

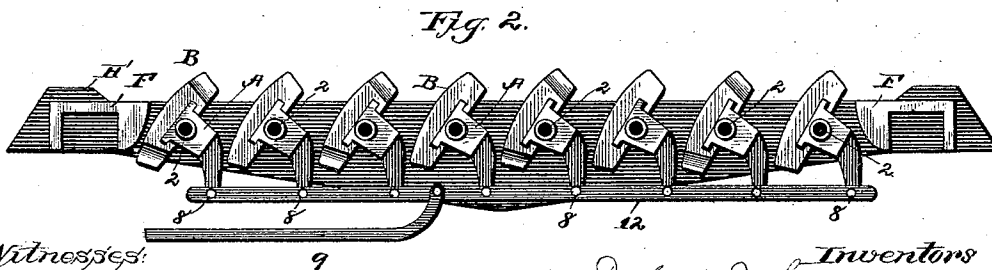
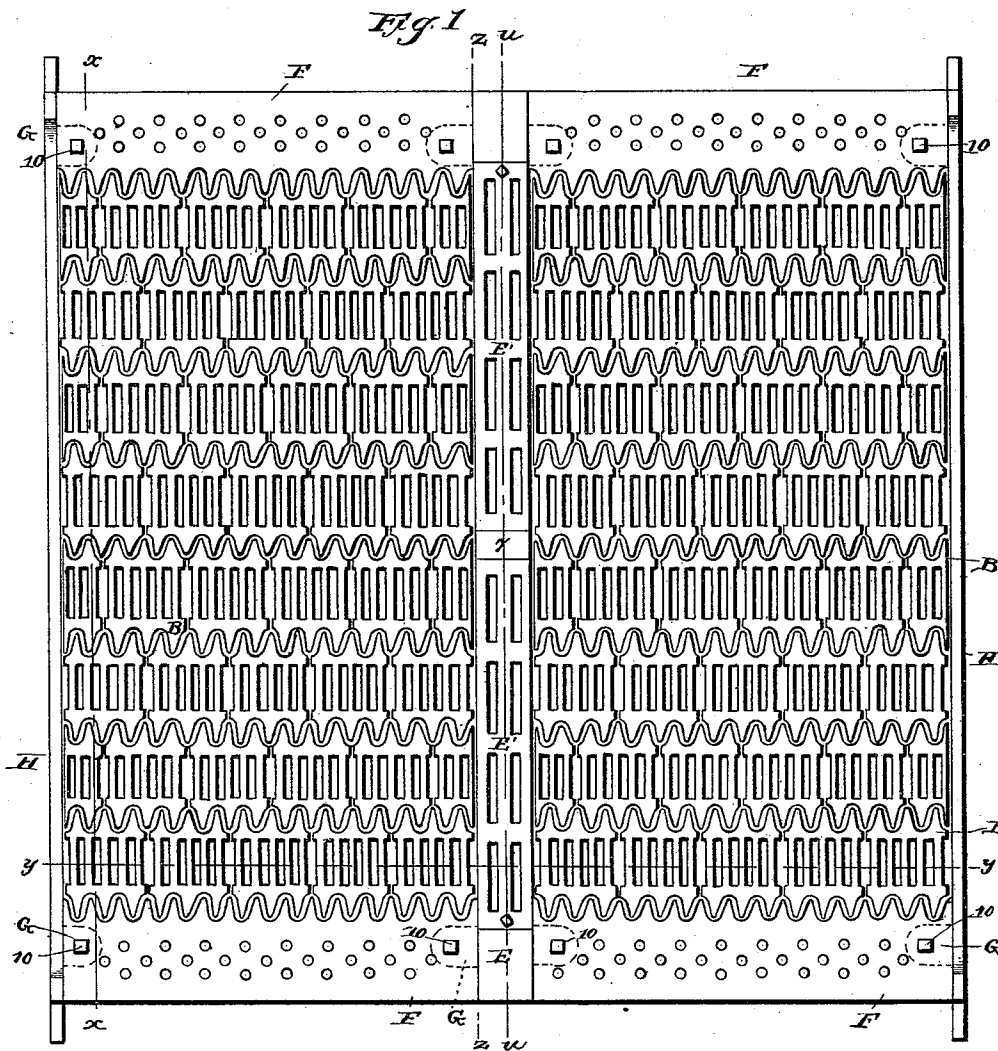
(No Model.)

