(No Model.)

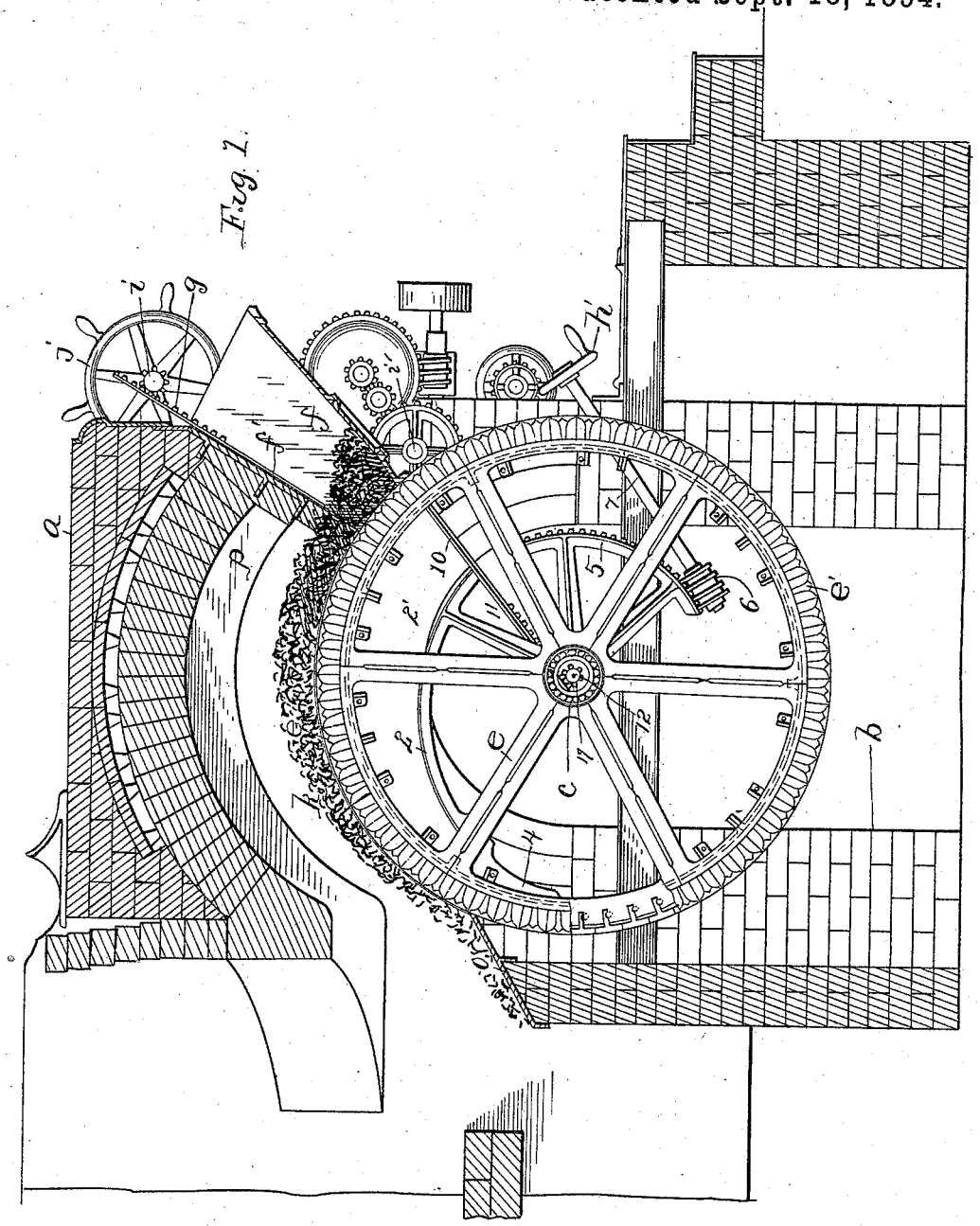
4 Sheets—Sheet 1.

T. R. BUTMAN.

MECHANICAL STOKER.

No. 526,341. Patented Sept. 18, 1894.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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MECHANICAL STOKER.

