March 11, 1941. W. A. RIDDELL 2,234,416

FURNACE GRATE CONSTRUCTION

Filed Aug. 15, 1939 3 Sheets-Sheet 1

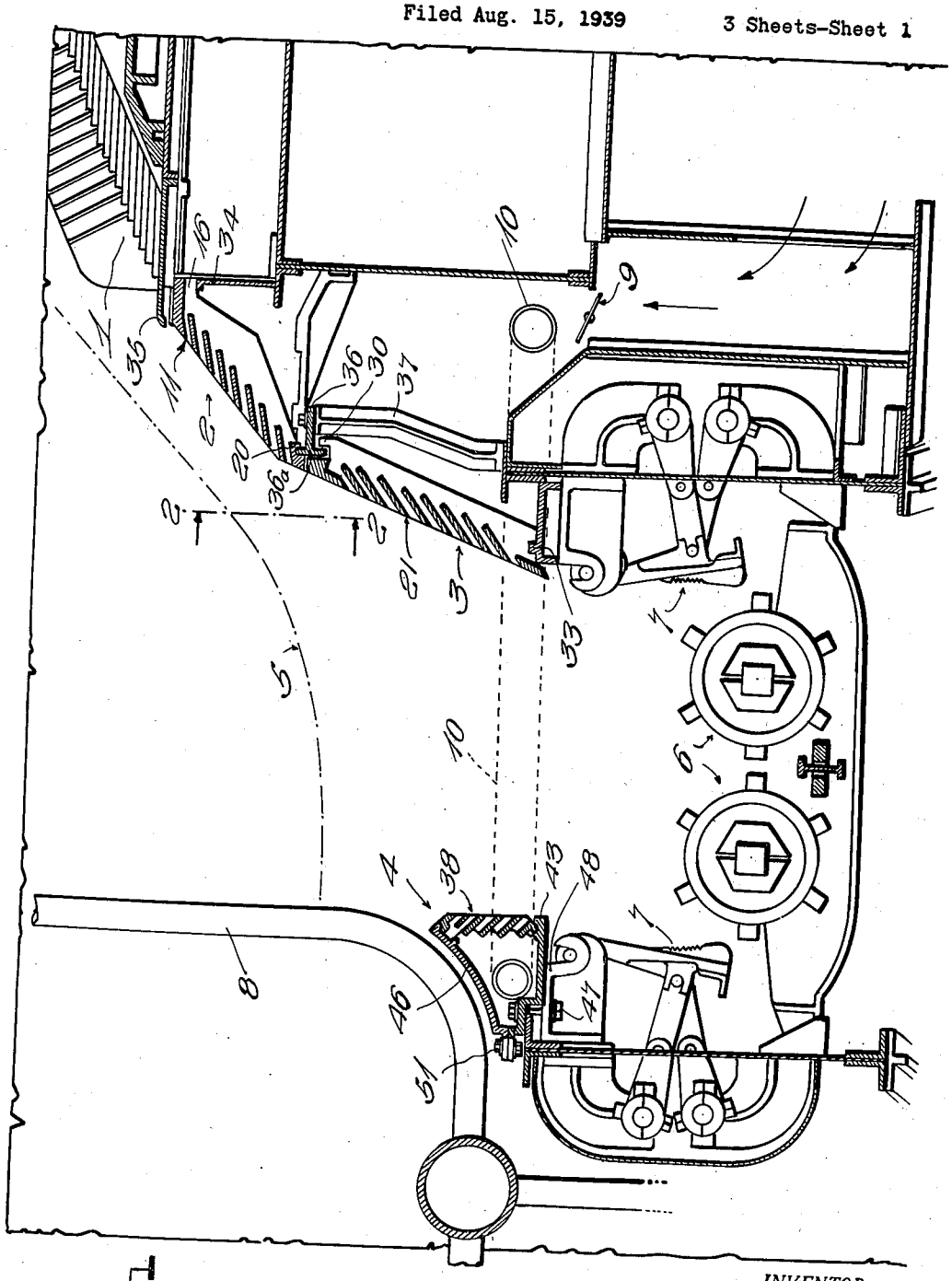


Fig. 1

INVENTOR.
William A. Riddell,
BY
John B. Brady
ATTORNEY.

