

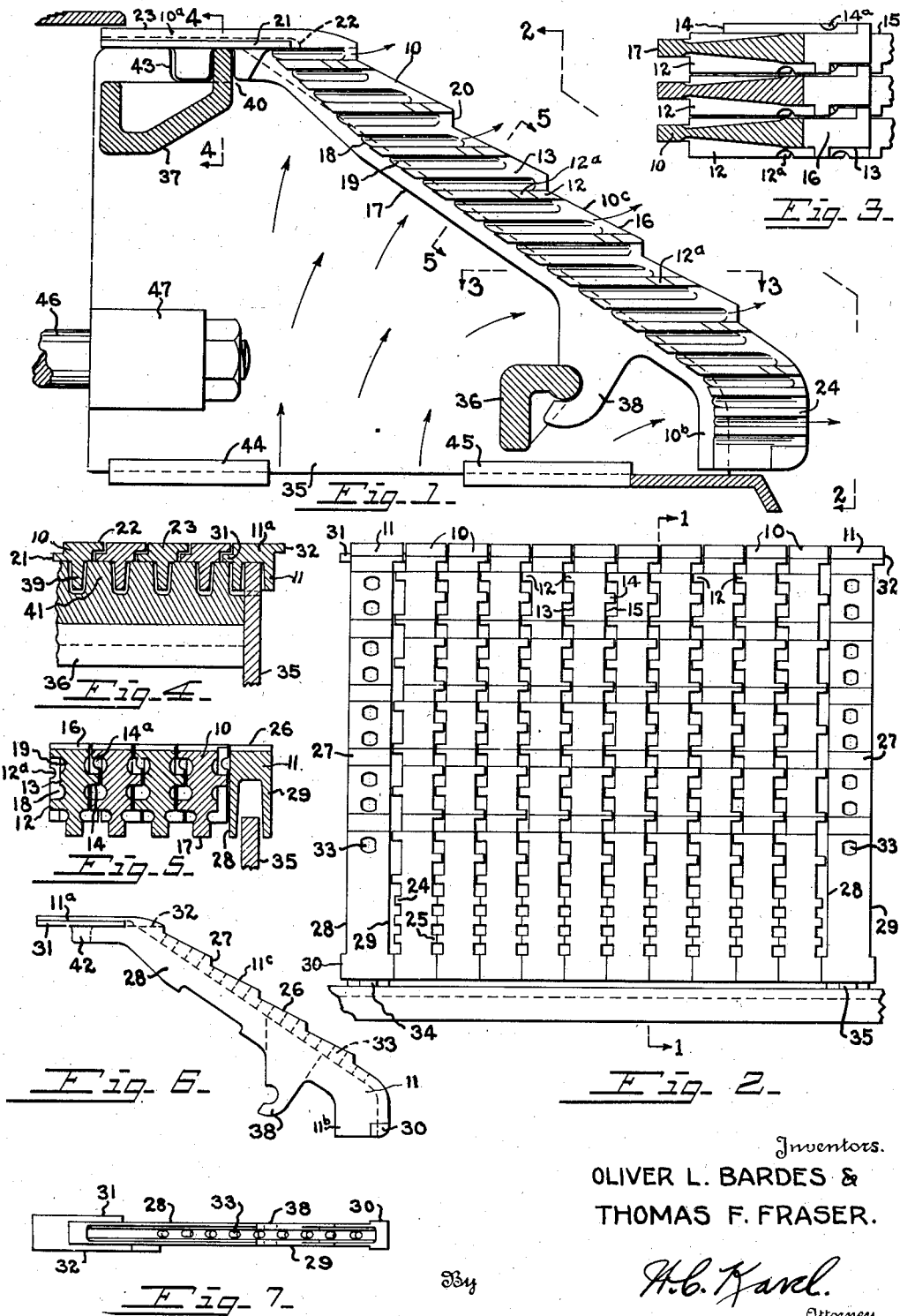
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GRATE BAR

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GRATE BAR

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This invention relates generally to the grate structures employed in furnaces equipped with automatic coal-feeding mechanism and provided with means for introducing air under pressure into the fuel-bed. It has particular reference to the grate bars which constitute that portion of the fuel-bed structure commonly known as the extension grates in multiple retort furnaces and which are usually disposed directly to the rear of the tuyères and retorts. It is in this portion of the fuel-bed that the complete burning of the coal is finally accomplished and the residuum subsequently discharged therefrom into the ash-pit. Therefore, in order to consume every particle of combustible material still remaining unburned after having passed through the major zone of combustion, it is important that this portion of the fuel-bed be kept in an active state; that is to say:—on account of the molten-like condition of the fuel at this stage of combustion, it is desirable to effect the maximum of activity in this portion of the fuel-bed so as to accomplish the fullest measure of combustion. To this end, it is common practice to impart a reciprocatory movement to the extension grates so as to break up insofar as is possible the cohesion of the fuel particles and thus enable the air currents to more readily penetrate the mass of burning embers.

