Oct. 25, 1966 W. E. MARIETTA 3,280,754

ENGINE

Filed Feb. 12, 1964

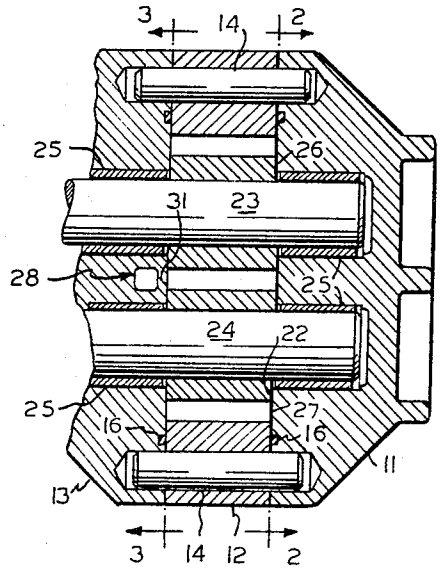


FIG. 1

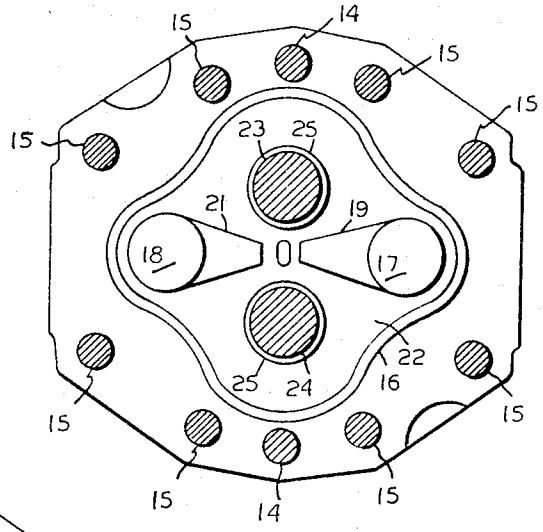


FIG. 2

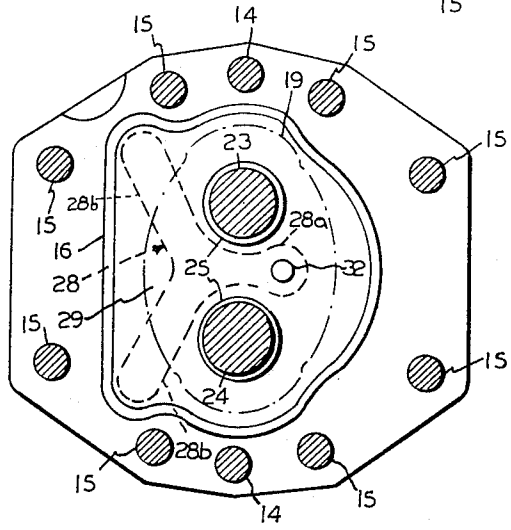


FIG. 3

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United States Patent Office

3,280,754

Patented Oct. 25, 1966

3,280,754

ENGINE

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Filed Feb. 12, 1964, Ser. No. 344,294
3 Claims. (Cl. 103—126)

This invention relates to rotary pumps and motors, hereinafter referred to by the generic term engine, of the gear type.

In engines of this kind, the meshing gears are located in a working chamber whose opposite ends are closed by transverse end walls that are susbtantially parallel with and lie closely adjacent the side faces of the gears. These faces and walls are intended to define running seals at the opposite sides of the gears, but, since the walls wear during operation, in time the running clearance increases to such an extent that leakage between the high and low pressure sides of the working chamber becomes intolerable. Because of this, it is common practice to use as one or both of the end walls a removable wear plate which is made of a bearing grade material and which is either deflected or moved into sealing engagement with the side faces of the gears by fluid under pressure. Since these plates are continuously biased toward the gears, this scheme automatically compensates for the increase in running clearance resulting from wear. While this approach to the wear problem is effective, it is expensive because it requires additional parts and also because of the rather elaborate means required to seal the pressure chambers at the rear faces of the wear plates.

The object of this invention is to provide a gear engine incorporating an improved scheme of wear compensation which is less expensive than the removable wear plate approach just mentioned. According to this invention, the transverse end walls of the working chamber are defined by surfaces of two separable sections of the engine casing which are made from a bearing grade material. One or both of these sections contains an internal bias chamber which is spaced inward from the surface that constitutes a transverse end wall to define a deflectable portion of the casing section. The bias chamber is connected with a high pressure space of the engine so that, during operation, the deflectable portion is bowed outward into engagement with the side faces of the gears and maintains an effective seal between the high and low pressure sides of the working chamber. Since the bias chamber may be formed at the time the casing section is cast, and since it is inherently sealed because it is contained wholly within the section, this approach to the wear compensation problem is less expensive than the prior approach mentioned earlier because it requires fewer parts and no complicated sealing means for the bias chamber.

The preferred embodiment of the invention is described herein with reference to the accompanying drawing in which:

FIG. 1 is an axial sectional view of a gear pump of the externally meshing gear type incorporating the invention.