March 11, 1941. W. A. RIDDELL 2,234,416

FURNACE GRATE CONSTRUCTION

Filed Aug. 15, 1939 3 Sheets-Sheet 2

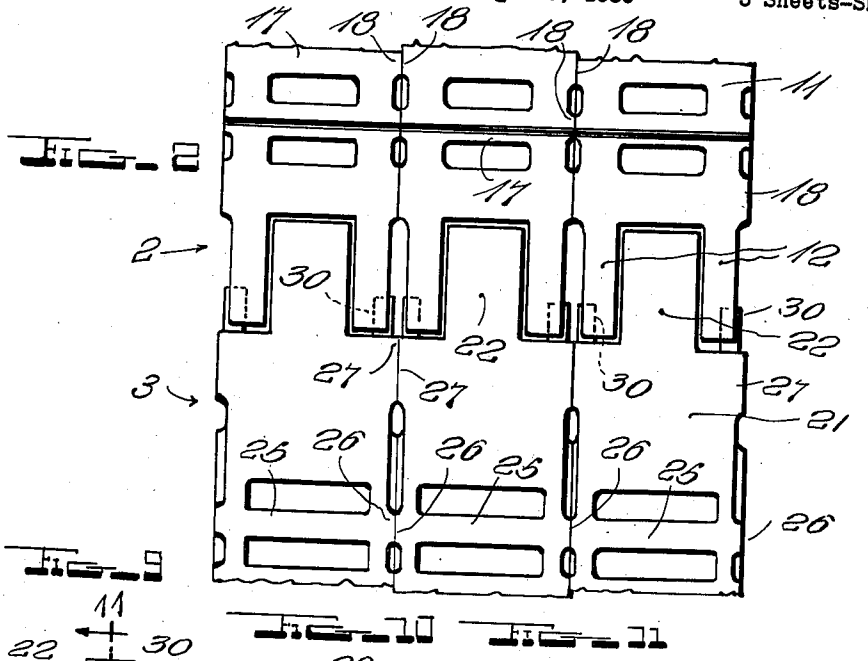


FIG. 2

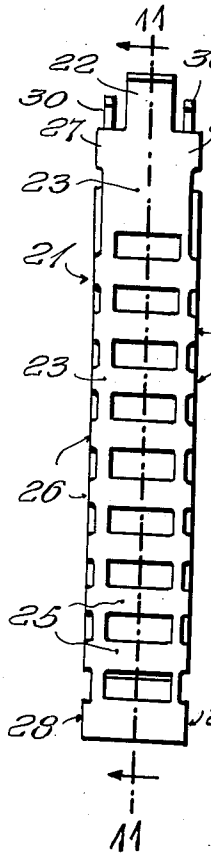


FIG. 9

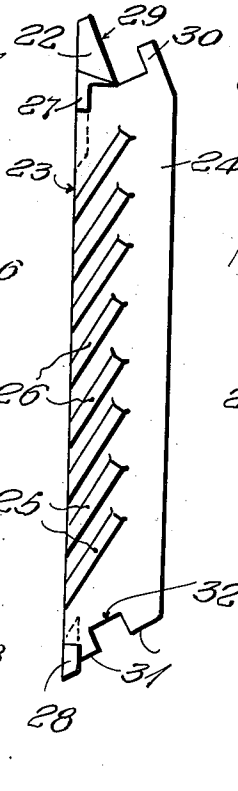


