

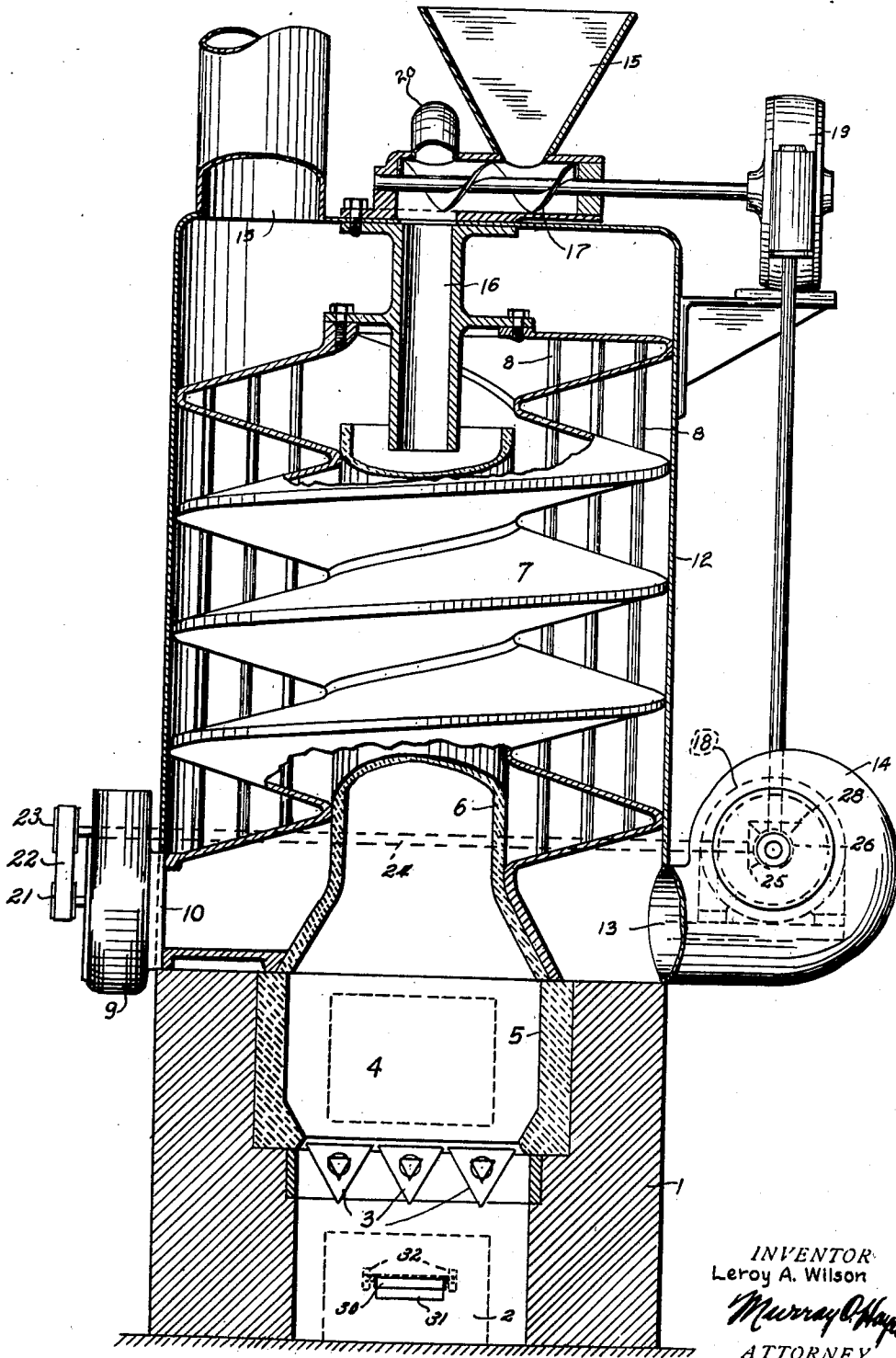
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DROP FEED COUNTERFLOW HEATER

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DROP-FEED COUNTERFLOW HEATER

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2 Claims. (Cl. 126—99)

This invention relates to a counterflow coal burning heating device, and has among its objects:

To invent a thermal device which is adapted to burn solid fuel, and has the high efficiency of the counterflow principle;

To provide a mechanism of the kind set forth which has the fuel feed synchronized with the means which causes the circulation of the medium that is to be heated.

These and other objects are achieved in a manner presently to be set forth.

The drawing shows a view of one embodiment of my invention, in the main a vertical section, though the spiral flue is partly in elevation to disclose the form thereof.

I employ a base 1 of any suitable kind to support the superstructure; within the said base are an ash pit 2, a grate 3, and a firebox 4 lined with suitable refractory material 5; rising above the said firebox is a combustion chamber 6 which is also of a refractory nature and is preferably cylindrical in form.

