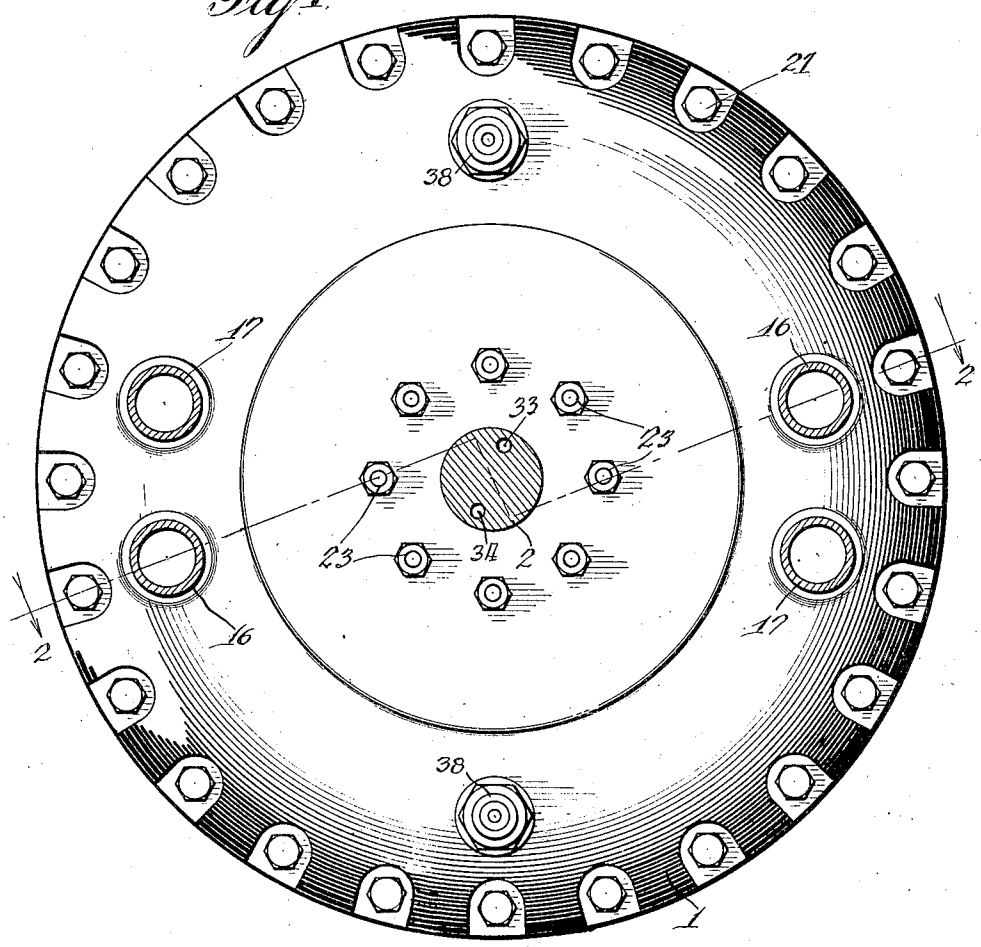
Sept. 11, 1934. O. E. E. STROMBERG 1,973,397

ROTARY ENGINE

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Fig. 1.



