

May 16, 1961

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2,984,407

DRAFT INDUCING FAN

Filed Dec. 15, 1958

2 Sheets-Sheet 1

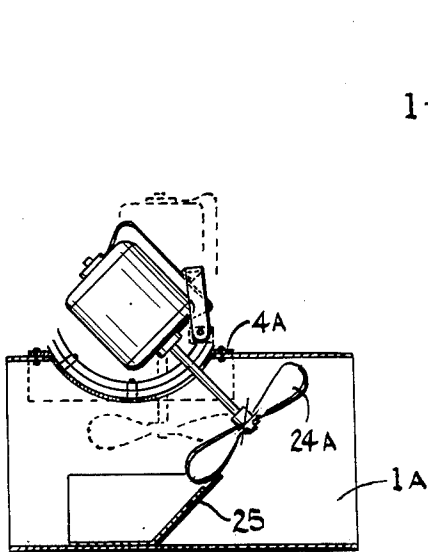


Fig. III

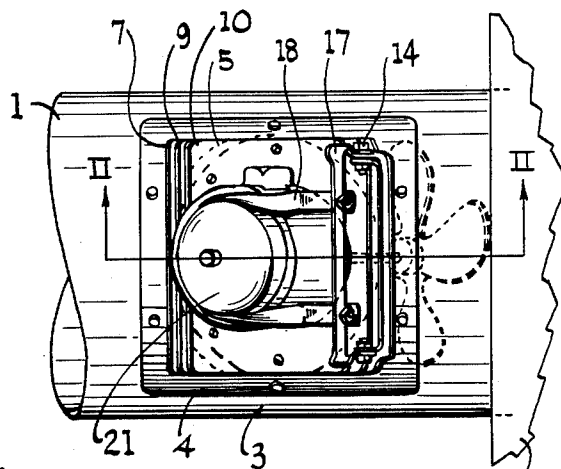


Fig. I

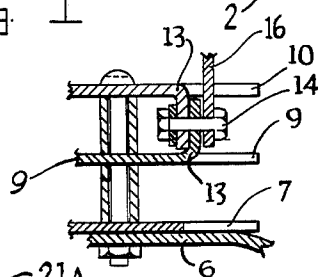


Fig. IV

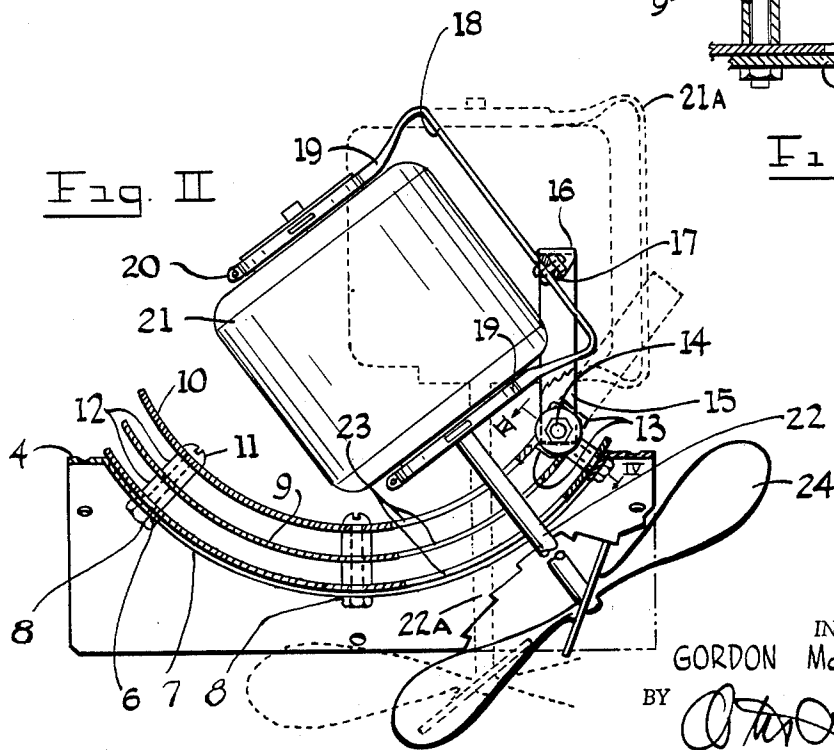


Fig. II

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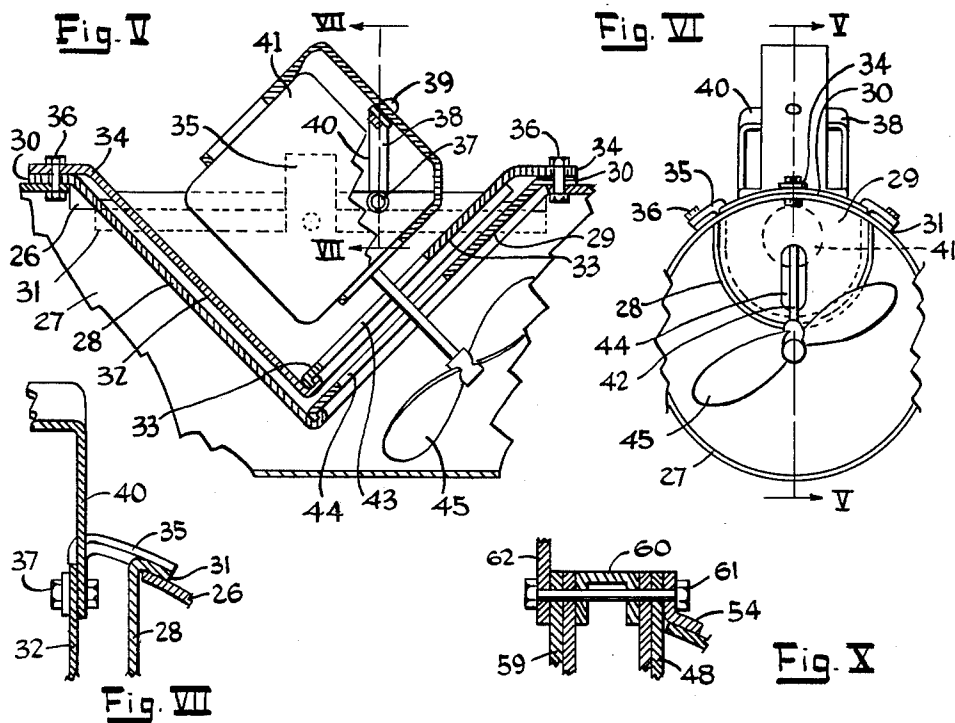
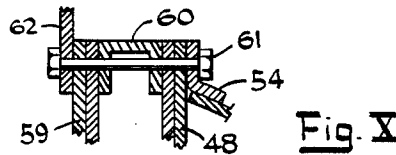
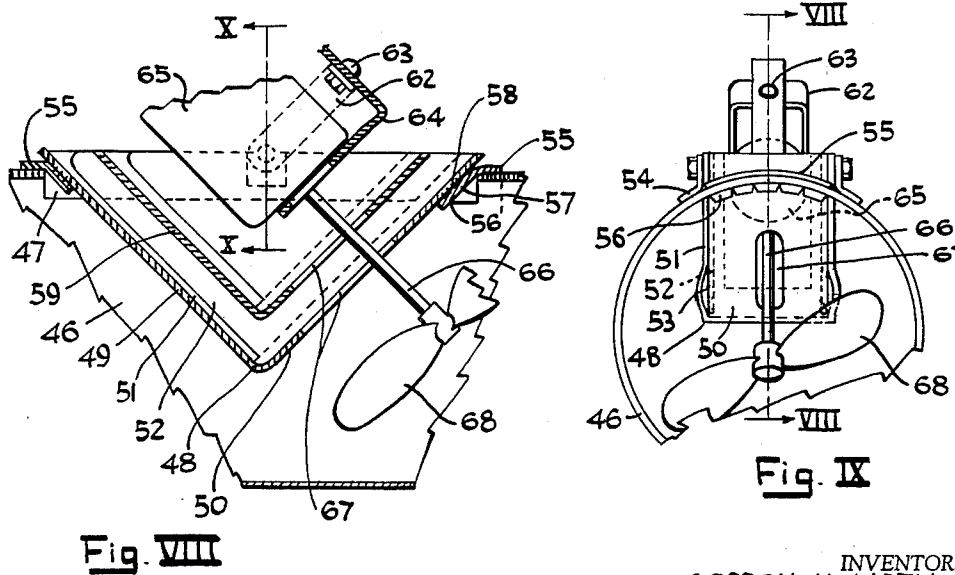
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DRAFT INDUCING FAN

Filed Dec. 15, 1958

2 Sheets-Sheet 2



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2,984,407

DRAFT INDUCING FAN

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Filed Dec. 15, 1958, Ser. No. 780,541

11 Claims. (Cl. 230-114)

This invention relates to improvements in a draft inducing fan. The principal objects of this invention are:

First, to provide a draft inducing fan which is durable and yet inexpensive due to reduced loads placed on the motor bearings as the result of the method of mounting the fan and its motor.

