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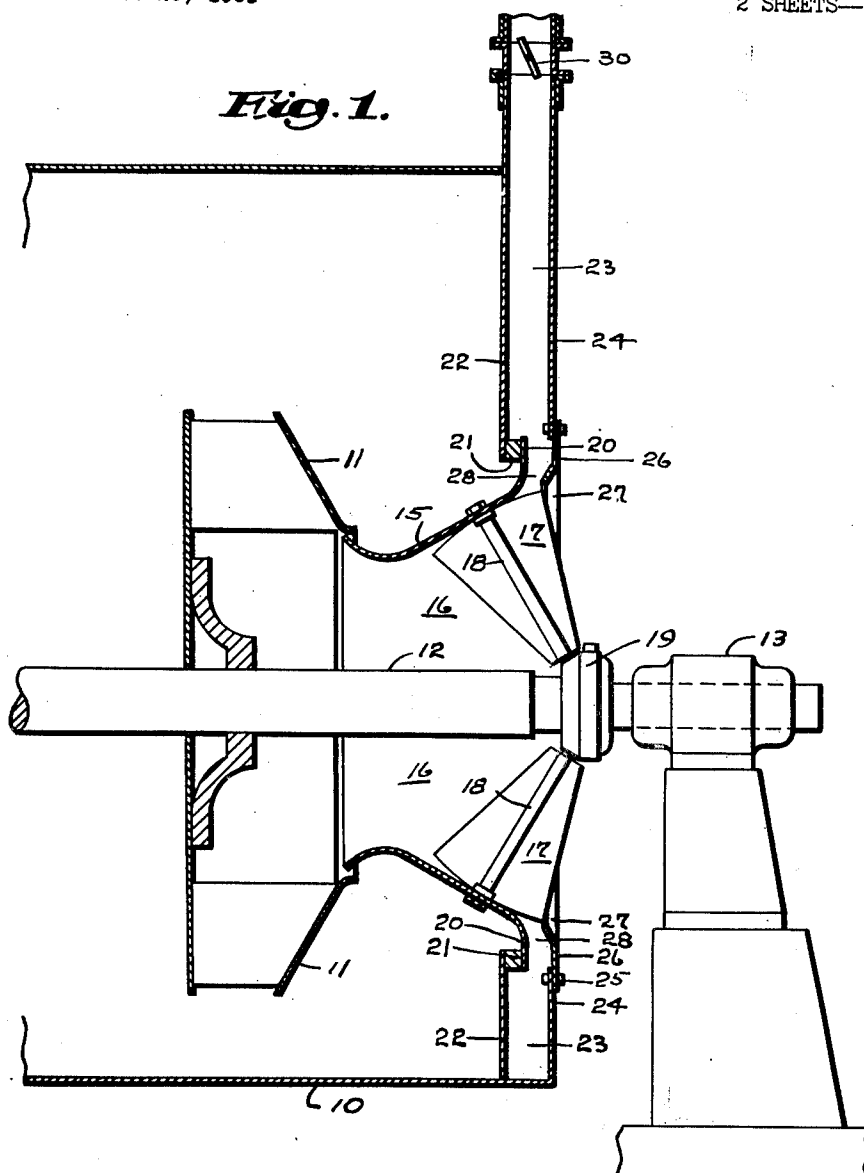
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FAN

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2 SHEETS—SHEET 1



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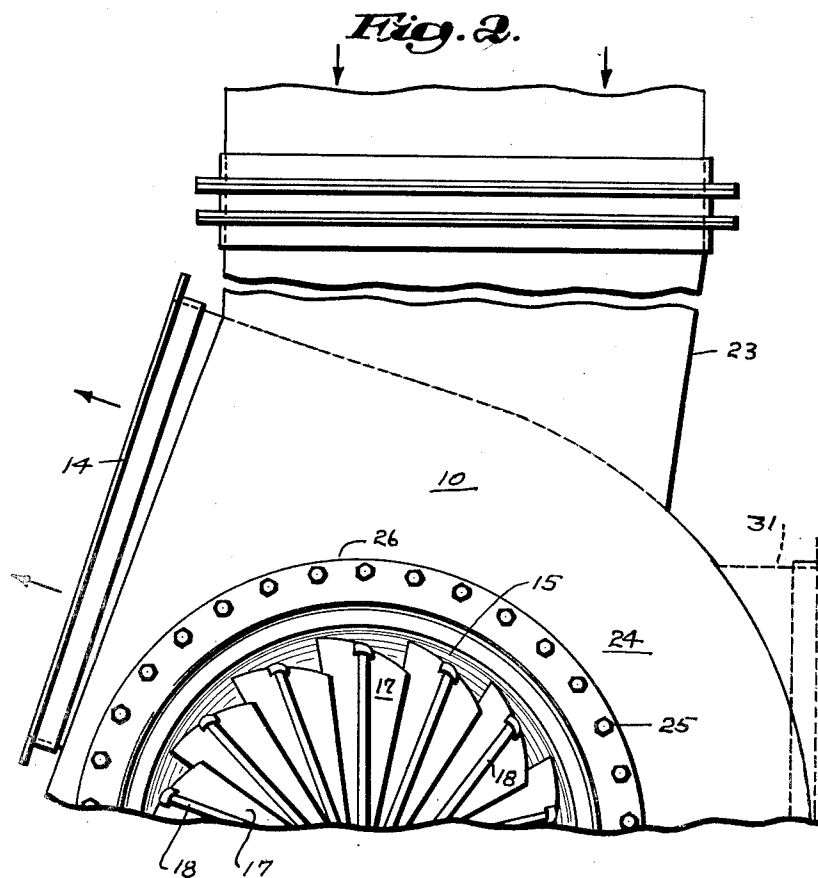
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2 SHEETS—SHEET 2



