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PROFILE CORRECTED FOR UNEQUAL EXPANSION
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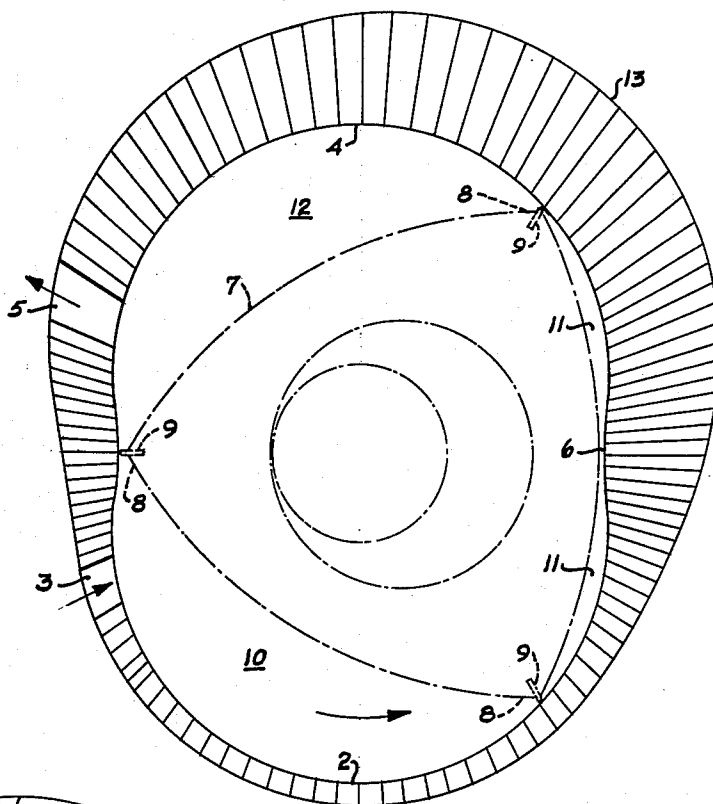


FIG. 1

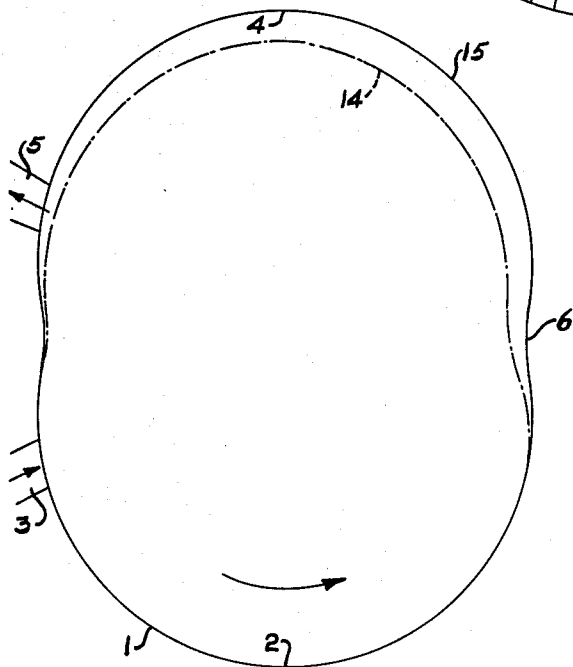


FIG. 2

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ROTARY MECHANISM WITH HOUSING HAVING INNER PROFILE CORRECTED FOR UNEQUAL EXPANSION

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1 Claim. (Cl. 123-8)

The present invention relates broadly to the art of rotary mechanisms.

The invention is particularly useful in connection with rotary mechanisms similar to that disclosed in U.S. Patent No. 2,988,065.

