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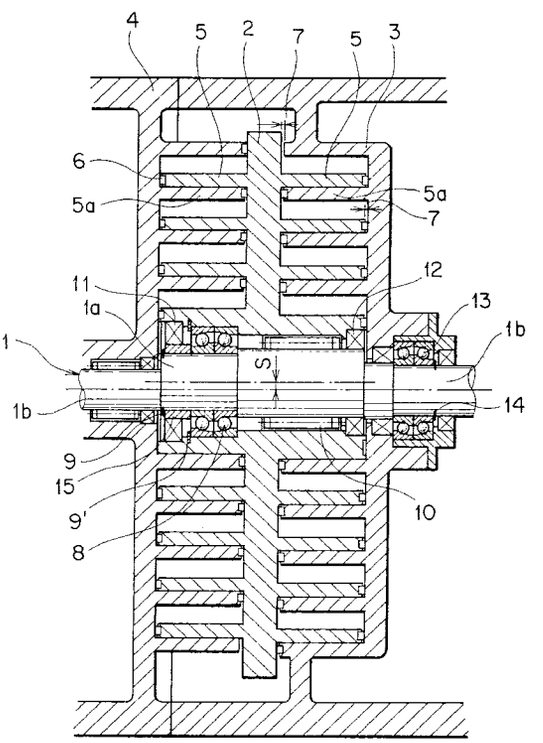
(54) Scroll fluid machine

(57) A scroll fluid machine having an orbiting scroll positioned at the center in an axial direction of an eccentric shaft portion of a driving shaft for improving abnormal wear of tip-seals or fluid leakage at the tip-seals due to uncontrollability of clearances at the tips of spiral wraps caused by an unfixity of an orbiting scroll on a driving shaft on a conventional scroll fluid machine. Axially rigid bearings are engaged with the driving shaft at two places, one for a stationary scroll and the other for the orbiting scroll so as to prevent the stationary scroll and the orbiting scroll from moving on the driving shaft in the axial direction. Thus, a structure improving the above abnormal wear of the tip-seals or fluid leakage at the tip-seals by equalizing pressure on the tip-seals can be provided, thereby ensuring smoother orbital movement of the orbiting scroll.

F I G. 2



EP 0 831 234 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a fixation of a driving shaft of an orbiting scroll used in a scroll fluid machine.

2. Description of the Prior Art

Figs.land 4 show a conventional twin-type scroll fluid machine.

Referring to Fig.4, an eccentric shaft portion la is rotatably fit into a boss portion of an orbiting scroll 2 and stationary scrolls 3 and 4 are assembled with a rotary shaft portion 1b so as to make stationary and orbiting spiral wraps 5 and 5a constructed to lap each other. Tips of the spiral wraps 5,5,5a, and 5a are provided with tip-seals 6 which are slidingly contacted to corresponding end plates of the scrolls 2,3, and 4, thereby performing orbital movement with a sealing at the tip-seals 6.

For a normal function of the tip-seals 6, it is necessary that clearances 7 between the orbiting spiral wraps 5 and 5 and the corresponding end plates of the stationary scrolls 3 and 4 and other clearances 7 between the stationary spiral wraps 5a and 5a and the corresponding end plates of the orbiting scroll 2 are equal.

The orbiting scroll 2 is, however, movable on the eccentric shaft portion 1a of a driving shaft 1 in an axial direction since bearings of the orbiting scroll 2 are all needle bearings 10. Further, the stationary scrolls 3 and 4 are not fixed to the driving shaft 1 in the axial direction, then they are movable within clearances 7 at the tips of the spiral wraps 5,5,5a, and 5a since a ball bearing 13b allows slight slips in the axial direction as shown with "X" in Fig.5. Therefore, it is difficult to set and keep the orbiting scroll 2 at a position where the above two kinds of clearances 7 are equal.

Accordingly, the orbiting scroll 2 is likely to be offset more or less to either side of the eccentric shaft portion la in the axial direction due to the above reason, an assembling skill, or a machining accuracy of related parts.

Since a fitting force between the orbiting scroll 2 and the eccentric shaft portion la through a plurality of bearings and of oil-seals is larger than a force due to a pressure on the tip-seals 6 with elasticity, the orbiting scroll 2 being offset to either side is not expected to be shifted on the eccentric shaft portion la by the latter force, in other words, the offset of the orbiting scroll 2 could not be improved by the pressure on the tip-seals 6.

