Nov. 13, 1934. J. F. HIGBEE 1,980,726

COMPRESSOR

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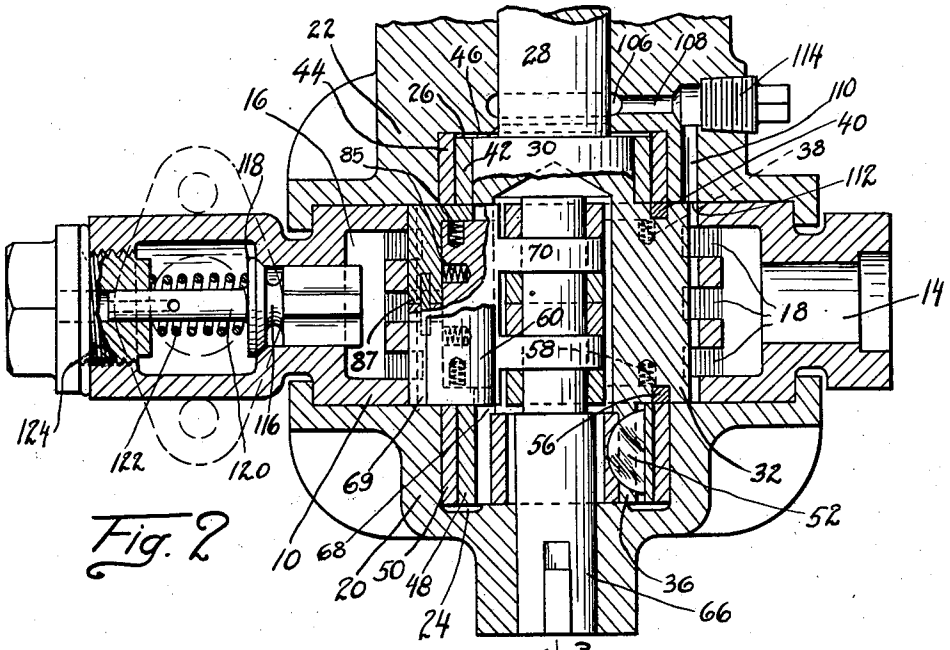


