No. 828,417. PATENTED AUG. 14, 1906.

E. N. MOLLIER & E. E. MARINIER.

ROTARY ENGINE.

APPLICATION FILED JAN. 31, 1906.

2 SHEETS—SHEET 1.

Fig. 1

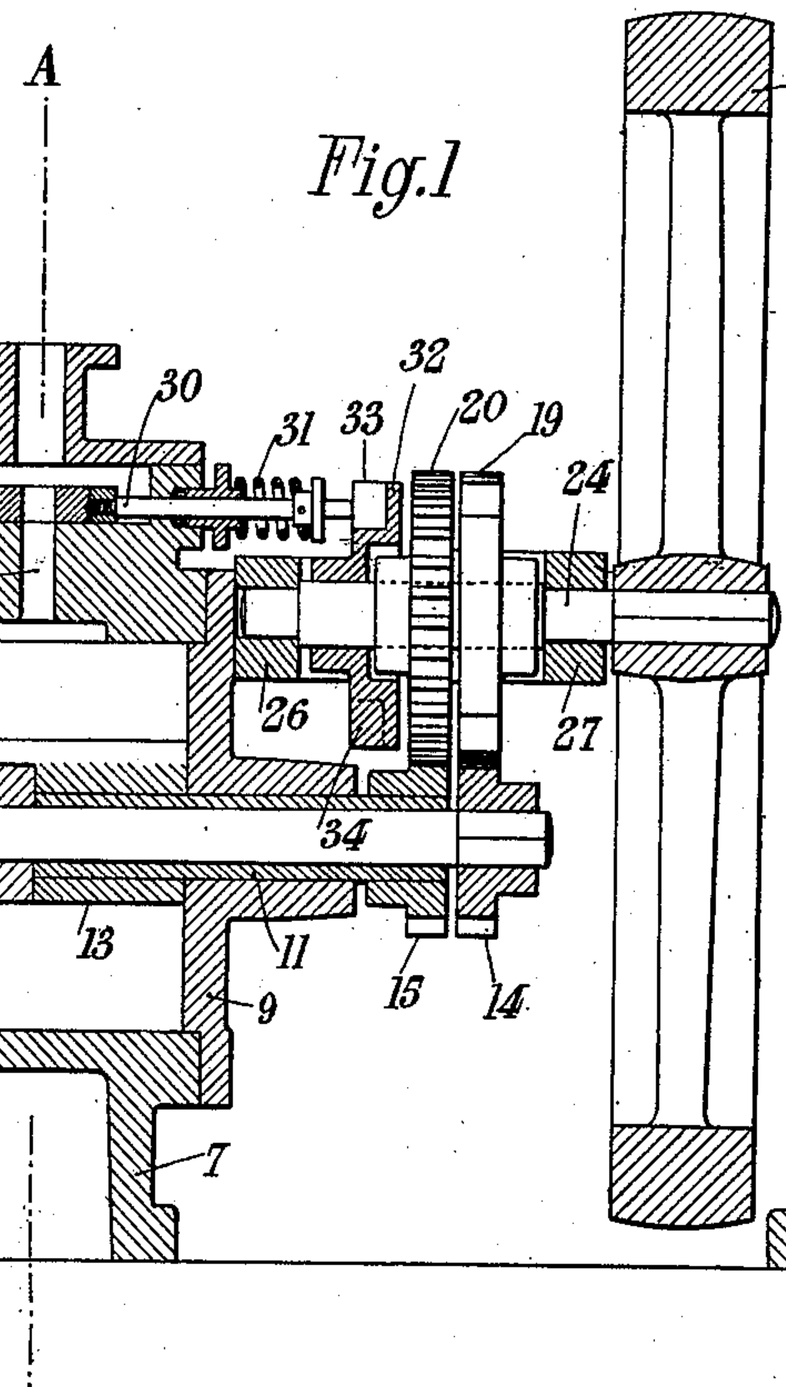


Fig. 2

