April 9, 1935. H. RUEHMAN 1,997,184

ROTARY ENGINE

Filed Oct. 17, 1932 3 Sheets-Sheet 1

FIG. 1.

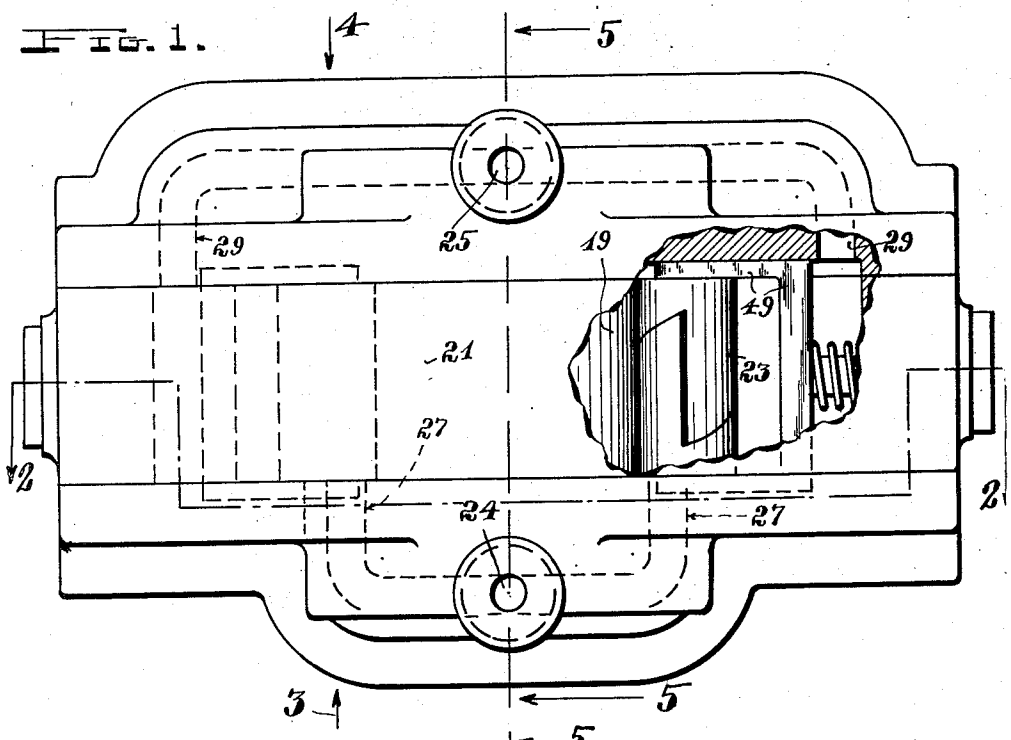
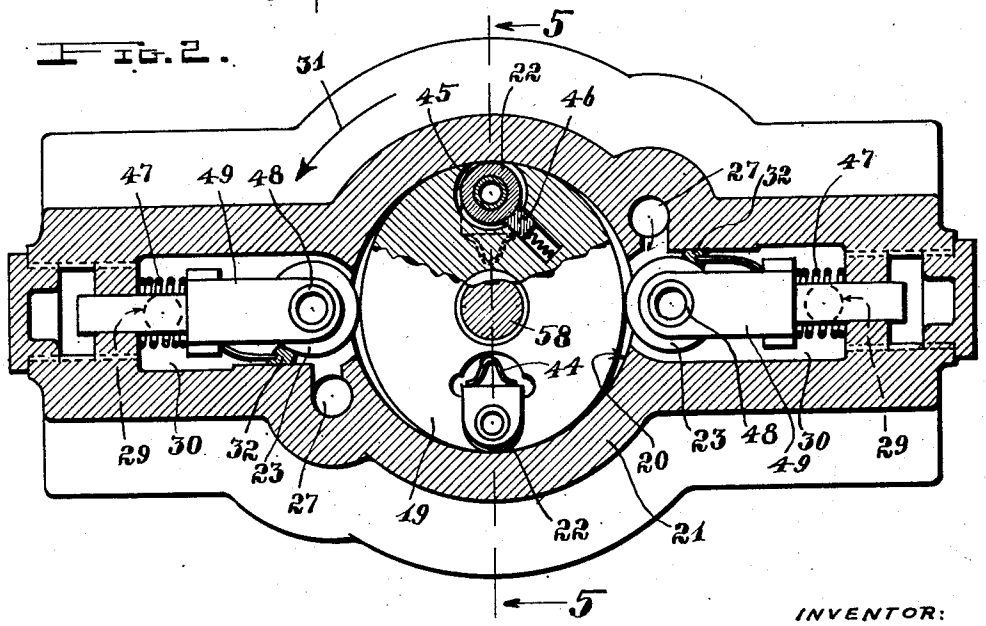


FIG. 2.



