United States Patent

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[54] SELF-CONTAINED CENTRIFUGAL REFRIGERANT GAS COMPRESSOR AND ELECTRIC MOTOR

7 Claims, 2 Drawing Figs.

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[51] Int. Cl. **F04b 17/00,** F04b 35/04, F01d 15/12
[50] Field of Search 417/423, 424, 360; 415/122, 201

[56] **References Cited**
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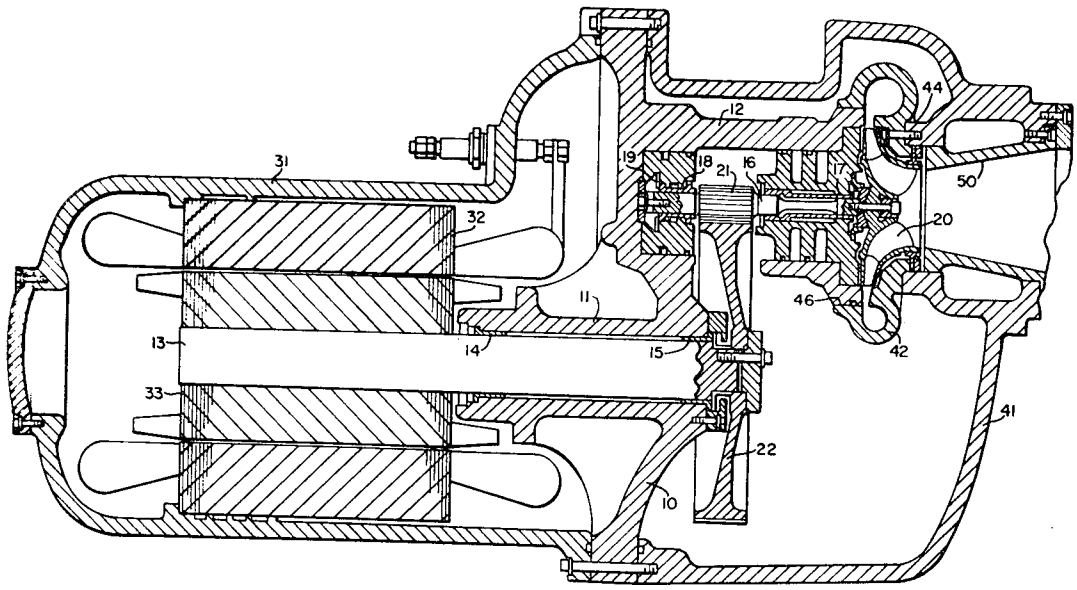
ABSTRACT: A self-contained electric motor-driven refrigerant gas compressor assembly is comprised of a bearing support member having a first cantilevered bearing assembly support means projecting from its back side with an electric motor armature shaft journaled therein and a second cantilevered bearing assembly support means projecting from its front side with a centrifugal gas impeller and shaft journaled therein. The armature shaft projects through the support member to its front side and suitable means for rotatably interconnecting the projecting armature shaft and the impeller shaft is provided on the front side.



