Dec. 8, 1925. 1,564,286

B. E. SMITH

ROTARY MOTOR

Filed April 17, 1922 3 Sheets-Sheet 1

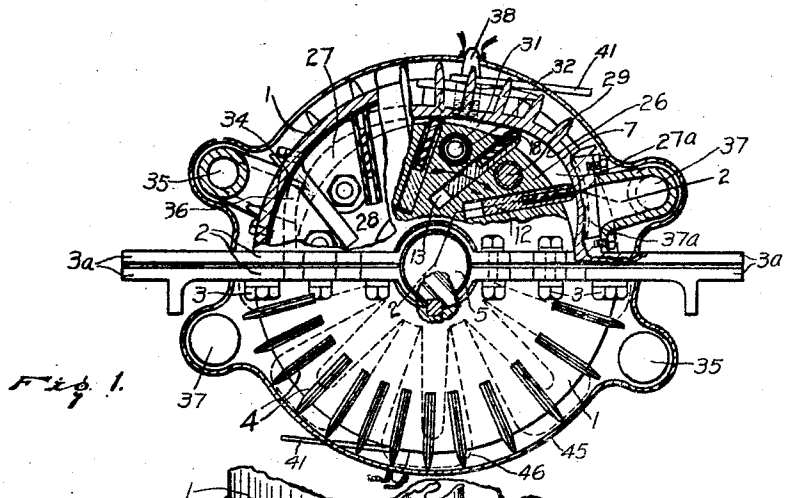


Fig. 1.

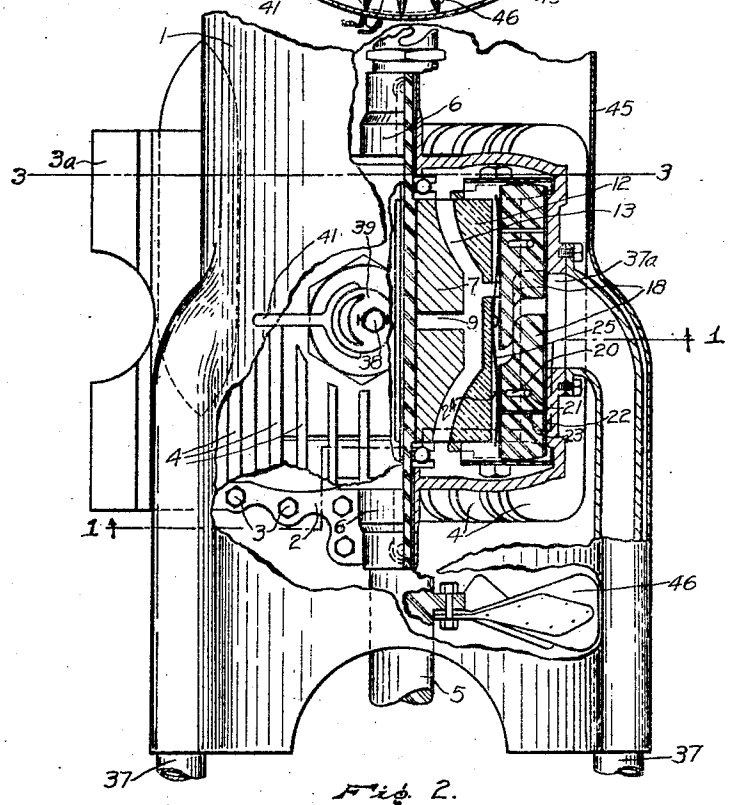


Fig. 2.

INVENTOR.

Bruce E. Smith

BY

Whittemore, Hulbert, Whittemore & Belknap

ATTORNEYS

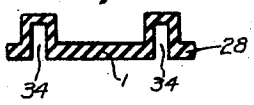
Dec. 8, 1925. 1,564,286

B. E. SMITH

ROTARY MOTOR

Filed April 17, 1922 3 Sheets-Sheet 2

Fig. 4.



