R. H. RICE.

CENTRIFUGAL COMPRESSOR AND PUMP.

APPLICATION FILED MAY 22, 1908.

1,013,312.

Patented Jan. 2, 1912.

Fig. 1.

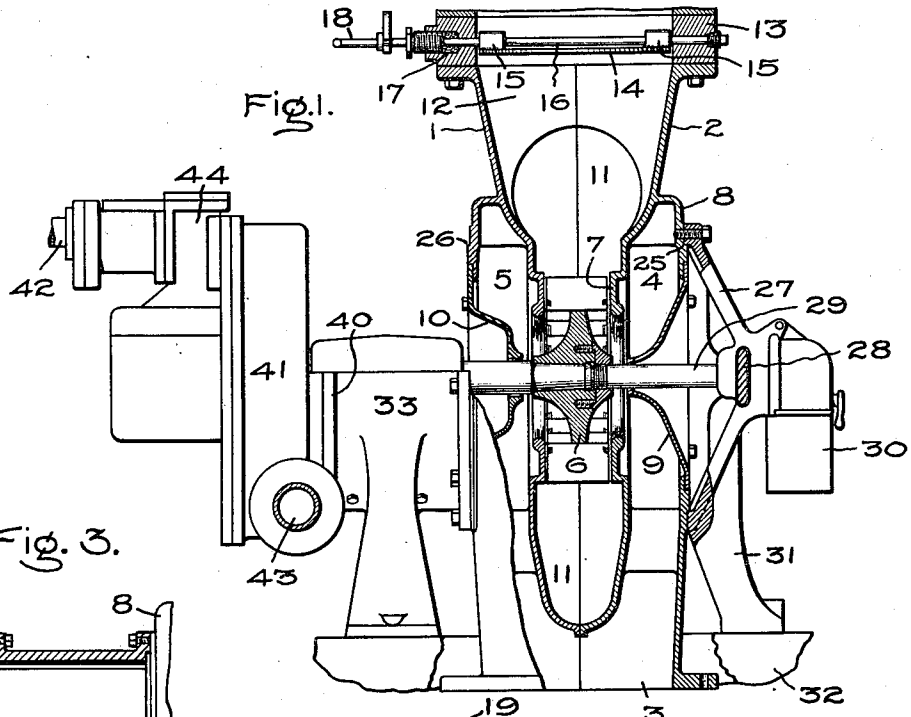


Fig. 3.

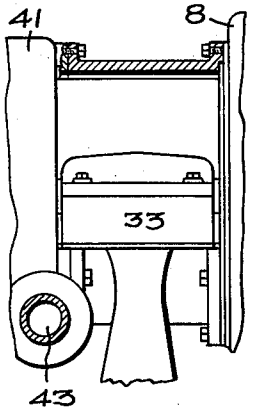
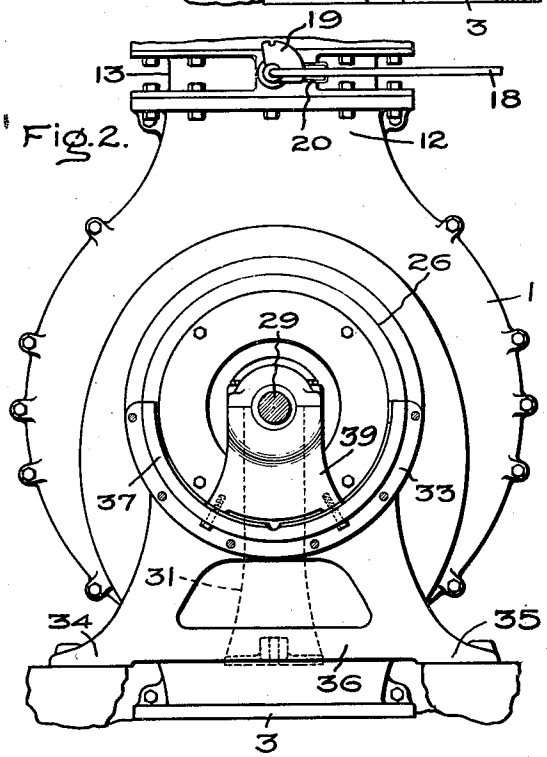


Fig. 2.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL COMPRESSOR AND PUMP.

