United States Patent

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[33] **Great Britain**
[31] **46,739/68**

[54] **ROTARY PISTON ENGINES**
7 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **418/210**
[51] **Int. Cl.** **F01c 11/00,**
F04c 11/00
[50] **Field of Search** 418/60,
212, 213, 210; 91/411 A; 92/151; 285/381

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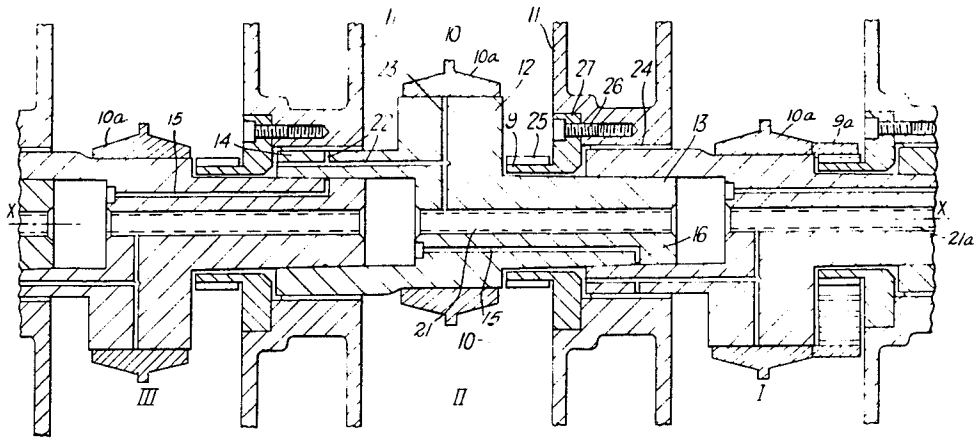
ABSTRACT: A multiunit arrangement of rotary piston engines has a three-section eccentric shaft. Each section of the shaft is driven by a rotary piston engine and one end of each section is an interference fit within the adjacent end of the neighboring section.



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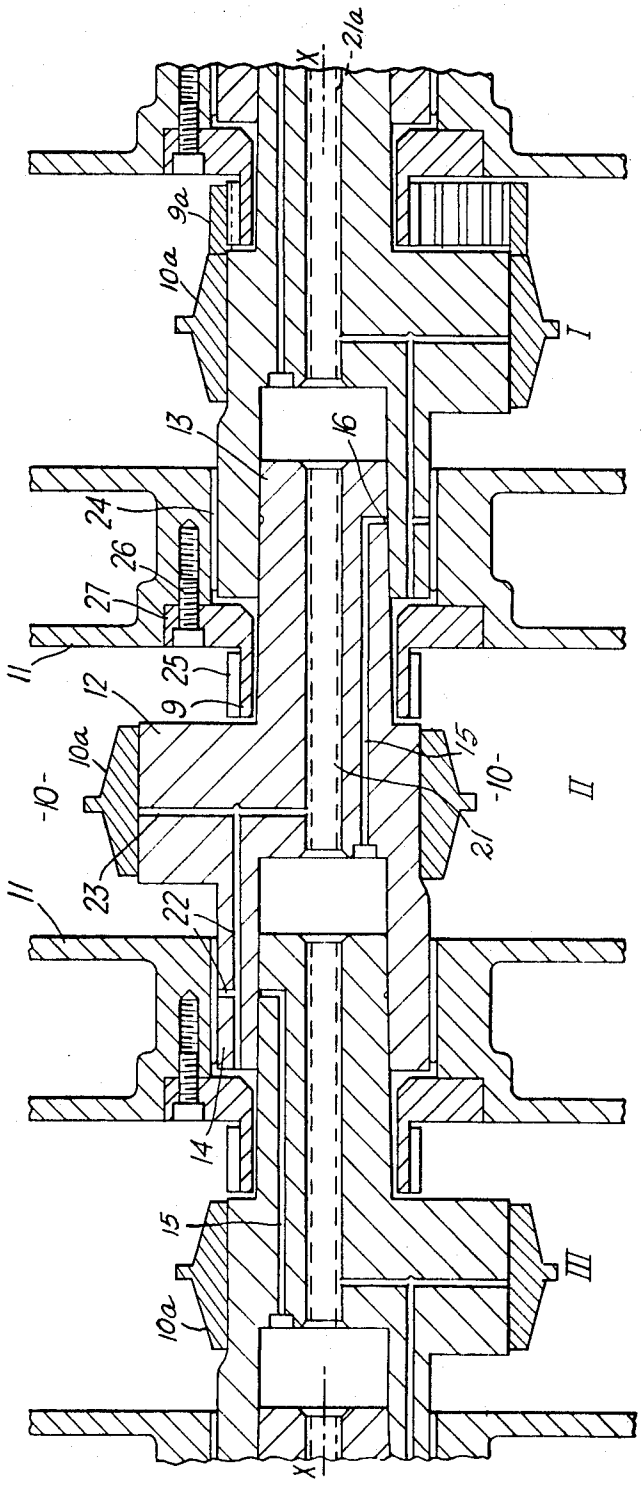