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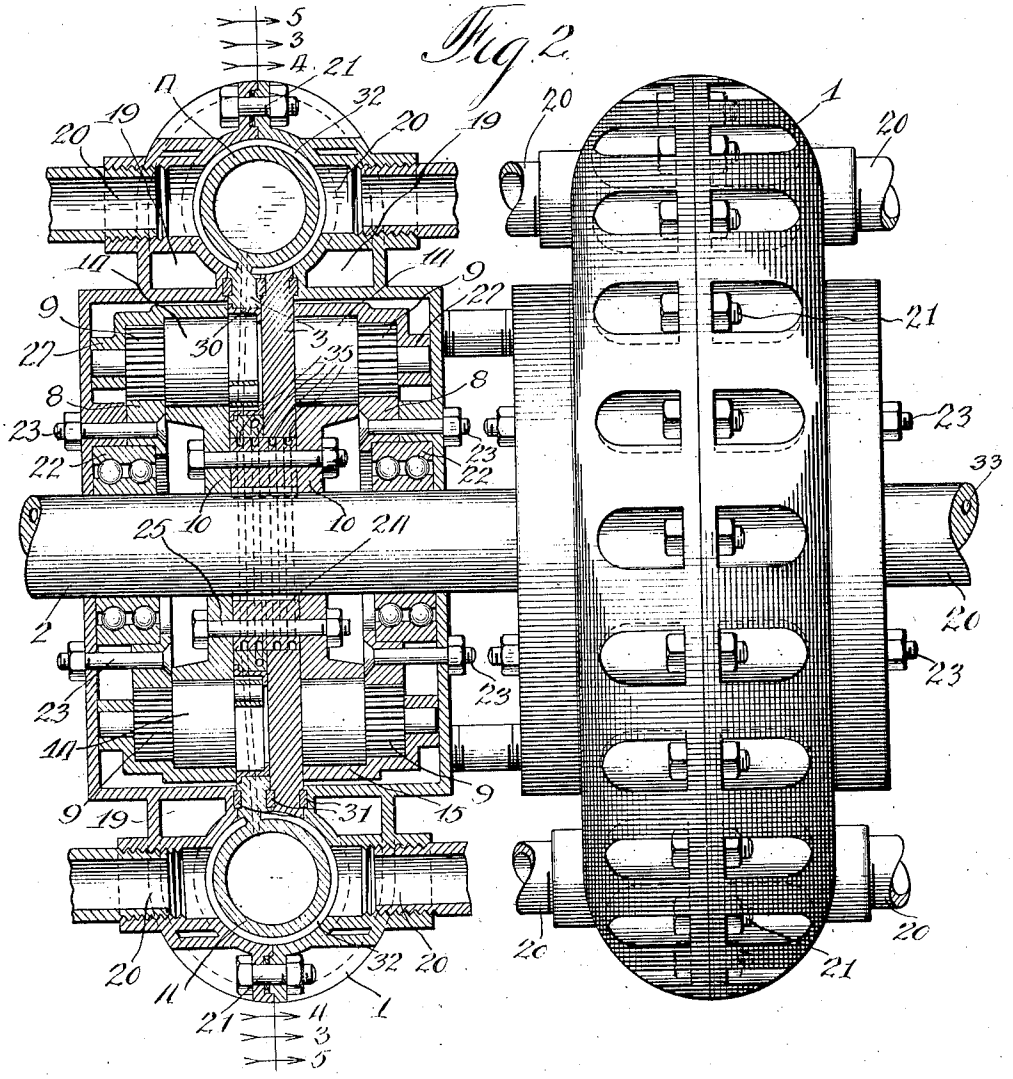
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ROTARY ENGINE

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Fig. 2.



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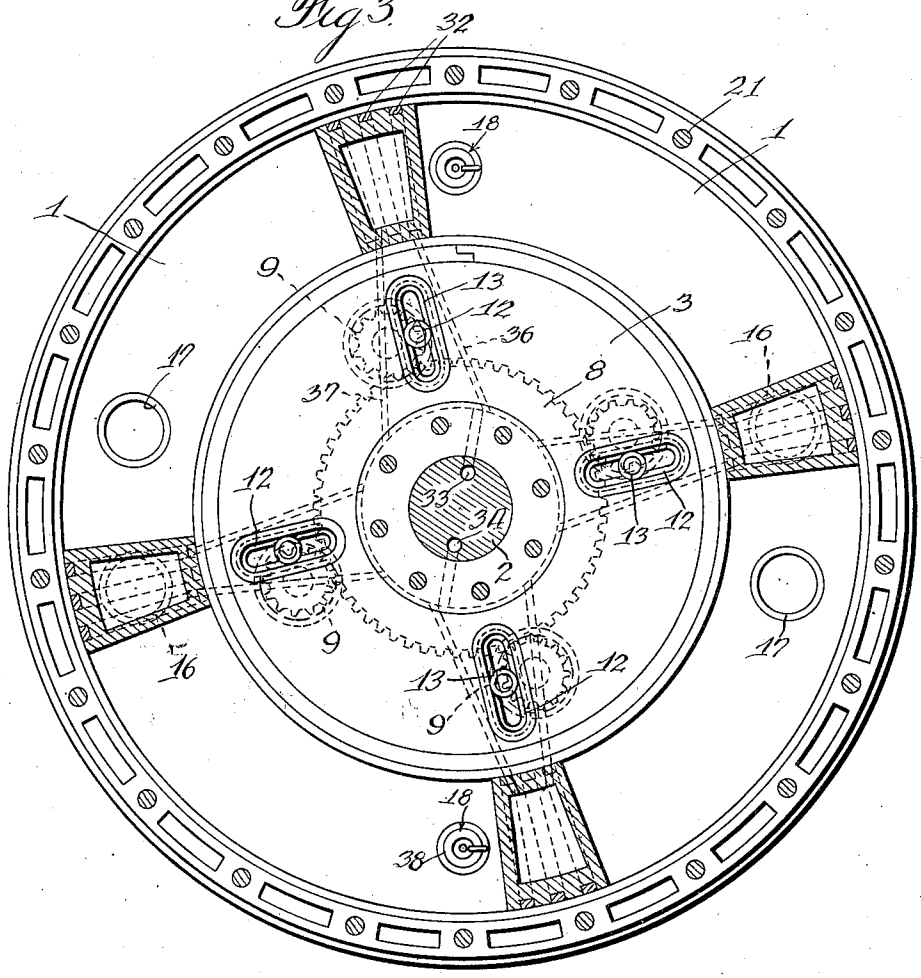
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ROTARY ENGINE

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Fig 3.



