April 9, 1957 T. F. KULOW 2,788,171

FAN APPARATUS

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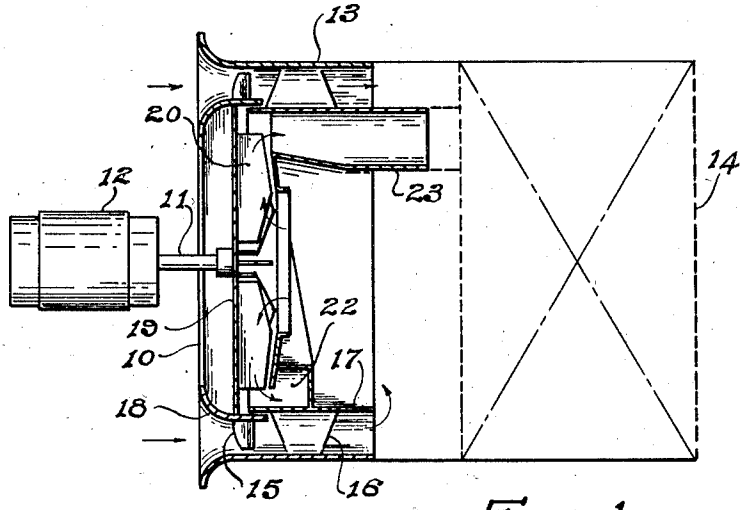


Fig. 1

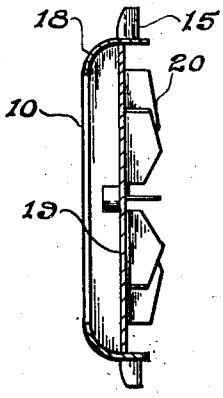


Fig. 2

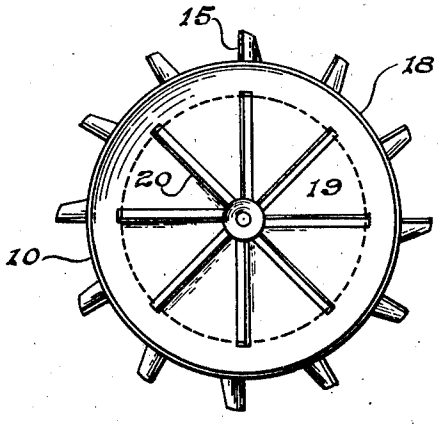


Fig. 3

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FAN APPARATUS

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6 Claims. (Cl. 230—119)

This invention relates to fan apparatus, and more particularly to a fan impeller for delivering an annular stream of a large volume of low pressure air to be heated in an air heater and a stream of high pressure air in relatively low volume for combustion in the air heater.

Much difficulty, added expense and complication of apparatus together with excessive weight and volume of apparatus has been tolerated in obtaining a source of relatively high pressure air for combustion in an air heater and a source of lower pressure air in larger volumes for air to be heated in the air heater. This problem becomes extremely acute in aircraft carried air heaters.

This invention provides an extremely simple, small and light weight solution to the problem of supplying two such streams of air.

For a consideration of what I believe to be novel and my invention, attention is directed to the following portion of the specification and the drawing and claims thereof.

In the drawing:

Fig. 1 is a partially schematic, sectional view of a fan unit according to this invention.

Fig. 2 is a partially sectioned view of the impeller or rotor of Fig. 1.

Fig. 3 is a front view of the impeller of Fig. 3.

Referring to the drawing, a rotor **10** is supported on a shaft **11** and driven by a motor **12**. The rotor is disposed in a casing **13** leading to an air heater generally indicated at **14**. The casing has a flaring mouth at its inlet end which cooperates with a curved portion **18** on the rotor disc **19** to form a converging air inlet to the apparatus. Air is initially propelled by the axial flow portion of the fan which includes impeller blades **15** on the rotor and stator blades **16** on the casing. An inner sleeve **17** is supported by the blades **16** to form with the casing **13** an annular duct for low pressure air from the axial flow part of the fan.

Air leaving the annular duct between sleeve **17** and casing **13** would be at substantially atmospheric pressure if freely discharged into the atmosphere. With a resistance to air flow in the casing **13** downstream of the fan unit, air pressure rises and the impeller blades **15** then are utilized to provide pressure air downstream in the casing **13**. In this case the downstream resistance to air flow from the annular duct is the air heater **14**. Due to the resistance to flow formed by the air heater **14**, some of this "low pressure air" doubles back around the sleeve **17** to the axis of the fan and is moved by radial vanes **20** on the disc **19** to an annular plenum **22** formed by an extension of the sleeve **17**, from which it is conducted by a pipe **23**.

In a practical example of this fan unit, a rotor having an overall diameter of about fifteen inches and a radial vane tip diameter of about nine and one half inches and driven at about 3,450 R. P. M. delivered about 1,100 C. F. M. of low pressure air at about 3½ inches of water pressure, together with about 170 C. F. M. of high pressure air at about six inches of water pressure. This combination

was ideally suited to furnish relatively high pressure air for combustion in a lesser volume and lower pressure air to be heated in greater volume.

This fan unit is particularly useful where, as is generally the case, the burner unit is disposed centrally and the air to be heated is ducted about a combustion tube or heat exchanger. Variations of the pressures and volumes of low and high pressure air flow may be obtained by varying the dimensions and the speed of the impeller unit in conventional ways.

I claim:

1. An impeller for fan apparatus which comprises a solid, impervious disc adapted for rotation about an axis normal thereto; a peripheral sleeve mounted on the disc concentric with the axis; a series of radial flow vanes mounted on the disc for impelling air movement; and a series of axial flow vanes mounted on the sleeve for impelling air movement.

2. Fan apparatus comprising wall means forming a circular duct; stator vanes for flowing air, disposed within the duct; a sleeve supported by the stator vanes in the duct concentrically in the duct to form an annular passage between the sleeve and the wall means; second wall means supported on the sleeve forming an annular plenum within the sleeve; pipe means forming a conduit from the annular plenum; and a rotor disposed centrally within the first mentioned wall means and comprising axial flow vanes for moving air into the annular passage, and radial flow vanes for receiving a stream of air from the annular passage and delivering the same into said annular plenum.

3. Apparatus according to claim 2 wherein said annular passage is in open communication at its outlet with the axial ends of the radial flow vanes whereby air at the inlet to the radial flow vanes is at the pressure leaving the axial flow vanes.

4. Housing apparatus for a fan comprising, in combination: a duct forming an inlet and an outlet for air; a sleeve supported concentrically within the duct; stator vanes positioned between said duct and sleeve for directing flow of air from said inlet and between said duct and sleeve toward the outlet; a circular wall on said sleeve forming therewith an annular plenum within the sleeve open toward said inlet and having a central opening open to inflow of air; and pipe means connected to the plenum for delivery of air therefrom.

5. Apparatus according to claim 4 wherein said outlet is in open communication with said central opening whereby air from said outlet may flow into said central opening.

6. Fan apparatus comprising wall means forming a circular duct; a sleeve supported concentrically within the duct to form an annular passage between the sleeve and the wall means; second wall means supported on the sleeve forming an annular plenum within the sleeve; pipe means forming a conduit from the annular plenum; and a rotor disposed centrally within the first mentioned wall means and comprising axial flow vanes for moving air into the annular passage, and radial flow vanes for receiving a stream of air from the annular passage and delivering the same into said annular plenum.

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