

Sept. 6, 1966

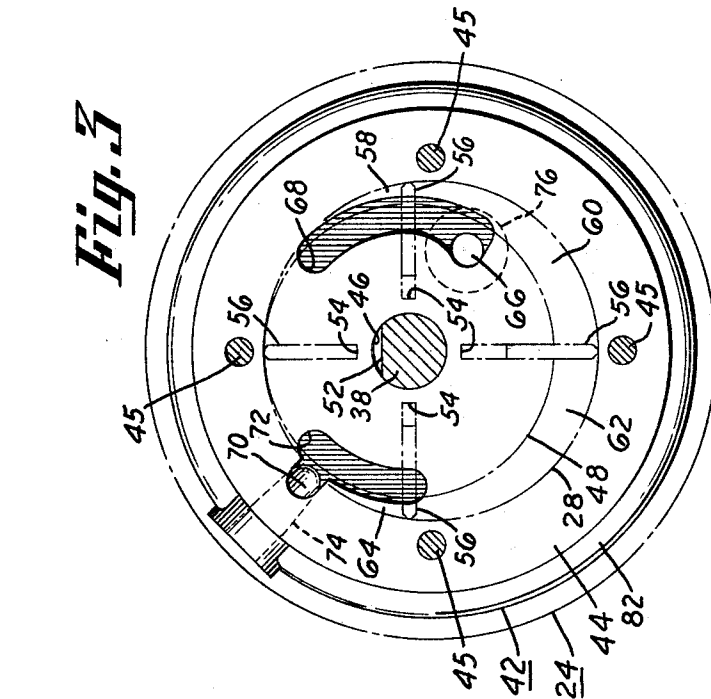
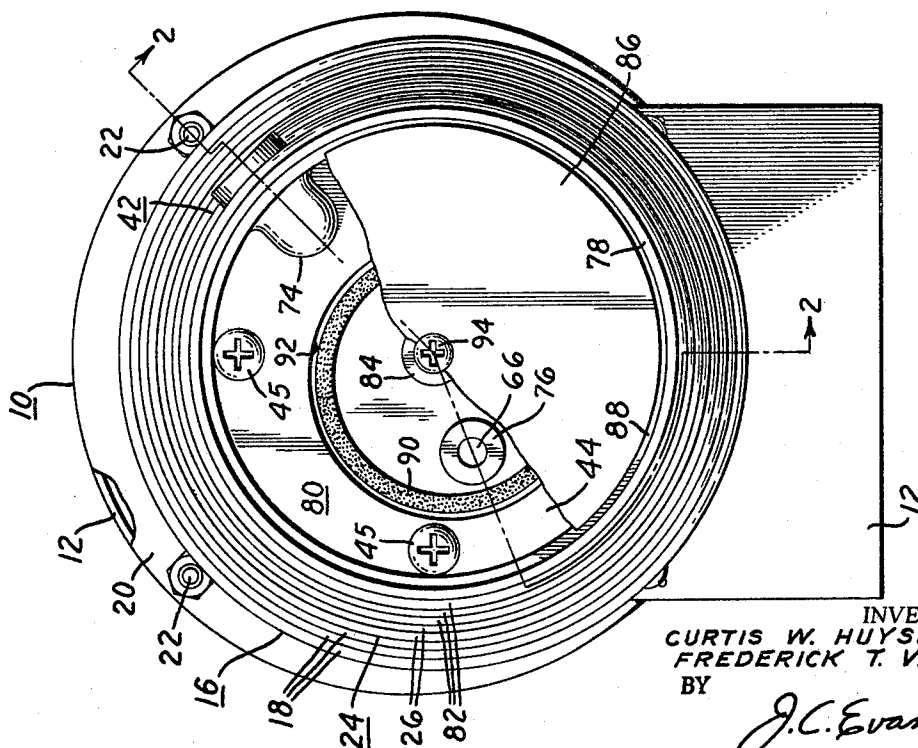
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3,270,955