FIG. 10

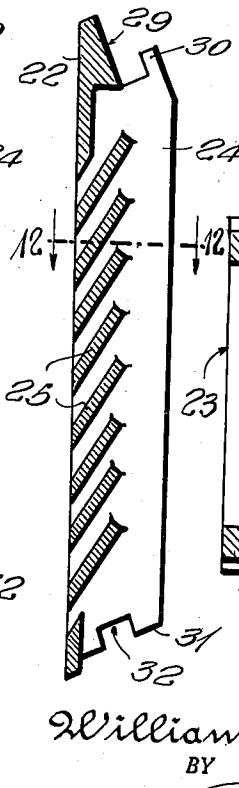


FIG. 11

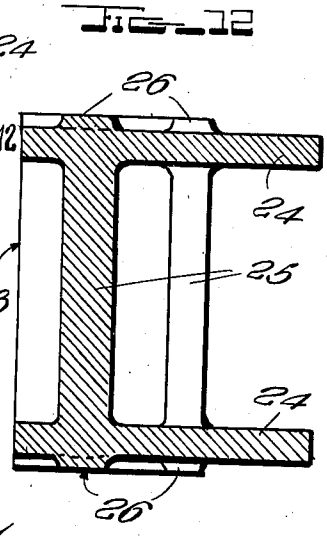


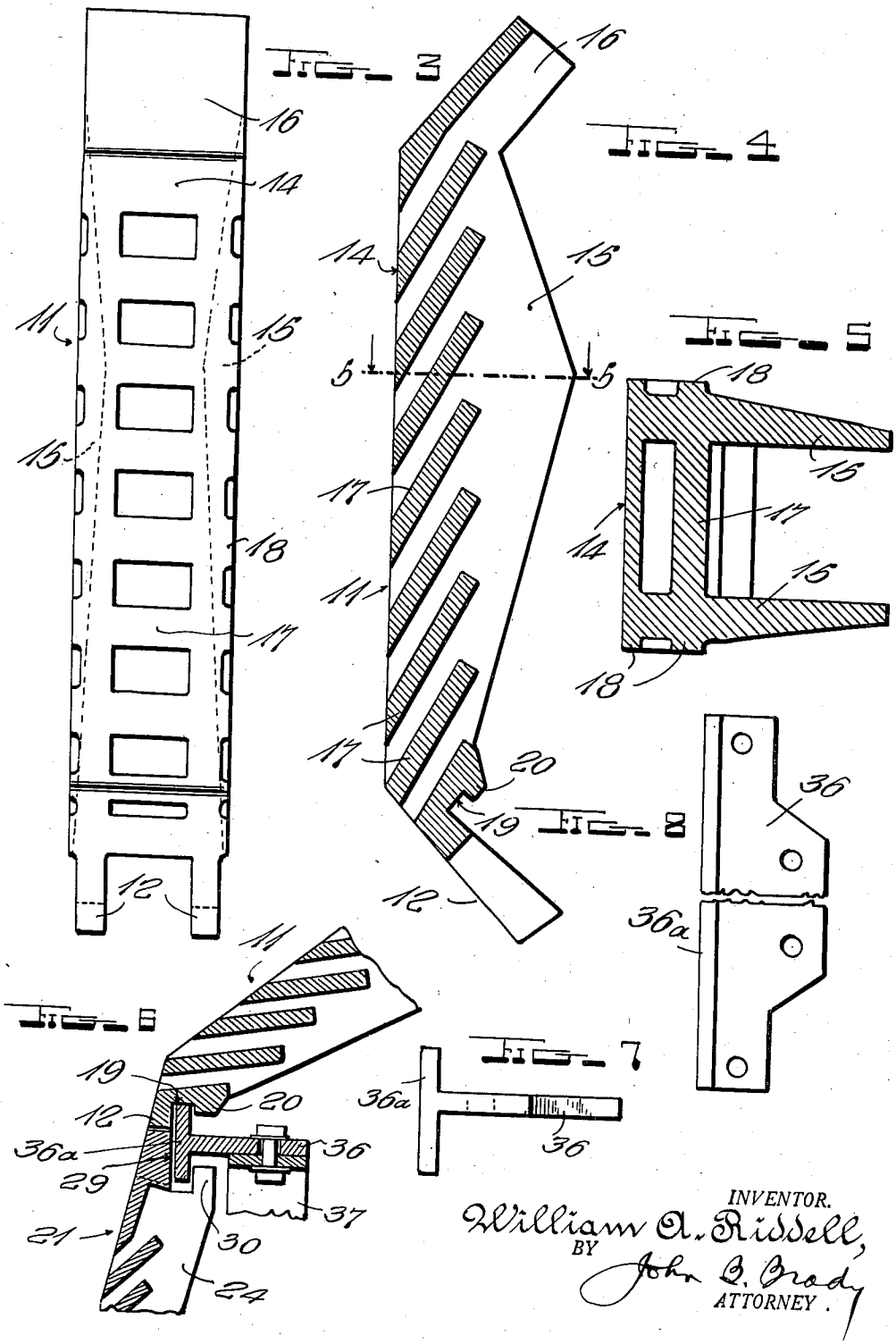
FIG. 12

INVENTOR.
William A. Riddell,
BY
John Q. Grady
ATTORNEY.

