

SCROLL MACHINE WITH ANTI-ROTATION COUPLING DEVICE

This invention in general relates to a scroll machine and more particularly to anti-rotation coupling a scroll machine with an anti-rotation coupling device.

Fluid displacement apparatus of the scroll type typically include two parallel plates, each having an involute wrap element disposed on one side. These involute elements, having offset and parallel axes, intermesh with each other such that the sides of the involutes and the parallel plates define sealed fluid pockets.

As one involute orbits the other, the fluid pockets move from an inlet port, along the flank surfaces of the involute wrap elements, and through an outlet port. Depending on the configuration of the involutes and their direction of orbital rotation, the volume of these moving pockets will either increase, decrease, or remain relatively constant. Thus, a scroll machine may function as an expander (vacuum pump), a compressor, or a liquid pump, respectively.

If one involute element were free to rotate with respect to the other, some of the fluid pocket seals would leak and the intermeshed involutes would bind together. Therefore, to prevent this it is necessary to have an anti-rotation coupling that maintains a fixed angular relationship between the involutes yet still allows one to orbit the other.

Designs for such couplings are well-known in the prior art. For example, US Patent No. 3,924,977 discloses a conventional so-called "Oldham coupling" comprising an annular ring with four sliding keys
5 disposed at 90 intervals around its perimeter. Two of the keys, at opposite sides of the ring engage slots in the orbiting element while the other two engage slots in the stationary portion of the machine. Although this coupling is effective, its bulk requires
10 substantial space within the scroll machine and it is somewhat costly to manufacture.

The invention aims to provide a scroll machine with a simple anti-rotation coupling that requires minimal space in a scroll machine, and which is less
15 expensive to manufacture than conventional coupling designs.

The invention provides a scroll machine comprising: two generally parallel scroll plates, the facing surfaces of which define involute wrap elements
20 that mesh with each other, and an anti-rotation coupling device for preventing the relative angular rotation of the scroll plates as one orbits relative to the other, wherein the anti-rotation coupling device comprises a substantially annular member having
25 a plurality of radially extending tabs integrally formed at edge portions of the annular member such that at least one of said tabs slidably engages a

respective slot in an orbiting scroll plate and at least one other of the tabs slidably engages a respective slot disposed in a stationary portion of the scroll machine.

5 As will be described in greater details hereinafter in relation to preferred embodiments, the coupling, comprising a generally annular member blanked as a unitary piece from sheet metal, includes a plurality of tabs disposed about the member. Each
10 of these tabs extend in a radial direction at spaced-apart intervals around the annular member with at least one tab arranged to slidably engage with at least one slot disposed in the orbiting scroll plate, and with at least one other tab generally
15 perpendicular to the first slidably engaging at least one slot in a stationary portion of the scroll machine. The tabs, being free to slide within the slots, allow one scroll plate to be driven in an orbital path relative to the other while constraining
20 it in a fixed rotational relationship. This coupling means requires minimal space within the scroll machine because the coupling is a relatively thin item that can be easily blanked from sheet metal in a single operation.

25 In order that the invention may be well understood, embodiments will be described, by way of

example only, with reference to the accompanying drawings, in which:

Figure 1 is a part section view showing a first embodiment of a scroll machine incorporating a first
5 anti-rotation coupling device having two tabs above and two tabs below a thrust bearing;

Figure 2 shows a cross-sectional view of the coupling lying below the scroll plates;

Figure 3 shows an isometric view of the coupling;

10 Figure 4 shows a cutaway view of a scroll machine incorporating a second anti-rotation coupling disposed between scroll plates; and

Figure 5 shows a top cutaway view of the scroll machine of Figure 4 with the coupling disposed around
15 the scroll elements.

Referring now to the drawings, Figure 1 illustrates a scroll compressor generally denoted by numeral 4. As in many other scroll compressors, two parallel, intermeshed scroll elements 6 and 8 are
20 driven to orbit relative to each other in a fixed angular relationship. In compressor 4, this fixed angular relationship is maintained by an anti-rotation coupling 10 which is similar in some respects to an "Oldham coupling". The form of the anti-rotation
25 coupling 10 can best be seen in Figure 3.

The coupling 10 includes an oblong ring 12 with four spaced apart
5 tabs 14, 16, 18, and 20 extending outwardly from its perimeter at 90° intervals. This simple design facilitates manufacture of the coupling as a unitary piece, not requiring assembly or fabrication of component parts. For example, it can be blanked and formed from sheet metal in a single progressive die operation. In addition, since coupling 10 is relatively
10 thin, the material cost and space required within compressor 4 is minimal.

