

Jan. 14, 1958

F. C. GILMAN
PROPELLER PUMP OR BLOWER
Filed Aug. 18, 1953

2,819,675

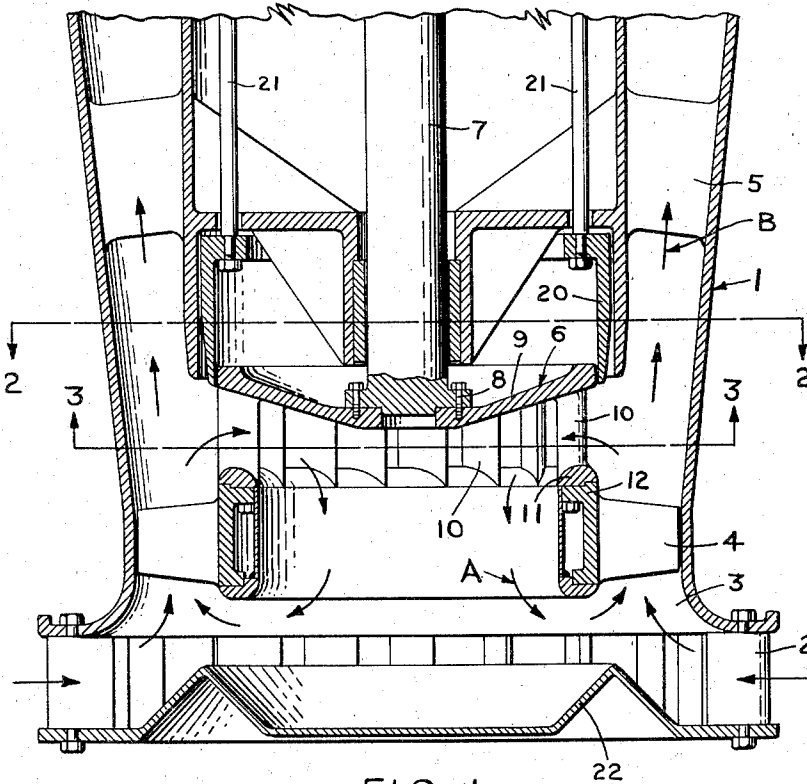


FIG. 1

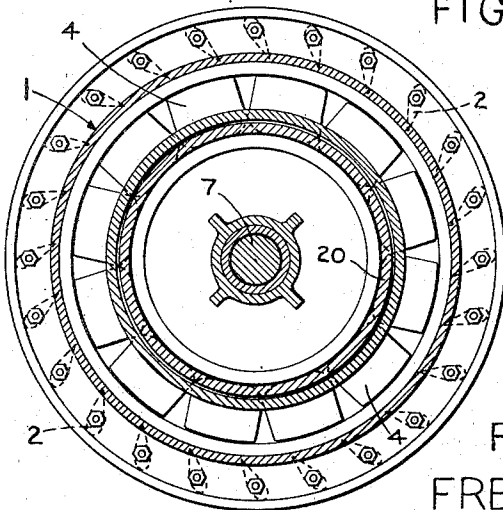


FIG. 2

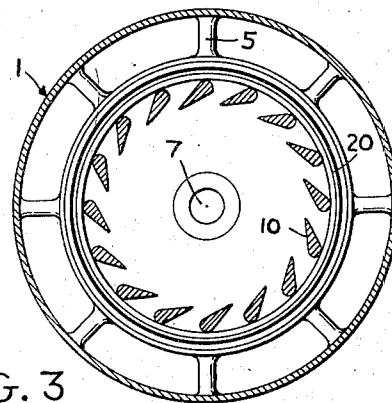


FIG. 3
FREDERICK C. GILMAN
INVENTOR.