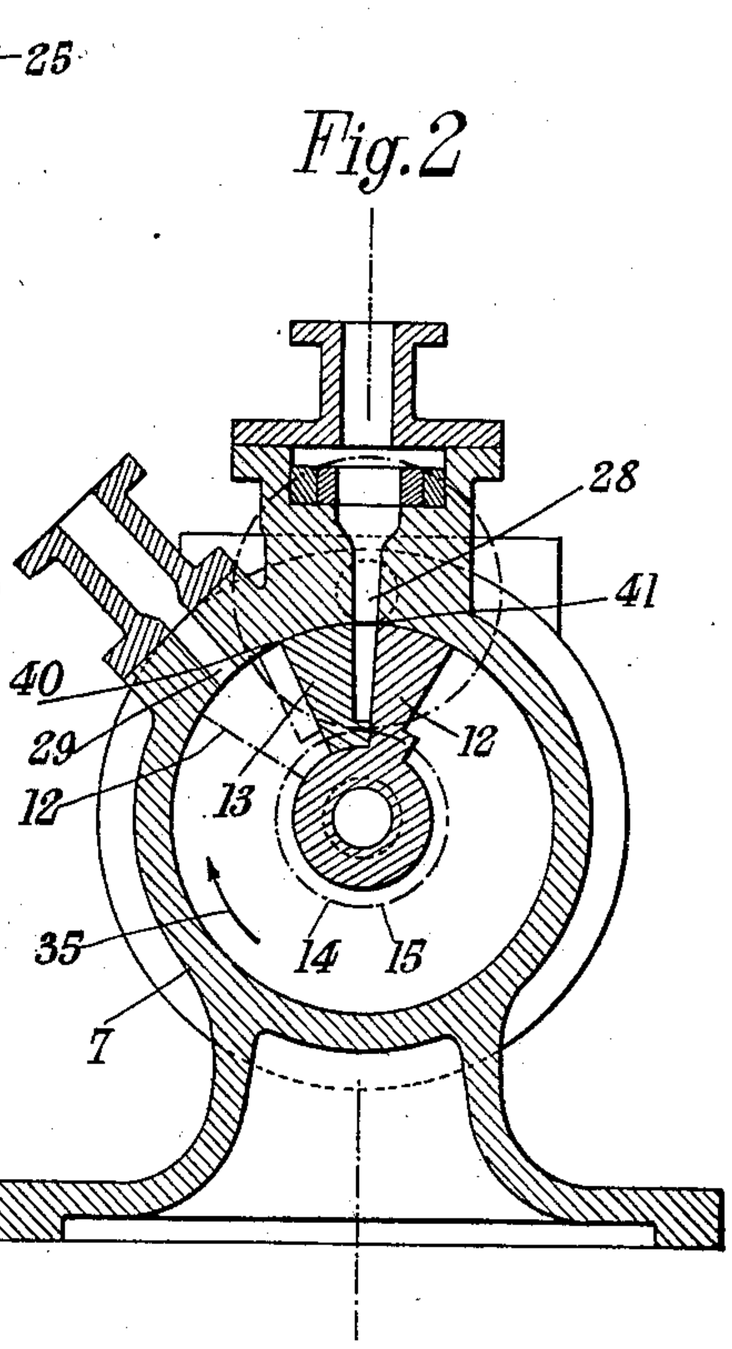


Fig. 3

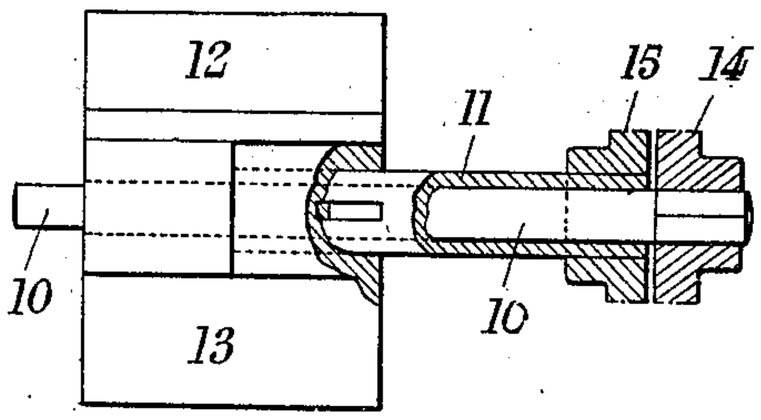
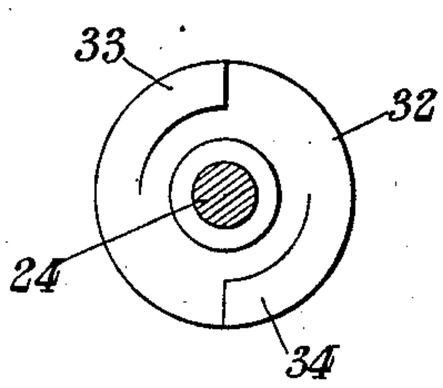


Fig. 4



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2 SHEETS—SHEET 2.