5 Sheets—Sheet 1.

R. & R. A. WHELAN.
FURNACE GRATE.

No. 474,931.

Patented May 17, 1892.



Witnesses:

M. M. Rheims.
E. H. Erdman.

Inventors

Robert Whelan.
Robert A. Whelan By
Butterworth Hall & Brown

Attest

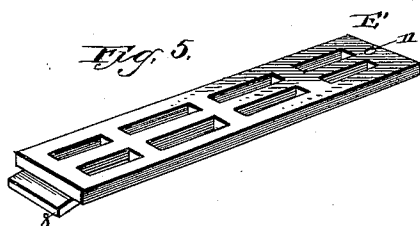
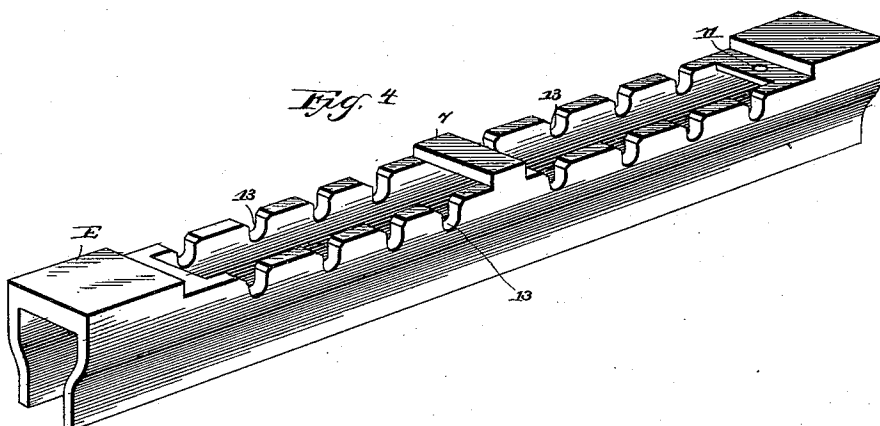
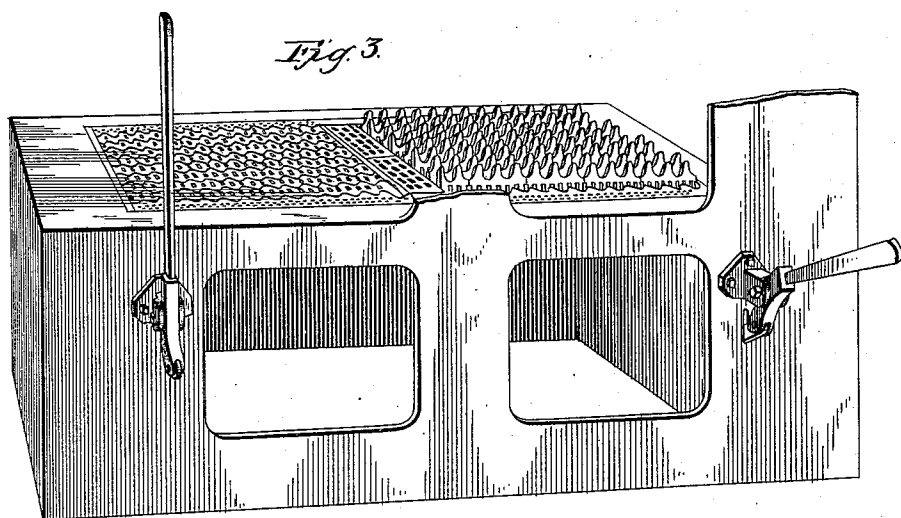
(No Model.)

