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E. M. BASSLER

KILN AND BURNER THEREFOR

Filed March 22, 1920

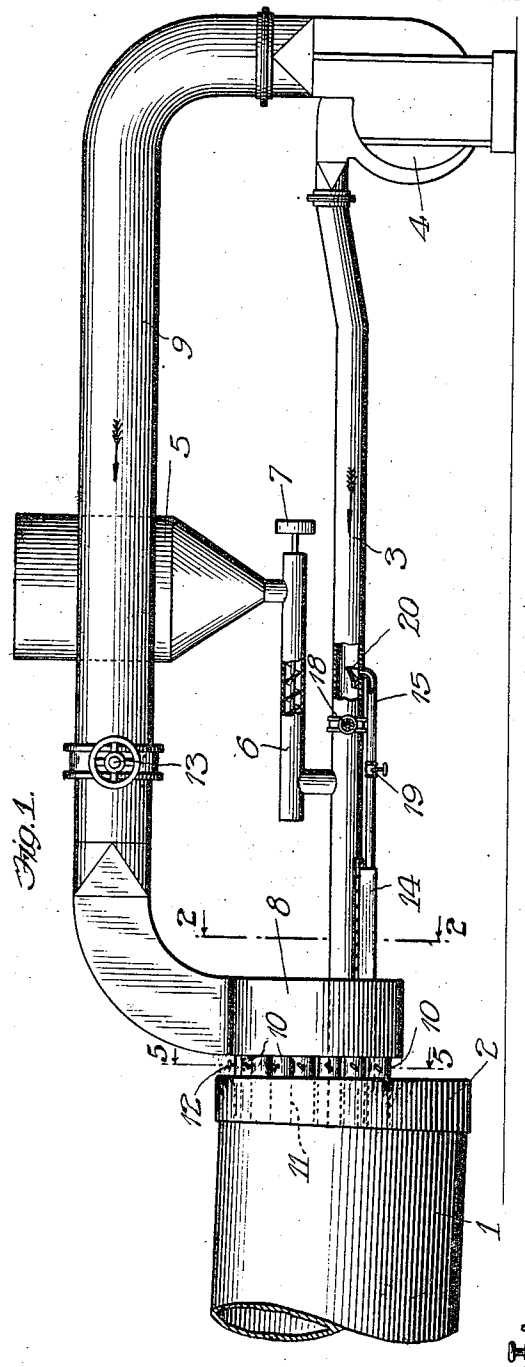


Fig. 1.

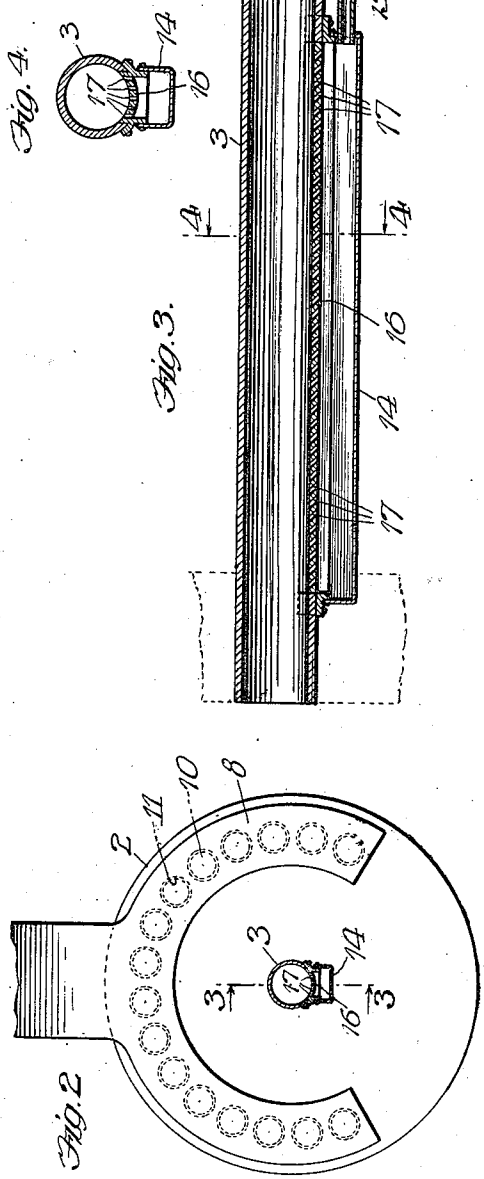


Fig. 2.



