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G. A. MERKT

2,164,880

DRAFT PRODUCING APPARATUS

Filed Oct. 25, 1937

2 Sheets-Sheet 1

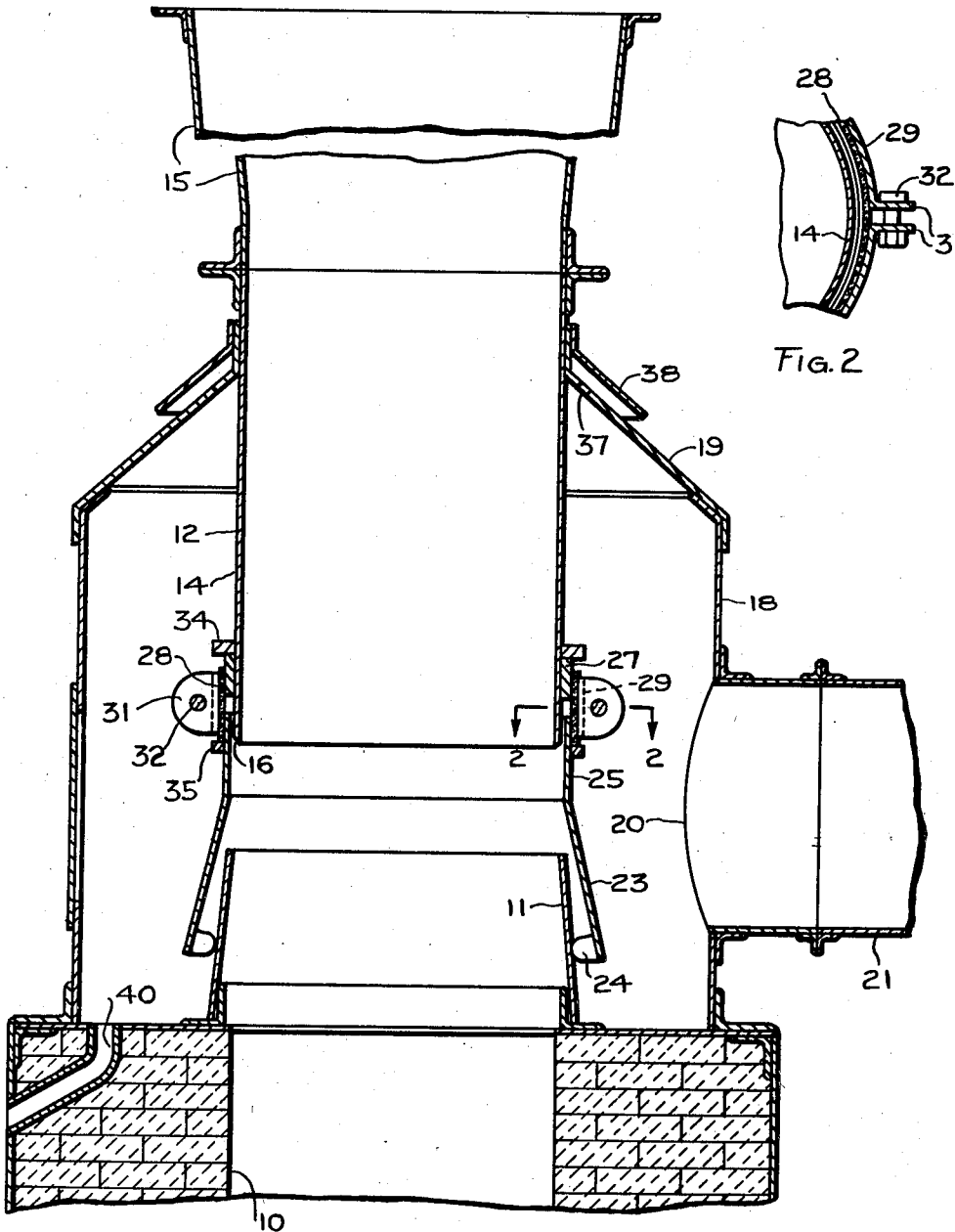


Fig. 1

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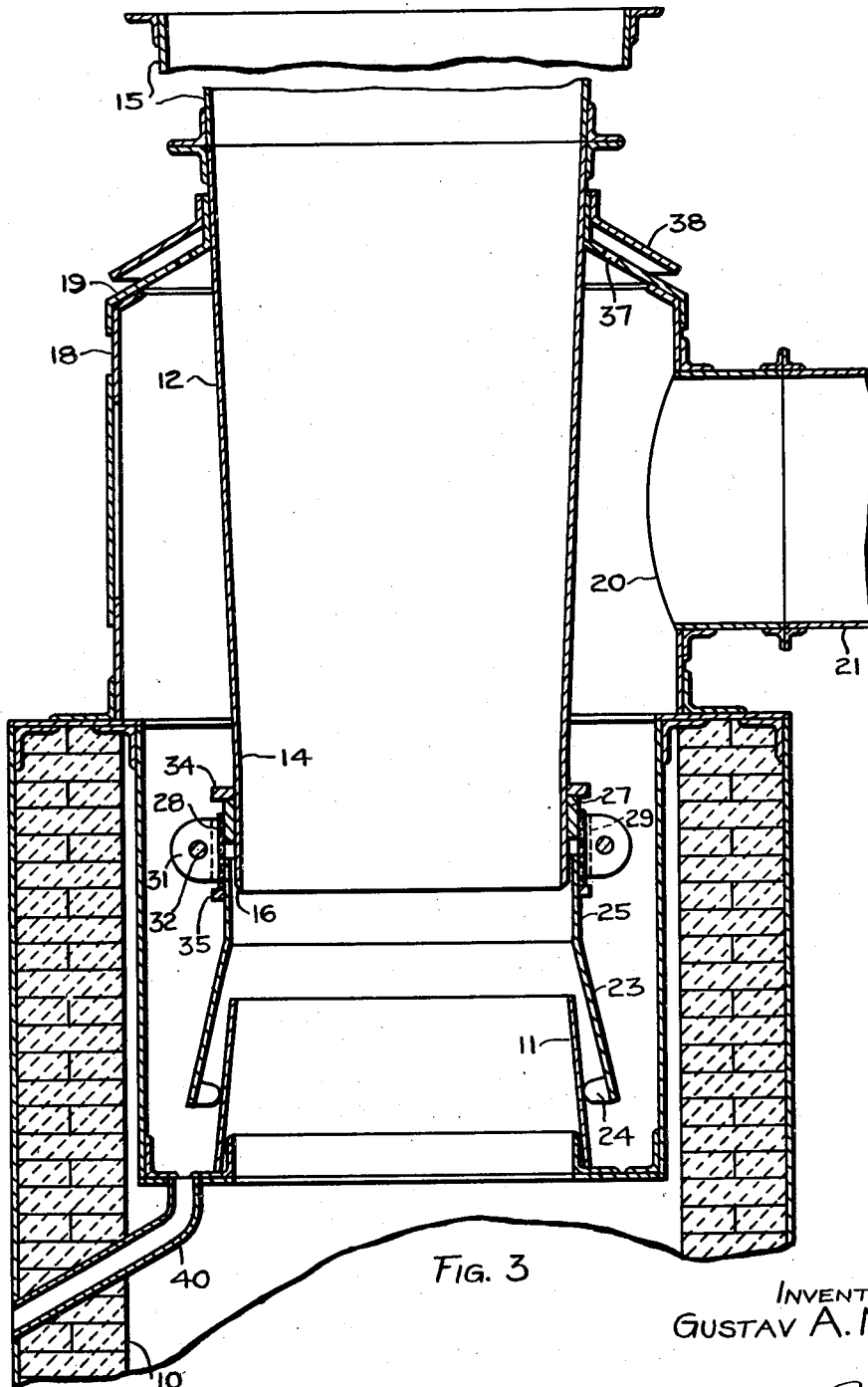
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DRAFT PRODUCING APPARATUS

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9 Claims. (Cl. 230—96)

This invention relates to draft producing apparatus, and more particularly to the construction of ejector stacks arranged to utilize a motive fluid, such as air under pressure, for the entrainment and discharge of another fluid, such as the waste gaseous products of combustion from a furnace or the like.