Fig. 5

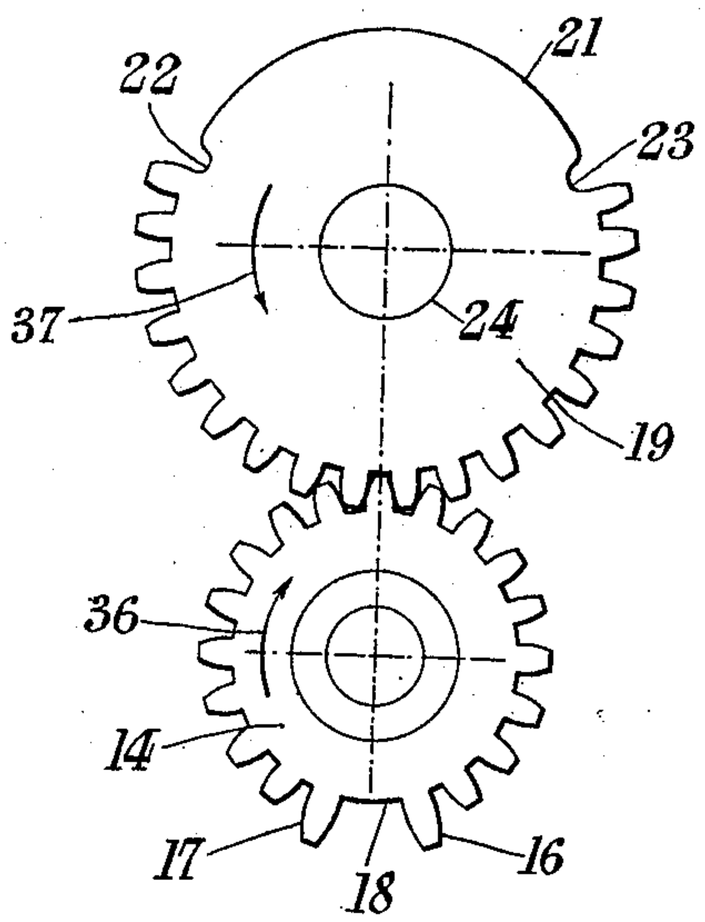


Fig. 6

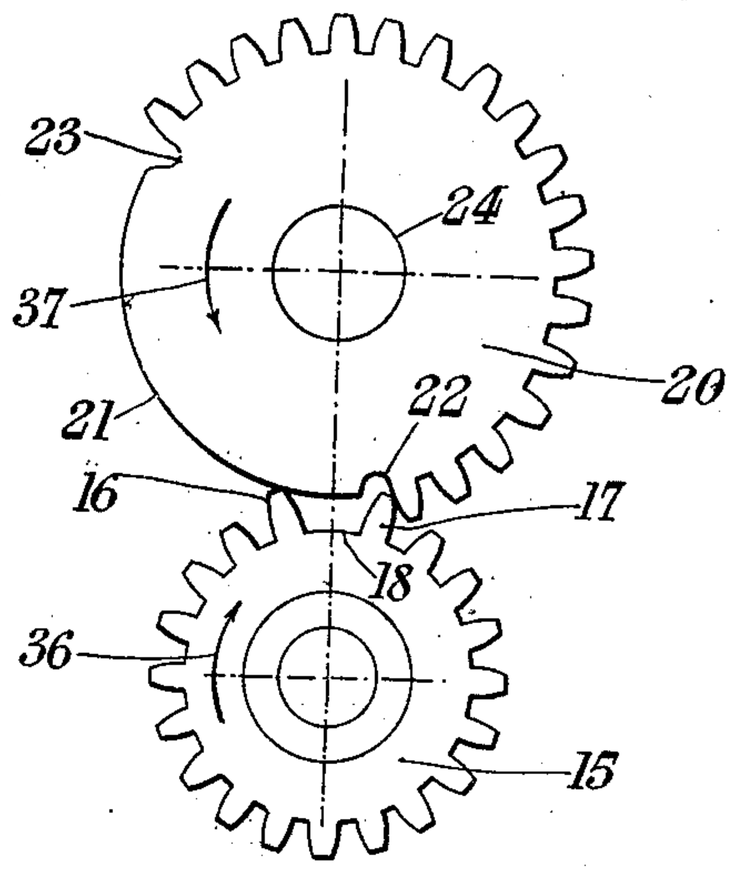


Fig. 7

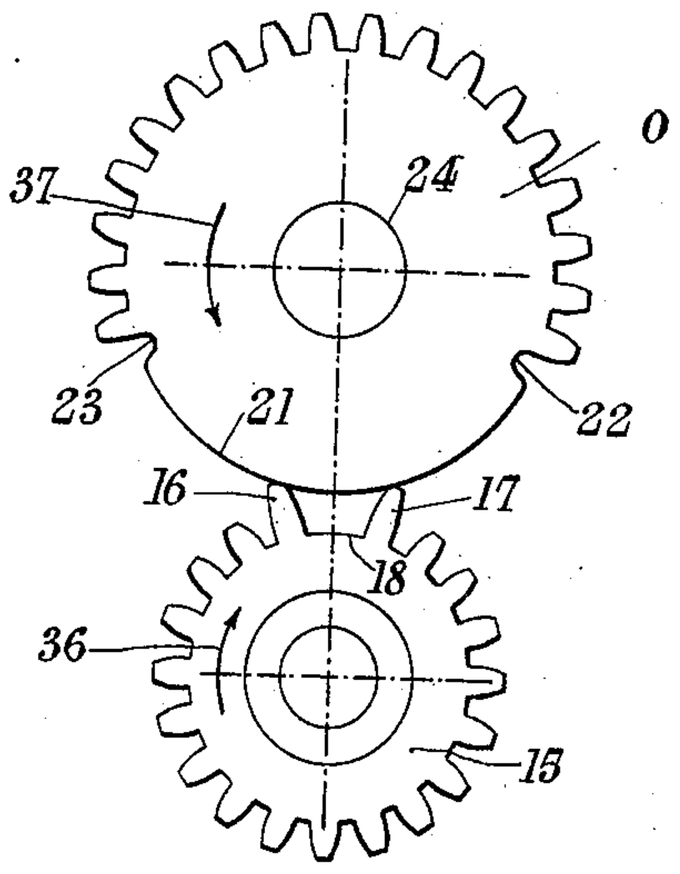
