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GAS AND AIR MIXING DEVICE

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Fig. 2

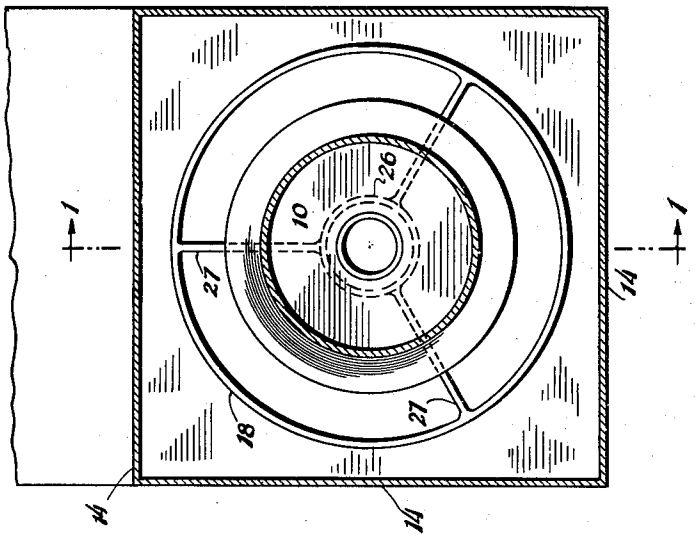
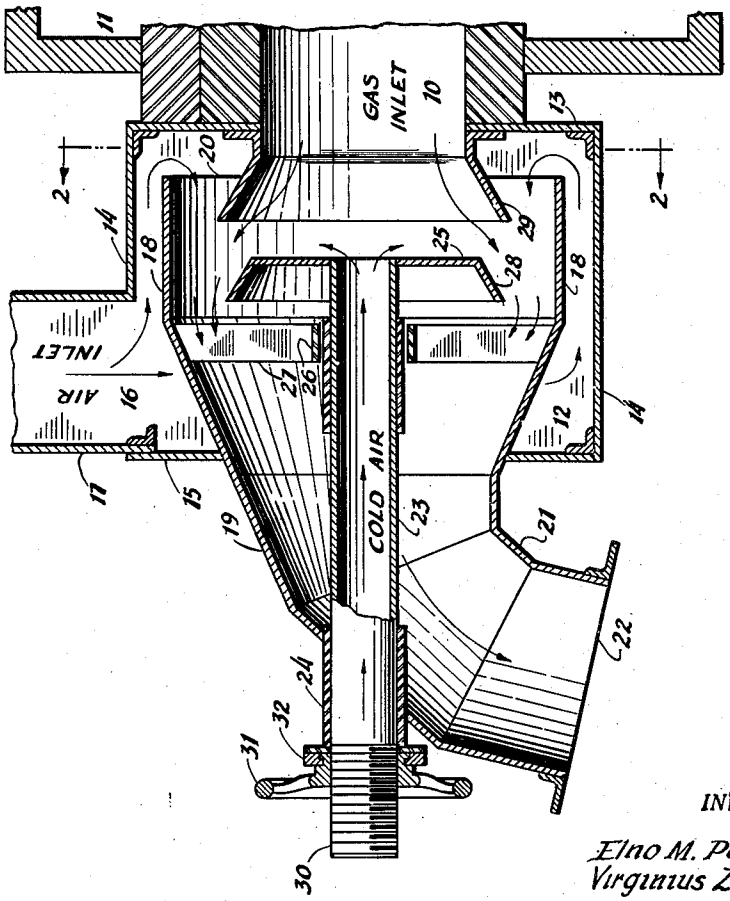


Fig. 1



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GAS AND AIR MIXING DEVICE

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5 Claims. (Cl. 251—20)

1

This invention relates to apparatus for mixing fluids of different temperatures and particularly for mixing gases taken directly from a furnace with a cooler gas.

Heretofore apparatus for mixing gases taken directly from a furnace with air required the use of a considerable amount of heat resisting alloys and brick lined ducts which were both cumbersome and expensive. It is an object of this invention to provide improved means for mixing hot and cold fluids.

Figure 1 is a sectional elevation of the improved gas mixing apparatus, the section being taken on line 1—1 in Figure 2.

