Nov. 10, 1931. V. G. LEACH 1,830,798

DEVICE FOR ELIMINATING HOPPER SMOKE

Filed Dec. 21, 1929 2 Sheets-Sheet 1

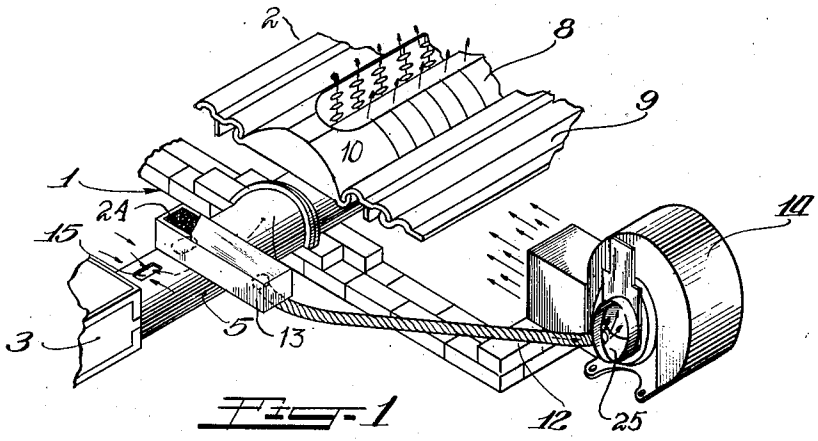
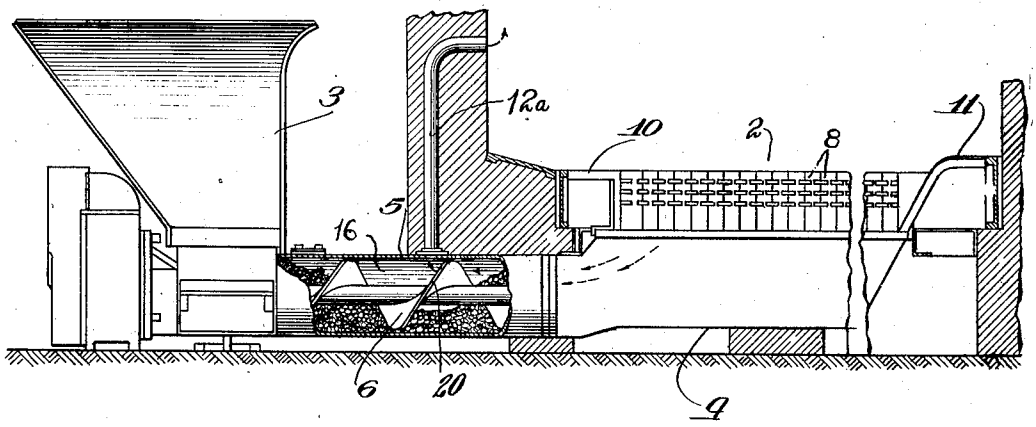


Fig-1

Fig-2



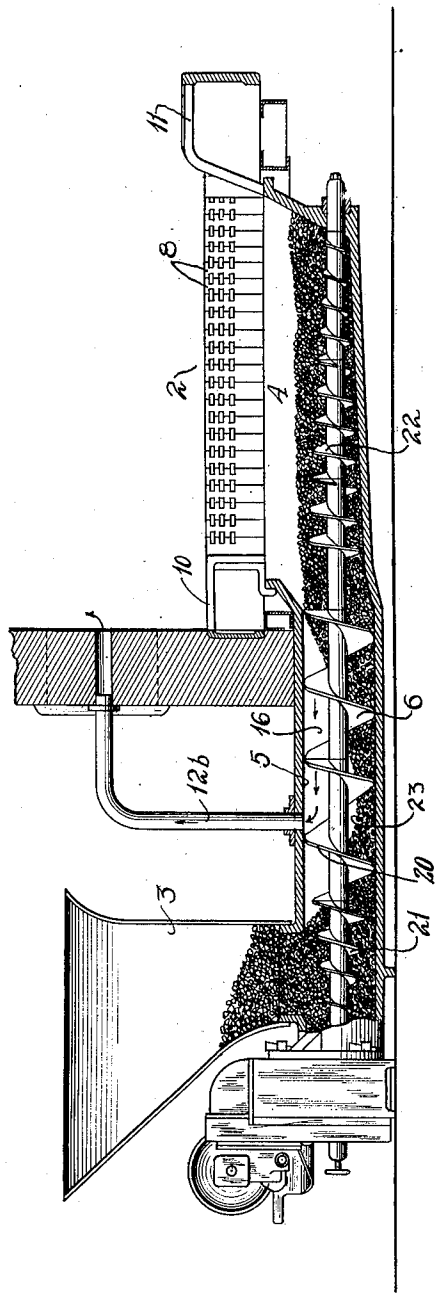
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Fig. 3



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UNITED STATES PATENT OFFICE

VERNON G. LEACH, OF CHICAGO, ILLINOIS, ASSIGNOR TO MODERN COAL BURNER CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

DEVICE FOR ELIMINATING HOPPER SMOKE

Application filed December 21, 1929. Serial No. 415,635.