5 Sheets—Sheet 2.

R. & R. A. WHELAN.
FURNACE GRATE.

No. 474,931.

Patented May 17, 1892.



Witnesses:
Wm. M. Sheen
E. H. Hurdman

Inventors.
Robert Whelan
Robert A. Whelan
Butterworth, Hall & Brown
attys—

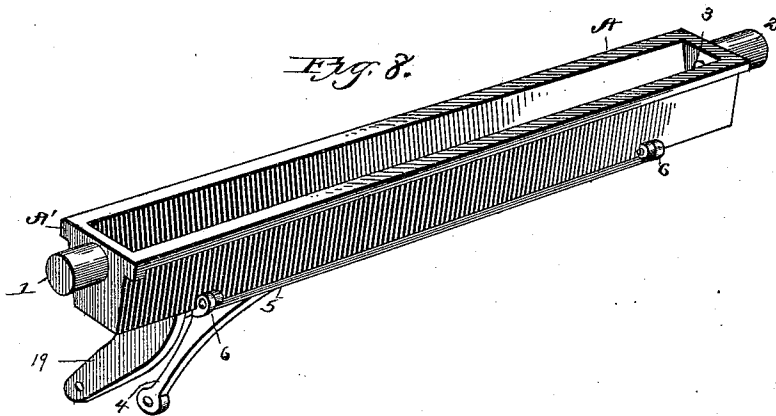
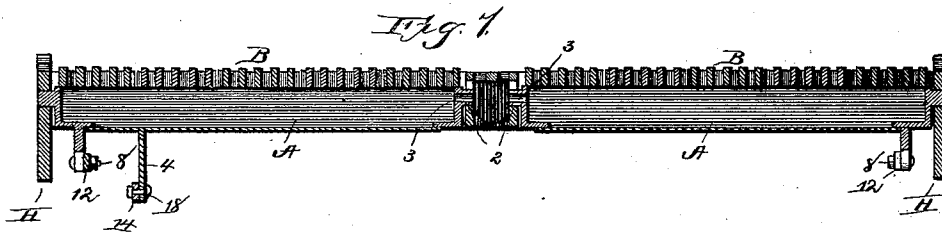
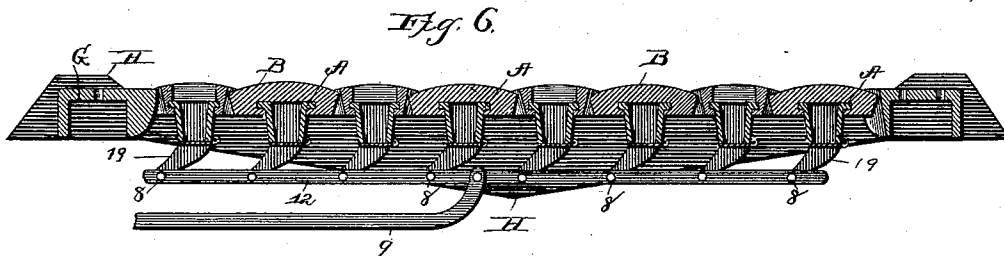
(No Model.)

5 Sheets—Sheet 3.

R. & R. A. WHELAN.
FURNACE GRATE.

No. 474,931.

Patented May 17, 1892.



Witnesses:

Wm. M. Rheem.
E. W. Lutzman

Inventors

Robert Whelan
Robert A. Whelan
Butlerworth Hall & Brown
ALLIES.

(No Model.)

5 Sheets—Sheet 4.

R. & R. A. WHELAN.
FURNACE GRATE.

No. 474,931.

Patented May 17, 1892.

Fig. 9.

