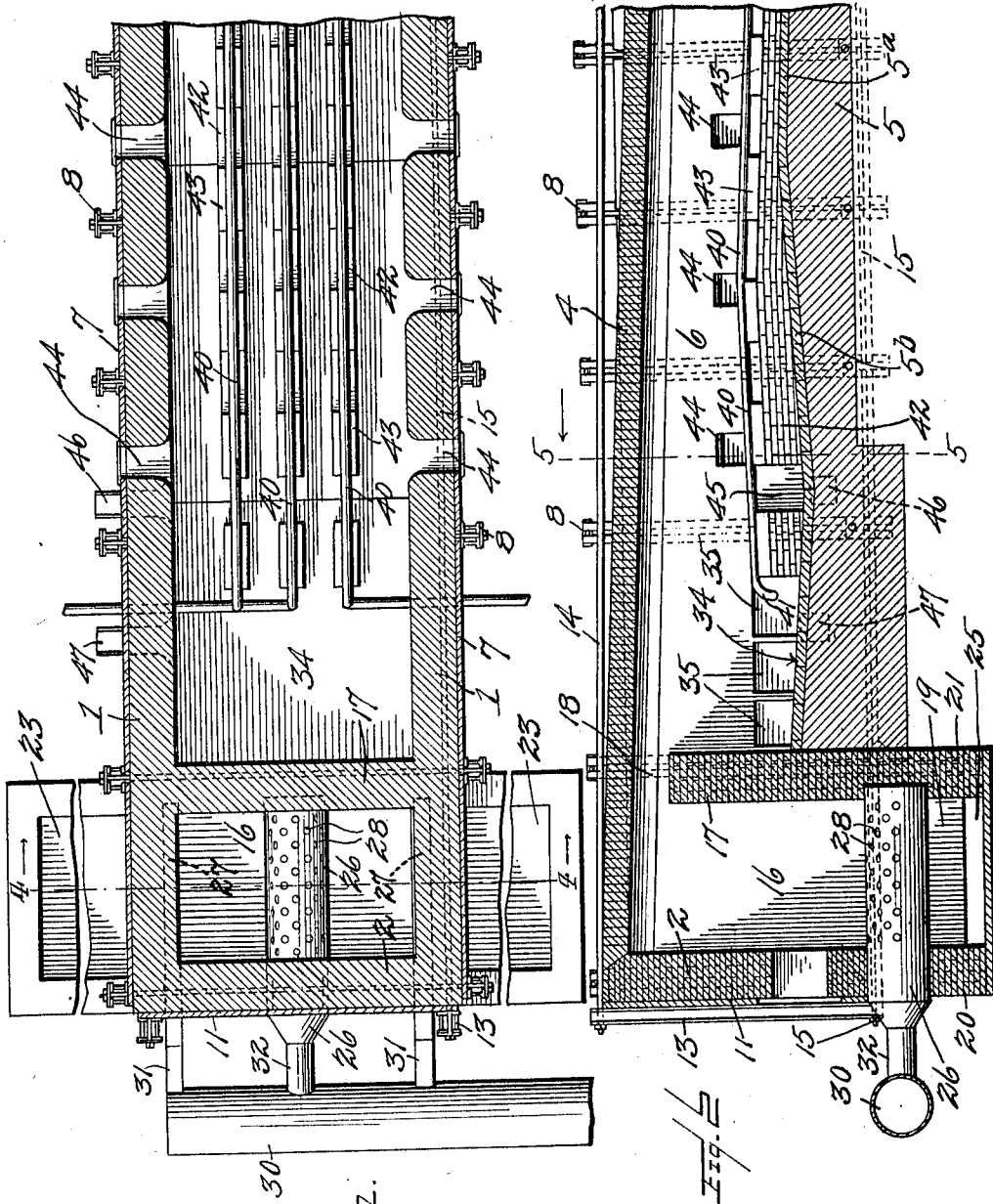


W. J. BRADLEY.
CONTINUOUS HEATING FURNACE.
APPLICATION FILED SEPT. 30, 1908.

1,040,868.

