Aug. 15, 1933. H. C. FLIND 1,922,477

CONSTRUCTION OF MOTIVE POWER ENGINES AND PUMPS

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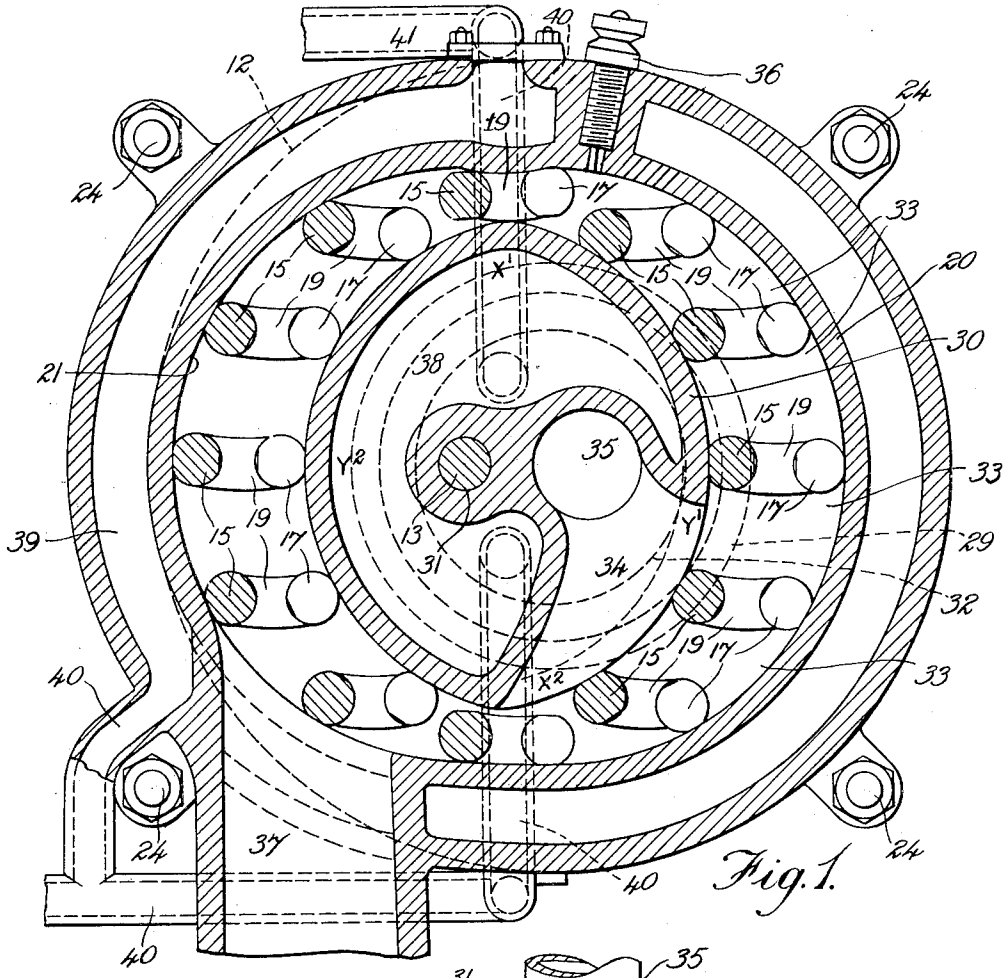


Fig. 1.