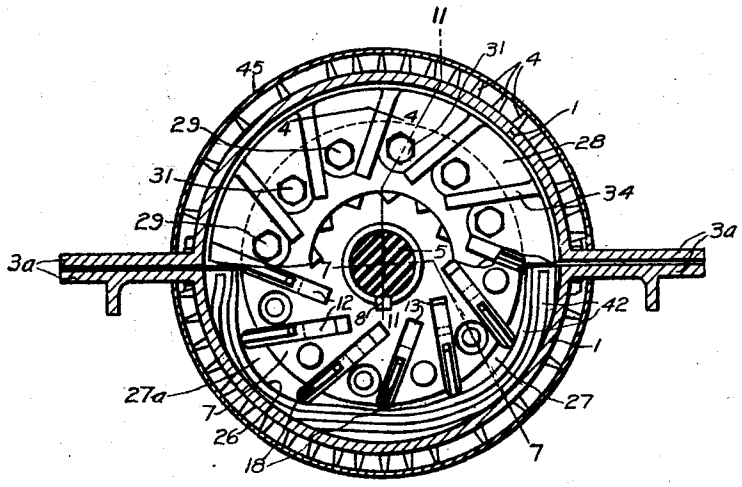


Fig. 3.

Fig. 5

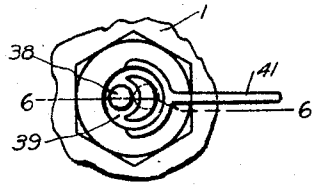
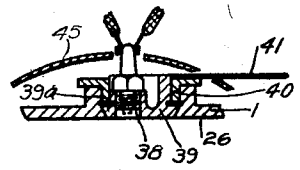


Fig. 6.



INVENTOR.

Bruce E. Smith.

BY

Whittemore, Hulbert, Whittemore, and Belknap

ATTORNEYS

Dec. 8, 1925. 1,564,286

B. E. SMITH

ROTARY MOTOR

Filed April 17, 1922 3 Sheets-Sheet 3

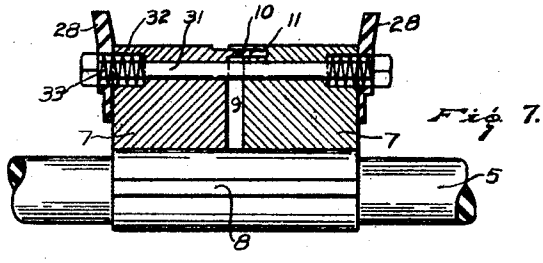


Fig. 7.

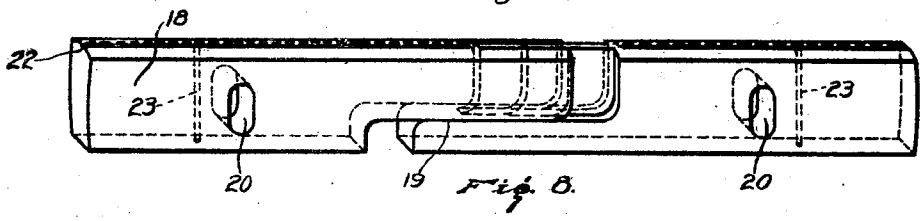


Fig. 8.

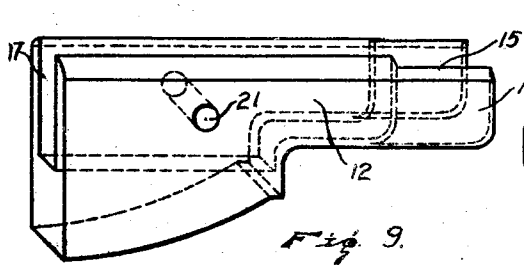


Fig. 9.

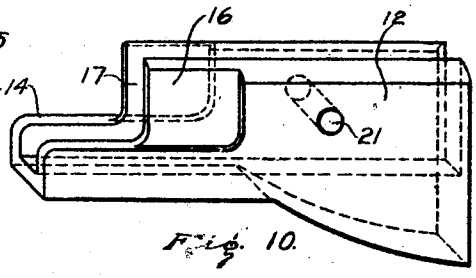


Fig. 10.