In one form of ejector stack heretofore proposed the air is delivered into the bottom of the stack in the form of an upwardly converging annular jet which serves to draw the waste gases upwardly through a gas passage beneath and coaxial with the stack. These gases are frequently at a high temperature, and they have caused serious damage to the various metal parts and greatly shortened the life of the apparatus. Moreover, some parts are heated to a greater extent than others, and the resultant unequal expansion has resulted in distortion, reducing the efficiency and causing the operation to be generally unsatisfactory. Further difficulties have been caused by the corrosive action of rain water and condensed moisture on the metal parts.

It is accordingly one object of the invention to overcome these difficulties and to provide an ejector stack capable of handling high temperature gases without damage or distortion.

It is a further object of the invention to provide an ejector stack so constructed and arranged as to reduce to a minimum the corrosion caused by rain water and condensed moisture.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

In accordance with the invention in its preferred form, an expansion joint is provided between the inlet end or throat of the stack and the associated air nozzle, the air nozzle being secured to the gas nozzle in coaxial relation therewith. The inlet portion of the stack is surrounded by a casing into which the air is delivered and from which it flows into the air nozzle. The air flows over the outer surface of the stack to cool the same, and, to enhance this flow, openings may be provided in the casing through which a part of the air may escape to atmosphere. The throat of the stack is preferably made slightly smaller than the gas nozzle so that rain water which enters the stack will flow into the gas flue rather than into the casing. A drain may be connected to the casing to prevent accumulation of condensed moisture therein.

Referring to the drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a vertical section through a draft producing apparatus;

Fig. 2 is a section on the line 2—2 of Fig. 1; and

Fig. 3 is a view similar to Fig. 1 showing a slight modification.

The embodiment illustrated in Fig. 1 comprises a vertical flue 10 through which the hot gaseous products of combustion may escape from a furnace (not shown). On the top of the flue 10 there is mounted an upwardly converging frusto-conical gas nozzle 11. A stack 12 is arranged above the gas nozzle in coaxial relation therewith, these parts being slightly spaced apart so that air may be delivered to the stack for the purpose of entraining the hot gases and discharging them to the atmosphere. The stack 12 comprises a cylindrical portion or throat 14 at its lower end, and an upwardly and outwardly flaring diffuser section 15 which extends from the throat to the top of the stack. The throat 14 has a slightly smaller internal diameter than the top of the gas nozzle 11, and the lower end of the throat is beveled at 16 to form a sharp inner edge, so that any rain water which may enter the stack will pass through the gas nozzle and into the flue 10 where it can do no harm.

The lower portion of the stack 12 is surrounded by a casing 18 which rests upon the flue 10. This casing is generally cylindrical in form and has an upwardly and inwardly sloping upper wall 19 which is secured to the stack. This construction provides a plenum chamber 20 to which air is delivered under pressure from a suitable fan or other means (not shown) through a duct 21, this duct leading to one side of the casing 18. The chamber 20 surrounds the adjacent inlet portion of the stack 12 and overlaps the outer surface thereof for a substantial distance in the direction of flow through the stack.

In order to direct the air from the chamber 20 into the stack for entrainment of the gases, there is provided an upwardly converging frusto-conical air nozzle 23 which is mounted on the gas nozzle 11 in surrounding coaxial relation thereto. The air nozzle 23 is shown provided on its inner surface with spaced lugs 24 which may be welded at assembly to the outer surface of the gas nozzle. The conical angle of the air nozzle is preferably somewhat larger than that of the gas nozzle so that the annular space between these parts converges upwardly. Furthermore, the angle of the air nozzle is such, in relationship

to the sharp lower edge of the throat 14, that the air stream will not impinge upon this edge. This construction avoids the formation of undesirable eddy currents at the entrance of the throat.