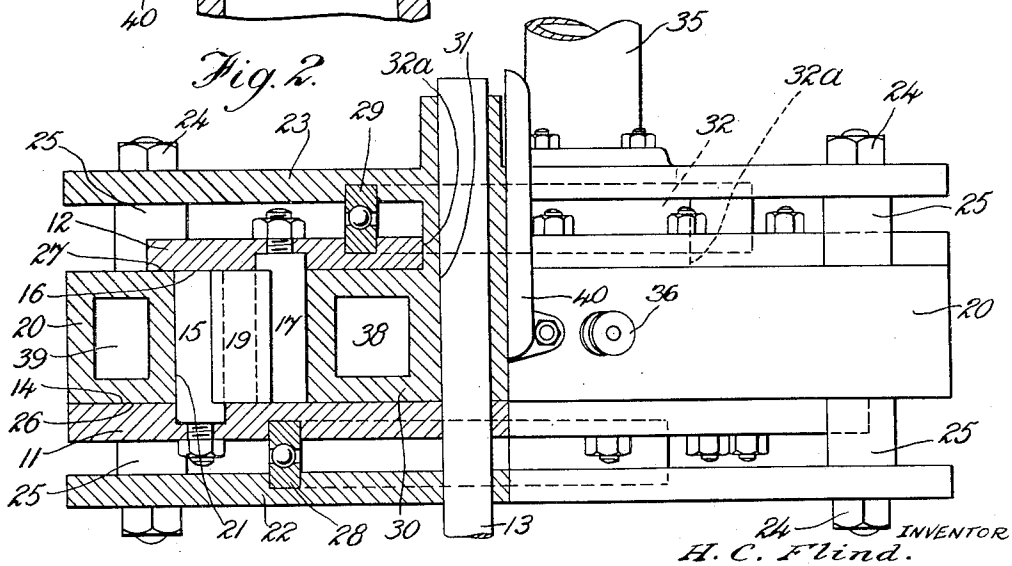


Fig. 2.

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Fig. 3.

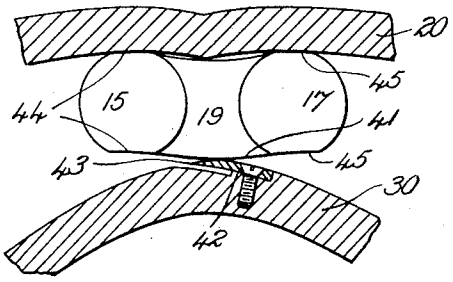


Fig. 4

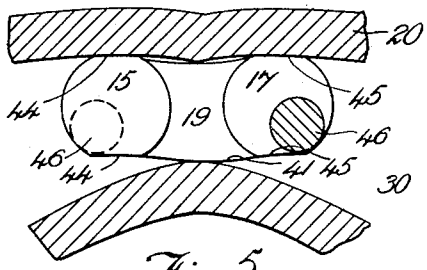
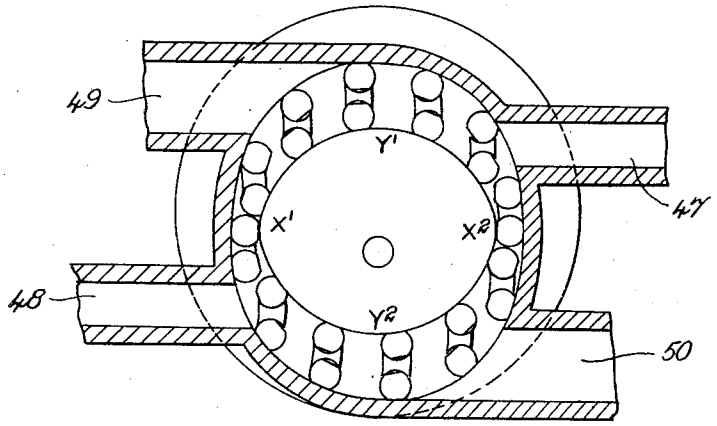


Fig. 5.



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UNITED STATES PATENT OFFICE

1,922,477

CONSTRUCTION OF MOTIVE POWER ENGINES AND PUMPS

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Application June 7, 1930, Serial No. 459,726, and in Great Britain June 18, 1929.

2 Claims. (Cl. 123—8)

This invention relates to the construction of motive power engines and pumps.

The object of this invention is to provide, in a rotary engine or pump, an improved arrangement of working parts in which the motion is purely rotational, and thus tends to give quiet and smooth running and in which there may be two compression operations and two expansion operations for each revolution of the shaft, thus greatly simplifying the adaption of said engine to work on the four-stroke Otto cycle.

According to the invention, in a rotary engine or pump having a plurality of similar piston elements or vanes which move in succession around an endless path within an annular working chamber, the piston elements or vanes are always parallel one with another and move so that every point in each piston element or vane as a whole, travels along a circular path of the same diameter.

The piston elements or vanes may be each carried upon two parallel pivotal axes which move similarly each in a circular path contained in a plane at right angles to said axes, the diameters of said paths being equal, and the centres of the latter being spaced apart at a distance equal to that between the pivotal axes of any one piston element or vane.

An engine or pump may comprise two plates, mounted eccentrically for rotation in parallel planes, each being provided on its face presented to the other plate, with outstanding pins which extend parallel with and in a circle concentric with the axis of rotation of the plate and bear upon the opposed surface of the other plate, each of said pins being connected with a corresponding pin on the other plate by means of a pivotally mounted partition extending completely across the space between said corresponding pins, thus forming one of a series of piston elements or vanes the whole of which series is enclosed within an annular chamber, bounded in addition to a part of each plate, by an outer casing disposed between the plates and outside the series of piston elements or vanes, and by an inner casing, also between said plates but disposed within said series of piston elements or vanes, both said outer and inner casings being formed on their inner and outer surfaces respectively to conform substantially with the paths of the outermost and innermost extremities, respectively, of the piston elements or vanes.