Second, to provide a flue fan which can be adjusted to create different draft velocities in a flue but which utilizes an inexpensive one speed motor.

Third, to provide an exhaust flue fan that can operate effectively in hot flues such as smoke pipes without detrimental effects from the heat and without resorting to expensive special heat resistant bearings and parts in the fan motor.

Fourth, to provide an exhaust fan mounting in a flue that provides a maximum efficiency or air flow in one position of the fan in the flue without creating an undue obstruction to natural draft air flow when the fan is not operating and in which the fan may be adjusted for any lesser degree of induced draft including a negative or back draft if necessary.

Fifth, to provide a mounting for a draft fan and motor therefore that permits the motor to be mounted close to the fan and a flue in which the fan operates and which protects the motor from flue heat by establishing cooling air flow from around the motor through baffle plates into the flue.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings, of which there are two sheets, illustrate a highly practical form of the fan assembly and three methods of mounting the same in a flue.

Fig. I is a fragmentary side elevational view of a portion of a smoke pipe or flue with the draft fan of the invention mounted thereon.

Fig. II is a fragmentary cross sectional view taken along the plane of the line II—II in Fig. I.

Fig. III is a fragmentary cross sectional view showing a modified method of installing the fan shown in Figs. I and II.

Fig. IV is a fragmentary enlarged cross sectional view taken along the plane of the line IV—IV in Fig. II.

Fig. V is an axial cross sectional view through second modified form of fan mounting taken along a plane corresponding to the line V—V in Fig. VI.

Fig. VI is an end elevational view of the flue and fan mounting shown in Fig. V.

Fig. VII is an enlarged fragmentary cross sectional view taken along the plane of the line VII—VII in Fig. V.

Fig. VIII is a fragmentary axial cross sectional view through a third modified form of fan mounting taken along the plane of the line VIII—VIII in Fig. IX.

Fig. IX is a fragmentary end elevational view of the flue and fan mounting shown in Fig. VIII.

Fig. X is an enlarged fragmentary cross sectional view through the motor mount connection in Fig. VIII and taken along the plane of the line X—X.

While the draft inducing fan of the invention is applica-

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ble to any flue such as an exhaust flue for stale air, it is particularly adaptable to furnace exhaust flues or smoke pipes and will be described in this latter relation. In Fig. I a smoke pipe is indicated in part at 1 extending into a chimney 2. The draft inducing fan assembly indicated generally at 3 is mounted on the side of the flue. It may be mounted on the bottom of the flue but mounting on the top of the flue is objectionable in that it subjects the motor to heat rising from the flue.

The fan assembly consists first of a mounting plate 4 that is generally rectangular in outline but curved longitudinally to fit against the side of the flue and close an opening 5 cut in the flue wall. The center of the mounting plate is depressed or curved about an axis extending transverse to the flues and the depressed portion is cut away leaving a narrow flange 6 disposed generally along the surface of a segment of a cylinder.

The opening within the flange 6 is closed by a first baffle plate 7 secured to the flange by bolts 8. For cold ventilating flues the single baffle plate is sufficient but for hot flues additional baffle plates 9 and 10 are mounted on the first baffle plate by the bolts and spacing sleeves 12 that hold the baffle plates in spaced apart relation. The right hand corners of the baffle plates 9 and 10 are slit to form anchor tabs 13 that are bent into overlapping relation to receive the pivot bolts 14 disposed along a pivot axis transverse to the flue and located thereabove. The side arms 15 of a yoke 16 are adjustably secured to the anchors by the pivot bolts so that the transverse cross piece 17 of the yoke extends swingably across the right ends of the baffle plates.