AIR COMPRESSOR

Filed March 16, 1965

2 Sheets-Sheet 1



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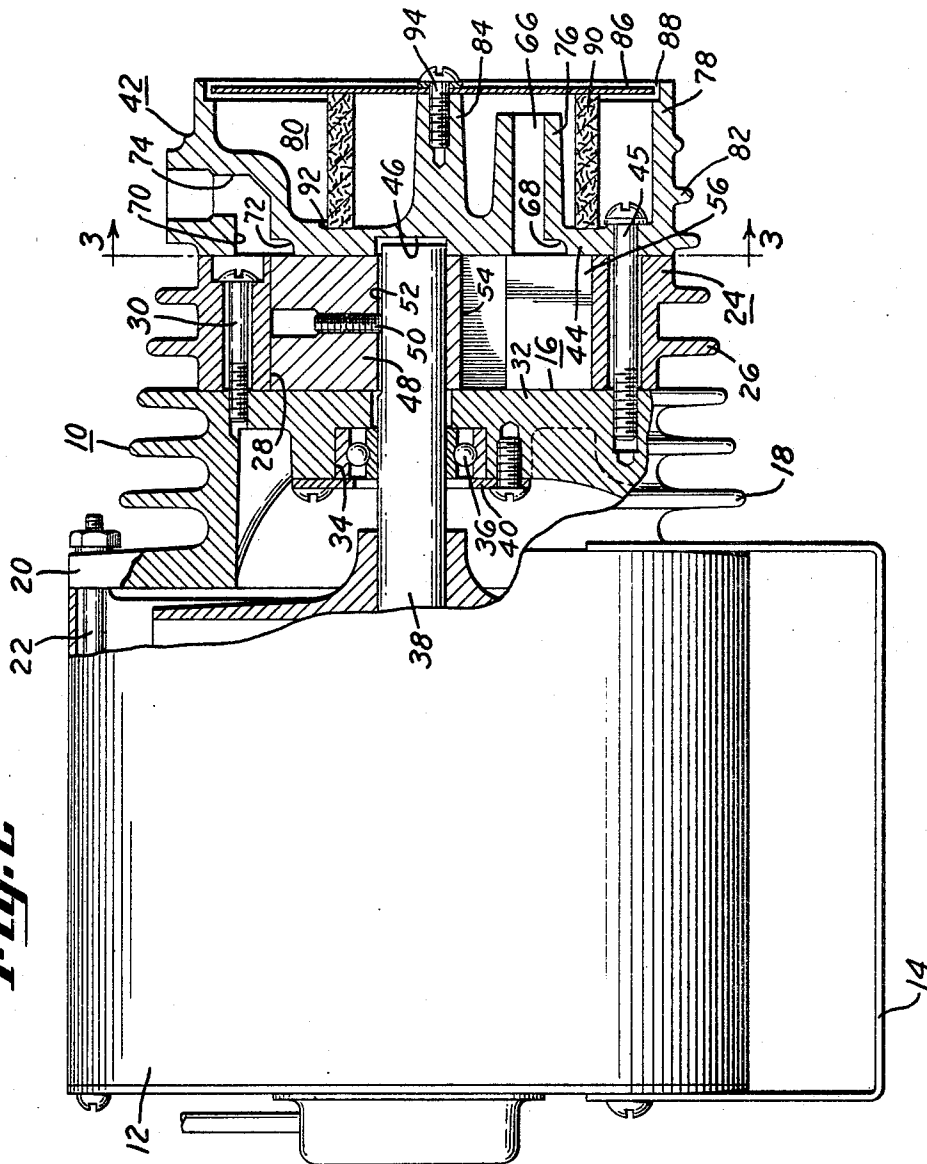
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Fig. 2



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AIR COMPRESSOR

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Filed Mar. 16, 1965, Ser. No. 440,130
5 Claims. (Cl. 230-232)

This invention relates to air compressors and more particularly to air compressors of the positive displacement rotary impeller type.

In various pressurized air systems it is desirable to include an air compressor that operates quietly. Such systems, for example, are incorporated on motor vehicles to provide a source of pressure for super-charging, anti-smog control devices, air suspension systems or the like and the proximity of the compressor unit in the system to the passenger car compartment is such that the compressor should operate without unnecessarily increasing the general level of noise transmitted into the passenger compartment. Compressed air systems might also be used in household heating systems located closely adjacent living quarters, in which case, the level of noise from the compressor unit is also an important consideration.