Patented Oct. 8, 1912.

2 SHEETS—SHEET 1.



WITNESSES:
W. F. Roy & Co.
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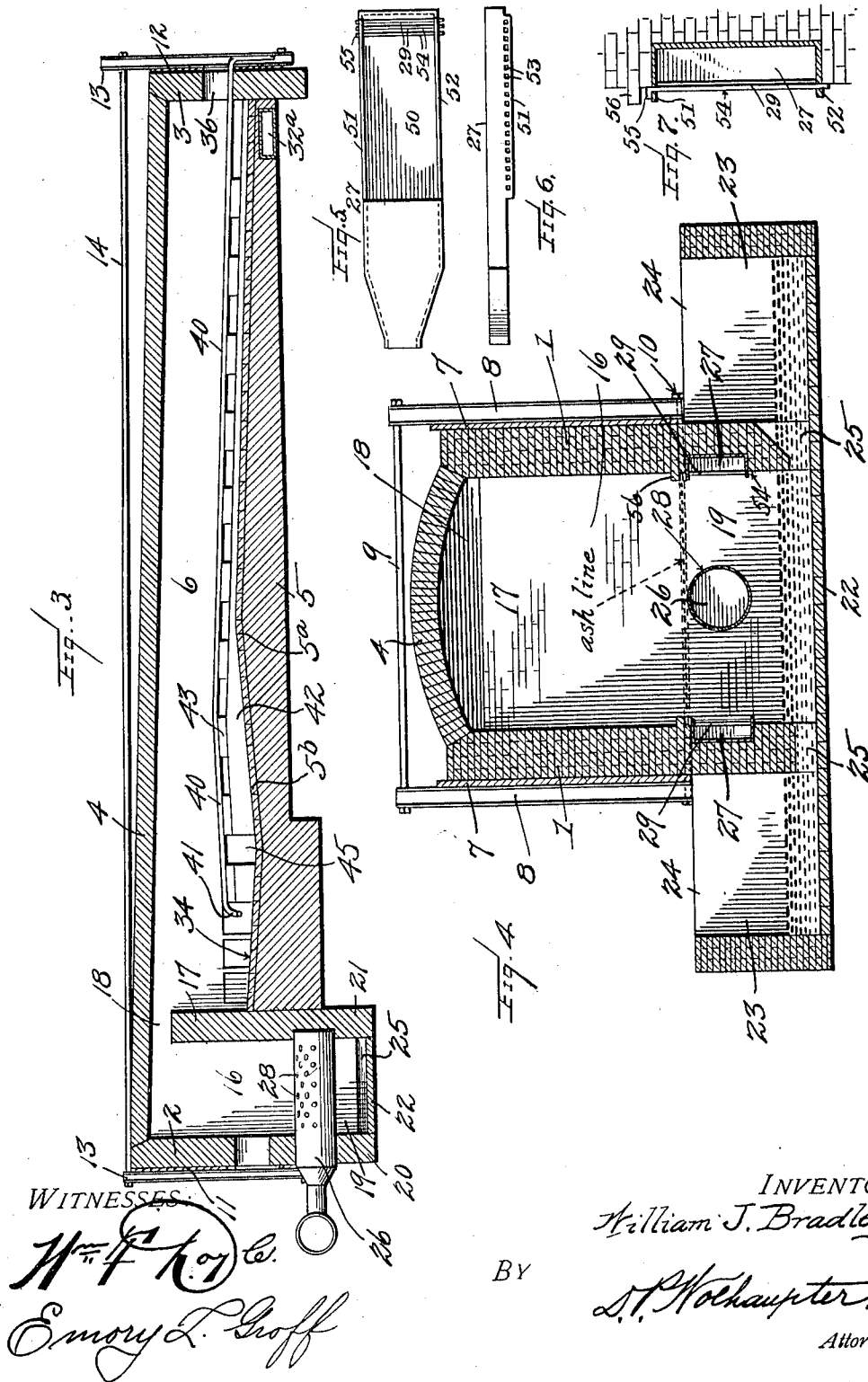
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UNITED STATES PATENT OFFICE.