In the first embodiment shown in Figure 2, coupling 10 is disposed around drive pin 22 which extends from the bottom face of orbiting scroll element 8. Coupling 10 is disposed directly below and generally
15 parallel to orbiting scroll element 8. Referring to Figures 1 and 2, two parallel tabs 14 and 16, extending from opposite sides of ring 12 and adjacent thrust bearing 24 are bent upwardly to slidably engage slots 26 and 28 which are disposed in the bottom face of orbiting scroll element 8. This sliding engagement allows orbiting scroll element 8 to move in
20 one direction relative to coupling 10 and prevents it from rotating with respect to the coupling. Two other tabs 18 and 20 are perpendicular to the first two tabs and are bent downwardly to extend underneath thrust bearing 24, slidably engaging slots 30 and 32. Alternatively, tabs 18 and 20 may be co-planar with ring 12, i.e., not downwardly offset, if
25 ring 12 clears thrust bearing 24. These slots are disposed in a stationary portion of compressor 4 such as frame 34. As illustrated in Figure 1, tabs 30 and 32 are longer than the first two tabs because, they are disposed on the shorter axis of oblong ring 12 and must extend further to remain slidably engaged in their respective slots 30 and 32. The sliding
30 engagement of tabs 18 and 20 with slots 30 and 32 in frame 34 pre-

vents coupling 10 from rotating but allows coupling 10 to move along the Y-axis. Therefore, drive pin 22 orbits in a circular path within ring 12, as coupling 10 moves along the X-axis sliding within slots 26 and 28, and forcing scroll element 8 along with it as it moves along the Y-axis.

5 Coupling 10 thus insures that scroll element 8 moves in fixed angular relationship relative to fixed scroll element 6.

Coupling 10 is lubricated with oil from reservoir 36. Centrifugal pump 38 mounted on the lower end of hollow drive shaft 40 delivers oil from reservoir 36, up through hollow drive shaft 40 and into
10 cavity 42 which is disposed in the lower side of swing link 44. Oil received in cavity 42 is centrifugally slung outward to the perimeter of the cavity where the inlet of riser 46 is located. Riser 46, vertically disposed in swing link 44, provides a path for the oil and directs the flow towards thrust bearing 24 and coupling 10.

15 In the second embodiment, coupling 10' is disposed between and extends around scroll elements 6' and 8' as shown in Figures 4 and 5. Anti-rotation coupling 10' is similar to coupling 10 in Figure 3 as it includes ring 12' with four tabs 14', 16', 18' and 20' disposed around its perimeter at 90° intervals and can be blanked as a unitary piece from
20 sheet metal. But referring to Figures 4 and 5, it is shown that tabs 18' and 20' extend inward from ring 12' and slidably engage slots 30' and 32' which are disposed on the top face of orbiting scroll element 8'. The other two tabs 14' and 16', extending outward from and perpendicular to the first two, slidably engage slots 26' and 28' which are disposed
25 in the outer perimeter of stationary scroll element 6'. The sliding engagement of tabs 14', 16', 18' and 20' in their respective slots 26', 28', 30' and 32' serves the same purpose as the similar arrangement described in the first embodiment.

Although the invention is described with respect
to two preferred embodiments, modifications thereto
will become apparent to those skilled in the art.
Therefore, the scope of the invention is to be
5 determined by reference to the appended claims.

CLAIMS:

1. A scroll machine comprising: two generally parallel scroll plates, the facing surfaces of which define involute wrap elements that mesh with each other, and an anti-rotation coupling device for preventing the relative angular rotation of the scroll plates as one orbits relative to the other, wherein the anti-rotation coupling device comprises a substantially annular member having a plurality of radially extending tabs integrally formed at edge portions of the annular member such that at least one of said tabs slidably engages a respective slot in an orbiting scroll plate and at least one other of the tabs slidably engages a respective slot disposed in a stationery portion of the scroll machine.

2. A scroll machine according to claim 1, further comprising a supporting frame, and wherein the or each slot in the stationary portion of the scroll machine is disposed in said frame such that the longitudinal axis of the or each slot in the supporting frame is substantially perpendicular to the longitudinal axis of the or each slot in the orbiting scroll plate.

3. A scroll machine according to claim 1 or 2 further comprising driving means extending through the



center of said annular member to connect to said orbiting scroll plate for driving said scroll plate in orbital motion.

4. A scroll machine according to any one of the preceding claims, wherein the annular member is substantially planar and the coupling device is provided with two tabs for sliding engagement with respective slots in the orbiting scroll plate and two tabs for sliding engagement with respective slots in the said stationary portion.

5. A scroll machine according to claim 4, wherein two of the said four tabs extend outwardly from the annular member along a common axial line and are bent out of planar alignment with the annular member.

6. A scroll machine according to claim 5, wherein the other two tabs extend outwardly from the annular member along a common axial line

7. A scroll machine according to claim 5, wherein the other two tabs extend inwardly from the annular member along a common axial line.

8. A scroll machine according to claim 6 or 7,



wherein the said other two tabs are bent out of planar alignment with the annular ring in a direction opposite that of the first two tabs.

9. A scroll machine according to any one of claims 4
5 to 8, wherein the annular member is substantially oval with two tabs parallel to the longer axis of the oval and two tabs parallel to the shorter axis of the oval, and wherein said two tabs that are parallel to the longer axis are shorter in length than the two tabs
10 parallel to the shorter axis and slidably engage the slots in the orbiting scroll plate, while said two tabs that are longer, slidably engage the slots in the stationary portion of the scroll machine.

10. A scroll machine according to claim 1, wherein
15 the annular member is disposed between the scroll plates and around the involute wrap elements, with at least one tab slidably engaging a slot disposed in one scroll plate and at least one tab slidably engaging a slot in the other scroll plate.

20 11. A scroll machine according to any one of the preceding claims, wherein the anti-rotation coupling device is blanked from sheet metal.



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12. A scroll machine having an anti-rotation coupling and substantially as described herein with reference to Figures 1 to 3, or to Figures 4 and 5 of the accompanying drawings.