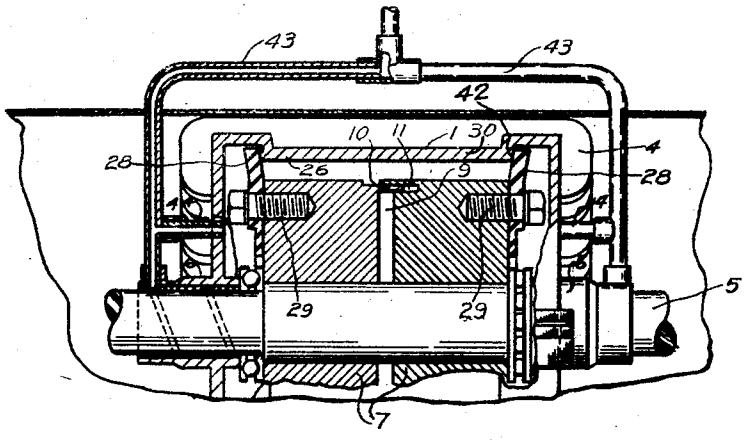


Fig. 11.

INVENTOR.

Bruce E. Smith.

BY

Whittemore, Hulbert, Whittemore, and Belknap

ATTORNEYS

Patented Dec. 8, 1925.

1,564,286

UNITED STATES PATENT OFFICE.

BRUCE E. SMITH, OF WINDSOR, ONTARIO, CANADA.

ROTARY MOTOR.

Application filed April 17, 1922. Serial No. 553,682.

To all whom it may concern:

Be it known that I, BRUCE E. SMITH, a subject of the King of Great Britain and Ireland, residing at Windsor, in the Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Rotary Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to rotary motors and consists in the structural features and arrangement of parts hereinafter described and illustrated in the accompanying drawings, wherein:—

Figure 1 is an end view of the improved motor, in partial cross section on line 1—1 of Figure 2;

Figure 2 is a bottom view of the same partially in section, the plane of section being indicated by line 2—2 of Figure 1;

Figure 3 is a cross section of the motor on line 3—3 of Figure 2;

Figure 4 is a broken section on line 4—4 of Figure 3, showing end guides for the pistons;

Figures 5 and 6 are respectively a plan view and cross section of a spark plug showing a provision for advancing and retarding the spark, the section being taken on line 6—6 of Figure 5;

Figure 7 is a cross section on line 7—7 of Figure 3;

Figure 8 is a perspective view of a bearing member adapted to be mounted in a piston;

Figures 9 and 10 are perspective views of members forming a two-part piston;

Figure 11 is a cross section on line 11—11, of Figure 3, showing the provision for lubricating the motor main bearings.

In these views the reference character 1 designates a casing or rotor chamber comprising complementary upper and lower members having abutting horizontal flanges 2, connected by clamping bolts 3. At the sides of the motor, said flanges are formed with extensions 3^a forming supports for the motor. Exteriorly, said casing is formed with a plurality of radial heat-radiating ribs 4. 5 is the shaft of the motor, passing axially through the rotor chamber 1 and journaled in bearings 6 integral with the ends of said chamber. Within the chamber 1, a two-part rotor 7 is splined upon the shaft 5 as indicated at 8, the parts of said rotor being spaced in the direction of the motor axis as indicated at 9. As will be best seen in Figure 7, one of said parts is formed adjacent its periphery with an annular tongue 10 which snugly engages in a conforming groove 11 formed in the other part. Said rotor carries a set of pistons 12 mounted in grooves 13 jointly formed in the two parts of the rotor, said pistons extending from end to end of the rotor and being approximately tangential to the shaft 5. Each of said pistons is formed in two parts the adjoining ends of which parts have end portions 14 adapted to overlap one another (see Figures 9 and 10). The end 14 on one of said parts furthermore is radially grooved as indicated at 15 to embrace a reduced portion 16 of the other part. Each piston is longitudinally formed with a radial groove 17 jointly extending in the two parts of said piston, and within each groove 17 a two-part bearing member 18 (see Figure 8) is radially slidable. The two-parts of each member 18 have their adjoining end portions overlapping as indicated at 19. Endwise relative movement between the pistons and their bearing members 18 is prevented by forming radial grooves 20 in the parts of each bearing member and engaging in said grooves pins 21 mounted respectively in the two parts of the piston. In the outer edge of each bearing member 18 there is formed a longitudinal oil groove 22, extending in the two parts of said member, and in each of said parts there is radially formed a lubricating passage 23 connecting the groove 22 with a lubricant passage 24 as shown in Figure 2 formed between the bearing member 18 and the bottom of the corresponding groove 17. There is also interposed between the inner face of each bearing member and the bottom of the corresponding groove 17 a leaf spring 25, urging said bearing member outwardly. The outer edges of said bearing members engage the peripheral face 26 of the rotor chamber which face is of such a contour as to form with the rotor 7 a plurality of compression chambers 27 and corresponding explosion chambers 27^a. Thus in the illustrated form of the invention, two of the compression chambers 27 are provided in diametrically opposed relation, and in a transverse diametrically opposed relation corresponding explosion chambers 27^a

