

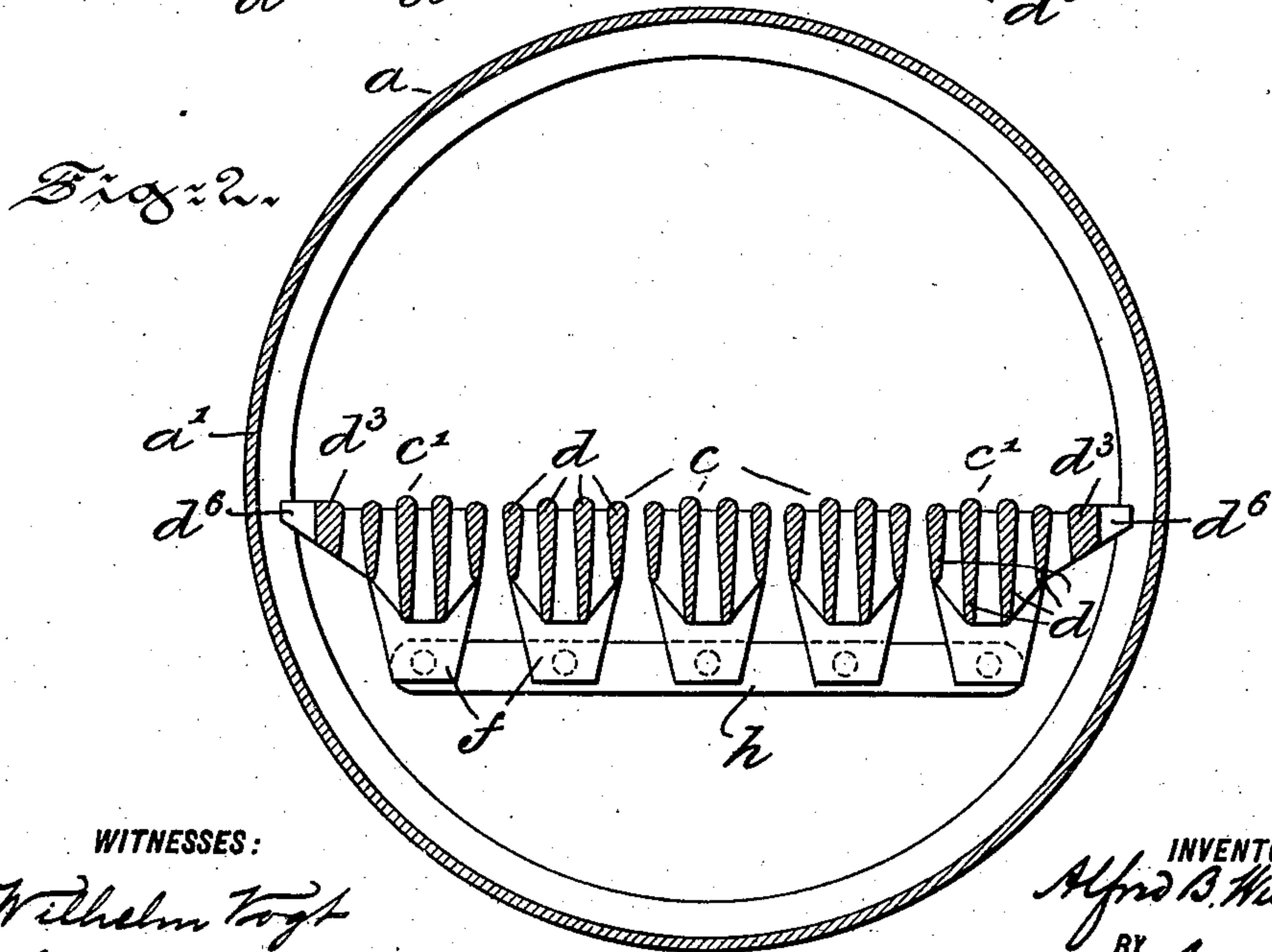
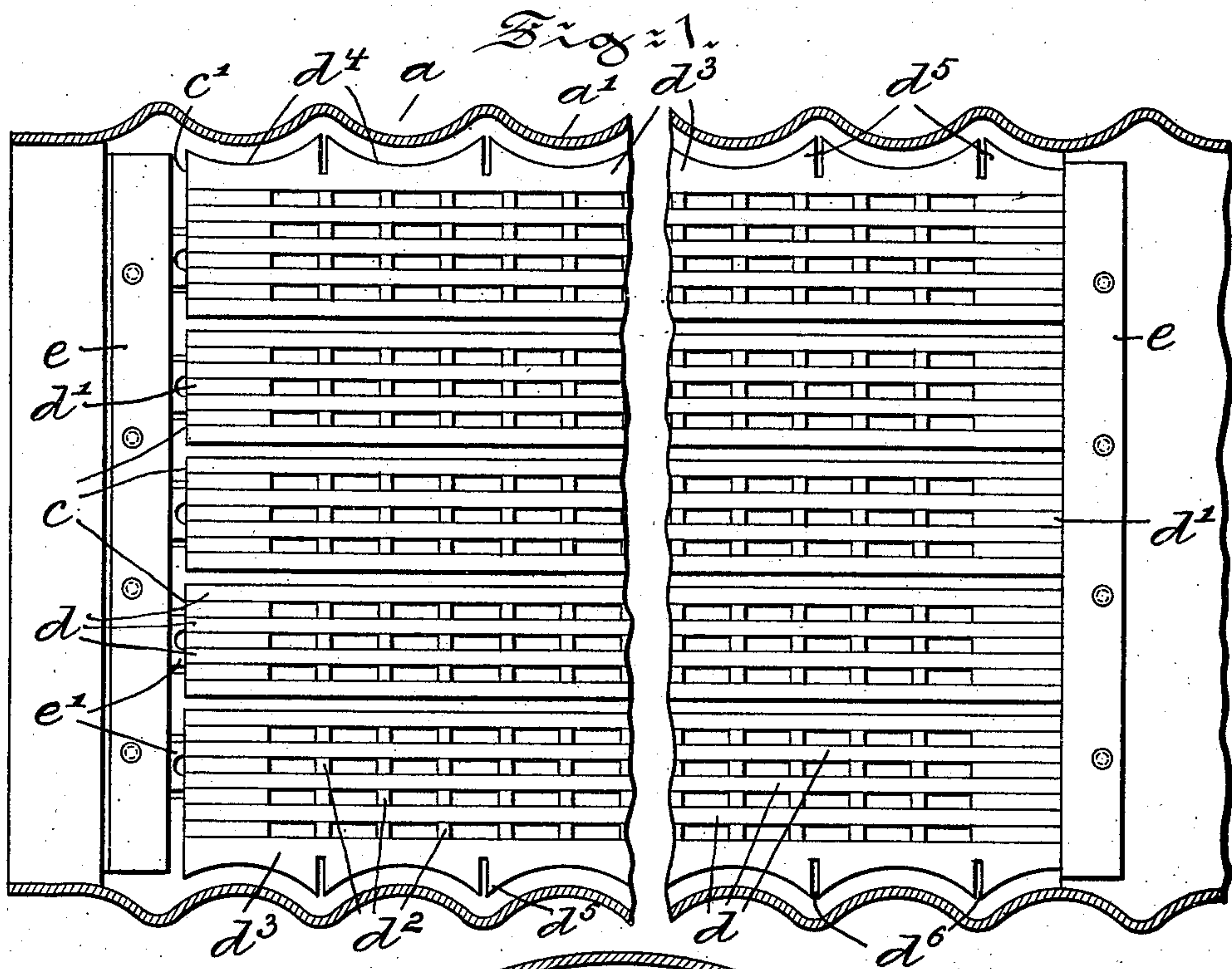
No. 857,136.

