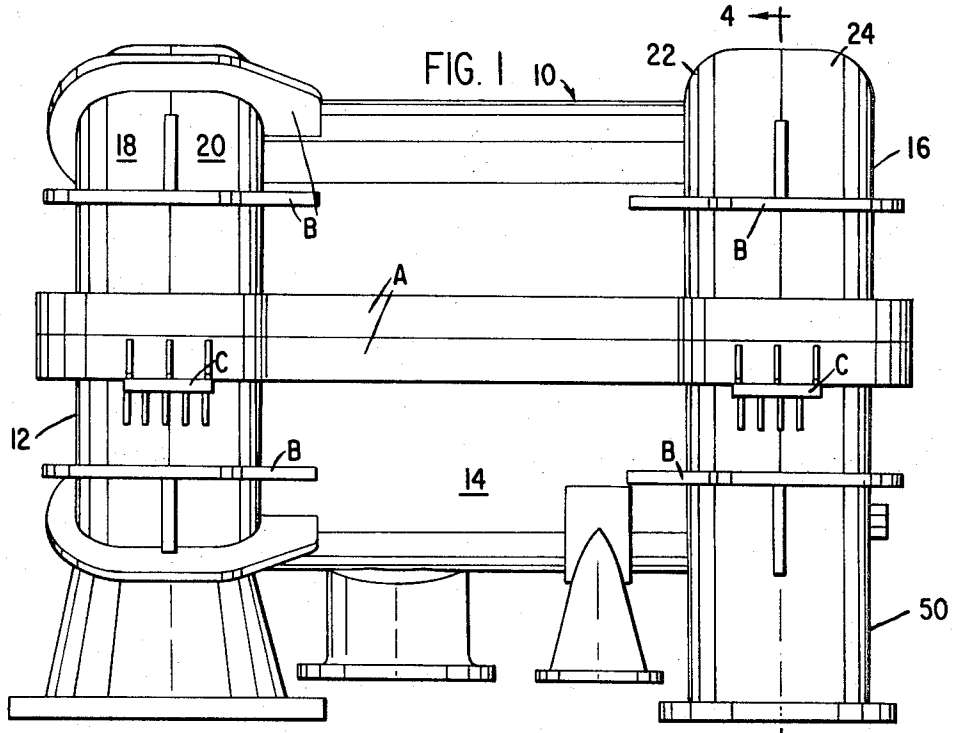
Feb. 6, 1968 R. C. BURNS 3,367,567

COMPRESSOR CASING

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FIG. 1



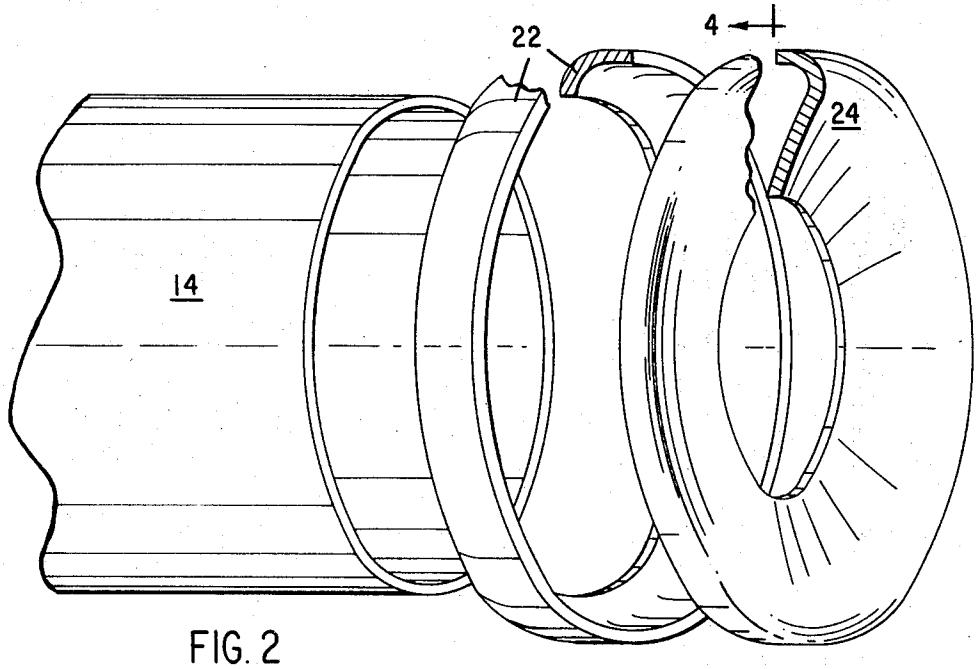


