

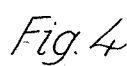
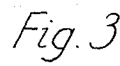
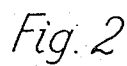
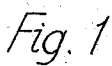
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ROTARY DEVICE

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ROTARY DEVICE

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15 Claims. (Cl. 230-143)

The present invention relates to a rotary device comprising a casing and enclosed therein a set of rotors having cooperating lands and grooves, which casing with a jacket portion encloses the rotors and is provided with an inlet and an outlet. The rotary device under consideration is intended for compression or expansion of a gaseous medium and particularly there is contemplated suitable embodiments of a rotary device operating as a low pressure compressor.

According to the ordinary design of rotary devices of the kind under consideration the jacket and the end plates of the casing are manufactured as separate parts. When assembling the jacket and the end plates together with the rotors considerable difficulties are encountered in adjusting all parts with the required precision and in spite of greatest accuracy of manufacture an exact centering of the rotors in the bores of the jacket for the rotors and the required parallelism between the rotor shafts is difficult to accomplish. Manufacture also is very complicated, expensive and time-consuming.

The invention contemplates a simplification and thus a cost reduction as compared with methods hitherto employed for manufacturing such rotary devices and at the same time to obtain an improved precision for the assembling of the parts of a rotary device operating efficiently and safely. This has primarily been attained by providing the casing with only one end plate for supporting the rotors solely at one end thereof. The casing and this end plate may then be made in one piece or, if they for certain reasons in a simpler way may be manufactured as separate parts they may be fastened together to form a unit, whereafter turning of the bores of the jacket and the bores of the end plate for the rotors is performed in one and the same operation, so that an exact centering and parallelism of the shafts may be secured. Since the ends of the rotors remote from the end plate terminate freely in a corresponding jacket bore, no centering problems at this side will occur. Difficulties otherwise occurring in the coordination of a centering at one end plate with the centering at the other end plate is thus eliminated.

A specific object of the invention is to eliminate as far as possible the risks of seizing between the rotors and between rotor and jacket respectively.

According to a preferred form of the invention the rotors are constructed in accordance with the principles set forth in the U. S. specification 2,622,787 according to which the lands of the male rotor are of generally convex cross section lying substantially outside of the pitch circle of the male rotor and the lands of the female rotor are of generally concave cross section lying substantially within the pitch circle of the female rotor. Further, the profiles of said lands are of such curvature that upon rotation of the rotors the crest of each convex land of the male rotor comes into contact or space packed contact (sealing proximity) with the walls of the cooperating groove of the female rotor at a place inside the pitch circle of the female rotor. According to a modified de-

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sign also described in the said specification the major portions of the lands of the male rotor lie outside the pitch circle of the male rotor and are of substantially symmetrical convexly curved profile and the minor portions of which lie within the pitch circle of the male rotor and are of substantially symmetrical concavely curved profile, and the major portions of the lands of the female rotor lie within the pitch circle of the female rotor and are of substantially symmetrical curved profile and the minor portions of which lie outside the pitch circle of the female rotor and are of substantially symmetrical convexly curved profile. For further details as regards the profiles reference is made to the said specification. The designs of the profiles of the lands and grooves of the rotors disclosed by said specification are particularly adapted to the present type of rotary devices and to a certain extent it may be said that they are indispensable in order to ensure the satisfactory operation of the rotary device or to render such operation possible at all.

Other characteristic features and details of the invention will appear from the description of an embodiment shown in the accompanying drawing and illustrating a rotary device suitable for operation as a low pressure compressor.

In the drawings:

Fig. 1 is a vertical longitudinal section taken on the line 1—1 of Fig. 2, of a rotary device.

Fig. 2 is an end view of the same rotary device taken on the projection 2—2 of Fig. 1.

Fig. 3 is a horizontal longitudinal section of the same rotary device, taken on the line 3—3 of Fig. 2.

Fig. 4 is a side elevational view of the same rotary device, partly in section.

The rotary device shown has a casing 10 comprising a jacket 12 and an end plate 14 manufactured in one piece. The outer sides of the jacket are provided with cooling flanges 16. In the jacket two bores 18 and 20 are provided intersecting each other along the lines 22 and 24 and form the bores for a male rotor 28 provided with four helical, substantially convex lands 26, and a female rotor 32 provided with six helical substantially concave lands 30. The manner of operation of such rotary device is assumed to be known to everyone familiar with the art, so that the same will not be described here in detail.