March 11, 1941. W. A. RIDDELL 2,234,416

FURNACE GRATE CONSTRUCTION

Filed Aug. 15, 1939 3 Sheets-Sheet 3



INVENTOR.
William A. Riddell,
BY
John B. Brady
ATTORNEY.

Patented Mar. 11, 1941 2,234,416

UNITED STATES PATENT OFFICE

2,234,416

FURNACE GRATE CONSTRUCTION

William A. Riddell, Frederick, Md., assignor to The General Engineering Company, Frederick, Md., a corporation of Maryland

Application August 15, 1939, Serial No. 290,249

5 Claims. (Cl. 110—44)

My invention relates broadly to stoker furnaces and more particularly to an improved arrangement and construction of grates for multiple retort underfeed stoker furnaces.

This application is a continuation-in-part of my copending application Serial No. 254,130, filed February 1, 1939, for Grate.

One of the objects of my invention is to provide a construction of stationary extension grate and lower grate structure affording a continuous smooth fuel supporting surface for the gravitation of fuel thereover, and having air supply passages therethrough disposed for admitting air without interrupting the continuous movement of fuel on the grate.

Another object of my invention is to provide a construction of lower grate for feeding air to the fuel in the ash pit in opposite cooperative relation to an air-back, disposed beneath the boiler tubes and feeding air to the fuel in the ash pit and to the space over the ash pit for minimizing the precipitation of fly dust and scale on the boiler pipes.

A further object of my invention is to provide a construction of lower grate bar for forming a continuous stationary lower grate, with air supply passages adequate for cooling the lower grate and assuring complete combustion in the ash pit.

A still further object of my invention is to provide a construction of lower grate bar for cooperation with supporting furnace structure whereby the grate bar is independently mounted and demountable without the use of bolts, rivets or similar securing means, but is maintained in place by retaining portions of the grate bar and the furnace structure.

Another object of my invention is to provide a construction of lower grate bar which is strong and durable, and substantially uniform in thickness in the various portions thereof, and cooperable with adjacent grate bars to form a continuous stationary grate presenting a smooth inclined supporting surface over which the fuel gravitates into the ash pit.

Other and further objects of my invention reside in the construction and arrangement of grates and grate elements hereinafter described with reference to the accompanying drawings, in which:

Figure 1 is a central, vertical, longitudinal sectional view through a portion of a stoker furnace with grates constructed in accordance with my invention; Fig. 2 is a fragmentary view of the grates taken at the position of line 2—2 on Fig. 1; Fig. 3 is a front elevation of one of the extension grate bars; Fig. 4 is a central, vertical, longitudinal section thereof; Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 4; Fig. 6 is a fragmentary sectional view showing more particularly the interlocking of the lower end of the extension grate bar and the upper end of the lower grate bar; Fig. 7 is an end view of one of the supports for the grate bars at the junction illustrated in Fig. 6; Fig. 8 is a plan view of the support shown in Fig. 7; Fig. 9 is a front elevation of one of the lower grate bars; Fig. 10 is a side elevation thereof; Fig. 11 is a central, vertical, longitudinal sectional view taken on line 11—11 of Fig. 9; and Fig. 12 is a horizontal sectional view on an enlarged scale taken on line 12—12 of Fig. 11.

Fig. 1 illustrates in general form the type of furnace adapted to embody my invention, and more particularly that portion of the furnace beyond the lower end of the stoker grate 1. In the construction of my invention a stationary extension grate at 2 connects with the stoker grate 1 and in turn is connected with a lower grate, indicated generally at 3, which extends substantially into the ash pit opposite an air-back shown at 4. The approximate line of the fire bed and the level of fuel and ash over the ash pit are indicated by the broken line 5. Clinker grinders are shown at 6 in the bottom of the ash pit with auxiliary crushers at 7, 7. Boiler tubes 8 rise at the rear of the furnace facing the fire bed.

