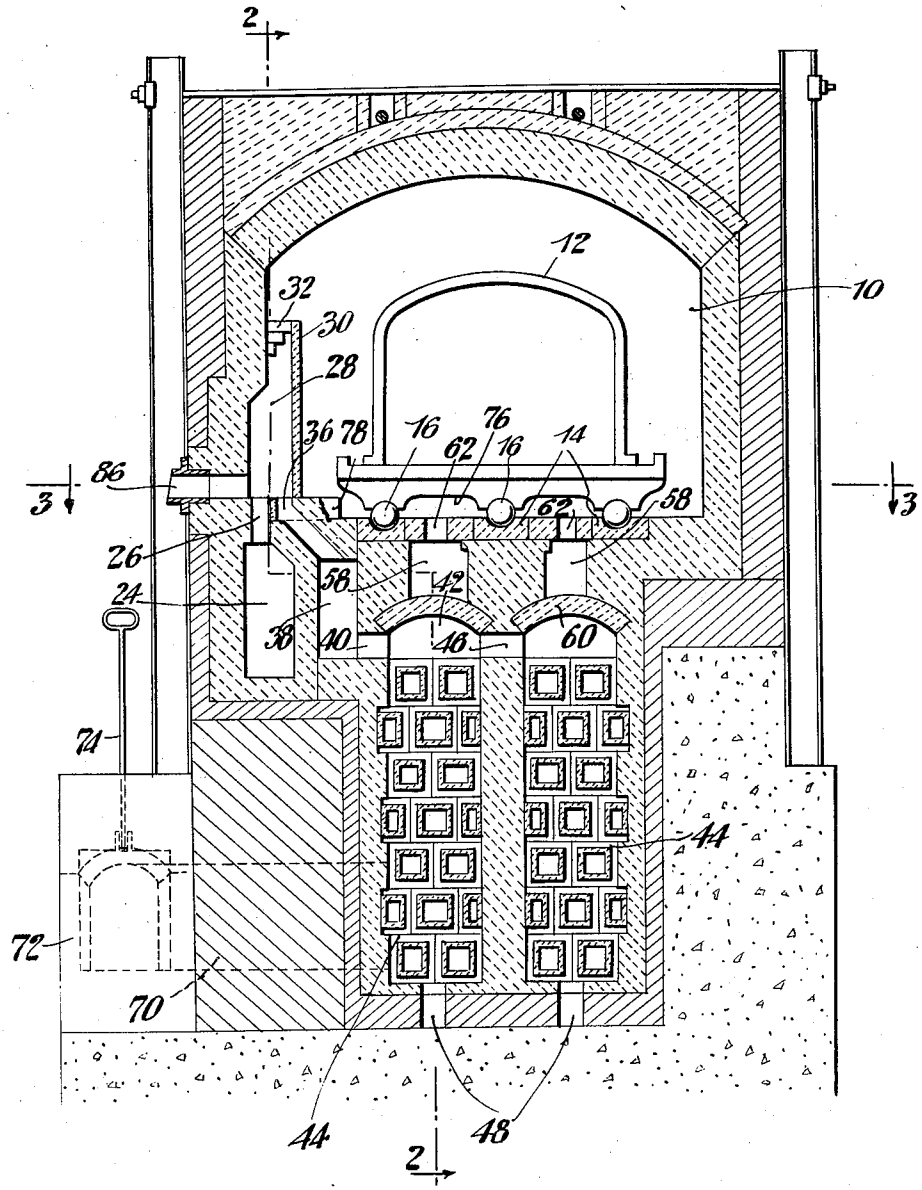
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FURNACE

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Fig. 1.



