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ROTARY COMPRESSOR OR MOTOR

Filed April 30, 1941

FIG. 1.

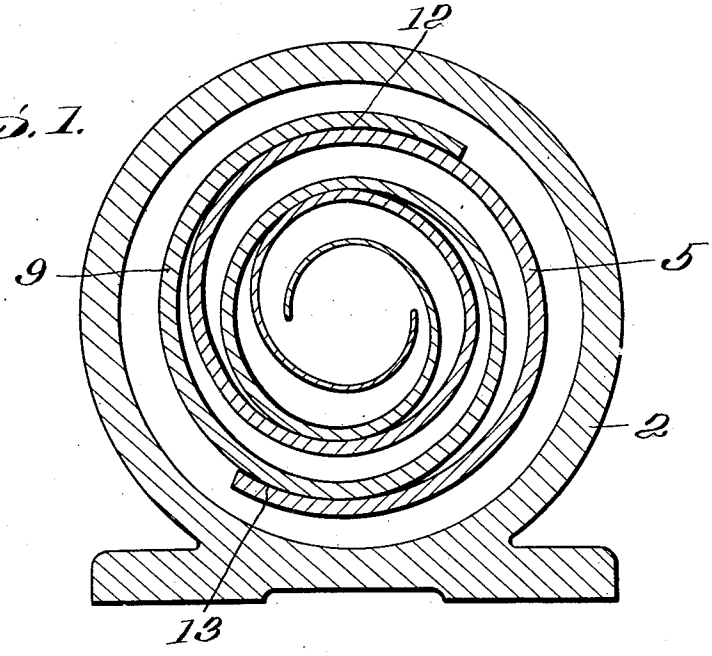
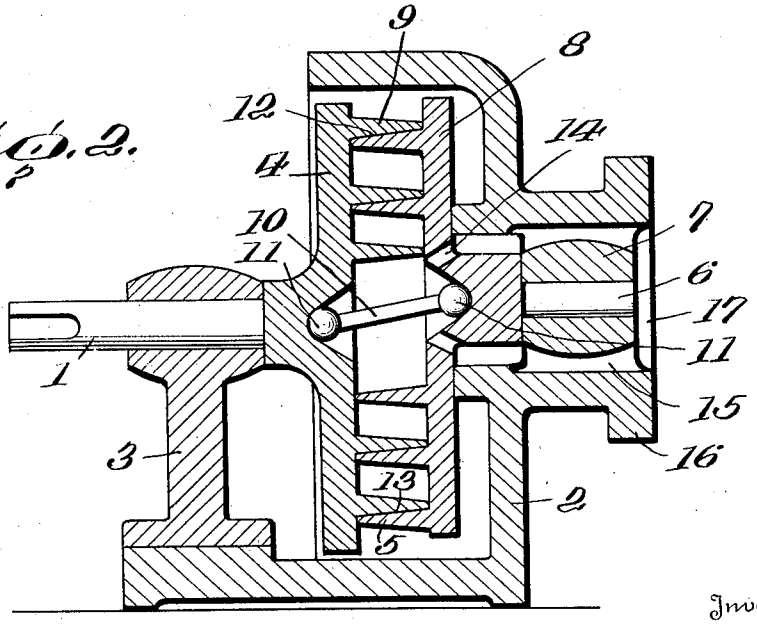


FIG. 2.



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ROTARY COMPRESSOR OR MOTOR

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3 Claims. (Cl. 230—140)

The present invention refers to improvements in rotary compressors or motors of the type in which the compression chambers or expansion chambers, respectively, are bounded by two co-operating spiral surfaces which are eccentrically arranged on parallel axes and which are brought to rotate in the same direction with the same speed.

In compressors of this type the two co-operating spiral surfaces are arranged on flanges which project toward each other from two opposite disks which bound the compression chambers in the axial direction, while said flanges form the radial boundary of the same, and the edge of the flange on one disk is situated immediately adjacent or in contact with the inner surface of the other disk.

In prior compressors of this type it has been found impossible to get a good seal, because one has failed to make the spirals sealing one against the other in all positions. As the purpose of such a compressor is that at the rotation the air or gas which is caught at the outer periphery shall be moved toward the centre while being compressed, it is of the greatest importance that the surfaces really are in sealing contact one against the other.