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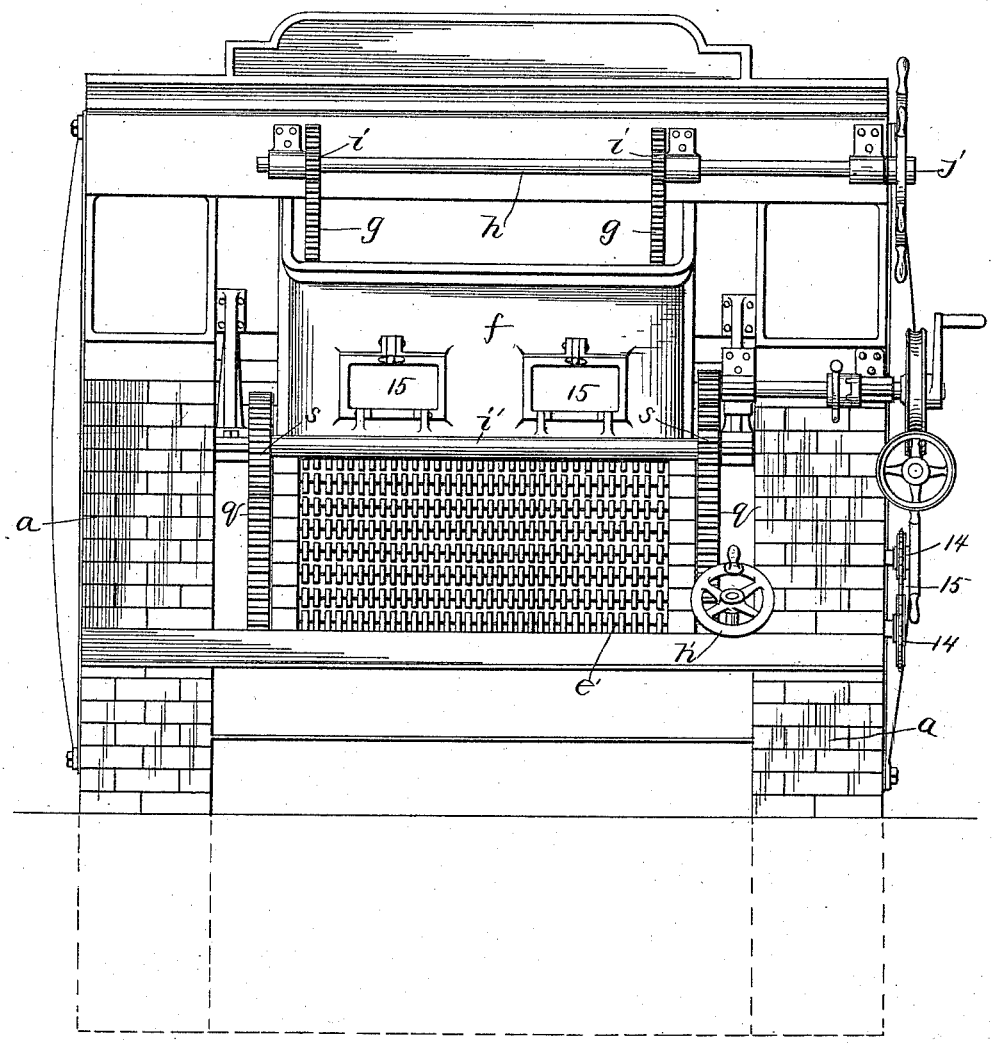
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

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MECHANICAL STOKER.

No. 526,341. Patented Sept. 18, 1894.