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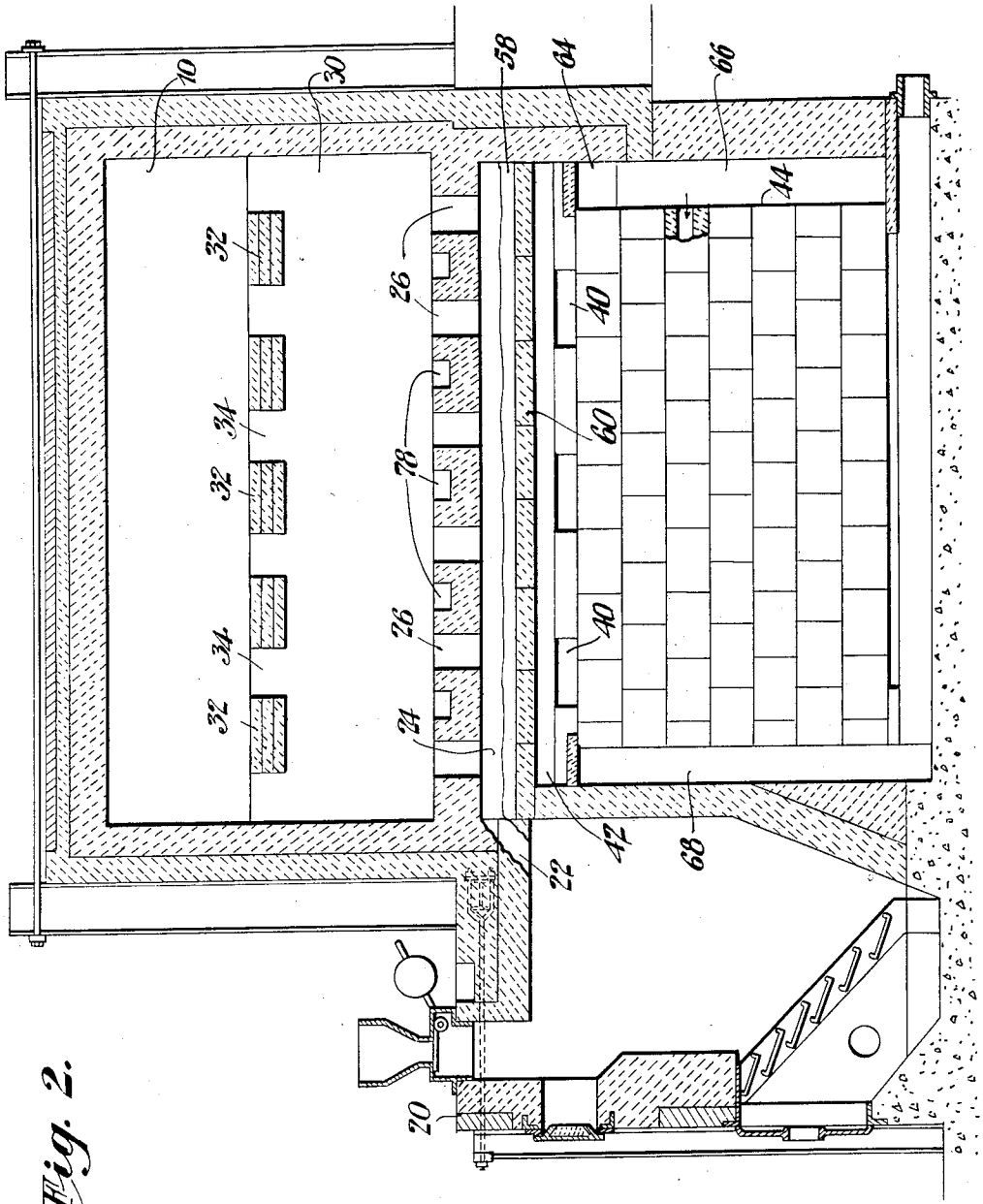


Fig. 2.