5 An expansion joint is provided between the lower end of the stack 12 and the air nozzle 23 so that undue stresses and distortion of the structure with changing temperature conditions may be avoided. For this purpose the air nozzle 23 is
10 formed at its upper end with a cylindrical extension 25 slightly larger in diameter than the lower end of the stack and overlapping this lower end slightly in surrounding relation thereto. A sleeve 27 is welded or otherwise secured to the
15 outside of the stack 12 a short distance above the upper end of the extension 25, this sleeve and the extension having equal outside diameters. A ring 28 of a suitable packing material overlaps both the sleeve 27 and the extension 25 to seal the
20 joint between these parts. This ring is held in place by means of a clamping ring 29 formed in arcuate sections, each section having at its ends outwardly extending apertured lugs 31. The opposing lugs of the respective ring sections are connected by means of bolts 32. In order to prevent the packing ring 28 and the clamping ring 29 from moving out of position axially, there is provided an outwardly projecting flange 34 on the
25 stack 12 above these rings, and a similar outwardly projecting flange 35 on the extension 25 below the rings. These flanges may be welded in position and they are spaced apart a distance somewhat exceeding the width of the packing ring 28 so that there will be ample room for the throat 14 to expand in a downward direction without interference.

When the air inlet duct 21 enters the casing 18 some distance below the upper wall 19 thereof, as in the embodiment illustrated, this tends to form a dead air pocket in the upper part of the chamber 20, and the adjacent portion of the stack may not be cooled to the desired extent. In order to avoid this difficulty, I preferably provide
30 openings 37 in the upper wall 19 near its junction with the stack, and I mount a frusto-conical hood 38 on the stack to overlie these openings and prevent rain water from passing through them. While the apparatus is in operation, a portion of the air supplied to the chamber 20 will
35 escape to the atmosphere through the openings 37, and the resultant flow through the upper portion of the chamber will ensure adequate cooling of the stack.

Under certain conditions of temperature and humidity, moisture may condense from the air which is supplied to the chamber 20, and if this moisture is allowed to remain in contact with the metal surfaces it may cause corrosion thereof. I accordingly prefer to provide a suitable
40 drain pipe 40 which extends from the bottom of the chamber 20 downwardly and outwardly through the wall of the flue 10. This pipe is preferably of small size, to minimize the flow of air outwardly therethrough, and such air flow as does occur will aid in keeping the pipe clear.

In Fig. 3 there is illustrated a slight modification in which the casing 18 is arranged with its lower portion extending downwardly into the flue
45 10. This arrangement will lower the structure by several feet, and is particularly suitable when the apparatus is to be applied to an existing flue of considerable height.

The operation of the invention will now be
50 apparent from the above disclosure. Air is de-

livered under pressure to the plenum chamber 20 by the duct 21 and after flowing downwardly through the chamber it passes upwardly at high velocity through the nozzle 23 and enters the throat 14 in the form of an upwardly converging
5 annular jet. This jet entrains and withdraws hot gases from the flue 10, and discharges them upwardly to the atmosphere through the diffuser section 15. The heat from the gases causes the lower portion of the stack to expand downwardly, but this expansion causes no great stressing or distortion of the structure since the lower end of the stack is free to slide axially in the packing
10 28. The air nozzle 23 is secured directly to the gas nozzle 11, so that these parts are maintained in the desired coaxial relationship. Excessive heating of the stack is prevented by the cooling action of the air flowing through the chamber 20, the holes 37 allowing a slight leakage to maintain a flow in the upper portion of the chamber. Rain water which may flow downwardly along the inner surface of the stack will drop from the sharp lower edge of the stack through the gas nozzle 11 into the flue 10. Any water which may collect in the chamber 20 by reason of condensation can escape through the drain 40.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Draft producing apparatus comprising a nozzle for hot gases, a stack in alignment with the nozzle, an air nozzle surrounding the gas nozzle in spaced relation thereto to direct a jet of air into the adjacent end of the stack and thus entrain the hot gases from the gas nozzle and discharge them through the stack, a casing forming a chamber which communicates with the air nozzle, the chamber surrounding the adjacent inlet portion of the stack and overlapping the outer surface thereof for a substantial distance in the direction of flow through the stack, and means to deliver air under pressure to the chamber and produce a flow of air therethrough in cooling contact with the outer surface of the said adjacent inlet portion of the stack.

2. Draft producing apparatus comprising an upwardly directed nozzle for hot gases, an upright stack above and in vertical alignment with the nozzle, an air nozzle surrounding the gas nozzle in spaced relation thereto to direct a jet of air upwardly into the lower end of the stack and thus entrain the hot gases from the gas nozzle and discharge them upwardly through the stack, a casing forming a chamber which communicates with the air nozzle and surrounds the lower portion of the stack, and means to supply air under pressure to the chamber, the casing having an opening near the top thereof through which a part of the air can escape, thereby maintaining a flow of air through the chamber in cooling contact with the outer surface of the lower portion of the stack.