One particular type of compressor is especially suitable from a cost standpoint. This type of compressor can be characterized as a positive displacement rotary compressor having a rotor operable within a cavity to produce air compression. In such compressors there are two primary sources of noise that can be undesirable. Namely, the rotation of the rotor within the pumping cavity can cause physical impacting noises, especially in the case of low-cost units having minimum bearing support for the drive shaft and rotor. Also, the variable volume pumping characteristics of such compressors can cause a noticeable and, in some cases, undesirable pulsating noise attributable to the flow of fluid into and out of the cavity.

It is an object of the present invention, therefore, to improve low-cost rotary compressors for association with compressed auxiliary air systems by silencing operating noises in the compressor by the provision of a compressor housing end cover plate having inlet and outlet openings therein associated with a large volume muffling cavity serving as a housing for a large surface area filtering element and wherein the fluid flow through the muffling cavity is directed through an elongated tubular inlet member which, in cooperation with the large volume muffling cavity, reduces fluid flow noise.

A further object of the present invention is to improve low-cost air compressors of the rotary positive displacement type by silencing operating noises in the compressor by the provision of a compact outer housing cover plate with an extension thereon forming a large volume cavity for receiving a large surface area filter member where the large volume cavity of the extension is closed by an end plate forming in cooperation with the extension a continuous annular inlet opening to the large volume cavity; wherein the large volume cavity and end plate combine to muffle mechanical noises generated during the compressing operation; and wherein an elongated tubular intake member within the filtering element cooperates with the large volume cavity to effectively muffle pulsating fluid flow produced noises in the structure.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

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In the drawings:

FIGURE 1 is an end elevational view, partially broken away, of the compressor of the present invention;

FIGURE 2 is a view in vertical section taken along the line 2-2 of FIGURE 1; and

FIGURE 3 is a view in vertical section taken along the line 3-3 of FIGURE 1.

Referring to the drawings, in FIGURES 1 and 2, a compressor 10 is shown associated with an electric drive motor 12 having a U-shaped bracket 14 thereon for mounting the combination motor-compressor assembly with respect to an associated system, for example, a fuel supply system for a gas turbine requiring compressed aspiration air for directing fuel into the combustion chamber of the turbine.

The compressor 10, more particularly, includes a base plate 16 having integrally formed cooling fins 18 thereon directed radially outwardly from the outer periphery thereof. On one end of the base plate 16 is located a radially outwardly directed flange 20 secured to the housing of the motor 12 by suitable means such as tie bolts 22 for securing the compressor 10 to the motor 12. On the opposite end of the base plate 16 is located a cylinder 24 having a plurality of cooling fins 26 on the outer periphery thereof and including an interiorly located compressing cavity 28. In this embodiment of the invention the cylinder 24 is secured to the base plate 16 by a plurality of screws 30 whereby one opened end of the cylinder 24 is closed by an end wall 32 of the base plate 16. A recess 34 in the wall 32 receives a bearing assembly 36 through which is directed a rotatable shaft 38 from the motor 12 and interiorly of the pumping cavity 28. The bearing 36 is held in the recess 34 to rotatably support the shaft 38 by a bearing retainer plate 40 secured on the inner surface of the end wall 32 to overlie the recess 34.

On the opposite end of the cylinder 24 is located a cover plate 42 having an end wall 44 serving to close the opposite open end of the cylinder 24. Tie bolts 45 connect the plate 42 and cylinder 24. The end wall 44 includes a centrally located recess 46 therein which supportingly receives the terminal end of the shaft 38 for guided rotation within the cavity 28. One characteristic of the compressor 10 is that the bearing support for the shaft 38 is relatively inexpensive requiring only a common roller bearing assembly 36 and the recess 46 in the end wall 44 of the cover plate 42.

