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APPARATUS FOR SUPPLYING AIR TO FUEL BURNER

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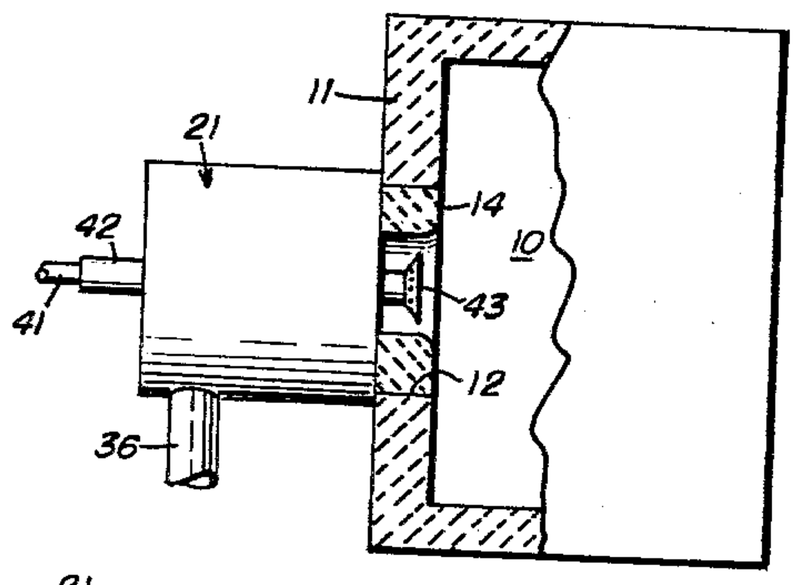

