Aug. 2, 1932. J. M. LE GRAND 1,869,855

ROTARY HEAT EXCHANGER

Filed Nov. 15, 1930

Fig. 1.

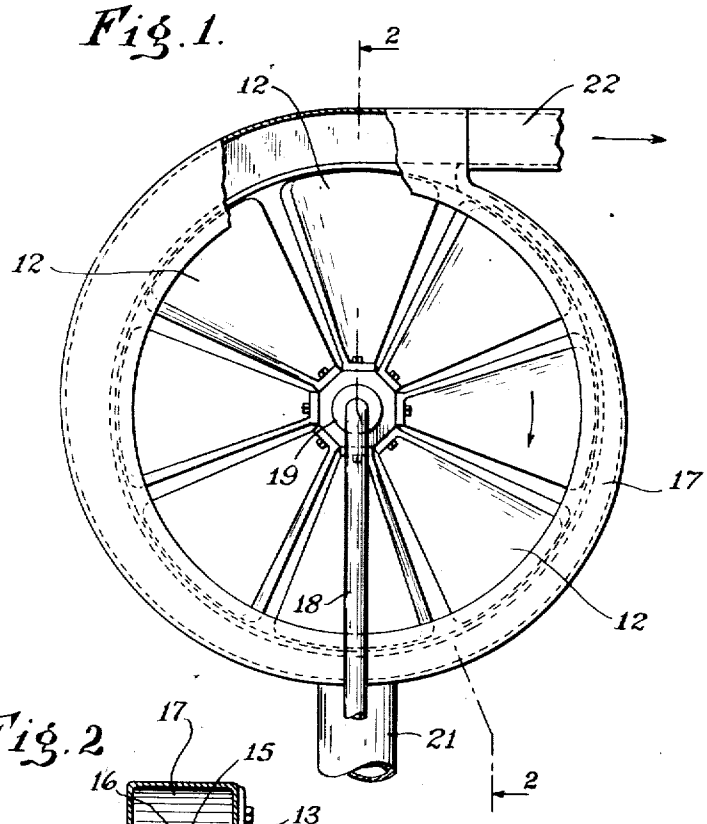
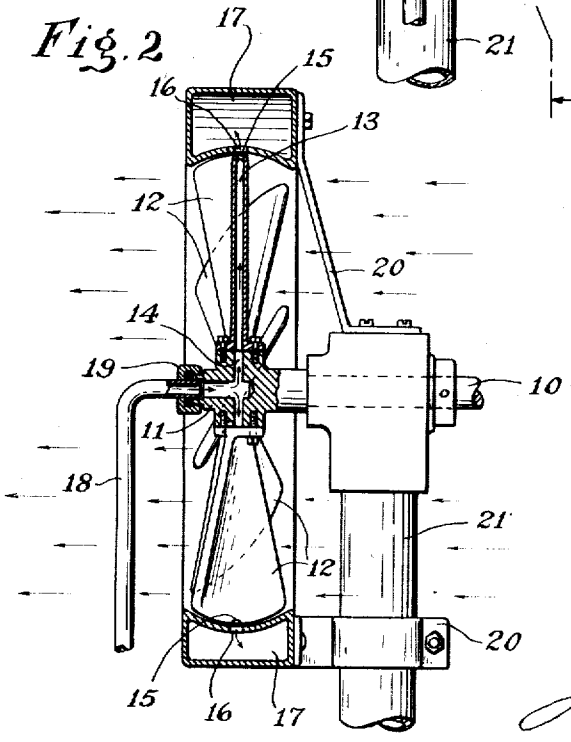


Fig. 2.



INVENTOR
Joseph M. LeGrand
BY
Joseph F. Schofield
ATTORNEY

Patented Aug. 2, 1932 1,869,855

UNITED STATES PATENT OFFICE

JOSEPH M. LE GRAND, OF NEW YORK, N. Y., ASSIGNOR TO CARRIER ENGINEERING CORPORATION, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW YORK

ROTARY HEAT EXCHANGER

Application filed November 15, 1930. Serial No. 495,907.

This invention relates to a rotary fan or impeller and particularly to a fan of this type adapted for use as a heat exchanger.

An object of the present invention is to provide a simple, compact, self-contained and effective unit for effecting transfer of heat to either heat or cool air within a relatively large space.