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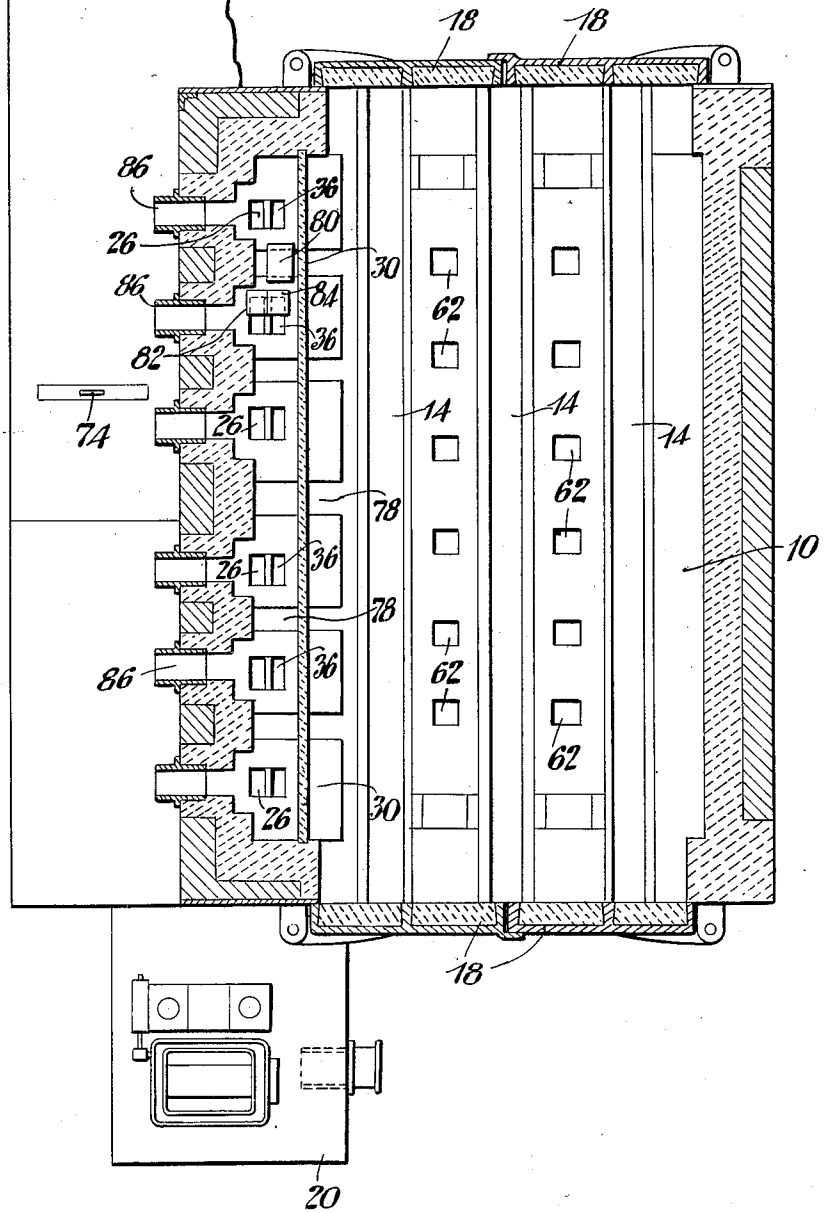
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Fig. 3.



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UNITED STATES PATENT OFFICE.

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FURNACE.

Application filed September 12, 1925. Serial No. 55,930.

This invention relates to improvements in furnaces and more particularly to annealing furnaces.

It is an object of the invention to provide an annealing furnace which may be heated economically and efficiently by means of producer gas generated in a coal fired producer which is built into the furnace construction.

A further object is to provide an annealing furnace in which the burning gases shall enter the heating chamber at one side of the same and flow around the annealing box in which the work is placed, in such a manner that the contents of the box may be thoroughly heated from below as well as from above.

Another object is to provide an annealing furnace in which a portion of the burned gases or products of combustion may be recirculated to maintain a more uniform temperature of the burning gases and to cut down the amount of fuel required for maintaining the proper temperature in the heating chamber.

An additional object is to provide an annealing furnace wherein the air to be mixed with the fuel gas may be efficiently and highly heated by the products of combustion passing out of the heating chamber.

Still another object is to provide an annealing furnace which shall be compact and simple in construction.

The above and other objects of the invention will more fully appear from the detailed description taken in connection with the accompanying drawings forming the following construction.

Referring to the drawings:

Fig. 1 is a vertical transverse section taken through the improved annealing furnace, showing the position of the annealing box with respect to the sides of the heating chamber; the ports or passages through which air and fuel gas are entered into the heating chamber; the ports through which the products of combustion pass out of the heating chamber; recuperators in which the air for supporting combustion and fuel gas is heated, and various other features of the furnace construction.

Fig. 2 is a vertical longitudinal section through the furnace showing somewhat diagrammatically ports and passages between the floor of the heating chamber and the top of the recuperators, and the passages through which the producer gas is passed into the manifold extending longitudinally of the heating chamber,—the section being taken for the most part along the irregular line 2—2 of Fig. 1, and

Fig. 3 is a horizontal transverse section taken on lines 3—3 of Fig. 1, the annealing box of Fig. 1 being omitted for clarity of illustration.

In the drawings, numeral 10 indicates generally the annealing or heating chamber; 12 the annealing box therein and in which the work to be annealed is contained, and 14 a plurality of longitudinally extending spaced tracks adapted to form guideways for balls 16 on which annealing box 12 is adapted to be supported in a manner to permit it to be readily moved into and out of the heating chamber through suitable doors 18 at the ends of the heating chamber.

