Oct. 2, 1956 | SHELDON S. L. CHANG | 2,765,114

CONE TYPE COMPRESSOR

Filed June 15, 1953

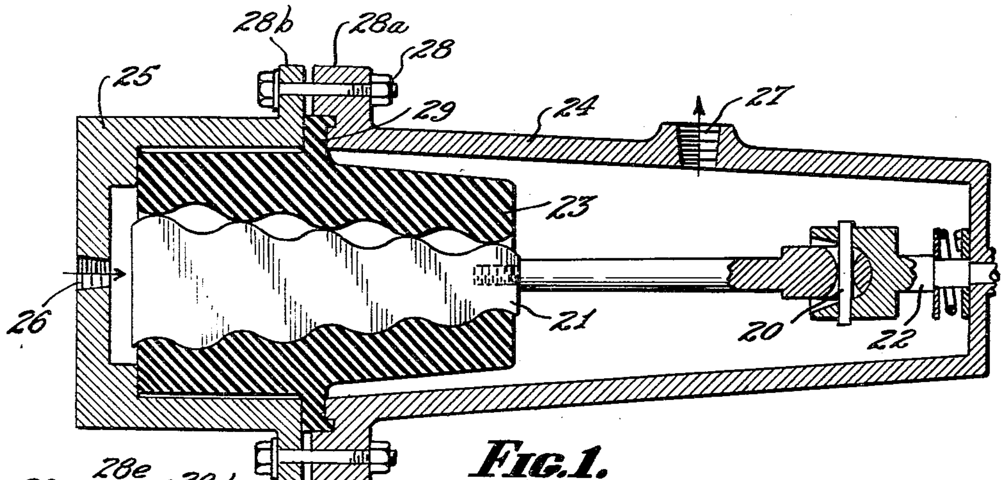

FIG. 1.

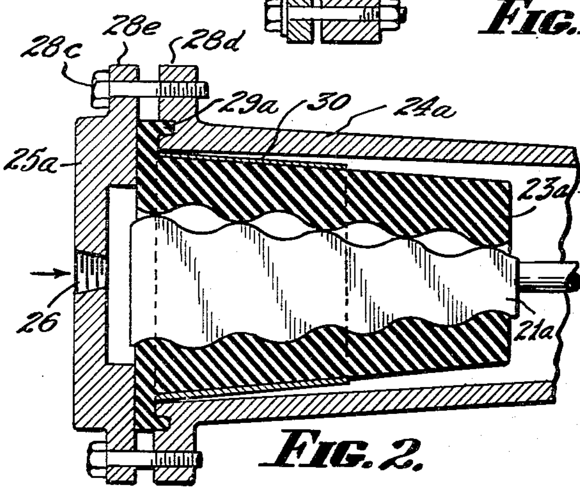

FIG. 2.

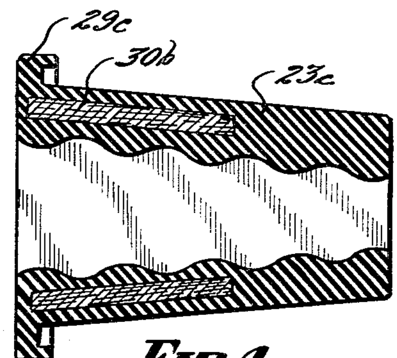

FIG. 4.

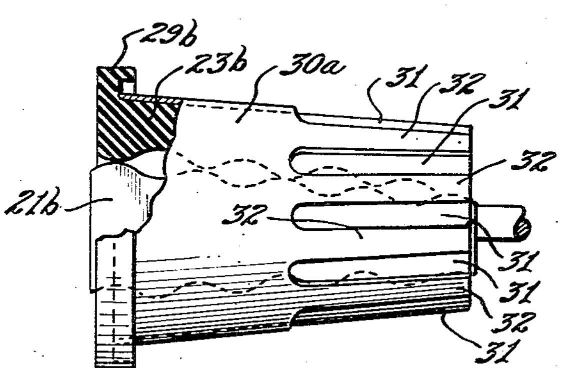

FIG. 3.

