Sept. 24, 1957 E. KRZYSZCZUK 2,807,217

FLUID COMPRESSOR

Filed Sept. 16, 1955 2 Sheets-Sheet 1

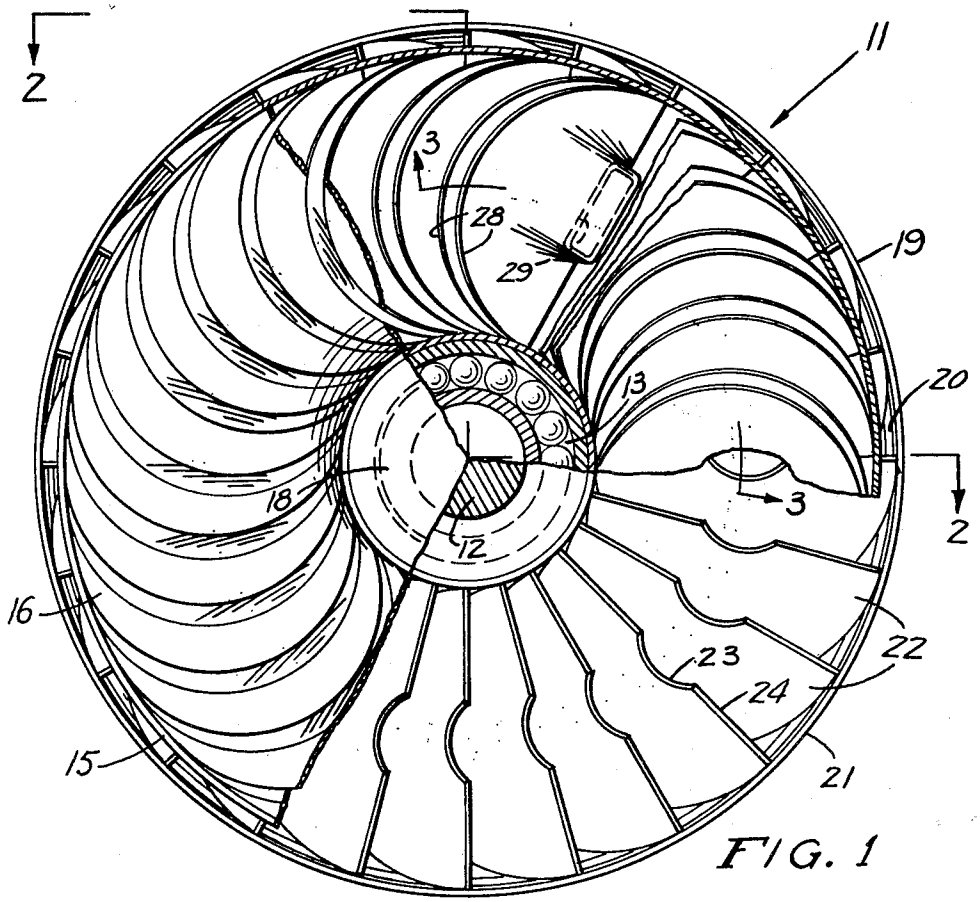


FIG. 1

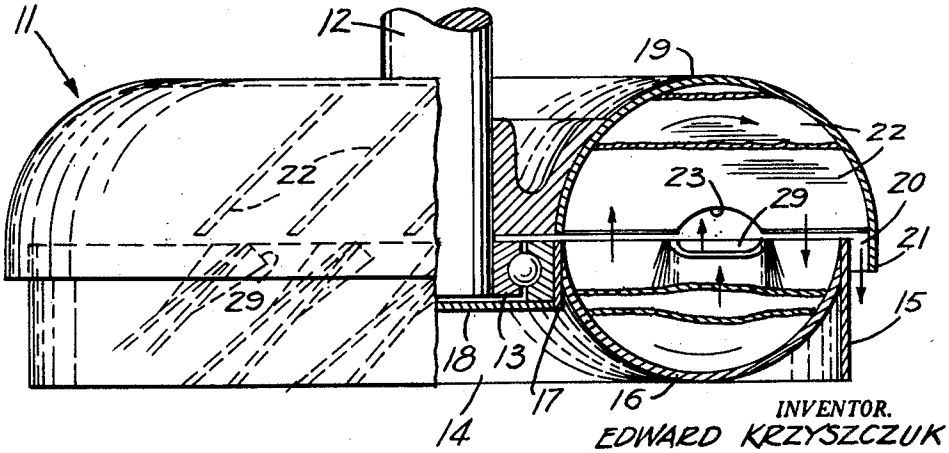


FIG. 2

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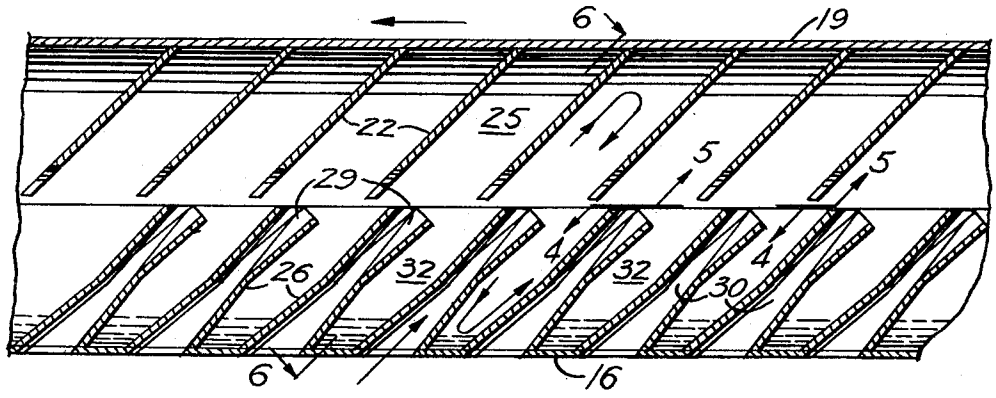


FIG. 3

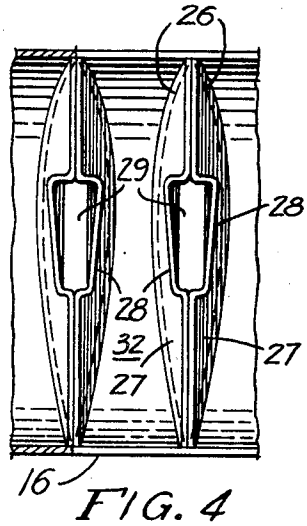


FIG. 4

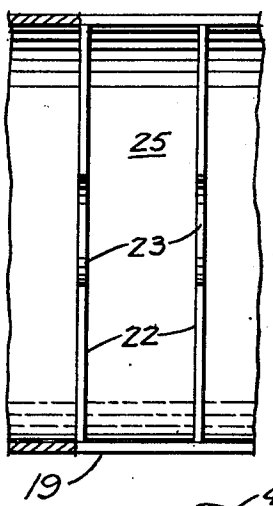


FIG. 5

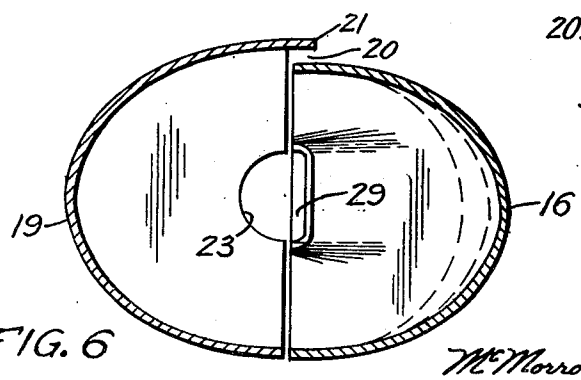


FIG. 6

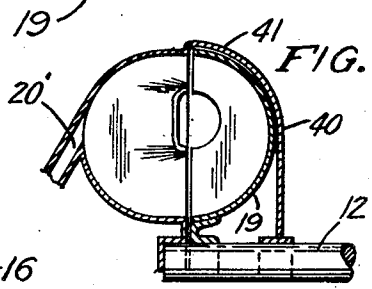


FIG. 7

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FLUID COMPRESSOR

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Application September 16, 1955, Serial No. 534,743

4 Claims. (Cl. 103—103)

This invention relates to fluid pressure converting devices, and more particularly to an improved fluid pressure converter which may be employed either as a compressor or turbine.

The main object of the invention is to provide a novel and improved device for converting fluid pressure, said device being relatively simple in construction, providing an efficient conversion of the energy applied thereto, and being suitable for a large number of applications, for example, for use as a gas compressor, for use as a power plant, or for use as a pump.

A further object of the invention is to provide a novel and improved fluid compressor of the centrifugal type, said compressor using relatively inexpensive components, involving relatively few parts, being sturdy in construction, being reliable in operation, and having high operating efficiency.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is an end elevational view, partly in cross section, of the basic elements of a centrifugal compressor constructed in accordance with the present invention, said view being taken from the stator side of the compressor assembly;

Figure 2 is a top view, partly in horizontal cross section, of the basic compressor assembly of Figure 1, said view being taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged cross sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a cross sectional detail view taken on the line 4—4 of Figure 3;

Figure 5 is a cross sectional detail view taken on the line 5—5 of Figure 3.

Figure 6 is a cross-sectional view taken on line 6—6 of Figure 3; and

Figure 7 is a fragmentary cross-sectional view taken longitudinally through a modified form of centrifugal compressor construction in accordance with the present invention.