3. Draft producing apparatus comprising an upwardly directed nozzle for hot gases, an upright stack above and in vertical alignment with the nozzle, an air nozzle surrounding the gas nozzle in spaced relation thereto to direct a jet of air upwardly into the lower end of the stack and thus entrain the hot gases from the gas nozzle and discharge them upwardly through the stack, a casing forming a chamber which communicates with the air nozzle and surrounds the lower portion of the stack, means to supply air under pressure to the chamber, the casing having an opening in its upper wall through which a part of the air

can escape, thereby maintaining a flow of air through the chamber in cooling contact with the outer surface of the lower portion of the stack, and a hood overlying the opening to prevent rain water from passing therethrough.

4. Draft producing apparatus comprising an upwardly directed nozzle for hot gases, an upright stack above and in vertical alignment with the nozzle, the lower end of the stack being somewhat smaller than the upper end of the nozzle so that rain water which enters the stack will drop into the nozzle, and means to direct a jet of air upwardly into the lower end of the stack and thus entrain the hot gases from the nozzle and discharge them upwardly through the stack.

5. Draft producing apparatus comprising an upwardly directed nozzle for hot gases, an upright stack above and in vertical alignment with the nozzle, the lower end of the stack being somewhat smaller than the upper end of the nozzle and the said lower end being beveled to form a sharp inner edge from which rain water which enters the stack will drop into the nozzle, and means to direct a jet of air upwardly into the lower end of the stack and thus entrain the hot gases from the nozzle and discharge them upwardly through the stack.

6. Draft producing apparatus comprising an upwardly directed nozzle for hot gases, an upright stack above and in vertical alignment with the nozzle, the lower end of the stack having a somewhat smaller diameter than the upper end of the nozzle so that rain water which enters the stack will drop into the nozzle, an upwardly converging frusto-conical air nozzle surrounding the gas nozzle in spaced relation thereto to direct a jet of air upwardly into the lower end of the stack and thus entrain the hot gases from the gas nozzle and discharge them upwardly through the stack, and a substantially cylindrical extension projecting upwardly from the air nozzle in surrounding relation to the lower end of the stack.

7. Draft producing apparatus comprising a nozzle for hot gases, a stack in alignment with the nozzle, a casing forming a chamber surrounding the nozzle and the adjacent inlet portion of the stack and overlapping the outer surface of the

said inlet portion for a substantial distance in the direction of flow through the stack, means to deliver air under pressure to the chamber, an air nozzle located within the chamber and secured to the gas nozzle in surrounding relation thereto, the air nozzle being arranged to direct air from the chamber into the stack and thus entrain the hot gases and discharge them through the stack, and means providing a sealed expansion joint between the air nozzle and the adjacent end of the stack.

8. Draft producing apparatus comprising a nozzle for hot gases, a stack having a substantially cylindrical end portion in alignment with the nozzle, a casing forming a chamber surrounding the nozzle and the adjacent portion of the stack, means to deliver air under pressure to the chamber, a frusto-conical air nozzle secured to the gas nozzle in surrounding relation thereto and arranged to direct air from the chamber into the stack and thus entrain the hot gases and discharge them through the stack, and a substantially cylindrical extension projecting from the air nozzle in surrounding relation to the adjacent end of the stack, the stack being free to slide axially within the extension as a result of expansion by heat.

9. Draft producing apparatus comprising a nozzle for hot gases, a stack having a cylindrical end portion in alignment with the nozzle, a casing forming a chamber surrounding the nozzle and the adjacent portion of the stack, means to deliver air under pressure to the chamber, a frusto-conical air nozzle secured to the gas nozzle in surrounding relation thereto and arranged to direct air from the chamber into the stack and thus entrain the hot gases and discharge them through the stack, a cylindrical extension projecting from the air nozzle in surrounding relation to the adjacent end of the stack, a cylindrical sleeve fixed to the stack and slightly spaced from the end of the extension, the sleeve and the extension having equal outside diameters, and a ring of packing material overlapping both the sleeve and the extension to seal the joint between these parts while allowing axial movement of the stack resulting from expansion by heat.

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