April 5, 1932. C. K. ERNST 1,852,876

GRATE

Filed July 23, 1929 2 Sheets-Sheet 1

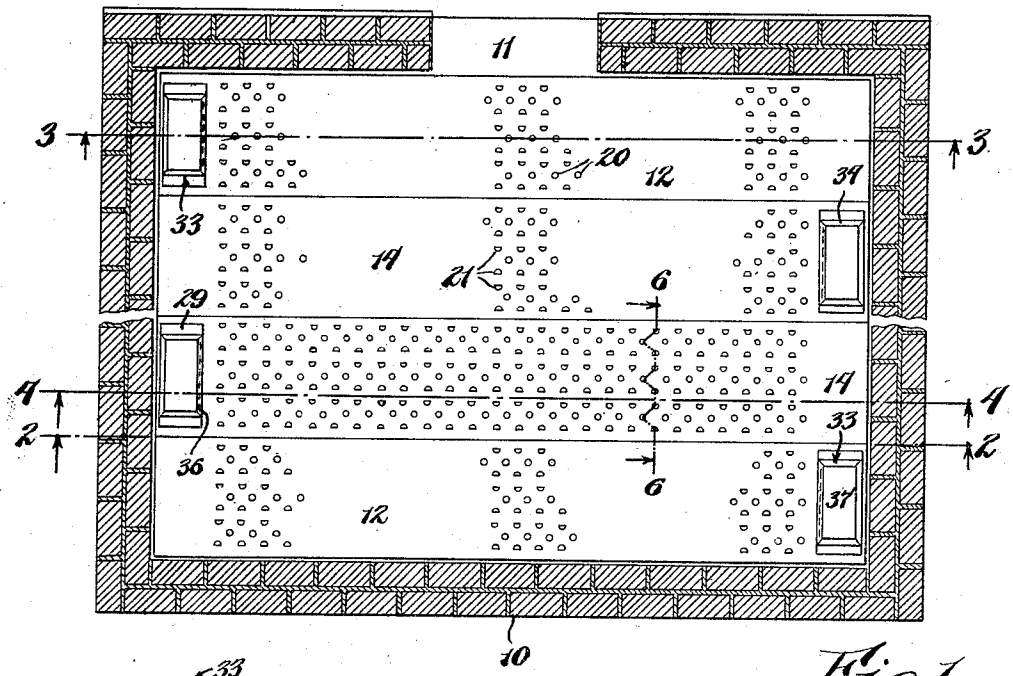

Fig. 1.

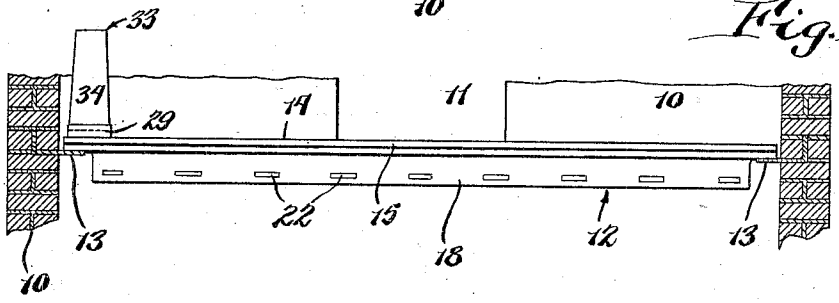

Fig. 2.

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GRATE

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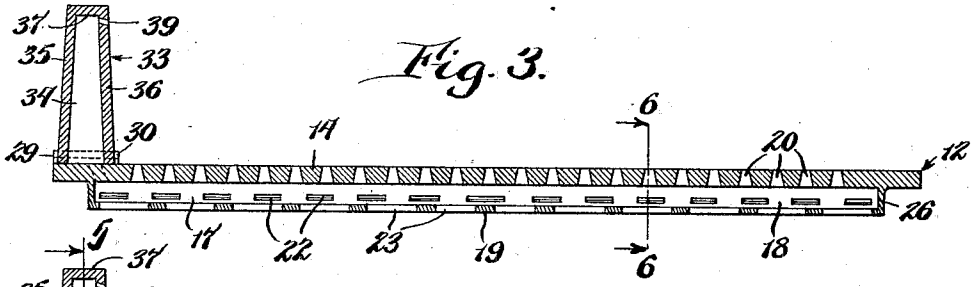

Fig. 3.