In the arrangement of my invention, the extension grate 2 and lower grate 3 are stationary, as is the air-back 4 also. Fuel is supplied to the stoker grate 1 by stoker means of appropriate design giving an initial impetus to the fuel, and the extension grate 2 is inclined at an angle such as to permit gravitation of the burning fuel without additional agitation by movement of the extension grate; this feature of the stationary extension grate is described more fully in my copending application referred to above. The lower grate 3 is also stationary and together with the extension grate provides for the free movement of fuel, by gravity, to the ash pit. The air-back also is stationary and is arranged to perform its functions without impeding the flow of fuel.

In the use of stationary grates as above described, provision has been made for adequate cooling of the grate bars as well as for the supply of air for combustion on the grates. To this

end, the lower grate as well as the extension grate and the air-back is provided with air passages, as illustrated, and means such as damper 9 in the main air supply duct are employed to regulate the amount of air admitted. If desired, separate regulator means may be provided for the extension grate air supply. The air-back receives air through a conduit 10 communicating with the space behind the lower grate 3. All air passages in the various grate bars are inclined downwardly to provide not only for the prevention of clogging by fuel and ash but also for a maximum of supporting surface in conjunction with the openings from the passages to maintain an even continuous surface for the gravitation of fuel and ash in the furnace. In the stationary grate structure of my invention, this is of special importance in providing not only for the ready movement of fuel and ash but also for preventing localized heating which might otherwise burn out a grate bar. The features of the individual grate bars by which these results are achieved are shown more clearly in the subsequent drawings.

Fig. 2 illustrates the junction of the extension grate 2 and lower grate 3, in elevation, showing the interlocked arrangement of extension grate bars 11 and lower grate bars 21 with a substantially uninterrupted surface contour over the junction of the grate bars. Grate bar 11 has a bifurcated lower end 12 which embraces the narrowed upper end 22 of grate bar 21, to maintain lateral stability.

Figs. 3–5 illustrate the extension grate bar 11 as comprising an inverted channel member having a grate surface portion 14 and depending side walls 15, 15. The upper end of the bar 11 terminates in a portion 16 which extends at an angle with respect to the surface portion 14 and provides an upper resting support for the grate bar. The grate bar includes a plurality of substantially downwardly extending webs 17 and a plurality of projections 18 cast integrally with the channel member 14, 15, to define air passages intermediate the side walls 15 and between adjacent grate bars when in position, as illustrated in Fig. 2. Side walls 15 are tapered as shown particularly in Fig. 5 to facilitate the flow of air to the air passages formed by projections 18. The bifurcated portion 12 at the lower end of grate bar 11 extends at an angle with respect to the grate surface portion 14 and on its under side is recessed to form a lower resting support 19 and a retaining lug 20, by which the grate bar may be held in mounted position as indicated in Fig. 6.

Figs. 9–12 illustrate the lower grate bar 21 which is similar to the extension grate bar 11 in its channel construction providing a grate surface portion 23 and depending side walls 24. Similarly, also, a plurality of substantially downwardly extending webs 25 and a plurality of projections 26 are cast integrally with the channel member 23, 24, to provide air passages intermediate the side walls 25 and between adjacent grate bars 21 when in position as illustrated in Fig. 2. Additional projections, 27 at the upper end of the bar and 28 at the lower end, serve to guide the grate bars 21 in proper spaced relation in mounting the bars. At the upper end of the bar 21, the narrowed portion 22 thereof is substantially thickened to provide an abutment surface 29 as a resting support for the bar, and the side walls 24 are notched to provide a pair of retaining lugs 30 by which the upper end of the grate bar is held in mounted position, as shown in Fig. 6. At the lower end of the grate bar 21, the side walls 24 terminate at an angle with respect to the grate surface 23 to provide, in mounted position, a substantially horizontal resting support 31, having notched portions 32 adapted to engage a retaining member, shown at 33 in Fig. 1.

