

Feb. 28, 1933.

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1,899,374

ENGINE

Filed Jan. 2, 1932

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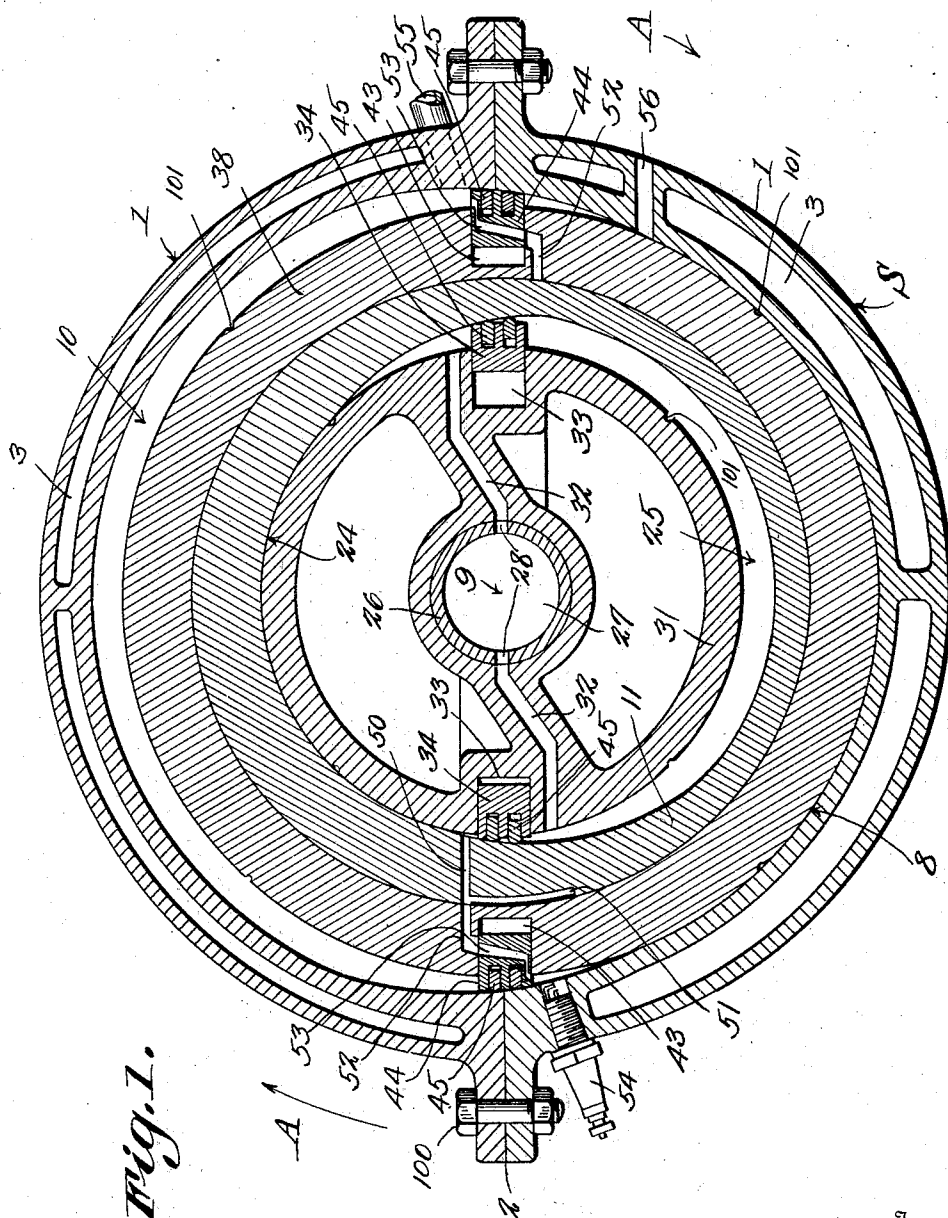


Fig. 1.