FIG. 2

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COMPRESSOR CASING

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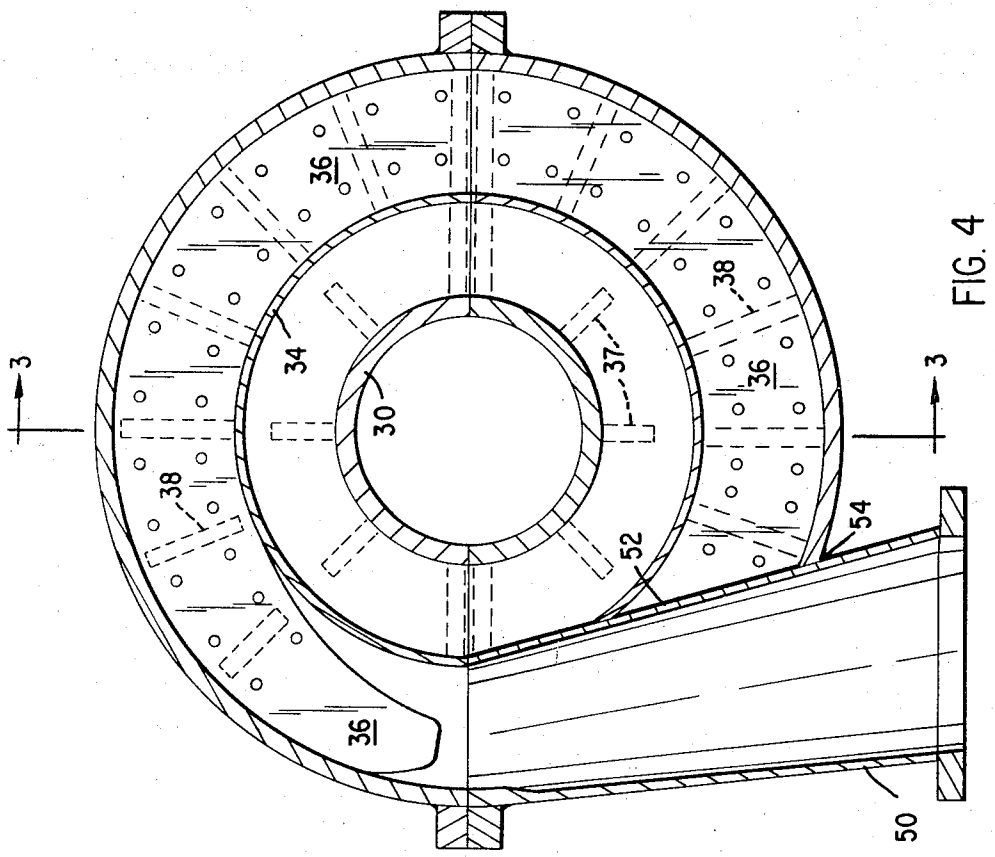