This invention relates to a mechanical underfeed stoker and more particularly to such a device equipped with means for preventing the emission of "hopper smoke".

The usual type of underfeed stoker comprises a retort connected to a fuel hopper by means of a conduit with a conveyor extending through the conduit into the retort for feeding coal from the hopper into the retort. Air is delivered to the fuel bed through tuyères to effect combustion of the fuel. Most of the gases of combustion pass upwardly out of the furnace but a small fraction of these gases occasionally finds a passageway from the retort through the conduit connecting with the hopper and out through the hopper. Such gases are known as "hopper smoke". These gases constitute a source of annoyance to users of underfeed stokers for they contain a relatively large amount of poisonous carbon monoxide, which detrimentally affects the workmen in the boiler room and are otherwise disagreeable.

It is accordingly an object of this invention to provide means in an underfeed stoker to eliminate the emission of "hopper smoke".

Other and further important objects of this invention will become apparent from the following description and the accompanying drawings.

This invention (in a preferred form) is illustrated in the accompanying drawings and hereafter more fully described.

On the drawings:

Figure 1 is a view in perspective of my improved stoker, illustrating one embodiment of my invention.

Figure 2 is a side elevation of my improved stoker, certain parts being shown in section, illustrating a modified form of my invention.

Figure 3 is a longitudinal sectional view of stoker, illustrating a further modification of my invention.

As shown on the drawings:

The reference numeral 1 indicates the brick masonry work for supporting and partially housing an underfeed stoker, indicated generally by the reference numeral 2. The stoker comprises a hopper 3 connected to a retort 4 by means of a conduit 5. Extending through the conduit 5 and into the retort 4 is a screw conveyor 6 for feeding coal from the hopper 3 to the retort 4. Said screw conveyor 6 is provided with flights or vanes 20 within the conduit 5 of substantially the same diameter as the conduit and with vanes 21 and 22 in the bottoms of the hopper 3 and retort 4, respectively, of gradually decreasing diameter and increasing pitch toward the ends of said conveyor. Tuyère blocks 8, dead plates 9, and front and rear plow plates 10 and 11 complete the stoker construction.

In a stoker of this description, owing to the peculiar construction of the screw conveyor 6, the coal conveyed from the hopper to the retort does not completely fill the conveyor conduit 5, with the result that a substantially unobstructed passageway 16 from the retort to the hopper is formed above the coal in the conduit. Occasionally, as when the fire bed extends below the air ports of the tuyères, gases generated in the retort will pass by way of such passage 16 into the hopper and out into the furnace room, or will at least collect in the passage, or pocket 16 above what may be termed the "disengaging surface" 23, of the coal lying within said conduit.

To prevent this flow or accumulation of gases, the following arrangements are provided, of which Figure 1 is one form of my invention.

In that figure the numeral 12 indicates a flexible metallic hose, which is connected through a box 13 to the conduit 5 and opens into the cavity or passageway 16. The box 13 is filled with steel wool saturated with oil, or with some other filler 24 adapted to filter tar and other condensable vapors out of the gases before entering the hose 12. The other end of the hose is joined to the intake 25 of the fan 14 which serves to deliver air to the fuel bed of the furnace. The hopper end of conduit 5 is provided with an aperture 15 that forms an opening from the passageway 16 into the atmosphere.

The fan 14 imposes a slight suction within the conduit 5, drawing either air into the same through the aperture 15 or potential hopper smoke from the retort. This air or

hopper smoke is mingled in the fan with the regular flow of air therethrough and fed to the fuel bed for combustion of the coal. By this arrangement, fresh air is caused to move in the conduit 5 in a direction counter to that taken by those gases of combustion that would tend to form hopper smoke. The flow of gas and smoke toward the hopper is thus effectively balanced by the counter flow of air. When, however, for any reason the pressure of gas and smoke overbalances the counter pressure of the air drawn through the aperture 15, then gas, smoke and air are drawn from the cavity 16 through the hose 12 into the fan 14.

There is no substantial tendency, due to the suction of the fan through the hose 12, to draw air down through the fuel bed, since less resistance is offered to the flow of outside air through the aperture 15 and passageway 16 and flow is always along the path of least resistance. Consequently, no downdraft of gases through the fuel bed into the conduit 5 is set up by the operation of the stoker.

Figure 2 illustrates a modified form of my invention for eliminating the hopper smoke, in which a conduit 12*a*, opening at its lower end into the cavity 16, is built into the front wall of the furnace housing. Due to the existence of a pressure lower than atmospheric pressure within the furnace, a gentle induced suction is set up in the conduit 12*a*, which draws out of the passageway 16 any gases of combustion which would normally find an exit through the conduit 5 and hopper 3.