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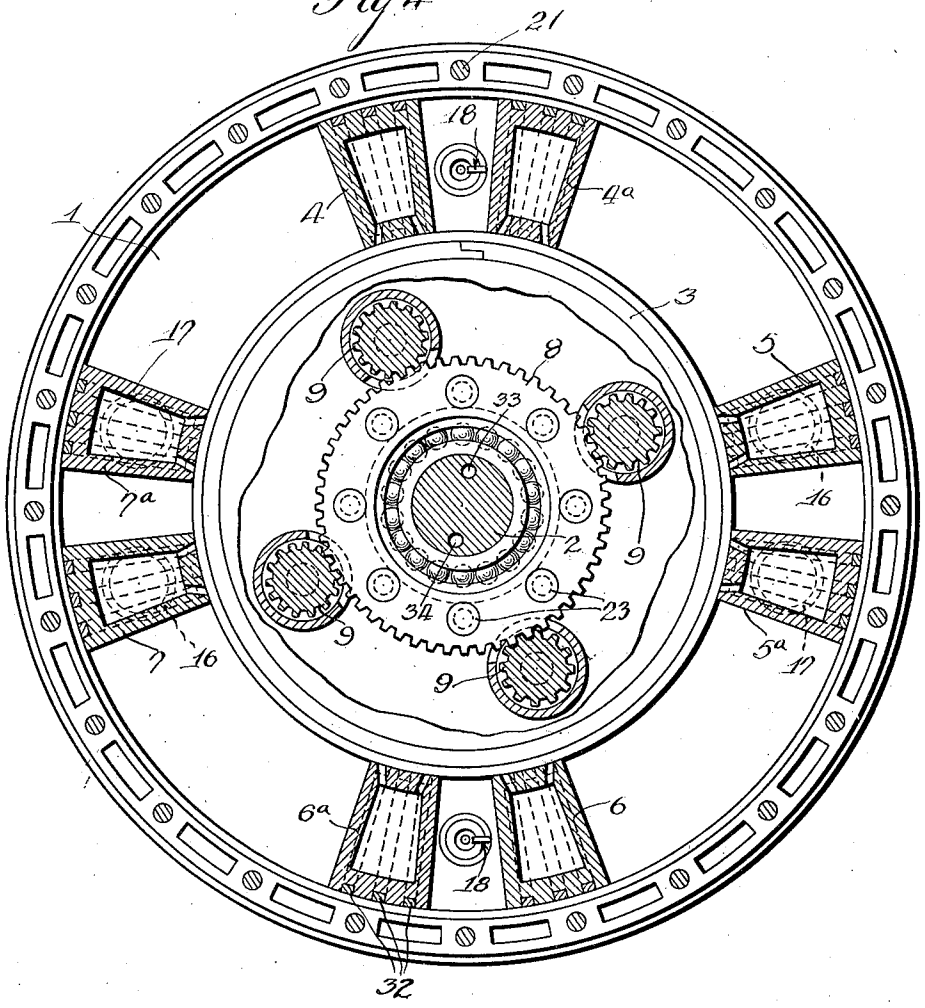
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ROTARY ENGINE

