Oct. 6, 1942. R. E. HUFFSCHMIDT 2,297,890

FURNACE

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FIG. 1.

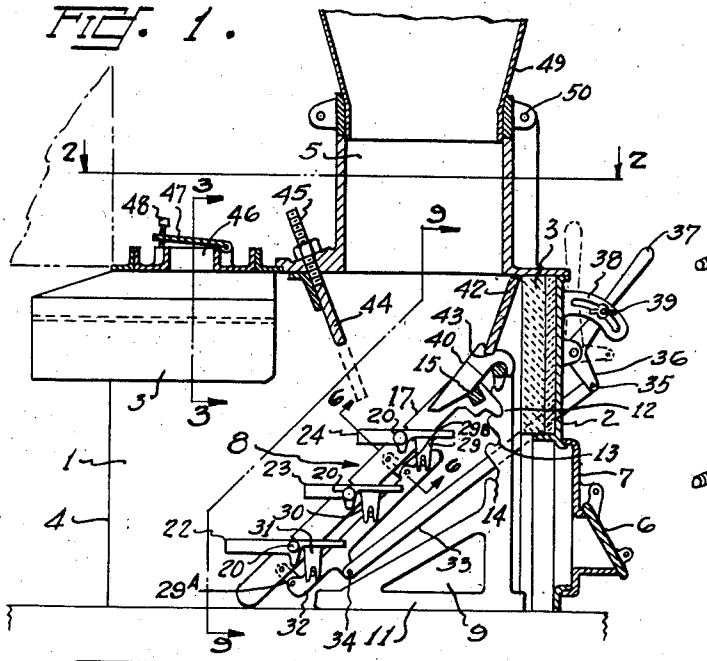


FIG. 4.

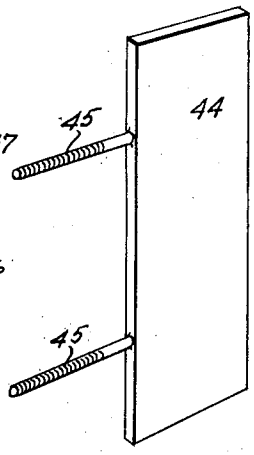


FIG. 2.

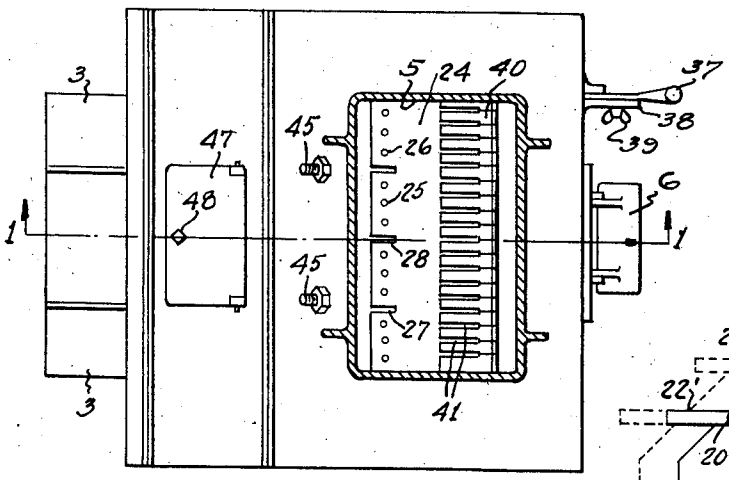


FIG. 11.

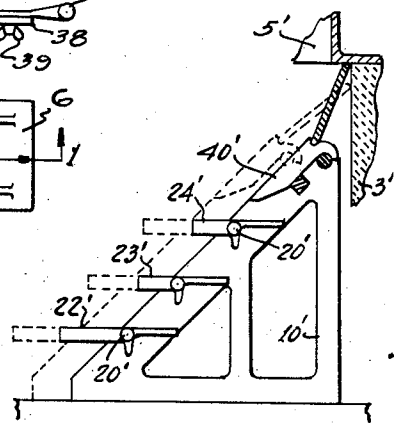
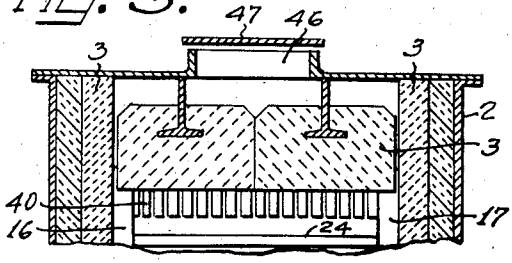


FIG. 3.