The cross piece 17 is bolted to the base 18 of a motor mount bracket having end arms 19 that coact with clamps 20 to secure the ends of an electrical motor 21 to the bracket. Rubber vibration dampening grommets (not illustrated) may be mounted between the motor and the bracket and clamps. The axis of the motor is thus mounted in a longitudinal plane through the center of the flue pipe 1 and is swingable in that plane. The shaft 22 of the motor projects generally radially through the baffle plates 7, 9 and 10 to within the flue pipe. The baffle plates define arcuate slots 23 passing the shaft and permitting tilting adjustment of the shaft and motor about the pivot bolts 14. Fig. II illustrates the motor in full lines in inwardly tilted, maximum draft position and it will be noted that in this position the motor 21 projects partially into the cylindrical contour of the flue 1. The outwardly tilted minimum or negative draft position of the motor and the shaft are indicated by the dotted lines at 21A and 22A respectively.

Secured to the end of the shaft within the flue is a screw type propeller fan 24. In the inwardly tilted position of the motor 21 the fan tilts to a transverse inclined plane within the flue with its upper edge closely adjacent the inside of the flue. In this position it has maximum efficiency in creating a draft in the flue. When the motor is swung outwardly the fan swings to parallel or slightly oppositely inclined position in the flue for zero or negative draft creating ability. It should be noted that due to the position of the pivot bolts 14 outside the contour of the flue and offset from the shaft 22, the fan will also swing outwardly away from the side of the flue opposite from the motor.

The inclined position of the fan 24 relative to the axis of the flue, in the maximum draft position of the fan, causes the fan to present an oval or elliptical surface to the transverse normally circular cross section of the pipe. In order to obtain maximum efficiency from the fan it is best to close off the open area between the ellipse and the circle to prevent air from circulating back around the fan and to increase the efficiency of the fan. This can be done as shown in Fig. III by placing a stationary

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baffle 25 within the flue with its edge lying closely adjacent the ends of the fan blades in the inwardly tilted position of the fan. The baffle may be formed as a separate metal plate or by an integral portion of the wall of the flue pressed inwardly from the normal cylindrical contour of the flue.

Fig. III also illustrates a modified assembly of the fan for insertion into a flue. The mounting plate 4A is pre-assembled in a separate section 1A of flue pipe to be assembled into a flue rather than cutting into an existing flue and mounting the plate 1 thereover. Other possible variations include forming the mounting plate 4A as an integral part of the flue section 1A.

Figs. V, VI and VII show a second modified form of fan mounting. A hole 26 of rectangular outline is cut into the flue 27. Mounted within the hole is an inner baffle 28 curved cylindrically about an axis inclined into the flue and closed at its inner end by an end wall 29. Flanges 30 on the ends of the baffle overlie the flue wall and support the baffle. Flanges 31 on the sides of the baffle support the sides. Within the baffle 28 is a second smaller baffle 32 having an end wall 33 and end tabs 34 and side tabs 35. Bolts 36 secure the flanges 30 and 31 and tabs 34 and 35 to the flue and locate the baffles in spaced relation.

The side walls of the inner baffle 32 carry pivot bolts 37 which swingably support the motor yoke 38. The yoke is secured at 39 to the base bracket 40 of the motor 41. The motor is thus supported to swing into the inner baffle with its shaft 42 inclined into the flue. The shaft 42 passes through slots 43 and 44 provided therefore in the end walls of the inner baffle and the outer baffle respectively. A screw propeller 45 is mounted on the inner end of the shaft 42 to operate and to be adjusted as in the first forms of the invention described. Due to the relatively narrow width of the hole 26 in the flue wall, the propeller 45 is desirably a two bladed propeller permitting its easy insertion into the flue.

Figs. VIII to X illustrate a third modified form of fan mounting. The flue 46 has a rectangular hole 47 cut in its side as in Figs. V to VII. An inner baffle 48 in the shape of the corner of a box fits into the hole. The bottom wall 49 has the end wall 50 folded therefrom and triangular side walls 51 and 52 on the bottom and end walls respectively are folded into overlapping relation at the sides of the baffle. The side walls are relatively bowed or offset as at 53 (see Fig. IX) to form a cooling passage between the walls into the flue. Angle strips 54 secured along the outer sides of the side walls overlap the side edges of the hole 47. An angle strip 55 having notches 56 in its depending flange 57 is secured at its center as by welding at 58 to each end of the baffle and when the baffle is inserted in the hole the ends of the strips are bent down around the curve of the flue to close the joint between the flue and the baffle.