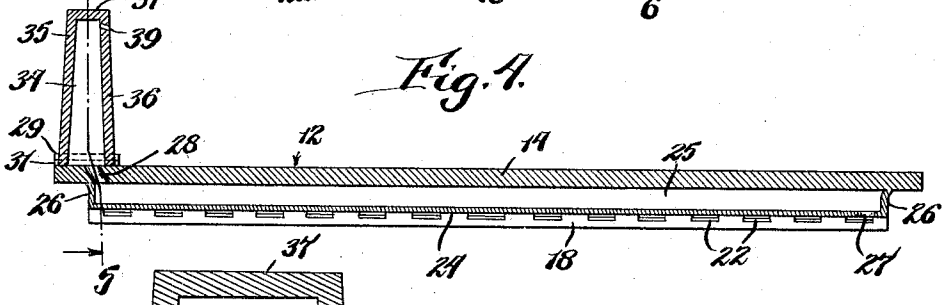

Fig. 4.

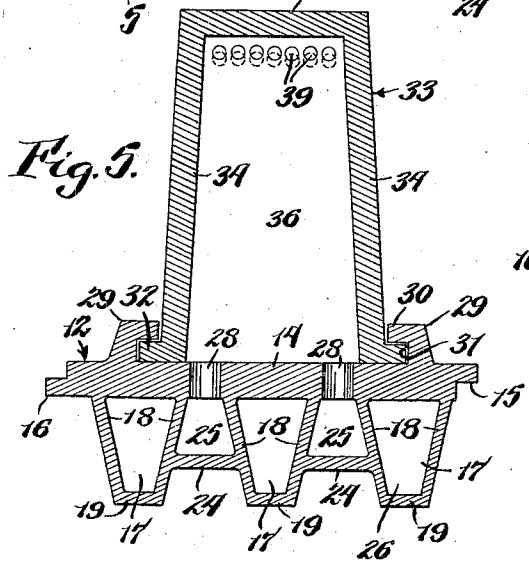

Fig. 5.

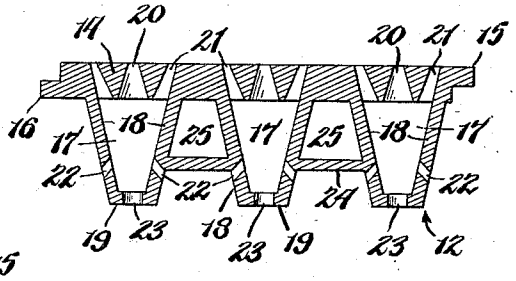

Fig. 6.

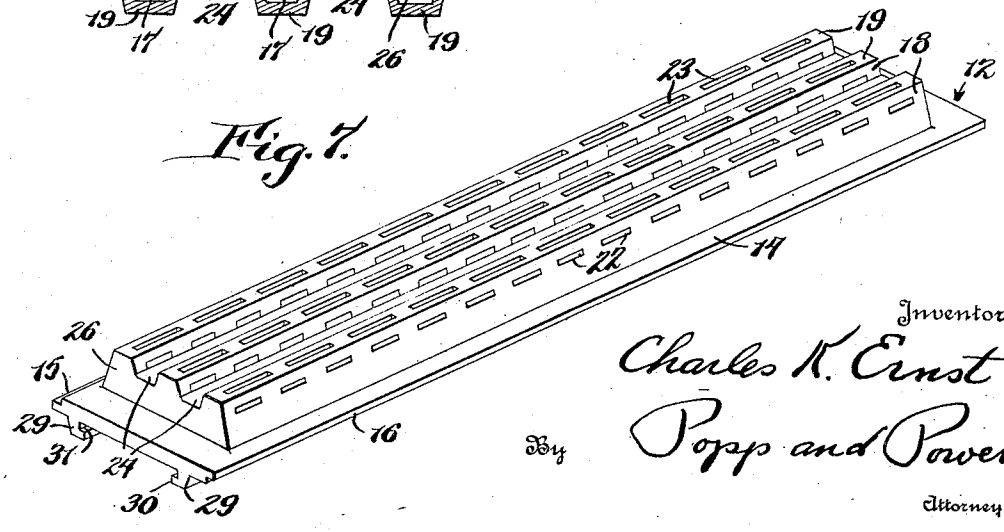

Fig. 7.

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UNITED STATES PATENT OFFICE

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GRATE

Application filed July 23, 1929. Serial No. 380,315.

This invention relates to a grate and more particularly to a non-shaking sectional grate for use in industrial heating plants having either forced or natural draft although the principles embodying this invention can also be embodied in a shaking grate.

