March 21, 1933. L. A. MEKLER 1,901,922

FURNACE

Filed Oct. 22, 1927

Fig. 1.

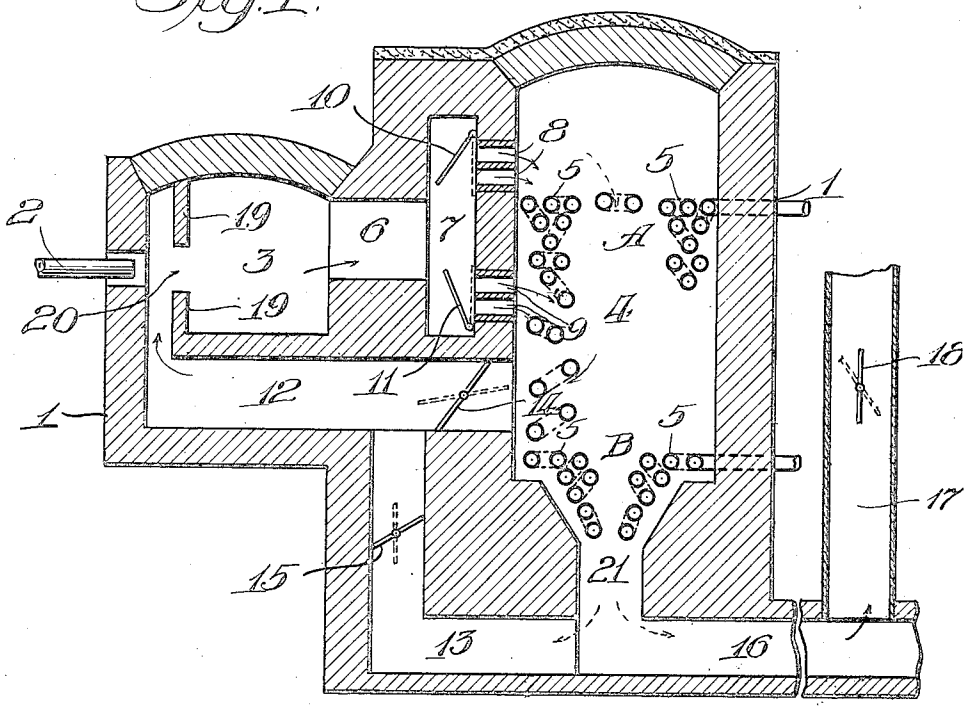
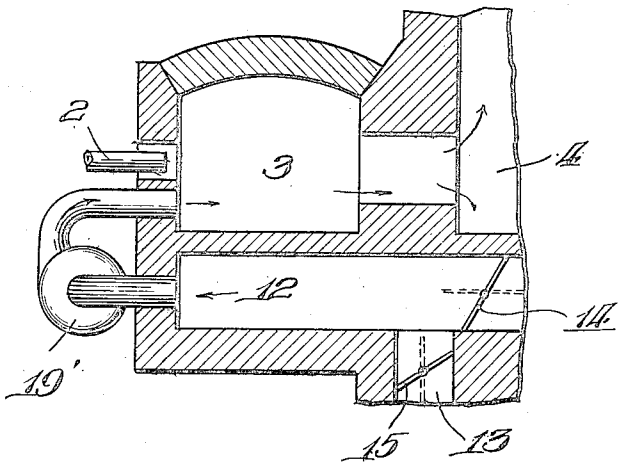


Fig. 2.



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UNITED STATES PATENT OFFICE

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FURNACE

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This invention relates to improvements in furnaces, and refers more particularly to a furnace wherein hydrocarbon oil to be heated may be passed through a heating coil in heat interchange with the gases of combustion.

An object of this invention is to provide an efficient method and means of heating wherein it is possible to control the amount of heating done in any portion of the furnace by regulating the quantity of the products of combustion passing through the different portions of the furnace.

Another object of the present invention is to control the amount of heat absorbed by different portions of the heat absorbing medium by the recirculation of regulated portions of the used gases of combustion to the heat generating zone.

The present invention is particularly applicable to the heating of hydrocarbon oil where said oil passes through the heating zone in an elongated conduit of restricted cross section, although it is to be understood, as above set forth, that the invention in its broader aspects is not to be limited to this particular field.

The utility of the invention as well as other objects and advantages will be more particularly apparent from the following description.

In the drawing, Fig. 1 is a vertical sectional view of a furnace built in accordance with the present invention.

Fig. 2 is a fragmentary vertical sectional view of a slightly modified form of a furnace built in accordance with the present invention.

Referring more in detail to the drawing, 1 designates the outer shell or casing which may be constructed of the usual material for furnaces such as brick. Any suitable fuel such as oil or gas for instance may be introduced to the burner 2 and burned in the chamber 3. A heating chamber 4 may be provided in which may be mounted the tubes 5 which may be connected into a continuous coil through which the material to be heated may be passed. Passages 6 and 7 and ports 8 and 9 controlled by dampers 10 and 11 respectively may be provided to convey the products of combustion from chamber 3 to heating chamber 4. Flues 12 and 13 controlled by dampers 14 and 15 respectively may be provided for the recirculation of the gases of combustion. Flue 16 communicates with stack 17 which is controlled by damper 18.

The fuel which may be either a powdered solid, liquid or a gas, may be introduced to the burner 2 and injected with the proper amount of air into the combustion chamber 3 where it may be burned. The gases of combustion pass through the flue 6 into the chamber 7 from which they enter the heating chamber 4 through either or both of the ports 8 and 9. By manipulating dampers 10 and 11 all or any regulated portion of the gases may be passed through either or both of the ports 8 and 9. Thus I may completely close damper 11 and cause all the hot gases to pass through port 8 whereby they contact the upper portion A of coil 5 in the chamber 4. Dampers 14 and 15 may be closed and the gases will pass over the lower portion B of coil 5, through flues 21 and 16 and out of the stack 17. This form of operation is similar to that of the conventional type of furnace.