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Fig 4



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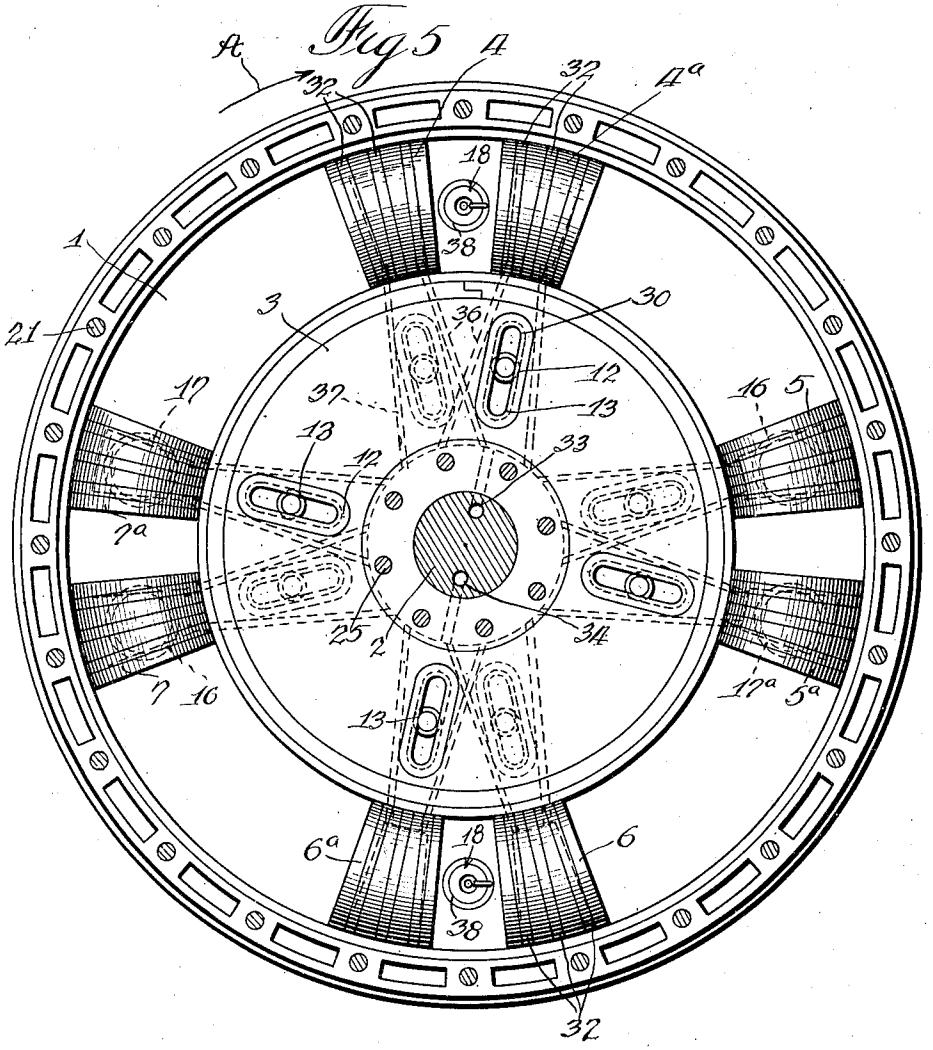
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ROTARY ENGINE

Filed Oct. 14, 1929 7 Sheets-Sheet 5

Fig 5



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ROTARY ENGINE

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Fig. 6.

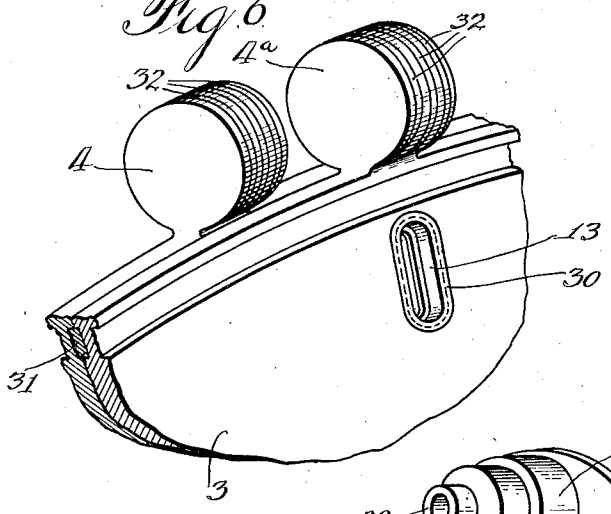


Fig. 7.

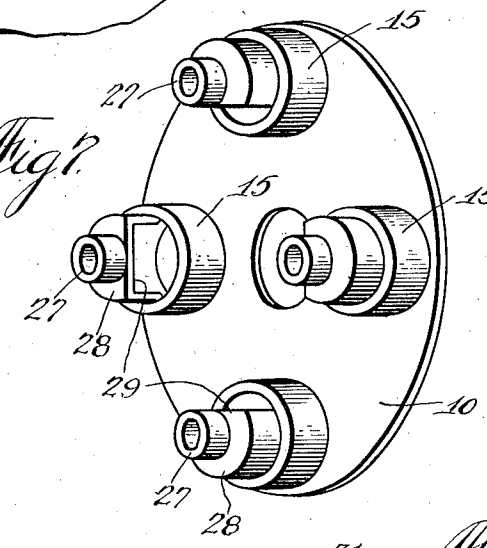


Fig. 8

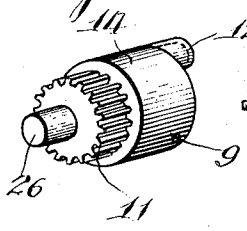
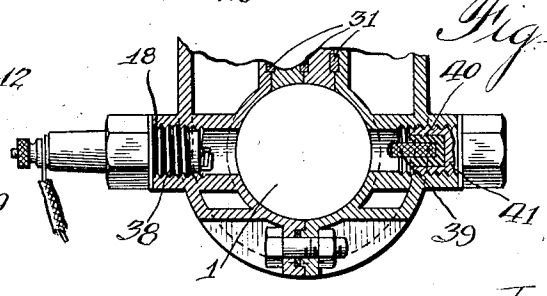


Fig. 14.