FIG. 1

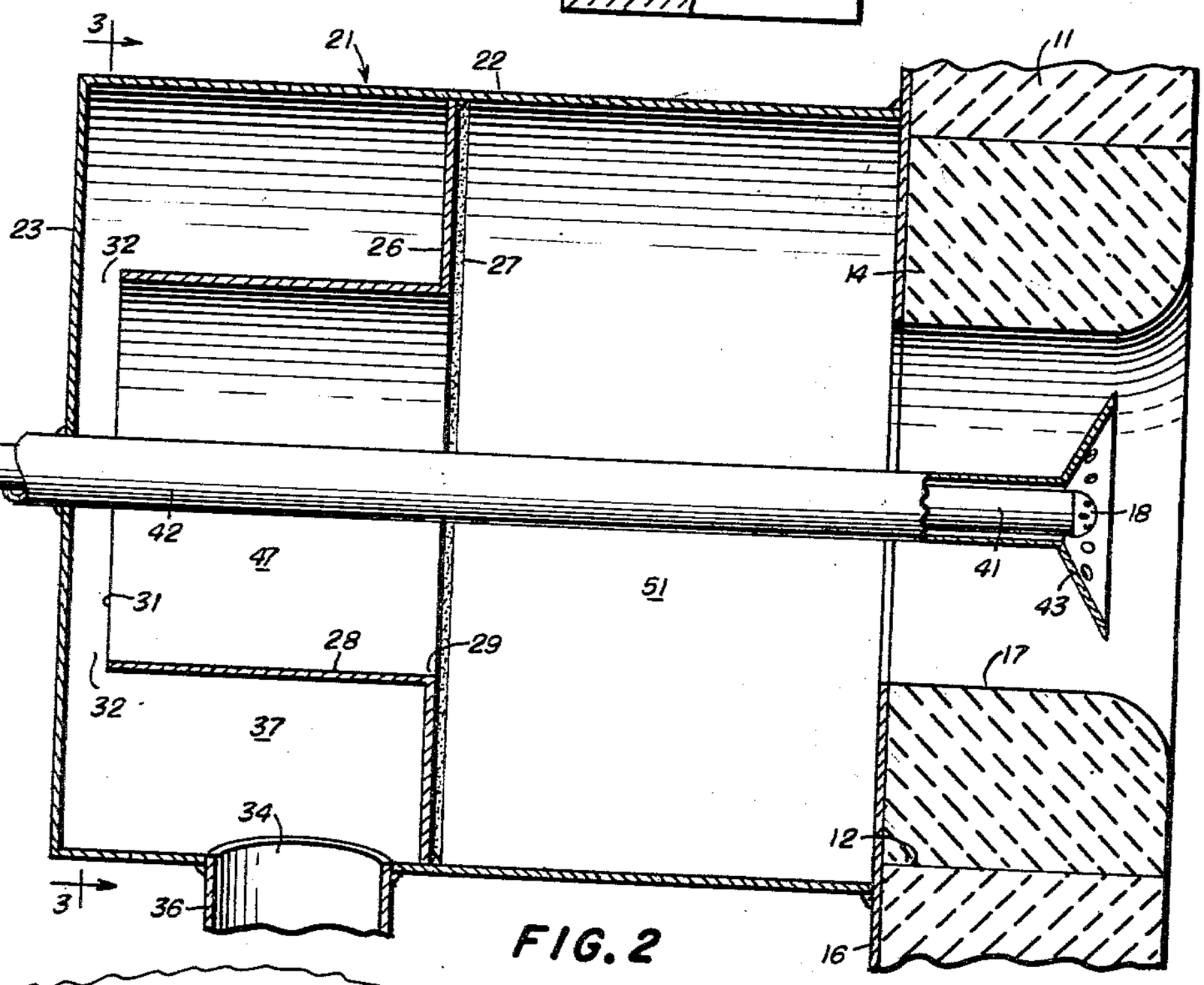

FIG. 2

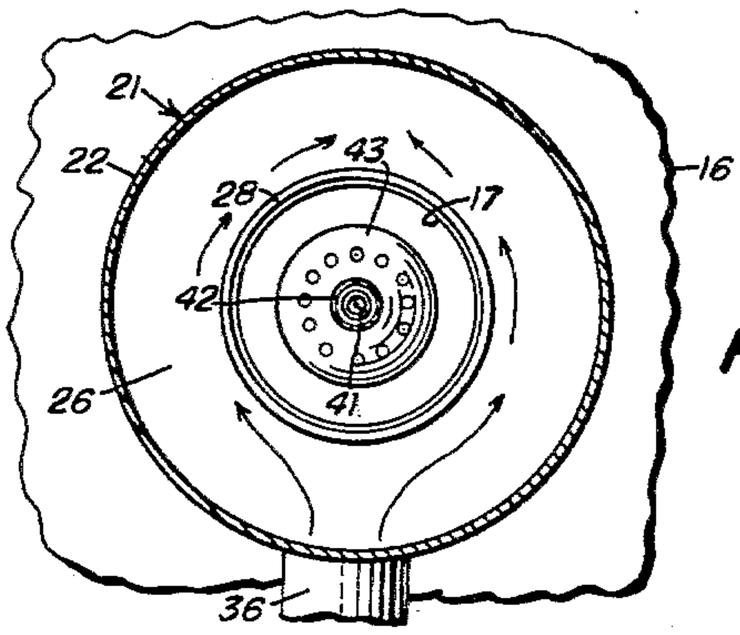

FIG. 3

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APPARATUS FOR SUPPLYING AIR TO FUEL BURNER

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The present invention relates to the combustion of fuel within a furnace chamber wherein the pressure is greater than atmospheric and the invention more specifically pertains to means for supplying air into the presence of a burner and into the furnace with such structure providing for substantially uniform distribution of the air to the portal of an opening in the furnace wall and through which the air moves into the presence of the burner and in proceeding into the furnace chamber.

