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METHOD OF AND APPARATUS FOR HEATING INGOTS

Filed March 20, 1930

Fig. 1.

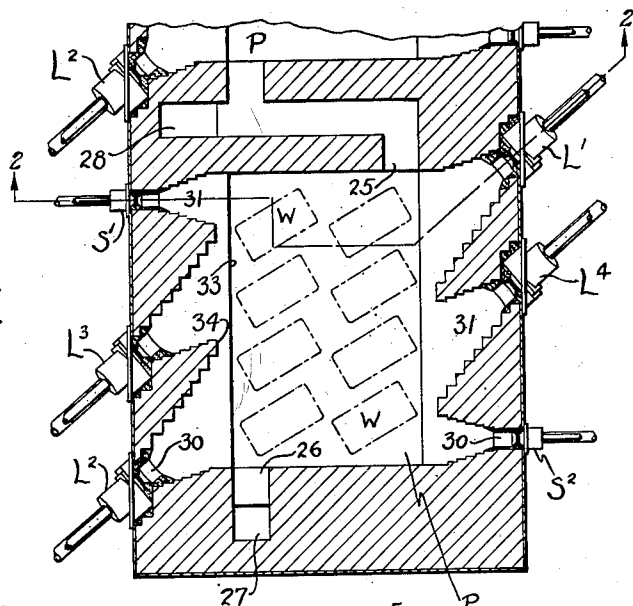


Fig. 2.

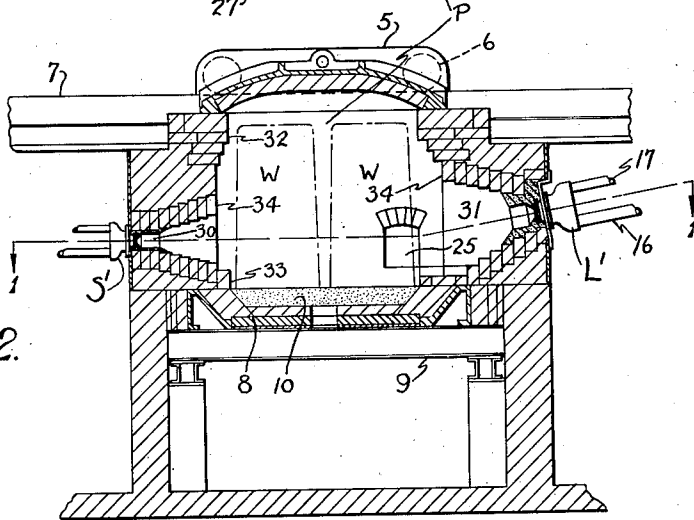
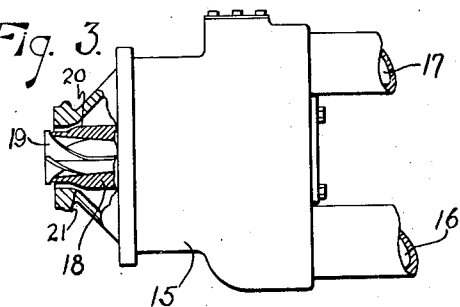


Fig. 3.



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METHOD OF AND APPARATUS FOR HEATING INGOTS

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This invention relates to improvements in soaking pits such as are used in the steel industry for heating ingots prior to rolling and has for its object to provide an improved method of and apparatus for obtaining a uniform distribution of heat in the pit.

In accordance with the present invention, the heating gases are introduced into the pit in a manner to induce a pronounced rotary motion of the heating gases about the ingots and withal an active swirling of the gases whereby stratification of the heating gases is prevented. The invention will be best understood from the detail description taken in connection with the accompanying drawing forming part of this specification.

Referring to the drawing, Fig. 1 is a horizontal section taken on line 1-1 of Fig. 2, the view showing the full outline of one pit or so-called "hole" and a portion of an adjoining hole, it being understood that the usual soaking pit installation ordinarily contains a plurality of holes or pits, each hole being adapted to receive a plurality of ingots, each hole being in a sense an independent furnace or heating chamber, the view showing the preferred arrangement of burners for firing the pit in accordance with this invention. Fig. 2 is a vertical section taken on line 2-2 of Fig. 1. Fig. 3 is an enlarged side elevation of the preferred form of apparatus for supplying a combustible mixture of air and gas to the pit, a portion of the apparatus being laid open to show certain details of the apparatus.