Inasmuch as the grate bars in this part of the fuel-bed are directly exposed to the intense heat of the incandescent fuel and consequently are subject to rapid depreciation, it is of the utmost importance that every precaution be taken and every provision be made in the design of such bars as to assure and facilitate cooling of the bars by the air currents and thus obtain the maximum of radiation of the heat so as to prolong the life of the bars to the greatest extent possible.

In view of these circumstances, one object of the present invention is to provide a grate bar for the extension grates which will effect a greater activity in the combustion of the fuel supported thereon than has heretofore been possible with bars constructed in accordance with prior practice.

Another object is to provide a grate bar for this purpose which will accomplish a maximum of radiation or diffusion of the heat away from the bar.

Another object is to provide a grate bar of this character which will withstand the intense heat and fluctuating temperature without undue distortion.

Another object is to provide for maintaining a

substantial circulation of air between adjacent bars if and when any of the air passageways become temporarily choked at the outlet by ash or other matter.

Another object is to provide a grate bar of this character having a fuel-supporting surface which is arranged so as to facilitate the maintenance of a disintegrated condition of the fuel-bed.

These and other objects will be apparent from the following description and accompanying drawing, in which:

Fig. 1 is a side sectional elevation of the extension grate structure, taken substantially on a line 1—1 of Fig. 2.

Fig. 2 is an elevation of one of the group units of the extension grate as viewed from the position 2—2, Fig. 1.

Fig. 3 is a sectional view of several of the center grate bars as taken on a line 3—3, Fig. 1.

Fig. 4 is a sectional view of several of the center grate bars and one end bar as taken on a line 4—4, Fig. 1.

Fig. 5 is a sectional view of the same bars as shown in Fig. 4 but taken on a line 5—5, Fig. 1.

Fig. 6 is a side elevation of the end grate bar on a reduced scale.

Fig. 7 is a bottom view of the end grate bar shown in Fig. 6.

Inasmuch as the invention disclosed herein pertains only to the grate bars of the extension grate structure, no illustration or description need be given of the coal feeding mechanism or of the other elements of the furnace structure such as the retorts, tuyères, etc.

Referring to the drawing:—the extension grate structure is shown as comprising a plurality of grate bars and a supporting framework for the group. As shown in Fig. 2, each group of grate bars consists of center bars 10 and end bars 11. Preferably all of the bars have substantially the same general profile in side elevation, each center bar comprising a horizontal portion 10a, a vertical portion 10b and an intermediate inclined portion 10c and each end bar having similar portions 11a, 11b and 11c respectively, but in certain other respects, the end bars are preferably different from the center bars. However all center bars are alike and all end bars are alike. As shown in Figs. 1 to 5, the center bars 10 are solid, and, as shown in Figs. 4 to 7, the end bars 11 are grooved on the bottom or forward side so that the cross-sectional form of the bar is like that of a channel.

As shown in Figs. 1 to 5, portion 10c of each center bar is provided with a plurality of hori-

zontally disposed ribs or flanges 12 on side face 13 and a plurality of similar flanges 14 are provided on the opposite face 15, the said flanges on one side being disposed in horizontal planes which alternate with the flanges on the opposite side so that, in assembly, the flanges on adjacent sides of the bars will overlap alternately, as shown in Figs. 2, 3 and 5, thereby effecting air passageways between the adjacent bars and at the same time baffling the transit of ash dust downward between the bars, as illustrated in Fig. 2. Preferably flanges 12 and 14 extend from the top or rear face 16 of portion 10c of the bar to substantially near the bottom or forward face 17 thereof and faces 13 and 15 of portion 10c are preferably provided with grooves 18 and 19 respectively on each side of each of said flanges, said grooves being spaced vertically and extending from a point near the face 16 to a point near the face 17, said grooves having greater depth at one end than at the other as clearly shown in Fig. 3, the arrangement being such that the portions of side faces 13 and 15 between the grooves register in assembly with the respective flanges 12 and 14 on adjacent bars.

Each of the flanges 12 and 14 is provided with a lateral passageway or notch 12a and 14a respectively, preferably located near the rear end of the flange, and the purpose of this notch will be hereinafter referred to.

The top or rear face 16 of portion 10c, which is a fuel-supporting surface, is arranged with a plurality of facets so as to provide in effect a series of steps 20 and the disposition of these steps is arranged relative to the flanges 12 and 14 so that the outlets of the air passageways formed between the overlapping flanges of adjacent bars will have an advantageous cooperative relation with the functional effect of the said steps as hereinafter referred to.