are arranged. To the respective end faces of the rotor 7, sealing rings 28 are peripherally secured by tap screws 29, said rings projecting outwardly beyond the rotor in a slightly divergent relation, as is well shown in Figures 7 and 11, and embracing an annular inward projection 30 upon the chamber 1 to maintain a constant sealing contact between said rings and the sides of said annular projection. Bolts 31 are passed transversely through the complementary parts of the rotor and through the rings 28, said bolts having terminal heads 31[a] engaging the exterior faces of the rings. Adjacent said heads recesses 32 are formed in the rings 28 and in the respective parts of the rotor, and within said recess the bolts 31 are embraced by coiled springs 33 urging the rotor parts toward each other with a total force adequate to resist the lateral component of the explosions. The bolts 31 and tap screws 29 are arranged alternately between the pistons 12. The ends of the bearing members 18 engage in tangential grooves 34 (see Figure 4) formed in the opposite faces of the sealing rings 28. 35 indicates two mixture supply passages, extending parallel to the axis of the motor exteriorly of the rotor chamber at diametrically opposed points and communicating with the rotor chamber through intake ports 36. 37 indicates two exhaust passages similarly arranged in diametrically opposed relation and communicating with the rotor chamber through exhaust ports 37[a]. Spark plugs 38 are eccentrically carried by members 39, rotatably mounted in suitably located openings 39[a] in the chamber 1, said members being retained in said openings by nuts 40. The members 39 are respectively engaged by levers 41 to adjust the spark plugs circumferentially of the motor to establish the most efficient firing position. The adjustment which is described takes into consideration the fact that the spread of the flame from the point of ignition throughout the explosive mixture requires a certain time interval, however brief. The described adjustment permits a location of the spark gap within the combustion chamber such that the flame may be communicated to the entire mixture in said chamber in a minimum time. It is to be noted that a quick explosion is particularly desirable in a rotary explosive motor as the constancy of direction of the rotor entails a much higher speed of travel than ordinarily prevails in a reciprocating type of motor. The side faces of the projection 30 of the rotor chamber are formed with oil grooves 42 conforming to the symmetrical contour of the inner face of said projection as best seen in Figure 3, oil being peripherally supplied to said grooves and being distributed by the latter to the engaging faces of the rings 28 and projection 30. Pipes 43 convey lubricant to shaft bearings 6, and branches 44 lead from said pipes into the ends of the rotor chamber.

The rotor chamber 1 is inclosed within a substantially cylindrical sheet metal casing 45 seating upon the ribs 4, the spaces 46 between said ribs and between the rotor chamber and said casing forming longitudinal passages for a cooling flow of air which is maintained by a fan 46 mounted upon the shaft 5 in suitable proximity to the rotor chamber.