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United States Patent Office

2,765,114

Patented Oct. 2, 1956

2,765,114

CONE TYPE COMPRESSOR

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Application June 15, 1953, Serial No. 361,619

10 Claims. (Cl. 230—148)

This invention relates to an improved cone type compressor. In the Byram and Chang Patent No. 2,590,751, dated March 25, 1952, there is a general disclosure of pumps having relatively flat disc-like pumping elements wherein the pumping elements are provided with spiral threads and wherein one of the elements has one thread more than the other element.

In the Chang patent, No. 2,590,435, dated March 25, 1952, there is a more detailed disclosure of such pumps. In the last mentioned patent there were disclosed pumps having cone shaped, bowl shaped, or flare shaped pumping elements as well as flat pumping elements.

In the Chang and Hagerman Patent No. 2,566,116, dated August 28, 1951, there is disclosed a machine for forming pumping elements for use with the relatively flat types of pumps and in my copending application, Serial No. 278,030, filed March 22, 1952, now Patent No. 2,720,130, dated October 11, 1955, there is disclosed a lathe having complex tool movement useful in the machining of a cone type compressor element, such as is used in a compressor according to my copending application, Serial No. 278,029, filed March 22, 1952, now Patent No. 2,733,854, dated February 7, 1956.

The principal object of the present invention is to provide a compressor of the cone type referred to in said last mentioned copending application having a stator of resilient or rubber-like material, and wherein the starting torque requirements are greatly reduced while the efficacy of the stator-rotor seal is maintained. Other objects of the invention include the provision of a compressor having all of the advantages mentioned in connection with the compressor of my said Patent No. 2,733,854, and without substantially increasing the cost thereof.

These and other objects of the invention which will be pointed out in greater detail hereinafter or which will be understood by one skilled in the art upon reading the specifications, I accomplish by that certain construction and arrangement of parts of which I shall now disclose certain exemplary embodiments.

Reference is made to the drawings forming a part hereof and in which:

Figure 1 is a longitudinal cross sectional view of one form of compressor according to the present invention.

Figure 2 is a fragmentary view similar to Figure 1 showing a modification.

Figure 3 is an elevational view, with parts broken away, of the compressor elements in another modification, and

Figure 4 is an axial cross sectional view through a stator representing a still further modification.

For details of the surfaces of the compressor elements, reference is hereby made to my said Patent No. 2,733,-854, since the present invention is not in any way concerned with the details of the surfaces.

Briefly, in the practice of my invention I provide means whereby the larger end of the resilient stator at least and preferably about the larger half of the stator

is protected from the discharge pressure so that only approximately the smaller half end of the stator is subject to the discharge pressure.

As pointed out in said last mentioned patent, the fact that the exterior of the resilient stator is subjected to discharge pressure enhances the stator-rotor seal and makes the compressor more efficient. I have found, however, that where the discharge pressure acts upon the entire stator as in my said last mentioned copending application, the frictional effect is such that the starting torque of the pump is greatly increased. I have found that if the larger end at least of the stator, and preferably about one-half at the larger end of the stator, is protected from discharge pressure, the starting load is greatly reduced while the sealing qualities are not adversely affected. I am thus enabled to produce a compressor which is just as efficient but it may be operated with a considerably smaller electric motor.

In Figure 1 I have shown a rotor or inner element **21** driven from a shaft **22** through a universal joint **20** and operating within a stator or outer element **23**. The compressor is housed within a casing element **24** having a separate head portion **25** carrying an inlet or suction port **26**. A discharge port is provided in the member **24** at **27**. The casing portion **24** and head **25** are held together by means of nuts and bolts, as generally indicated at **28**, through flanges **28***a* on the member **24** and **28***b* on the member **25**. The stator member **23** is provided with an annular flange **29** which is clamped between the flanges **28***a* and **28***b*.