Equipment has been employed in the past for firing into a pressurized furnace chamber but such burners do not provide a satisfactory flame condition. The known apparatus lacks means for dealing with the inertia of the entering air so that prior devices create an uneven distribution of air across the area of the burner opening. The absence of uniform distribution of air produces uneven burning of the fuel and while an unstable flame condition can be tolerated in some operations such a burner equipment is not satisfactory in process industries such as employed for the recovery of sulphur from gases such as hydrogen sulphide. In the known Klaus process the entire stream of hydrogen sulphide is admitted to the presence of the burner but the quantity of air is limited to one-third of that required to burn the hydrogen sulphide. Thus but one-third of the sulphur content of the hydrogen sulphide is converted to sulphur dioxide. The sulphur dioxide produced is catalytically combined with the remaining hydrogen sulphide to produce sulphur and water vapor. A burner for carrying out such a process must provide for equal distribution of the air to the hydrogen sulphide and to the presence of the burner.

It is accordingly an object of the invention to provide housing means into which air is admitted under pressure greater than that of the furnace chamber and to provide means within the housing means for dissipating the inertia of the air stream supply and to provide structure forming an orifice area which serves to provide a pressure drop within the housing means as the air moves into a storage chamber having such a cubical content and so disposed as to provide for uniform distribution of the air flowing into the presence of the burner head and into the furnace chamber.

Other objects and features of the invention will be appreciated and become apparent particularly to those skilled in the art to which the invention pertains as the present disclosure proceeds and upon consideration of the following detailed description taken in conjunction with the annexed drawing wherein a successful embodiment of the invention is disclosed.

In the drawing:

FIG. 1 is a side elevational view of apparatus exhibiting the invention shown in association with a furnace which is shown partly in section.

FIG. 2 is an enlarged sectional view of housing means for the air supply and for delivering the air to the portal of the opening in the furnace wall.

FIG. 3 is a transverse sectional view on a smaller scale and taken on the line 3—3 of FIG. 2.

The invention is directed to a fuel burner and housing means associated therewith for controlling and guiding air to the burner and furnace chamber and while the assembly has particular utility in a process of recovering sulphur from hydrogen sulphide the apparatus is useful for a desired operation wherein heat is to be developed in a chamber having pressure greater than atmospheric. Referring to the drawing a furnace chamber is diagrammatically represented at 10 having appropriate walls enclosing the fire box. The wall 11 of the furnace is provided with a circular opening 12 for accommodating a ceramic tile member which may be regarded as part of the furnace wall. The outer face of the furnace wall 11 and the tile member 14 may be covered in a conventional manner with sheet metal 16. A substantially cylindrical shaped opening 17 is provided in the tile for passage of air into the furnace chamber 10 and for accommodating a burner head 18 and attachments therefor. The tile member 14 may be of known construction having an outwardly flared exit end portion for the opening 17. The pressure within the chamber 10 is significantly above atmospheric pressure.

Housing means 21 which is advantageously of cup-shape fits over and encases the upstream end of the opening 17 in the furnace wall. A cylindrical skirt 22 of the housing means 21 may be secured to the metal covering 16 by welding or in any suitable manner so as to provide a closed joint between the housing means and the furnace wall. The axis of the cylindrical shaped skirt 22 is desirably aligned with the axis of the opening 17. A disc-shaped end wall 23 closes the upstream end of the skirt 22.

A transverse partition 26 is secured within the housing means 21 and the perimeter of the partition 26 is attached to the inner surface of the skirt 22 so as to prevent movements of air therebetween. Weld metal applied in an annular manner indicated at 27 may be employed to hold the partition 26 in place and to prevent movement of air between the perimeter of the partition 27 and the interior of the skirt 22. A tubular shaped baffle 28 is carried by the partition 26 and extends upstream therefrom. The baffle 28 is desirably of cylindrical shape and may be formed integral with the partition 26. The axis of the tubular shaped baffle 28 is desirably in alignment with the axis of the housing skirt 22 and in alignment with a projection of the axis of the opening 17. The partition 26 has a centrally located opening 29 which extends throughout the open interior area of the baffle 28. The upstream or free end 31 of the baffle 28 is spaced from the inner face of the end wall 23 to provide an annular orifice 32 between the end of the cylindrical wall of the baffle 28 and the end wall 23. The area of the orifice 32 is but a fraction of the area of the opening 17.