The horizontal portion 10a of the center bars is provided with a horizontal flange 21 on one of the side faces and a flange 22 on the other side face, these flanges being disposed in different vertical planes so as to overlap one another in assembly as shown in Figs. 2 and 4. Preferably the flange 22 is flush with the upper face 23 of portion 10a and extends forward from the face 16 to the forward end of said portion while flange 21 extends rearward from the said forward end to a point spaced forward of face 16.

The vertical portion 10b of the center bars is also provided on one of the side faces with a plurality of horizontally disposed ribs or flanges 24 and a like number of similar flanges 25 on the other side face, these flanges being arranged in vertical series so that in assembly flanges 24 are in abutting relation with flanges 25 thus forming air passageways between adjacent bars as shown in Fig. 2.

In reference to end bars 11:—the top or rear face 26 of portion 11c is arranged in a series of steps 27 similar to the face 16 of bar 10 but the side faces 28 and 29 are preferably devoid of flanges throughout the extent of portions 11b and 11c, the former having merely a spacing abutment 30 on each side face, while portion 11a is provided with flanges 31 and 32 similar to flanges 21 and 22 on bar 10. However, bar 11 is provided with a plurality of air passageways in the form of apertures 33 extending through the upper wall of the bar and these passageways are disposed relative to the steps 27 so as to cooperate functionally therewith in a manner hereinafter referred to.

The grate bars of each group are arranged so that they may be detachably mounted upon a supporting framework. This arrangement may be of any suitable character but we have herein shown a framework comprising side plates 34 and 35 rigidly secured one to the other by means of tie members 36 and 37 and each bar is provided with a hook portion 38 whereby the lower or rear end of the bar may effect engagement with tie member 36 which is suitably formed for the purpose. Moreover each of the center bars 10 is shown as having a web portion 39 and a recess 40 on each side of said web and tie member 37 is shown as formed with a series of prongs 41 each of which is disposed between the webs 39 and within the recesses 40 on adjacent bars thereby defining the position of the upper end of each of said bars whereas end bars 11 are each provided with a lug portion 42 which engages a recess 43 in each of the respective side plates 34 and 35 while the channel formation of the said end bars enables them to be nested upon or to straddle the side plate and thus the end bars are held in position both longitudinally and laterally.

The supporting framework carrying a group of grate bars may be arranged so as to be reciprocated bodily in any suitable manner but we have herein shown fixed guideways 44 and 45 in which the side plates 34 and 35 of the framework are slidably mounted and motion may be imparted to the framework by operatively connecting it with the coal feeding mechanism of the stoker (not shown) in any well known manner as by push-pull rods 46 which may be attached to any part of the framework such as brackets 47 secured to the side plates.

In operation, draft air is supplied to the space below and forward of the grate bars and, as shown by the arrows in Fig. 1, the air flows in a generally rearward and upward direction passing through the air passageways between the grate bars and through the apertures 33 in the end bars and thus the burning fuel carried by the extension grates is supplied with a multiplicity of air currents disposed in a substantially uniform manner throughout the extent of the grate area.

It will be observed that the formation of the grate bars is such as to enhance the effectiveness of the air currents in carrying the heat away from the bars thus avoiding excessively destructive temperature and thereby preserving the service life of the grate bar to the greatest extent. However, should the air outlet to any of the air passageways between the bars become temporarily clogged, as by ash or otherwise, circulation of air throughout a substantial portion of the closed passageway may still be maintained by means of the notch 12a or 14a in the flanges 12 and 14 and this feature has been found to be of distinct advantage in avoiding destructive hot-spots arising from closed air outlets.

The molten-like condition of the burning fuel carried by the extension grates often acts to give the effect of blanketing or choking the air currents emerging from the passageways through and between the bars and this retards the rate of combustion—that is, reduces the activity of the fire. To alleviate this condition, it has been common practice to give the extension grates a horizontal reciprocatory movement, the idea being to thus cause disintegration of the coherent mass of fuel and thus release the air currents but this method has been only partially successful in accomplishing a sufficient degree of

activity mainly because the fuel supporting surface of the extension grate bars has heretofore been disposed in a single angular plane and further because most of the commonly used grades of coal fuse so completely during the later stages of combustion that a smooth fuel-supporting surface is ineffectual to disrupt the mass. In order to effect an improvement in this condition, we have provided the extension grate bars with an irregular or offset fuel-supporting surface in the form of a series of steps and it is this feature which assures that the fused layer of coal will be broken up when the extension grates are moved back and forth. The result thus obtained represents not only a substantial increase in the efficiency of combustion due to the greater activity of the fire but it is an important factor in prolonging the life of the grate bars because of the greater rapidity with which the heat is carried away from the bars by the freer flow of air.