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1 showing the face of the casing cover.

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1 showing the face of the casing adapter.

As shown in the drawing, the improved gear pump comprises a casing having separable cover, housing and adapter sections **11**, **12** and **13**, respectively, which are aligned by two diametrically opposed locating pins **14** and which are held together by eight bolts **15** that pass through the cover and the housing and are threaded into bores formed in the adapter. Elastic rings **16** seal the

joints between the housing section and the other two sections. The cover **11** is provided with inlet and discharge ports **17** and **18**, respectively, which communicate with opposite sides of the working chamber enclosed by housing **12**, and whose outline is indicated by phantom line **19** in FIG. 3, through shallow chambers **19** and **21**, respectively, formed in its front face **22**. Extending through the working chamber **19** are a pair of parallel shafts **23** and **24** which are journaled in bearings **25** located in cover **11** and adapter **13** and onto which are pressed a pair of meshing gears **26** and **27**.

The adapter **13** contains a cored bias chamber **28** of generally Y-shape having a central leg **28***a* which extends between the bearings **25** and a pair of branched legs **28***b* that flare outward in the direction of the inlet or low pressure side of the working chamber **19**. This bias chamber **28** is spaced inward from the front face **29** of adapter **13** to define an intervening, deflectable adapter portion **31**. Fluid under pressure is admitted to chamber **28** from the discharge side of the working chamber through a bore **32** that communicates with leg **28***a*, and this fluid develops a biasing force on deflectable portion **31** that bows it outward into sealing engagement with the side faces of the gears. The magnitude of the deflection of portion **31** depends upon its thickness, the shape of and pressure supplied to bias chamber **28**, and the material used in adapter **13**. Since portion **31** is flexed during operation, the configuration of chamber **28**, and consequently of portion **31**, depends upon the allowable fatigue limit of the material from which adapter **13** is made. Inasmuch as the faces **22** and **29** are bearing surfaces, it is essential that cover **11** and adapter **13** be made of bearing grade materials, such as aluminum, bronze or a suitable plastic.

In a typical pump, the deflection of portion **31** is on the order of 0.0006 inch, and, therefore, it is important that the pump be designed initially to have close running clearances between the side faces of the gears and the faces **22** and **29**. In cases where a wide variation in initial clearance is expected, the cover may also be provided with a bias chamber **28**. However, because of space limitation, this might necessitate locating the inlet and outlet ports **17** and **18** in the housing section **12**.

Although the branched legs **28***b* of chamber **28** in the illustrated embodiment lie on the inlet or low pressure side of the pump, it will be apparent that they may be placed on the opposite side. However, since the forces developed on face **29** by the pressure on the discharge side of the pump are much greater than those developed by the pressure on the inlet side, this rearrangement would necessitate using a chamber **28** of larger area in order to obtan tihe same deflection of portion **31**. It should also be apparent that a bias chamber **28** could be provided in cover **11** in lieu of adapter **13**.

As stated previously, the drawing and description relate only to the preferred embodiment of the invention. Since changes can be made in the structure of this embodiment without departing from the inventive concept the following claims should provide the sole measure of the scope of the invention.

What I claim is:

1. In a gear engine of the type including a casing having separable sections and containing a working chamber whose opposite ends are closed by transverse end walls, one of said transverse end walls being a surface of a first one of the casing sections, and meshing gears located in the working chamber and having side faces substantially parallel with and closely adjacent the transverse end walls, the improvement which comprises

(a) a bias chamber defined by a void in the material from which said first casing section is made, said bias chamber being spaced inward from the surface

constituting said transverse end wall to define an intervening deflectable portion of said casing material that may be bowed outward into sealing engagement with the side faces of the gears; and

(b) means for transmitting to the bias chamber fluid from a high pressure space of the engine.

2. In a gear engine of the type including a casing having separable sections and containing high and low pressure ports and a working chamber whose opposite ends are closed by transverse end walls, one of said transverse end walls being a surface of a first one of the casing sections, a pair of externally meshing gears located in the working chamber and having side faces substantially parallel with and closely adjacent the transverse end walls, spaced parallel shafts carrying the gears and supported in said first and another casing sections, and means connecting the high and low pressure ports with high and low pressure regions, respectively, of the working chamber located on opposite sides of a plane containing the shaft axes, the improvement which comprises

(a) a bias chamber defined by a void in the material from which said first casing section is made, said bias chamber being spaced inward from the surface constituting said transverse end wall to define an intervening deflectable portion of said casing material that may be bowed outward into sealing engagement with the side faces of the gears,

(b) the bias chamber having a generally Y-shape with

the central leg located between the shafts and the two branch legs flaring outward in the direction of one of the low and high pressure regions of the working chamber; and

(c) an opening in the first casing section extending into the bias chamber from the high pressure region.

3. The improvement defined in claim 2 in which

(a) the two branch legs of the bias chamber extend in the direction of the low pressure region;

(b) a portion of the central leg of the bias chamber is on the high pressure side of said plane containing the shaft axes; and

(c) said opening enters that portion of the bias chamber located on the high pressure side of said plane.

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