

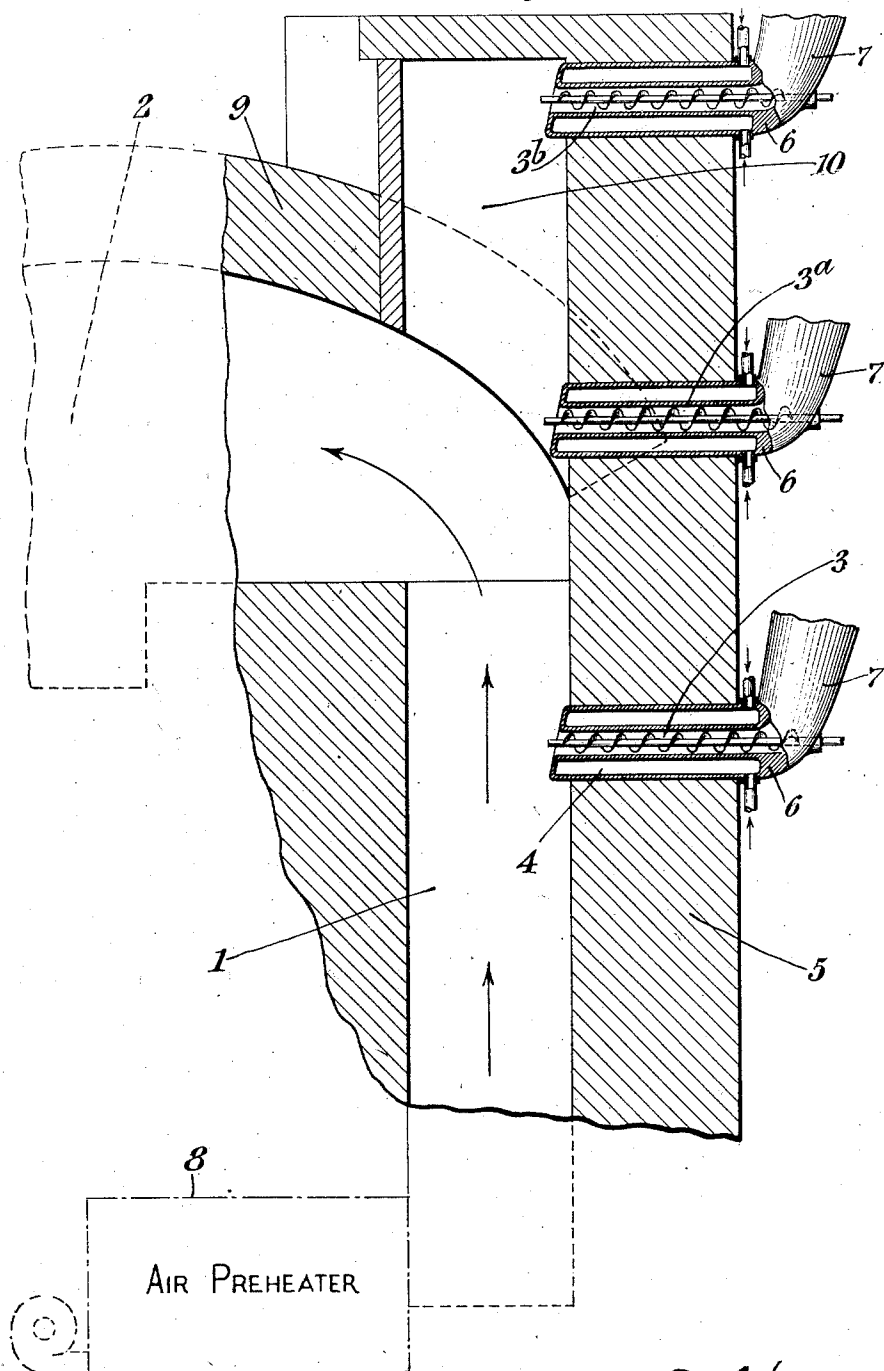
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METHOD OF BURNING POWDERED COAL

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METHOD OF BURNING POWDERED COAL.

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The invention has for an object to provide a method of feeding powdered coal to any desired heating device in such manner that substantially complete combustion of all the carbonaceous fuel particles will be obtained.

In its preferred form the invention automatically segregates, so to speak, the larger fuel particles from the smaller, whereby the small pieces of coal which ignite and burn relatively quickly are quickly carried over to the point of utilization of the heat, while the larger fuel particles which ignite and burn with greater difficulty are automatically afforded a longer period within which they may be ignited or kindled and completely burned before passing out of the region within which complete combustion may be effected. Thus the necessity is avoided of employing coal of extremely fine and uniform pulverization.