Fig. 4.



Fig. 3.

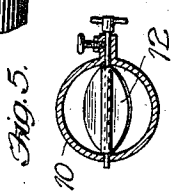


Fig. 5.

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# UNITED STATES PATENT OFFICE.

EDWIN M. BASSLER, OF MILWAUKEE, WISCONSIN.

## KILN AND BURNER THEREFOR.

Application filed March 22, 1920. Serial No. 367,624.

*To all whom it may concern:*

Be it known that I, EDWIN M. BASSLER, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Kilns and Burners Therefor, of which the following is a specification.

This invention relates to kilns and relates particularly to burners therefor, in which pulverized coal is used for fuel.

Heretofore, in accordance with the common standard practice, the pulverized coal is discharged into the kiln through a fuel supply pipe by means of an air blast of relatively high pressure and velocity, the pulverized coal being discharged into said fuel supply pipe from a bin or other source of supply by means of a screw conveyor or other suitable means.

The volume and velocity of the air used for injecting the coal is varied to suit local conditions, the amount of air introduced being approximately only twenty-five per cent of the volume of air necessary for complete combustion of the coal used. The additional air necessary to produce complete combustion of the coal introduced into the kiln is supplied by induced stack draft and enters the kiln through various openings. This method of introducing what may be referred to as the secondary air supply is at best haphazard, being subject to all changes of draft produced by atmospheric conditions, direction of the wind, etc., and cannot be controlled with any degree of accuracy. Such control as is possible is effected by regulation of the air blast in the fuel supply pipe and the stack draft, by means of valves or dampers.

The use of too much air tends to reduce the temperature in the kiln and requires the use of an excess of fuel to produce the desired temperature therein, while the use of too little air causes the generation of gases which are not consumed until after they reach the stack, where they combine with additional air to complete combustion. This also results in waste of fuel, loss of production and inferior quality of the resulting clinker due to the reducing action of the flame in connection with the unburned coal and coke coming into contact with the hot cement clinker without sufficient air to effect oxidation, the reducing action thereof affecting the iron and sulphur content of the clinker, and impairing the color and the soundness of the finished product.

The object of the present invention is to overcome the foregoing objectionable features by eliminating, so far as possible, all openings in the kiln through which leakage of air may be induced by the stack draft and providing means for supplying air to the kiln, which may be controlled and adjusted so as to supply a volume of air to the kiln proportioned to effect complete combustion of the fuel coal supplied thereto.

In accordance with what I now consider to be the preferable embodiment of my invention, the pulverized coal used for fuel is supplied to the kiln through a fuel supply pipe by means of a current of air of relatively high pressure. As previously stated, the volume of high pressure air thus admitted to the kiln is much less than is required to effect complete combustion of the pulverized coal, and additional air of relatively low pressure is admitted to the kiln through separate pipes which communicate with a header adapted to be connected with a source of air supply, said air admission pipes preferably forming a series arranged in the arc of a circle adjacent to the shell of the kiln. Each of said air admission pipes is controlled by a valve or damper whereby the quantity of air admitted therethrough may be separately adjusted and regulated. Preferably, also, the pipe through which air is supplied to the header with which said air supply pipes communicate, is also provided with a gate or valve by means of which the volume of air supplied to said header may be regulated to meet varying conditions of atmosphere, direction and velocity of wind, etc.

My invention also comprises the various other features, combinations of features and details of construction hereinafter described and claimed.