Considering now the operation of the described motor, it is to be understood that a charge of explosive mixture is drawn into the space between each adjacent pair of the pistons twice in each revolution, while said space is in communication with the intake ports 36. The charge thus admitted between said pistons is subjected to compression immediately after being cut off from communication with the intake ports, this compression resulting from the inward actuation of the pistons effected by the curvature of the wall 26 toward the rotor 7. Immediately after the charge is transferred by the rotor from the compression chamber 27 to the explosion chamber 27[a] the ignition circuit is closed, a spark is formed at the plug 38, and the charge is exploded. Expansion of the charge occurs progressively within the chambers 27[a] until the space between the pistons confining the chamber is carried into registration with one of the exhaust ports 37[a]. The products of combustion are now permitted to escape by way of said port to the corresponding exhaust passages 37, a scavenging or substantially complete expulsion of the combustion products being accomplished by the reduction of the space containing said products due to the convergence of the wall 26 and the peripheral face of the rotor in adjacent relation to the exhaust orifice. The described cycle of operation is repeated twice in each revolution since the upper and lower halves of the motor are duplicates. It is to be observed that the described construction is such as to permit the number of impulses per revolution to be multiplied to any reasonable extent either by an increase in the number of pistons or by an increase in the number of complementary compression and explosion chambers. Once the motor is in operation, the bearing members 18 will be centrifugally urged outwardly against the curved surface 26 of the rotor chamber with sufficient force to insure against a circumferential leakage of gases. It is necessary however to provide the springs 25 to urge the bearing members 18 outwardly under starting conditions, when the speed of the rotor is not sufficiently high to exercise the desired centrifugal action upon said bearing members. The coiled springs 33, urging the parts of the

rotor and the attached sealing rings 28 toward each other, maintain the necessary pressure of said rings upon the lateral faces of the annular projection 30 to insure against leakage of gases endwise from the compression or combustion chambers and the two-part formation of the rotor permits such shifting of the rings 28 toward each other as may be necessary to compensate for wear and for expansion in the direction of the motor axis. The provision of the described springs 33 avoids necessity for frequent adjustment and compensation of wear between the sealing rings 28 and the projection 30 whereon said rings bear. While it is true that said rings are subjected to some extent to the explosions in a direction opposing the sealing action of the springs 33, the area of said rings acted upon by the explosions is so much less than the exposed area of piston face that said springs are strong enough to resist the explosive force, while still maintaining a seal without creating undue frictional resistance to rotation and without unduly dissipating the explosive force by such frictional resistance. It is to be observed also that the bearing members 18 are free to adjust themselves outwardly relative to the pistons 12 to compensate for wear between said bearing members and the surface 26. By the employment of said bearing members in place of directly engaging the pistons with the surface 26 it is possible to employ relatively weak springs 25 to effect the necessary initial sealing engagement between said pistons and the surface 26. A complete lubrication of all of the pistons is centrifugally effected, the space between the rotor and its casing being maintained filled with oil. This lubricant enters the grooves 13 between the bottom thereof and the pistons and thoroughly lubricates the faces of said grooves slidably engaged by the pistons. Also the lubricant enters the grooves 17 lubricating the bearing members 18 in their radial sliding movement relative to the pistons. Flowing outwardly through the oil passages 22^a in said bearing members the lubricant is supplied to the oil grooves 22 thus lubricating the bearing members thereof at their lines of contact with the surface 26. The cooling air being confined by the casing 45 in close proximity to the rotor chamber acts most efficiently to dissipate the heat given off by the ribs 4. Owing to the large number of explosive impulses per revolution made possible by the described construction of motor, a high velocity of rotation may be secured and a large amount of power may be derived from a relatively small unit.

What I claim as my invention is:

1. A rotary motor comprising a two part rotor having its parts axially spaced and adjustable toward each other, a rotor casing forming with said rotor adjoining compression and explosion chambers and having an annular interior projection and a pair of sealing rings secured to said rotor at each end thereof and projecting outwardly beyond the rotor into engagement with said projection upon the rotor casing.

2. A rotary motor comprising a rotor casing, a rotor formed of two parts spaced transversely of the motor axis and adjustable toward each other, means urging said parts yieldably toward each other, sealing rings carried by said parts, one at each end of the motor, pistons mounted in the rotor and engaging the peripheral interior face of the rotor casing and adjustable to or from said face, an annular interior projection upon the rotor casing providing a face engageable by said pistons curved to form adjoining compression and explosion chambers, said rings engaging said projection laterally to seal said compression and explosion chambers.

3. A rotary motor comprising a rotor and a rotor casing, the peripheral interior face of the latter being spaced at intervals from the former to form adjointing compression and explosion chambers, the rotor comprising two parts spaced axially of the motor, sealing rings carried respectively by said parts for laterally closing the compression and explosion chambers, members extending parallel to the motor axis through the parts of said rotor, and springs coiled upon said member urging the rotor parts toward each other.

In testimony whereof I affix my signature.

BRUCE E. SMITH.