In an engine it is convenient and beneficial for the working fluid to enter the annular chamber at substantially the inner wall thereof, and the exhaust to leave said chamber at substantially the outer wall thereof.

For the purpose of forming a gas tight seal between the inner and/or outer casing and a piston element or vane when the latter is disposed substantially tangential to said casing, there is provided a flexible strip attached by one edge to said casing across the width thereof and projecting at the other edge into the annular chamber.

One form of the invention is illustrated in the accompanying drawings, in which

Figure 1 is a sectional side view of an internal combustion engine.

Figure 2 is a half sectional plan view corresponding to Figure 1.

Figure 3 is a detail view to an enlarged scale showing the method of sealing the joint between the inner casing and one of the piston elements or vanes during compression.

Figure 4 shows to an enlarged scale a method of sealing the joints between the pins and the adjacent casing.

Figure 5 shows diagrammatically a rotary engine adapted to be worked as a steam engine or pump.

The engine shown in Figures 1 and 2 comprises two circular plates 11 and 12, the former being mounted for rotation with a shaft 13 and having projecting from its face 14 a series of pins 15 . . . arranged in a circle concentric with the shaft 13, the outer ends of said pins 15 . . . bearing flat against the surface 16 of the plate 12. The plate 12 is provided similarly with a series of pins 17 . . . arranged in a circle of diameter equal to that of the circle of pins 15 and arranged so that the outer ends of said pins 17 . . . bear flat against the surface 14. The disc 12 is formed with a large hole at its centre and is mounted eccentric to the shaft 13 so that corresponding pins 15 and 17 lie opposite to one another, each of the spaces between said corresponding pins 15 and 17 being occupied by a partition member 19 so shaped that it fits partly round each of the pins 15 and 17 as shown in Figure 1, and extends from the surface 14 to the surface 16, (Figure 2).

Surrounding the whole of the pins 15 and 17 is a hollow casing 20 having a smooth inner surface against the right and left hand sides of which bear the outermost parts of the pins 17 and 15 respectively. The casing 20 is supported by and between two frame plates 22 and 23 by means of bolts 24 passing through lugs 25 thereon, the plates 11 and 12 being held in position so

as to bear against the sides 26 and 27 of the casing 20 by means of thrust bearings 28 and 29 respectively, the plate 22 also forming one of the bearings for the shaft 13. Within the circles of pins 15 and 17 is an inner hollow casing 30, fitting between the plates 11 and 12 and formed with a second bearing 31 for the shaft 13 and formed, eccentric with the bearing 31, with an outstanding boss 32 which forms the bearing 32a for the plate 12 and has a running fit in the central opening in said plate through which it passes, and also forms a means of attachment of the inner casing 30 to the frame plate 23. Thus a number of sealed compartments 33 . . . are formed which, as the shaft 13 revolves, alternately increase and diminish in volume, the maximum volume being enclosed when a compartment 33 is adjacent to either of the points Y^1 and Y^2, and the minimum volume when said compartment 33 is adjacent to either of the points X^1 and X^2.

In considering the action of the internal combustion engine shown, it will be convenient to trace the operations taking place in one compartment 33 only, but it will readily be understood that identical operations take place in the remaining compartments 33 when they respectively reach corresponding positions in the annular chamber between the casings 20 and 30, and thus the effect, with regard to the total working impulses, is equivalent to that produced by an ordinary engine with a number of cylinders equal to the number of compartments 33, in an engine according to the invention.

Thus, starting from the position X^2 when a given compartment 33 contains its minimum volume, the partitions 19 enclosing said compartment move upwardly past a flared inlet opening formed in the inner casing 30 and communicating with a pipe 35 for attachment to a carbureter or other fuel mixture source (not shown). Due to the velocity of the vanes and the extremely large area of the inlet opening, a compartment 33 is very thoroughly filled with fuel mixture when it reaches the position Y^1. As the compartment 33 approaches the position X^1 the fuel mixture therein becomes compressed and on reaching a position adjacent to said position X^1 is exploded by a sparking plug 36 in the known manner. Expansion of the gases in the compartment 33 then takes place as the latter moves downwardly to the position Y^2, after which the volume of said compartment 33 diminishes and the exhaust gases are expelled through an exhaust opening 37, this operation being performed thoroughly owing, firstly, to the large area of exhaust opening and secondly to the centrifugal force acting on the exhaust gases, due to their angular velocity.