One of the objects of this invention is to provide a grate of this character which is made up of several sections, the sections being identical in construction and dimensions so that the desired grate surface can be obtained by using the number of grate sections desired.

Another purpose is to provide a grate section in which the air supplied directly to the burning coal through the grate is heated by passing through openings provided in depending walls forming channels on the under side of each grate section before striking and passing through the horizontal grate surface on which the coal is arranged so that this air does not operate to chill the grate surface, which chilling would increase the production of large clinkers.

A further object is to provide such a grate, each of the sections of which is made hollow and formed to provide one or more longitudinal channels on the under side of the grate, the air fed directly to the burning coal on the top of the grate being admitted through openings or slots provided in each side channel wall and directed against the opposite side wall thereof so as to cool the channel walls, the air being subsequently conducted from these channels through the top of the grate on which the coal is arranged. By this means the incoming air first cools the channel walls which cooling, through conduction, cools the grate surface and prevents the grate surface from becoming too hot which would be liable to burn the grate bar, and at the same time the heat from the side walls of the channel operates to heat the air so that before passing through the burning coal the air is hot and therefore suited for the most efficient combustion of the coal.

Another aim is to provide such a grate which is particularly adapted for use with soft or bituminous coal in which in particular, each grate section is provided at one end with means for directing streams of hot air into the hot burning gases and other products of combustion generated by the burning coal. By this means the unconsumed products of combustion are brought in contact with a fresh supply of hot air so as to consume the same, thereby resulting in a more efficient consumption of the coal and a greater amount of heat as well as providing a smoke consumer.

A further aim is to provide such means for supplying fresh hot air to the products of combustion above the coal in which the air is heated by passing along enclosed channels or chambers formed on the under side of the grate so that before the air is discharged into the products of combustion the air is heated to a very high temperature so as to act in the most efficient manner.

A further aim is to provide such means for supplying a supply of fresh hot air to the products of combustion which are readily attached or detached to the grate and will thereby permit the manufacture of grate surfaces for use with both hard coal or soft coal, the smoke consumer being supplied with the grate surface when the grate is intended for use with soft coal.

Other objects are to provide a grate surface of this character which can be cast in one piece without complicated cores, which will provide for an efficient consumption of the coal and which will give satisfactory service for a long period of time and in which the ashes from the burning coal fall through the channels which preheat the air and to the ash

pit without clogging the channels and rendering them inoperative.

In the accompanying drawings:

Figure 1 is a horizontal section throughout a furnace having grate sections embodying my invention, the grate sections being shown in plan.

Figure 2 is a vertical longitudinal section through the furnace taken on line 2—2 of Fig. 1 and showing a side elevation of one of the grate sections.

Figure 3 is a vertical longitudinal section through one of the grate sections, the same being taken on line 3—3, Fig. 1.

Figure 4 is a section similar to Fig. 3 taken on line 4—4, Fig. 1.

Figure 5 is a vertical transverse section through one of the grate sections and the smoke consumer head, the same being taken on line 5—5, Fig. 4.

Figure 6 is a vertical transverse section through one of the grate sections, the same being taken on line 6—6, Figs. 1 and 3.

Figure 7 is a perspective view of one of the grate sections, showing the same inverted.

In its general organization this invention comprises a plurality of comparatively long and narrow grate sections which are adapted to be placed in a furnace side by side so as to form a continuous horizontal grate surface of any desired size adapted to support a bed of burning coal, each of said grate sections comprising a comparatively thick cast metal perforated plate, integrally formed comparatively thin walls projecting downwardly from said plate and forming longitudinal channels communicating with the perforations of said plates, a bottom wall enclosing the bottom of each of said channels, end heads enclosing the ends of each channel, said bottom wall being provided with a plurality of longitudinal slots and each of said side walls being provided adjacent its lower end with a plurality of longitudinal slots inclining upwardly to direct the incoming air against the opposite side wall, the perforations in said plate being arranged in rows along the center and sides of each channel, a horizontal web connecting the corresponding side walls of adjacent channels, above the openings therein and forming a passage between said channels, end heads enclosing the ends of said passage, said passage being provided with an opening at one end communicating with the air under the grate bar, and a hollow metal head fitted to the opposite end of said plate and rising therefrom said hollow head being open on its underside and said plate being provided with an opening for conducting said air to said hollow head and said hollow head being provided with openings above said coal whereby the air from below said grate is drawn through said passage and head and heated thereby and discharged into the burning gases above said coal.

