Dec. 13, 1949 C. CONE 2,491,000

APPARATUS FOR COOLING THE EXHAUST END OF COMBUSTION TUBES

Filed May 20, 1947

Fig. 1.

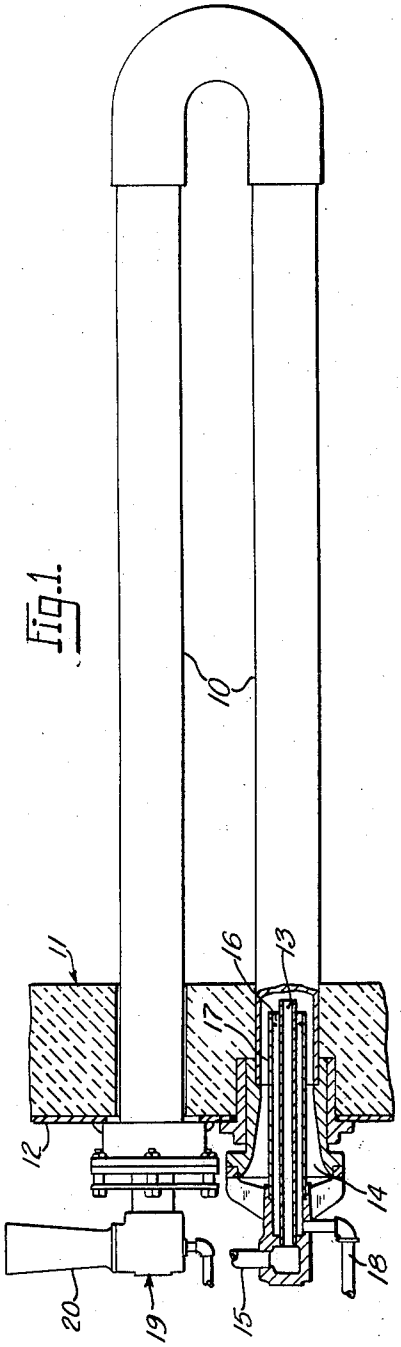
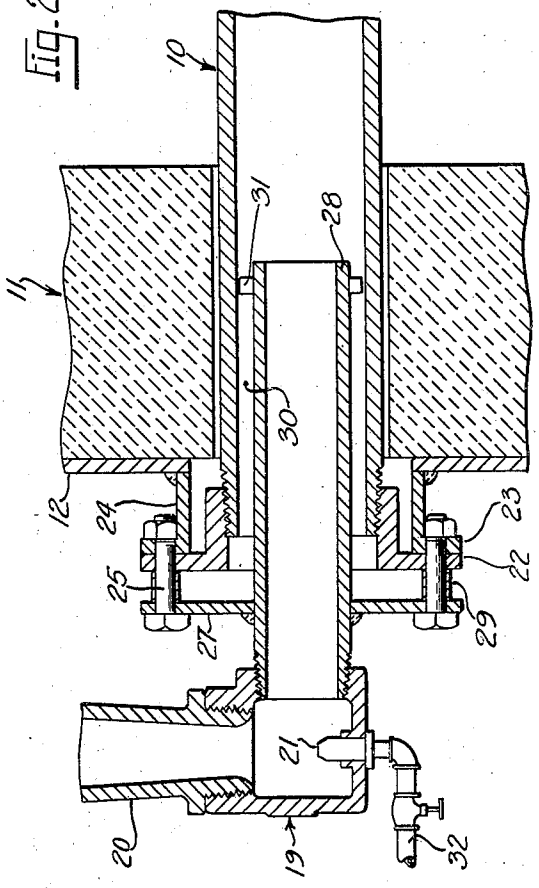



Fig. 2.




INVENTOR.
Carroll Cone
BY Charles A. Lind
ATTORNEY

Patented Dec. 13, 1949 2,491,000

# UNITED STATES PATENT OFFICE

2,491,000

## APPARATUS FOR COOLING THE EXHAUST END OF COMBUSTION TUBES

Carroll Cone, near Toledo, Ohio, assignor to Surface Combustion Corporation, Toledo, Ohio, a corporation of Ohio

Application May 20, 1947, Serial No. 749,387

4 Claims. (Cl. 126—91)

1

The present invention relates to heating apparatus for use with heat treating furnaces for producing heat therein without contaminating the furnace chamber with products of combustion, the heating element comprising an internally fired tube whose ends are outside of the furnace chamber. Where the ends of the heating tube extend out of the furnace chamber, infiltration of air into the chamber is prevented by gas-tight joints. However, because of the relatively high temperature of the spent heating gases at the exhaust end of the tube, special precautions must be taken to prevent overheating of the connection between the furnace wall and the projecting exhaust end of the tube. The object of the present invention is to provide improvements in means for maintaining the connection between the furnace wall and projecting exhaust end of the tube relatively cool and more particularly to provide a relatively simple and practical air cooling system for said connection.

For a consideration of what I consider to be novel and my invention, attention is directed to the following specification and the claims appended thereto.