A further object of the invention is that the same member is used to heat or cool the air and also as a circulating means therefor.

A feature of importance of the present invention is that the fan includes hollow blades into which heated or cooled medium may be admitted and exhausted so that by rotation of the fan the air drawn past this fan by the action of its blades will have its temperature affected by intimate contact with the surfaces of the blades.

Another object of importance of the invention is that gases such as the products of combustion of a gas or oil burner, ammonia, sulphur dioxide, may be employed as the medium within the blades equally well as steam or other odorless and harmless vapors and gases for the reason that this medium is maintained entirely separate from the air being cooled or heated, and is held confined within the fan until it is exhausted from its volute.

And finally it is an object to provide a heat exchanger in the form of a fan having the air being effected by the device forced axially through the rotary fan simultaneously with radial movement of the heat exchanging medium within the blades of the fan induced by centrifugal action due to the rotative speed of the circulating fan.

With the above and other objects in view, my invention includes the features of construction and operation set forth in the following specification and illustrated in the accompanying drawing.

In the accompanying drawing annexed hereto and forming a part of this specification, I have shown my invention embodied in a rotary fan having hollow blades detachably mounted upon a central hub portion, but it will be understood that the invention can be otherwise embodied and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawing:

Figure 1 is a front elevation of a complete fan made in accordance with the present invention, and

Fig. 2 is a side elevation in section showing the construction of the blades.

In the above mentioned drawing I have shown but one embodiment of the invention which is now deemed preferable but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

In the use of heat exchangers either to warm or cool a large space such as the complete floor or other part of a building, it is desirable to obtain effective circulation of air within the space being treated and provide means to pass this air over heated or cooled surfaces in intimate contact therewith. The present invention, therefore, relates particularly to a means for effecting a rapid heat exchange by and within a compact and simple mechanism comprising a blower fan enabling a large mass of air within the space to be heated or cooled by being brought intimately into contact with the surfaces affected by the heat exchanging medium, the force used to effect circulation of the air within the space being treated effecting intimate contact of the air against the heat exchanging surfaces.

Referring more in detail to the figures of the drawing, I show a rotary impeller fan having a central shaft 10 and hub portion 11 which may be rotated by any suitable means (not shown) at a relatively high velocity. Upon this shaft 10 and hub 11 are mounted radially disposed air circulating blades 12 set at an oblique angle as indicated by standard practice in the manufacture of fans of this type. These blades 12 are hollow and have the open space 13 within them directly associated with openings 14 within the hub member or portion 11. At the peripheral edges of these blades 12 may be provided one or more openings 15 closely adjacent a suitable an-

nular series of openings 16 within the inner wall of a volute 17 closely surrounding the peripheries of the blades 12.

Associated with the hub portion 11 of the fan is a tube or conduit 18 of suitable diameter through which may be admitted heated or cooled gases. A slip connection or freely rotatable joint 19 is interposed between this tube member 18 and the hub portion 11 so that the fan will be entirely free to rotate allowing the gases to pass into spaces within its hub portion 11. After entering the hub portion 11 of a blade 12 the gases or vapors are forced radially outward by centrifugal action due to the rotative speed of the fan.

The volute 17 forming the exhausting means for the fan is shown as being mounted upon and supported by bracket members 20 upon the same support or column 21 providing the bearing for the rotating shaft 10 of the fan structure. This volute 17 is adapted also to be directly attached to an exhaust conduit 22 shown fragmentarily in Fig. 1 permitting withdrawal of the gases passing through the fan blades 12 from the space being treated or conditioned.

In operation of the fan, which is designed in the embodiment shown primarly for and particularly adapted as a space heater, heated products of combustion of a gas or oil burner or other heated gas or vapor are admitted through the tubular member 18 past the rotatable joint 19 to the central or axial portion 11 forming the hub of the fan. From this point at the hub 11 of the fan these gases or vapors are thrown radially outward through the open spaces 13 within the interior of the blades 12 by means of centrifugal force due to the rotative speed of the blades 12 which forces the gases from the openings 15 within peripheries of the blades 12 into the annular space within the volute 17 closely surrounding the fan blades 12. It is to be understood, of course, that in place of heated products of combustion of an oil or gas burner, steam or other heated gas or air may be employed. Similarly, chilled air or other gases may be admitted as indicated above. The joint 19 between the intake member 18 and the hub 11 of the fan prevents the gases entering the fan from mingling with the air being conditioned by the fan. The volute 17 serves to collect these gases as they emerge from the periphery of the blades and prevents them from mingling with the air forced through the fan and heated or cooled by contact with the outside surfaces of the blades 12. The construction of the blades 12 is generally similar to that in fans the blades having their outside surfaces to efficiently force air in stream lines past the fan, the blades being made of metal having high heat conducting properlines past the fan, the blades being made of surfaces of the blades is rendered intimate by the pressure exerted upon the air in moving it past the fan to effect circulation of the air within the space being conditioned.