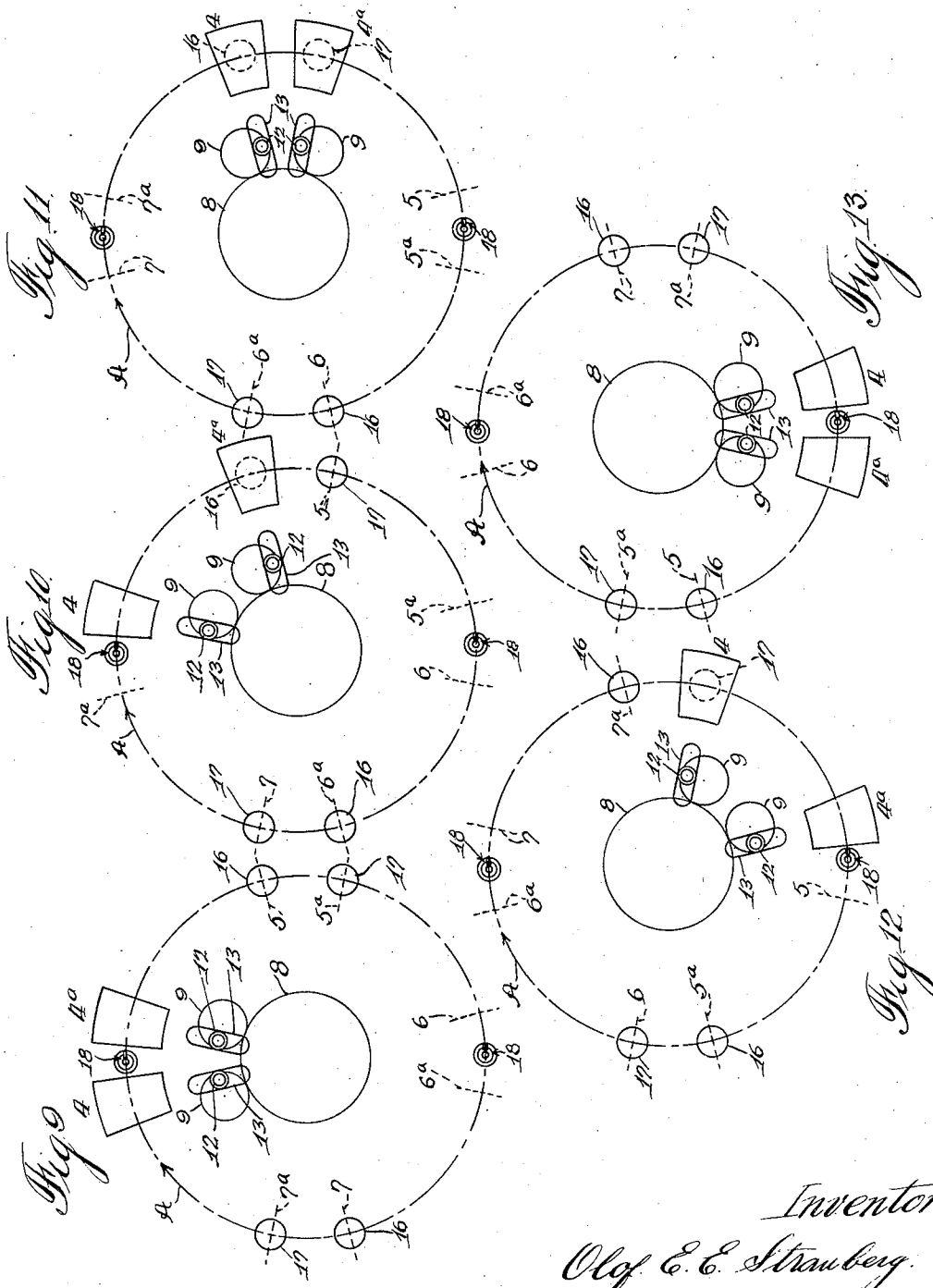
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ROTARY ENGINE

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Patented Sept. 11, 1934

1,973,397

UNITED STATES PATENT OFFICE

1,973,397

ROTARY ENGINE

Olof E. E. Stromberg, Chicago, Ill.

Application October 14, 1929, Serial No. 399,432

11 Claims. (Cl. 123—11)

My invention relates to rotary engines and more particularly to rotary engines of the type having an annular cylinder in which two sets of pistons operate, the two sets of pistons rotating at variable speeds whereby relative oscillation between the two sets of pistons is obtained.

One of the objects of my invention is to provide a construction of this type which will be very compact, smooth acting, and powerful, having little weight in proportion to the horsepower.

A further object of my invention is to reduce to a minimum the number of parts required.

A further object is to provide a construction which will be durable and efficient.

A further object is to provide improved means for cooling the engine.

Further objects will appear from the description and claims.