Fig. 3

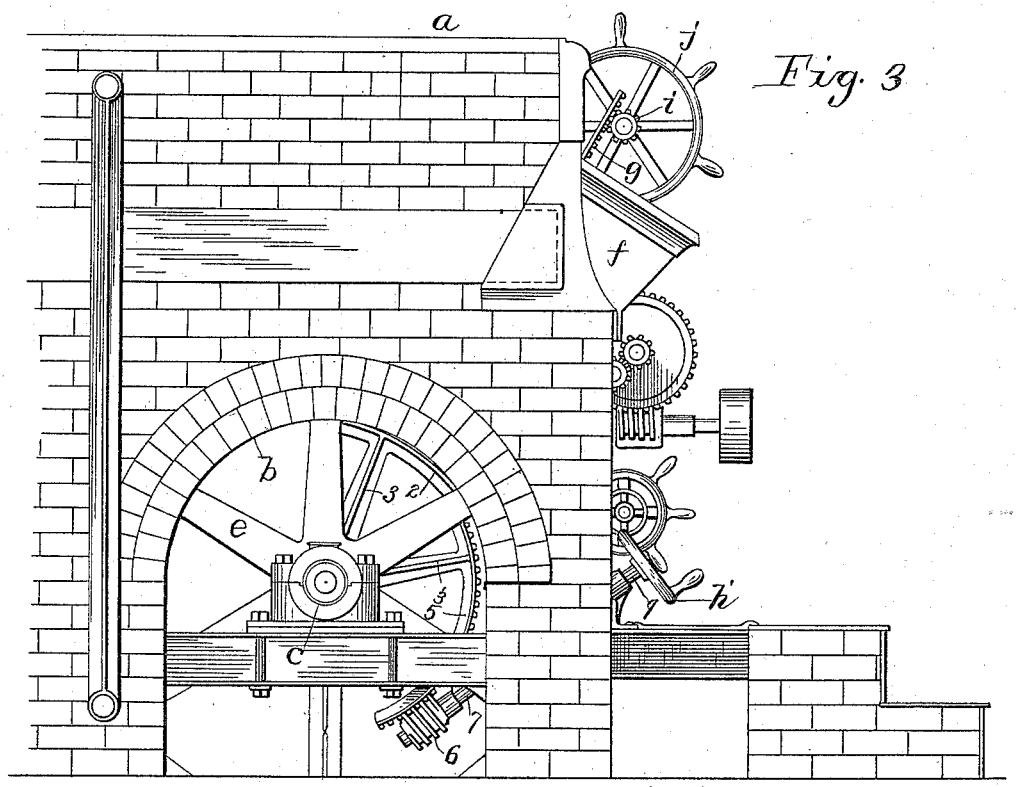
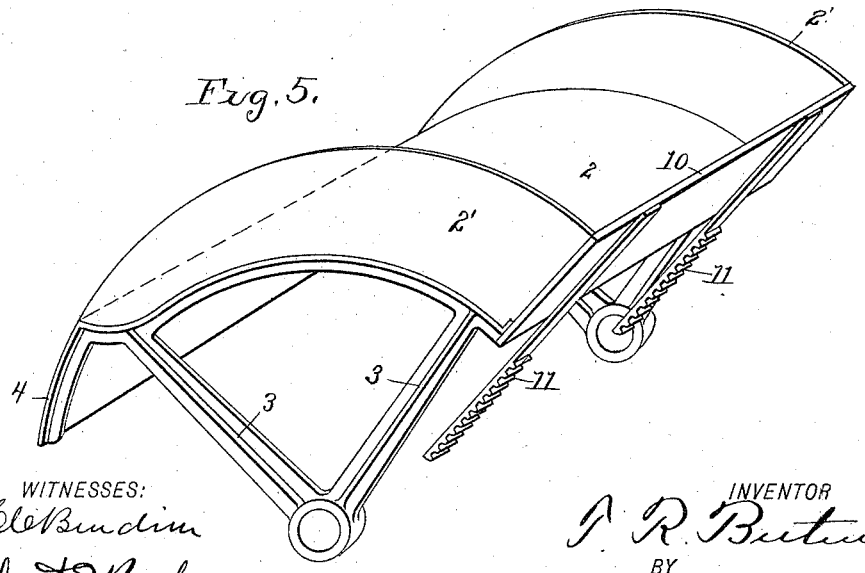


Fig. 5.



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(No Model.)