Secured to the portion of the shaft 38 located within the cavity 28 is a rotor member 48 fixedly secured to the shaft by set screws 50 in engagement with a flat 52 on one side of the shaft 38. The rotor 48 has a plurality of radially directed grooves 54 therein supporting radially outwardly directed vane members 56 for relative reciprocation with respect thereto. To reduce the cost of the unit, the vanes 56 during operation of the device have the ends thereof held in fluid sealing engagement with the inner surface of the cylinder 24 by centrifugal force. The compressing cavity 28 is eccentrically disposed with respect to the shaft 38 and the rotor 48 and vane elements 56 divide it into inlet cavities 58, 60 and discharge cavities 62, 64, as best seen in FIGURE 3. Formed on the end wall 44 of the cover plate 42 is an inlet opening 66 which communicates with the intake cavity 60 and with the intake cavity 58 through an arcuate groove 68 in the wall 44 intercommunicating the chambers 58, 60. The wall 44 also includes an outlet opening 70 communicated with the discharge cavities 62, 64 through an arcuate groove 72 in the end plate.

As best seen in FIGURE 2, the outlet 70 communicates through a passageway 74 in the wall 44 directed exteriorly of the cover plate 42 through the outer periphery thereof. The inlet opening 66 communicates with an

elongated tubular intake snout 76 shown as being integrally formed with the end wall 44 and directed therefrom exteriorly of the cavity 28. By virtue of this arrangement, upon rotation of the rotor 48 in the cavity 28, the vanes 56 sweep across the intake groove 68 to draw fluid through the snout 76 and opening 66 into the variable volume intake chambers 58, 60. Because of the eccentric arrangement of the pumping cavity 28 with respect to the rotor 48, the fluid is compressed in the discharge chambers 62, 64 to be discharged across the groove 72 thence through the outlet opening 70.

As indicated above, the compressor is characterized by a relatively inexpensive bearing and rotor-vane arrangement. Such units are very desirable from a cost standpoint, but they do have substantial play between the relatively movable parts. Thus, there is a tendency for impacting of relatively moving parts with respect to one another with a consequent undesirable noise emanation from the compressor unit 10. Moreover, because of the pumping characteristics of rotary pumps of the above-described type, a pulsating fluid flow pattern is present that can produced an undesirable fluid flow noise emission from the compressor 10.

In accordance with certain principles of the present invention, therefore, the cover plate 42 includes features for substantially reducing the mechanical and fluid noises produced in compressors of this type. The features are characterized by the fact that they can be incorporated in the relatively compact low-cost compressor structure without materially changing the low cost of the compressor and, furthermore, the noise muffling features also enable a highly effective air filtering arrangement to be incorporated in the unit whereby air being compressed thereby can be utilized in associated systems as, for example, the air aspiration portion of a fuel supply for a gas turbine without worrying about dirt particles or the like affecting the operation of the associated systems.

To accomplish these desirable results, the cover plate 42 includes a tubular extension 78 directed from the wall 44 to define a large volume cavity 80 opened to the surrounding atmosphere. The tubular extension has a plurality of air cooling fins 82 formed on the outer periphery thereof formed more or less in axial alignment with the fins 26, 18 on the pump cylinder 24 and base 16 of the compressor 10.

The cavity 80 has a planar extent substantially equal to the planar extent of the vertical cross section area through the pumping cylinder 24. Concentrically of the extension 78 is located a connection post 84 that extends from the end wall 44 substantially to the outer end of the tubular extension 78. Secured on the post 84 is a thin cover plate 86 that completely overlies the opening into the cavity 80 except for a limited annular opening 88 formed continuously therearound defined, in part, by the outermost end of the extension 78. The cover plate 86 and the relatively large volume cavity 80 serve in cooperation to effectively muffle mechanical noises directed therethrough from the operative parts of the compressor 10. Furthermore, the cavity 80 and plate 86 serve as a housing for a large surface area annular filtering member 90 having one end thereof supportingly received by a recess 92 on the outer surface of the end wall 44 and the opposite end thereof engaging the inner surface of the cover plate 86 which is held tightly thereagainst by a screw element 94 directed therethrough into threaded engagement with the post 84.