In the drawings, in which an embodiment of my invention is shown—

Figure 1 is an end elevation of my improved engine;

Fig. 2 is a part elevational, part sectional view showing two similar units;

Fig. 3 is a section substantially on the line 3—3 of Fig. 2 showing one set of pistons;

Fig. 4 is a section substantially on the line 4—4 of Fig. 2 showing two sets of pistons in place;

Fig. 5 is a section substantially on the line 5—5 of Fig. 2 showing both piston-carrying discs in place;

Fig. 6 is a perspective view showing juxtaposed parts of the two piston-carrying discs;

Fig. 7 is a perspective view of one of the crank pinion carriers;

Fig. 8 is a perspective view of one of the crank pinions;

Fig. 9 is a diagrammatic view showing two pistons at the beginning of the power stroke;

Fig. 10 is a diagrammatic view showing the same two pistons at the end of the power stroke;

Fig. 11 is a similar view showing the same two pistons at the end of the exhaust cycle;

Fig. 12 is a similar view showing the same pistons at the end of the intake cycle;

Fig. 13 is a view of the same two pistons at the end of the compression stroke or the beginning of the power stroke; and

Fig. 14 is a sectional view showing the dual ignition system.

In general, the construction shown comprises a stationary annular cylinder 1, a rotary driven shaft 2, two piston-carrying discs 3, each having a variable speed rotary motion with respect to the stationary cylinder 1 and an oscillatory motion with respect to each other, two sets of pistons 4, 5, 6, 7, 4*a*, 5*a*, 6*a* and 7*a* (as shown, four in each set) one set carried by each piston-carrying disc 3, two stationary external gears 8, coaxial with the driven shaft 2 and propulsion means between each stationary gear 8 and one of the piston-carrying discs 3, each of the propulsion means comprising a plurality (four as shown) of crank pinions 9, and a crank pinion carrier 10 secured to rotate with the driven shaft 2. Each crank pinion 9 (Fig. 8) has a pinion portion 11 meshing with the stationary gear 8, a crank pin portion 12 operating in a slot 13 in the piston-carrying disc 3, and a journal portion 14 rotatably mounted in a bearing portion 15 of the crank pinion carrier 10.

Before describing the construction in detail, I will describe in a general way the operation. Referring to Figs. 5 and 9 to 13, inc., and following first the operation with respect to the two pistons 4 and 4*a* (which is identical with the operation of all of the other pistons) and assuming that the engine has been put in motion in the direction of the arrow A, and that the ignition of the charge between the cylinders 4 and 4*a* has just taken place, it will be seen that as the momentum of the parts carries the pistons 4 and 4*a* to the right, the crank pin 12 corresponding to the piston 4*a* will move radially outwardly in the slot 13 while the crank pin 12 corresponding to the piston 4 will move radially inwardly in the slot 13. This will give the piston 4*a* an advantage in leverage over the piston 4 and, as a result, the tendency of the ignited gas to expand, acting on the pistons 4 and 4*a*, will exert a greater rotational effect on the pinion 9 corresponding to the piston 4*a* than on the pinion 9 corresponding to the piston 4 and hence a greater rotational effect will be exerted in the direction of the arrow A than in the reverse direction. The condition just disclosed corresponds to the condition shown in Fig. 9. This advantage in leverage of the piston 4*a* over the piston 4 will continue throughout the entire power stroke or until the pistons are in the position shown in Fig. 10 at which point the leverage has again become equal as in Fig. 9 and the space between the pistons 1 and 1*a* is about to be opened to the exhaust through the exhaust port.

Parenthetically, it is to be noted that the pistons 4 and 7*a* now occupy the same relation position as was occupied by the pistons 4*a* and 4 in Fig. 9 so that the pistons 4 and 7*a* are now in position to go through the power cycle. Going back now to the operation of the pistons 4*a* and 4, the momentum of the parts and the power ex-

erted by the power stroke of other pistons, now effective, will move the pistons 4 and 4*a* through the exhaust cycle from the position shown in Fig. 10 to the position shown in Fig. 11 in which the space between the pistons 4 and 4*a* will be exhausted of the burnt gas through the exhaust port 16.

The momentum and power of other pistons will then carry the pistons 4 and 4*a* through the charging cycle from the position shown in Fig. 11 to the position shown in Fig. 12, the relative motion of the pistons 4 and 4*a* through these various cycles being determined by the action of the crank pinions 9 between the stationary gear 8 and the two piston-carrying discs 3. In the movement from the position shown in Fig. 11 to the position shown in Fig. 12, a fresh charge of gas will be drawn in through the gas inlet port 17 to the space between the pistons 4 and 4*a*. Continued movement of the crank pinion carriers 10 will cause the pistons 4 and 4*a* to move from the position shown in Fig. 12 to the position shown in Fig. 13 in which the charge will be compressed in the space between the pistons 4 and 4*a* ready to be ignited to effect another power cycle, ignition means being provided at the two diametrically opposite points as indicated at 18. It will thus be seen that two explosions take place behind each piston for every revolution of the driven shaft so that for the construction in which 8 pistons are provided there will be 16 power impulses per revolution of the driven shaft 2. This results in a very compact, smooth acting, powerful engine having little weight in proportion to its horsepower.