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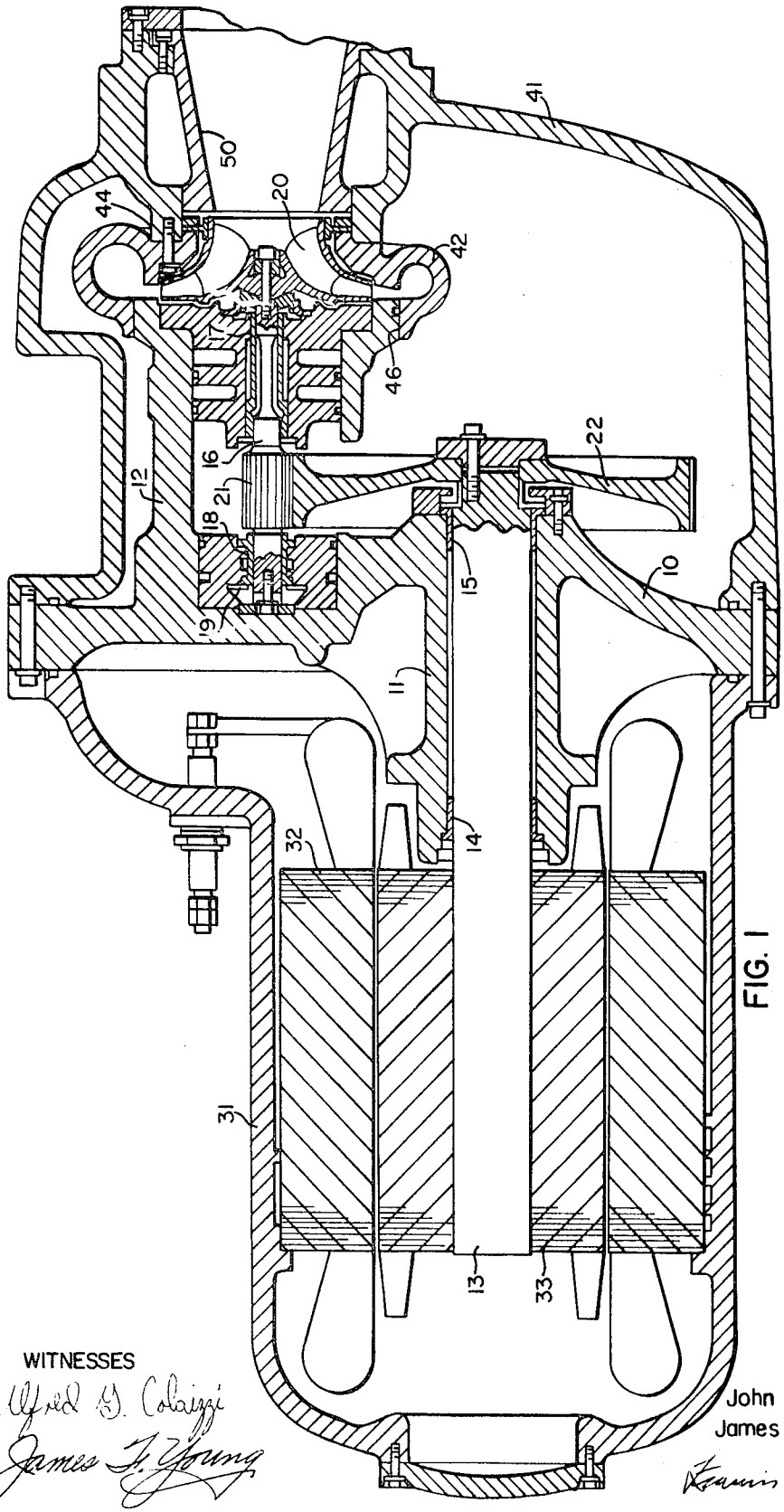