Fig. 2

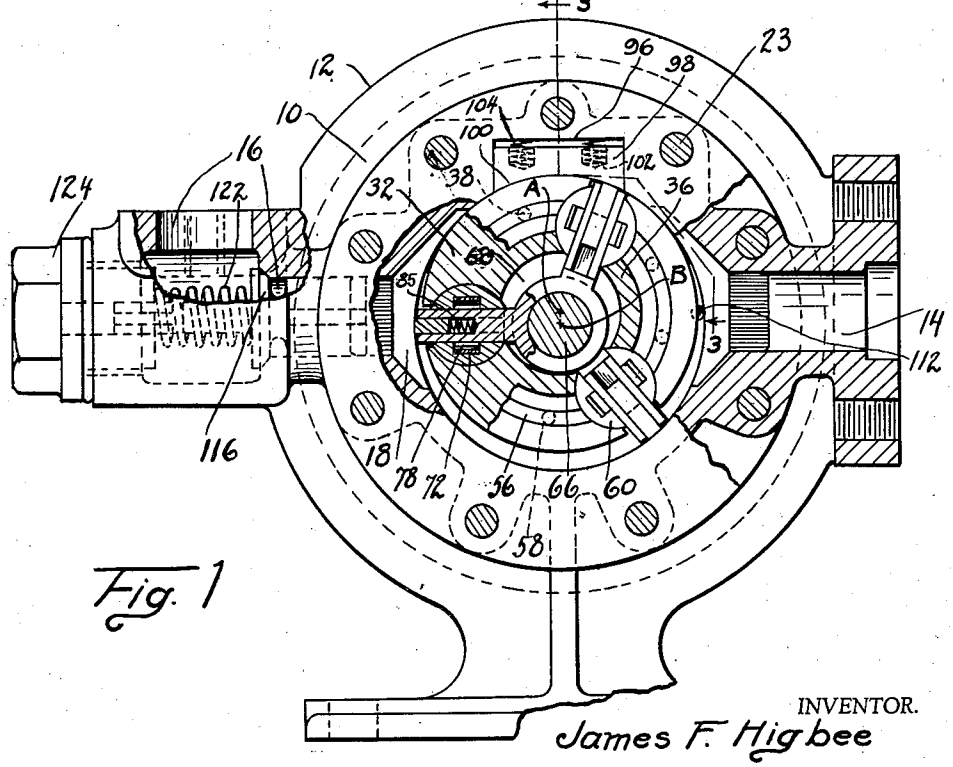


Fig. 1

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COMPRESSOR

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Fig. 3

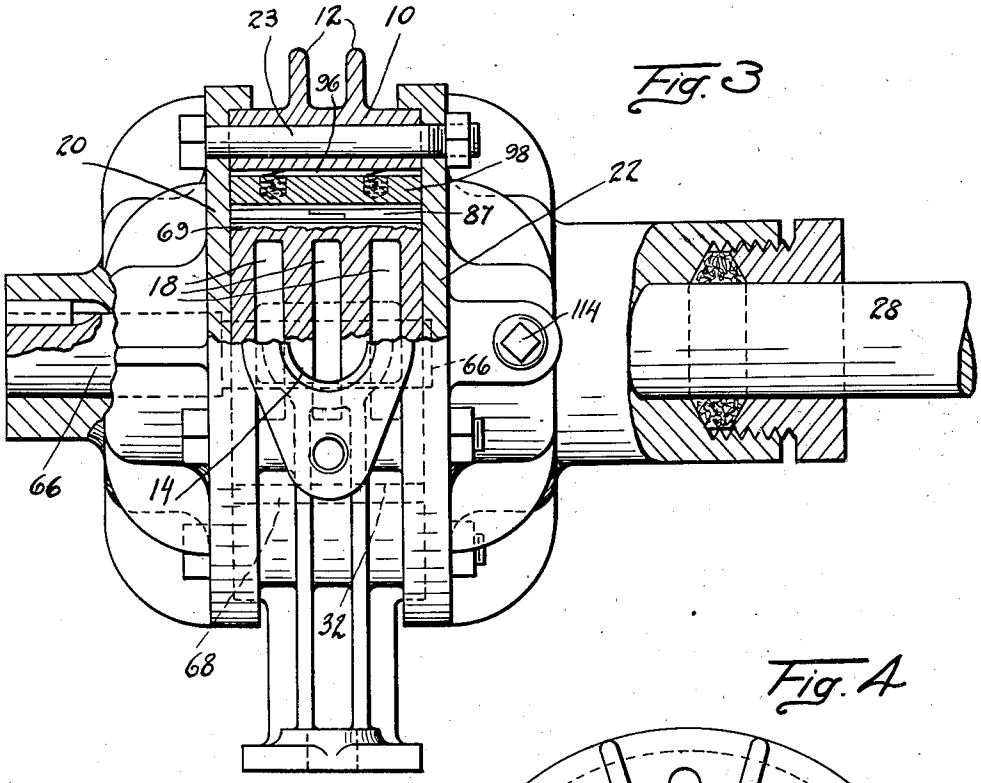
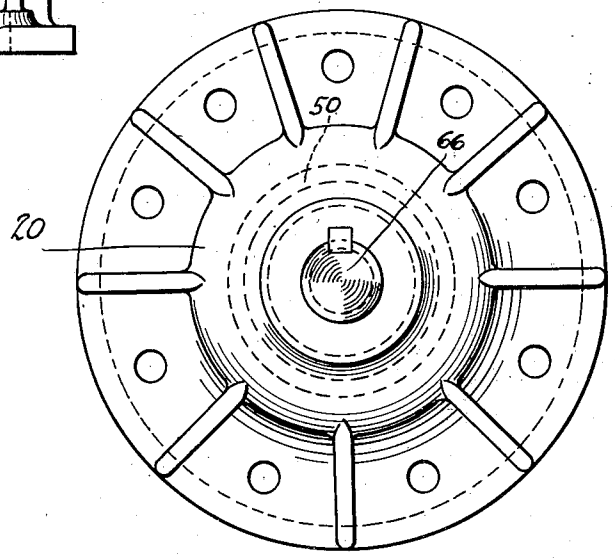