The various pits or holes are alike and a description of one will, therefore, suffice for all. The pit proper is indicated at P, each pit having a roof or cover 5 supported on rollers 6 adapted to ride on tracks 7 in order that the roof may be moved laterally of the pit to permit insertion and removal of the ingots W as will be readily understood. The pit has the usual bottom 8 supported on a suitable frame work 9, the ingots resting on the usual cinder bed 10.

In accordance with this invention, the pit is fired with fluid fuel, preferably gas. The fuel injecting means or burners may be of any suitable type but the type shown is preferred.

Referring to Fig. 3 wherein certain burner details are shown, 15 indicates the burner casing, 16 an air supply pipe, 17 the gas supply pipe, 18 the tube from which the mixture of air and gas is discharged, 19 a vaned member positioned in the tube 18 for imparting a rotary motion to the mixture issuing from the tube and 20 a seat on the tube for closing or restricting a flow passage for air between the tube and the adjacent nozzle-like wall 21 of the casing 15. The air delivered into the casing 15 by pipe 16 is under relatively high pressure as compared with the gas delivered by pipe 17 and some of the air but not the gas is free to flow through the passage which is controlled by said seat 20. The construction of the burner forms no part of the present invention except as regards the provision of means for imparting a rotary motion to the mixture as it issues from the tube 18, the burner itself forming the subject of a copending application, Serial No. 428,094, filed February 13, 1930, by Hugh B. Barber and myself now Patent No. 1,826,163 dated Oct. 6, 1931.

In accordance with this invention, the burners are so disposed with respect to each other and with respect to the walls of the pit that a rotary motion of the heating gases about a vertical axis in the pit is set up. Any suitable number of burners consistent with proper heating of the ingots may be used. In the present instance six burners are shown as firing into the pit, viz., four large burners generally indicated by the base letter L and two smaller burners designated by the base letter S. Burners L¹ and L² are at diagonally opposite corners of the pit and preferably have their axes in vertical parallel planes or in the same vertical plane and preferably fire at a compound angle to the walls of the pit, that is to say, they fire at an angle to the opposite side walls of the pit and also at an angle to the floor of the pit. By causing the burners to fire in a downwardly inclined direction, that is, towards the lower and thicker portion of the ingots (the usual ingots being tapered) it follows that the heat is initially directed to the point where it is most needed. While swirling of

the heating gas from burners L^1 and L^2 will result not alone because they fire at a compound angle but because of the rotary motion imparted by the spiral device 19 in the burner discharge tube 18 nevertheless very little if any rotation of the heating gases about a vertical would result by merely employing the two burners.

Therefore, in order to set up a pronounced rotary motion of the heating gases in the pit, burners S^1 and S^2 are provided, these burners being set to fire parallel to the end walls of the pit and directly towards the opposite side walls, this motion being clock-wise when the burner arrangement is as shown in Fig. 1. Other burners L^3 and L^4 preferably having their axes parallel to the axes of the respective adjacent burners L^2 and L^1 , may also be provided where proper heating of the pit or ingots so requires. It will be appreciated that the burners L^3 and L^4 will, even in the absence of burners S^1 and S^2 , tend to set up a rotary motion of the gases about a vertical axis in the pit. However, burners S^1 and S^2 are useful both from the standpoint of supplying heat to the ends of the pit and in assisting in the setting up of a rotary motion of the heating gases as said and consequently they will ordinarily be employed. The burners S are, as already stated, of considerably smaller capacity than the burners L since it is the function of the latter burners to supply the major heat requirements of the pit or ingots. The combustible mixture being supplied under pressure it follows that a pressure in excess of atmospheric pressure can be maintained in the pit and hence the entry of free air excluded from the pit.

The spent heating gases find exit from the pit at appropriate points, preferably from ports 25 and 26 at diagonally opposite corners remote from the burners S , the pressure within the pit being at a minimum at such ports due to the proximity of the burners L^2 and L^1 , respectively. Port 26, of course, is in connection with a suitable flue passage 27 and port 25 with a suitable flue passage 28, the spent gases being conducted to a recuperator (not shown) for preheating the air delivered to the burners as will be readily understood.