INVENTOR:
HENRY RUEHMAN,
By: Otto H. Ruger,
his Atty.

April 9, 1935. H. RUEHMAN 1,997,184

ROTARY ENGINE

Filed Oct. 17, 1932 3 Sheets-Sheet 2

FIG. 3.

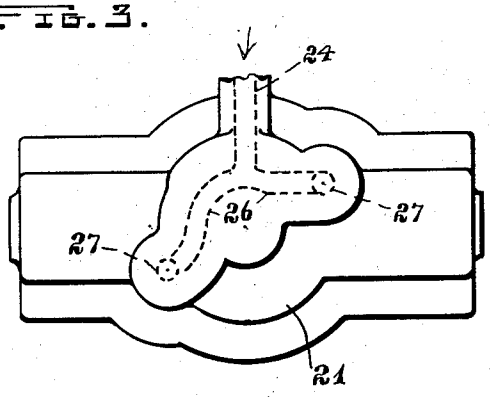


FIG. 6.

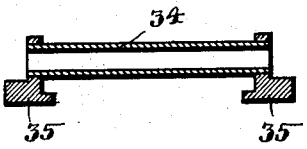


FIG. 7.

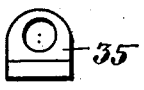


FIG. 4.

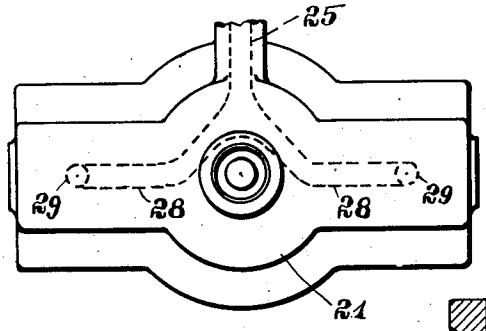


FIG. 8. FIG. 9. FIG 10.

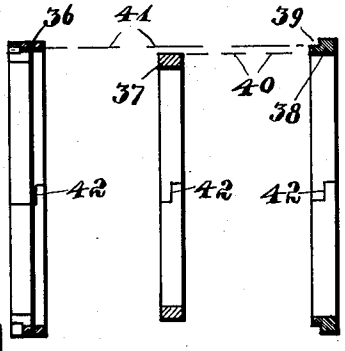


FIG. 5.

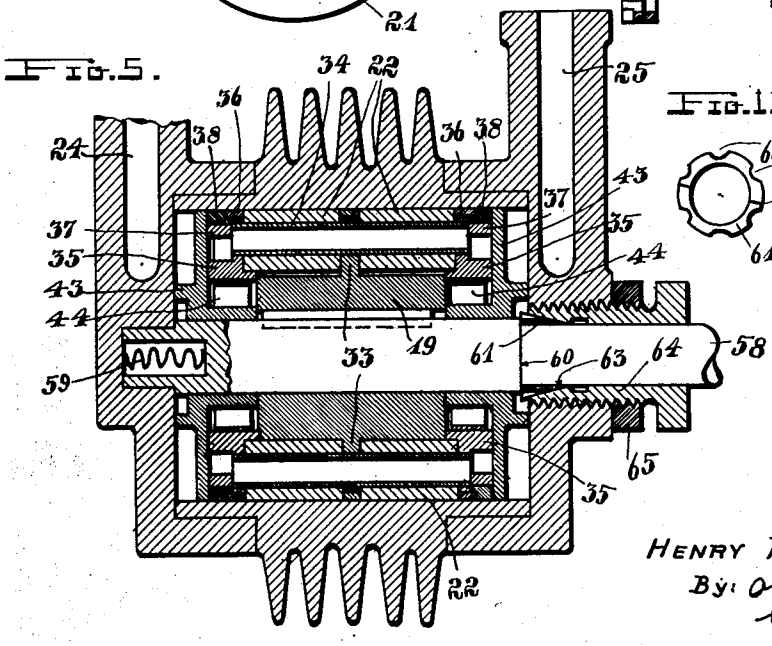
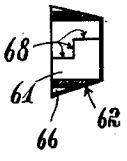


FIG. 11.