Therefore, there has been problems on the above-mentioned conventional twin-type scroll fluid machine that when the orbiting scroll 2 is assembled with the eccentric shaft portion 1a, for example with an offset on the right side, the clearances 7 in the right side portion of the fluid machine become too small, thereby causing rapid wear or short life of the tip-seals 6 due to too high pressure on the tip-seals 6, and at the same time, the clearances 7 in the left side portion become too large, thereby causing leakage from the clearances 7 or an insufficiency of pressure due to too low pressure on the tip-seals 6.

Also, there has been the same kind of problems as the aboves on a conventional single-type scroll fluid machine.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a scroll fluid machine with a structure of fixing an orbiting scroll to the center of an eccentric shaft portion of a driving shaft in an axial direction so as to eliminate the above-mentioned defects.

In order to achieve the above objective, the present invention adopts a structure, wherein a stationary scroll is fixed to a rotary shaft portion of a driving shaft by means of an axially rigid bearing and an orbiting scroll is fixed to an eccentric shaft portion of the driving shaft by means of another axially rigid bearing for preventing the stationary and orbiting scrolls from moving on the driving shaft in the axial direction.

This structure ensures to keep uniform clearances at the tips of spiral wraps and to make a pressure on tip-seals uniform, thereby ensuring smoother orbital movement with a condition for achieving a sufficient effect on a compression process.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view showing a conventional twin-type scroll fluid machine;

Fig. 2 is a sectional view showing an embodiment of scrolls and a driving shaft portion of a twin-type scroll fluid machine according to the present invention;

Fig. 3 is a partially sectional view showing an embodiment of a single-type scroll fluid machine according to the present invention;

Fig. 4 is a sectional view showing scrolls and a driving shaft portion of Fig. 1; and

Fig. 5 is a sectional view showing slips of a ball bearing used in a conventional scroll fluid machine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described in further detail with reference to the accompanying drawings.

Fig.2 shows an embodiment of a twin-type scroll fluid machine in accordance with the present invention.

As shown in Fig.2, an eccentric shaft portion 1a is rotatably fit into a boss portion of an orbiting scroll 2 by means of a needle bearing 10 and a double row angular

ball bearing 8. Stationary scrolls 3 and 4 are assembled with a rotary shaft portion 1b by means of a double row angular ball bearing 13 and a snap ring 14 in a bearing housing portion of the stationary scroll 3 so as to fixedly construct the stationary scrolls 3 and 4 against a driving shaft 1 in the axial direction. On the other hand, the orbiting scroll 2 is assembled with the eccentric shaft portion la fixedly in the axial direction, with the axial direction's center of the boss portion of the orbiting scroll 2 being positioned at the axial direction's center of the eccentric shaft portion 1a, by means of the angular ball bearings 8, snap rings 9 and 9', and a bearing collar 15 all being fit in the boss portion. All clearances 7 between the tips of spiral wraps 5,5,5a, and 5a and corresponding end plates are equally kept.

Referring to Fig.2, the orbiting scroll 2 relatively revolves around the rotary center of the driving shaft 1 due to rotation of the driving shaft 1 around the rotary center. On this movement, the stationary scrolls 3 and 4 are fixed against the driving shaft 1 in the axial direction by the angular ball bearings 13 and the snap ring 14, and the orbiting scroll 2 is fixed against the eccentric shaft portion 1a in the axial direction by the angular ball bearings 8 and the snap rings 9 and 9', having the clearances 7 with the stationary scrolls 3 and 4 at the both sides. With this structure, the orbiting scroll 2 is able to rotate constantly without moving in the axial direction, that is, without change of the clearances 7, thereby ensuring a normal operation of the fluid machine by maintaining a set pressure on any tip-seal 6 provided at the tips of the orbiting spiral wraps 5 and 5 and of the stationary spiral wraps 5a and 5a.

Fig.3 shows another embodiment of a scroll fluid machine, i.e. a single-type scroll fluid machine having an eccentric shaft portion 1a covering whole a driving shaft 1 with the same width as an orbiting scroll 5, in accordance with the present invention. This embodiment has the same features as the previous one.