Disposed about said chamber is a down draft spiral flue of the type heretofore disclosed in my copending application Ser. No. 82,834, filed Jan. 21, 1926; the said flue, which is designated by 7, has turbulence forming and heat transferring pillars 8 which extend across the inner spaces of the flue convolutions and also across the spaces between the adjacent surfaces of the exterior parts of the said convolutions. The purpose of the pillars 8 is to interrupt and break up the smooth flow of the fluid which is being circulated about the said flue and of the gases of combustion therewithin, as it is known that the rate of heat transfer is much higher where the stream that is being heated is vortical than when it is smooth; the said pillars serve also to transfer heat from within the flue to the exterior thereof. Into the upper end of the flue 7 the gases of combustion pass from the chamber 6; by means of fan 9 the said gases are drawn down through the flue to the exhaust opening 10; fan 9 is driven by motor 18. Fan 9 is driven by motor 18 through any desired power transmission means, such as pulley 21 on the shaft of fan 9 connected by belt 22 to pulley 23 on a shaft 24 having on it a bevel gear 25 meshed with bevel gear 26 on the shaft of motor 18.

A shell 12 is disposed about flue 7; opening on the interior of said shell adjacent the base of said flue is an air intake 13, through which air is forced by blower 14, whence the heated air rises to air outlet 15, by following around the con-

volutions of flue 7 in a flow counter to the direction of the movement of the gases within the said flue; thus relatively cool air is brought into thermal contact with the cooler part of the stream of gases of combustion, and as the air is warmed it comes into contact with successively hotter gas, and thus is maintained a thermal gradient that assures a maximum flow of heat from within the flue to the fluid around the outside thereof at all times during operation.

Solid fuel in relatively small sizes is placed in hopper 15, whence it is fed through pipe 16 to the fire on grate 3 by screw 17; the said screw is driven by a reduction gear 19 actuated by motor 18 which operates blower 14 by means of shaft 27 whereon is fixed bevel gear 28 meshed with bevel gear 26; the speed reduction is so adjusted that the fuel supplied at any speed will be perfectly consumed by the air drawn in by the fan 9 through draft opening 31 controlled by door 30 hinged in ears 32 and thus a short flame will be maintained and the deposition of soot will be prevented, and the remarkably high efficiency of the device will not be impaired.

In this device I cause the fuel to drop from above upon the fire and the combustion is practically complete before the particles of fuel reach the grate 3; the strong current of air drawn up through combustion chamber 6 by fan 9 not only provides for intimate contact of fuel and oxygen but retains the fuel suspended above the grate for an appreciably longer time than would otherwise be the case; this prevents the evolution of imperfectly oxidized volatiles, which give a long, luminous, sooty flame.

Inasmuch as all the air that enters at 13 must pass around all the convolutions of flue 7 to reach outlet 15 it is evident that it will be thoroughly heated by the prolonged contact with the broad heat transfer surfaces of said flue; the large surficial area of the said flue in comparison with the cross sectional area of it, combined with the turbulences in the currents both within and without said flue, assures the perfect removal of the thermal content of the gases of combustion by the air on the exterior of the flue 7; this would be impossible were it not that the counterflow brings the freshly intaken air into thermal contact with the relatively cooled gases of combustion and the warmer air into a similar relation with the hotter gases; where a counterflow is not employed the transfer of heat stops when the air reaches the temperature of the said gases, but in the device herein disclosed the air is always cooler than the gases until the said gases are

reduced to room temperature, which actually occurs in this heater by the time they reach the outlet 10.

Although I have shown my invention specifically applied to an air heater it is very evident that the same mechanism can be applied to heating any kind of fluid that can be caused to circulate around the exterior of flue 7.

I also provide an inlet 20 thru which the air for the combustion chamber is admitted. The purpose of this is not only to promote thorough admixture of the coal and air and the first volatiles distilled off with the air, but also to give a downward velocity of the finer particles in the coal (or other fuel, as the case may be) at high rates of driving which will insure that no considerable portion of the coal or ashes will be carried over into said flue.

I wish also to call attention to the fact that the circulation of the heating medium, the air for combustion and the fuel feed are all synchronized so that just the right amount of air for the proportional fuel fed is always available for perfect combustion. Also the proper amount of heating medium is circulated to carry off the heat generated and hence control the heating medium at a more or less constant temperature and insure against the burning out of the heating element, etc.

I claim:

1. A fuel burning device, comprising an elongated tubular combustion chamber vertically disposed, a grate below said chamber, means defining a passage for products of combustion in com-

munication with the upper end of said chamber and passing helically downward immediately exteriorly of said chamber, fuel supply means including an element extending through the upper portion of the first said means into the upper end of said chamber, a shell disposed around and enclosing said first means, air-propulsive means to set up a current of air between said shell and the first means and air-propulsive means to set up a current of air upwardly through said chamber and downwardly through the first said means, and common driving means for said fuel supply means and said air-propulsive means, both of said currents of air being proportionate to the fuel supply.

2. A fuel burning device, comprising an elongated tubular combustion chamber vertically disposed, means defining a passage for products of combustion in communication with the upper end of said chamber and passing helically downward immediately exteriorly of said chamber, fuel supply means including an element extending through the upper portion of the first said means into the upper end of said chamber, a shell disposed around and enclosing said first means, air-propulsive means to set up a current of air between said shell and the first means and air-propulsive means to set up a current of air upwardly through said chamber and downwardly through the first means, and common driving means for said fuel supply means and said air-propulsive means whereby the air supply is proportioned to the fuel supply.

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