FIG. 1

WITNESSES

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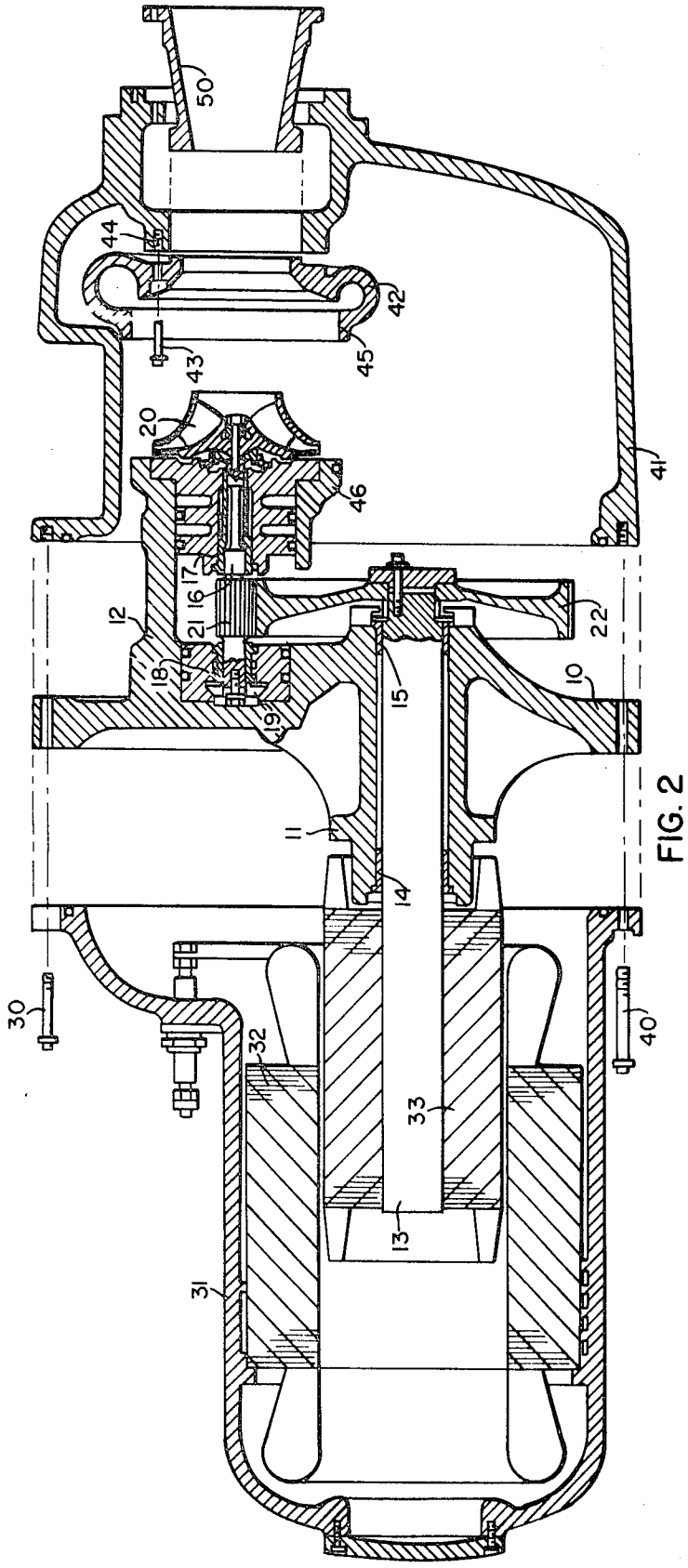
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FIG. 2

SELF-CONTAINED CENTRIFUGAL REFRIGERANT GAS COMPRESSOR AND ELECTRIC MOTOR

CROSS-REFERENCES TO RELATED PATENT APPLICATIONS

A novel arrangement for mounting a centrifugal gas impeller on its shaft as incidentally disclosed herein is specifically disclosed and claimed in the copending application, W. E. Case Ser. No. 41,566, —U.S. Pat. application Ser. No. 014,475, filed Feb. 26, 1970. A novel nozzle arrangement for the discharge outlet of the gas collecting scroll as may be used with the present invention is specifically disclosed and claimed in the copending application, W. E. Case Ser. No. 41,521, U.S. Pat. application Ser. No. 014,472, filed Feb. 26, 1970. A novel intake nozzle and capacity control for centrifugal gas compressor as may be used with the present invention is specifically disclosed and claimed in the copending application, W. E. Case Ser. No. 41,570.

BACKGROUND OF THE INVENTION

Electrically driven centrifugal refrigerant gas compressors have been used in large air-conditioning apparatus for many years. Prior to this invention, the relatively smaller air-conditioning systems have used reciprocating refrigerant gas compressors which by their nature have been considered to be more economical to manufacture or more suitable for the environment in which they are to be operated than were the centrifugal type of gas compressors. In order to economically compete with a reciprocating compressor of comparable capacity, the electrically driven centrifugal gas compressor should be artfully conceived to be of a simple design that is inexpensive to both machine, assembly and service and yet have the close tolerances that are required for the successful operation of a centrifugal gas compressor. Since very high rotational speeds for the impeller are desirable, the bearing structures for the associated gearing and shafting should have close tolerances and yet be readily accessible for maintenance and replacement or repair. Thus the advantages of relative small overall dimensions for a given capacity and the greater reliability of operation of a centrifugal gas compressor over a reciprocating compressor may be obtained. It is of course obvious that the mechanical movements involved in the centrifugal gas compressor are less complex than a reciprocating gas compressor and therefor more reliable.