According to the present invention as described hereinabove, the pressure on the tip-seals at the tips of the spiral wraps are equalized when the orbiting scroll orbits in an orbiting space formed in the stationary scroll, since the orbiting scroll is fixed so as to make the clearances at the tips of the spiral wraps uniform. As the result, the aforementioned problems such as rapid wear or short life of tip-seals due to too high pressure on the tip-seals and leakage from clearances or an insufficiency of pressure due to too low pressure on tip-seals are eliminated. Further, orbital movement is stabilized due to fixation of the orbiting scroll in an axial direction.

Claims

1. A scroll fluid machine comprising:

   a stationary scroll;
   an orbiting scroll combined with a driving shaft having an eccentric shaft portion for performing orbital movement;
   spiral wraps each provided axially on end plates of said stationary and orbiting scrolls, said spiral wraps forming lap-portion functioning as a compression chamber to compress a fluid inwardly from a periphery to a center;
   an axially rigid bearing engaged with a rotary shaft portion of said driving shaft and also with a bearing housing of said stationary scroll so as to prevent said driving shaft from moving in the axial direction; and
   another axially rigid bearing engaged with said eccentric shaft portion of said driving shaft and also with said orbiting scroll so as to prevent said orbiting scroll from moving on said eccentric shaft portion in the axial direction.

2. The scroll fluid machine according to claim 1, wherein clearance between an end plate of said stationary scroll and a tip of said spiral wrap of said orbiting scroll and clearance between an end plate of said orbiting scroll and a tip of said spiral wrap of said stationary scroll are equally constructed.

