

[54] ONE PIECE RADIAL VANE DIFFUSER AND METHOD OF MANUFACTURING THE SAME

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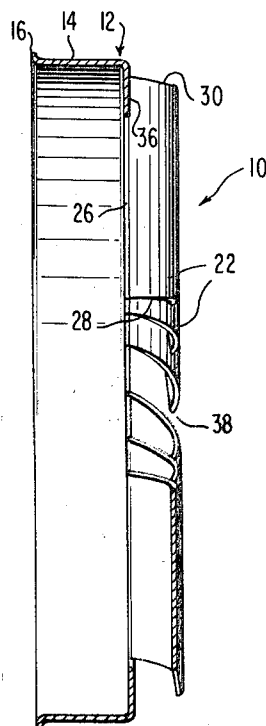
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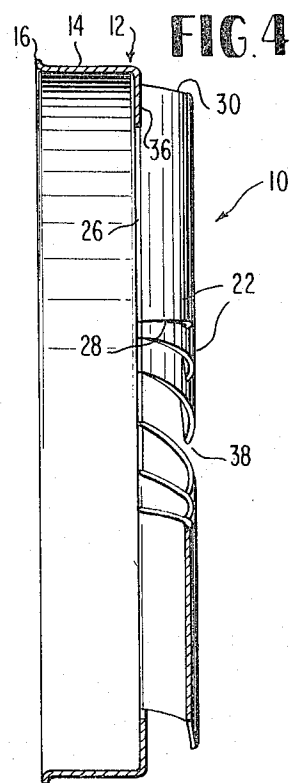
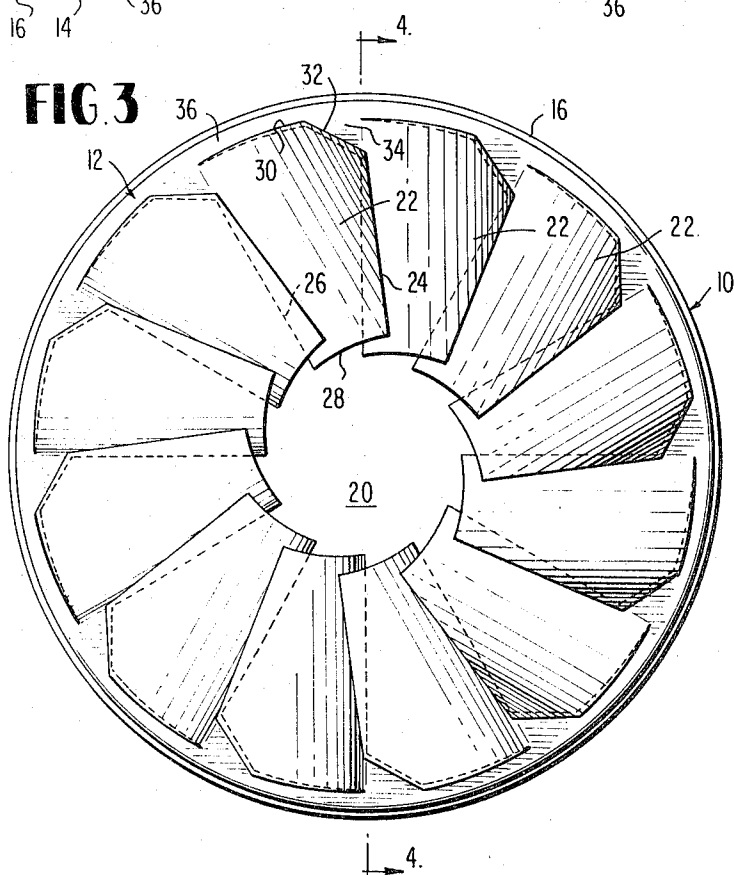
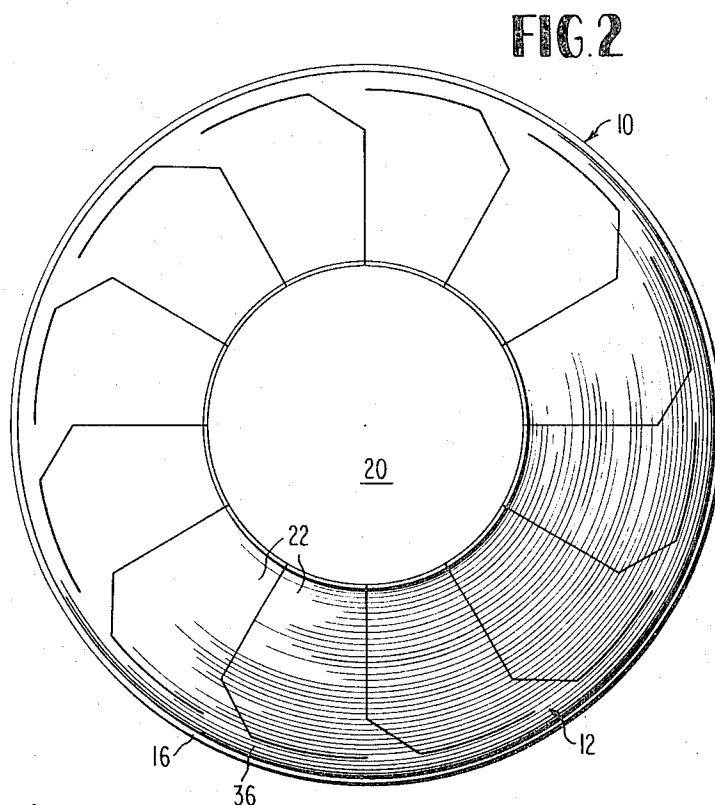
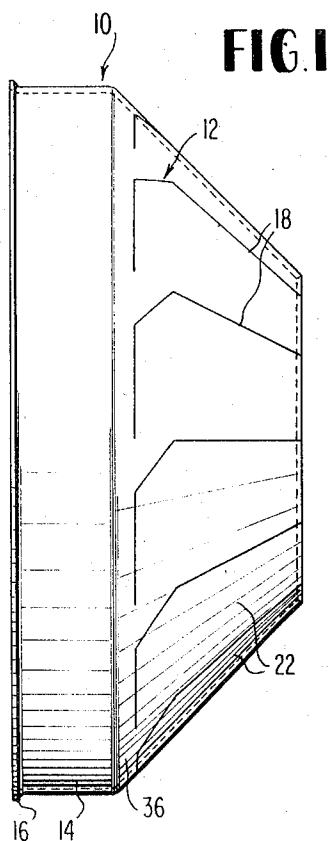
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[57] ABSTRACT