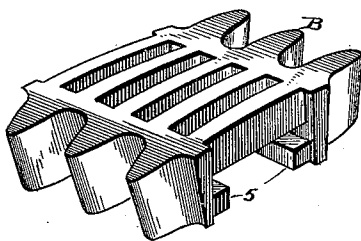


Fig. 10.

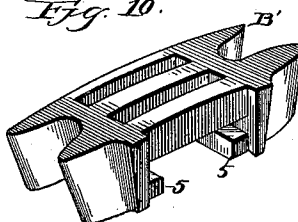


Fig. 11.

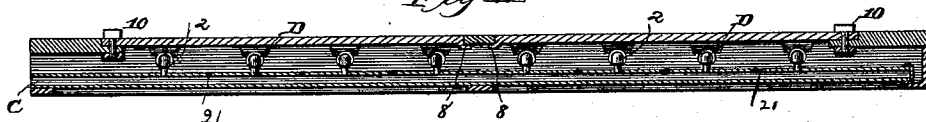
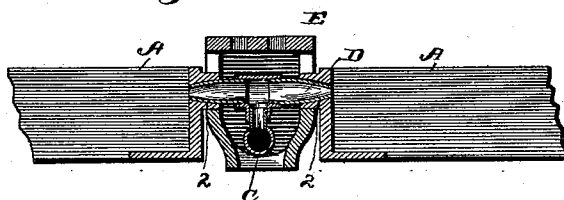


Fig. 12.



Witnesses:

Wm. M. Rheum
C. H. Hurdman

Inventors

Robert Whelan
Robert A. Whelan By
Butterworth O'Fallon Brown

Attest

(No Model.)

5 Sheets—Sheet 5.

R. & R. A. WHELAN.
FURNACE GRATE.

No. 474,931.

Patented May 17, 1892.

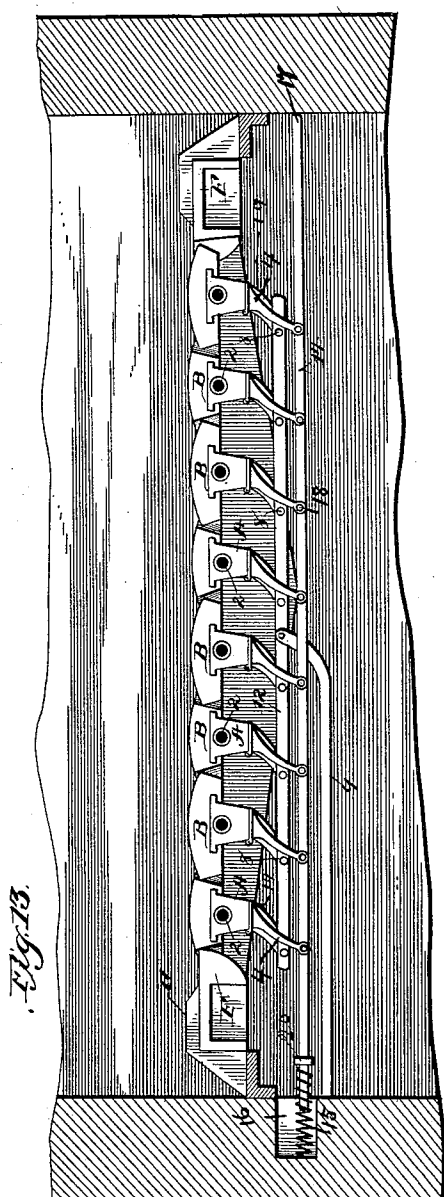
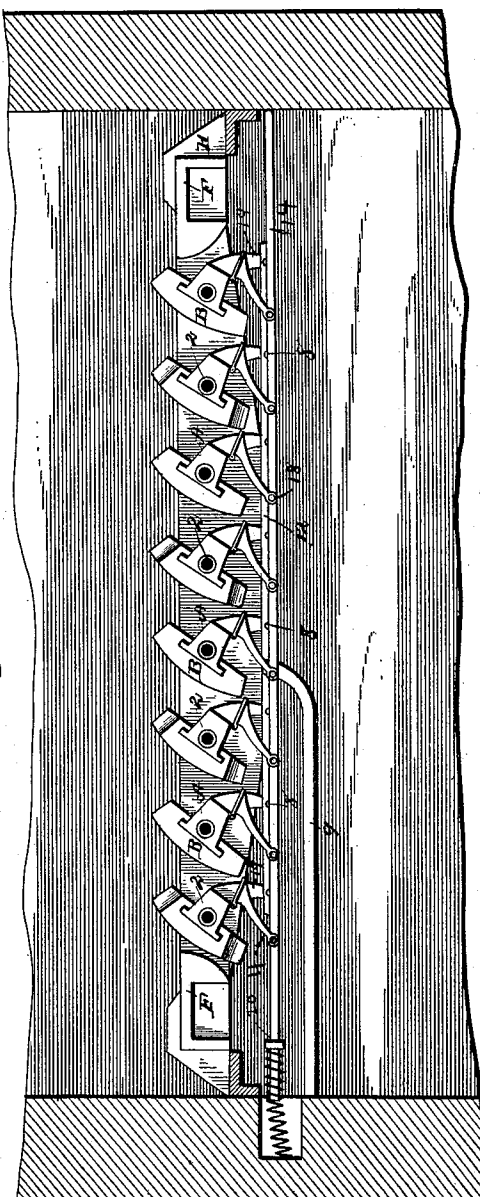