1,013,312. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed May 22, 1908. Serial No. 434,241.

To all whom it may concern:

Be it known that I, RICHARD H. RICE, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Compressors and Pumps, of which the following is a specification.

The present invention relates to centrifugal compressors and pumps, and has for its object to improve their construction.

In the accompanying drawing is shown one of the embodiments of the invention, wherein—

Figure 1 is a side elevation of a turbine driven air compressor with certain of the parts of the compressor broken away for the purpose of illustration; Fig. 2 is an end view of the apparatus with the turbine or other driving motor removed, and Fig. 3 is a detail view showing a modified structure for uniting the motor and compressor.

The casing for the centrifugal compressor is made up of two parts, 1 and 2. These are identical so that one pattern will serve for both. This arrangement avoids the necessity of keeping right and left hand castings in stock, and simplifies the machine work. The casing is provided with an inlet conduit 3 on the under side, which conduit is provided with a flange for bolting it to a supply conduit, tank or other apparatus. This conduit communicates with annular chambers 4 and 5 which are situated on opposite sides of the impeller 6. The chamber 4 is partly formed by the vertical wall 7 which is a part of the casing, by the wall 8 that is also a part of the casing and comprising an annular portion and a vertical portion, and the remainder by a detachable conical member 9 which is supported in a shouldered recess in the part 8. The walls of the chamber 5 are similarly constructed, except that the conical member 10 is made of slightly different shape on account of the shaft bearing situated adjacent thereto. It is to be noted that both members are of the same diameter and fit into counterpart shoulders. Air from the chambers 4 and 5 passes through the bores in the walls 7 into the impeller from which it is discharged outwardly under a certain pressure and velocity into the annular chamber 11, the latter communicating with the discharge conduit 12.

Mounted on top of the conduit and bolted thereto is a ring 13 containing a blast gate or butterfly valve 14, by means of which the discharge from the apparatus may be controlled. The compressor shown is more particularly intended for supplying air to a gas producer, and by closing the gate or valve the passage of gas to the compressor can be cut off when the latter is idle. The valve is also useful to close off the discharge in starting when the compressor is driven by a motor having small starting torque. The valve consists of a circular disk having lugs or equivalent securing means 15 through which the spindle 16 passes. This spindle extends through and is supported by the ring 13. The valve is of such size that when turned to the position shown it will engage and make a tight fit with the wall of the bore of the ring. The spindle is suitably packed at 17 to prevent the escape of fluid around it, and is provided with a lever 18 by means of which the valve can be opened or closed. It is also provided with a notched segment 19. Situated at one side of the segment and adapted to engage the notches therein is a spring pressed dog 20. The dog while it normally holds the gate or valve in a predetermined position, will yield when pressure is applied to the actuating lever 18 and the valve may be opened or closed as desired.

The means for supporting the compressor will now be described. On the right-hand side of the wall 8 is turned an annular shoulder 25 having its counterpart in the shoulder 26 on the opposite side. Attached to the wall 8 by equally spaced bolts and engaging the shoulder 25 is a spider 27. It is provided with a hub 28 that is bored centrally to receive the right-hand bearing for the impeller shaft 29, and with a casing 30 for the lubricating pump which is driven by the impeller shaft. The spider is further provided with a single foot 31 of small area that rests on the foundation 32. This foot is directly under the axis of the impeller. Secured to the left-hand side of the casing is a supporting member 33 which is provided with two feet 34 and 35 suitably spaced

apart, and which are strengthened and united by the web 36. These feet are located at equal distances from the axis of the impeller and on opposite sides of a vertical plane passing therethrough.

By referring to Fig. 2 it will readily be seen that the apparatus is supported at three points, namely by the feet 31, 34 and 35. By supporting the apparatus in the manner described I am able to dispense with a bed-plate and thus avoid its original cost and also the labor and expense involved in properly setting the same. Since the apparatus has three points of support and is self contained, it follows that the foundation therefor, whatever be its character, will require no particular finishing or leveling up. It is evident that the apparatus cannot be supported on three sharpened points, because they would either cut into the foundation or else be crushed. As I contemplate mounting my apparatus on wooden floors, decks of vessels, etc., it follows that the "points" of support must have at least a certain minimum area. The term "point" as used in this specification means a part whose area is such that it will support the imposed weight without penetrating the surface of the foundation on the one hand, or be crushed by the weight on the other. As wood will in all probability be the softest material used as a foundation, the area of the "point" will be designed with this in view. Such a point will be large enough for all other purposes. Where the foundation is made of harder material than wood, the area of each point will be somewhat in excess of the actual requirements, but this is of no particular importance.