Fig. 1.

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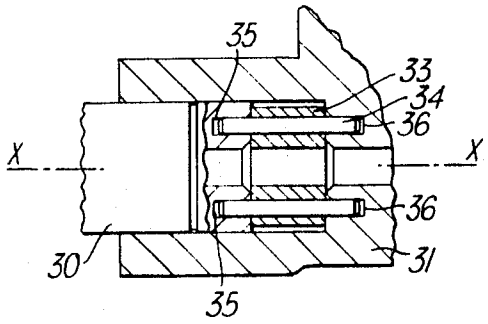

Fig. 2.

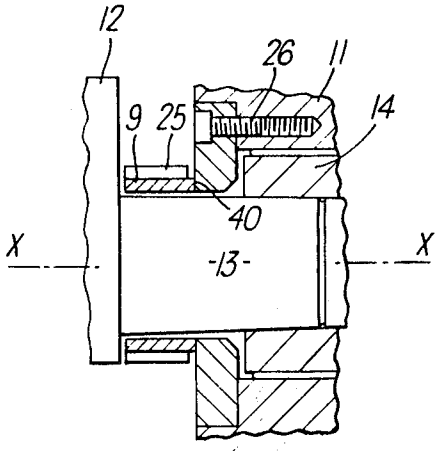

Fig. 3.

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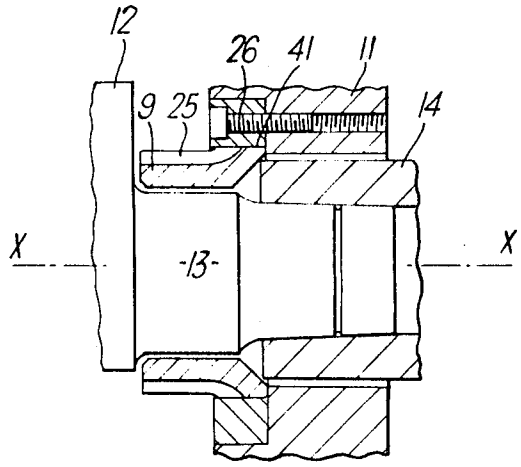

Fig. 4.

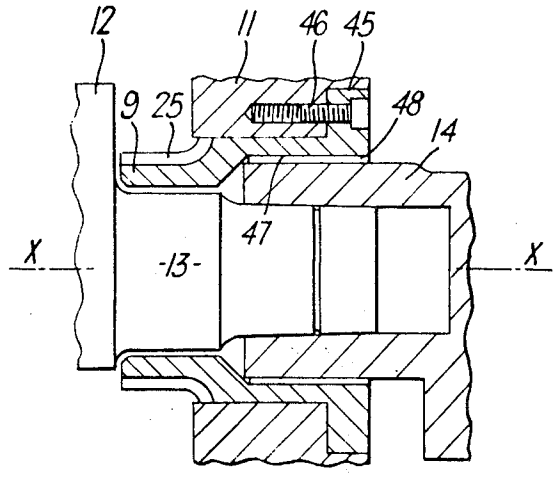

Fig. 5.