FIG. 4

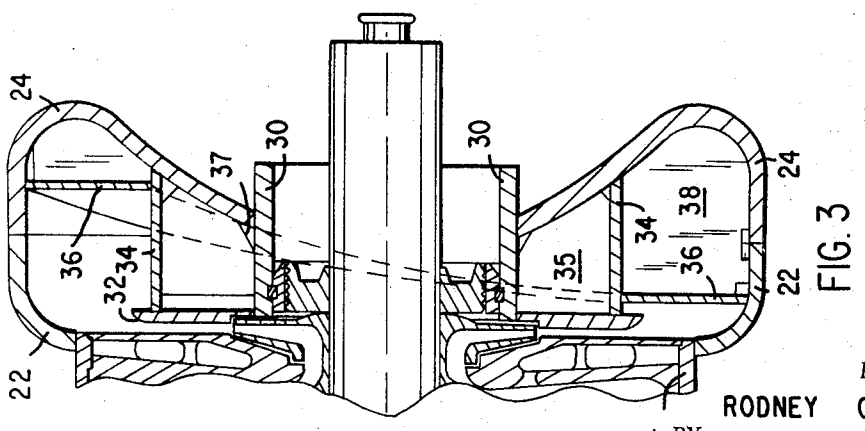


FIG. 3

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COMPRESSOR CASING

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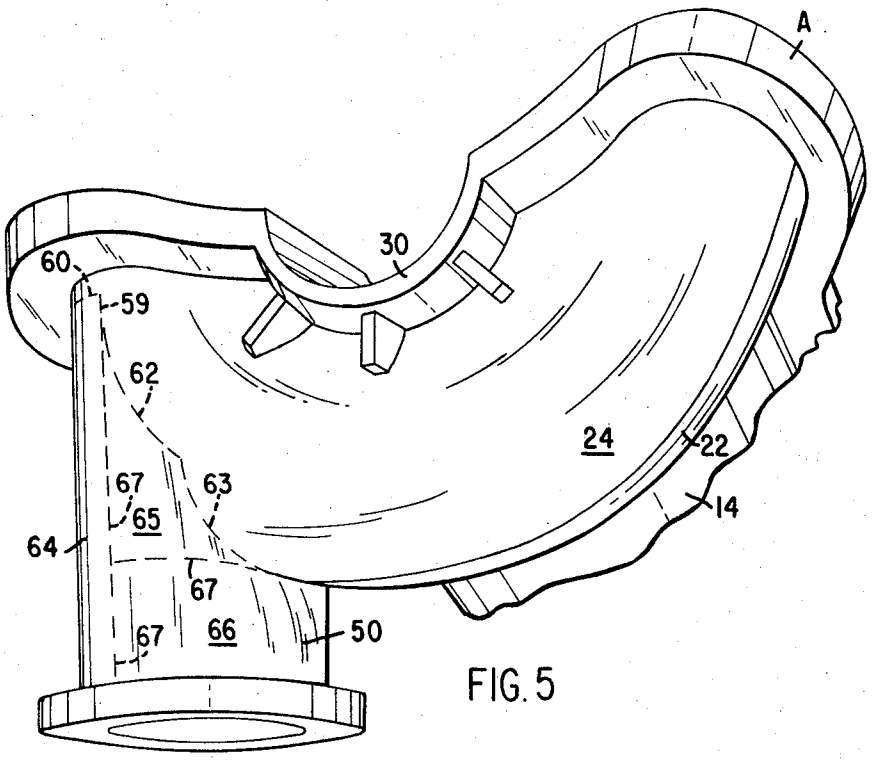


FIG. 5

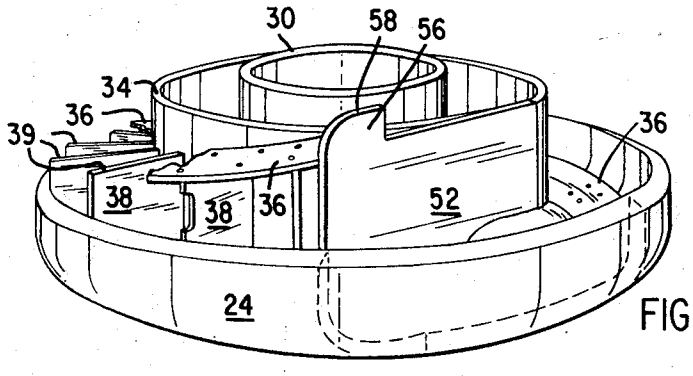


FIG. 6

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3,367,567

COMPRESSOR CASING

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Filed Aug. 1, 1966, Ser. No. 569,179

5 Claims. (Cl. 230—133)

This invention relates broadly to rotating machinery. More particularly, this invention relates to gas compressors. Still more particularly, this invention relates to a novel gas compressor casing formed without the necessity of including cast parts as components thereof.

This invention is directed to a casing for a gas compressor including an inlet section, a shell or central body section, and an outlet section in which the individual structural parts comprising the sections are composed of plate material formed and united in a predetermined manner.

In gas compression equipment of the kind contemplated, the outlet section normally includes a volute-shaped gas diffuser passage, the cross section of which gradually increases as it progresses around the circumference to collect the gas as it leaves the final stage of compression and to convert the velocity energy of this gas to pressure in an efficient manner. When an outlet section is formed by casting the metal, the volute diffuser passage is easy to form, taking the shape dictated by the pattern used in making the casting. When forming the outlet section from plate material in which substantially constant cross section parts are employed, it is necessary that the gas diffuser passage be constructed in at least a part of the section during the time the section is fabricated.

This invention contemplates forming the central or cylindrical body section of the casing from plate material formed into a cylinder with the abutting edges secured to one another by tack welding. The inlet and outlet sections are formed from two pieces of plate material, the first having a generally arcuate cross section one edge of which is joined to the central cylindrical portion of the casing and the second piece being formed of plate material to which is imparted a reverse curvature. One edge of the second part is joined to the other edge of the first part by welding. Openings are provided in the second part permitting passage therethrough of the power shaft of the machine. The interior of the outlet section is provided with a wall defining a generally helical path so as to define a gas diffuser passage of gradually increasing cross section as desired.

