ABSTRACT

A slider block has an inner bore which receives an eccentric pin, and a generally flat drive surface over a limited circumferential extent to be engaged by a flat drive surface on an eccentric pin. A counterweight is positioned on an outer periphery of the slider block. The counterweight has a center line defining a first plane. A second plane is defined parallel to the first plane, with the second plane including a point on the flat drive surface of the slider block, with the flat drive surface of the slider block including a third plane, and a non-zero angle defined between the second and third planes.
COUNTERWEIGHT INCORPORATED INTO SLIDER BLOCK FOR SCROLL COMPRESSOR

BACKGROUND

[0001] This application relates to a scroll compressor wherein a counterweight is incorporated into the drive connection such that it surrounds a slider block.

[0002] Scroll compressors are known and have become widely utilized in refrigerant compression applications. In a typical scroll compressor, a first scroll member has a base and a generally spiral wrap extending perpendicularly from the base. The first scroll member interferes with the orbit of a second scroll member. The second scroll member is driven to orbit by a drive connection relative to the first scroll member, and as it orbits, the wraps move relative to each other to entrap refrigerant, and then decrease the size of compression chambers to compress the refrigerant.

[0003] One standard type of drive connection includes a so-called “slider block.” The slider block surrounds an eccentric pin on a drive shaft. The slider block interferes upwardly into a boss in the second scroll member. As the shaft is driven to rotate, the eccentric pin moves eccentrically, and a relatively flat drive face on the pin engages a relatively flat drive face on the slider block to cause the wraps to be held in contact, and the wraps orbit relative to each other.

[0004] Counterweights are also utilized in scroll compressors. It has been known to incorporate a counterweight into the area of the drive connection, such that it surrounds and is fixed to the slider block.

SUMMARY

[0005] A scroll compressor has a first scroll member and a second scroll member, each of having a base and a generally spiral wrap extending from their base. The second scroll member has a boss extending away from the base in an opposed direction to the wrap. A motor drives a drive shaft, which has an eccentric pin extending upwardly into a slider block. The slider block is received between the pin and an interior surface of the boss. The slider block has an inner bore which receives the eccentric pin, and a generally flat drive surface over a limited circumferential extent to be engaged by a flat drive surface on the eccentric pin. A counterweight is positioned on an outer periphery of the slider block. The counterweight has a center line defining a first plane. A second plane is defined parallel to the first plane and including a point on the flat drive surface of the slider block, with the flat drive surface of the slider block including a third plane, and a non-zero angle defined between the second and third planes being.

[0006] These and other features of the present invention can be best understood from the following specification and drawings, of which the following is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a cross-sectional view through a scroll compressor.
[0008] FIG. 2A is a top view of a counterweight.
[0009] FIG. 2B is a cross-section along line A-A of FIG. 2A.
[0010] FIG. 2C is a bottom view of a combined counterweight and slider block.

[0011] FIG. 2D shows one graphical feature of the FIG. 2C combination.
[0012] FIG. 3 shows an alternative feature.

DETAILED DESCRIPTION

[0013] A compressor 20 is illustrated in FIG. 1 having a drive motor 122 driving a shaft 24. Shaft 24 is provided with an eccentric pin 26. A slider block 28 has a bore surrounding the eccentric pin 26. As is known, the slider block and pin each have a generally cylindrical section over a good deal of circumferential extent of the two. However, a relatively flat drive face is formed on both the eccentric pin and the slider block over a limited circumferential extent. These two relatively flat drive surfaces are brought into contact to cause an orbiting scroll member 21 to orbit relative to a non-orbiting scroll member 22. In addition, a non-rotating coupling, such as an Oldham coupling, may be positioned to cause the orbiting movement, as known. While the term “flat faces” have been utilized to describe surfaces on the eccentric pin and slider block, in practice, there may be a slight curve or barrel shape to one or both, and the term “flat” should be interpreted with this in mind.

[0014] A counterweight 30 surrounds the slider block 28. As shown, a cylindrical ring 36 on the counterweight 30 surrounds the slider block 28, and an extending portion 34 extends upwardly such that it circumferentially surrounds a boss 32 that receives the slider block 28 and eccentric pin 26. As shown, a hydrodynamic oil bearing 400 is positioned intermediate the inner periphery of the boss 32, and the outer periphery of the slider block 28.

[0015] As is well known in scroll compressors, refrigerant to be compressed enters the compressor 20 through a suction tube 160, and flows into a suction pressure chamber 101 surrounding the motor 122. That refrigerant passes upwardly into compression chambers 105 formed between the scroll members, and is compressed and delivered into a discharge pressure chamber 102. From the discharge pressure chamber 102, the refrigerant flows outwardly through a tube 103.