BY *Robert M. [Signature]*

1

2,819,675

PROPELLER PUMP OR BLOWER

Frederick C. Gilman, Pompton Lakes, N. J., assignor to Worthington Corporation, Harrison, N. J., a corporation of Delaware

Application August 18, 1953, Serial No. 375,036

5 Claims. (Cl. 103—41)

The present invention relates to propeller pumps or axial flow pumps and more particularly to a method and apparatus to provide controllable circulation for single stage propeller pumps whereby a broad range of high efficiency, a stable head characteristic and low starting power requirements may be provided in such pumps. The present invention relates to such pumps or machines whether employed for pumping liquids, gas, air or other fluids.

Fixed geometry axial flow pumps and blowers of conventional form are either unstable in their head vs. capacity characteristics or they suffer from increased internal fluid friction losses if the blades of the propeller are set at a flat angle to avoid the pressure instability.

The present invention contemplates the use of recirculation through the propeller of the pump to permit the use of highly efficient blading avoiding instability by maintaining sufficient flow over the blades of the propeller even when less than the stable quantity of fluid is being delivered by the pump.

In some installations propeller pumps are required to start against a closed discharge valve. In such cases excessive starting power is required unless low speed starting is provided. Since the driving motor of such pumps is usually more costly than the pump, any abnormal starting power requirements greatly increase the cost of the installation. To overcome this undesirable feature and to provide a broad range of efficient stable operation, adjustable blade propellers are sometimes used on large pumps. Another construction which secures the benefits of the adjustable propeller pump in considerable measure is the use of fixed propeller blades with adjustable inlet guide vanes. While such constructions are in measure satisfactory, they are complicated and expensive to manufacture and to repair.

The present invention contemplates a construction to provide the advantages above set out in a simpler, less expensive construction and it employs fixed blades on both the pump propeller and the casing together with an adjustable gate which controls the quantity circulation of the fluid to provide internal recirculation of the fluid through the pump.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a propeller pump or blower of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a vertical section through an improved axial flow or propeller pump constructed in accordance with the present invention.

Figure 2 is a cross section through the pump taken on the line 2—2 of Figure 1.

Figure 3 is a cross section taken on the line 3—3 of Figure 1.

2

Referring more particularly to the drawings, 1 indicates generically the casing of the propeller or axial flow pump which has an annular inlet 2 at its lower end and an upwardly curving throat 3 leading from the annular inlet 2 to the propeller blades 4. The liquid or fluid pumped is discharged in a substantially axial flow from the propeller blades 4 through the annular outlet passage 5 within the casing.

The propeller structure generically indicated by the numeral 6, is attached to the driving shaft 7 which may be operated by any suitable type of a prime mover (not shown). As shown in Figure 1 of the drawings the driving shaft 7 is connected by suitable bolting 8 to the shell 9 of the propeller structure 6. The shell 9 is substantially in the form of a dished disc which flares outwardly and upwardly from its point of connection with the shaft 7 and it has a plurality of guide vanes 10 rigidly attached thereto and connected at their ends which are remote from the shell disc 9 to an annular ring 11 as clearly shown in Figure 1 of the drawings. The vanes 10 are rigidly or non-adjustably connected to the shell 9 and are of the approved streamline flow construction employed in guide vanes of this type.

A propeller ring 12 is attached to the ring 11 in any suitable manner and it has the propeller blades 4 attached thereto. The propeller blades 4 are of the usual construction of propeller blades for fixed geometry axial flow pumps and blowers, designed, however, to provide a high degree of efficiency in the pumping action of the pump and avoid instability by maintaining sufficient flow over the blades even when less than a stable quantity of fluid is being delivered by the pump. As noted by particular reference to Figure 1 of the drawings the ring 12 and the ring 11 are so constructed that they provide an axial space within the propeller structure which opens out through the guide vanes 10 into the discharge passage 5 of the pump so that during operation of the pump a percentage of the fluid being pumped will flow through the spaces between the guide vanes 10, through the propeller structure back to the inlet side of the blades 4 of the propeller as indicated by the recirculation flow direction arrows A while the remainder of the fluid will follow the normal flow paths of the fluid being pumped as indicated by the arrows B.