In the accompanying drawings, in which my invention is fully illustrated,

Figure 1 is a side view of a kiln equipped with a burner of my invention.

Figure 2 is a sectional end view thereof on the line 2—2 of Fig. 1

Figure 3 is a sectional view of the discharge end of the fuel supply pipe on the line 3—3 of Figure 2, on an enlarged scale.

Figure 4 is a sectional view of the fuel supply pipe on the line 4—4 of Fig. 3; and

Figure 5 is a sectional view of one of

the secondary air supply pipes on the line 5—5 of Fig 1.

In the accompanying drawings, I have shown my invention and improvements as applied in use to a usual form of cement kiln comprising a shell indicated at 1, which is rotatably mounted at a small angle to the horizontal, the inclination thereof being downwardly towards its discharge end; a closure 2 for the discharge end of the shell 1, said closure being stationary and being made of suitable refractory material, as firebrick or the like; a fuel supply pipe 3, through which pulverized coal is adapted to be delivered into the kiln by a current of air of sufficiently high pressure and velocity to form a vehicle for said pulverized coal; a blower 4 adapted for supplying air under pressure to said fuel supply pipe; a bin 5 for containing the powdered coal to be used as fuel; and a screw conveyor 6 connected to the lower end of the hopper shaped bottom of the bin 5, adapted to discharge the pulverized coal from said bin into the fuel supply pipe 3, said screw conveyor being driven from a suitable source of power, not shown, by a belt applied to a pulley 7 secured to the projecting end of the shaft of the conveyor screw, or other means.

All of the foregoing features are old and well known in the art, and, excepting as hereinafter particularly described, may be of any usual or approved construction and will readily be understood by persons familiar with the art without a description thereof in detail.

As stated, the air entering the kiln through the fuel supply pipe 3 is only about twenty-five per cent of the total volume of air necessary for effecting complete combustion of the fuel supplied to the kiln, and to provide the additional air necessary to effect complete combustion of the fuel and for regulating the quantity of air as nearly as practicable, to the exact amount necessary to produce complete combustion, I provide what may be referred to as a secondary air supply, preferably of relatively low pressure and velocity. As shown, the means for supplying such secondary air consists of a header 8 supported adjacent to the closure 2 of the kiln and connected with a blower by means of a pipe 9.

In what I now consider its preferable form, the header 8 forms a segment of an annular receptacle, and may be described in a general way as substantially horse-shoe shaped. Air under pressure is adapted to be discharged from the header 8 into the rear or discharge end of the kiln by means of pipes 10, which are secured in the wall of said header and the outer ends of which extend into holes 11 formed in the closure 2 of the kiln. As shown, there is a considerable number of the pipes 10 arranged in a series arranged in an arc of a circle and which discharge into the interior of the shell of the kiln closely adjacent to the walls of said shell.

Each of the pipes 10 is controlled by a valve or damper 12 which affords convenient means for regulating the effective size or area of the pipe opening and which, in use, is designed to be secured in fixed adjustment by means of a set screw or other means.

The valves or dampers 12 in the pipes 10 are provided primarily for the purpose of proportioning the volume of secondary air to the volume of high pressure air discharged into the kiln through the fuel supply pipe 3, and, in operation, their adjustment will be substantially permanent or will be changed only at considerable intervals. The volume of air admitted to the kiln through the pipe 9 to meet varying conditions of atmosphere, wind, etc., is adapted to be controlled by a gate or valve indicated at 13.

Preferable means for supplying high and low pressure air to the kiln consists of a compound blower, indicated at 4, the pipe 9 being connected to the discharge opening of the first or low pressure unit of said blower and the pipe 3 to the discharge opening of the second or high pressure unit therefore. Fans suitable for the purpose may be purchased commercially or can be readily supplied by persons skilled in the art, and said fan is not, therefore, herein shown or described in detail.

If for any reason desired, my invention contemplates the use of separate blowers for supplying high and lower pressure air to the kiln.

