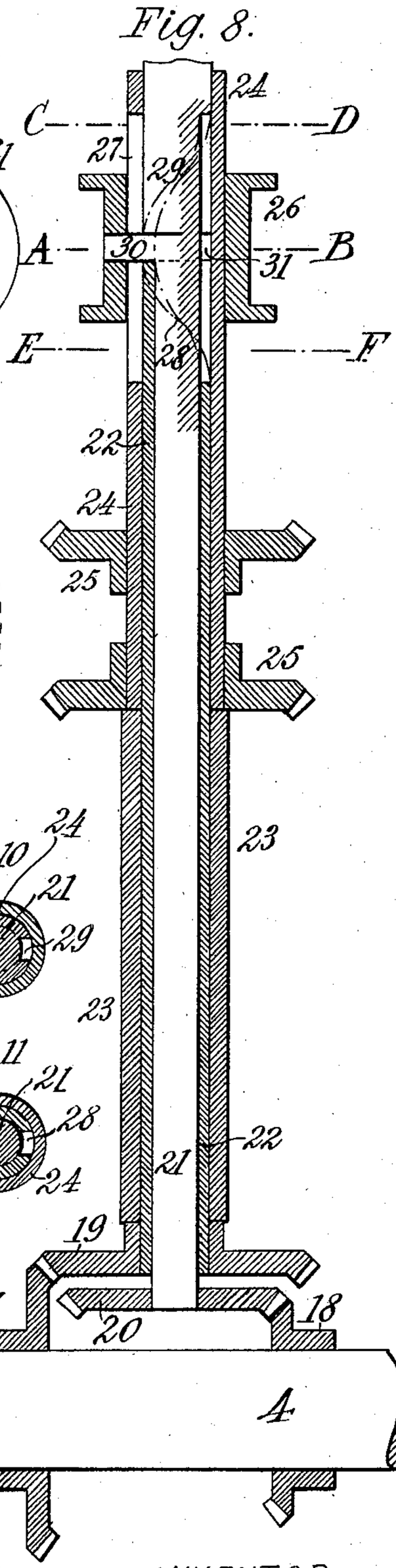

Fig. 9.

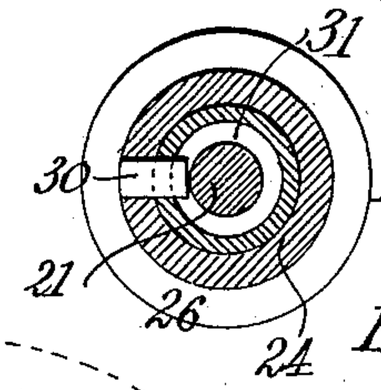

Fig. 10

Fig. 11

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No. 735,943. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

HILAIRE DE CHARDONNET, OF PARIS, FRANCE.

RECIPROCATING ROTARY MOTOR.

SPECIFICATION forming part of Letters Patent No. 735,943, dated August 11, 1903.

Application filed July 18, 1902. Serial No. 116,063. (No model.)

To all whom it may concern:

Be it known that I, HILAIRE DE CHARDONNET, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Motors, of which the following is a specification.

My present invention aims to provide improvements especially in the distributing mechanism of the steam or compressed-air motor described in my Patent No. 702,404, dated June 17, 1902. In said patented motor a piston is arranged to oscillate in a spherical or similar chamber.

The aim of the present improvement is to adapt the motor for convenient operation in either direction and to permit variation of the expansion.

My invention aims also to provide certain improvements in detail specified hereinafter.

The accompanying drawings illustrate an embodiment of the invention, in which—

Figure 1 is an end elevation of a complete machine looking at the end to which the connecting-rod is attached. Fig. 2 is a median transverse section. Fig. 3 is a transverse section through the machine at one end of the valves. Fig. 4 is a section longitudinally through the piston. Fig. 5 is a vertical section along the plane of the axes of the two valves. Fig. 6 is an external view of the controlling mechanism for the valves and also the speed-changing gear. Fig. 7 indicates diagrammatically the distribution of steam or compressed air for one direction of movement. Fig. 8 shows in section another mechanism for the change of speed and in which such change may be accomplished without stopping the engine, the section being taken along the shaft of the several pinions. Figs. 9, 10, and 11 are horizontal sections on the lines A B, C D, and E F of Fig. 8.

The motor comprises a disk or plate arranged with one-half of it on each side of a shaft, so as to form, in effect, a pair of pistons, each of which pistons oscillates in one of two opposite segments of a spherical or similar casing, and distribution-valves for the introduction and discharge of the motor fluid in the spaces between the quadrants, the valves of course being suitably connected to the quadrants to admit the fluid therein. The barrels of the distribution-valves are provided with spindles supported in bearings at the ends of the valve-case. The spindles of the valves at one end of the motor carry gears or similar devices, to which is transmitted the rotary movement of the main shaft. The valves preferably turn continuously in the same direction, the ports being properly arranged to produce the necessary expansion under this movement. The positions of the ports in the operation of the two pistons are immediately opposite each other.