PATENTED JUNE 18, 1907.

A. B. WILLOUGHBY.

SHAKING GRATE.

APPLICATION FILED MAY 16, 1906.



WITNESSES:

Wilhelm Torgt  
Thomas M. Smith.

INVENTOR  
Alfred B. Willoughby  
BY  
J. Walter Douglas  
ATTORNEY.



# UNITED STATES PATENT OFFICE.

ALFRED B. WILLOUGHBY, OF PHILADELPHIA, PENNSYLVANIA.

## SHAKING-GRATE.

No. 857,136.

Specification of Letters Patent.

Patented June 18, 1907.

Application filed May 15, 1906. Serial No. 316,923.

*To all whom it may concern:*

Be it known that I, ALFRED B. WILLOUGHBY, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Shaking-Grates, of which the following is a specification.

My invention has relation to a shaking grate; and in such connection it relates more particularly to the construction and arrangement of grate-bars conforming on one side to the outline of the furnace wall and on the other side to the outline of adjacent grate-bars so as to permit the shaking or rocking of the end bars to readily remove ash and clinker therefrom.

Heretofore grate-bars used at the ends of grates in annular furnaces were stationary, and served only to prevent the fuel from dropping unburnt into an ash-pit. In performing this function, however, upon stationary bars the ash and clinker accumulated thereon, thereby preventing the fire and heat acting upon the furnace wall at a point where the greatest heating effect of the fuel would otherwise be obtained and also thereby decreasing the available heating area of the grate.

The principal objects of my present invention are first, to overcome the disadvantages in the use of stationary end-bars in internal furnaces having annular straight or corrugated walls so as to render the same movable to readily permit of removal of ash and clinker therefrom; second, to shape the outer sides of the end-bars contiguous to the furnace wall so as to conform to the outline thereof and hence to prevent dropping of unburnt fuel into the ash-pit; third, to shape the inner side of the end-bars so as to conform to the shape of adjacent bars and hence to permit of free rocking or shaking thereof; and fourth, to provide the sides of the end-bars contiguous to the furnace wall with slots to permit of free expansion of said sides, when provided with projections and depressions.

The nature and scope of my present invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof, in which

Figure 1, is a view, illustrating partly in horizontal section and partly in top or plan view a corrugated furnace and a grate formed

of different shaped bars arranged therein, embodying main features of my said invention; and Fig: 2, is a vertical sectional view thereof.