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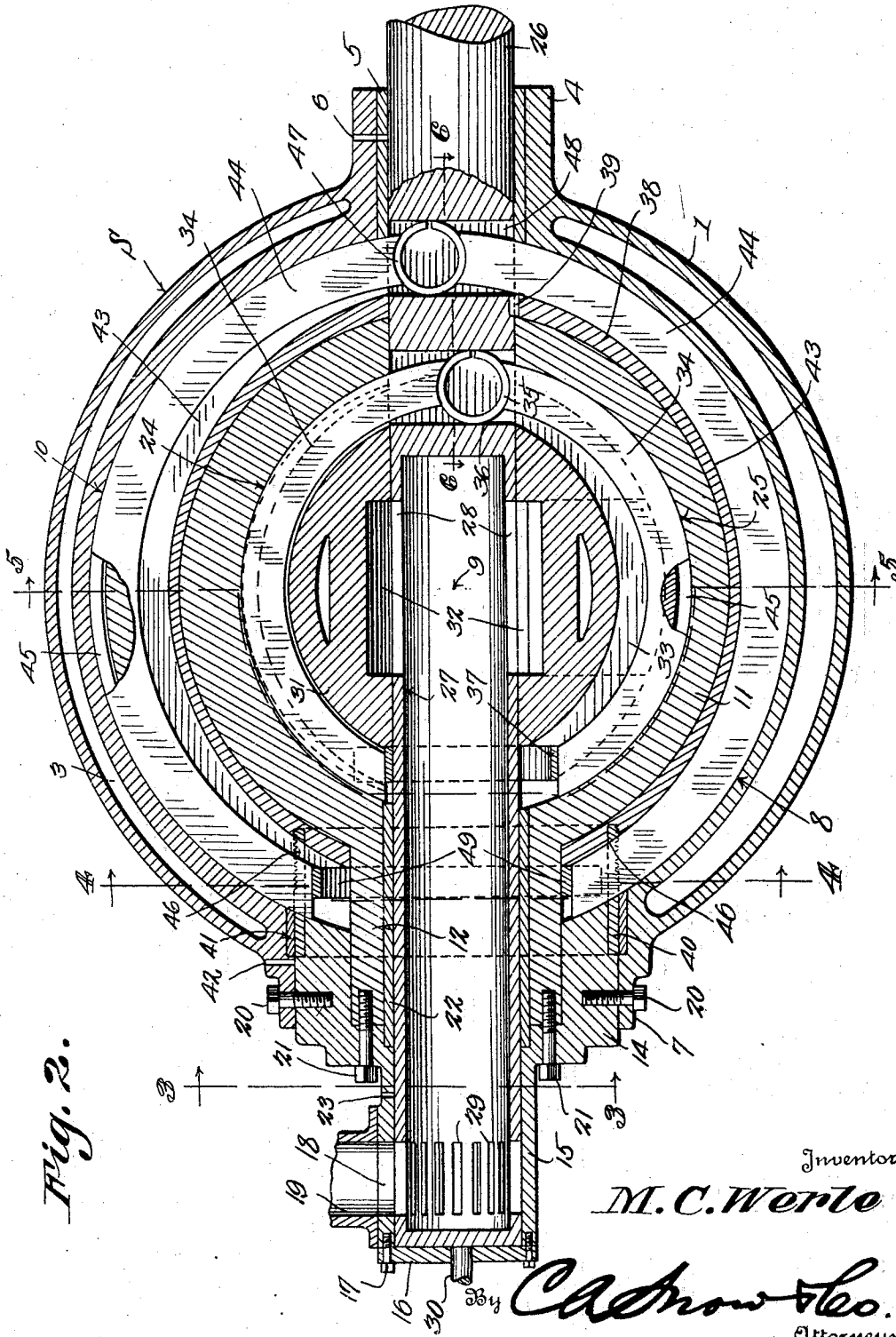


Fig. 2.

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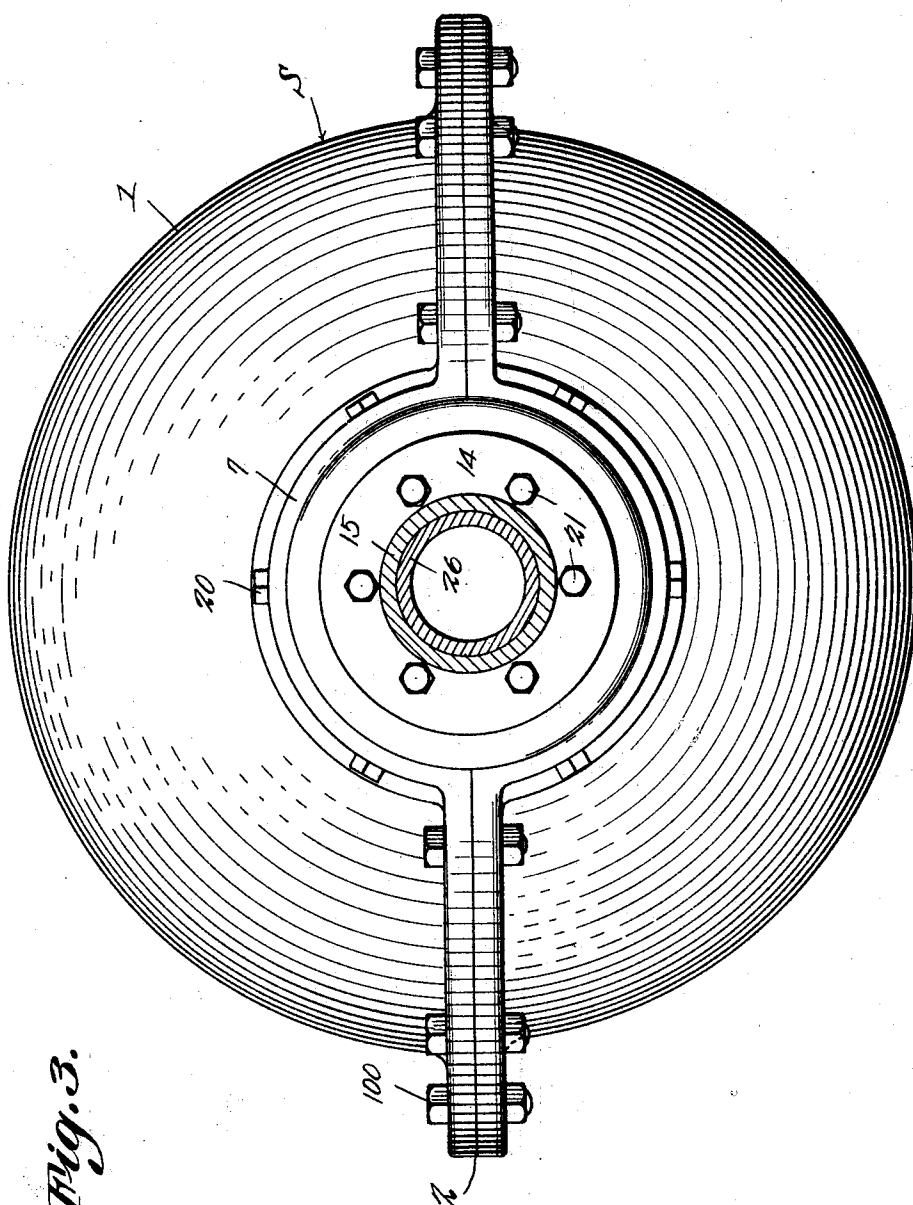