Referring now to the embodiment illustrated, a double piston *a* is carried on and preferably integral with a comparatively large shaft *b*, journaled in the bearings *c* of the frame *d*. The piston-shaft is provided with spring-segments *e*, engaging the bushings *f* of the spherical casing *g*. The edge of the piston *a* carries packing-segments *h*, which are pressed outward by means of springs *i*. The oiling is accomplished by means of a central distributing-canal *j*, the oil for which enters through a central connection *k*. The piston *a* carries projecting portions *l*, which enter the ports *v* of the valve-casing, so as to avoid any dead-air spaces at the end of its stroke.

The distribution-valves *m* are arranged with two chambers, one for admission and one for discharge of the steam, separated by a spiral partition *n*. The steam enters at one end of the valve on one side of the partition and is discharged on the other side of the partition and out through the opposite end of the valve. Around the admission-ports *p* of the valve and the escapement-ports *q* the diameter of the valve is reduced in order to surround it completely with steam and to reduce the lateral pressure on the bearings. The bearings are closed at the admission end of the valve by means of heavy caps *r* and are furnished at the opposite end with apertured heads *s* and suitable packing. The gears *t* are keyed on the spindles *u*, which form extensions of the valve-body, and these gears are acted upon by the regulating mechanism. Oiling is effected by means of small oilers discharging into the valve-casing and upon the periphery of the valve. The valve-casings *o* serve at the same time as connections between the spherical segments *g* and are apertured, as at *v*, by ports arranged op-

posite each other for each half of the piston. These ports are of unequal opening, being designed to compensate for the inequality of the angular distances between the mid-points of the stroke of the main or rotating shaft, as is shown in Fig. 7. This figure shows that in order to have equal expansion for the forward and the backward strokes it is necessary that the admission of steam be cut off on the one side at *x* sixty degrees from the dead-center and at the other side at *y* seventy-five degrees from the second dead-center with the connecting-rod and other parts of the dimensions shown. The connecting-rod 1 is preferably provided with complete steel bearing-blocks 2 and 3 at its opposite ends.

The edge of the valve-casing in contact with the shaft of the piston is provided with straight packing-strips *z*.

I have shown two mechanisms for changing speed. As has been explained above, the valves turn always in the same direction whatever be the direction of movement of the motor-shaft. It is necessary, furthermore, if the engine stop at a given point that the valve before the machine starts in the opposite direction shall take an opposite position at the end of the stroke. These conditions being defined, they may be satisfied in many different ways. In the engine shown there is on the main shaft 4 a movable sleeve 5, carrying two pinions 6 and 7, symmetrically arranged and adapted to engage alternately with the controlling-pinion 8 for the valves, the latter in turn driving the pinions *t* by means of pinions *w*, keyed on the shaft of the pinion 8. The bearing 9 of the rotary shaft 4 carries a circular projection 10, cut through by two slots 11, diametrically opposite each other. The nearest pinion 6 carries a hook 12, adapted to pass through the slots 11 when its position corresponds to the dead-point position of the valve—that is to say, the position which it takes when the piston is at the end of its stroke. A pin 13, held in place by a spring 14 in a hole 15 of the rotary shaft 4, serves to fix the pinions 6 and 7 in place on the rotating shaft 4. Let us suppose that the engine is in operation, the pinion 6 nearest to the frame being in engagement with the valve-controlling pinion 8. Suppose the machine to be stopped in any position whatever. To start again in the opposite direction, the pin 13 is withdrawn, the sleeve 5 is turned until the hook 12 meets one of the slots 11, and the sleeve 5 is pushed forward to pass the hook 12 through the slot. The first pinion 6 is thus disengaged and the second pinion 7 engaged. The sleeve is then turned again until the pin 13 falls into a hole 16 in the shaft 4 and longitudinally in line with the hole 15.

By varying the position of the valves at the end of the stroke of the piston we may obtain great variations in the expansion by varying slightly the point of admission computed in fractions of the stroke, and it is this principle which in properly-arranged combination permits variation of the expansion even during operation.