The engine shown in Figures 1 and 2 is adapted for water cooling, the inner casing 30 and the outer casing 20 being formed with cavities 38 and 39 respectively through which water is circulated by means of pipes 40. . . . Study of Figs. 1 and 2 will show that the pipes 40 are brought to the engine in a plane between the planes of the plates 11 and 12, and each has a branch connected directly with the outer wall of the casing 20 to communicate with the chamber 39. The pipes then pass laterally to clear the plate 12 and then toward the center of said plate alongside the same, the ends of the pipes being then turned toward the plate to pass within the boss 32 and be connected with the casing 30 to communicate with the chamber 38.

It is desirable that, in order to maintain a gas-tight joint between the inner casing 30 and a partition 19, when the latter is passing the point X^1, said partitions 19 should be of curved formation as shown at 41 in Figure 3, and further, a strip 42 of flexible material may be attached to the inner casing 30 so as to bear at its outstanding edge 43 against said curved surface 41, against which it is forced into contact by the explosion pressure acting upon the underside of said edge 43. A gas-tight joint is not necessary at the point X^2 as the pressure at this point is approximately atmospheric. In order to form a gas-tight joint between each of the pins 15, 17 and the inner and outer surfaces of the casings 20 and 30, the pins 15, 17 may be provided with surfaces 44 and 45 respectively, which form arcs of circles concentric with the pitch circles of the pins 15 and 17 respectively.

If desired the pins 15 and 17 may be arranged so that the gas pressure in the adjacent compartments tends to force said pins 15 and 17 against the appropriate casings 20 and 30; thus, for instance, as shown in Figure 4, the pins 15 and 17 may be mounted eccentrically upon further pins 46.

The application of the invention to the design of a steam engine is shown in Figure 5, in which the steam is admitted to the compartments 33 when the latter come opposite the port openings 47 and 48, expansion taking place until the points Y^1 and Y^2 are reached, after which the steam is exhausted through the ports 49 and 50, respectively. This design is also suitable for a pump, or if desired a complete motor-pump unit, the steam or other working fluid being admitted and exhausted at 47 and 49 respectively, while the fluid to be pumped enters at 48 and is delivered at 50.

In an internal combustion engine according to the invention the cooling may be performed by air or any known method, and also the application of lubricating oil may be either by the admixture of said oil with the fuel mixture, or by the application of said oil direct, under pressure or otherwise, preferably introduced at the position X^2 where there is practically no internal pressure.

When the sparking plug 36 is in the position shown in Figures 1 and 2, a variation of 20° to 25° is obtainable in the position of a compartment 33 at which ignition takes place. If, however, this is insufficient a greater variation may be obtained by fitting a second sparking plug (not shown) in the outer casing at a suitable point.

In some cases it may be desirable, when once the position of the sparking plug 36 for best running has been determined, to arrange such sparking plug to give a continuous spark at this point, the charges in the compartments 33 being automatically exploded when they successively arrive opposite this point.

Further, the pins 15 and 17 may be of unequal diameters, provided the pitch diameters of the two circular series of said pins are equal.

What I claim is:—

1. A rotary engine or pump, comprising two plates, mounted eccentrically relative to each other for rotation in parallel planes, and each provided on its inner face with outstanding pins which extend to the inner surface of the other plate, pivotally mounted partitions each extending completely across the space between and engaged at its opposite side edges with corresponding pins, thus forming one of a series of vanes, and inner and outer casings disposed between the plates and defining an annular chamber contain-

ing the series of vanes, both said outer and inner casings being formed on their inner and outer surfaces respectively to conform substantially with the paths of the outermost and innermost extremities, respectively, of the vanes.

2. A rotary engine comprising two plates mounted eccentrically relative to each other for rotation in parallel planes, pins projecting from each plate to the other plate, the pins on each plate being arranged in a circle concentric with the axis of rotation of the plate, partitions each extending entirely across the space between corresponding pins and having its side edges partly encircling the respective pins to be carried pivotally thereby, and inner and outer casings disposed between the plates and defining an annular chamber containing said pins and partitions, the inner casing having an inlet port discharging through its periphery into said annular chamber, and the outer casing having an outlet port leading from said chamber.

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