Coming now to a more detailed description of the construction, the annular cylinder 1 may be water-jacketed, as indicated, to provide chambers 19 for the circulation of a cooling medium, suitable passages 20 being provided through this water jacket for the inlet and exhaust passages. The cylinder and water jacket may be made in two mating halves secured together by means of bolts 21. The housing for the shaft bearings 22, gears 8, crank pinions 9 and associated parts may also be formed as integral parts of the cylinder castings. The ball bearings 22 of the driven shaft may be seated in recesses in the cylinder castings. The stationary gears 8 may be secured to the cylinder castings by means of bolts 23. The crank pinion carriers may be secured to an intermediate collar 24 by means of bolts 25, this intermediate collar 24, in turn, being keyed to the driven shaft 2 so that the crank pinion carriers 10 and collar 24 rotate as a unit with the driven shaft 2. Each crank pinion 9 is provided with two journal portions 14 and 26, a smaller journal portion 26 mounted in a reduced bearing portion 27 of the carrier 10 and a larger journal portion 14 mounted in an enlarged bearing portion 15, the pinion itself operating in a housing portion 28 cut away at one side to permit engagement of the pinion 9 with the stationary gear 8, as indicated at 29. The slot 13 in the piston carrier 3 may be provided with a bushing or lining 30 of suitable material, such as brass for cooperation with the steel crank pin 12 of the crank pinion 9. Suitable annular packing rings 31 may be provided between the piston-carrying discs 3 and the cylinder 1 and between the piston-carrying discs themselves. The pistons themselves may be provided with split piston rings 32 which may be snapped into suitable grooves provided in the pistons. If desired, a cooling medium may be supplied to the interior of the pistons, the cooling medium being introduced through the driven shaft 2 and thence outwardly to the pistons through the collar 24 and piston-carrying discs 3. For this purpose, the driven shaft 2 is provided with inlet and outlet passages 33 and 34 and the collar 24 is provided on its periphery with four annular grooves 35, two of which are in communication with the inlet passage 33 of the shaft and two of which are in communication with the outlet passage 34, thus providing an inlet and an outlet passage for each of the piston-carrying discs. The chamber in each piston is connected with one of the annular grooves 35 in the collar through a slanting inlet passage 36 and with another of the annular passages in the collar through a slanting outlet passage 37, thus providing for circulation of the cooling medium into and out of the pistons.

It will be seen that the construction shown lends itself to multiple unit design as shown in Fig. 2, in which two units are shown, having common inlet and exhaust passages whereby a single fuel supply will provide for a plurality of units and similarly a common exhaust will suffice.

It will be seen that I have designed a construction which is very compact, smooth acting, and powerful, having little weight in proportion to the horsepower and in which the number of parts required is reduced to a minimum.

I may find it desirable to provide a dual ignition system, one system employing a distributor and spark plugs and the other employing ignition elements heated by the fuel combustion and maintained in a state of incandescence or, at least, at a temperature sufficiently high to ignite the compressed charge. The two systems might be used concurrently, so that if one ignition element should fail there would still be the other one to be depended on, or they might be used independently, the spark plug and distributor system being used in starting and until the other ignition elements become warmed up and the combustion system being used thereafter, suitable switch mechanism being provided for cutting out the spark plug system at the proper stage. This might also be combined with a selective fuel supply in which a relatively high grade of fuel might be employed until the engine had become warmed up whereupon a change could be made to the lower grade fuel.

Referring to Fig. 14, illustrating the dual ignition system, on one side there is provided the spark plug 38 which may be of any usual or suitable type for use with a suitable distributor while on the other side is shown the combustion heated ignition plug comprising an element 39 of suitable material which will be heated by the combustion within the cylinder to a temperature sufficient to cause the ignition of the compressed charge, the combustion maintaining the element at this temperature so that in effect the pistons themselves serve as the timing element. This combustion-heated element may be mounted in a suitable heat-insulating socket 40 which, in turn, is seated in a recess in the plug 41, screwed into the side of the cylinder wall.

While I have shown my invention as embodied in an internal combustion engine, it is obvious that in some of its aspects it might be applicable to engines other than the internal combustion type.

I claim:

1. A rotary annular cylinder engine comprising a stationary annular cylinder having a shaft

extending centrally therethrough, two juxtaposed rotatable piston-carrying members loosely mounted on said shaft, two sets of pistons, one set mounted on each member, means whereby the members are caused to have relative oscillation as they rotate to cause the pistons of one set to approach and recede with respect to the pistons of the other set, and means for supplying a cooling liquid through said shaft to the interior of said pistons.