FIG. 1
PRIOR ART

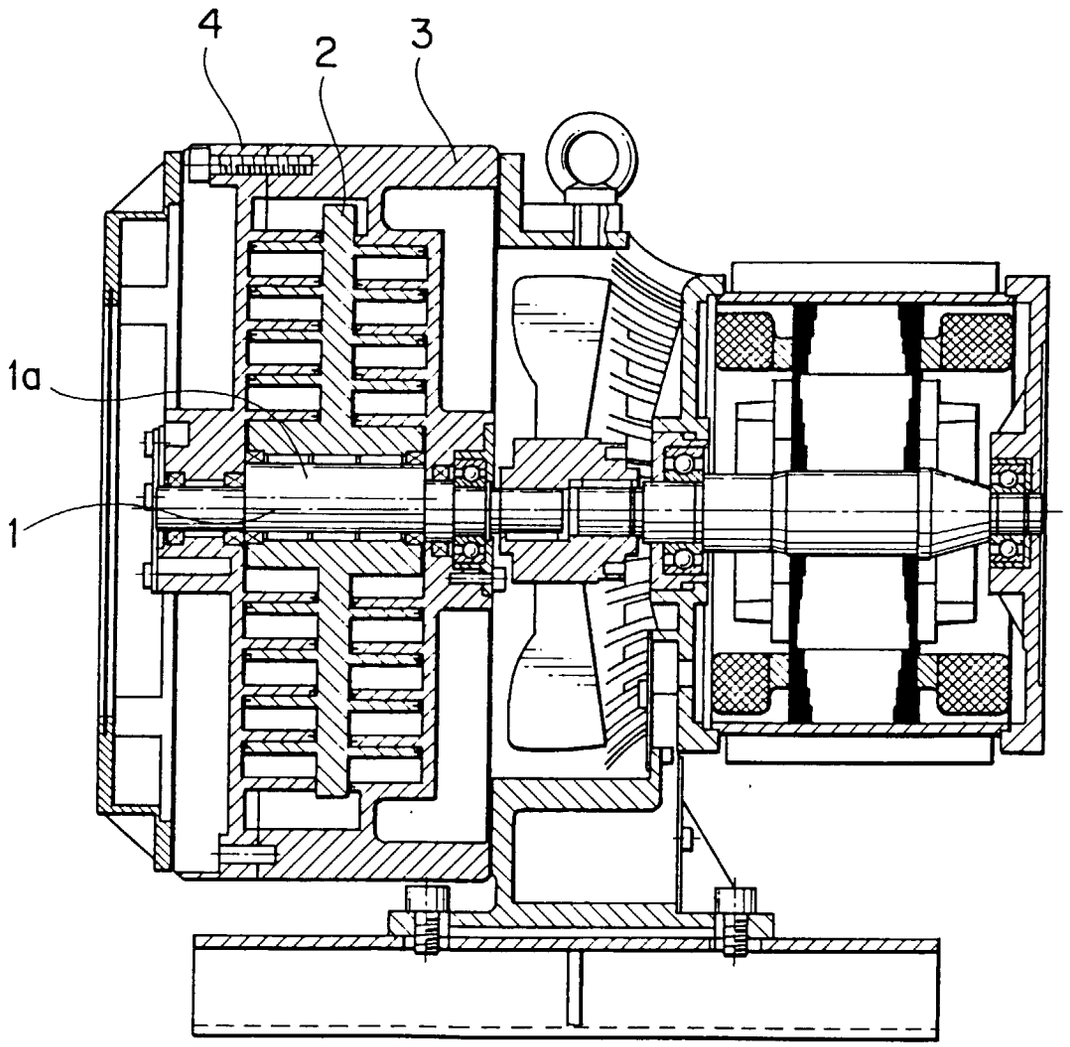


FIG. 2