The object of the present invention is to avoid the above deficiency and provide a compressor of the type in question in which there is a perfect sealing contact between the co-operating spiral surfaces. Another object is to provide a form of flanges having a thickness of material not greater than necessary with regard to the strength at any point.

These objects are attained by making the outer spiral surface of the flanges of a higher pitch than the inner spiral surface of the same flange. It has also been found preferable that the ratio of the pitch of the outer surface to the pitch of the inner surface of the flanges should be increased as the surfaces approach the centre. This may be attained for example by making the inner flange surfaces of a pitch which at the outer periphery of the disk on which the flange is mounted is only slightly greater than the pitch of the inner surface of the same flange to increase as the first mentioned surface approaches the centre or by keeping the pitch of the outer spiral surfaces constant, while the pitch of the inner surfaces is made only slightly less near the periphery but is progressively reduced toward the centre. By "pitch" is meant the increment of the radius for a certain angle unit. If the formula of a spiral of Archimedes is $r=a\cdot\phi$, where r is the radius and ϕ the angle, in the case under consideration the pitch a is no longer a constant, at least not for both the co-operating spiral surfaces.

By this varying pitch which is necessary for obtaining an efficient sealing contact between the spirals is also obtained that the thickness of the material of the spiral flanges is increased from the inner parts outwardly toward the periphery, and as such a compressor is generally intended to be driven at high speed and at the same time with a great capacity it is preferred to make these flanges of as great a length as possible and of as small dimensions otherwise as permissible with regard to the strength, the necessary thickness of the material in the parts of the spiral flanges adjacent the outer periphery may be attained without the same thickness of material being necessary nearer to the centre. To increase the strength still further and also to enable the surfaces to be fitted together with the least possible clearance in spite of the specific shape of the surfaces, it has also been found preferable to make the spiral flanges of trapezium-shaped cross section, i. e. to permit the thickness of the material of the flanges to decrease in cross section in the axial direction from the supporting disks toward the free edges of the flanges.

The invention is explained below with reference to the accompanying drawing which shows one form thereof and in which—

Figure 1 is a cross-section through the compressor and

Figure 2 shows the compressor in an axial section.

On a shaft 1 which is driven by a suitable power source and which is mounted in a pedestal 3 on a frame 2, a disk 4 is concentrically secured. Another shaft 6 having a similar concentric disk 8 is provided parallel with the axle 1 but supported eccentrically in relation thereto in a bearing 7 mounted in the frame 2. An oblique spindle 10 which at both ends is provided with universal ball joints 11, connects the disks 4 and 8, so that they are brought to rotate in the same direction at the same angular velocity. The side of the disk 4 facing the disk 8 is provided with a spiral-shaped flange 9 the free edge of which fits with a sealing contact against the flat inner surface of the disk 8, and the latter disk is in a similar manner provided with a uniform spiral flange 5 which is turned half a revolution in relation to the spiral flange 9 and the free edge of which is in a sealing contact with the flat inner surface

of the disk 4. The outer surface of the spiral flange 9 is at a generatrix indicated at 13 in sealing engagement with the inner surface of the spiral flange 5, and the inner surface of the first flange is in sealing engagement at a generatrix at 12 with the outer surface of the latter flange. If therefore the rotary parts are brought to rotate in a clockwise direction in Figure 1, these sealing points 12, 13 will travel toward the centre, be reestablished at the periphery and opened at the innermost position. Every half revolution a new volume of air is caught and enclosed which is brought toward the centre where it can be discharged through a number of holes 14 in the disk 8 to pass further through passages 15 provided about the bearing 7 to an outlet 17 provided with a connection flange 16.

In the parts described above the compressor is already known, and the function thereof will be clear without further from what has been stated. If instead steam or gas under pressure is supplied to the outlet 17, the machine will work as a motor. The higher the ratio of compression or expansion, respectively, desired, the greater total angle should be covered by the spiral flanges. Figure 1 shows spirals having a centre angle between the ends corresponding approximately to $4 \cdot \pi$, but in the case of great ratios of compression or expansion it is preferred to use a still greater angle.

The attempts earlier made to construct machines of the type indicated above have not given the desired result, because it was not realized how to give the spiral flanges a suitable form. It was assumed that the surfaces should be shaped as spirals of Archimedes, but then it is found, however, that sealing contact is not obtained with such a form, so that such compressors have not come into use.