Referring to the drawings *a*, represents a furnace of annular outline, in cross-section, the wall *a*<sup>1</sup>, of which may be straight or corrugated. The grate employed in the furnace *a*, consists of movable intermediate and end-bars *c* and *c*<sup>1</sup>, respectively, each intermediate bar *c*, formed with the exception of the end-bars *c*<sup>1</sup>, of four longitudinal ribs *d*, terminating in solid end portions *d*<sup>1</sup>, and of transverse ribs *d*<sup>2</sup>, slightly depressed below the upper surface of the ribs *d*. Each of the bars *c* and *c*<sup>1</sup>, in the present instance is supported by a projection *e*<sup>1</sup>, extending laterally from bearer-bar *e*, and provided with a drop-arm *f*.

As shown in Fig: 2, the drop-arms *f*, are connected with each other by a bar *h*, so as to be simultaneously rocked or shaken upon the projection *e*<sup>1</sup>, or the same may be shaken separately, for which purpose, the drop-arms *f*, are disconnected from each other. The end bars *c*<sup>1</sup>, are provided in addition to the four longitudinal ribs *d*, with ribs *d*<sup>3</sup>. The additional ribs *d*, of the end bars *c*, terminate at different planes to form a curved upper surface, similar to the intermediate bars *c*, while the additional ribs *d*<sup>3</sup>, terminate in the same plane coequal with adjacent ribs *d*, of the end bars *c*, thus forming a straight continuation of said bars. The sides of the additional ribs contiguous to the furnace wall will conform to the corrugations *a*<sup>1</sup> of the furnace wall, and have depressions *d*<sup>4</sup>, and projections *d*<sup>5</sup>, alternately arranged therein, with respect to each other, or these projections and depressions may be dispensed with, if the furnace wall is straight. The additional rib *d*<sup>3</sup>, of the end-bar *c*<sup>1</sup>, is of less depth than the other ribs *d*, so as to permit these ribs to be held out of engagement with the wall *a*<sup>1</sup>, of the furnace *a*, when the end-bars *c*<sup>1</sup>, are rocked or shaken to remove ash and clinker therefrom. When the bars *c* and *c*<sup>1</sup>, are rocked or shaken on their support *d*<sup>1</sup>, the ribs *d*, thereof, will be brought owing to their curved outline, successively into engagement with the fuel bed resting thereon thus preventing the breaking of the crust yet permitting of the free removal of ash and clinker without disturbing the crust. In contradistinction the ribs *d*, of the end bars *c*<sup>1</sup>, will perform the same function, in not breaking the crust and in addition thereto by means of the end bar *d*<sup>3</sup>, will



force the ash resting thereon in an upward direction, thereby forcibly removing the same from the furnace wall, to which the accumulating ash has a tendency to adhere. This ash so removed at this portion of the grate will lay bare that portion of the furnace wall which is always otherwise protected against the influence of the heat by the accumulating ash, which could not be destroyed with the use of a bar of the shape of my said invention. In order to permit of the free expansion of the projections  $d^5$ , of the end ribs  $c^1$ , and thus to prevent cracking of the same, under the influence of heat, each of the projections  $d^5$ , is provided with a slot  $d^6$ , extending from the outer face of the end bars  $c^1$ , a certain distance into the rib  $d^3$ , as shown in Fig: 1. The grate-bars  $c$  and  $c^1$ , as hereinbefore explained may be rocked or shaken simultaneously, separately or in groups, if desired, and the form of bars employed may differ from the form of bars shown, as long as the end-bars employed conform to the sides contiguous to the furnace wall, as to outline thereof, and at the sides contiguous to the adjacent grate-bars as to outline of these bars to permit of free shaking or rocking of said end bars, without contacting with the furnace wall or with the other bars.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination with a horizontal furnace of substantially annular outline, of a grate, consisting of bars arranged parallel to each other and to the longitudinal axis of said

furnace, each bar consisting of ribs terminating in solid end portions, the ribs of said bars being of equal number and the end bars being provided with an additional rib located adjacent to the furnace wall, the additional rib of said end bars when the same are rocked or shaken adapted to remove the ash of the fuel bed adjacent to said wall by passing the same and the remaining ribs thereof and ribs of said intermediate bars adapted to rub against and to remove the ash from the fuel bed by a lateral movement and without breaking the crust of said fuel bed.

2. In combination with a horizontal corrugated furnace of substantially annular outline, of a grate, consisting of bars arranged parallel to each other and to the longitudinal axis of said furnace, each bar consisting of ribs terminating in solid end portions, the ribs of said bars being of equal number and the end bars being provided with an additional rib, the additional rib of said end bars being shaped to form alternate contracted and expanded portions at the outer side so as to conform to the outline of the corrugations of said furnace wall and the expanded portions of the additional ribs having slots to permit of the free expansion of the same.

In testimony whereof, I have hereunto set my signature in the presence of two subscribing witnesses.

ALFRED B. WILLOUGHBY.

Witnesses:

J. WALTER DOUGLASS,  
THOMAS M. SMITH.