FIG. 12.



INVENTOR:
HENRY RUEHMAN,
By: Otto H. Ringer,
his Atty.

April 9, 1935. H. RUEHMAN 1,997,184

ROTARY ENGINE

Filed Oct. 17, 1932 3 Sheets-Sheet 3

Fig. 13.

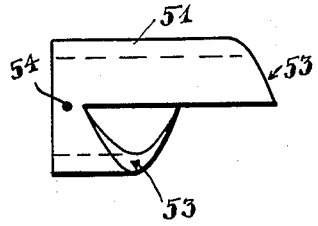


Fig. 14.

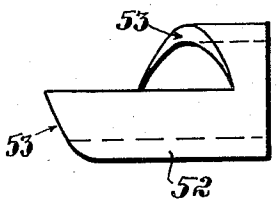


Fig. 15.

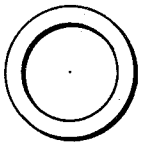


Fig. 16.

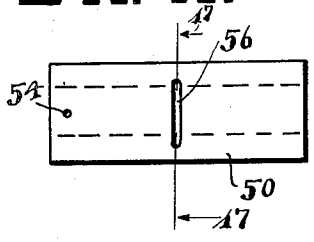


Fig. 17.

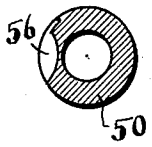
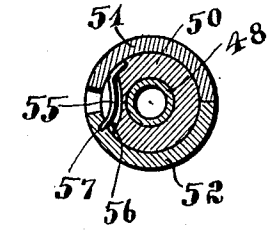


Fig. 18.



INVENTOR:
HENRY RUEHMAN,
By: Otto H. Ranger,
his Atty.

Patented Apr. 9, 1935 1,997,184

UNITED STATES PATENT OFFICE

1,997,184

ROTARY ENGINE

Henry Ruehman, Los Angeles, Calif.

Application October 17, 1932, Serial No. 638,128

7 Claims. (Cl. 103—123)

This invention relates to a rotary engine in which a spacing between a rotor and a housing is utilized in transferring a pressure medium from the intake to the outlet.

One of the objects of this invention is to provide a rotary engine, embodying an elliptic rotor, with improved sealing means by which a desired pressure can be maintained at a low rate of rotation of the rotor.

Another object is to provide a sealing means with the least tendency of producing a clicking or other noise during the rotations of the rotor.

Other objects will appear from the following description and appended claims as well as from the accompanying drawings, in which—

Fig. 1 is a top plan view of compressor, partly broken away to show inside parts, designed to operate according to this invention.

Fig. 2 is a horizontal midsection on line 2—2 of Fig. 1, the yokes of the sealing rollers being shown in end elevation.

Fig. 3 is a roughly outlined front elevation in the direction of the arrow 3 in Fig. 1, having the inlet-conduits marked therein in dotted lines, the scale being reduced as compared to the scale of the illustration of Fig. 1.

Fig. 4 is a roughly outlined rear-side elevation having the outlet conduits marked therein.

Fig. 5 is a cross section on line 5—5 of Figs. 1 and 2.

Fig. 6 is a detail longitudinal sectional view of the supporting tube and end-lugs for the sealing-rollers as illustrated in Fig. 5 without the cooperating parts.

Fig. 7 is an end elevation of the lugs shown in Fig. 6.

Figs. 8, 9, and 10 are cross sections in detail of the cooperating sealing rings shown in Fig. 5 at the opposite ends of the rotor.

Fig. 11 is an end elevation of the sealing bushing for the rotor-shaft.

Fig. 12 is a longitudinal section of the sealing bushing shown in Fig. 11.

Fig. 13 is a side view of one half of the gate-roller sleeve.

Fig. 14 is a side view of the second half of the gate-roller sleeve.

Fig. 15 is an end view of the sleeves.