Fig. 14.



Witnesses:
Wm M. Rheem:
H. Hurdman

Inventors
Robert Whelan
Robert A Whelan By
Butterworth Hall Brown

UNITED STATES PATENT OFFICE.

ROBERT WHELAN AND ROBERT A. WHELAN, OF CHICAGO, ILLINOIS.

FURNACE-GRATE.

SPECIFICATION forming part of Letters Patent No. 474,931, dated May 17, 1892.

Application filed August 15, 1890. Renewed April 20, 1892. Serial No. 429,847. (No model.)

To all whom it may concern:

Be it known that we, ROBERT WHELAN and ROBERT A. WHELAN, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Furnace-Grates, of which the following is a specification.

Our invention relates to improvements in furnace-grates by which the floor of the furnace or that part thereof that supports the burning material is constructed of movable parts, so that the burning material and ashes and other product thereof may be thoroughly and quickly shaken and freed therefrom, and in which blasts of air may be introduced through the said parts from below through the burning material, intensifying combustion uniformly throughout the burning mass.

The objects of our invention are to provide movable grate-bars for shaking the burning material and freeing it from ashes and clinkers and other products of combustion, and in addition quickly freeing the grate of all material and also providing tubes and conduits for blasts of air, so that they will flow uniformly from below on and through all parts of the burning material. We attain these objects by mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top view of the frame and grate with its several parts in position. Fig. 2 is a sectional view upon the lines zz of Fig. 1. Fig. 3 is a perspective view of a furnace with the grate in position ready to be operated. Fig. 4 is a perspective view of the central mullion or central bar of the frame that supports the grate-bars. Fig. 5 is a perspective view of the plate that completes the mullion or central bar and holds the parts in place. Fig. 6 is a sectional view upon the line xx , Fig. 1. Fig. 7 is a sectional view upon the line yy , Fig. 1, with the air-tube omitted. Fig. 8 is a perspective view of one of the cross-bars that supports and carries the grate-bars. Figs. 9 and 10 are perspective views of the grate-bars proper immediately upon which rest the burning material. Fig. 11 is a sectional view upon the lines uu , Fig. 1. Fig. 12 is a sectional view upon the lines yy , Fig.

1, with the air-tubes inserted. Figs. 13 and 14 are sectional views upon the lines zz , Fig. 1, showing (Fig. 13) the grates in normal position and (Fig. 14) the grates when rocked.