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ROTARY PISTON ENGINES

The invention concerns improvements in or relating to rotary piston engines.

According to the present invention there is provided a multiunit arrangement of rotary piston engines having a shaft; at least two sections constituting said shaft one section being drivingly connected to each engine; mating surfaces on the ends of adjacent sections so that said adjacent sections are an interference fit; passageway means in said shaft for feeding a fluid under pressure to said mating surfaces so that the interference fit between adjacent sections is reduced by the fluid under pressure to permit assembling and disassembling of adjacent sections and; aligning means in the end of adjacent sections for locating each section of the shaft relative to the adjacent section.

Each section of the shaft may have an eccentric portion and a journal portion. Each journal portion thus may be located in annular fixed structure forming the casing of the engines. Preferably the fixed structure carries an externally toothed gear ring adapted to mesh with an internally toothed gear ring carried by the rotary piston.

Preferably each section of the shaft has a central bore and has securing means passing therethrough to locate the sections fixedly relative to each other.

The aligning means may comprise dowels fitted into holes provided in the end faces of each section of the shaft.

Preferably the ends of each section are tapered.

In one embodiment the externally toothed gear ring is provided with a flange which extends axially between said fixed structure and the ends of each said section.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:

FIG. 1 is a longitudinal section taken through the shaft of a three-unit arrangement of rotary piston engines.

FIG. 2 is an enlarged section of a part of the arrangement shown in FIG. 1,

FIG. 3 is a modification of a part of the arrangement shown in FIG. 1,

FIG. 4 is a still further modification of a part of the arrangement shown in FIG. 1, and

FIG. 5 is an additional modification of a part of the arrangement shown in FIG. 1.

Referring first to FIG. 1 there is shown a bank or multiunit arrangement of identical rotary piston engines designated by I, II, III, respectively. Since each is identical it will suffice to only discuss one in detail and its connection with its neighbor. The rotary piston engines are, in the present case, internal combustion engines but it will be appreciated that the present invention is applicable to any rotary piston engine e.g. a compressor or pump.

Piston engine II has a cylinder **10** in which a rotating piston part of which is indicated at **10***a* moves. The rotating piston may be any suitable shape but preferably for an internal combustion engine is of substantially triangular shape, the cylinder **10** being of a two-lobed substantially epitrochoid shape. The planetary motion of the rotating piston is preferably controlled by gearing which comprises a stationary externally toothed gear ring **9** rigidly connected to an engine casing **11**, and an internally toothed gear ring **9***a* (only one of which is shown) rigidly connected to the rotating piston, the internally toothed gear ring rolling on the externally toothed gear ring **9** thus producing the planetary motion of the rotating piston.

The stationary gear has passing therethrough an eccentric shaft section **12**, rotating about an axis X—X, the shaft having end portions **13** and **14**. The portion **14** journals the shaft section in the casing. The portion **13** is so dimensioned as to be an interference fit within the portion **14** of the adjacent eccentric shaft section **12**.

The force required to drive the portion **13** into the portion **14** is reduced by forcing oil under pressure between the mating surfaces so that these surfaces are separated by a thin film of oil. The mating surfaces are tapered, thus improving the interference fit.

The oil for this purpose is pumped by a pump (not shown), through a plurality of drillings **15** in the shaft section **12**, during the assembly or disassembly of the engine shaft to an annular groove **16** in the portion **13**. Thus the oil is squeezed between the mating surfaces and on release of the pressure causing it to be fed to the mating surfaces returns back to the pump.

The shaft sections of piston engines I, II and III are drawn together during assembly of the engine shaft or restrained during dismantling of one or more of the engines by a bolt **21***a* shown in phantom lines passing through a central bore **21** in the shaft sections.

The central bore also supplies lubricating fluid to the engine bearings by way of conduits **22**, **23**. Conduit **22** feeds lubricating fluid to an engine shaft bearing **24** and conduit **23** feeds lubricating fluid to the other engine bearings (not shown).