The arrangement for mounting the extension grate bars 11 and the lower grate bars 21 is best shown in Figs. 1 and 6. The furnace structure shown in Fig. 1 provides an upper support 34 for the resting portions 16 of grate bars 11 which lie on the support 34 without being bolted or riveted thereto. The overhanging lip 35 of the stoker grate provides for delivery of the burning fuel directly to the inclined grate surfaces 14 of the grate bars. The lower ends of the lower grate bars 21, as already noted engage a mounting member 33, supported in the furnace structure, by means of the notches 32 provided in the grate bars.

The junction of the extension grate 2 and the lower grate 3 is made at an intermediate support comprising a T-shaped member 36 mounted on standards 37 in the furnace structure, in a horizontal position providing a grate bar supporting plate in the portion 36*a* of the T-shaped member 36, which is shown in detail in Figs. 7 and 8. Referring to Fig. 6 which shows the junction mounting on an enlarged scale, grate bar 11 is shown as supported at 19 on the upper edge of plate 36*a* with lug 20 preventing its outward movement with respect thereto. The bifurcated portion 12 of grate bar 11 depends over the face of plate 36*a*. The lower grate bar 21 has the resting portion 29 thereof abutting the plate 36*a* with lugs 30 engaged with the rear of the plate to prevent displacement of the grate bar outwardly but allowing a measure of upward movement sufficient to disengage the grate bar from the lower retaining member 33, Fig. 1.

Referring again to Fig. 1, the manner of replacement of the grate bars is as follows. To remove the extension grate bar 11, the lower end thereof is raised, pivoting on the upper portion 16, to disengage lug 20 from the plate 36*a* whereupon the bar 11 may be withdrawn from the assembly 2 and a substitute bar inserted by reverse operations, the upper portion 16 being first located on the support 34 and the bar then being lowered to engage the plate 36*a*. The lower grate bar 21 is removed by raising the lower end thereof to disengage the recessed portion 32 from the mounting member 33, whereupon the bar may be extracted by a subsequent outward and downward movement to disengage lugs 30 from the lower edge of plate 36*a*. Insertion of a substitute bar is effected in reverse manner by first engaging lugs 30 behind plate 36*a* and then raising the bar over the lower mounting member 33. A measure of vertical movement in bar 21 is afforded by the depth of the recess in the bar 21 accommodating the lower edge of plate 36*a*.

In general, the lower grate assembly 3 is installed first and then the extension grate assembly 2, but the construction is such that any individual grate bar in either assembly may be individually removed and replaced without removing adjacent grate bars in either assembly. At the same time, the arrangement at the junction of the grates 2 and 3 provides a smooth, uninterrupted supporting surface for permitting a uniform flow of fuel and ash, by gravitation, both

the extension grate 2 and the lower grate 3 being stationary in the arrangement of my invention.

The air-back 4, Fig. 1, comprises a series of grate bars 38 arranged, in the construction shown, in substantially vertical position. The grate bars are substantially channel shaped with side walls supporting a plurality of webs defining downwardly extending air passages intermediate the side walls, and a plurality of extensions for providing air passages intermediate adjacent grate bars.

The lower end of each bar 38 is angularly shaped to engage an angularly recessed channel in a supporting member 43, and the upper end of each bar 38 is correspondingly angularly shaped and is provided also with a projecting portion which together define a recess adapted to receive the retaining portion of a coacting supporting member 46. The supporting member 43 is bolted at 47 to the furnace structure 48, and has an outwardly extending flanged portion to which a coacting flange on the supporting member 46 is bolted as at 51. The grate bars 38 are supported at the edges of the respective supporting members 43 and 46 so that with the grate bars 38 in mounted position an enclosed air-back construction is provided to which air is admitted through conduit 10 as indicated in Fig. 1.