The male and female rotors 28 and 32, respectively, consist of sleeves 34 and 36, respectively, each being journaled on spindles 38 and 40, respectively, each spindle of which with their outer ends 42 is secured to the end plate 14 in bores 44 made in the same. The end plate forms reinforced portions 46 around the spindle ends 42. The spindle ends are threaded and are locked by means of lock nuts 48 by threading against the reinforcements 46 of the end plate, the spindles 38, 40 on the inside of the bores 44 of the end plate forming an abutment 50.

The rotor sleeves 34 and 36 are journaled on bearing rings which are mounted on the spindles 38, 40 and may, for example, consist of ball bearings or as in the present example of a ball bearing 52 and a roller bearing 54, the former being located at the low pressure end and the latter at the high pressure end of the rotary device. The bearing rings 52, 54 are separated by a distance sleeve 56. To lock the rotor sleeves 34, 36 to the spindles 38, 40 against sliding, lock nuts 58 are threaded on the outer ends 60 of the spindles and rest against the ball bearings 52, and lock rings 62 of steel or similar material are recessed into the ends of the rotor sleeves 34, 36 facing the end plate 14. The lock ring 62 of the male rotor sleeve and the lock ring of the female rotor sleeve is secured by means of screws 66. The lock rings 62 also serve as parts in a sealing construction and be-

tween them and the end plate 14 there are mounted sealing rings 68.

The ends of the rotor sleeves 34, 36 remote from the end plate 14 are covered by caps 70 and 72 respectively, cap 70 of the male rotor being secured by means of pin bolts 64 and the cap of the female rotor by means of bolts 74. The cap 28 of the male rotor 70 is integral with a shaft 76 which passes through a central bore 78 in the spindle 38 carrying the male rotor and serving as a driving shaft for the male rotor.

According to the invention a rotary device of the kind under consideration may be simplified as regards the construction and manufacturing. The female rotor as shown in the example is driven by the male rotor solely by the engagement of the lands of the male rotor with the grooves of the female rotor.

Thus the synchronizing gears may be dispensed with which otherwise have been necessary in order to get the female rotor to rotate with the male rotor without there being risk for seizing.

As a further measure to prevent seizing of the rotors it is suggested according to the invention to make the rotor sleeves of different materials. The sleeve 34 of the male rotor accordingly is made of a compressed fibre material bound by a suitable binding-medium as for example asbestos pressed together with suitable artificial resin, such as a silicone resin, whereas the sleeve 36 of the female rotor consists of steel or similar material. The sleeve of the male rotor may also consist solely of a plastic or similar material.

In the example of the rotary device illustrated as a low pressure compressor the casing forms a radially-axially extending outlet 80. The inlet of the rotary device is formed by the open end 82 of the jacket 14 and in order to prevent direct communication between the inlet and outlet openings a cover plate 84 is secured by means of bolts 86 at the open jacket end, which accordingly covers the jacket opening at least so far that the inlet and the outlet openings are cut off from direct communication but not more than an axial opening remains at the inlet or low pressure side. The inlet 82 is accordingly defined by the inner contour of the rotor bores 18, 20 and the edge profiles 88, 90, 92 of the cover plate.

The interspace between each rotor sleeve and corresponding bearing spindle is supplied with a lubricant from the outside at the end plate end of the device via a supply nipple 94 issuing into a channel 96 in said spindle. The surplus lubricant is able to escape by means of centrifugal action through a gap between the rotor sleeve and the bearing spindle for the same. In the present case the rotor sleeve at the end facing the end plate of the casing is fastened to the lock ring 62 which is sealing against the end plate of the casing by means of a sealing ring 68 recessed into the end plate of the casing. Between the lock ring 62 and an enlargement on the spindle clearance is provided for escape of the surplus lubricant centrifuged off from the interspace between the rotor sleeve and the bearing spindle therefor. Said surplus lubricant finally escapes through an outlet channel in the end plate. The arrangement for lubrication disclosed enables an ample lubrication without risk of heat conduction from the rotor sleeve to the sleeve spindle by means of lubricant medium filling the entire interspace between the parts. The arrangement further ensures ample lubrication of the bearings for the rotor sleeves.