In developing the wall, a series of spaced webs are arranged projecting inwardly from the second part of the outlet section. The webs vary in length and the outer or free end thereof locates the position in the outlet section at which the wall should be disposed. Thus a single plate or series of plates, if desired, connect to the unattached end of the webs to form the gas diffuser passage between the plate and the interior surface of the other part.

The completely welded enclosure is divided into an upper half and a lower half and appropriate flanges are applied thereto in order that the two sections may be bolted together and may be easily separated should the need arise.

The webs referred to above are provided with passages permitting drainage of condensate or liquid which may form or collect in the portion of the outlet section through which gas does not flow. The diffuser passage wall is provided with openings permitting equalization of pressure between the space defined by the webs and the space accommodating gas flow from the machine.

It is a chief object of this invention to provide a compressor casing that may be readily fabricated by welding sheet or plate metal parts in which the inlet and outlet sections are of a common design enabling manufacturing economies to be realized.

An additional object of the invention is the provision of a gas compressor as described wherein novel gas flow diffuser passage means are employed.

These and other objects of the invention will be apparent upon a consideration of the ensuing specification and drawings in which:

FIGURE 1 is a front, elevational view of a gas compressor formed in accordance with the invention;

FIGURE 2 is a partial perspective view of a part of the central section and certain of the parts forming the outlet section;

FIGURE 3 is a cross section through the outlet section taken along lines 3—3 of FIGURE 4 illustrating the gas diffuser passage formed in the outlet section;

FIGURE 4 is a cross section of the outlet section taken along lines 4—4 of FIGURE 1 illustrating the transition duct for directing compressed gas from the diffuser passage outwardly of the machine;

FIGURE 5 is a perspective view of part of the outlet section showing the manner of forming and connecting the transition duct to the outlet section; and

FIGURE 6 is a perspective view of the outlet section with one of the parts removed to show the details of the gas diffuser passage wall.

A machine utilizing a rotary power shaft and illustrating the invention is shown in FIGURE 1 as a gas compressor **10** including three primary sections, an inlet section **12**, a central section or shell **14**, and an outlet section **16**. Gas to be compressed enters the inlet section **12** and passes through the central section **14** where it undergoes a plurality of stages of compression. As the compressed gas leaves the central section, it flows from the machine through the outlet section **16**, traversing a gas diffuser passage of increasing cross section commonly referred to as a scroll or volute. Pedestal means, not shown, support the machine at a vertical location above the bottom of the machine so that, if desired, the compressor may be mounted over a depression in a floor or ground installation. Reinforcing ribs and grapple lugs are also welded to the sections described above.

The central section **14** is formed by bending or rolling a steel plate of the desired thickness to a cylindrical form and uniting the edges by tack welding. The inlet section **12** is composed of two separate parts, **18** and **20**. Part **20** is provided with an arcuate configuration by pressing or spinning a flat circular plate and thereafter removing a section to define a central opening. This formed configuration is commonly known as a "flanged only head" in the pressure vessel art. Part **18** is also formed from a flat circular plate in a similar manner. In forming part **18**, there is a reverse bending operation involved so that the part has a cross section similar to that obtained in forming outlet part **24** shown in FIGURE 2. This shape is commonly known in the pressure vessel art as a "flanged and reversed dished head." Appropriate inner strengthening struts, not shown, are secured to the inner surface of part **18** and the parts **18** and **20** are joined by welding. The sub-assembly comprising parts **18** and **20** is secured to one end of the shell preparatory to conducting further fabricating steps on the parts.

The outlet section **16** is also composed of two parts **22** and **24** similar in shape to parts **20** and **18**. Prior to uniting parts **22** and **24**, cylindrical sleeve **30** is secured to the edge of part **24** defining an opening formed in the part to accommodate the shaft, note FIGURE 3. This sleeve is provided as a housing for the shaft bearing and sealing assemblies employed with the machine. Located

inwardly of part **24** is annular wall **32** secured by welding to the sleeve **30**. Encircling wall **32** near its outer radial edge is cylindrical ring **34** engaging the inner surface of part **24** to define a space **35**. Spaced gussets **37** divide space **35** into a series of chambers.

Attention is directed to FIGURE 6 which illustrates a preferred manner of constructing the diffuser passage defining wall **36**. At predetermined spaced locations about the inner surface of part **24**, web members **38** are disposed. The webs are connected to the part **24** by welding an edge of the web to the inner surface. Each web **38** has a different height than its adjacent web so that the outer unattached edges **39** substantially define a helix. The outer edges **39** are connected by the wall **36** which now assumes the helical path formed by edges **39**. Once the part **22** is secured by welding in the manner shown in FIGURES 1 and 3 to the part **24**, the wall defines with the inner surface of part **22** and a portion of the inner surface of part **24** a gas diffuser passage of varying width.

