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ALL PURPOSE FLUE

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4 Sheets-Sheet 1

AIR DRAWN IN FROM OUTSIDE

10 - COOL OUTER PIPE

11 - INNER PIPE

16 - DOWN-FLOW AIR SPACE

LOWER DENSITY OF THE HOT GASES CREATES A LOW PRESSURE AREA AT THE BOTTOM SO THE MORE DENSE OUTSIDE AIR FLOWS IN AND THE TWO INTERMINGLE.

HOT GASES FROM COMBUSTION AREA

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This invention relates to improvements in flue pipes or chimneys and particularly to an all-purpose flue adapted for installation in the walls of wooden framed buildings and in places where the clearance between the flue and adjacent structural members of the building are at a minimum or there is no clearance at all. This application is a continuation of application Serial Number 363,224, filed June 22, 1955, now abandoned.

One of the problems solved by this invention is to eliminate the need for massive heavy walled masonry flue pipes or chimneys which construction has been necessary in the past to prevent travel of the heat from the flue outwardly to where it would overheat adjacent combustible materials. The danger of fire, ever present in any structure where a device is used which produces hot combustion gases that must be vented out of the structure, has led to very rigid building codes and regulations governing the kind of vent flue acceptable and safe for each different kind of structure and combustion device. The present invention provides a flue which meets the most rigid standards so that it can be classified as an all-purpose flue useable with any combustion device and in any type of structure.

The regulations for flues are an outgrowth of the work of the Underwriters Laboratories, Inc., the National Board of Fire Underwriters, the American Gas Association, and other testing agencies, whose work is directed to the prevention of destructive fires in houses and other structures. To comply with such regulations, most vents, chimneys, or flues in use heretofore have required a clearance space between the outer surface of the flue and any adjacent combustible materials. These clearances have varied with different flues and this has complicated the work of builders, who must watch their carpenters, and of building inspectors whose duty it is to make certain that the carpenters have provided the correct clearance. This major problem of clearances is solved by the present invention because it requires a minimum clearance. Any hazard from improper clearance is thus eliminated, and the builder's and inspector's job is simplified. By employing the novel principles of the present invention, it is possible to keep the outer surface of the flue cool enough so it can be built directly against a combustible wooden surface without risk of setting the latter afire.

Another advantage of the present invention is the relatively low cost, both of the flue and of its installation. In any embodiment, the present invention requires less space than the old types which it replaces. The present invention brings down the dimensions of the flue to a minimum, thus lowering the material required and the price at which it is sold.

Hitherto there has been no vent or chimney with two relatively thin walls which could meet the small clearance requirements of the regulating bodies. A novel feature of the present invention is that it takes some of the hitherto lost energy from the vent gases and uses this energy to induce a down-flow of cooling air in the jacket surrounding the pipe in which the flue gases are moving upwardly and then mixes this air in with the rising flue gases near the base of the flue.

The present invention does not cool the heat transfer through the walls theory, but instead effects a movement of the cooler air in at the top of the annular air space by introducing it into flue gases at or near the bottom of the flue where it intermingles with the flue gases. The difference in density of the warm flue gases (less dense) as compared to the cool outer air (more dense) causes the latter to flow down the annular air space to the upward direction of flow of the flue gases and then to enter into the flue.

Nor does the present invention work on the jet pump theory where air is pumped through jackets by restricting the suction pipe around the end of the engine exhaust muffler outlet. Applicant moves the air in the opposite direction and relies on heat to cause low density which lowers the pressure at the base of the flue, and the cool denser air moves down the airflow space and into the flue gas space near the base of the stack.

In compliance with the statute, I shall now describe typical successful embodiments of my new concept of a flue or chimney, however, with the distinct understanding that they are illustrative of the principle of the invention, which principle may be incorporated in modified devices and still come within the scope of the appended claims.

At the outset, it should be understood that the cross-sectional shape of the pipes, whether round, oval, oblong, rectangular, or any other shape, will be a matter of choice to the particular manufacturer or will be dictated by the space in building in which it must fit.

In the drawings:

Fig. 1 is a diagrammatic perspective sectional view in elevation of a preferred form of my flue pipe;
Fig. 2 is an enlarged cross-sectional view of the lower end of the flue;
Fig. 3 is a fragmentary view at the base of the flue showing how the smoke pipe from the combustion area may come in from the side instead of from the bottom as in Figs. 1 and 2;
Fig. 4 is a diagrammatic cross-sectional view taken on the line 4—4 of Fig. 1, omitting the smoke pipe from the combustion area;
Fig. 5 is a fragmentary cross-sectional view of a modification of the lower end of the flue in which a series of openings are used in lieu of supporting the inner pipe above the flue base;
Fig. 6 is a view like Fig. 5 of another modification of the lower end of the flue;
Fig. 7 is a cross-sectional view taken on the lines 7—7 of Fig. 6; and
Fig. 8 is a view in perspective of a modification of my flue employing a pair of down-flow air spaces.
Fig. 9 is a view in perspective and partly in section of the flue of Fig. 1, showing its relation, when installed, with the roof sheathing and a ceiling.