The furnace shown in Figs. 1 and 2 comprises the usual brick walls 10 having an opening 11 at one side through which the coal is stoked onto the grate sections 12. These grate sections 12 are arranged side by side and fitted to one another and supported within the furnace on suitable ledges 13 from the walls 10. Each of the grate sections 12 comprises an elongated horizontal plate 14 which is rectangular in plan and on which the burning coal is supported. To provide an interfitting connection between the edges of the several sections 12 when they are placed in a furnace, each of the horizontal plates of each grate section is undercut at one edge as indicated at 15 and is provided with an upper flange 16 at its opposite edge. By this means the flanges 16 of each section are fitted into the undercut part 15 of the adjacent section so as to provide an interfitting connection between the grate sections and also provide a mutual support for the grate sections.

As best shown in Figs. 3, 6 and 7, each grate section is formed to provide a plurality of depending channels 17 on the under side of the plate 14, these channels extending substantially the full length of the grate section and being formed by downwardly converging side walls 18 and a bottom wall 19 connecting these side walls. Three of such longitudinal channels are shown, but it is apparent that a greater or smaller number can be provided to suit the requirements of the use of the grate section. From each of these channels 17 air outlet passages lead to the upper surface of the grate plate 14 so as to supply air to the burning coal on top of the grates, these passages comprising central row of openings 20 which extend outwardly from the center of each channel 17 and two rows 21 which extend outwardly from each channel 17 along opposite sides of the central row of openings 20. These rows of openings 20 and 21 extend the full length of the grate plates 14 so that air is supplied directly to the burning coal on all parts of the grate sections, as best shown in Fig. 1. Each of the openings 20 and 21 is also preferably larger at its bottom than at its top so that ashes and cinders falling through the same will not plug but will fall through into the chamber 17.

Each of the side walls 18 of each channel 17 is provided near its lower end with a series of cold air inlet slots 22, these slots being arranged at an incline, and the bottom wall 19 of each chamber 17 is provided with a series of slots 23. Cold air entering the slots 22 from the ash pit passes along the side walls 18 of each channel 17 and thereby operates to cool the side walls of each channel and at the same time heat the air passing through the channel. The cooling of the side walls 18 of the chambers operates to cool the grate plate 14 since the

side walls 18 of the channel are formed integrally with the grate plate whereby the heat from the grate plate 14 is conducted through the metal to the side walls of the channels. This prevents the grate surfaces from becoming too hot and resulting in a possible burning or fusing of the grate plate 14. At the same time the incoming air by reason of being heated through contact with the side walls 18 of the preheating channels is heated before it strikes the grate plate 14 and therefore does not chill the grate plate 14. Such chilling would result in the formation of large clinkers. The preheated air from the channels 17 thereupon passes up through the openings 20 and 21 in the grate plate 14 and enters the burning mass of coal in a heated condition thereby providing for the most efficient combustion of the coal. Since the openings 20 and 21 are spaced over the entire surface of each grate plate 14, the fresh air is supplied uniformly throughout and further provides for efficient consumption of the coal. The slots 23 in the bottom wall 19 of each channel 17 are made of large size so that the ashes and cinders falling through the openings 20 and 21 in the grate plate 14 also fall through the large slots 23 in the bottom of each channel 17. By this means there is no tendency for the ashes and cinders falling into the channels 17 to fill and clog these channels so as to render the grates inoperative.

Between opposing side walls 18 of each of the channels 17 a horizontal web 24 is provided, this web extending the full length of the channels 17 above the air inlet slots 22 in the side walls of the channels 17 and being formed integrally with the channel walls and the grate plate 14. The passage 25 formed by this web 24 is closed at its ends by integrally formed end heads 26 which also enclose the ends of the channels 17, and at one end an air inlet 27 opening to the passage 25 is provided in the web 24. At the opposite end of the grate section an air outlet opening 28 is provided for the passage 25, this air outlet opening 28 being formed in the plate 14 and leading from the end of the passage 25 to the upper surface of the grate.