PRIOR ART

Applicants are not aware of any prior disclosures of a centrifugal gas compressor design concept as described and claimed for this invention.

SUMMARY

According to the invention, a single bearing support member is provided to support all of the bearing assemblies for both the electric motor armature shaft and the centrifugal impeller shaft. Thus with all the locations of the various bearing assemblies being on a single bearing support member, they may be accurately located and machined relative to each other and undesired buildup of critical tolerances in assembly is minimized. The arrangement of the single bearing support member is such that a first bearing assembly support means is cantilevered out from the back side of the bearing support member and is adapted to provide all of the bearing surfaces for journaling the electric motor armature with its shaft extending through the bearing support to the front side thereof. A second bearing assembly support means is cantilevered out from the front side of the bearing support member and is arranged to support all the bearing surfaces for journaling a rotatable centrifugal gas-impeller shaft. Each of the first and second bearing assemblies include both sleeve and thrust bearing surfaces and therefore comprise the entire bearing assembly for the respective electric motor armature or gas impeller. An electric motor housing is detachably secured to the back side of the bearing support and contains the electric motor field assembly to surround the armature in the assembled relation. A gas compressor housing is detachably secured to the front side of the bearing support member and a compressed gas-collecting scroll is secured between an inner wall of the gas housing and the projecting end of the second bearing assembly support on the front side of the bearing support member with the scroll surrounding the impeller in the assembled relation. Any suitable means such as gearing for rotatably interconnecting the electric motor armature shaft on the front side of the bearing support member with the impeller shaft is also provided. Since the electric motor housing is detachably secured to the rear side of the bearing support member by separate fastening means than the fastening means for detachably securing the gas housing to the front side of the bearing support member, either one of such housings may be separately removed from the bearing support member without disturbing the other housing to gain access to the machine components contained in the respective housing. For example if the centrifugal impeller is to be inspected or replaced or the gearing between the armature motor shaft and the impeller shaft is to be inspected or replaced, only the front gas housing need be removed from the assembled relation on the front of the bearing support member.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other features and advantages of the invention will be apparent with reference to the following specification and drawings, in which:

FIG. **1** is a side view in sectional elevation of the self-contained electric motor and centrifugal gas compressor assembly of the invention; and

FIG. **2** is a view similar to FIG. **1** but with the housings to be secured to the front and back sides of the bearing support member partially removed therefrom to show the manner of assembly and disassembly for the compressor apparatus of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring FIGS. 1 and **2** of the drawings, a single bearing support assembly **10** is shown to have a first bearing assembly support means **11** cantilevered out to project from the back side thereof. Cantilevered out from the front side of the bearing support member **10** is a bearing assembly support means **12**. The bearing support member **10** and bearing assemblies **11** and **12** may all be formed of a single metal casting.

An electric motor armature shaft **13** is journaled within suitable bearing surfaces such as shown at **14** and **15** of the bearing assembly projection **11** on the back side of the bearing support member **10**. Similarly a centrifugal impeller shaft **16** is journaled in suitable bearing surfaces **17**, **18**, and **19** of the bearing assembly support projection **12** on the front side of the bearing support member **10**. A centrifugal gas compressor impeller **20** is secured to the shaft **16** for rotation therewith and a pinion gear **21** on the shaft **16** is geared to the bull gear **22** to rotatably interconnect the electric motor armature shaft **13** and the centrifugal impeller shaft **16**. It is of course to be noted that the electric motor armature shaft **13** projects through the bearing support member **10** to the front side thereof sufficiently to enable the bull gear **22** to be secured to the armature shaft on the front side of the bearing support member **10**. It should be understood that various lubrication passages (not shown) are provided within the bearing support member **10** to distribute lubricating oil to all of the bearing surfaces as required and an electric motor-driven lubricating oil pump (not shown) is secured within the housing **41**. Since the lubricating means for the various bearing assemblies is not a part of the present invention, and any suitable lubricating means may be provided as may be obvious to those skilled in the art, for the sake of simplicity of the drawings, the details of these lubricating arrangements have been omitted.