4 Sheets—Sheet 4.

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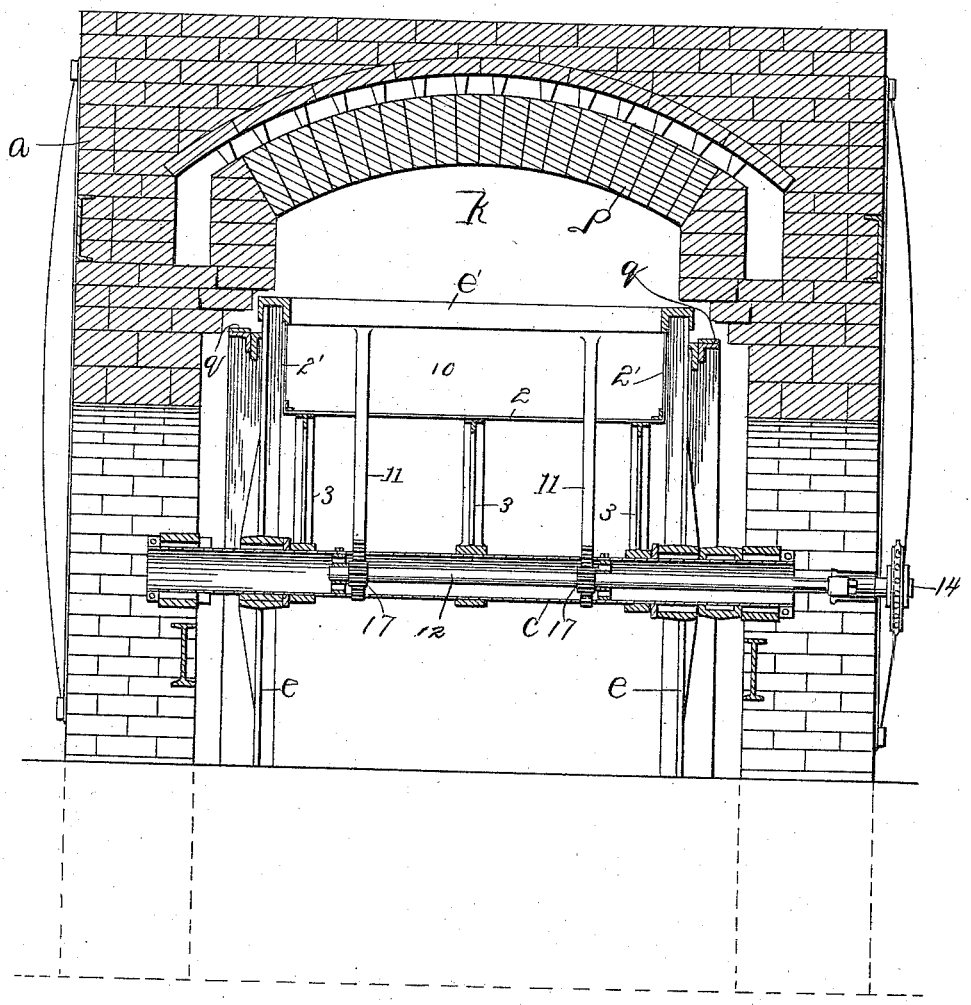
MECHANICAL STOKER.

No. 526,341. Patented Sept. 18, 1894.

Fig. 4



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UNITED STATES PATENT OFFICE.

THOMAS R. BUTMAN, OF CHICAGO, ILLINOIS.

MECHANICAL STOKER.

SPECIFICATION forming part of Letters Patent No. 526,341, dated September 18, 1894.

Application filed January 5, 1894. Serial No. 495,809. (No model.)

To all whom it may concern:

Be it known that I, THOMAS R. BUTMAN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Mechanical Stokers; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form part of this specification.

This invention relates to certain improvements in mechanical stokers.

The object of the invention is to provide an improved furnace, economical in construction, durable and inexpensive to operate, and whereby a uniform heat will be produced and the fuel completely consumed with the smoke and combustible gas, so that all heat-producing parts and elements in the fuel are completely consumed and utilized for the purpose intended.

A further object of the invention is to provide an improved automatic self-feeding furnace or mechanical stoker, cheap, simple and durable in construction, and composed of a minimum number of parts so arranged that an even fire can be produced and the fuel will be completely and economically consumed and all the heat therefrom utilized.

The invention consists in certain novel features of construction, and in combinations of parts more fully and particularly pointed out hereinafter.

Referring to the accompanying drawings: Figure 1 is a vertical sectional view through the furnace. Fig. 2 is a front elevation of the furnace. Fig. 3 is a side elevation of the furnace. Fig. 4 is a vertical sectional view taken in a plane at right angles to the plane of the section shown in Fig. 1. Fig. 5 is a detailed perspective view of the movable ash pan and the air-controlling means or damper at the open end thereof, the damper being shown at its limit of outward movement and hence closing the air supply opening.