According to the invention one surface, for example the inner one, of each spiral flange may be made according to a spiral of Archimedes, but in such case the outer surface must be made of a higher pitch, which besides should not be constant but increase toward the centre. On the other hand, the outer spiral surfaces may be given a constant pitch, and then the inner ones will be given a smaller pitch which besides should decrease toward the centre. While maintaining the same principle with regard to the difference in pitch between the two kinds of surfaces, both kinds may naturally also be given a varying pitch.

As a consequence of this formation of the surfaces, the thickness of the material of the flanges will increase outwardly which is favourable also because the strength requires a certain minimum thickness at the outer portions which is unnecessary at the inner ones. To obtain the best results the cross section of the spiral flanges which is shown in Figure 2 is preferred, i. e., one having a greater thickness of the material at the base where the flange 5 or 9, respectively, is fixed to the disk 4 or 8, respectively, than at the free flange edge. The cross-section will then be trapezium-shaped.

The invention is naturally not limited to the embodiment which is shown in the drawing, nor to the employment of a single spiral flange on each disk. While maintaining the principle of the invention the conditions will be analogous, if each disk is provided for example with two spiral flanges of the same form and angularly displaced half a revolution in relation to each other, or with any number of spiral flanges having a relative angular displacement of $1/n$, if n is the number of spirals.

What I claim and desire to secure by Letters Patent is:

1. A rotary compressor comprising a frame, said frame being provided with a fluid inlet opening, a first rotary element mounted in said frame, a second rotary element mounted in said frame eccentrically with respect to the axis of said first rotary element, means operatively connecting said rotary elements with each other, said elements being severally provided with radial surfaces, a radial surface of said first rotary element facing a radial surface of said second rotary element to provide opposed radial surfaces, spiral means projecting axially from each said opposed radial surface into engagement with the other opposed radial surface and each said spiral means having an inner and an outer spiral surface, the inner spiral surface of each said spiral means being in line contact with the outer spiral surface of the other said spiral means at spaced points, whereby spaced fluid working chambers which move during rotation of said rotary elements and which are alternately open and closed at each end of said spiral means are formed, the pitch of said spiral surfaces being greater for the outer than for the inner surfaces, means for rotating said rotary elements, and an outlet for compressed fluid near the center of the compressor.

2. A rotary compressor comprising a frame, said frame being provided with a fluid inlet opening, a first rotary element mounted in said frame, a second rotary element mounted in said frame eccentrically with respect to the axis of said first rotary element, means operatively connecting said rotary elements with each other, said elements being severally provided with radial surfaces, a radial surface of said first rotary element facing a radial surface of said second rotary element to provide opposed radial surfaces, spiral means projecting axially from each said opposed radial surface into engagement with the other opposed radial surface and each said spiral means having an inner and an outer spiral surface, the inner spiral surface of each said spiral means being in line contact with the outer spiral surface of the other said spiral means at spaced points, whereby spaced fluid working chambers which move during rotation of said rotary elements and which are alternately open and closed at each end of said spiral means are formed, the pitch of said spiral surfaces being greater for the outer than for the inner surfaces and said pitch increasing from the periphery towards the center, means for rotating said rotary elements, and an outlet for compressed fluid near the center of the compressor.

3. A rotary compressor comprising a frame, said frame being provided with a fluid inlet opening, a first rotary element mounted in said frame, a second rotary element mounted in said frame eccentrically with respect to the axis of said first rotary element, means operatively connecting said rotary elements with each other, said elements being severally provided with radial surfaces, a radial surface of said first rotary element facing a radial surface of said second rotary element to provide opposed radial surfaces, a spiral flange projecting axially from each said opposed radial surface into engagement with the other opposed radial surface and each said spiral means having an inner and an outer spiral surface, the inner spiral surface of each said spiral flange being in line contact with the outer spiral surface

of the other said spiral flange at spaced points, whereby spaced fluid working chambers which move during rotation of said rotary elements and which are alternately open and closed at each end of said spiral flanges are formed, the pitch of said spiral surfaces being greater for the outer than for the inner surfaces and the thickness of the material of said flanges decreasing from the radial surface from which each flange projects toward the free edge thereof, means for rotating said rotary elements, and an outlet for compressed fluid near the center of the compressor.

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