Fig. 3.

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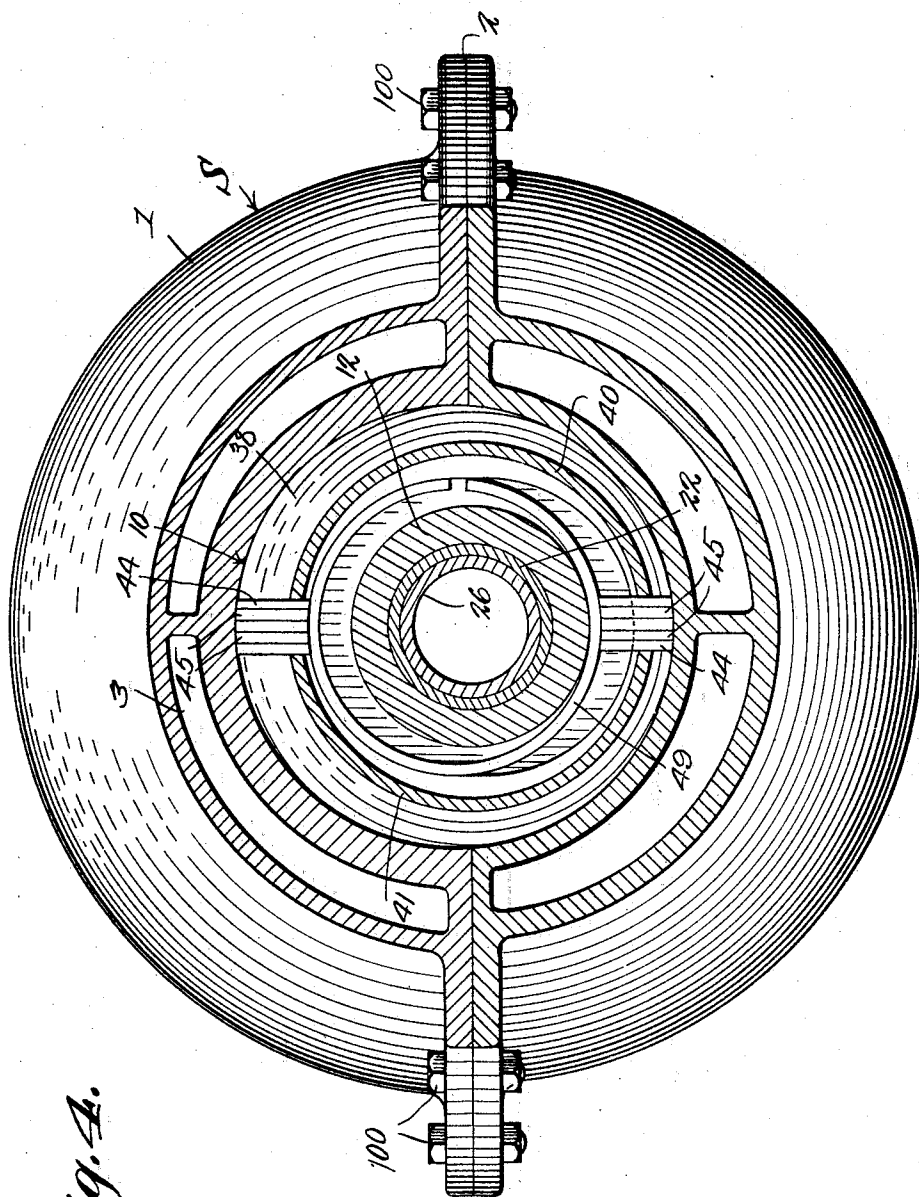


Fig. 4.