In the drawings the reference letter *a* indicates a suitable masonry structure or casing of refractory material. This structure can be provided with the side arches "*b*" and the front arch or opening.

"*c*" indicates a strongly constructed, preferably hollow, horizontal shaft extending through the structure between said arches, and at its end mounted in suitable bearings carried by supports extending across said arches. Two heads or wheels "*e*" are loosely mounted so as to revolve on certain portions of said shaft by means of suitable bearings, such as ball bearings, although I do not wish to limit myself to their employment, so that the said heads can rotate independently of the shaft, and the shaft can rotate within the heads independently thereof. Each head preferably consists of an outer rim and spokes extending from the shaft to the rim. The rims are provided with suitable radial openings in which grate bars "*e'*" are secured, so that a drum shaped grate is formed, having its grate surface composed of the grate bars arranged close together and secured in, and extending between, the rims of said head.

Above the forward upper quarter of the drum is located a hopper *f* for receiving the fuel, said hopper being open at its lower end. The inner side of the hopper is provided with a sliding gate *f'* with two arms *g* rigidly attached and extending upward, said arms being provided with racks at their upper ends engaging the pinion wheels *i* mounted on a shaft *h* extending across the upper portion of hopper, and provided with a suitable hand wheel *j* for revolving said shaft. By means of this mechanism the sliding gate can be raised or lowered to control the depth of the fuel admitted to the grate. As the drum grate revolves the upper surface thereof moves rearwardly, and the fuel from the feed hopper spreads evenly over the grate surface thereof.

The combustion chamber "*k*" extends downwardly and rearwardly to a point preferably slightly or a short distance above the plane of the horizontal diameter of the drum, where it is provided with the discharge to the uptake and with the downwardly and rearwardly inclined tail piece "*o*" or dump plate with its inner and upper end, preferably scraping or located close to the surface of the grate so as to remove all ashes and clinkers therefrom,

and permit the same to slide downwardly into the ash pit. The discharge mouth or end of the combustion chamber "*k*" is preferably contracted.

The arch "*p*" of the combustion chamber is formed of suitably refractory material, and is located a short distance from the surface of the grate, and is preferably curved transversely and longitudinally and is so formed and proportioned as to radiate heat back from the incandescent fuel on the grate, thereby igniting the green fuel from the top where it is first introduced into the combustion chamber. The gases from the green coal being evolved pass forward, and, being controlled and deflected by the curved arch, come in contact with the highly heated body of incandescent fuel and being supplied with highly heated air passing up through said fuel in a constant current, are thoroughly consumed, thereby producing perfect combustion and eliminating the production of smoke as well as giving the greatest efficiency possible. It will be seen that the arch is so constructed as to retain the heat within the combustion chamber and reflect it backward toward the grate at the front end of said chamber by having the ends of the chamber somewhat contracted so that as soon as the arch becomes highly heated it will immediately kindle the green coal that is passing in on the wheel under the gate of the hopper, thereby igniting the green coal from the top so that the fire can gradually work down through the fuel which reaches an incandescent state by the time it passes the central vertical line of the drum.

Any suitable means can be employed to rotate the grate, such as the gearing "*q*" on each head of the grate and the shaft "*i'*" at the front of the furnace beneath the hopper parallel with the grate and provided with the pinions "*s*" engaging said gearing of the heads. Any suitable means can be employed to rotate this shaft whether by hand or by power, and I do not wish to limit myself to any particular means for revolving the grate. I here show a series of gear wheels and shafts whereby the grate can be revolved by power applied to a pulley. I also wish it understood that I do not wish to limit myself to any particular means for operating the gate controlling the depth of coal on the grate, nor to any particular style or construction of gate. Although an air chamber is here shown above the arch of the combustion chamber "*k*" to prevent radiation of heat, yet I do not wish to limit myself to the use of such air chambers. Suitable means are located within the grate to control the supply of air to the grate surface and to control the area of grate surface to which air is supplied at any one time. This means preferably consists of an ash box or air controlling box or chute located within the drum beneath the active grate surface thereof, and composed of the curved bottom 2 extending from a point a distance from one side of the grate periphery over the shaft to the inner side of the grate bars at the opposite side of the shaft and near the discharge from the combustion chamber and the vertical side plates 2' extending up from the side edges of said bottom upwardly to the inner surfaces of the rim of the grate head, so that a complete box or conduit is formed beneath the active surface of the grate with an opening at the front end of said box at the front side of the grate. This box is supported by arms "3" extending upwardly from and rigid with the shaft and rigidly secured to said box, so that the box can be moved or rocked within the drum by rotating or turning the shaft. The inner or closed end of said box is provided with a shoe, "4" fitted and curved to conform to the curvature of the inner surface of the periphery of the grate, so that by rocking the hollow shaft the said box can be rocked to throw said shoe forwardly and rearwardly and thereby decrease or increase the area of the grate to which air will be supplied from said box.