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FIG. 5.

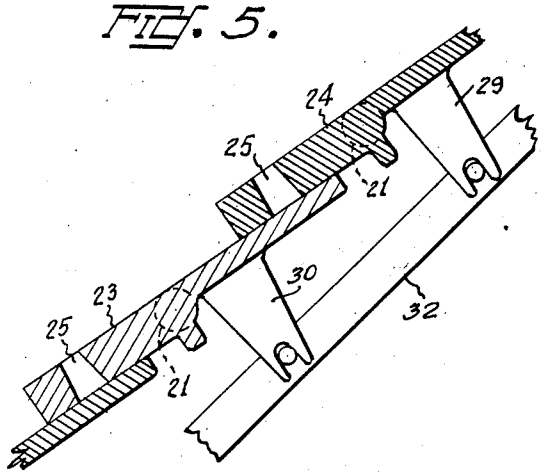


FIG. 6.

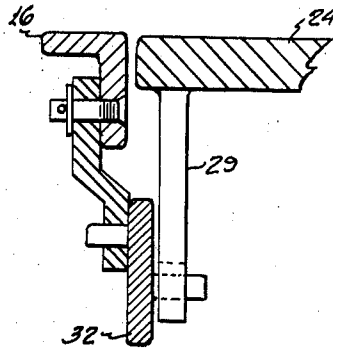


FIG. 7.

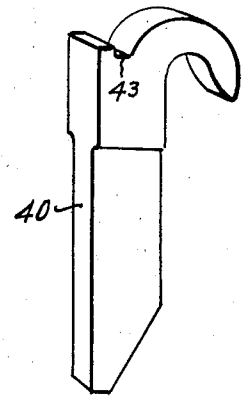


FIG. 8.

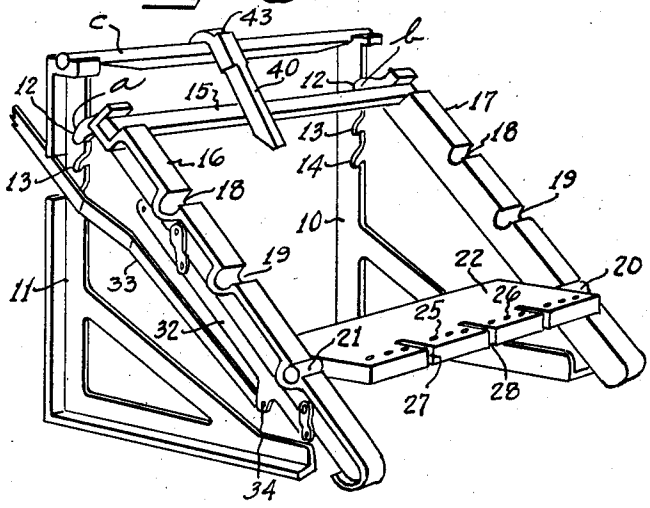


FIG. 10.

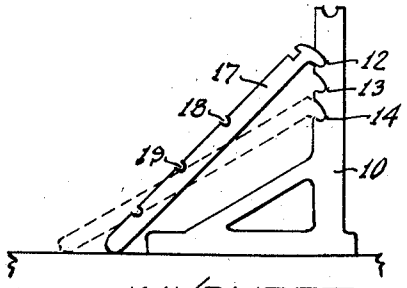
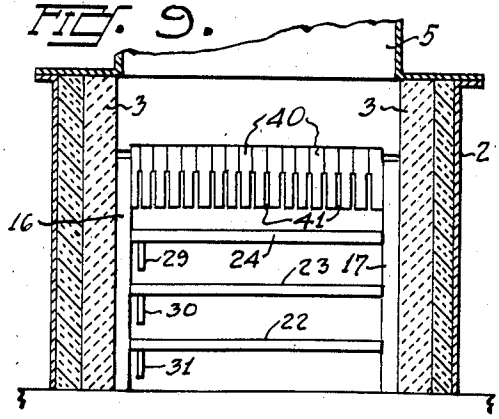


FIG. 9.