Further objects and advantages of the invention will be in part obvious and in part specifically pointed out in the description herein contained, which, taken in conjunction with the accompanying drawings, discloses certain preferred embodiments thereof; such embodiments, however, are to be considered merely as illustrative of its principle. In the drawing:

The single figure illustrates in section and somewhat diagrammatically an apparatus adapted to operate in accordance with the invention.

If powdered or pulverized coal be employed as a fuel for a heating apparatus, the combustion of the fuel is liable to be incomplete and inefficient, due to the fact that the fuel particles tend to pass out of the region of combustion before being completely burned; this is particularly the case if the fuel is fed at high velocity into a small combustion chamber so that it remains in a region hot enough to burn it, and provided with sufficient air to burn it, only for a short period. The heavier pieces of coal especially pass relatively quickly from the region within which ignition of such pieces may be effected, and if the fuel has a comparatively large moisture content the contact between the same and the hot gases which are to cause combustion may be insufficient to insure that the fuel particles will be completely burned. Thus fuel of the

above nature has had to be ground to an exceedingly fine and uniform degree of pulverization.

According to the present invention, the air which is to support combustion is formed into a moving column and the powdered coal is fed into said column, the velocity of the air being so proportioned with regard to the fineness of the coal that the latter is carried along with the air to the combustion chamber or point of utilization of the heat. Thus the coal is floated, so to speak, by the air column, and is supported by the air until it burns, and therefore the fuel particles do not pass through the region of combustion at such a high rate of speed as would have to be the case if their own velocity of feed were relied upon to project them into the region of combustion, and the fuel need not be pulverized either so finely or so uniformly to obtain efficient combustion.

Preferably the powdered coal is fed into the air column in a direction substantially opposed to the direction of travel of the air, and thus the smaller fuel particles are quickly carried along with the air to the combustion chamber or point of utilization of heat, while the larger particles penetrate further into the air column until the velocity of the latter arrests their motion and carries them along with the air.

I prefer to move the air column upwardly in a substantially vertical direction and to feed the powdered coal into the upper portion of such column, the point of feed of the particles, the depth of the air column and its velocity being so proportioned to each other that substantially all of the small and large fuel particles will be carried along with the air as above described.

Referring to the drawing, I have shown a heating apparatus having a substantially vertical air conduit 1, the conduit having such depth and area and the air being carried into the lower end of the conduit with such velocity, that pulverized coal particles dropping into the conduit will be lifted and carried along to the point of utilization of the heat, for example, a combustion chamber 2, indicated at the left of the figure. For any given furnace the amount of coal necessary to be fed in to produce the required amount of heat, may be determined,

also the amount of air necessary for the proper combustion of this quantity of coal. The minimum velocity in the air column necessary to support the size of coal to be employed, will also be known, and thus for any given installation the size of conduit 1 to be employed may be determined from the above factors. In other words, the size of the conduit 1 should be such that the air necessary for the proper combustion of the amount of fuel to be employed, will travel through the conduit at such velocity as to support and carry along the fuel particles in all parts of the conduit.

15 The fuel may be fed into the air conduit 1 by means of a spout or the like 3 extending through an opening 4 in the side wall 5 of the conduit, and containing a suitable feeding device such as worm 6, which carries the coal from a hopper 7 to the mouth of the spout 3 from, whence the coal drops by gravity into contact with the upwardly moving air column. The fuel is then carried along with the air column until the heat within the combustion chamber 2 raises it to ignition temperature. In most instances, the flames from combustion chamber 2 will extend back far enough to reach the fuel as the latter is fed into air conduit 1, and thus the particles of coal pass through a sheet of flame which may be sufficient to start their combustion at once. When the fuel particles begin to burn, the resulting gaseous expansion accelerates the movement of the burning particles over into the combustion chamber 2, thus facilitating the operation of carrying the powdered coal along to the point where its heat is to be utilized. The fine particles which burn quickly are readily picked up by the air column and their combustion may easily be completed within chamber 2 before they pass out of the zone in which their heat may be utilized. The larger or heavier fuel particles may also be ignited by the flames at the upper end of air conduit 1, but will tend to penetrate further into the air column until they burn sufficiently to enable their reduced mass and the expanding gases surrounding them to carry them along with the air into the combustion chamber. Thus a longer period of time is afforded for the larger particles to ignite and burn completely before they pass out of the zone within chamber 2, wherein their combustion may be completed.