Such a rotary mechanism comprises an outer body having a cavity therein and an inner body disposed therein and rotatable relatively to the outer body about an axis laterally spaced from but parallel to the axis of said cavity. The outer body has axially-spaced end walls and a peripheral wall interconnecting the end walls to form said cavity, the inner surface of the cavity peripheral wall having a multi-lobed profile which preferably is basically an epitrochoid. The inner body has end faces disposed adjacent and parallel to said outer body end walls for sealing cooperation therewith and has a peripheral surface with a plurality of circumferentially-spaced apex portions, each carrying a radially-movable seal for sealing engagement with the multi-lobed inner surface of the outer body peripheral wall to form a plurality of working chambers between the two bodies which vary in volume upon relative rotation of the two bodies. Each such apex seal of the inner body runs axially from one end face to the other of the inner body.

Such an outer body generally comprises a middle housing or envelope and two end plates, in which the inner body or rotor is journaled.

Definite geometrical forms for the inner contour of the middle housing must be maintained to enable the apex seals during rotation of the rotor to remain in steady contact with the inner contour of the middle housing. Epitrochoids and outer curves parallel to the epitrochoid curves have proven to be especially suitable. A deviation of the inner contour from these geometric curves leads to considerable radial movement of the seals, and consequently to wear and leaks. In combustion engines of this type it is an operating condition that the middle housing does not heat up equally over its whole periphery. The arch or lobe having the intake port remains considerably cooler than the lobe having the exhaust port, because the latter is heated by the combustion gases. When the hot and cold arches are of the specified geometrical form and are of equal dimensions in the cold state, during operation the hot arch expands more and thus becomes larger in size than the cold arch. Therefore, the seals disposed at the apexes of the rotor must undergo considerable radial movement during travel through the hot arch in order to remain in contact with the inner wall of the housing. This considerable radial movement of the seals results in wear and affects the sealing of the separate working chambers and impairs the functioning of the engine.

This invention provides a way to largely avoid the radial movement of the sealing members in the hot lobe of an engine heated by operation. It is an object of the invention to provide a middle housing machined in such a way that the arch having the exhaust port is smaller, in the cold engine, than the arch containing the intake port, that is, both arches will have the same dimensions in an operationally heated engine and the inner contour

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will then have the specified geometrical form. Aside from manufacturing tolerances, the seal members then do not have to undergo radial movement in an engine at operating temperature in order to remain in contact with the inner wall of the middle housing.

Another object of the invention is to provide a basically epitrochoidal housing having exhaust lobe dimensions reduced in proportion to the difference in temperature between the two lobes during operation.

A further object is to provide a method of manufacturing a basically epitrochoidal housing having arches of such disparate dimensions in the cold state.

The foregoing objects and other ancillary thereto will be readily understood from the following description in connection with the accompanying drawings, in which

FIGURE 1 is a schematic end view of a two-arched epitrochoidal middle housing of a rotating combustion engine, with a superimposed heat distribution curve; and

FIGURE 2 is a schematic view of the inner contour of the middle housing corrected in relation to the heat distribution shown in FIGURE 1.

The correction of the inner contour of the middle housing can be accomplished most simply when the shape is produced by contour grinding, following a template or cam. Therefore the invention provides that during manufacturing such a template, the portion corresponding to the hot lobe of the housing is kept at a higher temperature than the portion which corresponds to the cold lobe. The grinder grinds this variably heated cam exactly to the specified geometric curve, for example, an epitrochoid or an outer curve parallel thereto. When the temperature of the cam is equalized, the area corresponding to the hot arch is then a little smaller than the area corresponding to the cold arch. When a middle housing is ground according to such a template the hot arch is also smaller than the cold arch, so that upon expansion at operating temperature both arches will have the same form and dimensions.

The difference in temperature between the pertinent areas of the template has a decisive influence on the form of the finished template in this method of manufacturing. This temperature difference must not correspond to the actually occurring temperature difference between the hot and cold lobes of the housing during operation. It has been found that the actual expansion of the hot lobe is approximately half of the theoretically expected expansion.

Referring more particularly to FIGURE 1, there is shown the basically epitrochoidal inner contour 1 of the middle housing of a rotating combustion engine having a cool or intake arch 2 and a hot or exhaust arch 4. The cool arch is provided with an intake port 3, and the hot arch is provided with an exhaust port 5. The position of the spark plug is shown at 6.