Similar letters and figures refer to similar parts throughout the several views.

The grate-floor is constructed of a frame H, F, and E and the cross-bars A and grate-bars B. The longitudinal bars H and the mullion or center bar E are provided with lugs G, which may be made integral with those parts or riveted thereto, and to which the flat bars F are firmly bolted by bolt and screws 10. The longitudinal bars H of the frame are provided with openings or bearings to receive and support the trunnion or journals I of the several cross-bars A, and are formed so that their extensions H may rest upon walls to support the frame. The cross-bars A are constructed in the form of a rectangular frame having an opening extending vertically through the same and provided with integral bottoms from the ends to the point 6, Fig. 8. It is provided with ledges A' and its body is wedge-shaped, the bottom being narrower than the top. It is also provided with trunnions or journals 1 2. The trunnion or journal to be received and held by the mullion or center bar E is provided with a circular opening 3 for the insertion of the end of the air-pipe D, as hereinafter explained. The cross-bar A is also provided with a flap or apron 5, which, when in normal position, forms the bottom of the trough; but it is held by hinges 6, and is arranged so that it can open and close when the cross-bars and grate-bars are tilted or shaken. The primary purpose of these flaps or aprons is to close the lower opening of the cross-bars, so that when a blast of air is introduced it cannot pass out through the bottom of the cross-bar. The cross-bars are also provided with ears or lugs 19, which are to be pivotally connected with rods 12 and 9, so that the cross-bars and the grate-bars supported by them may be simultaneously tilted and shaken by operating the rod 9. These ears or lugs extend vertically below the cross-bars, as shown at 8 in Fig. 7. The flaps or aprons 6, constituting the bottoms of the grate-bars, are pro-

vided with ears or lugs 4, extending downward and pivotally connected with the horizontal rod 14. This rod 14 is constructed of such length and so pivoted to said ears or lugs 4 that one end rests against the rear wall of the furnace at 17. At the other end it is provided with a collar 20 and a spring 15, located in a nich in the front wall of the furnace. This spring forces the rear end of the rod against the rear wall and holds the flaps or bottoms of the cross-bars closed when the cross-bars and grates are in normal position, and causes them to open and be slightly depressed when the grate-bars are rocked and shaken by the shaking-rod 9.

The grate-bars B B' are constructed with openings and with interior or male ledges 5 to receive and be held upon the cross-bars. They are arranged so that the serrated ends upon one series of a given cross-bar will dovetail with the corresponding ends of the next series, and their faces are inclined so that they may be tilted without contact or friction with each other. Ordinarily they are constructed in pairs having, respectively, two and three teeth bearing two and four vertical openings, as shown. This enables an easy adjustment of the number of grate-bars to a given length of the cross-bar. It is evident that, if necessary, each series may be made in one solid piece or in such number of pieces as will suit the size of the furnaces.

The central bar or mullion E may be made of several parts bolted and riveted together, or it may be made in one solid piece, as shown in Fig. 4. The lugs or ears 10, Fig. 1, may be riveted or bolted to it or made integral with it. It is provided with openings or depressions 13, Fig. 4, in its upper edges or bearings to support and carry the trunnions or journals of the cross-bars, and the latter are held in position by plates E', Fig. 5, which are constructed with openings and with a lug 8. This lug is inserted under the bridge 7, Fig. 4, and the plate laid upon the edges of the mullion or center bar and bolted through openings 11.

The mullion or center bar may be made with parallel sides, as shown in Fig. 7, or with sides with curved faces, as shown in Fig. 4. The mullion or center bar E is closed by plates or the walls of the furnace at the ends and bottom. Into the interior of this mullion or center bar is introduced a pipe or tube C, Figs. 11 and 12, and the pipe or tube has a T cross-section D opposite the circular openings of the cross-bars A, the upper ends of this T cross-section being introduced and fitting closely in the respective circular openings in the trunnions or journals of the cross-bars. The pipe or tube C is also provided with small openings 21 in the chamber of the mullion or center bar E, so that a blast of air may be sent through them, it being designed that the

bottom of the chamber shall be closed by a plate or wall on which it rests. The pipe or tube C is carried outside the furnace and connected with the means for driving a blast of air.