An inner baffle 59 of the same configuration but smaller in size than the outer baffle 48 is mounted in spaced relation within the outer baffle in spaced relation to the walls thereof. A U-shaped bracket 60 positioned between the side walls of the baffles at each side thereof spaces the baffles and is held in place by the pivot bolts 61 that also adjustably support the motor mounting yoke 62. As in the other forms of the fan assembly, the yoke 62 is connected at 63 to the mounting bracket 64 of the motor 65. The motor shaft 66 extends through slots 67 in the baffles to support and drive the screw propeller 68 in the flue.

The last two forms of the baffle insert into the flue shown in Figs. V and VIII have a certain advantage in that they do not occupy and obstruct the entire chord of the flue and they can be formed by merely folding or rolling sheet metal. Thus they do not require dies and presses for their formation. All forms of the baffle and fan mount provide passages for cooling air to be drawn

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around the motor and between the baffle plates through the slot that passes the motor shaft. The motor and shaft are thus cooled and the motor is shielded from radiant heat of the flue. Due to the adjustability of the motor and fan an inexpensive standard single speed motor can be used to create the desired draft in any flue depending upon the needs of the particular flue. The motor is close to the propeller and this reduces the effect of vibration of the propeller on the motor bearings so no special bearings are required. It should be noted that perfect balance of the fan is impossible as soot collecting on the propeller will unbalance the blade regardless of its initial balance so the matter of bearing loads becomes important.

15 What is claimed as new is:

1. A draft fan assembly for furnace flues comprising a mounting plate curved as a segment of a cylinder to fit a flue pipe and having an opening therein with a flange around the opening disposed along a cylindrical surface transverse to said segment and intersecting the bend of the mounting plate to a substantial depth, a plurality of curved baffle plate secured in spaced relation with the lower plate secured to said flange to close said opening, ears turned from adjacent corners of two of said baffle plates into overlapping relation to form anchors at transversely opposite sides of said baffle plates, a yoke having the ends of its arms adjustably pivoted to said anchors, an electric motor secured to said yoke with its shaft extending generally radially through said baffle plates and transverse to the line of said pivots and therebelow, said baffle plates defining slots passing said shaft, and a screw propeller fan on the lower end of said shaft having a diameter approaching the diameter of the cylinder of said segment.

2. A draft fan assembly for furnace flues comprising a mounting plate to fit a flue pipe and having an opening therein with a flange around the opening disposed along a cylindrical surface transverse to and intersecting the bend of the mounting plate to a substantial depth, a plurality of curved baffle plates secured in spaced relation with the lower plate secured to said flange to close said opening, anchors at transversely opposite sides of said baffle plates, a yoke having the ends of its arms adjustably pivoted to said anchors, an electric motor secured to said yoke with its shaft extending generally radially through said baffle plates and transverse to the line of said pivots, said baffle plates defining slots passing said shaft, and a screw propeller fan on the lower end of said shaft having a diameter approaching the diameter of the cylinder of said mounting plate.

3. A draft fan assembly for furnace flues comprising a mounting plate curved to fit a flue pipe and having an opening therein disposed along a surface curved transverse to and intersecting the bend of the mounting plate to a substantial depth, a curved baffle plate secured to said mounting plate to close said opening, anchors at transversely opposite sides of said baffle plate, a yoke having the ends of its arms adjustably pivoted to said anchors, an electric motor secured to said yoke with its shaft extending generally radially through said baffle plate and transverse to the line of said pivots, said baffle plate defining a slot passing said shaft, and a screw propeller fan on the lower end of said shaft having a diameter approaching the diameter of the curve of said mounting plate.

4. A draft fan assembly for furnace flues comprising a baffle plate shaped to fit within a flue pipe having an opening therein and intersecting the flue to a substantial depth, a second baffle plate secured in spaced relation within said first plate, anchors at transversely opposite sides of said plates, a yoke having the ends of its arms adjustably pivoted to said anchors, an electric motor secured to said yoke with its shaft extending generally radially through said baffle plates and transverse to the line of said pivots, said baffle plates defining slots passing

said shaft, and a screw propeller fan on the lower end of said shaft.

5. A draft fan assembly for a flue pipe and having an opening therein disposed along a cylindrical surface comprising an outwardly opening chambered baffle positioned in said opening and intersecting the pipe to a substantial depth, anchors at opposite sides of said baffle having a yoke pivoted thereto and extending transversely of said pipe and the chamber of said baffle, an electric motor supported from said yoke and extending partially into the outline of said pipe with its shaft extending through said baffle in a longitudinal plane of the pipe and inclined relative to the pipe, said baffle plate defining an opening passing said shaft, and a screw propeller fan on the lower end of said shaft having a diameter approaching the diameter of the pipe.