WILLIAM J. BRADLEY, OF TROY, NEW YORK, ASSIGNOR TO THE RAIL JOINT COMPANY,
OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CONTINUOUS HEATING-FURNACE.

1,040,868.

Specification of Letters Patent.

Patented Oct. 8, 1912.

Application filed September 30, 1908. Serial No. 455,474.

To all whom it may concern:

Be it known that I, WILLIAM J. BRADLEY, a citizen of the United States, residing at Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Continuous Heating-Furnaces, of which the following is a specification.

This invention relates to the subject of metallurgy, and more particularly to that class of metal heating furnaces designed for preparing billets, blooms, or ingots for subsequent handling in rolling mills, or for other manipulation.

To this end the invention has specially in view certain novel and practical improvements in that type of heating apparatus known as the continuous heating furnace, which comprises means for permitting of the regular feeding of a continuous supply of billets, while at the same time providing for a graduated, but effective, heating thereof, whereby there may be maintained a regular and constant supply of uniformly and thoroughly heated billets ready for handling in the rolling mills or for other purposes.

In carrying out the foregoing object, the invention provides a continuous furnace structure, the various parts of which are so constructed and arranged as to secure the most satisfactory results with respect to the effective and thorough heating of the furnace casing throughout. Also, a special and distinctive feature of the invention resides in the provision of improved means for securing a maximum temperature in the furnace, and the maintenance of a uniform heat at all times and under all conditions. This latter function of the furnace is of special importance inasmuch as the best results are only attained by having constant conditions in the furnace whereby all of the billets or blooms will be uniformly heated alike and placed in the best possible condition for handling in the rolling mill or otherwise. This phase of the invention involves a novel fire box structure, and also improved means for supporting and maintaining combustion. Hence, a special and important feature of the present invention resides in providing the furnace with a grateless fire box so constructed as to permit of the maintenance of the fire on an ash bed under forced draft conditions, and with an effectual water-seal

which seals the fire box against the back-escape of air or other gases from the fire box.

With these and many other objects in view, which will more readily appear to those familiar with the art as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

The essential features of the invention involved in carrying out the objects above indicated, are necessarily susceptible of modification without departing from the scope of the invention, but a preferred embodiment of the latter is shown in the accompanying drawings, in which:

Figure 1 is an enlarged horizontal sectional view of one end portion of a continuous heating furnace embodying the novel fire box construction. Fig. 2 is an enlarged vertical longitudinal sectional view of the portion of the furnace shown in Fig. 2 of the drawings. Fig. 3 is a diagrammatic vertical longitudinal sectional view of the furnace, showing the same complete in one view. Fig. 4 is a vertical transverse sectional view of the improved fire box structure on the line 4-4 of Fig. 1. Fig. 5 is a side view of one of the side wind chests with all except a few of the slats removed to expose the open side portion. Fig. 6 is a top edge view of the said side wind chests. Fig. 7 is a detail vertical cross sectional view through one of the side wind chests and the adjacent portion of the wall, said view also including the removable slats and means for retaining them in place.

Like references designate corresponding parts in the several figures of the drawings.

The continuous type of furnace with which the improved fire box construction, claimed herein, is preferably combined, and embodied therein as a part of its organization, includes a casing having opposite parallel side walls 1 1, the front and rear end walls 2 and 3 respectively, the longitudinal crown or roof 4, and the furnace base 5. This casing is preferably constructed of substantial masonry capable of withstanding the service to which it is subjected, and is made in an elongated, rectangular, form so as to present what may be characterized as a tunnel-like furnace structure inclosing therein a long heating tunnel or chamber 6

that is unobstructed or continuous throughout its entire extent so as to receive therein a continuous line of billets or blooms which are consecutively advanced through the tunnel in a direction toward the main combustion chamber or fire box.