Fig. 4



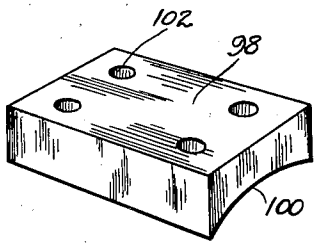


Fig. 5

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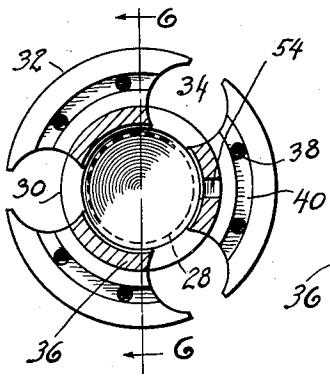


Fig. 7

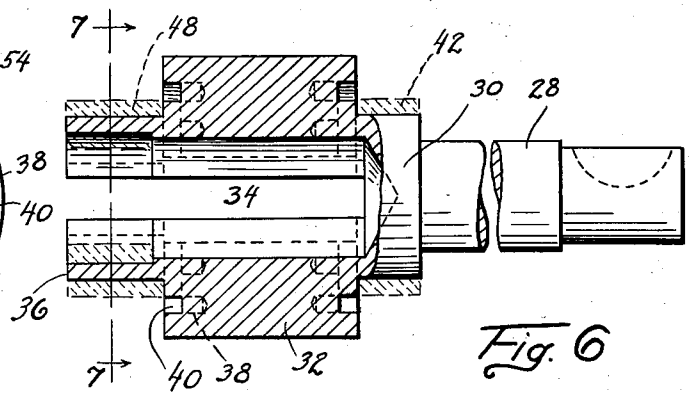


Fig. 6

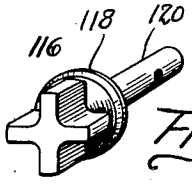


Fig. 13

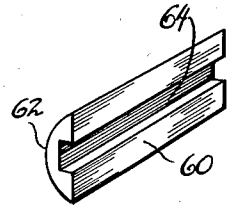


Fig. 8

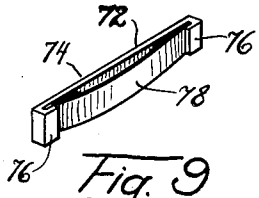


Fig. 9

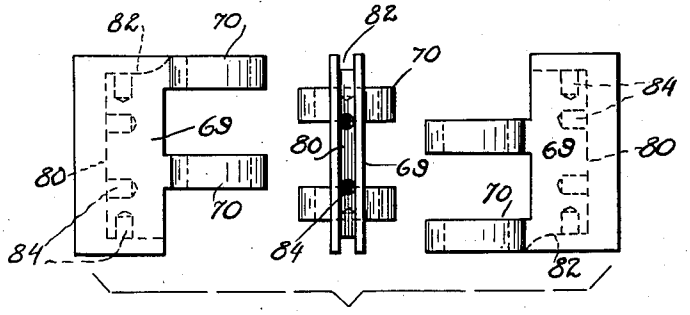


Fig. 11

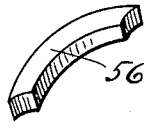


Fig. 10

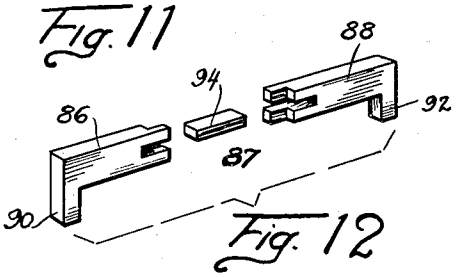


Fig. 12

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Patented Nov. 13, 1934 1,980,726

UNITED STATES PATENT OFFICE

1,980,726

COMPRESSOR

James F. Higbee, Detroit, Mich., assignor of one-half to Stephen A. Griggs, Detroit, Mich.

Application March 27, 1931, Serial No. 525,816

2 Claims. (Cl. 230—157)

My invention relates to compressors and has particular reference to that type wherein a plurality of blades are rotated rapidly within a cylinder to produce a vacuum.

The object of my invention is to procure a high vacuum without the annoying sound effects which customarily accompany the pumping operation. As is well known, vacuum pumps and compressors have a myriad of uses and in a great number of instances it is extremely desirable to secure a noiseless operation while maintaining a maximum efficiency. My invention contemplates a pump assembly wherein the lines of joinder between the movable units and the stationary units are constantly sealed by elements under spring pressure. In this way the various units of the assembly are maintained at all times in proper relation to one another and positively urged into such relationship, thereby eliminating the development of much of the noise which customarily is found in such machines.