The flue construction shown in the drawings, Figs. 1 to 7 and 9, consists generally of inner and outer spaced apart pipes extending substantially the full length of the flue with the inner pipe spaced above the bottom of the flue (or perforated to get the same effect—Fig. 5); and an inlet pipe extending upwardly from the bottom of the flue for a distance sufficient so the flue gases do not enter the down flow air space.

In Figs. 1 and 2, the double-walled flue is made up of the outer pipe 10, the inner pipe 11, and the bottom closure plate 12, which is integral with the inlet pipe 13. The inner and outer pipes are secured in spaced relation to each other by any suitable means, such as the vertically extending channel spacers 14 shown in Fig. 4. The inner pipe 11 is held spaced above the bottom closure plate 12 by the spacers 14, or if the inner pipe 11 rests
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3 on the bottom plate 12, as in Fig. 5, perforations 15 of suitable capacity to allow the flow of air may be used.

The space 16 between the outer and inner pipes 10 and 11 constitutes an air space for the passage of cooling air downwardly from the top of the flue to the bottom where it passes under the lower edge of the inner pipe 11 (or through perforations 15 in Fig. 5) and is drawn upwardly through the passage 17 between the inner pipe 11 and the inlet pipe 13 and into the lower end of the flue space 19. As this cooling air passes the top 18 of the inlet pipe 13 it intermingles with and becomes a part of the flue gases and continues on up the flue 19.

My invention provides a flue construction which relies upon low pressure existing inside the flue at or near the bottom. This low pressure derives from the hot gases there present and its effect on the more dense (therefore heavier) air in the downflow air space 16 is to cause the latter to flow downwardly. The net effect is to suck air down the space 16 and up the space 17 into the space 19 where it mingles with the flue gases from the combustion area.

While the preferred construction is to have the air leave the downflow air space 16 and enter the space 17 at the bottom, as shown, yet the flue will work if the transfer of the cooling air from the space 16 into the flue 19 is made above the bottom 12 and above the end 18 of the inlet pipe 13. The latter construction loses some in efficiency and yet it is low enough down in the flue to get the benefit of the low pressure existing in the base of the flue.

The opening 20 in the bottom plate 12 is of a size to receive the smoke pipe 21 from the appliance, fireplace, furnace, incinerator, or other combustion device, to be vented.

The size of the inlet pipe 15 in general would be the same as that of the smoke pipe 21 or it may be reduced in diameter above the point of connection to the smoke pipe, or as shown in Fig. 6, the pipe 21 and pipe 15 may be substantially the same diameter. Preferably the pipe 13 should be smaller in diameter than the pipe 11 and, as pointed out before, preferably should be long enough to carry the flue gases past the lower open end of the pipe 11.

The size of the pipe 10 in relation to the pipe 11 will be such as to provide a space 16 sufficient to carry the volume of air needed to flow downwardly to maintain the surface of the pipe 10 at a temperature considered safe by the regulatory bodies mentioned above. I have obtained good results where the pipe 10 is 12 inches in diameter, the pipe 11 is 9 inches in diameter, and the pipe 13 is 6 inches in diameter.

Instead of having the smoke pipe 21 enter through the opening 20 in the bottom plate 12, many installations will require that the smoke pipe enter at an angle to the inlet pipe 13. This does not change the operating characteristics of the flue and, as shown in Fig. 3, the inlet pipe 13 has an elbow 22 which passes out through the inner wall 11 and outer wall 10 for connection to the smoke pipe.

The length of the inlet pipe 13 should be such as to carry the hot gases above the point where they can flow into the air space 16. I have found that with pipes 10, 11 and 13 of the diameters mentioned above, a length of pipe 13 extending one inch above the bottom of pipe 11 performed well. I have tried longer and shorter lengths for pipe 13 and so far have not found any failure of the smoke pipe to perform. I prefer to keep the pipe 13 as short as possible so as to reduce resistance to flow over the air which has traveled down the air space 16. My invention makes direct use of the heat energy in the flue gases—energy which has in the past been wasted.

In the cross-sectional views, Figs. 4 and 7, the dot in a circle indicates the flow of gas is toward the viewer whereas the plus sign in a circle indicates the flow of gas is away from the viewer.

It is understood that the outer pipe 10 will continue through the roof of the building to substantially the same height as the pipe 11 (see Fig. 9). The latter will have the usual chimney cap which in this case may be large enough to shield the passage 16 from the entry of rain and snow. A suitable deflecting shield may be provided over the passage 16.

As Fig. 9 shows, the cool air is drawn in above a roof 26 and passes down through the passage 16, keeping the outer pipe 10 so cool that it can either be installed immediately next to a studding or a ceiling joist 27, though, if desired, a solid annular metal firestop ring 28 may be between them, the ring being heat-conductive by virtue of being metal, so even here the pipe 10 is mounted in substantially direct thermal contact with the joist 27.