I prefer to preheat the air before it enters the lower end of conduit 1 to a temperature sufficient to ignite the fuel particles when the same are brought into proper contact therewith as by an air preheater 8 shown diagrammatically in the drawing, and which may be of any suitable type. Thus when fuel particles fall by gravity into the conduit 1 in opposition to the upward motion of the preheated air therethrough, the result-

ant heating of the particles will assist in igniting them, and the smaller or dry particles will be quickly ignited and carried along to the point of utilization of the heat, whereas the heavier or wetter fuel particles will drop further into the conduit 1; the length of such conduit and the velocity of the air passing therethrough being so regulated with reference to the fuel fed that substantially all the fuel particles will be ignited. When ignition of the fuel particles begins, the resulting expansion of the burning gases accelerates the movement of the same over into the combustion chamber 2, as previously described. Thus the particles are kindled or ignited within the conduit 1, and are carried along to combustion chamber 2 where their combustion is completed. When the air is preheated in the above manner, the initial velocity of the air column may be relatively less, since the ignition of the fuel particles assists materially in producing a current strong enough to carry the burning particles along to the combustion chamber 2.

Furthermore, it will be noted that the small fuel particles ignite quickly and pass along with the air column while the large fuel particles drop down further into the conduit and are thus automatically afforded a longer period of contact with the preheated air until ignition occurs. This prolonged period of contact with the preheated air also insures that the large fuel particles will have time enough to burn completely before they pass out of the zone within combustion chamber 2 in which their combustion may be completed. This is an important feature of the invention since the necessity is thereby avoided of pulverizing the coal exceedingly fine to prevent the larger particles from passing out of the region where combustion may be effected before ignition takes place, or from coming into contact with the material being heated before combustion is completed. In other words, according to the present invention fuel of non-uniform size or quality may be efficiently burned owing to the fact that the invention automatically heats each particle sufficiently to kindle it before reaching the combustion chamber, and affords each particle sufficient time to burn completely before it passes out of the region wherein its heat may be utilized or its combustion completed.

The point from which the fuel is fed into the column of preheated air, or the level from which the coal is dropped, may be varied according to the conditions. The spout 3 being located below the top of conduit 1, is particularly adapted for use when small or dry fuel particles are employed, such fuel being easily ignited, and thus the short period of contact which is afforded between the fuel issuing from spout 3 and the preheated air column, will be sufficient to bring about ig-

5 nition before the particles remain very long
in the conduit 1. The coal may be dropped
into conduit 1 from the level of the roof 9
of the apparatus by means of a spout 3^a and
10 associated parts as previously described, or
where the fuel contains a relatively high
percentage of large or wet pieces, or if the air
is not preheated, it may be fed into the air
conduit from a level above that of the roof
15 9 of the apparatus. As indicated in the
drawings, a spout 3^b similar to the spout
3 previously described may be located above
the roof 9 of the apparatus and positioned to
feed the coal from a chamber 10 above conduit
20 1. As the large or wet fuel particles
fall from the spout 3^b, they will be subjected
to the heat of the air column and the pre-
viously-fed burning fuel particles for a rela-
tively longer period of time, whereby large
or wet pieces may be more intensely heated
to ignite them.

While certain specific embodiments of the
invention have been described, it is obvious
that many changes may be made therein
25 without departing from the spirit of the
invention, as defined in the following claims.
I claim:

1. The method of burning powdered coal,
which consists in forming outside of the
30 combustion chamber proper an upwardly
directed confined column of preheated air
of restricted area moving with sufficient ve-
locity to support substantially all the fuel
particles, feeding powdered coal into such
35 column and igniting the fuel therein, where-
by the said column will arrest the fall of
substantially all the fuel particles and pre-
vent them from escaping without being ig-
nited, and then passing the kindled fuel and
40 air into the combustion chamber proper.

2. The method of burning powdered coal,
which consists in forming outside of the

combustion chamber proper an upwardly di-
rected confined column of air moving with
sufficient velocity to support substantially 45
all the fuel particles, feeding powdered coal
through a flame into such column and ignit-
ing the fuel therein, whereby the said col-
umn will arrest the fall of substantially all
the fuel particles and prevent them from 50
escaping without being ignited, and then
passing the kindled fuel and air into the
combustion chamber proper.

3. The method of burning powdered coal
which consists in forming outside of the 55
combustion chamber proper an upwardly
directed confined column of air of restrict-
ed area and moving with sufficient velocity to
support substantially all the fuel particles,
feeding powdered coal by gravity into such 60
column, whereby the latter will arrest the
fall of substantially all the fuel particles
and prevent them from escaping without
being ignited, and then passing the kindled
fuel and air into the combustion chamber 65
proper.

4. The method of burning powdered coal
which comprises pre-heating air to a tem-
perature sufficient to ignite the coal, forming
outside of the combination chamber proper 70
an upwardly directed confined column of air
moving with sufficient velocity to support
substantially all the fuel particles and carry
them along, feeding powdered coal into such
column, whereby the latter will arrest the 75
fall of substantially all the fuel particles
and prevent them from escaping without
being ignited, and then passing the kindled
fuel and air into the combustion chamber
proper. 80

In testimony that I claim the foregoing,
I have hereunto set my hand this 8th day of
July, 1921.

WILLIAM B. CHAPMAN.