The air supplied to the lower grate 3 and the air-back 4, Fig. 1, is delivered through the air passages in the respective grate bars 21 and 38 in substantially downward directions from opposite positions to permeate thoroughly the fuel and ash below the approximate line 5. The air cools the stationary grate bars in passing therethrough, and continues the combustion of any fuel remaining with the ash at this stage of the furnace operation. Furthermore, the air which ultimately escapes through the fire bed at the approximate line 5 serves to cool somewhat the particles of fly ash and incandescent fuel in the space above the fire bed and prevents the accumulation thereof on the boiler pipes at 8. A more even furnace temperature is thus maintained throughout the combustion area, and excessive heating and undue scale accumulation are prevented in the improved furnace grate construction of my invention.

While I have described my invention in a preferred embodiment, various modifications may be made therein and I intend no limitations upon my invention by reference thereto except as are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a furnace, an inclined lower grate comprising a plurality of grate bars each being apertured for passing air therethrough and having a recessed mounting portion at each end thereof, and means for mounting said grate bars in stationary position in said furnace comprising an upper retaining member and a lower supporting and retaining member extending in parallel relation across said furnace with the recessed mounting portions of said grate bars engaged with the respective upper and lower mounting members, the recessed mounting portion at the upper end of each grate bar being extended in depth beyond the limit of said upper retaining member a distance substantially equal to the height of the retaining portion of said lower mounting member, to permit a vertical movement of said bar sufficient to engage and disengage the recessed mounting portion at the lower end of the grate bar with respect to said lower supporting and retaining member, for mounting and dismounting said grate bars.

2. In a stationary inclined lower grate, a lower grate bar having side walls and a plurality of intermediate webs integral therewith for defining air passages in said grate bar, a mounting portion at the lower end of said grate bar including a notched portion at the lower end of each side wall constituting primary retaining means for the grate bar in a mounted position, and a mounting portion at the upper end of said grate bar including a notched portion at the upper end of each side wall constituting secondary retaining means for the grate bar in a mounted position, the notched portion at the upper end of each side wall being extended in depth beyond the depth required to constitute said secondary retaining means a distance substantially equal to the depth of the notched portion at the lower end of each side wall, for permitting movement of said bar to engage and disengage the notched portions constituting said primary retaining means, in mounting and dismounting said grate bar.

3. In a stationary inclined lower grate, a lower grate bar having side walls and a plurality of intermediate webs integral therewith for defining air passages in said grate bar; a mounting portion at the lower end of said grate bar comprising a notched portion at the lower end of each side wall, and lateral spacing projections at the base of said grate bar; and a mounting portion at the upper end of said grate bar comprising a notched portion at the upper end of each side wall, a grate end portion narrower in width than the spacing of said side walls and having an inner face coacting with the notched portions at the upper ends of the side walls, and lateral spacing projections on said grate end portion.

4. A grate bar comprising a channel shaped member having a grate surface and side walls depending therefrom, a plurality of webs integral with said channel shaped member for defining air passages intermediate said side walls, a multiplicity of external projections integral with said side walls and aligned with said webs for cooperation with similar projections on adjacent members in a grate assembly for defining air passages intermediate said members, one end of said grate surface having lateral spacing projections, the opposite end of said grate surface having lateral spacing projections and an extended portion narrower in width than the spacing of said side walls, said extended portion having an inner face constituting a bearing for said grate bar in a mounted position, opposite ends of said side walls being notched to provide supporting and retaining means for said grate bar in a mounted position, said bearing being disposed for coaction with the notched side walls at the same end of said grate bar in mounting and dismounting said grate bar.

5. In a furnace, a stationary grate inclined at a sufficiently sharp angle so that fuel supplied to the upper end may gravitate downwardly thereover while in a state of combustion, said grate comprising separately removable elongated sections disposed in generally vertical parallel planes, an upper support extending adjacent to the upper ends of the sections, and a lower support extending horizontally under lower parts of the sections, said upper support and upper section ends being connected by coacting tongue and groove means partly engaged with said sections in mounted positions and wholly engageable for

limited vertical movement of said sections from mounted positions, and said lower support and lower section parts being connected by vertically separable tongue and groove means which are held in locked engagement by the weight of the sections to restrain forth and back movements thereof, the limited vertical movement of said sections being adequate for separation of said tongue and groove means by lifting the lower section ends to permit selective removal of the sections.

WILLIAM A. RIDDELL.