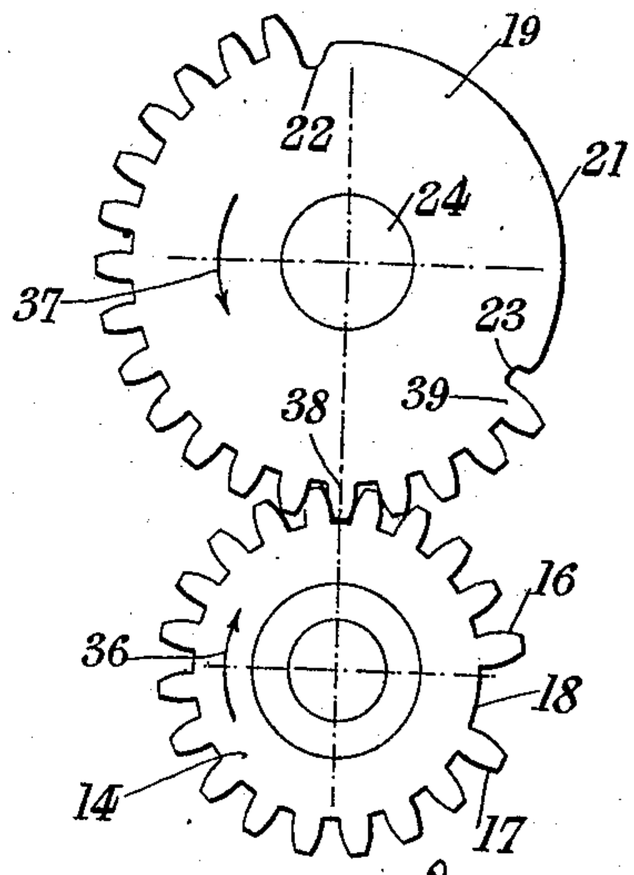


Fig. 8



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UNITED STATES PATENT OFFICE.