Figure 2 is a view taken on line 2—2 of Figure 1.

A conduit 10 within refractory lined wall conducts hot gases directly from a furnace indicated fragmentarily at 11 to a plenum chamber 12 comprising a side plate 13 mounted on the end wall of conduit 10, four sides 14 and a front 15. An opening 16 is provided in one side 14 in communication with an air duct 17. Projecting centrally into plenum chamber 12 is the open ended inlet 18 of a duct 19. The inlet end 18 of the duct is preferably made cylindrical and is open at one end to form an inlet 20. Outside plenum chamber 12 duct 19 is formed into a bend 21 which terminates in an outlet 22. Concentric with inlet 18 is a pipe 23 which passes through a sleeve 24 mounted in the outer wall of duct 19. The end of said pipe 23 carries a valve member 25 in the nature of an adjustable baffle. Pipe 23 is supported adjacent the valve member 25 by means of sleeve 26 and spider 27 which centers it in the cylindrical end portion 18 of conduit 19. Member 25 is provided with an inclined face 28 shaped to fit a valve seat 29 mounted on wall 13 of the plenum chamber 12 at the end of the gas inlet conduit 10. The pipe 23 is provided with means outside of duct 19 for seating or withdrawing the valve member 25 with respect to the valve seat 29. For example, threads 30 on the end of pipe 23 are engaged by threads within a hand wheel 31, the hand wheel being retained from axial movement by a collar 32 fastened to sleeve 24.

In operation, air, either preheated or cold, is introduced through air duct 17 (either under positive pressure or by induced draft) into the plenum chamber 12 where it is distributed substantially uniformly around the circumference of the inlet end 18 of duct 19, this distribution being caused by the restriction of the passage around inlet wall 18 as well as by a 180 degree turn around into the inlet 20 to duct 19. The air is thus directed as a relatively thin sheet past the outside surface of valve seat 29. The gas enters through conduit 10 at a very high temperature, preferably directly from the furnace 11, and is deflected by the valve member 25, which when open acts as a baffle, outwardly in a thin sheet into the air stream which enters duct 19. Because of the relatively thin layers and uniform distribution of the two fluids a thorough and rapid mixing takes place. Thereafter the mixture of air and gas at a substantially reduced temperature due to their admixture passes through duct 19 to the point of use. The central pipe 23 which carries the valve member 25 may be left open to the atmosphere so that cold air may pass therethrough to the face of the member 25 and thence radially over that face to there mix with the gas coming from the gas inlet 10.

2

By introducing the gas from furnace 11 into the center of the air stream no metal is subjected to temperatures higher than that of the ultimate mixture, except the valve member 25 and seat 29. Valve seat 29 is cooled by air from inlet 16 sweeping over its outer side, while the member 25 is partly cooled by air from pipe 23 sweeping across its face. It has been found that no insulation is required inside of the duct 19 for protection of the metal against over heating. All of the sleeves or bearings which support pipe 23 are located in relatively cool zones. The pipe 23 provides easy access the the furnace opening or conduit 10, for inspection and cleaning. The quantity of alloy material required to resist high temperatures is limited to the valve member 25 and valve seat 29. By making the parts cylindrical or conically formed they may be kept of relatively light weight to withstand explosion pressures. The adjustment of pipe 23 provided by the hand wheel 31 permits the valve member 25 to be moved back and forth so as to control the amount of gas flow.

In a typical application of the mixer apparatus here disclosed, the heated air from outlet conduit 22 is drawn into a fuel pulverizing mill (not shown) under suction created by a fan in that mill system which maintains the interior of conduit 22 under a given negative pressure; the air thus drawn through the mixer apparatus by the named suction may come into inlet conduit 17 directly from the furnace room or from an air heater (not shown) attached to inlet 17 or from some other source of heated air whose pressure is higher than that maintained in outlet conduit

22; and the furnace 11 communicating with hot gas conduit 10 normally operates under a slight negative pressure (created by the stack draft) which is, however, not as far below atmospheric as that in the interior of conduit 22.