A one piece radial vane diffuser constitutes an annular array of curved, radially directed vanes, surrounding the combustion area of a fuel oil burner, downstream of the nozzle, and at the downstream end of a cylinder defining a primary air flow path concentric with the nozzle. A circular sheet metal sheet is first drawn into a cone, the vanes are lanced from the cone to form a circumferential array of integral, radially directed, side by side, generally rectangular vanes linked to an annular rim at their radial outermost ends by an integral hinge. The cone is then flattened, at least in the area of the vanes, to cause the vanes to move into edge overlapping position and preferably the vanes are bent or twisted about a radial axis passing through the hinge to provide air passages between vanes of predetermined size. The vanes may be curved relative to their radial axes to effect swirling of the primary air flow.

10 Claims, 4 Drawing Figures





ONE PIECE RADIAL VANE DIFFUSER AND METHOD OF MANUFACTURING THE SAME

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to fuel oil burners, and more particularly, to a one piece radial vane diffuser and its method of manufacture, for the oil burner. Conventionally, the primary combustion air for a fuel oil burner is caused to pass through a cylindrical passage concentric with the fuel burner nozzle and controlled at the downstream of the nozzle by a plurality of radial vanes disposed in a circular array across the primary air path.

SUMMARY OF THE INVENTION

The present invention is directed to forming such a radial vane diffuser from a single circular plate of sheet metal. A circular, flat sheet metal plate is first drawn into a cone, and the cone is then lanced to form an annular outer rim and a plurality of integral, circumferentially spaced, radially directed and generally rectangular vanes joined to the rim only at their radially outermost ends by an integral hinge. The lanced cone, at least in the area of the vanes, is flattened to cause the vanes to move into edge overlapping position. Preferably the vanes are bent at their hinges about a radial axis passing through the vanes to form air passages of predetermined size and configuration between vanes to control the primary air flow. Preferably, a portion of the rim adjacent the hinges is also flattened with the vanes, while the outermost peripheral portion of the rim is maintained at right angles thereto, to assist mounting of the rim within the cylinder defining the secondary air flow path. Further, the vanes may be curved about their radial pivot axes to cause the primary air flow passing therethrough to spiral at the exit end of the one piece diffuser.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a circular, flat sheet of metal forming the one piece radial vane diffuser subsequent to having at least its center drawn into conical form and lanced to form the individual vanes prior to flattening of the conical portion of the plate.

FIG. 2 is a right hand, end elevational view of the drawn sheet from the right side of FIG. 1.

FIG. 3 is a similar, end view of the one piece diffuser formed from the sheet of FIGS. 1 and 2, after flattening of the conical portion, twisting of the vanes about their integral hinges and curving of the individual vanes about a radial vane axis.

FIG. 4 is a vertical sectional view of the diffuser of FIG. 3 taken about line 4-4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The one piece radial vane diffuser 10 of the present invention as applied to a liquid fuel burner (not shown) is formed preferably from a circular sheet of flat, thin metal stock and, as illustrated in FIGS. 1 and 2, has at least a center portion 12 drawn into conical shape. In the illustrated embodiment, that portion 12 is integrally joined to an annular rim 14 which terminates at its periphery in a radially outwardly turned edge 16. Further, subsequent to drawing at least portion 12 of the sheet into conical shape, the sheet metal plate is lanced irreg-