The fuel gas to be used in firing or heating the annealing chamber is generated in any approved or preferred form of coal-fired producer generally indicated by numeral 20, the details of which need not be explained in the present application. The producer is preferably an integral part of the furnace construction and the gases generated thereby flow by suitable passage diagrammatically indicated at 22 in Fig. 2 to a manifold 24 which extends longitudinally of the heating chamber below the floor thereof.

Extending upwardly from the manifold are a series of gas ports 26, these ports extending along one side wall of the heating chamber into a combustion chamber generally indicated at 28, Fig. 1, this combustion chamber being formed by a baffle wall or partition 30 which extends upwardly toward the top of the heating chamber and terminates some distance therebelow. The baffle wall is braced along its top by a series of spaced abutments 32, the space between the abutments constituting ports 34 through which the burning gases from the combustion chamber pass into the heating chamber.

Heated air is mixed with the fuel gas coming through the ports 26. For this purpose there is provided a series of ports 36, Figs. 1 and 3, between the combustion chamber 28 and a longitudinally extending air manifold or passage 38 running parallel with the gas manifold 24. The air manifold 38 is connected by ports 40 with an air chamber 42

formed at the top of a recuperator generally indicated at 44.

In the drawings the recuperator has been shown as in two units, the top chambers 42 of which are connected by lateral ports 46. The recuperators are preferably of hollow tile construction through which products of combustion from the annealing chamber may pass on their way to the stack as will presently be explained, the air to be heated entering at the bottom of the recuperators through suitable ports 48 and circulating between the tiles through suitable passages provided therebetween and finally collecting in the air chambers 42 above the recuperators.

Extending longitudinally beneath the floor of the heating chamber are two channels 58 which are separated from the air chambers 42 by a suitable wall construction 60. These channels 58 are in communication with the heating chamber 10 by means of a series of ports 62 extending through the floor of the chamber. Products of combustion may pass out of the heating chamber through the ports 62 in the floor thereof and into the channels 58 from whence they pass by suitable ports or passages 64, Fig. 2, into a passage 66 extending downwardly in front of the recuperators. Upon entering the passages 66 the burned gases or products of combustion pass through the recuperators and into another passage 68 at the other end thereof from whence they pass by way of a suitable passage 70 indicated in dotted lines in Fig. 1 to a flue 72 which leads to the stack, this flue being preferably provided with a damper for controlling the draft, the handle of the damper being indicated at 74.

The burned gases or products of combustion flow continuously in a given direction through the recuperators and the air to be heated by the recuperators likewise flows continuously in a given direction. In other words, there is no reversal of the flow of the products of combustion or of the air to be heated.

The bottom of the annealing box is undercut as generally indicated at 76 to provide for the free circulation of the hot gases therebelow and to permit the same to flow freely through the ports 62 on their way out of the heating chamber. The balls on which the annealing box rests are so spaced as to provide open passages therebetween through which the hot gases may circulate which will be readily understood.

As previously indicated it is an object of the invention to provide for the recirculation of some of the products of combustion. This is accomplished by establishing communication between the bottom of the combustion chamber 28 and the annealing chamber 10 by means of ports 78 which extend transversely below the baffle wall 30. In order to show one of these ports in Fig. 1, a portion of the dividing wall has been broken away. The floor of the heating chamber through which the gas and air ports 26 and 36 respectively pass, is elevated somewhat above the general level of the main floor and the ports 78 constitute in effect open top channels, the bottoms of which are on a level with the main floor as will be readily understood from the drawings.

Means are provided for controlling the amount of air, gas and products of combustion which enter the combustion chamber 28 and this is preferably accomplished by regulating the effective size of the ports where they enter the combustion chamber. Regulation is accomplished by cover tiles which are adapted to be placed over the port openings, the cover tiles for the ports 78 being indicated at 80, for the gas ports at 82, and for the air ports at 84, adjustment of the same being had through inspection ports 86 extending through the wall of the furnace on a level with the elevated floor 80. The showing of these cover tiles has been confined to Fig. 3 and for simplicity of illustration only one set of cover tiles has been shown.

By providing a series of independent ports for the air and gas and by providing for the independent control of the various ports of the series, the temperature and the character of the burning gases within the heating chamber may be very readily controlled. Another advantage of this construction is that the ends of the heating chamber adjacent the doors thereof may be more effectually maintained at the desired temperature by reason of the fact that more fuel may be allowed to flow through those ports adjacent the ends of the heating chamber.