Under all operating conduits of this novel mixer apparatus, the given negative pressure or suction in outlet conduit 22 draws air from inlet 17 into the open end 18 of mixer duct 19 and thence downwardly through elbow 21 into outlet conduit 22. This is true even though valve member 25 may be fully closed (to the right) against seat 29. Such full closure shuts off all outward flow through conduit 10 of hot gas from furnace 11; the left end of pipe 23 being open to the atmosphere the negative pressure within furnace 11 then draws unheated air to the right through the pipe and into the furnace (without damage to any of the parts).

The full closure of valve member 25 above described is sometimes found desirable when inlet conduit 17 gets its air from heater apparatus (not shown) which under certain conditions itself raises the air temperature high enough for proper operation of the mill or other equipment that outlet conduit 22 supplies. Usually, however, the air flowing through mixer duct 19 will require some supplemental heating; this is provided by adjustably opening (to the left) valve member 25 in the manner aforesaid to allow flow from furnace 11 of hot gas into mixer duct 19 in sufficient quantity to raise to the elevated value desired the temperature of the air leaving the apparatus by way of outlet 22.

What we claim is:

1. Means for mixing hot and relatively cold gases comprising walls enclosing a chamber having an inlet in one wall for cold gases; a conduit connected into the chamber through a contiguous wall for the introduction of hot gases; a member aligned with said conduit and spaced from the outlet end thereof so as to define an annular passage for the hot gases between the face of the member and the end of the conduit, an offtake duct surrounding the annular passage with the wall of its inlet end spaced from the facing wall surfaces of the chamber to provide a cold gas passage therearound, said duct passing out of the cold gas chamber through a wall thereof.

2. Means for mixing hot and relatively cold gases comprising walls enclosing a chamber having an inlet in one wall for cold gases; an open ended conduit having a valve seat at its open end extending into the chamber for the introduction of hot gases; a disc movable axially of said conduit to and from said seat; means for controllably spacing the disc from the seat thereby defining an annular passage for the hot gases between the disc and the seat; an offtake duct surrounding the annular passage with the wall of its inlet end of said duct being spaced from the facing wall surfaces of the chamber for providing a cold gas passage therearound, said duct passing out of the gas chamber through a wall thereof.

3. Means for mixing hot and cold gases comprising walls enclosing a cold gas chamber having an inlet in one wall for cold gases, a conduit extending into the chamber for the introduction of hot gases, an extension on said conduit flaring in the direction of gas flow to form a seat, a cooperating disc having a bevelled periphery parallel to the flare of said seat; means for controllably spacing the disc from the seat thereby defining an annular passage for the hot gases between the face of the disc and the end of the conduit, an offtake duct surrounding the annular passage with the wall of its inlet end spaced from the facing walls of the chamber to provide a cold gas passage therearound, said duct passing out of the gas chamber through a wall thereof.

4. Means for mixing hot and relatively cold gases comprising walls enclosing a cold gas chamber having an inlet in one wall for cold gases, a conduit connected into the chamber through a contiguous wall for the introduction of hot gases, a member aligned with the conduit and spaced from the outlet end thereof for defining an annular passage for the hot gases between the face of the member and the end of the conduit, a pipe centrally supporting and spacing the member from the conduit outlet and arranged to admit cold gases onto the face of said member opposite the conduit, an offtake duct surrounding the annular passage, the inlet end of which is spaced from the adjacent wall of the chamber providing a cold gas passage therearound, said duct passing through the cold gas chamber and thence out through a wall thereof.

5. Means for mixing hot and relatively cold gases comprising walls enclosing a cold gas chamber having an inlet in one wall for cold gases, a conduit connected into the chamber through a contiguous wall for introduction of hot gases, a member aligned with the conduit and spaced from the outlet end thereof for defining an annular passage for the hot gases between the face of the member and the end of the conduit, a pipe centrally supporting and spacing said member from the conduit outlet and arranged to admit cold air surrounding the chamber onto the face of said member opposite the conduit, an offtake duct surrounding the annular passage the inlet end of which is spaced from the adjacent wall of the chamber providing a cold gas passage therearound, said duct passing through the cold gas chamber and thence out through a wall thereof.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
393,332	Heatley	Nov. 20, 1888
1,863,391	Bluemel	June 14, 1932
2,164,954	Stephens	July 4, 1939