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1

This invention relates to fans having axial inlets, and relates more particularly to duct connections at the axial inlets of such fans for admitting secondary air thereinto without adversely affecting the flow of primary air.

For maximum performance, the axial inlet of a fan should be nicely stream-lined with no obstructions to flow extending thereinto. However, for some duties, it is necessary to supply secondary air into such an inlet through a supply duct. In the past such supply ducts, when not used for supplying secondary air, have extended into the fan inlets, and have interfered with the flow of primary air. An example of such a duty is the supply of air through an air heater into the combustion chamber of a steam power plant. The air supplied by a fan is drawn from an apparatus room in which the fan is located, and blown through the interiors of heat-exchange tubes, over the exteriors of which, the flue gases of the plant pass. At low plant loads, the temperature of the inlet header sheet of the air heater may fall below the dew point temperature of the corrosive vapors in the flue gases, resulting in the condensation of such vapors on the inlet sheet with resulting corrosion. Accordingly, it is the practice at low plant loads to recirculate heated air from the outlet of the air heater into the inlet of the fan for maintaining a large volume of heated air through the heater. In the past, recirculation ducts have extended into the inlets of the fans, and have interfered with the flow of primary air thereinto at high plant loads when no recirculation was required. The Geissler et al. Patent No. 2,476,543 discloses one effective way of supplying secondary air into the inlet of a fan without affecting the performance of the fan when the supply of secondary air is discontinued, but requires a special form of duct for accomplishing this, such a duct usually having to be fabricated and installed after installation of a fan.

This invention provides duct connections for supplying secondary air or other gases, into the axial inlet of a fan, which are made an integral part of the fan at the time it is fabricated, requiring only the connection of an ordinary secondary air duct to the fan when the fan is installed. This invention is particularly suited for use with centrifugal fans having spin vanes such as are disclosed in the H. F. Hagen Patent No. 1,989,413, and a feature of this invention is that the secondary air as well as the primary air is acted upon by the spin vanes.

An object of this invention is to provide at the axial inlet of a fan of the forced draft type, duct

2

connections for secondary air which do not interfere with the flow of primary air into the fan inlet.

The invention will now be described with reference to the drawings, of which:

Fig. 1 is a partial side elevation, in section, of a forced draft fan embodying this invention, and Fig. 2 is a partial end elevation of the fan.

The fan illustrated is a double inlet centrifugal fan of the forced draft type, having the usual scroll housing 10 around the fan wheel 11 which is mounted on the rotary shaft 12 supported in end bearings 13, only one of which is illustrated. The fan has the centrally located outlet 14. For convenience of illustration only one of the fan wheels which would be used, is shown.

The fan has the inlet shroud 15 forming an inlet passage 16 which converges towards the wheel 11. The spin vanes 17 are provided in this passage pivoted on the pivot rods 18 which are rotatably supported at their inner ends by the shroud 15, and at their outer ends by the housing 19 around the shaft 12, and which contains vane rotating mechanism as disclosed in the E. L. Richardson Patent No. 2,100,489.

The fan construction described so far with reference to the drawings, is conventional. This invention adds to such a fan the construction which will now be described, for providing a secondary air passage into the fan inlet.

A conventional fan would have a side plate forming an upper and lower extension of the outer vertical portion 20 of the fan illustrated by the drawings. According to this invention, however, the outer ends of the shroud terminate at, and are attached to, a ring 21 concentric with the shaft 12, and the lower end of the inner wall 22 of the secondary air duct 23 terminates at, and is attached to, the ring 21 opposite the shroud portion 20.

The side plate 24 of the fan is spaced from the inner duct wall 22 and forms the outer wall of the secondary air passage or duct 23.