If the greater part of the heating is desired on the upper portion A of coil 5, dampers 11 and 15 may be closed and damper 14 in the recirculating flue opened. The hot gases will then enter chamber 4 through ports 8 and pass over the A portion of coil 5, a portion of them being drawn by the induction induced by the spray of burner 2 into recirculating flue 12, through the passage between wall 1 of the furnace wall 19 of the combustion chamber 3 and through opening 20 into the combustion zone where they are recirculated through the heating chamber 4. The proportion of the gases passing over the lower portion B of coil 5, through flues 21 and 16, and out stack 17 may be controlled by damper 18 which regulates the pull of the stack 17.

By opening damper 15 and partly closing damper 14 some of the gases may be recirculated after they have passed the lower

portion B of coil 5, thus increasing the amount of heating accomplished in the lower portion of the coil.

In case it may be desirable to accomplish the greater part of the heating in the lower portion of the coil 5, damper 14 may be closed and damper 15 opened. By closing ports 8 by means of damper 10 and opening ports 9 by means of damper 11 the gases will not pass over the upper portion of coil 5, but will all pass over the lower portion of the coil 5. The proportion of gases recirculated may be determined by manipulating damper 15 and controlling the pull of stack 17, by means of damper 18.

Any portion of the gases may be caused to pass over the upper portion of coil 5 by manipulating dampers 10 and 11.

As an example of the operation of the furnace, I will assume that 1000 pounds of fresh products of combustion are produced by the burning of the fuel introduced through the burner 2 and that the spray of the burner is able to induce and recirculate 2000 pounds of the spent products of combustion. Assuming the dampers in the recirculating flues are opened, a total of 3000 pounds of combustion products may therefore pass over the A portion of the coil 5. If the damper 14 is closed 3000 pounds of products of combustion, somewhat cooled by the passage over the A portion of the coil will also pass over the B portion of the coil and the recirculated gases will be drawn in after having passed over all the coil 5 through recirculating flues 13 and 12 and then into the combustion chamber 3. If the damper 15 is closed and damper 14 opened, then while 3000 pounds of combustion products pass over the A portion of coil 5, only 1000 pounds of combustion products will pass over the B portion of coil 5. In this case the heat applied to the B portion of the coil will be substantially one-third of that applied in the operation with damper 14 closed and damper 15 open. By manipulating dampers 14 and 15 any amount of heating from one-third of the total up to the possible total can be accomplished in the B portion of coil 5 without substantially changing the heating effect on the A portion of coil 5.

A similar control may be effected upon the A portion of coil 5 by proper manipulation of the dampers as will be apparent to those skilled in the art.

It is thus apparent that by manipulation of the dampers any heating effect may be accomplished in the heating chamber 4. Any amount of the fresh gases may be passed over any portion or all of the coil 5, while at the same time the recirculated gases may be so controlled as to pass over any portion or all of coil 5. Thus the material to be heated may be subjected to a gradual increase in temperature as it flows through the coil 5 and then raised quickly to a high temperature just before it leaves the furnace. Or if desired, the material may be quickly heated upon entering the furnace and then maintained at a desired temperature during the balance of its travel through the furnace.

It is to be understood that instead of inducing the recirculation of the gases by means of the spray from the burner, a blower 19′ may be employed in the manner illustrated in Fig. 2.

It is obvious that the gases may be drawn from the heating chamber for recirculation at more than two points and in such a manner as to produce any desired heating effect on a given portion of the heating medium.

While I have shown in the drawing a furnace wherein the heat exchange between the combustion gases and the material to be heated through the coils is effected while the combustion gases are passed in a downward direction, if desired, a similar design involving the features and principles of the invention may be utilized wherein the combustion gases heat the liquid while said gases ascend. In other words the gases of combustion and material to be heated may flow either in concurrent or countercurrent travel.

The coil within the chamber 4 may be divided into two or more separate units each having a separate inlet and outlet. Thus, material requiring a relatively large amount of heating may be passed through one section, and material requiring a relatively small amount of heating may be passed through the other section, the flow of the gases being regulated to accomplish such heating effects.

I claim as my invention:

1. A furnace comprising in combination, a heat generating zone, a heating zone communicating therewith through which material to be heated is passed, means for introducing and controlling the introduction of the heated gases generated in the heat generating zone into said heating zone comprising separated valve controlled flues communicating with said heating zone at separated points, means for recirculating regulated portions of the gases from the heating zone to the heat generating zone, and means for controlling such recirculation comprising a plurality of recirculating flues independently controlled communicating with said heating zone at separated points.

2. A furnace comprising in combination, a heat generating zone, a heating zone communicating therewith, tubular conduits located in said heating zone having inlet and outlet through which material to be heated is passed, flues disposed to introduce the hot gases of combustion to any selected portion or all of said tubular structure, means for

recirculating regulated portions of the gases from the heating zone to the heat generating zone, and means for controlling such recirculation, comprising a plurality of recirculating flues independently controlled communicating with said heating zone at separated points.

3. A furnace comprising in combination a combustion zone, a heating zone communicating therewith, means for selectively introducing and controlling the introduction of combustion gases from said combustion zone to said heating zone, means for recirculating used gases of combustion after their passage to said heating zone from a point intermediate the length of said heating zone to said combustion zone, and in combination therewith, means for recirculating said used gases of combustion after their passage to the outlet of said heating zone.

In testimony whereof I affix my signature.

LEV A. MEKLER.