The inner body or rotor 7 is shown in dotted lines, and rotates in the direction shown by the arrow. In this embodiment the rotor is of generally triangular form, with convexly arcuate sides, and each of the apexes 8 is provided with a sealing member 9 which is to remain in constant contact with the inner contour 1, whereby the variable volume working chambers 10, 11, and 12 are formed. A normal four-stroke cycle takes place in these chambers. In the embodiment shown, intake occurs in chamber 10, the compressed mixture has just been ignited in chamber 11 and expansion is beginning, and exhaust of the burned gases is beginning in chamber 12 through the exhaust port 5.

Because each location in the middle housing contains always the same portion of the cycle, variant heating of the housing results. This variant heating is diagrammed in curve 13, where the length of the radial beams from the inner contour 1 to curve 13 illustrates the magnitude

of the temperature at all points of the inner contour. As may be seen, the temperature of the middle housing in hot arch 4 is approximately four times as great as the temperature in cool arch 2.

In an engine of this type the inner contour 1 must have definite mathematical forms, especially that of an epitrochoid or a corresponding outer parallel curve, so that the sealing members 9 during rotation of the inner body 7 remain in constant contact with the inner contour without excessive radial movement of the seals. By reason of the variant heat distribution, greater expansion occurs in the hot arch than in the cool arch; therefore, the inner contour 1 during operation does not retain its cold shape and dimensions. If the cold shape were a true epitrochoid the hot arch would be distorted therefrom and the seals would perform extensive radial movements.

This disadvantage is eliminated by the present invention, which provides a housing wherein the hot arch has a form corresponding to curve 14 shown in FIGURE 2, so that upon expansion during operation the hot arch conforms with the true curve 15. The distance between curves 14 and 15 in FIGURE 2 is shown considerably exaggerated for clarity of illustration. Actually, in an engine in which the major diameter of the middle housing is 200 mm., the difference between the two curves is approximately .3 mm.

The manufacture of such a modified inner contour can be accomplished most simply by contour grinding to where the hot arch has a form corresponding to curve 14. The cam or template is produced on a machine tool set up to grind an exact geometrical curve, such as a two-lobed epitrochoid or an outer curve parallel thereto. However, during manufacture of the template the section corresponding to hot arch 4 of the middle housing is kept at a higher temperature than the section corresponding to the cold arch. This temperature difference can be obtained by heating the hot arch section of the template, or by cooling the cold arch section. The grinder grinds the heated or cooled template to exactly the specified geometrical curve. After the template is brought back to room temperature it will have a form corresponding to curve 14 in the hot arch section. The

middle housing is thereafter copied according to the template, so that the cold engine also has the form of curve 14 in the exhaust arch end.

The temperature difference between the hot and cold lobes amounts to about 150° C. in an engine which has reached operating temperature. It has been shown that the amount of expansion in the hot arch does not correspond to the above heat, but only to approximately half, or 75° C. Therefore, the temperature difference maintained during manufacture of the template must be only half the actual difference observed during operation of the engine. Thus, the section of the template corresponding to the hot arch must be maintained at 95° C. during manufacture at a room temperature of 20° C., or the cool arch section must be lowered to minus 55° C. Since the temperature gradient in a template made by this method is gradual rather than abrupt, such a template will produce an inner contour in the middle housing which at operating temperature will be very close to the desired geometrical form.

What is claimed is:

A rotary internal combustion engine having a hollow outer body comprising a middle housing with a basically epitrochoidal inner surface at operating temperature, and a pair of end plates closing said housing, said inner surface having a plurality of arches, and having an intake port in one arch and an exhaust port in another arch, said housing having a longitudinal axis, an inner body disposed within said outer body and rotatable relatively thereto on an axis parallel with said housing axis but displaced therefrom, said inner body having a plurality of apexes adjacent to said epitrochoidal surface, each of said apexes bearing a radially movable sealing member in constant sliding contact with said epitrochoidal surface, the said arch having the exhaust port being smaller in the cold engine than the said arch having the intake port and being substantially equal in size at operating temperature to the said arch having the intake port, whereby radial movement of said sealing members is diminished at operating temperature.

No references cited.