It is found in practice that the pulverized fuel delivered into the fuel supply pipe 3 by the screw conveyor 6 has a tendency to settle and collect at the bottom of said fuel supply pipe adjacent to its discharge end, thereby choking said pipe and destroying the balance between the high pressure and the low pressure air. To overcome this objectionable feature, I provide for discharging jets of air upwardly through the bottom of the section of said pipe where said coal tends to deposit, said air jets being preferably directed at an angle upwardly and towards the discharge end of said fuel supply pipe. Simple means for this purpose consists of a jacket 14 on the pipe 3, which is connected with said pipe 3 by a pipe 15, which communicates with said pipe 3 between the blower 4 and the point where the conveyor 6 discharges into said pipe. Also, to provide for directing the jets at an an angle upwardly and towards the discharge end of the pipe 3, the jacket 14 preferably comprises a plate 16 fitted to the outside of the pipe 3, said pipe 3 being cut away beneath said jacket. Said plate 16 is

of such thickness, say one-quarter of an inch, that jet orifices 17, inclined at a desired angle to give the air jets discharged therefrom a desired direction, may be formed therein.

The pipe 3 is controlled by a valve 18 positioned between the points at which the pipe 15 leading to the jacket 14 and the screw conveyor 6 communicate therewith, thereby providing not only for regulating the volume of air passing through said fuel supply pipe, but also providing for diverting a portion of air from the pipe 3 into the pipe 15 and thence into the jacket 14, where it is again discharged into the fuel supply pipe in the form of air jets in the manner described. Preferably, also, the pipe 15 is controlled by a valve 19.

Also, if desired, my invention contemplates the use of a lip or wing 20 on the inside of the pipe 3 for diverting air from said pipe into the pipe 15.

I claim:

1. The combination of a kiln and a burner therefor, said burner comprising a fuel supply pipe, means for creating a current of air therethrough forming a primary air supply, a header, pipes which connect said header with the interior of the kiln and are spaced radially from said fuel supply pipe, and means for supplying air under pressure to said header forming a secondary air supply, said secondary air supply being of relatively low pressure and large volume as compared with the primary air supply, substantially as described.

2. A kiln and a burner therefor as specified in claim 1, in which the secondary air supply pipes discharge into the kiln adjacent to the shell thereof, substantially as described.

3. A kiln and a burner therefor as specified in claim 1, in which the fuel supply pipe and the secondary air supply pipes are arranged substantially centrally and adjacent to the shell of the kiln, respectively, substantially as described.

4. A kiln and a burner therefor as specified in claim 1, in which the secondary air supply pipes are arranged in series, the extreme pipes of which are spaced a considerable distance above the bottom of the shell of the kiln, substantially as described.

5. A kiln and a burner therefor as specified in claim 1, comprising means for delivering pulverized fuel into the fuel supply pipe, and means for preventing the deposit of fuel therein, comprising a jacket which encloses the under side of said fuel supply pipe, a wall separating said jacket and fuel supply pipe provided with jet openings, a pipe which connects said jacket with the fuel supply pipe between the means for supplying air under pressure to said fuel supply pipe and the point at which fuel is delivered into the same, and means for diverting a sufficient volume of air from said fuel supply pipe into said jacket to create a differential pressure in said jacket greater than the pressure in the section of the fuel supply pipe which said jacket encloses, substantially as described.

6. A kiln and a burner therefor as specified in claim 5, in which a valve is connected into the fuel supply pipe between the points where the pipe connecting said fuel supply pipe and jacket communicates with said fuel supply pipe and fuel is delivered thereto, substantially as described.

7. A kiln and a burner therefor as specified in claim 6, in which there is a lip in the fuel supply pipe adapted to divert air therefrom into the pipe which connects said fuel supply pipe and jacket, substantially as described.

In testimony that I claim the foregoing as my invention, I affix my signature this 12th day of March, 1920.

EDWIN M. BASSLER.