For the purpose of regulating the quantity of fluid recirculated through the pump, an adjustable recirculation control gate 20 is provided. The gate 20 is circular in cross-section as clearly shown in Figure 2 of the drawings and has operating rods 21 connected thereto which may be connected to any suitable operating mechanism to provide movement of the gate 20 in a direction parallel with the axis of the driving shaft 7. When the cylindrical recirculation control gate 20 is in the position shown in Figure 1 of the drawings, maximum recirculation of fluid pumped through the impeller of the pump is provided. However, by moving the cylindrical recirculation control gate 20 over the inlet edges of the guide vanes 10 towards the propeller blades 4 the degree or cross-sectional area of the recirculation inlet may be varied for varying the quantity of the fluid being pumped which is recirculated through the propeller.

If it is so desired a deflector 22 which, as shown in Figure 1 of the drawings, is substantially triangular in cross-section, may be placed in the pump casing 1 inwardly of the normal inlet 2 and below the propeller structure 6 for the purpose of guiding and deflecting the incoming fluid being pumped and the recirculated fluid towards the propeller blades 4.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

3

What is claimed is:

1. In an axial flow propeller pump, a casing having inlet and outlet passages, a propeller unit in said casing, means for rotating said propeller unit, said propeller unit including a propeller blade-carrying ring, a plurality of recirculation flow-guiding vanes rigidly connected to said carrying ring rotatable therewith and spaced to provide communication between the interior of the ring and the casing outlet passage and arranged to guide part of the discharge flow of fluid pumped by said propeller blades back through the open carrying ring to the inlet side of the propeller blades, and adjustable means movable to regulate the area of the communicating spaces between said flow-guiding vanes and the outlet passage for controlling the quantity of fluid recirculated through said carrying ring.

2. A propeller pump as claimed in claim 1 wherein the last mentioned means consists of an adjustable cylindrical recirculation flow-control gate, movable with relation to said recirculation flow-guiding vanes to control the quantity of fluid recirculated through said open carrying ring.

3. In an axial flow propeller pump, a casing having inlet and outlet passages, a propeller unit in said casing, means for rotating said propeller unit, said propeller unit including a propeller blade-carrying ring, propeller blades carried by said ring, a plurality of flow-guiding vanes rigidly connected to said ring and located at the discharge side of said propeller blades and establishing vane fluid-flow passages from the outlet passage into the ring, the opening in said ring communicating with

4

said inlet passage, and an adjustable means in said casing movable to vary the flow area of said fluid-flow passages.

4. An axial flow propeller pump as claimed in claim 3 wherein said adjustable means includes a movable gate movable between said flow-guiding vanes and the outlet passage to vary the flow area of said vane fluid-flow passages and regulate the recirculation fluid-flow through the pump.

5. In an axial flow propeller pump, a casing having inlet and outlet passages, a propeller unit in said casing including a shell, a propeller carrying-ring spaced from said shell, propeller blades carried by said ring, a plurality of flow-guiding vanes rigidly connecting said ring and shell and providing recirculation vane flow passages between the casing outlet and inlet through said ring, a control gate adjustably carried by said casing and movable axially of the propeller unit between the inlet edges of said flow-guiding vanes in the outlet passage to control the recirculating fluid-flow through the impeller.

References Cited in the file of this patent

UNITED STATES PATENTS

1,261,457	Stott	Apr. 2, 1918
2,277,868	Meyerhoefer	Mar. 31, 1942
2,379,133	Curtis	June 26, 1945
2,380,606	Moody	July 31, 1945
2,418,801	Baumann	Apr. 18, 1947
2,520,697	Smith	Aug. 29, 1950

FOREIGN PATENTS

900,439	France	June 20, 1945
---------	--------	---------------