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FURNACE

Robert E. Huffschmidt, Portland, Oreg.

Application October 9, 1939, Serial No. 298,557

4 Claims. (Cl. 110—7)

This invention relates to a furnace adapted for use as the heat generator suitable for application to boilers, furnaces and other heat using devices, and more particularly relates to that type thereof in which sawdust, or hogged fuel, or other pulverized hard fuels are burned, and the products of combustion of which are conducted more or less directly to the heating surfaces of the boiler or furnace.

Referring to the drawings:

Figure 1 represents a view of a vertical longitudinal section of the burner and fragmentary portions of certain appurtenances commonly used therewith.

Figure 2 represents a view of a horizontal section taken on the line 2—2 of Figure 1.

Figure 3 represents a view of a fragmentary transverse vertical section, taken on the line 3—3 Figure 1.

Figure 4 represents a view, in detail, of one of the parts in perspective.

Figure 5 represents a view of a vertical longitudinal section of a fragment of typical grate-bars embodied in the assembly.

Figure 6 represents a view of a fragmentary oblique section taken on the line 6—6 of Figure 1.

Figure 7 represents a view of a typical part shown in perspective.

Figure 8 represents, in perspective, a view of the supporting structure for the grate-bars, particularly showing the method of mounting the same.

Figure 9 represents a view of a section, taken on the line 9—9 of Figure 1.

Figure 10 is a diagram illustrating alternative adjustments of some of the parts shown in Figure 1.

Figure 11 illustrates a modified form of grate-supporting standards.

Referring now more particularly to the drawings:

A combustion chamber 1 is formed within a steel or cast iron shell 2, lined with suitable refractory material 3, and formed with a gas-discharge aperture 4, a fuel aperture 5, and suitable draft-control means 6 attached to the conventional fire-door 7. Within the combustion chamber 1 is disposed a grate, indicated generally at 8, which divides off the said combustion chamber to form an ash pit 9, disposed between said grate and said fire-door.

The grate structure consists essentially of two standards 10 and 11, slidable upon the floor of the ash pit 9 to adjust the disposition of the grate 8 with reference to the fuel aperture, or throat 5.

The upper portions of the standards 10 and 11 are formed with notches, as 12, 13 and 14, adapted to receive, respectively, the upper hooked ends *a* and *b* of the rails, 16 and 17, formed with series of semi-cylindrical recesses, as 18 and 19, engaging the pintles, as 20 and 21, of the grate-bars, as 22.

In the particular embodiment of this invention shown in the drawings, such grate-bars 22, 23 and 24 are shown mounted respectively in the recesses, as 18 and 19, illustrated in Figure 8. These grate-bars 22, 23 and 24 are formed in further detail with perforations, as 25 and 26, and other supplementary slots, as 27 and 28, and with depending lugs 29, 30 and 31 in turn engaged by a connecting rod 32 pivotally attached to the links 29A and 29B and engaging the lugs 30 and 31 by means of suitable slots supplanting the pivotal attachment, as in the lug 29, to avoid the necessity for extremely critical dimensions and alignment of parts. This connecting rod 32 constrains the grate-bars 22, 23 and 24 to mutually parallel relationship.

A link 33 is pivotally connected at 34 to the connecting rod 32 and extends exteriorly to a pivotal attachment 35 with the lower leg 36 of a control handle 37 in the form of a bell-crank. A slotted arcuate fixture 38, together with a thumb-screw 39, provides a means for locking the handle 37, and hence the grate-bars 22, 23 and 24, in selected positions, or attitudes.

Next above the grate, formed as above described, is a series of fingers, as 40, shown in Figure 1, arranged in laterally contacting relationship across the width of fuel aperture 5 and suspended from the bar *c*, as particularly shown in Figure 2. Each of these fingers is formed with narrowed lower portions to provide a series of slots, as 41, shown in Figure 2, therebetween, and which, in the aggregate, constitute a hinged member serving to connect the plate 42, shown in Figure 1, with the transverse member 15 in the various adjustments of the rails 16 and 17 upon the standards 10 and 11.