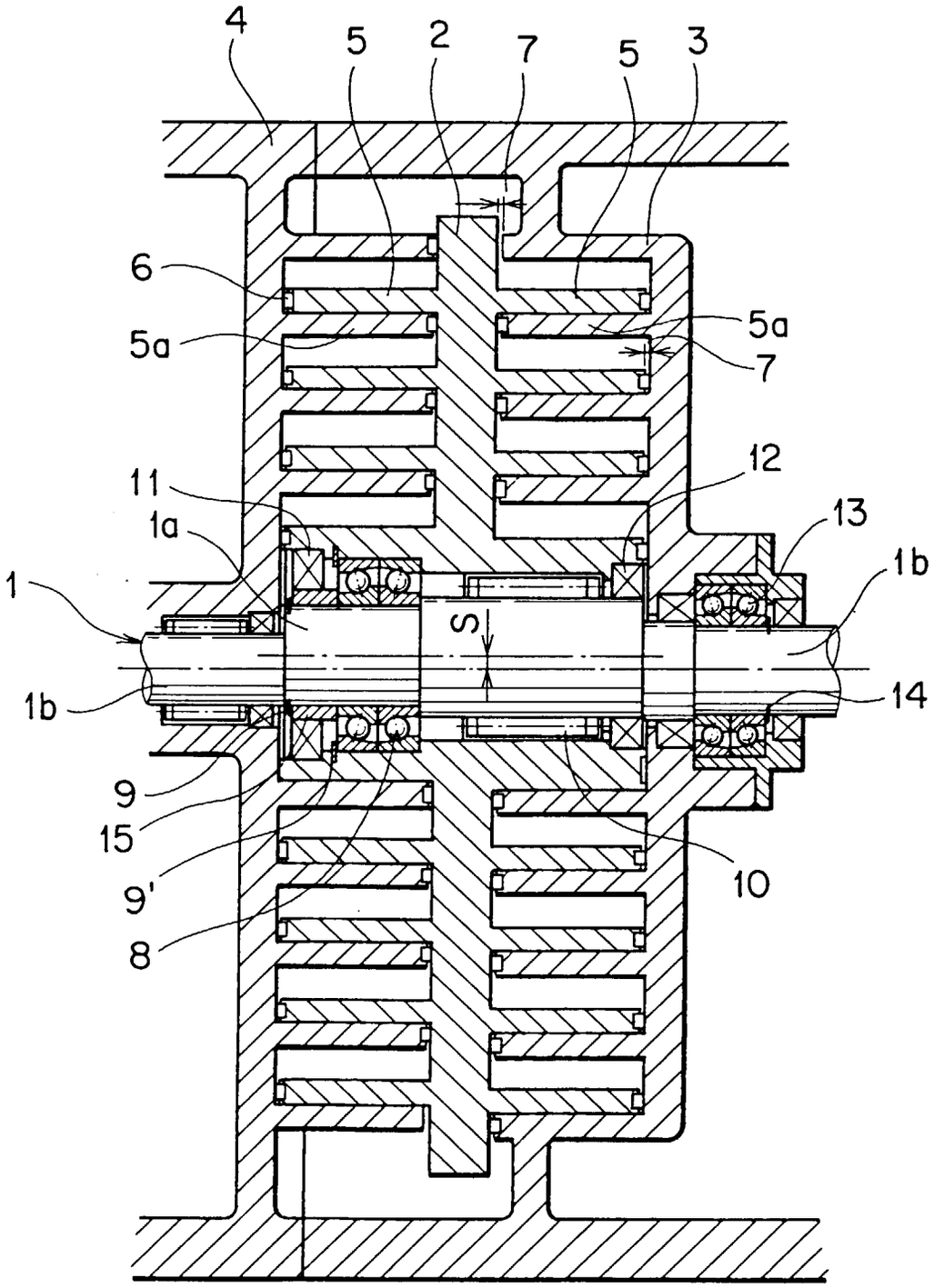


FIG. 3

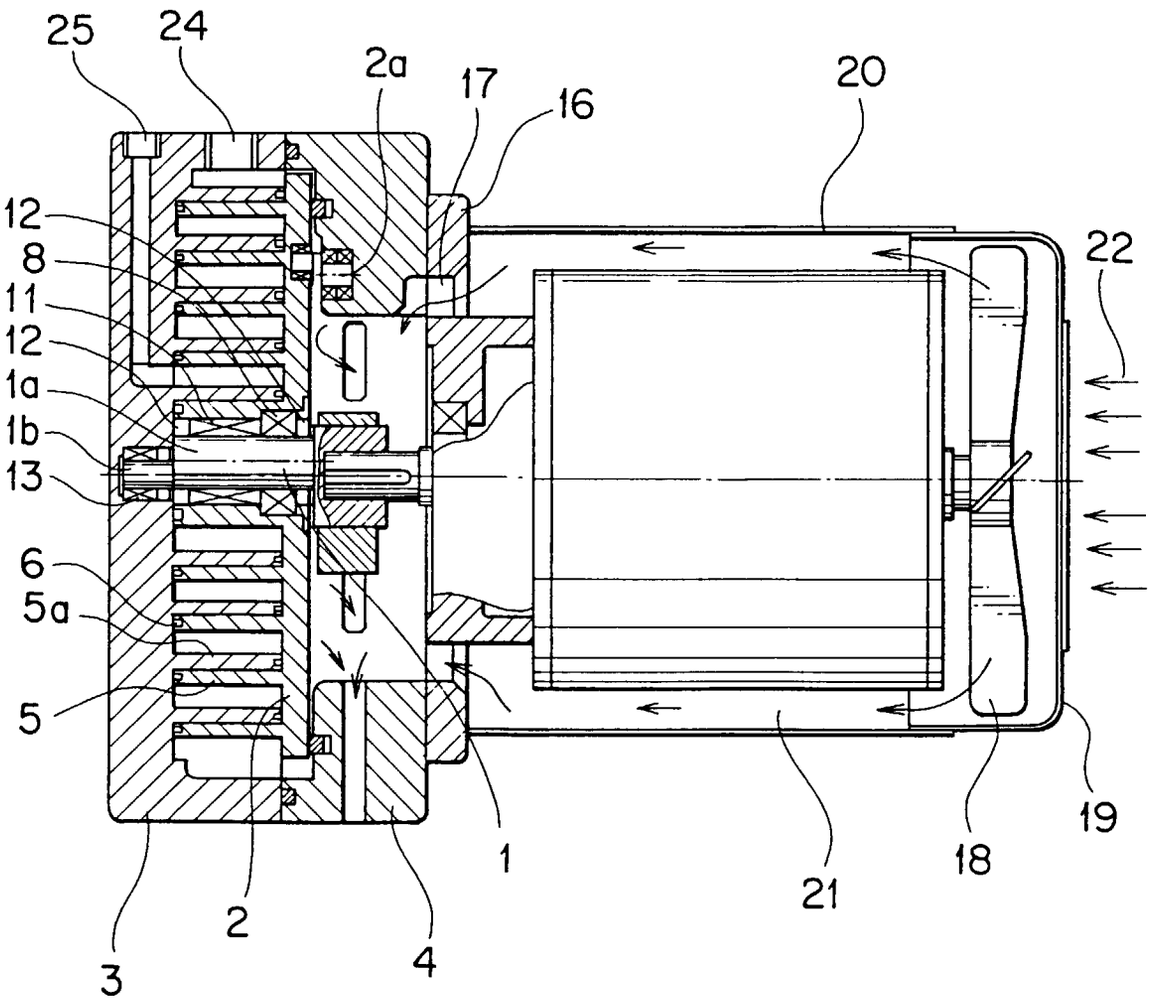