2. A rotary annular cylinder engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston-carrying members loosely mounted on said shaft, two sets of pistons, one set mounted on each member, means whereby the members are caused to have relative oscillation as they rotate to cause the pistons of one set to approach and recede with respect to the pistons of the other set, and means in said shaft and piston-carrying members for supplying a cooling liquid through said shaft and piston-carrying members to the interior of said pistons.

3. A rotary annular cylinder engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members loosely mounted on said shaft, two sets of pistons, one set mounted on each member, means whereby the members are caused to have relative oscillation as they rotate to cause the pistons of one set to approach and recede with respect to the pistons of the other set, said shaft being provided with passages, and means for circulating a cooling liquid from the passage in said shaft to the interior of said pistons and back again to said shaft.

4. A rotary annular cylinder engine comprising a stationary annular cylinder having a shaft extending centrally therethrough with a collar fixedly mounted thereon, two juxtaposed rotatable piston carrying members loosely mounted about said collar, two sets of pistons, one set mounted on each member, means whereby the members are caused to have relative oscillation as they rotate to cause the pistons of one set to approach and recede with respect to the pistons of the other set, and means in said shaft, said collar and said piston-carrying members for supplying a cooling liquid from said shaft to the interior of said pistons.

5. A rotary annular cylinder engine comprising a stationary annular cylinder having a shaft extending centrally therethrough with a collar fixedly mounted thereon, two juxtaposed rotatable piston carrying members loosely mounted about said collar, two sets of pistons, one set mounted on each member, means whereby the members are caused to have relative oscillation as they rotate to cause the pistons of one set to approach and recede with respect to the pistons of the other set, said shaft being provided with passages and said collar having annular grooves on the periphery thereof which communicate with the passages of said shaft, and means for supplying a cooling fluid from said annular grooves through said piston-carrying members to the interior of said pistons.

6. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member, a stationary gear and transmission means between said gear and said members, a carrying member fixedly mounted on said shaft for carrying said propulsion means comprising a circular plate, bearing members on a face of said plate at a uniform distance from said shaft, each of said bearing members having an inner and an outer bearing portion, and a housing portion between, said housing portion being cut away on the side facing said shaft.

7. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member, a stationary gear and transmission means between said gear and said members, a carrying member fixedly mounted on said shaft for carrying said propulsion means comprising a circular plate, bearing members on the face of said plate at a uniform distance from said shaft, each of said bearing members having an enlarged bearing portion, a reduced bearing portion, and a housing portion therebetween cut away on the side facing said shaft.

8. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member, a stationary gear and transmission means between said gear and said members, a carrying member fixedly mounted on said shaft adjacent one of said piston carrying members for carrying said propulsion means comprising a flat circular plate having bearing members secured to the outer face of said plate at a uniform distance from said shaft and equidistant from each other, each of said bearing members having an enlarged inner bearing portion adjacent said plate, a reduced bearing portion at the outer end of said bearing member and a housing portion between said bearing portion, said housing portion being cut away on the side facing said shaft.

9. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member and a stationary gear, a set of crank pinions and a carrying member fixedly mounted on said shaft for carrying said crank pinions, each of said crank pinions having a pinion with a bearing portion on each side thereof, said carrying member comprising a circular plate having bearing members on a face thereof at a uniform distance from said shaft, each of said bearing members having a housing portion open on one side for housing said pinion and a bearing portion on each side thereof for receiving the bearing portions of said crank pinion.

10. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member and a stationary gear, a set of crank pinions and a carrying member fixedly mounted on said shaft for carrying said crank pinions, each of said crank pinions having a large and a small bearing portion with a pinion between, said carrying member comprising a circular plate having bearing members on the face thereof at a uniform distance from said shaft, each of said bearing members having a reduced bearing portion and an enlarged bearing portion for receiv-

ing respectively the small and large bearing portions of said crank pinion, and a housing portion between said bearing portions, said housing portion being open at the side facing said shaft.

11. In a rotary engine comprising a stationary annular cylinder having a shaft extending centrally therethrough, two juxtaposed rotatable piston carrying members, two sets of pistons operating in said cylinder, one set mounted on each member and a stationary gear, a set of crank pinions and a carrying member fixedly mounted on said shaft for carrying said crank pinions, each of said crank pinions having a large inner bearing portion and a small outer bearing portion with a pinion between and a crank pin at the end adjacent said large bearing portion, said pinion meshing with said gear and the crank pin engaging a slot in one of said piston carrying members, said carrying member comprising a circular plate having bearing members on the face thereof at a uniform distance from said shaft and equidistant from each other, each of said bearing portions having a reduced outer bearing portion and an enlarged inner bearing portion for receiving respectively a small and larger bearing portion of said cranking pinion and a housing between said bearing portions, said housing portion being open at the side facing said shaft.

OLOF E. E. STROMBERG.