Having thus described the different parts of the said mechanism by which we attain the purposes of our said invention, we now proceed to describe and explain its mode of operation. The several grate-bars being placed and located upon the cross-bars, and the latter then being placed in the frame, the trunnions or journals placed in their respective openings or bearings in the longitudinal bars and the mullion or center bar, the tubes are inserted and the external connection made with the blast-driving mechanism. The rods 9, 12, and 14 are connected pivotally with the lugs or ears of the cross-bars and their flaps or bottoms and the rod 9 is connected with a lever located externally to the furnace, as shown in Fig. 3. By moving this lever and the rods 9 and 12 the cross-bars partially rotate back and forth upon their trunnions or journals and the grate-bars are caused to tilt back and forth and the flaps or bottoms of the cross-bars will open to let out the ashes and cinders and the serrated edges of the adjacent series of grate-bars will be separated and closed. In this manner the grate-bars may be shaken and tilted, so as to permit only the finer ashes and cinders and smaller portions of material on them to be sifted out and fall below, or the entire mass can be suddenly thrown down and the floor of the grate cleaned and freed of all material. The air driven into the tube C flows through the small openings therein into the chamber of the mullion or center bar and through the T cross-section into the chambers of the cross-bars, and thence upward through the openings in the grate-bars to and uniformly through the entire burning mass, thereby furnishing it with additional oxygen and greatly intensifying the combustion. By this means the fuel is more completely and evenly burned, and the smoke and combustible gases, the result of combustion, are more completely consumed. It is evident that in this arrangement the functions of the grate-tilting devices and of the cold blast of air devices greatly aid and cooperate with each other. The more regularly and perfectly the grates are shaken and the more uniformly the ashes and other non-refractable material are removed and the blast of air sent throughout the entire mass the more rapid, perfect, and complete will the combustion be made and the more completely will the smoke and gases be consumed.

It is evident that there may be many variations and modifications in the arrangement of parts and construction of our invention without departing from the spirit thereof.

Having described our invention and its mode of operation, what we claim, and desire to secure by Letters Patent, is—

1. In a furnace, the combination of a frame, with chambered cross-bars respectively provided with a flap or bottom held by hinges, each cross-bar provided with a lug or ear, and the flap or bottom of each cross-bar provided with a lug or ear, horizontal rods pivotally connected with each series of said ears or lugs, the rod connected with the lugs or ears of said cross-bars being pivotally connected with an operating rod and lever, and grate-bars with vertical openings supported and held on said cross-bars, all substantially as shown.

2. In a furnace, a frame, chambered cross-bars supported in said frame, with an opening in the trunnion or journal of each leading into the chambers thereof, said cross-bars provided with flaps or bottoms held by hinges, each cross-bar and each flap or bottom provided with its respective lug or ear, horizontal rods pivotally connected with each series of lugs or ears, an operating rod or lever pivotally connected with said rod, connecting the ears and lugs of the cross-bars, and a pipe with small openings along its side and having sections or branches connecting with the openings in the trunnions or journals of the cross-bars, with means for sending a blast of air through said pipe and grates, all substantially as shown.

3. In a furnace, a frame, chambered cross-bars supported in said frames, with an opening in the trunnion or journal of each cross-bar leading into the chamber, said cross-bar provided with flaps or bottoms held by hinges, each cross-bar and each flap or bottom provided with its respective lug or ear, horizontal rods pivotally connected with each series of lugs or ears, the rod connected with the lugs or ears of said flaps or bottoms, provided with a collar and spring to hold the same in position, the rod connected with said cross-chambers being connected with an operating rod and lever, and grate-bars with vertical openings supported on said cross-bars, all substantially as shown.