Another object of my invention is to prolong the life of such a pump and to maintain a constant efficiency without the necessity of replacing parts. By reason of the friction produced between the relatively movable elements there is a tendency for the parts to wear, thereby resulting in inefficient operation and attendant noise. The spring pressed sealing structure which I have incorporated in my pump assembly constantly adjusts itself for the wear which takes place by virtue of such friction and maintains a tight seal at all times.

Various other objects and meritorious features of my invention will be found in the particular combination and arrangement of parts hereinafter more fully described in conjunction with the drawings wherein:

Fig. 1 is a front elevation of my improved pump assembly, partly in section,

Fig. 2 is a sectional plan of the assembly illustrated in Fig. 1,

Fig. 3 is a side elevation, a section being broken away along 3—3 of Fig. 1,

Fig. 4 is a front elevation of one casing unit,

Fig. 5 is a perspective of a sealing unit,

Fig. 6 is an elevation, partly in section along the line 6—6 of Fig. 7, of my power driven rotor,

Fig. 7 is a section along 7—7 of Fig. 6,

Fig. 8 is a perspective of one of the bearing units for the pump blades,

Fig. 9 is a seal for the pump blades,

Fig. 10 is a detail of another of the sealing elements,

Fig. 11 is a disassembled view of the pump blades, in elevation and plan,

Fig. 12 is a detail of another sealing unit, and

Fig. 13 is a perspective of the check valve used at the exhaust port.

The cylinder chamber proper for the pump assembly is composed of an open ended cylinder 10 which is provided with exterior fins 12 extending circumferentially therearound. On opposite sides of the cylinder walls are an intake port 14 and an exhaust port 16, each of which is divided into a plurality of passageways, as at 18, adjacent its opening into the interior of the cylinder. The open ends of the cylinder 10 are closed by the casing units 20 and 22 which are positioned by bolts 23, and each of which is provided with a pocket 24 and 26 which is designed to house a bearing assembly for the power driven rotor illustrated in Fig. 6.

The rotor includes a driving shaft 28, an end bearing portion 30 which is journalled in pocket 26 in a manner to be more clearly defined hereinafter, a cylindrical rotor portion proper 32 which is machined out in the manner illustrated at 34 in Fig. 7 for a purpose to be hereinafter described, and an opposite end bearing portion 36 which is adapted to be journalled in the pocket 24. Each end face of the rotor proper 32 is provided adjacent its periphery at spaced apart intervals with a plurality of pockets 38 extending inwardly from segmental grooves 40 which extend between the machined out portions 34. The pockets 38 are adapted to seat coil springs for a purpose to be more clearly brought out.

The bearing 30 is provided with a bushing 42 which may be shrunk thereabout and the cylindrical inner wall of pocket 26 is provided with a similar bushing 44. The bushing 42 is flush with the outer extremity of the bearing 30 whereas the bushing 44 extends the entire length of the cylindrical wall of pocket 26. It will be noted that this arrangement provides a small passage 46 which is designed for a purpose which will be more clearly brought out hereinafter. This passageway also provides a clearance between the shouldered portion 30 of the power driven rotor and the bottom of pocket 26, thereby eliminating unnecessary friction.

Bearing 36 of the rotor is journalled in the pocket 24 in much the same manner as described in conjunction with bearing 30. A plurality of bushings 48 and 50 are utilized and these are journalled for rotation with the rotor by means of the key 52 which extends through slots therein and through a slot 54 in the rotor bearing 36.

Segmental rings 56 are seated in the grooves 40 and are constantly urged outwardly against the edge faces of bushings 44 and 50 by means of coil springs 58 seated in pockets 38. In this way a tight seal is maintained at each end of the rotor. At the same time any wear which may take place is taken up or absorbed by the spring elements.

A stud shaft 66 extends through and is keyed to the casing 20 and its axis is concentric with the axis of the cylindrical casing 10. This stud shaft 66 extends into the central opening 68 in the rotor element. The rotor portion proper 32 is of somewhat smaller diameter than the cylindrical casing 10 and is mounted somewhat eccentrically therein. As may be clearly seen in Fig. 1, the rotor revolves about the axis A, slightly offset with relation to the coincident axes B of the stud shaft 66 and the cylindrical casing 10.