Fig. 16 is a side view of the supporting-sleeve for the two gate-sleeve halves.

Fig. 17 is a cross section on line 17—17 of Fig. 16.

Fig. 18 is a cross section through an assembled gate-roller with the innermost supporting tube.

Rotary engines of the type to which this invention refers are generally operated at a high velocity or a great number of revolutions of the rotor to overcome leakages between the moving and stationary parts, while the device of the present invention is designed to operate slowly with a possibly low amount of friction.

The elliptic rotor 19 revolves within a cylindrical bore 20 of the housing 21, sealing rollers 22 disposed in the rotor serving to properly engage the rotor with respect to the bore of the housing, and the gate rollers 23 serving to control the inlet and discharge, as will be described more fully later on, with reference to the illustration of Fig. 2.

In the illustrations of Figs. 3 and 4, inlet- and outlet-conduits have been indicated in dotted lines, the inlet-conduit 24 in Fig. 3 branching at 26, terminating at 27, which terminations have also been indicated in Figs. 1 and 2 in operative relations to other parts and structures; the outlet-conduit 25 in Fig. 4 branching at 28, terminating at 29, which terminations have also been indicated in dotted lines as having communication with the compartments 30 within the housing 21.

When the rotor is being rotated in the direction of the arrow 31, an operating or operative medium is passed or allowed to pass by way of the inlet-terminations 27 into the space formed between the elliptic rotor and the cylindrical housing, and as the rotor continues to rotate such a medium passes from one end of the housing to the opposite, the gate-rollers 23 dividing the compartments 30 into intake- and outlet-sides or sections, having sealing slides 32 interposed between the gate-rollers and the walls of the compartments.

The apexes of the rotor would naturally form the principal points or surfaces subjected to wear deserving consideration with respect to the cylinder walls and thereby possible leakages, and these points have been provided with sealing rollers.

Though any wear between contacting surfaces could produce efficiency affecting leakages, such a wear between the parts involved here would at the most be so small that a very insignificant movement or yielding of the rollers will readily satisfy the requirements for suitably sealing the rotor within the cylinder.

However, the slightest yielding of the rollers 22, inasmuch as they have to pass under the gate-rollers 23, would have to produce an undesirable clicking. To eliminate this, the rotor 19 is provided with a central web 33, one or more webs, of course, may be used, one web necessitating the

division of the sealing-roller in each sealing edge or apex into two roller-sections, as clearly illustrated in Fig. 5 such a web serving to support and guide the gate-rollers over the gaps in the rotor surface.

The sealing rollers are mounted on a common central tube 34, the ends of which are mounted in supporting and guiding lugs 35, tube and lugs being illustrated in detail in Figs. 6 and 7, since in Fig. 5 other sealing means used on the rotor and also illustrated in Fig. 5 might have a tendency to leave the structure and function of the support and control of the sealing rollers not clear.

Such additional sealing means are illustrated in detail in Figs. 8, 9, and 10, the sealing-rings 36 being normally disposed adjacent to the ends of the sealing rollers 22, while the other rings 37 and 38 interengage with the first-named rings 36.

While the sealing-rollers 22 form the circumferential sealing means for the rotor, the interengaged rings form the endwise sealing means for the rotor within the cylinder. The ring 36 is made wide enough to overlap the ring 38, for which purpose an annular cut-out 39 has been provided in one edge of the ring 38. The ring 37 is designed to fit within the ring 38, thereby re-enforcing the sealing facilities of the ring 38, the dotted lines 40 indicating such fitting one within the other, as indicated in Figs. 9 and 10, and as will be understood from the illustration in Fig. 5. The overlapping of the ring 36 is also indicated between Figs. 8 and 10 by the dotted lines 41 connecting the ring 36 with the shouldered cut-out of the ring 38.

The rings 36, 37, and 38 are otherwise made of the expanding type and design commonly used in piston-rings, having the overlapping split indicated at 42.

End-washers 43 are inserted into the cylinder for keeping the rings and lugs properly in place in the rotor. Springs 44 serve to yieldingly support the lugs 35 and thereby the sealing rollers within the rotor against the cylinder-walls.

Though a comparatively wide spacing 45 has been shown around the sealing roller in Fig. 2, it should be understood from the above, by reason of the fact stated, that the roller has to move or yield exceedingly little, and that therefore this spacing can be comparatively very small.