At the end of the grate section having the air outlet openings 28, integrally formed retaining flanges 29 are provided on the grate plate 14, these flanges extending longitudinally of the grate plate and having inwardly projecting overhanging parts 30 which provide a slideway 31. These slideways 31 receive outwardly extending flanges 32 provided on a hollow head 33. This hollow head is open on its under side and is formed to provide side walls 34, outer and inner walls 35 and 36 connecting the side walls and a top wall 37. At the top of the inner wall 36 a horizontal row of openings 39 is provided, each of these openings preferably being directed downwardly toward the burning coal. This head 33 is slipped into the slideways 31 formed by the retaining flanges 29 on the plate and when in position covers the air outlet openings 28 leading to the channel 25. When so placed air entering each longitudinal channel 25 through the air inlet opening 27 is heated as it passes along the channel 25 before passing through the outlet opening 28 and into the head 33. This air is then discharged through the downwardly directed ports 39 and into the hot gas or products of combustion from the coal on the plates 14. This hot fresh air injected into the hot burning gases operates to consume any unconsumed gas or smoke and thereby provide for a more efficient consumption of the coal as well as reduce the smoke from the furnace. This smoke consuming device is more particularly suited for use with soft coal although it can also be used to advantage with hard coal. Its use is, however, entirely optional and the grate sections can be employed with or without the hollow head 33. The heads 33 are preferably in staggered arrangement as indicated in Fig. 1, the heads 33 being arranged at opposite ends of the adjacent sections 12. By this means hot fresh air is drawn into the hot products of combustion from opposite sides of the furnace, thereby securing uniform consumption of the unconsumed products of combustion in the hot gases.

As a whole this invention provides a grate which by reason of its section form can be made of substantially any desired size by employing the necessary number of sections; the air fed directly to the burning coal is fed uniformly over the entire grate surface and is heated to a high temperature before being so fed so as to provide for the most efficient consumption of the coal. By the arrangement of slots in the side walls of the hollow channels on the underside of each grate plate, the air fed to the burning coal is not only preheated but also serves to cool the grate plate without chilling the same thereby preventing burning of the grates and also the formation of large clinkers; the grate sections will not become clogged or plugged so as to interfere with the supply of the air to be cooled; and a simple and effective means are provided for each grate section for forcing streams of preheated fresh air into the burning gas from the coal thereby resulting in a consumption of the unconsumed products of combustion as well as eliminating smoke. The great section is also inexpensive to make and will operate efficiently for a long period of time without requiring cleaning or replacing.

I claim as my invention:

1. A grate bar, comprising a perforated horizontal plate, walls depending from said plate and forming a plurality of channels communicating with the perforations in said

plate, openings provided in said depending walls for admitting air to said channels, a horizontal web connecting the corresponding walls of adjacent channels and forming a passage between said channels, said passage being provided with an opening at one end communicating with the air under said grate bar, a hollow head rising above said plate, said plate being provided with an opening for conducting said air from said passage to said hollow head and said hollow head being provided with an opening whereby the air from below said grate is drawn through said passage and head and heated thereby and discharged into the burning gases.

2. A grate bar, comprising a comparatively thick cast metal horizontal perforated plate, integrally formed comparatively thin walls projecting downwardly from said plate and forming longitudinal channels communicating with the perforations of said plates, a bottom wall for each of said channels, end heads enclosing the ends of each channel, said bottom wall being provided with a plurality of longitudinal slots, each of said side walls being provided adjacent its lower edge with a plurality of longitudinal slots to direct the incoming air against the opposite side wall, the perforations in said plate being arranged in rows along the sides and center of each channel, a horizontal web connecting the corresponding side walls of adjacent channels above the openings therein and forming a passage between said channels, a head enclosing at least one end of said passage, said passage being provided with an opening at one end communicating with the air under said grate bar, and a hollow head rising from the opposite end of said plate, said plate being provided with an opening for conducting said air from said passage to said hollow metal head and said hollow head being provided with an opening above said coal whereby the air from below said grate is drawn through said passage and head and heated thereby and discharged into the burning gases above said coal.

3. A grate, comprising a grate bar adapted to support a bed of burning coal, spaced parallel horizontal flanges rising from said grate bar and at least one having a laterally extending portion at its upper end and a hollow head adapted to be slid along said grate bar between said flanges and to be retained against displacement by said flanges and said laterally extending portion, said grate bar being provided with an opening admitting air to said hollow head and said hollow head having at least one opening for directing said air into the burning gases above said grate bar.

4. A grate, comprising a grate bar adapted to support a bed of burning coal, spaced parallel horizontal flanges rising from said grate bar and having opposing laterally extending portions at their upper ends, a hollow head having laterally outward extending flanges at its lower end, said head being adapted to be slid along said grate bar and its flanges to be engaged under the opposing laterally extending portions of said first named flanges, said grate bar being provided with an opening admitting air to said hollow head and said hollow head having at least one opening for directing said air into the burning gases above said grate bar.

In testimony whereof I hereby affix my signature.

CHARLES K. ERNST.