4. In a furnace, a frame composed of two longitudinal sides provided with interior lugs at each end, cross-plates resting on and pivoted or bolted to said respective lugs, said mullion or center bar being hollow for the introduction of air-pipes, provided with openings or bearings in the depressed surfaces of the upper edges of its sides, and with plates having vertical openings held or riveted upon said depressed surfaces to hold and retain the journals or trunnions of the cross-bars in said openings or bearings, in combination with cross-bars provided with trunnions having openings to receive the air from the mullion or center bar, all substantially as shown.

5. In a furnace, a chambered cross-bar and

ledges along its upper longitudinal sides, provided with trunnions or journals at each end and an ear or lug, also with a flap or bottom hinged to the under side of said cross-bar, said flap or bottom being provided with an ear or lug whereby said chamber of said cross-bar may be opened or closed at the bottom thereof, in combination with one or more grate-bars supported thereon, all substantially as shown.

6. In a furnace, a chambered cross-bar with ledges along its upper longitudinal sides, provided with trunnions or journals at each end, one of which has an opening into said chamber, also with an ear or lug also provided with a flap or bottom held to said cross-bar by hinges, said flap or bottom having an ear or lug, whereby said flap or bottom can be made to open or close said chamber at the bottom, in combination with one or more grate-bars supported thereon, all substantially as shown.

7. In a furnace, a grate-bar B, with vertical openings and recessed upon one side to form in connection with another grate-bar B' a vertical opening between the two, the under side of said grate-bar B recessed and each of the walls of such recess provided with a transverse lug 5, leaving space for the introduction of a cross-bar A, provided with ledges or flanges A', whereby the two may be locked together, all substantially as shown.

8. In a furnace, a grate-bar B, having vertical openings, one side recessed to form in connection with another grate-bar B' a vertical opening between them, the lower side of said grate-bar B recessed, the opposite walls of said recess being provided with transverse lugs 5, so as to form a space for the introduction of the flanges or ledges A' of the cross-bar A, whereby the same may be locked, said grate-bar B having its edges serrated and the faces of said edges inwardly inclined, all substantially as shown.

9. In a furnace, a grate-bar B, with vertical openings, one side recessed to form in connection with another grate-bar B' a vertical opening between them, its lower side recessed and each of the walls of such recess provided with a transverse lug 5, leaving a space for the introduction of the cross-bar A with its ledges or flanges A', whereby the two may be locked together, in combination with a chambered cross-bar A, provided with flanges or ledges A', adapted to be received by the recess in said grate-bar B and to hold and support the same, all substantially as shown.

10. In a furnace, a series of grate-bars respectively provided with vertical openings and interior ledges, in combination with a series of chambered cross-bars, each cross-bar provided with a flap or bottom and with ledges adapted to carry and support said series of grate-bars, all substantially as shown.

11. In a furnace, a series of grate-bars B, with vertical openings, a series of chambered

cross-bars A, adapted to carry and support
such grate-bars, said cross-bars being pro-
vided with trunnions or journals 1 2, set in
bearings, one of said trunnions 2 being hollow
5 for the reception of the terminal of an air-
pipe D, and means for rocking said cross-bars
and tilting said grate-bars, in combination
with an air-pipe C, and branches D, connected
with the chambers of said cross-bars through
10 said hollow trunnions and connecting pipes
and branches in and through the chambers

of said cross-bars and the vertical openings
of said grate-bars, all substantially as shown.

ROBERT WHELAN.
ROBERT A. WHELAN.

Witnesses to Robert Whelan's signature:
J. W. VAN BUSKIRK,
J. F. RITCHHART.
Witnesses to Robert A. Whelan's signature:
WM. S. CAMERON,
BENTON J. HALL.