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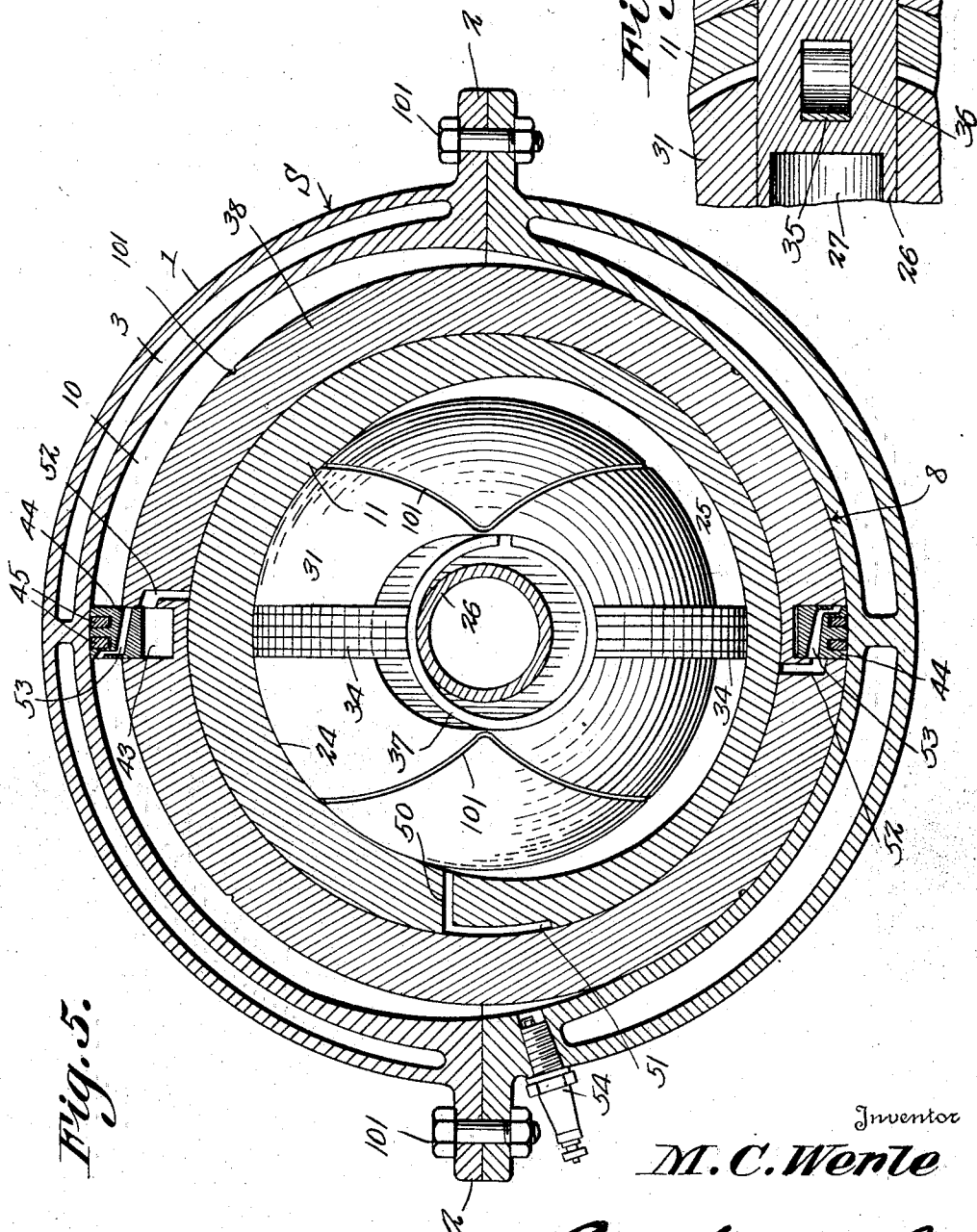


Fig. 5.

Fig. 6.