In the construction of the furnace casing, the same may be strengthened or reinforced in any suitable or approved manner, and protected in any suitable way from the warping and other effects of the temperatures to which the same is exposed without affecting the invention or the improvements claimed herein. But, as shown in the drawings, there may be utilized, in connection with the opposite parallel side walls 1, the metallic side facing plates 7 arranged upon the outer faces or sides of the walls 1, and extending the full height of said walls. These metallic side facing plates 7 have associated therewith, and are held in position by, the vertically disposed retainer bars 8 arranged in suitable or necessary number at the sides of the furnace casing and connected at opposite sides of the latter through the medium of the transversely arranged tie rods 9 and 10 respectively connecting the upper and lower ends of opposite retainer bars, and located at the top and bottom of the furnace casing proper, as may be plainly seen from the several figures of the drawings. This method of reinforcement and bracing is also preferably carried out in connection with the front and rear end walls 2 and 3 of the casing structure, said walls being respectively fitted with the front and rear casing plates 11 and 12 with which are associated the vertically disposed retainer bars 13, the upper and lower end portions of which bars, at opposite ends of the casing, being respectively connected by the upper and lower longitudinally arranged tie rods 14. This completes a very substantial and thoroughly braced structure possessing great durability and capable of most effectually withstanding the effects of the long continued heating and high temperatures which are maintained in continuous furnaces of this character.

The distinctive features of the present invention resides in the fire box structure, and the means employed for supporting and maintaining combustion therein. This fire box structure is located at what may be termed, for convenience in description, the front end of the furnace casing, that is, the end inclosed by the front end wall 2, and said fire box essentially consists of a combustion chamber 16 inclosed between the opposite side walls 1 of the casing, and between the front end wall 2 and the interior fire box bridge wall 17 arranged transversely of the casing in spaced parallel relation to the front wall 2 and joined to the side walls 1, as plainly shown in Fig. 1

of the drawings. The said fire box bridge wall 17 extends nearly the full height of the furnace casing, but terminates sufficiently short of the crown or roof 4 to provide over the top of the bridge wall a circulating passage 18 through which the fire and products of combustion pass into the front end portion of the heating tunnel or chamber 6.

One of the characteristic and practical features of the fire box structure resides in the fact that the said fire box is not equipped with a fire grate. Hence, the fire box is grateless and the combustion chamber thereof is in direct and open communication at its lower end with the bottom ash pit 19 which is confined between the lower edge portions of the side walls 1, and the lower end extensions 20 and 21 respectively of the front end wall 2 and the bridge wall 17, as clearly illustrated in Figs. 2 and 3 of the drawings.

The bottom ash pit 19, which is in open communication with the combustion chamber 16 thereabove, is entirely closed at its lower side by a suitable bottom portion 22, so that the ash pit not only serves to accommodate a constant filling of ashes to form an ash bed for the fired fuel, but also operates in the capacity of a sealing well designed to contain water to a sufficient depth to operate as a complete and effective water-seal to prevent the downward escape of air or other gases from the fire box, as hereinafter more particularly referred to.

In connection with the formation of the ash pit 19 so that the same will hold an ash bed for the fuel without the employment of a fire grate, and will also act as a sealing well for holding water, the fire box part of the furnace casing includes in its construction what may be termed the opposite lateral well extensions 23. These lateral or side well extensions 23, arranged at each side of the fire box part of the furnace casing, are designed to subserve the function of side clearing wells, inasmuch as they provide means for admitting of the removal of the ashes from the bottom of the ash pit proper, while also serving as elements of the sealing well itself inasmuch as said side clearing wells likewise contain a proper depth of water therein, and by reason of being open at the top, as at 24, the supply of water for sealing purposes may be readily maintained through the medium of the same. Communication is maintained between the interior of the side wells 23 and the bottom part of the ash pit 19 through the connecting passages or openings 25 formed in the lower edge portions of the side walls 1, as best shown in Fig. 4 of the drawings.