Nevertheless, a seeping from the compression to the suction side of the sealing roller might be possible, and a spring-controlled sealing slide 46 is used therefor.

The gate-rollers 23, being under the tension of the suitably strong springs 47, can easily be made to seal properly and perfectly with their circumferential surfaces with respect to the surface of the elliptic rotor, but a seeping might be possible at the ends of the gate-rollers since these must easily slide within the housing-compartments 30 as the gate-rollers are forced back and forth by the elliptic rotor under the tension of the springs 47. The gate-rollers are mounted on a tube member 48 in a yoke 49. A sealing of the gate-rollers endwise is best understood from the detailed illustrations in Figs. 13, 14, 15, 16, 17, and 18.

An intermediate sleeve 50 is turnably disposed on the central tube member 48. Upon this sleeve 50 is mounted an outer sealing-sleeve made in two sections 51 and 52, provided with helical faces 53, adapted to contact for an unscrewing-like movement, to result in an endwise expansion of this sectioned outer sealing-sleeve, the sealing-sleeve being turnable and endwise shiftable on the intermediate sleeve 50.

Though holes 54 have been indicated in one of the sections of the sealing-sleeve and the intermediate sleeve by which these two parts may be interconnected by means of an inserted pin, being principally done for the reason that a certain type of spring 55 has been indicated in the assembly of Fig. 18 which rests in the recess 56 of the intermediate sleeve 50 while one end 57 of this spring engages in a suitable hole in the inside of the sleeve-section 52, it must be understood that, by using different springs, the expanding movements of the sleeve-sections 51 and 52 may be procured in various manners and that, in fact, both sealing-sleeve-sections can easily be made to turn and shift on the intermediate sleeve 50 in a manner to produce an endwise sealing.

With the several sealing means in the cylinder, there might still be expected a slight seeping endwise between the shaft 58 and the main housing. To overcome this, a split conical sealing bushing 61 is provided to engage with the shoulder 60 of the shaft 58, a spring 59 being inserted in the opposite hollow shaft end, by which the conical face 62 of the bushing is forced snugly into engagement with the correspondingly shaped conical face 63 of the adjustable bushing 64, which is locked in place by the lock-nut 65.

To make the sealing bushing 61 more yieldable and pliable, it is provided with cut-outs 66 as illustrated in Fig. 11, the split feature being illustrated in Fig. 12, as indicated at 68.

Though the rotor, of course, must be keyed to the shaft 58, this engagement between the rotor 19 and the shaft is preferably suitably sliding, to facilitate the endwise shaft-sealing above described.

From the above it must be understood that the springs 44, with respect to the rotor-sealing-rollers, and the springs 47, with respect to the gate-rollers, principally serve to press and hold such rollers in contacting position only for starting purposes, since, after a start and during the operation of the engine or compressor, the back or rear pressure always overbalances any pressure from the front or contacting end or side of these rollers, inasmuch as the sealing slides 32 and 46 are disposed towards one side so as to provide a larger surface on the pressure side of the rollers over the surface on the suction side of the same rollers, or even over the outward and contacting side of the rollers, the contacting point or line being rather, so to speak, in the dead center or in line with a diagonal through the rotors while the sealing means are back of this line.

Having thus described my invention, I claim:

1. In an engine of the class described, in combination with a circular cylinder, an elliptic rotor, sealing rollers in the apexes of the circumferential surface of the rotor with the axes of the sealing rollers parallel to the main axis of the rotor, and gate-rollers turnable and shiftable in the said cylinder with their axes also parallel to the axis of the rotor; and combination sealing rings interengaged with one another and sealingly abutting against the ends of the rotor with its sealing-rollers as well as against the ends of the gate-rollers, one of the rings having a cylindrical inner face for engaging over a second ring and having an annular shoulder in its outer face for engaging a third ring from the inside as well as endwise, the said third ring hav-

ing cut-outs to engage over the ends of said sealing rollers and with its larger uncut-out portions abutting against the end of said rotor, the said three rings being in distinct units on opposite ends of the rotor within the said cylinder.