In the accompanying drawing—

Fig. 1 shows an internally fired heating tube of hair-pin type so that both the firing and exhaust ends of the tube extend out of the furnace chamber through one and the same wall portion thereof, the improvement at the exhaust end of the tube being in elevation and the firing end of the tube being in section.

Fig. 2 is an enlarged sectional view of the improvement at the exhaust end of the heating tube.

The heating tube is indicated at 10, the tube for illustrative purposes being shown as of hair-pin type so that its ends extend through one and the same wall 11 of a furnace chamber. At its outer side the wall 11 includes a metal plate 12 which constitutes part of the furnace casing.

The tube 10 is fired in a manner to avoid localized heating, and to this end a stream of fuel gas undiluted with air is introduced into the front end or mouth 14 of the tube by a burner tube 13 coaxial therewith, the burner tube projecting some distance into said mouth. Air for combustion enters the tube 10 through the mouth 14 thereof, the latter being open to the atmosphere. The main fuel supply pipe is indicated at 15. The fuel issuing from the burner tube is ignited by flame issuing from a pilot 16 to which combustible mixture is supplied by a tube 17 around the burner tube 13, the supply line for said mixture being indicated at 18. The burner

2

arrangement thus far described is well known in the art and, therefore, need not be further described.

A relatively strong draft is maintained through the heating tube 10 by a suction producing device 19 which is coupled to the exhaust end of the tube in a manner presently described so that the fuel from the burner tube 13 and combustion supporting air from the mouth 14 may be said to be drawn into the tube by said draft. The device 19 will ordinarily be an aspirator consisting of an entraining tube 20 into which motive fluid such as compressed air is discharged by a jet orifice nozzle 21.

The exhaust end of the heating tube 10 is anchored to the furnace casing 12 by means comprising a flange 22 carried by the terminal end of the tube, the back side of this flange being adapted to seat gas-tight against a flange 23 at the outer end of a barrel 24 whose inner end is welded gas-tight to the furnace casing 12, the two flanges being held in abutting relation by bolts 25, the latter being shown as of a length to extend through a disc 27 spaced from the front side of the tube flange 22 by spacer elements 29.

The disc 27 constitutes a supporting means for a tube 28, which projects coaxially into the exhaust end of the heating tube a substantial distance inwardly from the terminal flange 22 on the latter but not far enough to extend into the heating portion of the tube or in other words not beyond the plane of the inner side of the furnace wall 11. The tube 28 is substantially smaller than the discharge end of the heating tube so as to provide an annular air passage 30 therebetween. Centering fingers on the inner end of the tube 28 are indicated at 31. The outer end of the tube 28 is coupled to the suction producing device 19; hence, the suction produced by the latter will draw the waste combustion gas into the outer end of the tube 28 and will draw cooling air into the outer end of the combustion tube 10 by way of the annular passage 30, hence overheating of the connection between the exhaust end of the combustion tube 10 and the furnace casing 12 is prevented in a relatively simple and practical manner. It will, of course, be understood that only a relatively small portion of the partial vacuum produced by the suction producing means 19 is utilized to draw air into the tube 10 by way of the annular space or passage 30.

By adjusting a throttling valve in the supply line 32 leading to the nozzle 21 the degree of suction effective in the tube 28 may be regulated as circumstances require and by reducing the

spacing between the disc 27 and the flange 22 on the terminal end of the tube 10, the effective inlet area of the annular passage 30 may be decreased as conditions may require.

It will, of course, be understood that the air drawn into the passage 30 will be drawn into the inner end of the suction tube 28 along with the oncoming waste heating gases and thus partially cool the latter before they reach the aspirator 19.

What I claim is:

1. In apparatus of the class described, the combination which comprises a first tube forming an elongate combustion chamber, a furnace wall having an opening through which the exhaust end of the tube extends, means forming a gas-tight connection between the outer side of said wall and the projecting end of said tube, a second tube extending a relatively short distance into the projecting exhaust end of the first tube in spaced relation to form between the two tubes an annular passage, and a suction producing device coupled to the outer end of the second tube for drawing waste combustion gas into the second tube and cooling air into said annular passage.

2. The combination set forth in claim 1, which includes a disc on the outer portion of the second tube, and means for varying the spacing between said disc and the front end of the annular passage.

3. In apparatus of the class described, the combination which comprises a first tube forming an elongate combustion chamber, a furnace wall having an opening through which the exhaust end of said tube extends, the exterior side of said wall comprising a metal casing beyond which the said end of the tube extends, means including said casing forming a gas-tight connection between said wall and the projecting end of said tube, a second tube extending a relatively short distance into the exhaust end of the first tube in spaced relation to form between the two tubes an annular passage, and suction producing means coupled to the outer end of the second tube for drawing waste combustion gas into the second tube and cooling air into said annular passage.

4. In the combination set forth in claim 3, the said gas-tight connection comprising a barrel extending from said casing coaxial with the exhaust end of the first tube, a flange at the outer end of said barrel, and a complemental flange at the exhaust end of the first tube for seating against the flange on the barrel.

CARROLL CONE.


REFERENCES CITED

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

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,189,623 | Reid | July 4, 1916 |
| 2,077,043 | Gehnrich | Apr. 13, 1937 |