Detachably secured to the rear side of the bearing support member **10** by bolts such as the bolt shown at **30** is an electric motor housing **31** which supports within its structure the electric motor field coils **32** in a suitable manner. In the preferred form of the invention the field coils **32** are contained by a shrink fit within the motor housing **31** so that when the motor housing **31** is disconnected from the bearing support member **10** and removed therefrom, the electric motor field coils **32** are removed therewith and may be inspected or repaired. It will be noted, however, that the electric motor armature **33** is secured to the shaft **13** and remains supported thereon so long as the shaft **13** is journaled in the bearing assembly **11**.

Detachably secured to the front side of the bearing support member **10** by bolts such as the bolt **40** is a gas compressor housing structure **41** which in the assembled relation fully encloses the centrifugal gas compressor impeller **20** and the associated gearing **21** and **22**. The gas-collecting scroll **42** is detachably secured by the bolts such as shown at **43** to the inner wall surface **44** of the gas compressor housing **41** in a position to surround the centrifugal impeller **20** in the assembled relation with the inner end surface **45** of the scroll **42** supported on the surface **46** at the projecting end of the bearing assembly **12** on the front side of the bearing support member **10**. Thus by removing the bolts such as the bolt **40** the gas compressor housing **41** may be removed from the front side of the bearing support member **10** with the scroll **41** attached thereto by bolts **43**. Also, if it is desirable to remove the scroll **42**, bolts such as the bolt **43** are removed to detach the scroll **42** from the inner wall surface **44** of the gas compressor housing **41**.

In the assembled relation as shown by FIG. **1** of the drawings, the gas compressor housing **41** may also have detachably secured thereto an intake nozzle **50** leading to the centrifugal impeller **20**. The details of the intake nozzle structure **50** are not a part of this invention add are not shown but if a more detailed understanding of the nozzle arrangement **50** is desired reference may be made to the aforementioned copending application, W. E. Case Ser. No. 41,570, U.S. Pat. application Ser. No. 014,472, filed Feb. 26, 1970, which discloses an intake nozzle and capacity control as may be specifically intended for use with the subject gas compressor assembly.

Having now described the invention in some detail, it should be apparent that the unitary bearing support member **10** and the arrangement for detachably securing the housing **31** to the back side thereof and the housing **41** from the front side thereof provides a number of very advantageous features. In the first place the single bearing support member **10** for all of the bearing assemblies enables the various bearing assemblies to be accurately machined and located relative to each other without an undesired buildup of critical tolerances in assembly. Furthermore, disassembly of the entire compressor assembly is easily achieved by either removing the rear motor housing **31** or the front compressor gas housing **41**.

Various modifications will occur to those skilled in the art.

I claim:

1. A self contained electric motor-driven gas compressor assembly comprising, a bearing support member having a front side and a back side, first bearing assembly support means projecting from the back side of said support, an electric motor armature shaft journaled in said first bearing assembly support means with an end extending through the support to the front side of the support, second bearing assembly support means projecting from the front side of said support, a rotatable gas impeller and shaft journaled in said second bearing assembly support means, means rotatably interconnecting the extended end of said armature shaft and and said gas-impeller shaft on the front side of said support member, a gas compressor housing detachably secured to the front side of said support member, and a compressed gas-collecting scroll supported between an inside wall of said compressor housing and the impeller end of said second bearing means in a position surrounding said rotatable impeller.

2. The invention of claim **1** in which an electric motor housing is detachably secured to the back side of said support member.

3. The invention of claim **2** in which an electric motor field coil assembly is contained within said motor housing and an electric motor armature is mounted on said armature shaft extending from the back side of said support.

4. The invention of claim **1** in which said first bearing assembly support means is cantilevered out from the back side of said of support member and contains the entire bearing elements for said armature shaft.

5. The invention of claim **4** in which said second bearing assembly support means is cantilevered out from the front side of said support member and contains the entire bearing elements for said impeller shaft.

6. The invention of claim **5** in which first bearing assembly support means is cantilevered out from the back side of said support member and contains the entire bearing elements for said armature shaft.

7. The invention of claim **1** in which the bearing support member and the first and second bearing assembly support means are formed of an integral metal casting.

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