The modification shown in Figs. 6 and 7 has eliminated the pipe 13 and instead the pipe 11 has a plurality of louvers 22 formed near its bottom end to provide passageways 23 for the entry of the downwardly flowing cooling air in the air space 16 into the space 19 formed by the pipe 11. In this modification, the pipe 21 from the appliance may be about the same diameter as the pipe 11.

The modification shown in Fig. 8 provides an additional pipe 24 placed outside the pipe 10, so as to provide an additional cool air space 25. The air in the outer annular space 25 is down moving, and the air in the inner annular space 16 acts primarily as extra insulation. The air in the space 16 has been found to move in a downward direction, although if the appliance has been operating for a considerable period, this air may tend to stand still, but at all times it serves as a good insulation between the hot flue gases and the down moving cool air in the space 25.

What I claim is:

1. A vertical flue installation extending through a roof, comprising: supporting walls of combustible material, concentric inner and outer metal pipes, the upper ends of said pipes being open and said outer pipe being adapted for substantially direct thermal contact with said supporting walls; means spacing said pipes apart from each other to provide a cool air passage between them; closure means for the lower end of said cool air passage; support means for said outer pipe at said lower end, said spacing means serving to support said inner pipe; an inlet pipe emptying flue gas into and within said inner pipe adjacent said lower end, said inner pipe being the one through which the flue gases pass upwardly; and means connecting said cool air passage with the interior of said inner pipe adjacent said closure, and over substantially the entire circumference of said inner pipe, said means constituting the sole outlet from said cool air passage, whereby the heat of the flue gases through said inner pipe induces a flow of cool air from the upper end of said outer pipe above said roof through said cool air passage and all said cool air flows into the lower end of said inner pipe below said roof for mixture with and cooling of the hot flue gases, whereby said outer pipe does not endanger said combustible material when there is direct contact therewith.

2. A vertical flue comprising two concentric metal pipes, namely an inner pipe and an outer pipe; means spacing said pipes apart from each other to provide a cool air passage between said outer pipe, which is adapted for installation in direct contact with combustible construction materials, and said inner pipe, through which the flue gases flow upwardly, the upper ends of said pipes being open; a generally radial closure means at the lower end of said cool air air passage; support means for said outer pipe at said lower end, said spacing means serving to support said inner pipe through said outer pipe; an inlet pipe emptying flue gas into said inner pipe wherein said inner pipe, adjacent and above said lower end, and means interconnecting said cool air passage and the interior of said inner pipe adjacent said closure,
said means comprising the sole outlet from the lower end of said cool air passage, whereby the heat of the flue gases through said inner pipe induces a flow of cool air down from the upper end of said outer pipe through said cool air passage and all said cool air flows into the lower end of said inner pipe for mixture therewith, and the resultant cooling of, the hot flue gases and whereby the walls of said outer pipe are cool enough so that said combustible materials are not subjected to a fire hazard by said installation.

3. A vertical flue comprising concentric inner and outer metal pipes; support means for said outer pipe at its lower end; means spacing said pipes apart from each other and connecting said inner pipe for support by said outer pipe to provide a cool air passage between them; and to provide passage means connecting said cool air passage with the interior of said inner pipe adjacent said lower end, said cool air passage being open at the upper end of said outer pipe and closed off completely at said lower end except for said passage means; and a flue pipe leading into said and telescoping engaged in the lower end of said inner pipe and terminating closely adjacent said lower end, whereby the heat of the flue gases that flow through said inner pipe induces a downward flow of cool air from said upper end through said cool air passage into the lower end of said inner pipe where all the cool air mixes with the hot flue gases and cools them.

4. A vertical flue comprising a plurality of concentric metal pipes; means spacing said pipes apart from each other to provide cool air passages between them; closure and support means at the lower end of said flue, closing said cool air passage means; second passage means connecting said cool air passage means with the interior of the innermost said pipe adjacent said closure around substantially the complete circumference of said innermost pipe; and a flue inlet pipe leading into and terminating closely adjacent to the lower end of said innermost pipe.

5. The flue of claim 4 wherein said second passage means comprises openings through the walls of the innermost said pipe.

6. The flue of claim 4 wherein said second passage means comprises spacing the lower end of said innermost pipe away from said closure means.

7. The flue of claim 4 wherein said flue inlet pipe comprises a coaxial inlet conduit adjacent the lower end of said innermost pipe and terminating thereabove, and means for spacing said conduit concentrically within said innermost pipe.

8. The flue of claim 4 wherein said flue inlet pipe comprises a smoke pipe elbow that enters through the side wall of said flue adjacent said closure means and terminates in an upwardly directed mouth inside and spaced from the walls of said innermost pipe.

9. The flue of claim 4 wherein there are three spaced concentric pipes, the two passages between them both opening into said second passage means at their lower ends.

References Cited in the file of this patent

UNITED STATES PATENTS

2,130,385 Fluor et al. ---------------- Sept. 20, 1938
2,358,397 Howle ------------------ Sept. 19, 1944
2,619,022 Hergainrother -------------- Nov. 23, 1952
2,634,720 Tulum ---------------- Apr. 14, 1953
2,711,683 Ryder ------------------ June 28, 1955
2,773,301 McKann ----------------- July 19, 1955