The structure described is very similar to that disclosed in my said last mentioned patent. The difference lies in the fact that the annular stator flange **29** is substantially at the midpoint of the stator rather than at the large end and the head portion **25** is correspondingly lengthened to accommodate the large end of the stator.

It will be clear from a study of Figure 1 that only the right hand one-half of the stator, which is peripherally spaced from the casing element **24**, is subject to discharge pressure within the casing element **24** and that the larger end of the stator is subjected to suction pressure. In this way, the frictional effect or binding effect between stator and rotor is eliminated in that region where it would do more harm than good and is maintained in that region where its harmful effects are far outweighed by the beneficial sealing effect.

Similar results may be obtained with the structures illustrated in Figures 2, 3 and 4 and in other modifications which will be apparent to one skilled in the art. Thus, in Figure 2 the casing portion **24***a* is substantially like that in my said last mentioned copending application and likewise the head element **25***a* is similar. The head element again contains the suction port **26** and the sections **24***a* and **25***a* are held together by means of ports **28***c* passing through the flanges **28***d* and **28***e*. The rotor is indicated at **21***a* and the stator, which is peripherally spaced from the casing element **24***a*, is indicated at **23***a*. The stator flange is indicated at **29***a*. It will be observed also that the stator **23***a* with its flange **29***a* is similar to that disclosed in my said last mentioned patent. The larger end of the stator **23***a* is protected from the discharge pressure within the casing element **24***a* by a sleeve or shell **30** extending approximately half the length of the stator. The sleeve or shell **30** is bonded in any desired manner to the exterior of the stator and is of a material which is sufficiently rigid to prevent distortion of the larger end of the stator covered thereby by the discharge pressure.

In Figure 3 I have shown another modification where the rotor **21***b* operates within a stator **23***b* having a flange **29***b* and wherein the stator carries a shell **30***a* which is substantially like the shell **30** of Figure 2 over approximately one-half the length of the stator and which is slotted over approximately the smaller half as at **31**, leaving between the slots a number of fingers **32**.

It will be clear that the portion **30***a* functions in the same manner as the shell or sleeve **30** of Figure 2 and that the fingers **32**, while providing some protection for the smaller end of the stator, nevertheless permit access of the discharge pressure so as to provide for the sealing effect mentioned above.

In Figure 4, I have shown another modification of a stator **23***c* having the flange **29***c*. In this modilcation I have shown a ring of suitable material, such as fiberglass and indicated at **30***b* molded into the body of the stator over approximately the larger half thereof. This reinforcing material removes most of the resilience from the larger end of the stator and thus prevents its compression when it is subjected to discharge pressure.

It will be clear from the foregoing that there are various ways in which the results intended can be achieved. In the embodiments of Figure 1, the larger end of the stator is simply made to fall on the suction pressure side of the device by moving the flange **29** from the large end of the stator to a point preferably midway between its ends. In the embodiments of Figures 2, 3 and 4, the entire stator is within the discharge pressure side of the device and various means are provided to protect the larger end of the stator from the effects of discharge pressure.

The particular distance over which the member **30**, **30***a* or **30***b* extends or at which the flange **29** is placed will vary depending upon the discharge pressure for which the pump is intended. For most purposes, however, the midpoint will be a good compromise.

It will be clear that I do not intend to limit myself to details other than as set forth in the claims which follow.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A compressor having one pair, at least, of cooperating conical pumping elements one within the other, said pumping elements having threads extending in a conical path, a casing enclosing said elements and spaced from the outer one of said pumping elements over a portion at least of its length, the outer one of the elements of said pair being of resilient material and being stationary and having means in contact with the said casing and dividing said casing into a high pressure discharge and a low pressure suction side, means for rotating the inner one of said elements, an inlet port in said casing adjacent the larger ends of said elements, an outlet port in said casing adjacent the smaller ends of said elements, one of said elements being mounted for nutational movement with respect to the other about a fixed point on which an extension of the conical threads of said member would converge, and in a sense opposite to the sense of rotation of said inner element, and means for preventing the larger end, at least, of said outer element from being compressed radially by said discharge pressure, and permitting a desired portion of the length of said outer element, at the smaller end thereof, to be compressed radially by said discharge pressure.