In Fig. 1 the full active surface of the grate is shown supplied with air as the shoe is located below the tail piece over which the ashes are discharged, but if the rear end of the ash box should be rocked upwardly the said shoe would move up to a point above said tail piece and thereby shut off a corresponding area of the grate on which fuel is located from the supply of air passing in through said ash box. By this construction the air can be concentrated on the incandescent portion of the fuel or on the green fuel. Suitable means can be employed to rock the said shaft and pan. I hereby show a toothed segment, "5," rigid with the said shaft and in engagement with a worm, "6," carried by the inclined shaft, "7," suitably journaled and extending forwardly to the front exterior of the furnace where it can be provided with a suitable handle, "*h'*," for rotating the shaft.

The ash box has the upwardly curving bottom so that the area of the ash box gradually decreases rearwardly which assists in throwing the air outwardly and upwardly through the grate bars where the air is most needed, that is, at the point of greatest heat directly over the central portion of the drum.

The front opening into the ash box, which constitutes the air supply opening from the outer air, can be controlled in any suitable manner by a sliding damper, "10," arranged outside of said opening and ash pan to slide in a direction radial to the drum to vary and control the area of the air inlet opening into said ash box. This damper can be provided with arms, "11," extending inwardly through the hollow shaft, *c*. The shaft "12" is located concentrically in the hollow shaft *c* and is suitably journaled therein, and is provided with small pinions, "17," meshing with racks on the ends of said radial arms from the

damper so that by turning said shaft within the hollow shaft said gearing will raise and lower the damper to control the air inlet opening into said box. Suitable means can be employed to rotate this inner shaft, such as sprocket wheels, "14," and chains, "15," the outer wheel and handle, "14," being located in the front of the furnace so as to be easily operated by hand.

The quantity of fuel consumed per hour can be readily regulated either by increasing or decreasing the speed of the grate drum; by increasing or decreasing the depth of fuel by means of raising or lowering the hopper gate; by means of the damper in regulating the admission of air to the fuel, or by placing the box in such a position as to increase or decrease the actual grate area supplied with air.

When ashes accumulate in the ash box beneath the active portions of the grate surface said box can be rocked so as to drop the ashes on the lower portion of the grate. The ashes will pass through the lower portion of the grate into the pit beneath the grate drum.

In starting up a fire on the drum the hopper gate is lifted to the point desired and the drum turned by hand so as to start the coal thereon. Kindling is then introduced through the doors, "15," in front of the hopper, and on lighting the same the fire will travel forward over the surface of the bed of fuel and rapidly ignite same because of the peculiar formation of the arch which drives the heat down upon the fuel. As soon as the arch becomes heated it immediately kindles the green coal passing in onto the grate bars.

It is evident that various changes might be made in the forms, arrangements and construction of parts described without departing from the spirit and scope of my invention. Hence, I do not wish to limit myself to the exact construction herein set forth, but consider myself entitled to all such changes as fall within the spirit and scope of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a furnace the herein described rotary drum-shaped grate having the end heads and the periphery formed of grate bars, said end heads having gearing and the drive shaft parallel with the grate and having the gear wheels engaging said gearing of the heads, and means to rotate said shaft, substantially as described.

2. In the furnace, a support or casing, and the herein described drum-shaped grate having a central horizontal shaft, heads thereon, and parallel grate bars forming the periphery of the drum and at their ends removably secured in the rim of said head so that any grate bar can be independently removed, substantially as described.