By virtue of the aforementioned construction, air drawn through the annular opening 88 is cleaned by the filter member 90 prior to passage into the inlet snout 76. An additional feature of the above-described filter and muffling assembly is that by the provision of the large volume cavity and the inlet snout 76, the inlet air flow into the pumping cavity 28 is substantially evened out to reduce pulsating fluid noise emanations from the unit 10.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An air compressor comprising, an open-ended cylinder forming a cavity, impeller means in said cavity including means for dividing said cavity into a variable volume intake chamber and a variable volume discharge chamber, an inlet and an outlet in communication with said chambers, a base plate for closing one end of said cylinder, a cover plate for closing the other end of said cylinder having said inlet therein, said cover plate including an outwardly opened enclosure having a planar extent substantially equal to the outer dimension of said cylinder, an annular filter disposed within said enclosure surrounding said inlet opening in spaced relationship therewith, closure means for closing one end of said annular filter including means for producing an annular inlet opening into said enclosure for directing fluid intake across said filter and thence through said inlet into said cavity, said closure means in cooperation with said enclosure forming a large volume chamber serving to muffle noises within said cavity produced during compressor operation.

2. An air compressor comprising, an open-ended cylinder forming a cavity, impeller means in said cavity including means for dividing said cavity into a variable volume intake chamber and a variable volume discharge chamber, an inlet and outlet in communication with said chambers, a base plate for closing one end of said cylinder, a cover plate for closing the other end of said cylinder having said inlet therein, said cover plate including an outwardly opened enclosure having a planar extent substantially equal to the outer dimension of said cylinder, an elongated tubular intake member directed into said enclosure for communicating the interior of said closure with said inlet opening, an annular filter disposed within said enclosure surrounding said tubular intake member in spaced relationship therewith, closure means for closing one end of said annular filter including means for producing an annular inlet opening into said enclosure for directing fluid intake across said filter and thence through said tubular intake member into said pumping cavity, said closure means in cooperation with said enclosure forming a large volume intake muffling chamber which in cooperation with said tubular intake member muffles pulsating fluid intake noises in such structure, said muffling chamber and closure means also silencing mechanical noises during compressor operation.

3. In an air compressor, the combination of, a housing having an open end, means in said housing forming a cavity, impeller means in said cavity including means for dividing said cavity into variable volume inlet and discharge chambers, an inlet and an outlet communicating with said chambers, a cover plate for closing the open end of said housing including said inlet therein, said cover plate including an outwardly opened enclosure, closure means for covering the opened end of said enclosure to form a cavity having an annular inlet opening, an elongated tubular intake member disposed within said enclosure cavity for directing fluid into said inlet opening, said enclosure cavity and tubular intake member serving to muffle pulsating fluid flow produced sound waves.

4. In an air compressor, the combination of, a housing having an open end, means in said housing forming a cavity, impeller means in said cavity including means for dividing said cavity into variable volume inlet and discharge chambers, an inlet and an outlet communicating with said chambers, a cover plate for closing the open end of said housing including said inlet therein, said cover plate including an outwardly opened enclosure, closure means for covering the opened end of said enclosure to form a cavity therein having an annular inlet opening, an annular filter member disposed in said enclosure cavity having one end thereof in engagement with said

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cover plate and the opposite end thereof blocked by and in engagement with said closure means, an elongated tubular intake member disposed within said filter for directing fluid into said inlet opening, said enclosure cavity and closure means serving to muffle mechanical noise emanating from said air compressor, said enclosure cavity and tubular intake member serving to muffle pulsating fluid flow produced sound waves.

5 In an air compressor, the combination of, a housing having an open end, means in said housing forming a cavity, impeller means in said cavity including means for dividing said cavity into variable volume inlet and discharge chambers, an inlet and an outlet communicating with said chambers, a cover plate for closing the open end of said housing including said inlet therein, said 10 cover plate including an outwardly opened enclosure, closure means for covering the opened end of said enclosure including means for forming an annular inlet opening into the interior of said enclosure, said closure means being spaced from said pump housing a distance 15

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substantially equal to the depth of the cavity in said housing, an annular filter member disposed in said enclosure having one end thereof in engagement with said cover plate and opposite end thereof blocked by and in engagement with said closure means, an elongated tubular intake member disposed within said filter for directing fluid into said inlet opening, said enclosure forming a substantial air space in cooperation with said closure means serving to muffle mechanical noise emanating from said air compressor, said enclosure and tubular intake member serving to muffle pulsating fluid flow produced sound waves.

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