Referring to the drawings, **11** generally designates an improved fluid compressor assembly constructed in accordance with the present invention, said assembly being shown without its main housing and without the supporting bearing means for its driving shaft, shown at **12**, except for the end bearing assembly **13** for the shaft **12**, shown in Figures 1 and 2. The compressor assembly comprises a stator member **14**, consisting of a generally cylindrical peripheral member **15** in which is secured an annular concave housing **16**, said housing having secured to its inner periphery a cylindrical sleeve **17** in which the outer race of the bearing assembly **13** is secured, as clearly shown in Figure 2. A cover disk **18** is secured to the lower end of the inner sleeve **17**, as viewed in Figure 2, providing a seal therefor, and covering the ends of the driving shaft **12**.

Designated at **19** is an annular concave rotor housing which is secured on shaft **12** and which is disposed peripherally adjacent to and facing the stator housing **16**, the rotor housing **19** being slightly larger in diameter than the peripheral cylindrical member **15**, as is shown in Figure 2, providing an annular exhaust space **20** between the depending peripheral flange **21** of housing **19**, shown in Figure 2, and the cylindrical wall **15** of the stator.

Secured in the rotor housing **19** are a plurality of radial, evenly spaced, oblique, generally semicircular vanes **22** spaced in the manner shown in Figures 1 and 3, said vanes **22** being inclined at the same angles with respect to respective longitudinal radial planes containing their diameters. Each vane **22** is formed with a generally semicircular notch **23** at the intermediate portion of its diametrical edge **24**, as is clearly shown in Figure 1.

Thus, the successive vanes **22** define respective oblique radial impeller chambers in the rotor housing, said chambers being exposed for free discharge at their respective peripheral spaces **20** communicating with said chambers and defined by the depending peripheral flange **21** and the cylindrical wall **15**, as above explained.

Secured in the annular stator housing **16** facing the impeller chambers, designated at **25**, are the respective radially spaced hollow, radial, oblique vanes **26**, said hollow vanes **26** being of any suitable shape and being spaced apart by any suitable distances. As shown in Figure 3, the hollow vanes **26** are inclined at suitable angles with respect to longitudinal radial planes containing the diameters.

As shown in Figure 4, the hollow vanes **26** comprise converging wall elements **27, 27** which are respectively formed with opposing nozzle wall elements **28, 28** to define a fluid discharge nozzle **29** at the intermediate portion of each hollow vane **26**, the nozzle passage **29** being constricted at its intermediate portion, as shown at **30**, whereby each nozzle passage **29** defines a Venturi element directed toward a respective impeller chamber **25** of the rotor housing **19**, as shown in Figure 3.

Thus, the Venturi passages **29** are directed to the rotor vanes **22** and are located adjacent the intermediate notches **23** of the respective rotor vanes.

A suitable source of fluid, such as gas, is connected by means (not shown) to the stator shell **15**, whereby this gas passes through the stator housing **16** by way of the Venturi nozzle passages **29**. The rotor housing **19** is rotated by a suitable driving means connected to the shaft **12**, the gas from the nozzles **30** being discharged into the respective impeller housings **25** and being immediately redirected into the spaces **32** defined between the adjacent hollow stator vanes **26**, as shown in Figure 3. The movement of the rotor vanes relative to the stator vanes produces a certain amount of compression of the fluid, whereby the fluid flows from the spaces **32** into the next adjacent spaces **25** of the rotor housing and is again redirected to the next adjacent spaces **32** of the stator housing. Thus, as the rotor housing **19** revolves, the fluid from the Venturi nozzle passages **29** is successively recirculated between the impeller spaces **25** and the stator spaces **32**, the pressure of the fluid being gradually increased by the continued movement of the fluid and by the fact that as the pressure of the fluid increases its mass increases, whereby centrifugal force acts on the fluid and urges it outwardly against the concave internal wall surface of the annular rotor housing **19**, the pressure building up until it becomes a maximum adjacent to the annular discharge passage **20** at the periphery of the rotor.

The compressed gas discharging from the annular passage **20** is conveyed by suitable conduit means (not shown) to its intended point of application, said conduit means being conventional per se and being therefore not described or illustrated herein.

The semicircular notches **23** provide proper clearance

for the fluid discharging from the nozzle passages **29** as well as for the recirculation of the fluid from the chambers **25** and **32**, toward and from each other in alternating sequence, as above described.

Thus, the fluid emerging from a given Venturi passage **29** may circulate back and forth between the impeller chambers **25** and **32** of the rotor housing **19** and stator housing **16** a considerable number of times while its pressure is being built up, the energy required to recirculate the fluid and to build up its pressure being applied by the power source driving shaft **12**. Obviously, the degree of pressure intensification will depend upon a number of factors, including the design of the Venturi passages **29**, the spacing between the rotor and stator vanes, the speed of rotation of the shaft **12**, the properties of the gas being compressed, and the like. An additional factor involved in determining the maximum intensification of the fluid pressure obtained is the size of the annular exhaust passage **20** through which the compressed fluid discharges from the compressor device.