In the construction of a gas compressor in accordance with this invention, it is necessary to include a connection to the outlet section **16** so that compressed gas flowing from the gas diffuser may pass to a discharge line forming part of a system served by the compressor. As pointed out above when the parts **22** and **24** are connected, there results a distorted torus-shaped structure. The means enabling flow of the compressed gas from the gas diffuser passage in the torus includes a transition duct **50** having a particular configuration.

It has been found practical in constructing the transition duct to replace a segment of the annular ring **34** with a plate **52** forming in effect a chord of the circle defined by the ring. The plate then extends through the torus and connects to the part **24** at weldment **54**. The plate **52** has an enlarged portion **56** the outer edge **58** of which abuts against the inner surface of part **22** when the parts are joined.

In order to describe the connection between the transition duct **50** and the outlet section **16**, reference may be had to FIGURE 5 wherein dotted lines depict the joint between either the parts forming the duct or the welded connection between the duct and the torus formed by the parts **22** and **24**. The dotted lines thus indicate the boundary of the material removed from the section. Dotted line **59** together with a companion line on the other side of the line of juncture between parts **22** and **24** and together with a cross cut line **60** receive the end and adjacent side edges of a section **64** of the transition duct. Dotted lines **62** swing downwardly at a first given radius and dotted lines **63** swing inwardly at a second radius. The lines **62** and **63** define the junction between gusset plates **65** of a non-planar shape. An arcuate section **66** connects to the outlet section, the lower edge of the gusset plates and the section **64** at weld lines **67**.

Section **64** is provided with a cross section that changes throughout its height from a relatively shallow U-shape at its upper end (the connection shown at **59, 60**) to a substantially semi-circular cross section at its lower end. Thus gusset plates **65** provide a connection between the edges of section **64** and the curved surface of the torus so that gas may flow from the outlet section to a conduit system, not shown.

As pointed out above, a gas compressor casing of the kind described should be divided into an upper half and a lower half in order that access may be had to the internal operating elements of the machine. As the invention has been described, the parts have been united so as to form a complete casing. In practice, however, the parts **18, 20, 22** and **24** have substantial portions provided with slits through the center thereof so that after assembly into a

unit a small amount of flame cutting by a torch is all that is necessary to separate the assembly into upper and lower halves. It has been stated above that the central section is formed by rolling a plate into a cylinder and tack welding the abutting edges. The cylinder is then cut along diametrically opposed regions, one of which is the tack welded seam to form two separate halves.

After the casing including the inlet, outlet and central sections has been formed into two halves, flanges A are welded thereto in the appropriate places. In addition, stiffening ribs B and pedestal supports C are likewise welded to the individual halves preparatory ot assembling, within the casing, the operating parts of the gas compressor. It will thus be appreciated that a casing for a multi-stage gas compressor may be fabricated by employing plate material welded together. One important advantage obtained by employing plate material connected by welding is realized when unusually low or high temperature gas is processed. The individual parts may be of different materials to suit the temperature existing at that location in the casing whereas if a casting is used it ordinarily is necessary to use the same material throughout.

While I have described a preferred embodiment of my invention, it is to be understood that the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. A gas compression machine comprising a casing including a central section, an inlet section and an outlet section arranged to provide a path for the flow of gas through the machine, the outlet section comprising a first substantially annular part having an opening and a second substantially annular part having an opening, said first and second parts being joined in edge-to-edge contact with the opening in registry, a plurality of webs extending from the inner surface of said second part, at least two of said webs being of unequal length, the free ends of said webs defining a substantially helical path of increasing width, wall means attached to the edges of said webs opposite the connection thereof with said second part and discharge means connected to said outlet section for discharging gas flowing from said path.

2. A gas compression machine as defined in claim **1** wherein said outlet section includes a sleeve member positioned in said opening, a second wall encircling said sleeve, said wall providing support for a second edge of said webs.

3. A gas compression machine as defined in claim **2** wherein a portion of said second wall is provided with an arcuate configuration and a portion is provided with a linear disposition.

4. A gas compression machine as defined in claim **3** wherein said discharge means includes a transition duct forming an extension of the section of the path utilizing the linear portion of the second wall.

5. A gas compression machine as defined in claim **4** wherein said webs are provided with openings for flow of liquid, and said wall is provided with openings for equalization of pressure.

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