2. In an engine of the class described, a circular cylinder, an elliptic rotor with its apexes contacting with the cylinder and with its flattened sides spaced a short distance from the cylinder, a shaft disposed turnably concentric with respect to said circular cylinder, the said rotor having operative engagement with said shaft, sealing rollers in the apexes of the rotor with the axes of the sealing rollers parallel to the main axis of the rotor and said shaft, gate-rollers turnable and shiftable in said cylinder with their axes also parallel to said main axis of said cylinder and shaft, and combination circumferentially expanding sealing rings interengaged with one another and sealingly abutting against the ends of the rotor and therewith with the ends of the sealing-rollers as well as against the ends of the gate-rollers so as to overlap said distance between the cylinder and the flattened portions of the rotor.

3. In an engine of the class described, in combination with a circular cylinder and an elliptic rotor, a shaft disposed turnably concentric with respect to said cylinder, the said rotor having longitudinally sliding key-engagement with said shaft, sealing-rollers in the apexes of the circumferential surface of the rotor with the axes of the rollers parallel to the main axis of the said shaft and rotor, gate-rollers designed to expand endwise and being turnable and shiftable with respect to said cylinder with their axes also parallel to the said shaft-axis, combination circumferentially expanding sealing-rings interengaged with one another for seating and sealing engagement with said cylinder and abutting against the ends of the rotor and therewith with the ends of the sealing-rollers as well as against the ends of the gate-rollers, the one end of the said shaft being hollow and being turnably mounted in one end side of said cylinder, the other end of the shaft extending through the opposite end-wall of the cylinder and there being a shouldered portion on this shaft-end at a point within the cylinder, a spring disposed in the hollow shaft-end for keeping the shaft under tension in the direction of said shouldered portion and said last-named end-wall, and a sealing bushing abutting against the said shouldered portion and sealing within the said last-named end-wall.

4. In an engine of the class described, a housing having a circular cylinder, a rotor of elliptic cross section turnable within the cylinder, the housing having radially elongated compartments in communication with the cylinder, inlet- and outlet-conduits in the housing and terminating in said compartments, a shaft being turnable in the housing with its axis concentric with the axis of the cylinder and having means for actuating said rotor, gate-rollers with axes parallel to the first-named axis, guiding members for turnably supporting the gate-rollers and radially shiftable in said compartments, and sealing slides shiftable under pressure against the gate-rollers and against one of the sides of the compartments thereby exposing a larger portion of the gate-rollers to the compression side compared to the intake side within the compartments.

5. In a compressor, a housing having a circular cylinder, a rotor of elliptic cross section turnable within the cylinder, the housing having compartments in communication with said cylinder with inlet- and outlet-conduits in the housing terminating in each compartment, a shaft being turnable in the housing with its axis concentric with the axis of the cylinder, gate-rollers with axes parallel to the first-named axis, guiding members for turnably supporting the gate-rollers and having portions shiftable in the compartments radially to the axis, sealing rollers in the apexes of the rotor, guiding members for turnably supporting the sealing rollers yieldably mounted in the rotor for radial movements and so as to space the rollers evenly from the adjoining sides in the rotor, and sealing members shiftably mounted in the rotor for movements tangentially to said first-named axis and so as to expose a larger portion of the sealing rollers to the compression sides in the housing.

6. In a compressor, a housing with a crosswise cylindrical bore and with oppositely radially communicating chambers, a rotor of slightly elliptic cross section turnable in said bore, gate-rollers in said chambers, guiding members turnably supporting the gate-rollers and radially shiftable in said chambers, inlet-ports in said housing terminating in said chambers on one side of the gate-rollers, outlet-ports in the housing terminating in the chambers on the opposite sides of the rollers, and sealing members radially shiftable in the chambers under pressure from the compression sides of the rollers and thereby pressed against the sides of the chambers and against the sides of the gate-rollers.

7. In a compressor having an elliptic rotor, the rotor having recesses throughout its length in its apexes, roller-guides radially shiftable in said recesses, means for holding said guides forced towards the periphery on tension, sealing-rollers turnably mounted in said guides with their axes parallel to the central axis of the rotor, and sealing means under the tension of springs shiftably mounted in the rotor and extending into said recesses to contact with the said rollers at an angle tangentially to the center of the rotor thereby forming larger spaces in the recesses on one side of each of the rollers.

HENRY RUEHMAN.