Obviously, the device above described as a compressor may be employed as a turbine to drive the shaft **12** by admitting fluid under pressure through the passage **20** by suitable nozzles, not shown, whereby the fluid discharges into the impeller chambers **25** and is then recirculated back and forth between chambers **25** and the stator chambers **32** until the fluid exhausts from the device through passages **29**, the kinetic energy of the fluid being transferred to the rotor **19** and thus to the driven shaft **12**.

By providing the constricted intermediate portions **30** in the nozzle passages **29**, a Venturi effect is obtained, whereby the fluid entering the nozzle passages **29** and discharging therefrom into the impeller chambers **25** is increased in velocity due to the expansion of the fluid as it passes the constricted intermediate portions **30** of the nozzle passages.

As shown in Figure 7, a stationary outer housing **40** may be provided around the assembly, said outer housing extending adjacent to but being spaced from the rotary member **19** to define a clearance space **41**. Discharge ducts **20'** may be provided in said outer housing for discharging fluid from the device, corresponding to the annular discharge passage **20** of the previously described form of the invention, said discharge ducts **20'** being in communication with the interior of the stator portion of the assembly. The outer housing **40** thus forms the annular wall of the stator portion of the assembly, as well as an enclosure for the rotor **19**.

While a specific embodiment of an improved fluid converter device has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A fluid converter comprising an annular concave stationary housing, an annular concave rotor housing adjacent to, facing, and coaxial with said stationary housing, an axial shaft connected to said rotor housing, a plurality of regularly spaced, oblique vanes inclined at equal angles to radial planes and secured in said rotor housing, defining oblique impeller chambers spaced around said rotor housing, said rotor housing being larger in radius than said stationary housing, whereby said impeller chambers are exposed adjacent the periphery of said stationary housing, a plurality of oblique hollow vanes in said stationary housing inclined in the same manner as and spaced from said first-named vanes, and fluid nozzle passages formed in the respective hollow vanes facing said rotor

housing and being directed substantially parallel to said first-named vanes.

2. A fluid converter comprising an annular concave stationary housing, an annular concave rotor housing adjacent to, facing, and coaxial with said stationary housing, an axial shaft connected to said rotor housing, a plurality of oblique, regularly spaced vanes inclined at equal angles to radial planes and secured in said rotor housing defining oblique impeller chambers spaced around said rotor housing, said rotor housing being larger in radius than said stationary housing, whereby said impeller chambers are exposed adjacent the periphery of said stationary housing, a plurality of oblique hollow vanes in said stationary housing inclined in the same manner as and spaced from said first-named vanes, and fluid nozzle passages formed in the intermediate portions of the respective hollow vanes facing said rotor housing and being directed substantially parallel to said first-named vanes, said nozzle passages being relatively constricted at portions thereof.

3. A fluid converter comprising an annular concave stationary housing, an annular concave rotor housing adjacent to, facing and coaxial with said stationary housing, an axial shaft connected to said rotor housing, a plurality of regularly spaced, oblique vanes inclined at equal angles to radial planes and secured in said rotor housing defining oblique impeller chambers spaced around said rotor housing, said vanes being formed with notches at the intermediate portions of their diametrical edges, said rotor housing being larger in radius than said stationary housing, whereby said impeller chambers are exposed adjacent the periphery of said stationary housing to define a fluid discharge outlet, a plurality of oblique hollow vanes in said stationary housing inclined in the same manner as and spaced from said first-named vanes, and fluid nozzle passages formed in the intermediate portions of the respective hollow vanes, facing said rotor housing and opening adjacent said notches.

4. A fluid converter comprising an annular concave stationary housing, an annular concave rotor housing adjacent to, facing and coaxial with said stationary housing, an axial shaft connected to said rotor housing, a plurality of regularly spaced, oblique vanes inclined at equal angles to radial planes and secured in said rotor housing defining oblique impeller chambers spaced around said rotor housing, said vanes being formed with notches at the intermediate portions of their diametrical edges, said rotor housing being larger in radius than said stationary housing and being provided with a peripheral flange spaced from and extending adjacent the peripheral wall of said stationary housing to define a fluid discharge outlet adjacent the periphery of said stationary housing, a plurality of oblique, hollow vanes in said stationary housing inclined in the same manner as and extending substantially parallel to said first-named vanes, and fluid nozzle passages formed in the intermediate portions of the respective hollow vanes facing said rotor housing, opening adjacent said notches, and being directed substantially parallel to said first-named vanes, said nozzle passages being relatively constricted at portions thereof to define Venturis, whereby fluid entering the device through said nozzle passages discharges from said nozzle passages into said radial impeller chambers with increased velocity.

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