ularly, that is, severed along severance lines 18 which define a large central opening 20, FIG. 2, to form a plurality of radial vanes 22 defined by side edges 24 and 26, a radially inner edge 28 and a radially outer edge 30, the radially outer edge 30 being joined to side edge 26 by a tapered edge portion 32 which acts in conjunction with the severance lines 18 to form integral hinges 34. Hinges 34 join the vanes 22 to rim portion 14, initially through a remnant annular portion 36 of the cone portion 12 of the diffuser sheet 10. Because the effect of drawing the flat circular sheet forming diffuser 10, into at least a partial cone, increases the surface area, subsequent to the lancing of the conical area to define the vanes 22, the flattening of at least the vanes of cone portion 12 causes the individual vanes to overlap. Thus, as seen in FIG. 4, edge 26 of each of the vanes overlaps edge 24 of the next succeeding vane in a clockwise direction. Simultaneous with flattening of the conical section 12, the individual vanes are preferably twisted or bent about their hinges 34 to define flow passage 30 between the individual vanes, and further, the individual vanes 26 are preferably curved about a radial axis. In twisting or bending the individual vanes 22 about a radial axis, relative to each vane, it is preferred that the bend or twist take place about a line passing along edge 24 of each vane which intersects end portion 32.

Preferably, as seen in FIG. 4, the finished one piece radial vane diffuser consists of a narrow circular rim which may be of a diameter on the order of the cylindrical member (and not shown) defining the primary air path which acts to support the one piece radial vane diffuser 10 therewithin. The formerly conical portion 12 of the diffuser is flattened such that the annular portion 36 of the diffuser 10 is at right angles to mounting rim 14 and it is from this portion 36 that the curved radial vanes 22 emanate. The effect of the curved vanes and their spacing is to insure movement of the primary air flow into a spiral or helical path downstream of the diffuser 10 to effect greater mixing with the fuel oil from the nozzle and to promote excellent combustion of the fuel and air mixture downstream of diffuser 10, that is, in a direction to the left of the diffuser 10 in FIG. 4.

The diffuser may be formed of any sheet metal capable of withstanding the high temperature effects of combustion downstream of the nozzle but must be of a metal permitting: the drawing of the cone from the flat sheet, the subsequent lancing to form the individual vanes 22 forming an outer circular array, the bending or twisting of the individual vanes about the integral hinges 34 and the curving of the vanes 22 about a radial axis passing therethrough by the method of manufacture of the present invention.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A one piece radial vane diffuser comprising: a circular metal sheet including an annular rim, a plurality of circumferentially spaced radial vanes partially struck from said sheet and being joined to said rim at their radially outermost ends by hinges integral with said rim, said vanes being of a width so as to overlap at their side

edges, and said vanes being similarly twisted at said hinges, about a radial axis extending through said hinges to form air passages therebetween.

2. The radial vane diffuser as claimed in claim 1, wherein said vanes comprise sectors of said sheet and are severed therefrom except along one side edge of said vanes at their radial outer ends, with said vanes being twisted about a radial axis which coincides with said one side edge of said vanes.

3. The radial vane diffuser as claimed in claim 1, wherein the radially outer ends of said other side edge of each vane are tapered toward said one side edge thereof to form said hinge.

4. The radial vane diffuser as claimed in claim 2, wherein the radially outer ends of said other side edge of each vane are tapered toward said one side edge thereof to form said hinge.

5. A method of manufacturing a one piece radial vane diffuser comprising the steps of:

forming at least an interior portion of a circular flat sheet of metal into a cone,

lancing the cone to form an annular outer rim and a circumferential array of integral, radially directed, generally rectangular vanes joined to said rim only at their radially outermost ends, and

flattening at least that portion of said cone forming said vanes to cause said vanes to move into edge overlapping position.

6. The method of manufacturing a one piece radial vane diffuser as claimed in claim 5, further comprising twisting said vanes about a radial axis passing through the vanes to form air passages between vanes.

7. The method of manufacturing a one piece radial vane diffuser as claimed in claim 5, further comprising curving each vane about a radial axis thereof to cause swirl of the air flow passing through the air passages be-

tween vanes.

8. The method of manufacturing a one piece radial vane diffuser as claimed in claim 6, further comprising curving each vane about a radial axis thereof to cause swirl of the air flow passing through the air passages between vanes.

9. The method of manufacturing a one piece radial vane diffuser as claimed in claim 5, wherein the radially inner portion of said rim coupled to said vanes, is flattened along with said vanes at right angles to the radially outer peripheral portion of said sheet to define a circular, axially directed rim portion generally at right angles to the vanes and said inner rim portion.

10. A method of manufacturing a one piece radial vane diffuser from a unitary sheet metal plate comprising the steps of:

drawing said flat metal plate into conical form with a cylindrical rim portion at its outer periphery,

lancing the conical portion to form an unsevered intermediate annular portion and a circumferentially array of integral, radially directed generally rectangular vanes joined to said intermediate annular portion only at their radially outermost ends by an integral hinge portion, and

flattening the portion of said cone including said vanes and said intermediate annular portion to form an annular portion at right angles to said cylindrical rim and a plurality of circumferentially spaced edge overlapping vanes and curving said vanes about radial axes passing through the vanes to form axial air passages therebetween of predetermined size and configuration,

whereby, the air swirls as it exits the air passages between the vanes and enters the axial passage determined by said cylindrical rim.

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