An inner plate 26 extends around the inlet passage 27 to the spin vanes 17, and is secured by the bolts 25 to the side plate 24.

The secondary air duct 23 discharges into the inlet passage 16 through a converging passage 28 having a much smaller cross-sectional area than that of the duct 23, the reduction in area being provided by locating the vertically extending portion 20 of the inlet shroud between the inner and outer walls of the duct 23, and by curving the inner portion of the annular inlet plate 26 towards the shroud portion 20.

The duct 23 extends circumferentially around

3

the fan inlet, and discharges into the inlet passage through the constricted passage 28. This causes a static pressure to be built up in the duct 23 resulting in uniform flow of secondary air at all points around the fan inlet passage, and preventing short-circuit flow into the inlet passage at points above the inlet passage, and starved flow into the lower portion of the inlet passage.

The constricted passage 28 is located to discharge through the space occupied by the spin vanes 17 whereby the secondary air as well as the primary air is acted upon by the spin vanes when volume reduction is desired.

Since the heated, secondary air passes over all of the spin vanes, their thermal expansion is uniform. In prior constructions where secondary air ducts protruded into the inlets of fans having spin vanes, only those few vanes at the outlets of the secondary air ducts were heated, resulting in uneven expansion and binding.

Utilizing this invention, the secondary air is mixed with the primary air uniformly around the fan inlet passage without stratification.

The damper 30 in the upper portion of the duct 23 can be used for separately varying the volume of secondary air, or for closing the duct 23 when recirculation is not desired.

In operation, with the damper 30 closed, the fan operates as a conventional forced draft fan without a recirculated air connection since the secondary air duct does not protrude into the inlet passage and affect the flow of primary air. With the damper open, the secondary air stream merges smoothly into the primary air stream, both streams being acted upon by the spin vanes when they are adjusted towards closed positions.

The secondary air duct 31 indicated by the dashed lines at the right of Fig. 2 of the drawings, illustrates an optional location for the secondary air duct.

The invention is not limited to the exact apparatus and arrangement of apparatus illustrated since modifications may be suggested by those skilled in the art, without departure from the essence of the invention.

What I claim as my invention, is:

1. In a fan having a fan wheel and an inlet shroud forming a converging axial inlet passage for primary air into the wheel, and spin vanes pivoted in said passage on axes oblique to the axis of the wheel, the combination of means forming a secondary air passage extending circumferentially around said inlet passage, and means forming a circumferentially extending constricted outlet from said secondary passage into said converging passage, said vanes having outer portions extending across said constricted outlet.

2. In a fan having a fan wheel and an inlet shroud forming a converging axial inlet passage into said wheel for primary air, said shroud having outer ends extending substantially perpendicular to the axis of said wheel, the combination of means forming a secondary air passage ex-

4

tending circumferentially around said converging passage, said means including an inner wall attached to said outer ends of said shroud and extending substantially perpendicular to said axis, and including an outer wall spaced from said inner wall and extending substantially parallel thereto, and means forming a circumferentially extending constricted outlet from said secondary passage into said converging passage.

3. The invention claimed in claim 2 in which spin vanes are pivoted in the converging passage, and have outer portions which extend across the constricted outlet.

4. The invention claimed in claim 3 in which the last mentioned means includes an annular plate having an outer portion secured to said outer wall, and having an inner portion curved inwardly towards said shroud.

5. The invention claimed in claim 2 in which the last mentioned means includes an annular plate having an outer portion secured to said outer wall, and having an inner portion curved inwardly towards said shroud.

6. In a fan having a fan wheel, and a shroud forming an axial inlet passage into said wheel for primary air, said shroud having an outwardly turned outer portion extending substantially perpendicular to the axis of said wheel, the combination of means forming a secondary air passage extending around the outer portion of said inlet passage, said means including an inner wall attached to said outer portion of said shroud, and including an outer wall spaced from said inner wall, said outer wall having a circular opening centrally around said axis, and means forming a circumferentially extending constricted outlet from said secondary passage into said inlet passage, said last mentioned means including an annular plate secured to said outer wall around said opening, said plate having an inner portion curved inwardly towards said shroud.

7. The invention claimed in claim 6 in which spin vanes are pivoted in said inlet passage and have outer portions extending across said outlet.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,467,306	Carrier	Sept. 11, 1923
1,575,447	Moore	Mar. 2, 1926
1,787,655	Anderson	Jan. 6, 1931
1,989,413	Hagen	Jan. 29, 1935
2,100,439	Richardson	Nov. 30, 1937
2,274,033	Booth	Feb. 24, 1942
2,287,822	Odor et al.	June 30, 1942
2,476,543	Geissler et al.	July 19, 1949

FOREIGN PATENTS

Number	Country	Date
337,798	Italy	Mar. 13, 1936
643,846	Germany	Apr. 19, 1937