6. A draft fan installation in a flue comprising a closure plate curved about an axis transverse to said flue and projecting into the flue a substantial distance to close an opening provided therefor in the flue, a heat shield plate mounted in generally parallel and spaced relation to said closure plate, an electric motor mounted partially within the concave shape of said plates with its axis in a longitudinal plane of said flue and with its shaft projecting into said flue, said plates defining a slot passing said shaft, means pivotally adjustably supporting said motor about an axis transverse to said flue and said shaft and spaced from said shaft, and a screw propeller fan secured to the end of said shaft within said flue, said flue having a flow restricting baffle in its side opposite said plates conforming closely to the periphery of said fan in the inwardly adjusted position of said shaft and said fan with one tip of the fan closely adjacent the opposite side of the flue from the baffle.

7. A draft fan installation in a flue comprising a closure plate curved about an axis transverse to said flue and projecting into the flue a substantial distance to close an opening provided therefor in the flue, a heat shield plate mounted in generally parallel and spaced relation to said closure plate on the outer side thereof from said flue, an electric motor mounted partially within the concave shape of said plates with its axis in a longitudinal plane of said flue and with its shaft projecting into said flue, said plates defining a slot passing said shaft, means pivotally adjustably supporting said motor about an axis transverse to said flue and said shaft and spaced from said shaft, and a screw propeller fan secured to the end of said shaft within said flue.

8. A draft fan installation in a flue comprising a closure plate curved about an axis transverse to said flue and projecting into the flue a substantial distance to close an opening provided therefor in the flue, an electric motor mounted partially within the concave shape of said plate with its axis in a longitudinal plane of said flue and with its shaft projecting into said flue, said plate defining a slot passing said shaft, means pivotally adjustably supporting said motor about an axis transverse to said flue and said shaft, and a screw propeller fan secured to the end of said shaft within said flue, said flue having a flow restricting baffle in its side opposite said plate conforming closely to the periphery of said fan in the inwardly adjusted position of said shaft and said fan

with one tip of the fan closely adjacent the opposite side of the flue from the baffle.

9. A draft fan installation in a flue comprising a first baffle plate bent concavely outwardly relative to said flue and projecting into the flue a substantial distance to close an opening provided therefor in the flue, a second baffle plate angled concavely and supported in spaced nested relation in said first baffle plate, an electric motor mounted partially within the concave shape of said second plate with its axis in a longitudinal plane of said flue and with its shaft projecting into said flue, said plates defining slots passing said shaft, means pivotally adjustably supporting said motor about an axis transverse to said flue, and a screw propeller fan secured to the end of said shaft within said flue.

10. A draft fan assembly adapted to fit in a rectangular opening in the side of a flue pipe comprising a first baffle having angularly disposed bottom and end walls, inner and outer triangular side walls folded from the adjacent edges of said bottom and end walls with the side walls at each side of the baffle in lapped relation and secured together at their free edges but deflected and spaced apart to form air passage opening therebetween to said end wall, angled strips secured along the adjacent outer edges of said bottom, end and outer side walls to support said baffle in said opening and close the joint between the baffle and the flue, a second baffle shaped correspondingly to said first baffle but being smaller than said first baffle, means supporting and connecting said second baffle in spaced nested position within said first baffle, a motor projecting into said second baffle in generally parallel relation to the bottom thereof with the shaft of the motor projecting through said end walls, said end walls defining openings passing said shaft, and a screw propeller blade mounted on the end of said shaft to operate in inclined position in said flue pipe.

11. A draft fan assembly adapted to fit in a rectangular opening in the side of a flue pipe comprising a baffle having angularly disposed bottom and end walls, inner and outer triangular side walls folded from the adjacent edges of said bottom and end walls with the side walls at each side of the baffle in lapped relation and secured together at their free edges but deflected and spaced apart to form air passages opening therebetween to said end wall, angled strips secured along the adjacent outer edges of said bottom, end and outer side walls to support said baffle in said opening and close the joint between the baffle and the flue, a motor projecting into said baffle in generally parallel relation to the bottom thereof with the shaft of the motor projecting through said end wall, said end wall defining an opening passing said shaft, and a screw propeller blade mounted on the end of said shaft to operate in inclined position in said flue pipe.

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