As a part of the fire box equipment, in order to maintain a maximum and uniform heating throughout the furnace structure,

the invention contemplates the employment of an improved forced blast for the fire in the combustion chamber which is supported on the ash bed in the ash pit 19. This part of the invention involves a novel and effective arrangement of the parts for directing an air blast through the ash bed, and thence through the fuel and fire thereon in such a manner as to promote and maintain the best possible combustion conditions. These desirable results are secured through the employment of a main centrally arranged wind-chest 26, and oppositely located supplemental side wind-chests 27.

The main wind-chest 26 may be of any suitable form, and constructed in any suitable manner without affecting the present invention, but is preferably in the form of a cylindrical drum arranged centrally within the ash pit portion 19 of the fire box structure and disposed longitudinally of the furnace casing. The said drum constituting the main centrally arranged wind-chest 26 is provided in the side and top portions thereof with a multiplicity of blast openings 28, the centers of which are so arranged with relation to the longitudinal center of the drum or chest as to provide for distributing blasts of air obliquely upward through the ash bed toward the side walls of the combustion chamber, and also in direct vertical paths upwardly through the ash bed and into the combustion chamber, thus securing an effective and uniform distribution of air blasts, which provide for an even burning of the fire besides supplying a large amount of oxygen for maintaining the very best combustion conditions.

The above described action of the main centrally arranged wind-chest 26 is supplemented and augmented by the side wind-chests 27 which are suitably fitted or seated directly in the side walls of the ash pit 19, and preferably in the transverse or horizontal plane of the wind-chest 26. Each of the side wind-chests 27 is usually in the form of a rectangular hollow boxing, and the inner side thereof, exposed to the interior of the ash pit, is provided with suitably arranged blast openings 29 which are so disposed and located as to direct blasts of air inwardly and upwardly through the ash bed and into the fire with the result of materially assisting the action of the main wind-chest 26. The blast openings 29 of the side wind-chests 27 are preferably provided for by a specially constructed chest involving a very practical arrangement of parts. As shown in the detail Figs. 5, 6 and 7 of the drawings, the rectangular hollow boxing forming the body of each of the side wind-chests 27 is preferably constructed with an open side 50, and at the top and bottom edges of said open side portion with the upper and lower projecting supporting flanges 51 and 52 provided

therein with a line of perforations 53 which accommodate therein a line of vertically arranged removable slats 54. The upper ends of these slats are provided with retaining hooks or heads 55 overlying the upper supporting flange 51, and are adapted to be overhung by a corbel 56 which may be conveniently formed by extending out one course of the brick of the side wall of the fire box. The details of this construction are more plainly shown in Fig. 7 of the drawings, and it will be observed in the said figure of the drawings, that the construction illustrated provides a slatted formation for the open side of the side wind-chest which communicates with the ash pit of the fire box. The slatted structure necessarily provides a multiplicity of elongated vertical slits which constitute blast openings 29 of the side wind-chests, thus presenting an extensive blast area through which blast issues from the side wind-chests into the ash pit, with the result of supplementing and augmenting the blast action in a most effective manner. The structure is also of such a nature that the slats 54 are readily renewable.

Any suitable means may be utilized to provide for supplying the wind-chests 26 and 27 with air under sufficient pressure for blast purposes, but this may be conveniently accomplished by employing a blast supply drum 30 arranged exterior to the front end of the furnace casing and having air trunk connections 31 with the front ends of the side wind-chests 27, and an air trunk connection 32 with the front end of the central chest or drum 26. The blast supply drum 30 is connected in any desired manner with a suitable source of air pressure supply.

The fire and products of combustion from the combustion chamber 16 of the fire box pass over the bridge wall 17 through the passage or flue 18 and are delivered directly into the front end portion of the long heating tunnel 6, passing through the entire length of said tunnel between the crown 4 and the floor 5^a, and finally escaping through suitable gas outlet openings piercing the floor of the furnace casing at the extreme rear end portion thereof and in communication with a transversely arranged gas escape pipe 32^a. This gas escape pipe 32^a is placed within the rear end portion of the casing beneath the floor thereof and connects at one end exterior to the furnace casing with a suitable stack connection.