FIG. 4
PRIOR ART

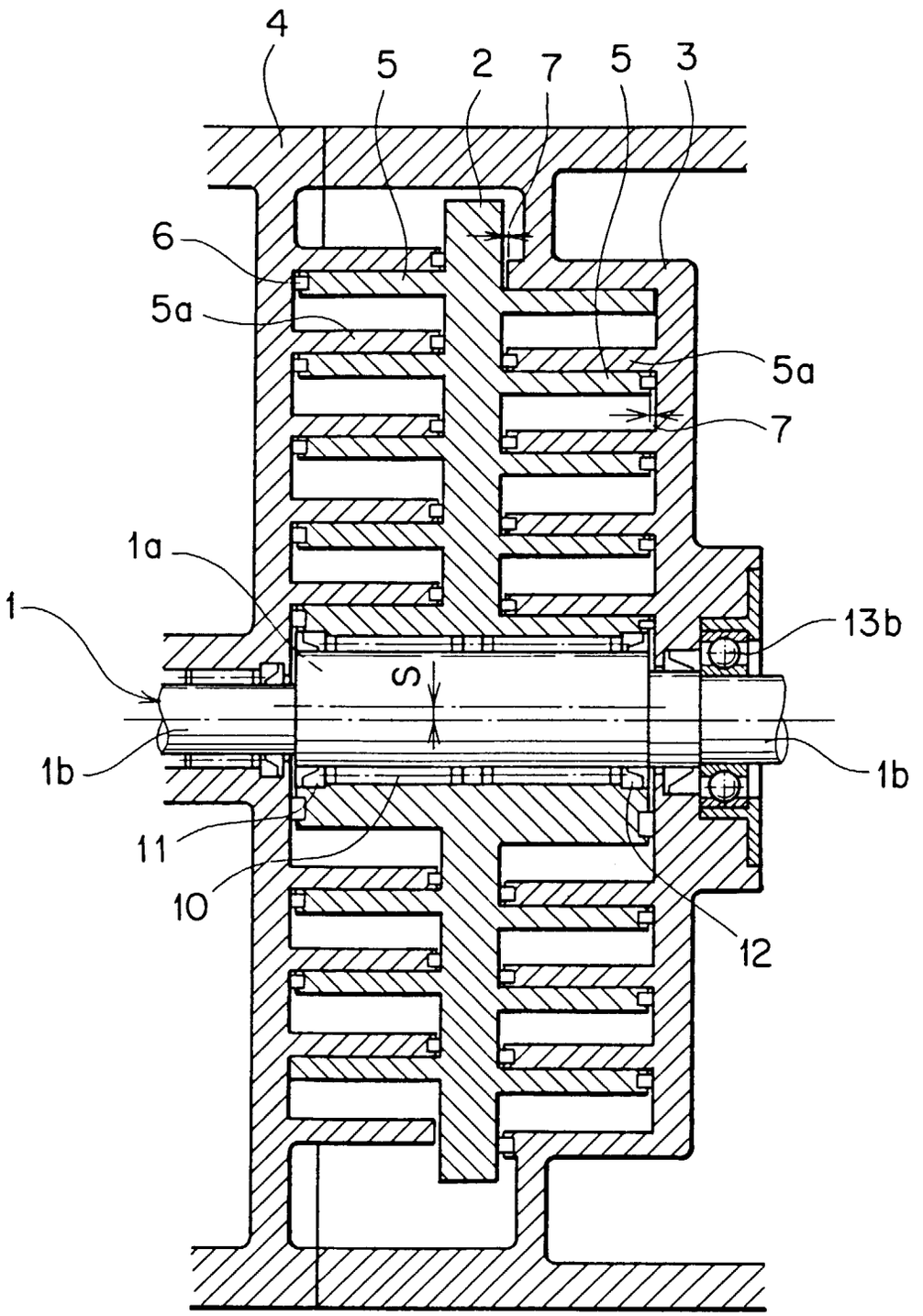


FIG. 5