An inlet opening 34 is provided in the housing means 21 and within the skirt portion 22 upstream of the partition 26. A conduit 36 provides for guiding air through the inlet opening 34 under pressure materially above atmospheric pressure and at pressures above those in the furnace chamber 10. The conduit 36 may be welded or otherwise secured to the cylindrically shaped skirt of the housing means 21.

The burner head 18 may take the form of a nozzle for liquid fuel which is delivered through a pipe 41 and which is supported by a guide tube 42. A frustoconical shield 43 may be provided and supported on the guide tube 42 in operative relationship to the burner head 18. The discharge ports for the atomized fuel may be of any conventional type but are desirably disposed to discharge the fuel in a conical pattern which diverges in proceeding downstream from the burner head. The guide tube 42 may be supported in any suitable manner and the upstream end extends through and may be attached to the end wall 23.

In operation air under pressure is supplied through the conduit 36 and passes through the inlet opening 34. The area of the opening 34 is relatively small and the velocity of the air entering the receiving chamber 37 may be as great as a thousand and eighty feet per sec-

ond. The inertia of the entering air stream carries the air into engagement with the peripheral surface of the baffle 28. The air stream is diverted principally in two directions as indicated by arrows in FIG. 3. One portion of the air moves along and around one segment of the outer annular surface of the baffle 28 and another portion of the incoming air moves in an opposite direction along and about an opposite segment of the outer annular surface of the baffle 28. The two air streams meet at the zone diametrically opposite the inlet opening 34. The inertia of the entering air is virtually dissipated in collision with the baffle 28. The air accommodated in the receiving or annular chamber 37 moves through the orifice 32 which has a small cross sectional area in relation to the opening 17 in the furnace wall. Any inertia of the air stream remaining after collision with the baffle 28 is dissipated as a consequence of the pressure drop across the orifice 32.

The pressure within the baffle 28 or within the chamber 47 is less than the pressure within the annular chamber 37. The air moves through the central opening 29 in the partition 26 into a chamber 51 within the housing means. The interior of the housing means 21 forms the chamber 51 and the pressure within the chamber 51 is less than the pressure in the chamber 47. The pressure within the furnace chamber 10 while above atmospheric pressure is less than the pressure within the chamber 51. Thus air moves from the chamber 51 through the opening 17 into the presence of the material undergoing heat treatment and into the presence of the fuel burner head 18. The annular chamber 51 serves to slow down movement of air moving furnaceward. The chamber 51 thus serves to stabilize the pressure immediately upstream of the zone of use and functions as a "settling chamber" for the air prior to the delivery to the portal of the opening 17. Air is thus present in the chamber 51 with sufficient volume around the tile member 14 that the air pressure is substantially uniform around the periphery of the opening 17 and remains at substantially uniform pressure around the entire mouth of the burner opening 17. Thus there is uniform movement of the air through the opening 17. Air is thus delivered uniformly to the presence of the burner head 18.

The uniform flow of air through the opening 17 results from the presence and disposition of the baffle 28 and the partition 26 in relation to the volume of the chamber 51 and as a result of the fact that the area of the orifice 32 is but a fraction of the net area of the opening 17. The inertia of the entering air stream is dissipated as a result of collision with the baffle 28 and as a consequence of the pressure drop across the orifice 32. The inertia of the entering air stream is thus prevented from influencing the pressure at the portal of the burner opening 17.