The portions 34 of the rotor are adapted to receive shims 60 (see Fig. 8) which are provided with an arcuate outer face 62 conforming to the arc of the machined out portion and a longitudinal groove 64 extending along the inner flat face. Pump blades 69, each provided with a plurality of supporting rings 70, are journalled by means of these rings for rotation about stud shaft 66 as clearly illustrated in Figs. 1 and 2. Each blade 69 is adapted to extend through a pair of shims 60, there being a spring seal 72 (see Fig. 9) inserted in the groove 64 of each shim to provide a seal between the blade and its bearing shims 60. Each of these spring seals comprises a rigid strip 74 having overlapping ends 76 which function to position the opposite ends of a spring metal strip 78 as clearly indicated in Fig. 9.

Each of the blades 69 is provided with a groove 80 which extends along its longitudinal edge and along a portion at least of its radial edge as indicated at 82. The bottom of each groove is provided with spring seats 84 adapted to position coil springs 85 which bear against a sealing member, generally indicated as 87, (see Fig. 12) adapted to wipe the cylindrical wall of the casing 10 and the end walls thereof.

The sealing element 87 illustrated in Fig. 12 in its disassembled position comprises two end pieces 86 and 88 with depending portions 90 and 92 at their outer extremities and mortised portions at their inner extremities adapted to cooperate with a joining tenent 94 to secure the two pieces in adjustable extensible relation.

It will be seen that the composite sealing unit 87 so made up is adapted to seat in the grooves which are provided along the edges of the pump blades 69 and are inwardly urged against the walls of the pump casing. The springs 85 operate to absorb any wear which may occur and the fact that the sealing unit is extensible permits the springs to do this with the end wall seal as well as the cylindrical wall seal.

A pocket 96 is provided in the cylindrical wall of the casing 10 for receiving a sealing block 98 (see Fig. 5). This block has a concave arcuate surface 100 on one side thereof adapted to bear against the exterior of the rotor portion proper 32 for sealing purposes and a plane surface on the opposite side thereof provided with a plurality of spring seats 102. The springs 104 are seated in 102 and bear against the bottom of pocket 96 (see Fig. 3), thereby maintaining the block 98 in constant sealing contact with portion 32 of rotor.

It will be apparent that as the rotor is revolved by means of its power driven shaft 28 it will carry with it the pump blades 69 which are slidable as well as rotatable within the bearings 60 provided in the portions 34. Inasmuch as the blades are mounted concentrically with the axis of the casing the sealing units 87 will constantly wipe the inside of the casing during the rotation of the blades and thereby maintain a tight seal. The spring pressed segmental rings 56 maintain a tight seal between the blades and the end walls of the pump casing 10, and are assisted in this function by the overhanging portions 90 and 92 of the seal 87.

Any possible leakage through the bearing 30 of the rotor element escapes through the passageway 46 and into a pocket 106 provided in the end casing 22. A passageway 108 connects this pocket with passage 110 which opens into the pump chamber as indicated at 112. The opening in the casing necessitated by drilling passage 108 is closed by plug 114.

The exhaust port 16 is provided with a check valve broadly indicated by the numeral 116 wherein there is a piston 118 having a stem 120 seated by means of spring 122 against the exhaust opening. The tension of the spring 122 may be adjusted by the threaded closure member 124 so that the check valve will open upon being subjected to any desired pressure created by the pump operation.

While I have disclosed specific units for securing a complete seal against leakage, it will be apparent that the broad idea of locating the units as indicated and providing means whereby they are constantly urged into position constitutes the basic inventive concept. For that reason I do not intend to be limited other than by the appended claims.

I claim:

1. A spring seal of the class described comprising a longitudinal member of rigid construction, said member having a plane face on one side thereof throughout its length and folded over to provide U-shaped extremities for the member, and a spring member of somewhat greater length than the plane faced side of the rigid member having its ends anchored in said U-shaped extremities.

2. In combination with a pump having a cylindrical casing, a cylindrical rotor eccentrically journalled for rotation therein, pump blades radially mounted within the casing for rotation therein, rocker bearings between said blades and the eccentrically journalled rotor, a longitudinal groove in the face of said rocker bearings adjacent the blades, a longitudinal member of rigid construction seated within said groove having folded over extremities, and a spring member of somewhat greater length than the longitudinal member having its ends anchored under the folded over extremities and its intermediate portion flexed outwardly against the rocker bearings to resiliently urge the rigid member against the blades to form a seal.

JAMES F. HIGBEE.