The lower edge of the plate 42 is supported in the groove formed by the series of notches 43 in the fingers 40, and the upper edge thereof inclines against the refractory lining, serving to deflect the fuel fed down through the throat 5 onto the grates 8.

The baffle plate 44 is adjustably supported in position by screws, as 45, and has an amplitude of movement through that distance indicated ap-

proximately by the dotted line extension figure.

Communicating with the combustion chamber 1 is an aperture 46, regulated by a suitable damper 47, micrometrically adjusted by means of the screws 48.

A hopper 49 is attached by a convenient hinge-means 50 to the aperture 5 and serves to retain a supply of fuel and feed the same as required.

Experience has shown that with granular, pulverized, or hogged fuel, different adjustments of the various elements of this type of burner are required to compensate for the varying angles of repose of these fuels, i. e. the hogged fuel requires an adjustment of the grate more nearly vertical than that required for the granular and pulverized fuels; also, the dimensions of the aperture between the lower edge of the baffle-plate 44 and the grate 8 are somewhat critical for the different kinds of fuels.

In accordance with the method of operation of this type of burner, a bed of coals upon the grates operates to heat the fresh fuel as the same is fed thereover, and to distill therefrom combustible gases into the combustion chamber 1 where the same are oxidized by air entering through the fuel upon the grates and, in addition thereto, through the aperture 46.

There are certain definite proportions of these gases which are economically combined with the air admitted as draft, and there are also certain definite relationships existing between the amount of heat required to distill the combustible gases from the fresh fuel in the granular, pulverized, or chipped forms. These differences may be due to typical differences in moisture content or to the inherent nature of the wood itself, or other fuel, but in any case, the heat balance must be taken into account in any provision for the efficient burning of such fuels.

A fuel having a relatively flat angle of repose, descending through the aperture 5, as regulated by the baffle-plate 44, will be projected, longitudinally, a greater distance into the combustion chamber, affecting the resistance offered to the passage of air thereinto. In the other extreme, with chipped fuel, the fresh fuel may be presented to the grate in such a thin layer as to permit too much air to pass in proportion to the quantity of combustible gases presented to the combustion chamber.

To provide for both of these exigencies, this invention embodies means to control the thickness of the fuel upon the grates and relative proportions of air admitted to the combustion chamber as referred to the quantity of gas distilled. With fuels not liable to compacting, such as the hogged fuel, it has been found necessary to provide other means for restricting the quantity of air passing through the fuel and into the combustion chamber other than the natural resistance offered thereto by the bed of fuel.

This means consists of the grate-bars 22, 23 and 24 of the form before described, capable of tilting at various inclinations, limited by actual contact of one with the other, as illustrated particularly in Figure 5. The normal aperture between two of these bars may be entirely closed and, as well, the perforations therethrough may be closed, as also particularly shown in Figure 5. Thus, in an extreme adjustment of the grate-bars, substantially no flow of air whatever through the fuel may occur. In the other extreme adjustment, the bars may be adjusted at such an opposite inclination as will allow free access thereto through the fire-door 7 for purposes of cleaning, or removing clinkers, or other foreign matter.

Now in addition to the tilting of the bars, as described, another adjustment of the grate is provided which permits of varying the angle of inclination of the grate 8 as a whole. This is accomplished by selective engagements of the rails 16 and 17 carrying the transverse member 15 with the standards 10 and 11.

A third adjustment of the grates consists in movement of the standards 10 and 11 and, hence, of the structure supported thereby, longitudinally, in a manner to change the inclination of the plate 42, and thus alter the distance between the grates and the lower edge of the baffle-plate 44.

It is to be especially observed that the adjustment of the grate-bars in mutual relationship, the adjustment of the grate as a whole at various inclinations, and the adjustment, longitudinally, of the entire grate assembly, may all be effected independently of each other, thus providing the very valuable feature of producing and observing different effects caused by a single adjustment without change in the others.