The suction in the conduit 12*a* is not, however, sufficiently strong to draw air down through the fuel, since the stack draft within the furnace exerts the same or a slightly greater force tending to draw the air delivered from the tuyères upwardly through the fuel bed.

The construction shown in Figure 3 differs only slightly from that of Figure 2 in that the conduit 12*b* is not built into the front wall of the furnace housing but extends through it into the interior of the furnace. Both of the conduits 12*a* and 12*b* are of sufficiently large internal diameter to prevent the possibility of their becoming clogged with tar or other condensed vapors, or solid particles of fuel.

It is apparent that the various forms of my invention operate on substantially similar principles in effecting the elimination of hopper smoke by withdrawing the gases from the pocket formed in the conduit above the disengaging surface of the coal therein. While the provision of a variable pitch screw conveyor makes possible the formation of the gas pocket in the conduit, the same result could be accomplished in other ways, as for instance by increasing the size of the conduit. It will be apparent to those familiar with the art that the conduit 12*b* may extend through any of the walls of the furnace housing. It will also be clear that the conduit 12*b* may be variously connected to open into the path of the stack draft above the retort provided that the discharge end of the conduit is in a region in which the gas pressure is lower than atmospheric so that gas is sucked from the coal conveying conduit.

I am aware that numerous details of construction may be varied without departing from the spirit of my invention and I, therefore, do not propose to be limited in the patent granted, except as necessitated by the prior art.

I claim as my invention:

1. In an underfeed stoker, the combination of a hopper, a retort, a conduit connecting said hopper and retort, said conduit being provided with an aperture and means for drawing outside air into said conduit through said aperture in a direction counter to the normal flow of gases from the retort to the hopper to prevent gases generated in the retort from passing to said hopper through said conduit.

2. In an underfeed stoker, the combination of a hopper, a retort, a conduit for the passage of fuel from the hopper to the retort, said conduit normally being but partially filled with fuel and thereby providing a passageway for gases generated in the retort back into said hopper and said conduit having an aperture for admitting air into said passageway in a direction counter to the flow of the generated gases, and means for drawing air or gases from said passageway and feeding said air or gases into said retort.

3. In an underfeed stoker, the combination with a retort, a hopper, a conduit for fuel connecting the retort and hopper, said conduit being provided with an aperture for admitting air into the same, and a fan for supplying air to the retort, of a hose connected to the conduit and to said fan, whereby said fan may draw air into the conduit through said aperture in the same direction as the moving fuel and out from the conduit through said hose.

4. In an underfeed stoker including a furnace housing, a hopper, a retort and a conduit for the passage of fuel from the hopper to the retort, said conduit normally being but partially filled with fuel and thereby providing a cavity in which smoke may collect. A duct opening at one end into said cavity through the conduit wall and at the other end communicating with the interior of the furnace housing above the retort, the operation of the furnace creating a draft or suction through said duct toward the interior of said furnace housing.

5. In an underfeed stoker including a furnace housing, a hopper, a retort, a conduit connecting said hopper and retort and a

screw conveyor having helical vanes of varying pitch or diameter whereby fuel conveyed thereby only partially fills said conduit to form a cavity therein, conduit means forming a passage for gases in said first named conduit from said cavity to the interior of the furnace housing above the retort and means for creating a draft in said passage in the direction named.

6. In an underfeed stoker including a furnace housing, a hopper, a retort, a conduit connecting said hopper and retort and a screw conveyor having helical vanes of varying pitch or diameter whereby fuel conveyed thereby only partially fills said conduit to form a cavity therein, means forming a passage for gases and dust in said conduit from said cavity to the interior of the furnace housing above the retort, means at the conduit end of said passage for filtering condensable vapors from said gases and means for creating a draft in said passage in the direction named.

7. In combination, a furnace housing, an underfeed stoker including a hopper, a retort. and a tubular conduit connecting said hopper and said retort for the passage of fuel to said retort. tuyères on said retort adapted to support an overlying bed of fuel, means to force air through said tuyères and the fuel, and a pipe communicating at one end with said conduit intermediate said hopper and said retort and at its other end with a furnace region in which the pressure is less than atmospheric to draw gas from said conduit to a region of lower gas density.

8. In an underfeed stoker, the combination of a hopper, a retort, a conduit for the passage of fuel from the hopper to the retort, said conduit being provided with an aperture, and means for drawing outside air into said conduit through said aperture to thereby prevent gases generated in the retort from passing through said conduit.

9. In combination, a furnace housing, an underfeed stoker including a hopper, a retort, and a tubular conduit connecting said hopper and said retort for passage of fuel to said retort, tuyères on said retort adapted to support an overlying bed of fuel, means to force air through said tuyères and the fuel. and a pipe communicating with said conduit and with a region in which there is a suction effect incident to the operation of said means.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

VERNON G. LEACH.