Both sets of burners L and S are secured to the exterior walls of the pit in any appropriate manner and each burner preferably delivers into an individual expanding combustion chamber 31 formed in the wall of the pit as will be readily understood, each combustion chamber having a restricted throat 30 whereinto the combustible mixture from the burner is initially discharged for more complete mixing and where combustion begins. By reason of the fact that the major portion of the burners is exposed to the atmosphere the heat absorbed by the burner is

rapidly dissipated and the parts consequently protected from over heating.

It is preferred that the ingots be so placed in the pit that the sides of the ingots be in parallelism with each other and more or less in parallelism with the axis of the burners L in order to facilitate passage of the heating gases from the burners L between the ingots. In any event the ingots adjacent burners S should be placed so as not to obstruct the flow of heating gases from the burners S and should be preferably placed as indicated in Fig. 1.

It will be noted that both the top and bottom rims 32 and 33 respectively, of the pit are inwardly of the plane of the adjacent terminal walls 34 of the combustion chamber and consequently even though the ingots be placed against the bottom rim of the pit the heating gases are free to flow from the combustion chambers.

While it is preferred that each of the burners or fuel ejecting means be provided with the vaned device 19 or its equivalent for setting up a rotary motion to the fuel gases delivered in its combustion chamber nevertheless it is within the spirit of the invention to omit such means and to rely upon the relative arrangement of the burners for setting up active swirling of the heating gases in the pit. By imparting a rotary motion to the fuel gases issuing from the combustion chamber, the hot gases or flames issuing therefrom spread out very rapidly and any tendency to spot heating of the ingots opposite the combustion chambers is materially reduced.

What is claimed is:

1. In the heating of ingots to prepare them for rolling, the method which consists in placing them in a pit at an angle to the sides of the pit and in spaced relation to each other and supplying gaseous fuel to the pit in a manner to cause the gases to swirl about the ingots.

2. A method of firing a soaking pit for heating ingots to prepare them for rolling comprising introducing into the pit at points lower than the tops of the ingots and at an angle to the sides of the pit a plurality of streams of gaseous fuel under pressure, the streams being so introduced as to set up a rotary motion of the body of gases in the pit.

3. The combination in a soaking pit, of means in opposite side walls of the pit at points lower than the top of the normal charge and removed from the pit proper for injecting fuel into the pit, said means firing into the pit at an angle to the side walls thereof in a manner to set up a rotary motion of the heating gases in the pit, and means associated with said fuel injecting means for imparting a swirling motion to the streams of fuel issuing from said means.

4. The combination with a soaking pit, of a plurality of fuel injecting means in each

of two opposite side walls, said means being set back from the pit proper and firing into expansion combustion chambers which converge from the pit toward said means, the axes of said chambers being at such angle to the side walls of the pit that the heating gases on entering the pit will tend to rotate about the vertical axis of the pit, and additional fuel injecting means at diagonally opposite corners of the pit firing thereinto in a manner to assist in imparting a rotary motion to the heating gases as said.

5. The combination with a soaking pit which is rectangular in plan, of a plurality of fuel injecting means in each of two opposite side walls, said means being set back from the pit proper and firing into expansion combustion chambers, which converge from the pit toward said means, the axes of said chambers being at such angle to the side walls of the pit that the heating gases on entering the pit will tend to rotate about the vertical axis of the pit, additional fuel injecting means at diagonally opposite corners of the pit firing thereinto in a manner to assist in imparting a rotary motion to the heating gases as said, and means associated with one or more of said fuel injecting means for imparting a swirling motion to the fuel issuing therefrom.

6. The combination with a soaking pit which is rectangular in plan, of fuel injecting means delivering into the pit from each corner of the pit, one set of diagonally opposite means firing toward each other and the other set firing in a common plane and parallel to the end walls of the pit.

7. The combination with a soaking pit which is rectangular in plan, of fuel injecting means at diagonally opposite corners firing diagonally of the pit, and fuel injecting means at the other corners of the pit firing in a common plane and parallel to the side walls thereof.

8. The combination with a soaking pit which is rectangular in plan, of fuel injecting means at diagonally opposite corners firing diagonally of the pit, and fuel injecting means at the other corners of the pit firing in a common plane and parallel to the side walls, thereof, the burners which fire diagonally of the pit firing at a downwardly inclined angle.

9. The combination in a soaking pit which is rectangular in plan, of fuel injecting means delivering into the pit from each corner of the pit, one set of diagonally opposite means firing toward each other and the other set firing parallel to the end walls of the pit, and exhaust ports in each of the end walls of the pit.

In testimony whereof I affix my signature.
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