To illustrate the utility of this feature—if we suppose that the fuel supply consists of a fine grade of relatively hard, wood, sawdust of high moisture content, which in a compacted state is almost impervious, the burner would be adjusted as follows:

The standards 10 and 11, and the grate 8 carried thereby, would be moved further into the combustion chamber so as to increase the angle to which the plate 42 is inclined from the vertical, and thus dispose the grates 8 in a slightly offset position with reference to the throat 5 and the weight of the fuel in the hopper 49;

The plate 44 would be adjusted to extend down relatively close to the grates;

The rails 16 and 17 would be elevated to the uppermost position in which the same are shown in Figure 1, and the bars 22, 23 and 24 would be adjusted to incline downward slightly;

The aperture 46 would be nearly closed by adjustment of the screw 48 providing, in all, the following conditions:

First, a minimum portion of the weight of the fuel in the hopper will be imposed upon the bed of fuel on the grates.

Second, by virtue of adjustment of the baffle-plate 44, the thickness of the bed of fuel will be a minimum.

Third, a substantial amount of air will be admitted through the grate-bars and a substantial portion thereof will be deflected upwardly through the perforations in these bars to support the combustion of the bed of coals.

Fourth, additional air will be admitted through the aperture 46 to combine with the relatively large proportion of fuel-gases distilled off from this type of fuel.

The intensity of the fire is, of course, controlled by regulation of the conventional draft-door 6, which may be actuated by thermostatically controlled or manually operated apparatus.

Apart from these adjustments which may be made independently of each other, a further adjustment in which these independent adjustments may be combined resides in the special construction of the lower bar 22 which is of such transverse dimensions as to provide that the inner edge extend further into the combustion chamber than would be indicated by a line drawn through the innermost edges of bars 23 and 24.

This effect is provided by making the bar **22** wider than the bars **23** and **24**.

The effect of this construction is to provide against closure of the space under the bar **22** by an excess quantity of fuel which might otherwise be deposited on the floor of the ash pit to obstruct this space. In another aspect this form, in this position of the bar **22**, provides that the toe or lowermost extremity of the fire will be of reduced thickness as compared with that adjacent the bars **23** and **24**. This condition is common to all of the adustments of the bars **22**, **23** and **24** effective by the adjustment of the handle **37**. That is to say that in any adjustment of the parts, as before described, the toe of the fire will never be thicker than that safe maximum which will allow sufficient air to enter beneath the bar **22** to support at least some combustion to prevent the accumulation of unignited combustible mixtures in the furnace or other heat using device which would be liable to explode upon the next ignition occasioned by the breaking through of the fire.

In Figure 11 a form of grate embodying the single feature of this group of adjustments, consisting of the use of grate sections of unequal width, is illustrated. While this type of grate is entirely operative, a more efficient burner is produced by the embodiment of all of the adjustments and features, as before described, but are by way of amplifications rather than limitations of this invention.

By the combination of these features, as described, a burner is provided which is substantially universally adaptable to any type of fuel before mentioned, and will burn any thereof in the most efficient manner between wide limitations of total heat generation under the control of the draft-door **6** without serious alterations in the efficiency with which the fuel is burned.

Having described my invention, what I claim is:

1. A furnace for burning granular fuel comprising, a shell formed with a throat to be served by a suitable hopper, draft aperture, and combustion chamber, an adjustably inclined grate element having equi-angularly adustable grate bars of progressively increased widths horizontally trunnioned in a common plane, and means to support said grate element under said throat between said draft aperture and said combustion chamber.

2. A furnace for burning granular fuel comprising, a shell formed with a throat to be served by a suitable hopper, draft aperture and combustion chamber, a grate element disposed within said shell under said throat between said draft-aperture and said combustion chamber, and obstructing means for adjusting the size of said throat.

3. A furnace for burning granular fuel comprising, a shell formed with a throat to be served by a suitable hopper, draft aperture, and combustion chamber, an adjustably inclined grate element having equi-angularly adjustable grate bars of progressively increased widths horizontally trunnioned in a common plane, means to support said grate element under said throat between said draft aperture and said combustion chamber, and obstructing means for adjusting the size of said throat.

4. A furnace for burning granular fuel comprising, a shell formed with a throat to be served by a suitable hopper, draft aperture and combustion chamber, an adjustably inclined grate element having equi-angularly adjustable grate bars of progressively increased widths horizontally trunnioned in a common plane, means to support said grate element under said throat between said draft aperture and said combustion chamber, apron means pivotally mounted within said throat to conduct fuel over said grates, and obstructing means to regulate the size of said throat.

ROBERT E. HUFFSCHMIDT.