[0016] FIG. 2A is a bottom view of the counterweight 30. As shown, a bore 40 is formed in the interior of the counterweight, and is tightly received on the outer periphery of the slider block 28. The counterweight 30 has a center line 59, which is a center of weight for the counterweight.

[0017] As shown in FIG. 2B, an angle A is defined at a ramp outer portion 50 which extends upwardly into the extending portion 34. Angle A may be between 20° and 60°. In some embodiments, this angle may be omitted entirely.

[0018] As shown in FIG. 2C, when the slider block 28 is received within the bore 40, there is a flat drive face 62 on the interior bore 60 of the slider block 28. The outer periphery of the eccentric pin 26 is shown, and can be seen to have a mating drive face 99. As shown, the outer periphery of the eccentric pin 26 also has a cylindrical portion 98 at locations spaced from the flat drive surface 99. Similarly, there is a cylindrical portion 61 forming part of the bore 60 of the slider block 28.

[0019] As shown, the inner periphery of the bore 40 is provided with a flat 300, as is the outer periphery of the slider block 28. This will ensure proper positioning of the counterweight on the slider block.

[0020] As shown in FIG. 2D, a line 159 can be defined which is parallel to the line 59. Line 159 has a point X which is on the flat drive surface 62. The plane of the flat drive surface 62, and the line 159, define an angle B. In practice, this angle is non-zero and may be between 5° and 40°, and
more particularly between 5° and 20°, and more particularly, between 6° and 20°. In one embodiment, the angle was between 7.5° and 17.5°.

[0021] By having this relationship between the flat drive surface 62 and the counterweight center axis 59, better control of the operation of the scroll compressor is achieved. The angle provides extra closing force, and better control to hold the wraps in contact during compression. The centrifugal force created by the moving elements has a part in holding the wraps in contact, and the use of the counterweight will somewhat limit that centrifugal force. As such, this angle provides additional force. On the one hand, if the angle is too small, there may not be enough force, but excessive force would also be undesirable. As such, the mentioned ranges provide valuable benefits.

[0022] FIG. 3 shows an alternative counterweight 198, wherein the extending portion 200 and the ring 202 are generally as shown in the earlier embodiment. However, a circumferential edge 204 of the extending portion 200 is formed at an angle C relative to an upper surface of the ring portion 202. This surface assists in directing oil flow to appropriate surfaces. In embodiments, the angle C may be between 95° and 125°, and in one embodiment was 110°.

[0023] Although an embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

What is claimed is:

1. A scroll compressor comprising:
   a first scroll member and a second scroll member, each of said first and second scroll members having a base and a generally spiral wrap extending from their base;
   said second scroll member having a boss extending away from said base in an opposed direction to said wrap;
   a motor for driving a drive shaft, said drive shaft having an eccentric pin, said eccentric pin extending upwardly into a slider block, said slider block being received between said pin and an interior surface of said boss, and said slider block having an inner bore which receives said eccentric pin, and having a generally flat drive surface over a limited circumferential extent to be engaged by a flat drive surface on said eccentric pin;
   a counterweight positioned on an outer periphery of said slider block; and
   said counterweight having a center line, and a second line being defined parallel to said center line, with said second line including a point on said flat drive surface of said slider block, with said flat drive surface of said slider block defining a plane, and a non-zero angle defined between said second line and said plane.

2. The scroll compressor as set forth in claim 1, wherein said angle is between 6° and 40°.

3. The scroll compressor as set forth in claim 2, wherein a locating feature is provided between said counterweight and said slider block.

4. The scroll compressor as set forth in claim 3, wherein said locating feature is a flat portion provided between the counterweight and the slider block.

5. The scroll compressor as set forth in claim 2, wherein said angle is between 5° and 20°.

6. The scroll compressor as set forth in claim 5, wherein said angle is between 7.5° and 17.5°.

7. The scroll compressor as set forth in claim 1, wherein said counterweight having a ring portion surrounding said slider block, and an extending portion extending upwardly and partially surrounding an outer peripheral surface of said boss.

8. The scroll compressor as set forth in claim 7, wherein said extending portion having an angled surface extending from said ring portion into said extending portion.

9. The scroll compressor as set forth in claim 8, wherein a second angle is defined from the angled surface relative to a plane which is perpendicular to a drive axis of the drive shaft, the second angle being between 20° and 60°.

10. The scroll compressor as set forth in claim 1, wherein a circumferential extent of said extending portion is formed at a third angle relative to a top surface of said ring portion, with said third angle being between 95° and 125°.

11. The scroll compressor as set forth in claim 1, wherein a locating feature is provided between said counterweight and said slider block.

12. The scroll compressor as set forth in claim 11, wherein said locating feature is a flat portion provided between the counterweight and the slider block.

13. The scroll compressor as set forth in claim 1, wherein a hydrodynamic oil bearing is positioned between an inner surface of said boss, and an outer surface of said slider block.

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