As before stated, the shoulder 26 on the left-hand side of the casing is turned to the same diameter as the shoulder 25. To this shoulder is secured by means of bolts, a semicircular portion 37 of the supporting member, said portion being integral with the feet 34 and 35. The said portion 37 is provided with bolt holes that are equally spaced, as are also the bolt holes in the shoulders 25 and 26 so that the casing of the compressor can be angularly adjusted with respect to the supporting member and spider, whereby the entrance and exit conduits may occupy any desired angular position about the shaft.

The inner surface of the supporting member is turned or bored concentric with the axis of the shaft 29, and mounted thereon is a bearing 39 which is held in place by radial bolts. On the left-hand side of the supporting member is a flange 40 that supports the motor 41, the movable member of which is mounted directly on the impeller shaft 29. As shown, this motor takes the form of a steam turbine wherein 42 is the conduit admitting steam to the wheel buckets and 43 the exhaust conduit. Any suitable form of valve mechanism may be employed and located in the steam chest 44. It will thus be seen that the motor is over-hung and tends to balance the weight of the impeller. This means that the right-hand bearing will have comparatively little work to do, and hence may be made small. The supporting member 33 has three principal functions; first it supports the weight of the motor and compressor casings; second it supports the main shaft bearing and the weight and strains imposed thereon, and third, it acts as a spacer between the compressor and motor casings.

From Fig. 2 it will be seen that the upper end of the support is semi-cylindrical where it engages or receives the motor and compressor casings, and that the base of the bearing 39 covers only a comparatively small portion thereof. Under some conditions I prefer to distribute the metal forming the supporting member as shown in Fig. 3. That is to say, the support is divided, and instead of being located entirely below the shaft a portion of it is located above the shaft and the motor and compressor casings are thereby united both above and below the shaft. This is a stronger construction, and for some cases is more desirable.

It will be observed that the impeller casing is supported solely by the supporting member and the spider 27 with its foot 31, and is located and forms the connection between them. By means of this arrangement the structure is greatly simplified, and the cost reduced to a minimum. The apparatus being self-contained, the troubles due to the lack of alinement are reduced to a minimum. As the parts can readily be bored and drilled in suitable jigs, accuracy and interchangeability of parts are assured. By using a three point support, the apparatus can be placed practically anywhere it is desired, and a firm support is assured.

I have described my invention in connection with a low pressure air compressor, but it is to be understood that it is equally applicable to high pressure compressors as well as to centrifugal pumps. As to the feature of a three point support, the invention is applicable to other structures than the one illustrated wherein there is a driving motor and an apparatus driven thereby, which structures are self-contained. By supporting the bearings for the impeller shaft by the spider on one side and by the supporting member on the other, instead of by some portion of the impeller casing, I avoid strains on the casing and can thus make the latter lighter than would otherwise be possible.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to

represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In combination, a motor and its casing, an impeller and its casing, a member located between and uniting the casings, a two-point support for the member, and a second member attached to the impeller casing which rests on the foundation at one point only.

2. In an apparatus of the character described, the combination of a motor, a rotor driven thereby, a casing for the rotor, a shaft common to the motor and rotor, a support which is located between and unites the motor and casing and which rests on the foundation at two points, a bearing for the shaft carried by the support, a second bearing for the shaft secured to the casing, and a support for the second bearing and casing that rests on the foundation at one point only.

3. In an apparatus of the character described, the combination of a rotating element, a casing therefor, a spider attached to one side of the casing and provided with a single foot adapted to rest on a foundation at one point only, a supporting member attached to the other side of the casing and having feet adapted to rest on a foundation at two points only, a driving motor which is supported solely by said member, a shaft common to said element and motor, and a bearing for the shaft carried by said member.