While the invention has been described with reference to one burner head and with regard to the representation of a furnace chamber and with respect to particular structural characteristic of the housing means for delivering air to the burner head it will be appreciated that changes may be made in the various elements as well as the overall assembly. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. Apparatus for supplying air into a furnace chamber comprising, means including a furnace wall forming said chamber, said wall having an opening therethrough, a burner head mounted within said opening, means for supplying combustible fuel to said burner head, a cup-shaped housing secured to said wall encasing said opening said housing including a cylindrical shaped skirt of larger diameter than said opening and an end wall

spaced from said furnace wall closing said skirt, a partition within the housing spaced from said end wall and spaced from said furnace wall to provide a settling chamber within the housing defined by the partition and the furnace wall and said skirt, a cylindrical shaped baffle within said housing supported at one end by said partition and extending upstream therefrom with its other end adjacent but spaced from said end wall providing an annular orifice between the end wall and said baffle of smaller area than the area of said opening, said partition having an opening therethrough substantially throughout the internal area of said baffle, the exterior of said baffle and the interior of said skirt and said end wall defining an annular chamber upstream of said partition, means for guiding air at pressures greater than atmospheric into said annular chamber in a direction generally radially of said baffle and into impingement with the periphery of said baffle whereby the energy of the air stream is virtually dissipated within said annular chamber and any remaining energy is dissipated as a consequence of the pressure drop across said orifice as the air moves from the annular chamber into the interior of said baffle and thence into said settling chamber, and said settling chamber having a volume greater than the volume of the annular chamber and greater than the volume of the interior of the baffle to provide a supply of air within the settling chamber substantially free of turbulence to provide uniform flow of air through all increments of the opening in the furnace wall.

2. Apparatus for supplying air into a furnace chamber according to claim 1 wherein the axis of the housing and the axis of the baffle substantially coincide with a projection of the axis of the opening in the furnace wall.

3. Apparatus for developing heat in a furnace chamber comprising, a furnace wall having an opening therethrough, a burner head mounted within said opening, means for supplying combustible fuel to said burner head, a housing secured to said wall and encasing said opening, said housing having a larger cross section than said opening, a partition within the housing spaced from said furnace wall to provide a settling chamber within the housing between the partition and the furnace wall, a substantially cylindrical shaped baffle within said housing supported at one end by said partition and extending upstream therefrom, said partition having an opening therethrough within said baffle, the exterior of said baffle and the interior of said housing providing a receiving chamber upstream of said partition, said baffle and said housing providing an orifice between said chamber and the interior of said baffle of smaller area than the area of said opening, means for guiding air at pressures greater than atmospheric into said receiving chamber in a direction generally radially of said baffle and guiding the air into impingement with the periphery of said baffle whereby the energy of the air stream is substantially dissipated within said receiving chamber and any remaining energy is dissipated as a consequence of the pressure drop across said orifice as the air moves into said settling chamber, said settling chamber having a volume greater than said receiving chamber and a volume greater than the interior of the baffle to provide a supply of air within the settling chamber substantially free of turbulence to provide uniform flow of air through all portions of said opening in the furnace wall.

4. Apparatus for developing heat in a furnace chamber comprising, a furnace wall, said wall having an opening therethrough, a burner head mounted within said opening, means for supplying combustible fuel to said burner head, a housing secured to said wall and encasing said opening, said housing having a larger cross section than said opening, a partition within the housing spaced from said furnace wall to provide a settling chamber within the housing between the partition and the fur-

nace wall, a substantially cylindrical shaped baffle within said housing, the exterior of said baffle and the interior of said housing providing a receiving chamber upstream of said partition, means providing an orifice extending from said receiving chamber into said settling chamber, means for guiding air at pressures greater than atmospheric into said receiving chamber in a direction generally radially of said baffle and guiding the air into impingement with the periphery of said baffle whereby the energy of the entering air stream is virtually dissipated within said receiving chamber whereby the air moves through said orifice into said settling chamber, and said settling chamber having a volume greater than the volume of said receiving chamber to provide a supply of air within the settling chamber substantially free of

kinetic energy to provide a uniform flow of air through said opening in the furnace wall.

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