The externally toothed gear ring **9**, disposed parallel to the shaft section **12** and having gear teeth **25**, is affixed to the casing **11** by means of bolts **26** passing through an integral radial projection **27** from the gear ring into the casing.

It will be appreciated that the correct phase relationship must be maintained between the rotating pistons of engines I, II and III and thus there must be little or no relative movement between the eccentric shaft section **12** of each engine once the correct phase relationship has been set up. The interference fit between the shaft sections prevents such relative movement.

One arrangement to simplify angular positioning of the eccentric shaft sections on assembly is shown in FIG. **2**. An end portion **30** of an eccentric shaft section (not shown) is fitted within an end portion **31** of an adjacent shaft section (also not shown). The two portions are located in their correct axial and angular positions relative to each other by means of a distance piece **33** carrying dowels **34**. The distance piece **33** and the associated dowels are fitted into holes **35** and **36** in the portions **30** and **31** respectively.

The length of the distance piece **33** can be adjusted to limit the extent to which the adjacent portions are driven together thus simplifying assembly and ensuring that the required torque can be transmitted by the shaft. The dowels **34** located in holes **35** and **36** fix the angular relationship of one shaft section relative to the other.

FIGS. **3** and **4** show, in detail, the fixing of the externally toothed gear ring **9** to the casing **11**. The parts similar to those shown in FIG. **1** have been designated with the same reference numerals. In FIG. **3** the gear ring **9** is fixed to a radial projection **27**, which are separate from each other, by welding along the radially extending line **40**. Alternatively as shown in FIG. **4**, the gear ring **9** and the radial projection **27** are welded along the axially extending line **41**. In both cases the projection **27** is bolted to the casing **11** by means of bolts **26**. The welding may be of any conventional type although electron beam welding techniques ensure that distortion of the gear teeth **25** is kept to a minimum.

FIG. **5** shows a different arrangement for connecting the externally toothed gear ring **9** to the casing **11**. In this case the gear ring **9** extends the whole axial extent of the casing **11** and has an integral flange **45** situated at the end remote from the gear teeth **25**. The flange **45** is affixed to the casing **11** by means of bolts **46**. Thus the internal surface **47** of the gear ring **9** forms the bearing surface between itself and the portion **14** and lubricating fluid is fed in the manner described with reference to FIG. **1** to a space **48** therebetween.

I claim:

1. A multiunit arrangement of rotary piston engines comprising at least two rotary piston engines having an interconnecting shaft means; at least two sections constituting said shaft means with one section being drivingly connected to each engine; mating surfaces on the ends of adjacent sections defining an interference fit; passageway means in said shaft means for feeding a fluid under pressure to said mating surfaces so that the interference fit between adjacent sections is reduced by the fluid under pressure to permit assembling and disassembling of adjacent sections and; aligning means in the

end of adjacent sections for locating each section of the shaft means relative to the adjacent sections, said aligning means comprises circumferentially spaced dowel rods fitted into holds provided in end faces of each section of the shaft means.

2. A multiunit arrangement of rotary piston engines as claimed in claim 1 in which each section of the shaft means has an eccentric portion and a journal portion.

3. A multiunit arrangement of rotary piston engines as claimed in claim 2 in which each journal portion is located in an annular fixed structure forming the casing of the engine.

4. A multiunit arrangement of rotary piston engines as claimed in claim 3 in which the fixed structure carries an externally toothed gear ring meshing with an internally toothed gear ring carried by the rotary piston.

5. A multiunit arrangement of rotary piston engines as claimed in claim 4 in which the externally toothed gear ring is provided with a flange which extends axially between said fixed structure and the ends of each said section.

6. A multiunit arrangement of rotary piston engines as claimed in claim 1 in which each section of the shaft means has a central bore and has securing means passing therethrough to locate the sections fixedly relative to each other.

7. A multiunit arrangement of rotary piston engines as claimed in claim 1 in which the ends of each section are tapered.

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