Particular attention is also directed to the advantageous results obtained by arranging the air passageways so as to have a definite cooperative relationship with the offsets or steps 20 and 27 in the fuel-supporting surface of the bars. As shown in Fig. 2, it will be noted that, in the assembly of the center bars, there are three air passageways associated with each step; one directly in horizontal alignment with the vertical face of the step; another just above the step, and the other just below the step. In substantially like manner, the air passageways 33 in the end bars 11 are disposed one above and one below each of the steps 27. This particular arrangement causes the air currents to be discharged into the fuel directly at those points where they will be most effective, that is, where the fused layer of embers has been fractured by the offsets in the fuel-supporting surface. In this way the final stage of combustion is accomplished in a more highly efficient and thorough manner than has been possible heretofore.

It is thus apparent that we have provided a grate bar which accomplishes the objectives set forth herein and one which represents a substantial improvement over bars constructed in accordance with prior practice.

It is obvious that the novel features disclosed may be variously modified as to form and as to application in grate bars of similar character in general and it is to be understood that the invention is limited not by the particular form of construction shown herein but only by the scope of the following claims.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. Grate bars adapted for horizontal reciprocation in assembly with like bars arranged side by side, said bars, in operative position, comprising a solid inclined portion having a relatively narrow and imperforate rear face exposed to the fire and relatively wide side faces, said rear face being composed of longitudinally alternating vertical and sloping facets which extend fully from one side face to the other, and each of said side faces arranged with a plurality of substantially horizontal flanges extending from said rear face to a point near the opposite face of said inclined portion, the flanges on one of said side faces being disposed in horizontal planes alternating with those on the other side face so as to provide in assembly substantial air passageways formed by the overlapping flanges between adja-

cent bars, each of said flanges being provided with a crosswise passageway which effects communication between the air passageways on opposite sides of said flanges.

2. Grate bars adapted for horizontal reciprocation in assembly with like bars arranged side by side, said bars, in operative position, comprising a solid inclined portion having a relatively narrow and imperforate rear face exposed to the fire and relatively wide side faces, said rear face being composed of longitudinally alternating vertical and sloping facets which extend fully from one side face to the other, and each of said side faces arranged with a plurality of substantially horizontal flanges extending from said rear face to a point near the opposite face of said inclined portion, the flanges on one of said side faces being disposed in horizontal planes alternating with those on the other side face so as to provide in assembly substantial air passageways formed by the overlapping flanges between adjacent bars, said flanges being further disposed so as to provide a passageway in direct horizontal alignment with each of said vertical facets, another passageway above and still another passageway below each of said vertical facets, each of said flanges being provided with a crosswise passageway which effects communication between the air passageways on opposite sides of said flanges.

3. In an extension grate structure in combination with a supporting framework adapted to be reciprocated horizontally, a group of grate bars attached to said framework and disposed in side-to-side relation, said group comprising end bars grooved longitudinally on the underside to receive the side members of said framework and a plurality of other bars positioned intermediate said end bars, each of said bars, in operative position, comprising an inclined portion having a relatively narrow rear face exposed to the fire and relatively wide side faces, said rear face being composed of longitudinally alternating vertical and sloping facets which extend fully from one side face to the other, a plurality of substantially horizontal flanges arranged on each of the side faces of said intermediate bars and extending from said rear face to a point near the opposite face of said inclined portion, the flanges on one of said side faces being disposed in horizontal planes alternating with those on the other side face so as to provide air passageways formed by the overlapping flanges between adjacent bars, and a longitudinally disposed series of apertures extending through the inclined portion of said end bars from said sloping facets to the groove on the underside thereof.

4. In an extension grate structure in combination with a supporting framework adapted to be reciprocated horizontally, a group of grate bars attached to said framework and disposed in side-to-side relation, said group comprising end bars grooved longitudinally on the underside to receive the side members of said framework and a plurality of other bars positioned intermediate said end bars, each of said bars, in operative position, comprising an inclined portion having a relatively narrow rear face exposed to the fire and relatively wide side faces, said rear face being composed of longitudinally alternating vertical and sloping facets which extend fully from one side face to the other, a plurality of substantially horizontal flanges arranged on each of the side faces of said intermediate bars and extending from said rear face to a point near the oppo-

site face of said inclined portion, the flanges on, one of said side faces being disposed in horizontal planes alternating with those on the other side face so as to provide air passageways formed by the overlapping flanges between adjacent bars, said flanges being further disposed so as to provide a passageway in direct horizontal alignment with each of said vertical facets, another passageway above and still another passageway below each of said vertical facets, and a longitudinally disposed series of apertures extending through the inclined portion of said end bars from said sloping facets to the groove on the underside thereof, the said apertures being positioned one above and one below each of said vertical facets.

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