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6 Sheets-Sheet 6

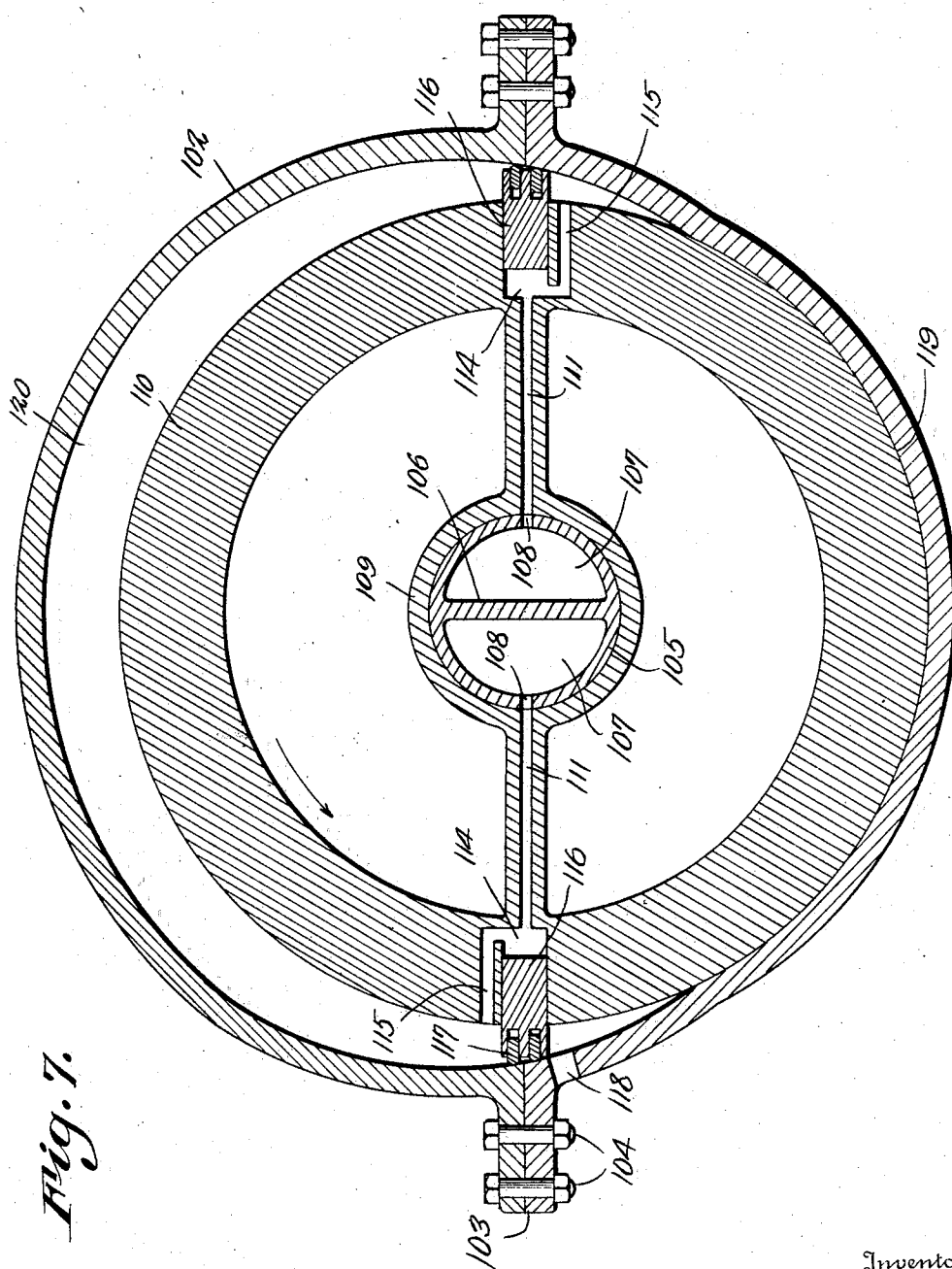


Fig. 7.

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UNITED STATES PATENT OFFICE

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ENGINE

Application filed January 2, 1932. Serial No. 584,480.

This invention aims to provide a rotary engine of simple construction, embodying approximately spherical members, contained one within the other, and so arranged that a charge will be drawn in, compressed, and conducted to the explosion chamber. Although the device has been shown in the form of an internal combustion engine, it will be understood, without extensive illustration or explanation, that the principles involved may be embodied in many other structures beside an internal combustion engine.

It is within the province of the disclosure to improve generally and to enhance the utility of devices of that type to which the invention appertains.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, may be made within the scope of what is claimed, without departing from the spirit of the invention.

In the accompanying drawings:—

Fig. 1 shows, in vertical section, a device constructed in accordance with the invention;

Fig. 2 is a section at right angles to Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 2;

Fig. 6 is a section on the line 6—6 of Fig. 2;

Fig. 7 is a sectional view showing a modification.

In carrying out the invention, there is provided a stator, which, as a whole, is designated by the letter S.

The stator S comprises an outer member 1 which, as to exterior surface, may be in the form of a sphere, the outer member 1 of the stator being supported in any suitable way, preferably by outstanding flanges 2, containing the securing elements 100 that hold the constituent parts of the outer member 1 of the stator together. The outer member 1 of the stator S may be water-jacketed, as shown at 3, although any other means for cooling the engine may be provided.