ETIENNE NOËL MOLLIER AND EDOUARD ERNEST MARINIER, OF PARIS, FRANCE.

ROTARY ENGINE.

No. 828,417. Specification of Letters Patent. Patented Aug. 14, 1906.

Application filed January 31, 1906. Serial No. 298,872.

To all whom it may concern:

Be it known that we, ETIENNE NOËL MOLLIER and EDOUARD ERNEST MARINIER, citizens of the Republic of France, residing at Paris, France, have invented new and useful Improvements in or Relating to Rotary Engines, Pumps, and the Like, of which the following is a specification.

This invention relates to rotary engines, pumps, and the like, and has for its object to avoid the necessity for any sliding parts in the path of the piston.

According to this invention two pistons are employed in connection with the cylinder, and said pistons are operated in coacting relation by mutilated gearing, and such operation preferably includes alternate action of the pistons. The gearing is preferably so formed that it serves to rigidly anchor the non-acting piston for a period of time until it becomes the acting piston and also coöperates likewise with the acting piston when it becomes non-acting. The valve control for the admission of fluid to the pump or motor is preferably of the sliding type and is yieldingly held in operative relation with a cam which operates with the aforesaid gearing.

In the accompanying drawings, which show one form of this invention, Figure 1 is a sectional longitudinal elevation of the engine. Fig. 2 is a sectional transverse elevation on line A B of Fig. 1. Fig. 3 is a detail view of two unfolded shutters alternately constituting the piston. Fig. 4 is a detail front view of the disk constituting the cam for driving the valve. Figs. 5, 6, 7, and 8 are detail views, on an enlarged scale, of toothed wheels in different respective positions, by means of which the movements of the shutters are obtained.

In the accompanying drawings, 7 is the casing of the engine, which is closed at the sides by means of two disks 8 and 9, forming bearings for the rotating shaft 10 and its sleeve 11. The shaft 10 is secured to the piston 12, the sleeve 11 being secured to the piston 13, so that the two pistons practically constitute two parts of a hinge. These pistons drive alternately and when stationary form a wall which constitutes the point of rest for the fluid under pressure. In order to obtain this result, two equal pinions 14 and 15 are keyed, respectively, to the spindle 10 and sleeve 11. As shown in Figs. 5, 6, 7, and 8, each of these pinions has a tooth missing at one portion of its circumference, and the teeth 16 and 17 on either side of the gap 18 are higher than the others.

The pinions 14 and 15 respectively engage toothed wheels 19 and 20, each of which has mutilated parts 21. At each of the ends of the mutilated portion of the toothed wheels 19 20 there are formed recesses 22 23 of suitable depth in order that the teeth 16 or 17 may engage with them. These two wheels 19 and 20, arranged relatively to each other, as shown in Figs. 6 and 8, are both keyed to a shaft 24, to which is keyed the fly-wheel 25. The shaft 24 has its ends supported in brackets 26 and 27, secured to the disk 9, with which one or both of them could be formed integral. The wheels 19 and 20 are each provided with teeth on more than half their circumference in order that the movement imparted to them by the pinions 14 and 15 should be continuous.

A conduit 28 serves for the admission of the fluid and the conduit 29 for its exhaust. A slide-valve 28[a] serves for the temporary admission of the said fluid when it is gaseous, and consequently capable of expanding; otherwise this slide-valve is unnecessary. The rod 30 of the slide-valve 29 passes through a stuffing-box, and a spring 31 tends to force the rod out of the admission-chest and make it rest with its outside end against a disk 32, keyed to the shaft 24 and provided with two inclined portions 33 and 34, suddenly terminating and arranged diametrically opposite each other.