On driving shaft 76 of the male rotor there may be provided a transmission disc. In the example shown this disc consists of a belt pulley 98 which is journaled on a ball bearing ring and a roller bearing ring 100 and 102, respectively, mounted on the outer end 104 of the spindle 38 supporting the male rotor. A lock nut 106 secures the bearings 100 and 102 which are provided with a distance ring 108 therebetween. The belt pulley 98 at its inner end has an abutment 110 resting against

the roller bearing 102 and is at its outer end by means of bolts 112 secured to a flange 114 of a sleeve 116 mounted on the outer non-cylindrical end 118 of the driving shaft.

5 The construction of the new machine may be varied without departing from the scope of the invention. Accordingly, for example, the number of rotors may be varied or the number of lands thereon. The metallic rotor can have a hardened surface, for instance a chrome-plated one.

10 What I claim is:

1. A helical screw device operating with a gaseous medium and comprising a casing providing a jacket and having an inlet and an outlet opening disposed adjacent opposite ends, a set of rotors having cooperating convex lands and concave grooves rotatably mounted in said casing, said casing being provided with only a single end plate at its high pressure end, while the low pressure end of said casing terminates freely at an open end of the casing, spindles mounted on said end plate and projecting into said casing and said rotors being overhung on said end plate and being journaled as sleeves on said spindles.

2. A helical screw device according to claim 1, in which the open end of said casing opening is covered by a plate at least to a degree providing that the inlet and outlet openings are cut off from direct intercommunication but not more than to leave an axial opening at the low pressure end.

3. A helical screw device according to claim 1, in which said end plate supporting the rotors is formed integral with the jacket.

4. A helical screw device according to claim 1 having at least one male rotor and at least one female rotor, in which the female rotor is driven by the male rotor merely through the engagement of lands of the male rotor with grooves of the female rotor.

5. A helical screw device according to claim 1, which includes an interspace between the rotor sleeve and rotor spindle supplied with lubricant from the outside at the end adjacent said end plate, a channel for the lubricant formed in said spindle, and clearance being provided between the rotor sleeve and rotor spindle for escape of surplus lubricant centrifuged off from the interspace.

6. A helical screw device according to claim 5, which includes an escape channel in the end plate for the centrifuged-off lubricant.

7. A helical screw device according to claim 1, in which the spindle supporting the sleeve of the male rotor is hollow and receives a driving shaft for the sleeve of the male rotor.

8. A helical screw device according to claim 1, in which the rotor sleeves are journaled on their spindles by means of ball bearings.

9. A helical screw device according to claim 1, in which the rotor sleeves are journaled on their spindles by means of a ball bearing at the low pressure end and a roller bearing at the high pressure end.

10. A helical screw device according to claim 9, in which means are provided to space the bearings apart and the end of the rotor sleeve adjacent the end plate carries a ring member in sealing relation with the end plate by means of a seal entering a recess of the end plate, clearance being formed between said ring member and an enlargement of the spindle to allow escape of surplus lubricant centrifuged off from the interspace between the sleeve of the rotor and the spindle.

11. A helical screw device according to claim 1, in which the rotor sleeves are secured to the spindles by a locking ring at the end plate end of the rotor sleeves and by a lock nut at the free end of the spindles.

12. A helical screw device according to claim 11, in which the rotor sleeves at the free ends of the spindles are covered by caps secured to the ends of the respective sleeves.

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13. A helical screw device according to claim 12, in which the cap of the male rotor is rotationally fixed with respect to the driving shaft of said rotor.

14. A helical screw device according to claim 1 in which said set of rotors includes a male rotor having a driving shaft therefor and which includes a transmission disc secured to said driving shaft journaled on the spindle of the male rotor sleeve.

15. A helical screw device according to claim 1, in which the lands of the male rotor are of generally convex cross section located substantially outside the pitch circle of the male rotor and the lands of the female rotor are of generally concave cross section located substantially within the pitch circle of the female rotor, the profiles of said lands being of such curvature that upon rotation of the rotors the crest of each convex land of the male rotor comes into contact or sealing proximity with the walls of the cooperating groove of the female rotor at a place disposed inside the pitch circle of the female rotor.

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