4. In an apparatus of the character described, the combination of a rotating element, a casing therefor, a spider attached to one side of the casing and provided with a single foot adapted to rest on a foundation at one point only, a supporting member attached to the other side of the casing and having feet adapted to rest on a foundation at two points only, and a motor for driving the element which is attached to the other side of and which is supported solely by said member.

5. In an apparatus of the character described, the combination of an impeller, a casing therefor, having an inlet and an outlet, supports located on opposite sides of the casing and secured thereto, a single foot for one of the supports located in line with the axis of the impeller, a pair of feet for the other support which are situated on opposite sides of the said axis and at equal distances therefrom, and an overhung motor comprising a casing and a rotor, said casing being attached to the second support and said rotor being arranged to partly balance the weight of the impeller.

6. In an apparatus of the character described, the combination of an impeller, a casing therefor, having an inlet and an outlet, chambers communicating with the inlet, supports located on opposite sides of the casing and secured thereto and forming walls of said chambers, a single foot for one of the supports located in line with the axis of the impeller, and a pair of feet for the other support which are situated on opposite sides of the said axis and at equal distances therefrom, and bearings for the impeller shaft which are carried by the said supports.

7. In an apparatus of the character described, the combination of an impeller, a casing therefor, a spider attached to one side of the casing for supporting it on one side, a motor for driving the impeller, a member located between the motor and impeller which supports the casing on the other side and also the motor and in addition serves as a means for uniting the casing and motor and maintaining a fixed relation.

8. In an apparatus of the character described, the combination of an impeller, a casing therefor split in a plane perpendicular to the axis of the impeller, the parts of the casing being duplicates and each containing an inlet chamber forming a part of the discharge chamber, a shoulder on the outer surface of each part of the casing, the diameter of the shoulders being the same, a supporting spider attached to one side of the casing and seated in the shoulder, a bearing for the impeller shaft carried thereby, a supporting member attached to the other side of the casing and seated in its shoulder, a bearing for the impeller shaft carried by said member, and inlet and discharge conduits that are situated between the said bearings, said inlet conduit being common to the two inlet chambers.

9. In an apparatus of the character described, the combination of an impeller, a casing therefor split in a plane perpendicular to the axis of the impeller, the parts of the casing being duplicates, shoulders on the outer surface of each part of the casing, those on one part having the same diameters as those on the other, a supporting spider seated in one of the shoulders, a supporting member seated in the corresponding shoulder on the opposite side of the casing, and means seated in the shoulders on opposite parts of the casing and surrounding the impeller shaft for directing the passage of fluid to the impeller.

10. In an apparatus of the character described, the combination of an impeller and its shaft, a casing therefor having chambers on opposite sides of the impeller, a spider that is attached to one side of the casing and is provided with a foot directly below the shaft, a support that is attached to the opposite side of the casing and is provided with two feet which are displaced laterally

from a perpendicular plane passing through the shaft, a bearing for the shaft which is carried by the support, and an inlet and an outlet conduit carried by the casing and occupying the space between the spider and the support.

11. In an apparatus of the character described, the combination of an impeller, a casing therefor having inner and outer walls between which inlet chambers are formed, the inner walls being situated in close proximity to the impeller, a shaft, a spider which is attached to one of the outer walls and forms a support for one side of the casing, a support which is attached to the other outer wall and to the motor for sustaining the weight of the parts, bearings for the shaft carried by the spider and by said support, a conduit connected with the inlet chambers, and a conduit receiving the discharge from the impeller.

12. In an apparatus of the character described, the combination of an impeller, a casing therefor having inner and outer walls between which inlet chambers are formed, the inner walls being situated in close proximity to the impeller, a shaft, a spider which is attached to one of the outer walls and forms a support for one side of the casing, a support which is attached to the other outer wall and to the motor for sustaining the weight of the parts, bearings for the shaft carried by the spider and by said support, a conduit connected with the inlet chambers, a conduit receiving the discharge from the impeller, and members carried by the outer walls that direct the fluid to the impeller.

In witness whereof, I have hereunto set my hand this nineteenth day of May, 1908.

RICHARD H. RICE.

Witnesses:
JOHN A. McMANUS, Jr.,
CHARLES A. BARNARD.