In order to obtain the variable expansion during the operation and the change of movement by means of a simple fork, the following mechanism may be used. (See Figs. 8 to 11.) The mechanism shown in these figures is supposed to be applied directly to the prolongation of the shaft of the bevel-pinions transmitting the rotation of the motor-shaft to the valves. The opposite pinions 17 18 on the motor-shaft 4 are keyed in position on this shaft. They are of unequal diameter and engage two pinions 19 20, respectively, keyed on two concentric shafts 21 22, that of the large pinion 19 turning about that of the small pinion 20, the whole being carried in a bearing 23. Above this bearing is a third hollow shaft or sleeve 24, on which is keyed the bevel-pinion 25, engaging the pinions on the spindles of the shafts. Preferably each of the pinions described has the same number of teeth as that with which it engages, so that the rotation of the valves is synchronous with that of the main shaft. About the three concentric axes referred to there is a sleeve 26, which is reciprocated by means of the ordinary forked lever, in which the sleeve is adapted to rotate. The exterior shaft 24, which carries the pinion 25, has a straight longitudinal slot 27, which, by means of a pin 30 extending therethrough, communicates motion from the shafts 21 or 22 to the pinion 25 and thence to the valves in the manner hereinafter explained. The intermediate shaft 22, corresponding to the larger pinion 17 of the main shaft 4, is terminated at about the middle of the slot referred to and is provided with an oblique slot 28 of the same width as the straight slot 27 of the outer shaft 24. Finally, the interior shaft 21, corresponding to the small pinion on the main shaft, is formed above the intermediate shaft 24 with a diameter equal to the latter and carries a helicoidal groove 29, opposite in direction to the groove 28 on the intermediate shaft. They are shown as if straight at the right of the figure. The exterior sleeve 26 carries a pin 30, which penetrates the first and the second shaft, so that according to the longitudinal position occupied by the sleeve the latter is fixed to one or the other of the pinions on the main shaft 4 and at different angular positions determined by the obliquity of the internal grooves. Between the intermediate shaft and the enlarged upper portion of the central shaft an annular passage 31 is provided equal to the diameter of the pin 30. The oblique grooves join this passage, forming a complete funnel in such a way that on moving the sleeve by means of the fork pin 30 slides in the groove and takes its place there, so as to turn the valves to an angular position determined by the point at which the pin 30 is stopped.

The shape and position of the grooves 28 and 29 are so designed that as the pin 30 is

moved along it varies the angle of the valves, so as to determine the period of admission, as above explained. If then the pin is fixed in any angular position whatever relatively to the shafts 21 or 22 while the machine is in operation, the sleeve 26 (which turns with the pinion 25) may be moved to the middle of its path, when the pin 30 will arrive at the central circular groove 31 and will no longer unite the main axis to the valve. Accordingly the distribution of steam will cease and the engine will stop. Then by means of the forked lever the pin 30 may be pushed into the groove opposite that in which it previously was, and the engine is ready to go in the opposite direction with an expansion corresponding to the position of the pin 30. Thus we see that in this arrangement the same conditions are fulfilled as to the direction of rotation of the valves and the opposite positions which they must occupy as in the operation explained above; but here the admission of steam is gradually cut off and retakes its proper magnitude after the movement of the engine has been changed in direction. The fork for operating the sleeve 26 may be controlled by any suitable mechanism—such, for example, as a hand-wheel, a screw, or a governor.

Though I have described with great particularity of detail an apparatus embodying my invention, yet it is not to be understood that the invention is limited to the particular apparatus shown and described. Various modications thereof are possible to those skilled in the art without departure from the invention.

What I claim, therefore, is—

1. In an oscillating-piston engine, the combination of a main rotating shaft, a rotary valve, and means operated by said shaft for rotating said valve in the same direction regardless of the direction of rotation of said shaft.

2. In an oscillating-piston engine, the combination of a main rotating shaft, a rotary valve, means for rotating said valve continuously in one direction from said shaft, means for changing the direction of rotation of said shaft, and means for turning said valve at the moment of such change to the position which it would occupy with the piston at its dead-center.

3. In an oscillating-piston engine, the combination of a main rotating shaft, a valve rotating always in the same direction, a controlling-shaft for said valve, a pinion on said controlling-shaft, a pair of pinions on said main shaft adapted to alternately engage the pinion on said controlling-shaft to rotate the same in opposite directions, a sleeve carrying said pinions on said main shaft, interengaging provisions connected with the frame of the machine and with said sleeve respectively for permitting the reciprocation of said sleeve only when said valve has been turned to a defined position, and means for locking said sleeve on said main shaft always at a given angular position.

4. In an oscillating-piston engine, the combination with a rotating main shaft, of a valve rotating continuously in one direction, and means for varying the expansion and the speed without stopping the engine.

5. In an oscillating-piston engine, the combination of a rotating main shaft, a valve rotating continuously in one direction, a valve-controlling pinion, a pair of secondary shafts geared with said main shaft and adapted to be rotated in opposite directions thereby, and means for bringing said valve-controlling pinion in engagement with said secondary shafts and at a variable angle relatively thereto.

6. In an oscillating-piston engine, the combination of a rotating main shaft, a valve rotating always in the same direction, a controlling-pinion for said valve, a pair of secondary shafts driven in opposite directions from said main shaft, a sleeve carried by said controlling-pinion, rotating therewith and movable longitudinally, and a pin on said sleeve, said secondary shafts being provided with oblique grooves in which said pin engages whereby the angular position of said secondary shafts relatively to said controlling-pinion may be varied.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HILAIRE DE CHARDONNET.

Witnesses:
MARCEL ARMENGAUD, Jeune,
EDWARD P. MACLEAN.