It will be noted that the annealing box 12 is so disposed within the heating chamber as to be nearer that side wall of the furnace which is most remote from the combustion chamber. Inasmuch as the arch or roof of the heating chamber extends directly from one side wall to the other, it follows that the space between the roof and the annealing box is gradually decreasing in a direction away from the combustion chamber. This reduction of space therefore compensates for the natural reduction of gas volume which follows with the reduction of the temperature of the gases as they flow away from the point of most intense heat, namely, the combustion chamber. To put the matter in another way, the annealing box 12 is off center with respect to the sides of the heating chamber. The burning gases flowing from the combustion chamber will, therefore, heat the contents of the annealing box in a uniform manner, by reason of the fact that the gradually reducing space between the annealing box and the far side of the furnace is gradually decreasing.

The recirculation of the products of com-

bustion through the heating chamber has a very important bearing on the heating of the chamber. The products which are recirculated have a comparatively high temperature. These products tend to lower somewhat the temperature of the burning gases, but at the same time a very large volume of gases having a comparatively high temperature is formed. The added volume of the gases of combustion to the gases being burned means that a larger volume of gases is circulated, and therefore in order to take care of this added volume of gas with the same size of flues requires a high velocity of movement of the gases through the heating chamber. The high velocity of circulation of the gases together with the increased volume provides an increased and larger body of heat for carrying on the heating operation, and the higher velocity increases the rate of transfer of the heat upon the work being heated. Furthermore, the dilution of the gases being burned with the products of combustion provides a longer flame combustion and therefore distributes the heat of a uniform nature throughout the entire volume of the furnace. In this way the zones of very high temperature are done away with, and a uniform heating is accomplished.

A heating furnace constructed in accordance with the present invention has been found to effect a very material saving of fuel and to heat the work to be annealed in a uniform manner, in a considerably shorter period of time than has heretofore been required.

While the invention has been described with considerable particularity of detail, it will be readily appreciated that various changes may be made as to the arrangements of ports, etc., without departing from the spirit of the invention.

What is claimed is:

1. The combination with a heating chamber, of a combustion chamber extending along one side wall of said chamber, and means for supporting the work to be heated in an off-center relation with respect to the sides of the heating chamber whereby the burning gases flowing from the combustion chamber will flow into a gradually decreasing space in passing to the far side of the heating chamber.

2. The combination with a heating chamber, of a work-holding carriage within the chamber, means for confining said carriage to a path of travel which is nearer one side wall of the chamber than the other, a wall extending upwardly from the floor of the heating chamber in spaced relation to that side of the chamber which is the more remote from said carriage, said wall terminating short of the roof of said chamber and constituting with the adjacent side wall a combustion chamber, means for entering combustible gases into the combustion chamber and means causing the products of combustion to pass out of the bottom of the heating chamber.

3. The combination with a heating chamber, of a work-holding carriage within the chamber, means for confining said carriage to a path of travel which is nearer one side wall of the chamber than the other, a wall extending upwardly from the floor of the heating chamber in spaced relation to that side of the chamber which is the more remote from said carriage, said wall terminating short of the roof of said chamber and constituting with the adjacent side wall a combustion chamber, and independent air and gas ports opening into the combustion chamber at the bottom thereof.

4. The combination with a heating chamber, of a raised portion of floor in the said chamber along a side wall thereof, transverse channels in said raised floor portion, an upright wall in spaced relation to the adjacent wall forming with said wall a combustion chamber, said upright wall straddling said channels, and air and gas ports opening into the combustion chamber, said channels serving as ports through which some of the products of combustion in the heating chamber may enter the combustion chamber for recirculation with the burning gases in the combustion chamber.

5. The method of heating an annealing chamber, comprising introducing the burning gases into the chamber along one side thereof through a plurality of individual ports, and compensating for the leakage of air through the end doors opening into the chamber by permitting more combustible gas to enter the chamber through the ports adjacent said doors.

6. The combination with a heating chamber, of a work-holding carriage within the chamber, means for confining said carriage to a path of travel which is nearer one side wall of the chamber than the other, a wall extending upwardly from the floor of the heating chamber in spaced relation to that side of the chamber which is the more remote from said carriage, said wall terminating short of the roof of said chamber and constituting with the adjacent side wall a combustion chamber, and means for entering combustible gases into the combustion chamber.

In testimony whereof I affix my signature.

FORREST WILLIAM MANKER.