2. A compressor according to claim 1 wherein said means prevent substantially the larger half of said outer element from being compressed radially by said discharge pressure.

3. A compressor having one pair, at least, of cooperating conical pumping elements one within the other, said pumping elements having threads extending in a conical path, a casing enclosing said elements and spaced from the outer one of said pumping elements over a portion at least of its length, the outer one of said elements being of resilient material and being stationary and having an annular flange at a desired point between its ends secured to said casing to divide said casing into a high pressure discharge and low pressure suction side, means for rotating the inner one of said elements, an inlet port in said casing adacent the larger ends of said elements, an outlet port in said casing adjacent the smaller ends of said elements, one of said elements being mounted for nutational movement with respect to the other about a fixed point on which an extension of the conical threads of said members would converge, and in a sense opposite to the sense of rotation of said inner element, the larger end of said outer element up to said flange being thus subjected to suction pressure, while the smaller end of said outer element, up to said flange, is subjected to radial compression by the discharge pressure.

4. A compressor according to claim 3 wherein said outer element flange is disposed approximately midway between the ends of said stator.

5. A compressor having one pair, at least, of cooperating conical pumping elements one within the other, said pumping elements having threads extending in a conical path, a casing enclosing said elements and spaced from the outer one of said pumping elements over a portion at least of its length, the outer one of the elements of said pair being of resilient material and being stationary and having means in contact with said casing and dividing said casing into a high pressure discharge and low pressure suction side, means for rotating the inner one of said elements, an inlet port in said casing adjacent the larger ends of said elements, an outlet port in said casing adjacent the smaller ends of said elements, one of said elements being mounted for nutational movement with respect to the other about a fixed point on which an extension of the conical threads of said member would converge, and in a sense opposite to the sense of rotation of said inner element, the larger end, at least, of said outer element being encased in a rigid shell to prevent its radial compression by said discharge pressure.

6. A compressor according to claim 5 wherein said rigid shell covers substantially the larger one-half of said outer element.

7. A compressor having one pair, at least, of cooperating conical pumping elements one within the other, said pumping elements having threads in a conical path, a casing enclosing said elements and spaced from the outer one of said elements over a portion at least of its length, the outer one of the elements of said pair being of resilient material and being stationary and having means in contact with said casing and dividing said casing into a high pressure discharge and low pressure suction side, means for rotating the inner one of said elements, an inlet port in said casing adjacent the larger ends of said elements, an outlet port of said casing adjacent the smaller ends of said elements, one of said elements being mounted for nutational movement with respect to the other about a fixed point on which an extension of the conical threads of said member would converge, and in a sense opposite to the sense of rotation of said inner element, said outer element being encased in a shell which is axially slotted from the small end for a portion of its length, to prevent radial compression of the larger end, at least, of said outer element by said discharge pressure, while permitting radial compression of the smaller end of said outer element by said discharge pressure.

8. A compressor according to claim 7 wherein said slots extend substantially one-half the length of said shell.

9. A compressor having one pair, at least, of cooperating conical pumping elements one within the other, said pumping elements having threads extending in a conical path, a casing enclosing said elements and spaced from the outer one of said pumping elements over a portion at least of its length, the outer one of said elements of said pair being of resilient material and being stationary and having means in contact with said casing and dividing said casing into a high pressure discharge and low pressure suction side, means for rotating the inner one of said elements, an inlet port in said casing adjacent the larger ends of said elements, an outlet port in said casing adjacent the smaller ends of said elements, one of said ele-

ments being mounted for nutational movement with respect to the other about a fixed point on which an extension of the conical threads of said member would converge, and in a sense opposite to the sense of rotation of said inner element, the larger end, at least, of said stator having reinforcing elements molded thereto, to prevent its radial compression by said discharge pressure.

10. A compressor according to claim 9 wherein said reinforcing elements extend substantially one-half the length of said stator.

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