The outer member 1 of the stator is supplied with an outwardly extended tubular projection 4, shown in Fig. 2, and in this projection, a bearing 5 is secured, the projection and the bearing having an oil hole 6, it being understood that the aforesaid oil hole, and any other oil holes hereinafter mentioned, may be taken to represent any suitable means for lubricating the shaft 26, hereinafter alluded to as well as all other parts that need lubrication.

Fig. 2 of the drawings shows that the outer member 1 of the stator is provided with an outwardly extended projection 7, disposed diametrically opposite to the projection 4.

The lower part of the cavity of the outer member 1 of the stator is designated by the numeral 8, and is spherical, the center of this spherical surface being a point 9 in the axis of rotation of the shaft 26. The upper part of the cavity of the outer member 1 of the stator is enlarged and curved, to form an explosion chamber 10. The surface of the explosion chamber 10 merges into the surface of the part 8 of the cavity in the outer member 1.

Disposed within the outer member 1 of the stator S is the inner member 11 of the stator, and as to outer surface, the inner member 11 is spherical. The inner member 11 of the stator has a tubular extension 12, to be seen in Fig. 2, the tubular extension 12 projecting into a ring 14 having a reduced tubular neck 15, on the outer end of which a cap 16 is secured at 17. Near to its outer end, the neck 15 has an inlet port 18 in its upper side, the said inlet port communicating with a fuel inlet 19, which is secured to the neck 15. Securing elements 20 connect the ring 14 with the projection 7 of the outer member 1 of the stator, and securing elements 21 connect the ring 14 with the end of the tubular extension 12 of the inner member 11, the inner member 11 and the outer member 1 thus being joined fixedly together. A bearing 22 is mounted in the extension 12 of the inner member 11 of the stator, and projects into the ring 14, as Fig. 2 will show. The neck 15 carries an oil hole 23, located outwardly of the bearing 22. The upper part 24 of the interior of the in-

ner member 11 of the stator is spherical, but the lower part of the interior of the member 11 is enlarged and curved, as shown at 25 to form a compression chamber.

5 A shaft 26, hereinbefore alluded to incidentally, is journaled for rotation in the bearing 5, in the bearing 22, and in the neck 15 of the ring 14, the shaft 26 and other parts of the engine being capable of being lubricated through the oil holes 6 and 23, or in any other suitable manner. The shaft 26 has a longitudinal bore 27, and near to the inner end of the bore 27, the shaft 26 is provided with oppositely disposed outlet ports 28. At 10 the outer end of the shaft 26 there are circumferentially arranged inlet ports 29, which, as shown in Fig. 2, communicate with the fuel inlet port 18 of the neck 15 and with the fuel inlet member 19. The shaft 26 has a reduced end 30, projecting outwardly through the cap 16, and adapted to operate the timer (not shown), or for any other purpose.

A spherical compressor 31 is mounted on the shaft 26, and has oppositely disposed passages 32, communicating with the ports 28 of the shaft, the compressor being secured to the shaft.

The spherical compressor 31 is provided with an external circumferential groove 33, in which lies the parts 34 of a resilient compression ring. The compression ring 34 has sliding movement in the groove 33 of the compressor 31, and is adapted to follow the curved walls 24 and 25 of the inner member 11 of the stator. Between the ends of the parts 34 of the compression ring is located a spring expansion ring 35, which can be seen in Fig. 2. The ring 35, and the adjacent ends of the parts 34 of the compression ring can slide in a transverse opening 36 which is formed in the shaft 26. A spring ring 37 surrounds the shaft 26 and is interposed between those ends of the parts 34 of the compression ring which are opposite to the ends engaged by the ring 35, and the ring 37 is large enough so that it can move transversely of the shaft 26, as the ring parts 34 slide up and down, in Fig. 2, to cooperate with the inner surfaces 24 and 25 of the member 11 of the stator.

The outer surface of the compressor 31 is spherical, and the compressor is enclosed within a rotor 38, which has external oil grooves 101. One side of the rotor 38 is secured at 39 in Fig. 2 to the shaft 26. Into the opposite portion of the rotor 38 is threaded or secured otherwise, a short tubular shaft 40, surrounding and spaced from the extension 12 of the inner member 11 of the stator, the shaft 40 being mounted to turn in a bearing 41 carried by the outer member of the stator, oil being supplied to the shaft 40 and other parts of the engine through an oil hole 42 in the projection 7 of the outer member 1 of the stator.