It is obvious that the heating or conditioning medium sent through the blades may be recirculated and returned from the volute to the member 18. If desired, heating or conditioning meanes may suitably be arranged to modify the temperature of the returned conditioning medium, in accordance with the requirements of the area to be heated or conditioned, before the medium again enters the blades.

What I claim is:

1. A heat exchanger comprising in combination, a support, a rotary fan mounted thereon having openings within its blades, means to pass gases through the openings within said blades during rotation, means to collect the gases after having past through said blades closely adjacent their peripheries, said last means comprising a volute having openings within its interior wall.

2. A heat exchanger comprising in combination, a support, a rotary fan mounted thereon having openings within its blades, means to pass gases through said blades, and a volute surrounding said fan closely adjacent the ends of said blades having openings within its interior wall, whereby gases from said blades may be collected and withdrawn.

3. A conditioning unit comprising a fan having hollow blades, a hollow shaft mounting said fan, means for circulating a conditioning medium through said shaft and blades and a volute surrounding the fan closely adjacent the ends of the blades for withdrawing said medium from the blades.

4. A unit of the character described, having a fan, hollow blades on the fan, means for supplying a conditioning medium to said blades and a volute surrounding the fan having openings for receiving said medium from the blades.

5. In a device of the character described, a fan including at least one blade provided with a passage leading from the fan hub outwardly to a point of discharge, means within the hub for supplying conditioning medium to said passage, and vented means including a volute in position to receive the medium discharged from said passage.

6. In a device of the character described, a hollow shaft having radial outlet ports, a fan on the shaft having hollow blades and a hub, the hub having inlet ports communicating with the ports of the shaft, the hollow blade having discharge ports in the end portions of the blades, a vented scroll surrounding the periphery of the fan blade path and having an inlet slot in the path of the fan blade discharge ports, the scroll walls on each side of the inlet slot converging outwardly with respect to the fan.

7. In a device of the character described, a fan having at least one hollow blade with

an inlet and a discharge, a scroll surrounding said fan having an inlet slot in the path of said discharge and means located to receive the discharged medium and to return it to the inlet.

8. A conditioning unit comprising a fan having hollow blades, a shaft mounting said fan, means for circulating a conditioning medium through said shaft and blades, a scroll surrounding the periphery of the fan blade path having an inlet slot for withdrawing said medium from the blades, the scroll walls on each side of the inlet slot converging outwardly with respect to the fan.

In testimony whereof, I hereto affix my signature.

JOSEPH M. LE GRAND.

CERTIFICATE OF CORRECTION.

Patent No. 1,869,855. August 2, 1932.

JOSEPH M. LE GRAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 63, strike out the words "lines past the fan, the blades being made of" and insert instead the syllable and words "ties. The contact of the air against the lateral"; and line 72, for the misspelled word "meanes" read "means"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

an inlet and a discharge, a scroll surrounding said fan having an inlet slot in the path of said discharge and means located to receive the discharged medium and to return it to the inlet.

8. A conditioning unit comprising a fan having hollow blades, a shaft mounting said fan, means for circulating a conditioning medium through said shaft and blades, a scroll surrounding the periphery of the fan blade path having an inlet slot for withdrawing said medium from the blades, the scroll walls on each side of the inlet slot converging outwardly with respect to the fan.

In testimony whereof, I hereto affix my signature.

JOSEPH M. LE GRAND.

CERTIFICATE OF CORRECTION.

Patent No. 1,869,855. August 2, 1932.

JOSEPH M. LE GRAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 63, strike out the words "lines past the fan, the blades being made of" and insert instead the syllable and words "ties. The contact of the air against the lateral"; and line 72, for the misspelled word "meanes" read "means"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.