From the foregoing it will be observed that the heated products of combustion enter from the front end of the heating tunnel or chamber 6 at the crown or roof thereof, and leave said tunnel or chamber through the floor at its rear end, thus providing a circulation for the heated products, which secures in effect a reverberating action, inas-

much as the circulation of the heated products has a constant downward tendency toward the floor 5^a of the tunnel or chamber 6. This tendency is assisted by the crown or roof 4, the latter preferably sloping in a direction which causes the same to have a declination toward the rear end wall 3, as may be plainly seen from the diagrammatic view in Fig. 3 of the drawings. These details contribute materially to throwing heat downward upon the line of billets within the heating tunnel or chamber and maintaining uniform and constant temperature conditions whereby the heating of the billets or blooms may be uniformly carried out during the operation of the furnace.

It is preferable in the construction of the furnace casing to build the base 5 of a masonry filling, and to line the upper face thereof with a fire brick or equivalent covering forming the casing floor 5^a. The casing floor 5^a from an intermediate point to the rear end of the casing is approximately parallel with the inclined crown or roof 4, but forward of said intermediate point is dipped, as at 5^b, to provide an enlarged front portion for the heating tunnel or chamber 6. Directly adjoining the bridge wall 17 the floor or flooring of the casing is arranged to form a terminal receiving hearth 34 upon which are received the heated billets ready to be withdrawn from the furnace for use. In connection with this terminal receiving hearth 34 for the heated billets or blooms, the side of the furnace casing, from which the billets are withdrawn, is provided with a plurality of door inclosed delivery openings 35 through which the operator enters the withdrawing appliance for the billet, all of which is well understood by those familiar with the art.

The billets or blooms are introduced into the furnace casing through a feed opening 36 piercing the rear end wall 3.

Water-pipe guide rails 40 are arranged in the chamber 6 to support and guide the billets, said rails having deflected terminals 41 over the hearth 34 and being supported upon the piers 42 in connection with suitable rest pieces 43.

The side walls of the furnace casing are preferably provided at suitable intervals therein with door inclosed observation holes 44 through which the condition of the billets at any point in the furnace may be observed

from time to time, and adjacent to the terminal receiving hearth 34 there is preferably formed by the floor 5^a a slag basin 45 in communication at one end with a slag spout 46. Also, a similar spout 47 may be associated with the hearth 34 so that slag may be removed from the enlarged front end portion of the heating tunnel or chamber where the billets or blooms are necessarily subjected to the greatest heat.

From the foregoing, it is thought that the construction, operation, and many advantages of the herein described furnace will be apparent without further description, but it will of course be understood that various changes in structural details, or modifications in the form and proportion of parts may be resorted to without departing from the invention or sacrificing any of the advantages thereof.

I claim:

1. In a furnace of the class described, the furnace casing having a grateless fire box provided with an upper combustion chamber and a lower ash pit, the latter being in open communication with the combustion chamber, a single wind-chest centrally supported within the ash pit below the ash-line and having means for directing the blasts of air upwardly, supplemental wind-chests arranged at the side walls of the ash pit and also below the ash-line, and each of which supplemental chests is provided with an open side portion exposed to the interior of the ash pit, and removably mounted slats arranged in spaced relation over the open side portions of said supplemental chests.

2. In a furnace of the class described, the combination with the furnace casing having a fire box provided with an ash pit, of a wind-chest arranged at the side of the ash pit and having an open side portion and perforated supporting flanges at the top and bottom edges of said open side portion, the latter being exposed to the interior of the ash pit, a series of spaced removable slats mounted in said perforated supporting flanges, and retaining means for holding said slats in place.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

WILLIAM J. BRADLEY.

Witnesses:

BENJ. WOLHAUPTER,
WALTER S. OGILVY.