On its outer surface, the rotor 38 has a circumferential groove 43, in which are slidably mounted the parts 44 of a resilient abutment ring, which receives the force of the exploding charge, as will be explained hereinafter. Both the parts 44 of the abutment ring, and the parts 34 of the compression ring, may be supplied with the usual packings 45. The short tubular shaft 40 of the rotor 38 has openings 46, receiving the ends of the parts 44 of the abutment ring, and within the shaft 40, about the tubular extension 12 of the inner member 11 of the stator is disposed a spring ring 49, interposed between the parts 44 of the abutment ring. The ring 49 is considerably larger than the part 12. Between the opposite ends of the parts 44 of the abutment ring is placed a ring 47, like the ring 35, and movable in an opening 48 in the shaft 26. The general construction is such that the abutment ring parts 44 can slide, as one piece, in groove 43 of the rotor 38, so as to enable the said abutment ring parts to follow and conform to the inner surfaces 8 and 10 of the outer member 1 of the stator.

In the stator 11 there is a port 50, having a circumferential extension 51 (Fig. 1) located on the outer surface of the stator 11, and this extended part 51 of the port 50 is adapted to cooperate with transverse passages 52 in the rotor 38, the passages 52 communicating with transverse conduits 53 in the parts 44 of the abutment ring, and the conduits 53 communicating at their outer ends, with the space between the rotor 38 and the inner surface of the member 1 of the stator. The charge may be fired by any suitable means, for instance a spark plug 54, carried by the outer member 1 of the stator, and disposed of in the position shown in Fig. 2, near the lower edge of the explosion chamber 10. At a point approximately opposite to the spark plug 54, the outer member 1 of the stator has an exhaust 55 that communicates with the explosion chamber 10. At the extreme lower part of the explosion chamber 10 (Fig. 1) and below the exhaust 55, the outer member 1 of the stator is supplied with a vent 56.

In practical operation, suppose that the shaft 26, the compressor 31, and the rotor 38, are turning in the direction of the arrow A in Fig. 1. The compression ring 34, sliding to the right in Fig. 1, in the groove 33 of the compressor 31, follows at the outer wall of the compression chamber 25 in the stator 11, and a charge is sucked into the compression chamber 25 of the inner member 11 of the stator, through the passage 32 of the compressor 31, the port 28 of the shaft 26, the longitudinal bore 27 of the said shaft, the inlet ports 29, the port 18, and the fuel inlet 19. When the part of the compression ring 34 which is at the left hand side of the compressor 31 in Fig. 1 gets to a position spaced

a little above the position occupied by the right hand part of the ring in Fig. 1, the compression of the charge begins, and is continued as the ring moves toward the position shown at the left hand side of Fig. 1. The rotor 38 turns with the compressor 31 and the shaft 26, and a time arrives when there is established a flow-line for the compressed fuel, from the compression chamber 25 of the inner member 11 of the stator, to the explosion chamber 10 of the outer member of the stator. This time is when the inner end of the passage 52 in the rotor 38 is at the lower end of the circumferential extension 51 of the port 50 in the inner member 11 of the stator, and the said flow-line comprises the port 50 in the inner member 11 of the stator and the conduit 53 in the left hand part of the ring 44 in Fig. 1, the circumferentially elongated extension 51 of the port 50 giving the compressed fuel time to enter the explosion chamber 10 in the outer member 1 of the stator, below the left hand part of the ring 44, which, it is to be recalled, is moving in the direction of the arrow A. When the passage 52 in the rotor 38 is clear of the port 50, the charge is trapped in the compression chamber 10, behind the ring 44. When the charge is fired by the spark plug 54 or its equivalent, rotation is imparted to the rotor 38 and the shaft 26, the ring 44 being carried outwardly, by engagement with the curved surface shown at 8, to follow the outer wall of the explosion chamber 10.

As the left hand side of the ring 44, in Fig. 1, moves in the direction of the arrow A, it scours out, through the exhaust 55, any increment of the previously exploded charge which may be in the explosion chamber 10, ahead of the ring 44. The vent 56 lets out the small part of the charge which otherwise would be trapped in the lower right hand part of the chamber 10, below the right hand part of the ring 44, in Fig. 1.

Generally stated, the compressor 31 compresses the charge in the compression chamber 25 of the inner member 11 of the stator, and the compressed charge flows through the ports 50 and 52 into the explosion chamber 10 of the outer member of the stator, the charge being there exploded, behind the left hand part of the ring 44 in Fig. 1, the rotor being turned, rotation being imparted to the shaft 26, and the charge, after explosion, finding an exit mainly through the exhaust 55, but to a small extent through the vent 56 also.

The general principle involved in the structure hereinbefore described is capable of being employed in pumps, steam engines, and many other devices of a like kind. It is not possible or desirable to show all the forms which the invention may take, but one modification is delineated in Fig. 7, which shows an engine adapted to be operated by steam,

compressed air, or any other suitable fluid.