The pistons 12 and 13 are of such shape that when they are in the position nearest to each other, Fig. 2, there is left between them a suitable space for admission of the pressure fluid without an excessive clearance and so that the lead resulting therefrom tends to stop the piston when it is on the point of becoming stationary. If the pistons rotate in the direction indicated by the arrow 35, Fig. 2, and the toothed wheels and pinions in the respective directions indicated by the arrows 36 and 37, the pistons being in the initial position shown in Fig. 2, the pinion 15 and the wheel 20 being at that moment in the position shown in Fig. 6, while the pinion 14 and the wheel 19 are in the position shown in Fig. 8, it will be understood that the fluid will act on the piston 12 and drive it, together with the

pinion 14, keyed to the spindle 10. The pinion will drive the wheel 19, and consequently the spindle 24 and the wheel 29, as long as its teeth engage with those of the wheel 19, Figs. 8 and 5; but the latter has a sufficient number of teeth to permit all the teeth of the pinion 14 engaging with them, the engagement beginning with the tooth 16 in the recess 23 and terminating with the tooth 17 in the recess 22. As long as the smooth arc of the wheel 20, Figs. 6 and 7, is passing between the two long teeth 16 and 17 of the pinion 15 the latter remains stationary and plays the part of a "Maltese cross" or Geneva stop, so that the piston 13, which is secured to it, is held stationary. When the piston 12 arrives at the position shown by dotted lines in Fig. 2, the recess 23 of the wheel 20, Figs. 6 and 7, enables the latter to engage with the pinion 15. The two pistons 12 and 13 are then both movable until they have taken each other's position. (Shown in full lines, Fig. 2.) At that moment the pinion 15 and the wheel 20 occupy the position shown in Fig. 8, which was the initial position of the pinion 14 and of the wheel 19, while the latter are in the position in which the pinion 15 and the wheel 20 were at the start. It follows therefrom that the toothed sector 38 39, Fig. 8, must correspond to an angular movement of the width 40 41, Fig. 2—that is to say, that of a piston, including that of the clearance—and that the diameter of the wheels 19 and 20 is then a function of that of the pinions 14 and 15 and of the said width 40 41. At each turn of the spindle 24 the disk 32, with projections 33 and 34, causes at suitable intervals the slide-valve 29 to move twice the requisite extent to uncover the orifice of the conduit 28 during the time required for the admission. The escape of the fluid takes place through the conduit 29 as soon as the piston which has just been the driving one has uncovered it.

It will be obvious that the apparatus just described could work as a pump as well as a motor and that the arrangement and the kind of packing to be used for insuring tight joints will depend on the method of use of the said engine and on the driving fluid employed.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. The combination of a cylinder, a shaft, a sleeve, radial pistons mounted thereon and operating in said cylinder, and mutilated gearing connecting said pistons in coacting relation.

2. The combination of a cylinder, radial pistons therein, and mutilated gearing connecting said pistons in coacting relation.

3. The combination of a cylinder, pistons therefor, and mutilated gearing operating said pistons in coacting relation.

4. The combination of a cylinder, radial pistons therefor, a sleeve and a shaft for said pistons, a mutilated gear for said shaft and for said sleeve, and two mutilated gears for driving said first-mentioned gears to operate the pistons in coacting relation.

5. The combination of a cylinder, pistons therefor, a mutilated gearing operating said pistons in coacting relation, certain of said gears having mutilated portions of reduced diameter with respect to their greatest diameter, the coöperating gears having elongated teeth engaging said mutilated portions and coöperating therewith to form a rigid stop for said pistons.

6. The combination of a cylinder, pistons therefor, a mutilated gearing operating said pistons in coacting relation, one of said gears having a mutilated portion of reduced diameter with respect to its greatest diameter, said mutilated portion being provided with recesses, the coöperating gear having elongated teeth spaced apart and engaging said mutilated portion and serving as a rigid stop for said pistons.

7. The combination of a cylinder, pistons therefor, mutilated gearing operating said pistons in coacting relation, a cam operating with said gearing, and a valve for said engine held in yielding engagement and operated by said cam.

In testimony whereof we have affixed our names to this specification in the presence of two subscribing witnesses.

ETIENNE NOËL MOLLIER.
EDOUARD ERNEST MARINIER.

Witnesses:
HENRI VIGNAUD,
ALFRED HAURIOT.