The stator is designated by the numeral 102 and has intermediate supporting flanges 103 connected by securing elements 104. In the stator 102, a shaft 105 is journaled. The shaft 105 is hollow and has a longitudinal partition 106, defining longitudinal inlets 107 in the shaft, the steam, compressed air, or other fluids being admitted into the inlets 107, alternately, by any suitable mechanism forming no part of the present invention. The hollow shaft 105 has oppositely disposed ports 108 communicating with the inlets 107. The shaft 105 is secured within the hub 109 of a rotor 110 located within the stator 102. The rotor 110 has diametrically opposite passages 111, communicating at their inner ends with the ports 108 on the shaft 105, and communicating at their outer ends with a circumferential groove 114 in the rotor 110, the groove 114 having offset outlet ports 115, which communicate with the space between the stator 102 and the rotor 110. A ring 116 is slidable in the groove 114, and is resilient and expansible, the ring being expanded by any suitable means, such as that shown at 35 in Fig. 2. The ring 116 carries packings 117 adapted to cooperate with the inner surface of the stator 102. The stator 102 has an exhaust port 118.

The rotor 110 is spherical on its outer surface. In the lower part of the inner surface of the stator 102 is also spherical, and conforms closely to the external surface of the rotor 110. The lower part of the inner surface of the stator 102 is designated by the numeral 119. The upper part of the cavity in the stator 102 is enlarged to form an expansion chamber 120.

The steam or compressed air is admitted into the inlets 107 of the shaft 105 alternately. The steam flows outwardly, to the right, for example, in Fig. 7, through the port 108 and the passage 111 into the right hand groove 114, and out of the groove 114, by way of the corresponding port 115. The pressure fluid thus is behind or below the ring 116, and the rotor 110 is caused to move in the direction of the arrow, until the exhaust port 118 is passed, whereupon the pressure fluid will discharge through the said port. By admitting the pressure fluid alternately into the inlets 107 of the shaft 105 the rings 116, one after another, exercise their function in an obvious manner, the rings sliding in the rotor 110 and keeping contact with the inner surface of the stator 102.

Having thus described the invention, what is claimed is:—

1. In a device of the class described, a stator, a rotor having an external surface forming a complete sphere, the rotor being journaled in the stator, and an expansible ring slidable in the rotor and cooperating with the inner surface of the stator, and one

part of the inner surface of the stator being spherical and conforming to the outer surface of the rotor, another part of the inner surface of the stator being bulged away from the rotor, to form an expansion chamber.

2. In a device of the class described, a stator comprising inner and outer members, a compressor journaled in the inner member, a rotor journaled between the inner and outer members, the compressor and the rotor each having a spherical external surface, the inner and outer members of the stator having cavities, portions of the walls of which are spherical, to conform, respectively, to the outer surface of the compressor and to the outer surface of the rotor, and portions of which are enlarged to form a compression chamber about the compressor, and an expansion chamber about the rotor, and means for conducting compressed pressure fluid from the compression chamber to the expansion chamber, the compressor and the rotor having oppositely expansible rings cooperating with the walls of the cavities of the inner and outer members of the stator.

3. In a device of the class described, a stator comprising inner and outer members, a hollow shaft journaled in the stator, a compressor carried by the shaft and located within the inner member of the stator, a rotor carried by the shaft and located between the inner and outer members of the stator, a compressor and rotor each having spherical external surface, the inner and outer members of the stator having cavities, portions of the walls of which are spherical, to conform respectively to the outer surface of the compressor and to the outer surface of the rotor, portions of the cavities being enlarged to form a compression chamber about the compressor, and an expansion chamber about the rotor, expansion rings slidable in the compressor and in the rotor and cooperating, respectively, with the surface of the compression chamber and with the surface of the expansion chamber, means for conducting pressure fluid from the shaft into the compression chamber, and means for conducting compressed fluid from the compression chamber into the expansion chamber.

4. A stator comprising inner and outer members, a hollow shaft journaled in the stator, a compressor carried by the shaft and located within the inner member of the stator, a rotor carried by the shaft and located between the inner and outer members of the stator, the compressor and the rotor each having a spherical external surface, the inner and outer members of the stator having cavities, portions of the walls of which are spherical, to conform, respectively, to the outer surface of the compressor and to the outer surface of the rotor, portions of the cavities being enlarged to

form a compression chamber about the compressor, and an expansion chamber about the rotor, expansion rings slidable in the compressor and in the rotor and cooperating, respectively, with the surface of the compression chamber and with the surface of the expansion chamber, the compressor having a passage leading from the interior of the hollow shaft to the compression chamber, the rotor having a port communicating with the expansion chamber, and the inner member of the stator having a port communicating with the compression chamber, and coming into contact with the port of the rotor, as the rotor is turned.

5. A device of the class described constructed as set forth in claim 4, and further characterized by the fact that the port of the inner member of the stator has an external circumferential extension which registers with the port of the rotor for an appreciable length of time, as the rotor turns.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

MATHEW C. WERLE.