3. In a furnace, the casing, a horizontal shaft supported therein, and a drum-shaped rotary grate on said shaft and composed of heads free to rotate on the shaft and grate bars connecting the heads, substantially as described.

4. In a furnace, the combination with a rotary drum-shaped grate of the combustion chamber formed above the upper portion of said drum, having the contracted front and discharge ends, substantially as set forth.

5. In a furnace, the combination with the rotary grate, of the combustion chamber above the same, having the curved arch dropped at the receiving and discharging ends, substantially as set forth, so as to contract the combustion chamber at its front and rear ends for the purpose mentioned.

6. In a furnace, the combination of a rotary grate, the combustion chamber above the same having the curved arch, the feed hopper at the front end of said chamber, and the rear discharge end of the chamber in a lower plane than the front receiving end, substantially as set forth.

7. A furnace having the rotary grate and the curved arch of refractory material located a short distance above the surface of the grate so as to throw back heat from the incandescent fuel upon the green fuel entering the gate, thereby igniting the same from the top, as set forth.

8. A furnace having the rotary grate, the curved arch above the same, the feed hopper at the front end of said arch, and the dump or tail plate at the lower discharge end of the combustion chamber beneath the arch arranged to remove the ashes, &c., from the surface of the grate, substantially as set forth.

9. In a furnace, the rotary drum-shaped grate, the arch above the same, a movable ash pan within the grate arranged to direct air upwardly through the grate surface supplied with fuel, combined substantially as described.

10. A furnace having the rotary grate and the movable ash pan located within the grate beneath the upper surface thereof, and controlling the distribution of air through said upper surface.

11. In a furnace the rotary grate provided with means within the same controlling the distribution of air up through the surface of the grate supporting the fuel and fire.

12. In a furnace, the rotary drum-shaped grate having the ash pan within the same formed by a bottom and sides so that the air passes into said pan and is distributed up through the surface of the grate beneath which the pan is located.

13. In a furnace, the rotary grate in combination with the tilting ash pan, said ash pan having the curved bottom, the sides extending up within the heads of the grate and an outlet opening at one end, and means to tilt said pan, substantially as described.

14. In a furnace, the rotary grate provided with the air distributing means, such as an

ash pan located within the same, said means provided with a shoe engaging the inner surface of the grate, said means being movable so that the shoe can be removed along the inner surface of the grate to vary the area of the grate to which it is applied.

15. In a furnace, the combination of a horizontal shaft, the drum-shaped grate mounted thereon to turn independently thereof, and the ash pan supported on said shaft within the upper portion of the grate and arranged to turn with the shaft, substantially as set forth.

16. In a furnace, in combination, the horizontal rotary shaft, the drum-shaped grate free to turn thereon independently thereof, the ash pan carried by and rigid with the shaft and located within the grate beneath the upper surface thereof, for the purpose set forth and means substantially as described, to rock said shaft to move the ash pan independently and within the grate.

17. In a furnace in combination, the casing having the arch, the horizontal rotary shaft mounted in the casing, the drum-shaped grate mounted on said shaft to turn independently thereof, a shaft and gearing to rotate said grate, the ash pan carried by arms rigid with said shaft and located within the grate and beneath the upper surface thereof to control the distribution of air thereto, a toothed segment rigid with said shaft, the shaft having a worm gear engaging with said segment so that said box can be rocked within the grate independently thereof.

18. A furnace having the rotary grate and the ash pan located within the grate and inclosing the surface of the grate having the fire and fuel thereof, said ash pan having an air inlet opening and being movable and provided with controlling means so that the ash pan can be rocked to control the distribution of air up through the grate to the fuel.

19. The furnace having the rotary grate in combination with the ash pan having a shoe at its front end and conforming to the curvature of the inner surface of the grate, said ash pan being movable and provided with controlling means so that the pan can be rocked to move the shoe up or down within the inner surface of the grate and thereby vary the grate area to which air is supplied, substantially as set forth.

20. In a furnace, the combination of the grate, the rocking ash pan located within the same and controlling the supply of air to the upper surface of the grate the air inlet opening into said pan provided with a damper and means for controlling the same.

21. In a furnace the drum-shaped grate in combination with the ash pan located in the upper portion thereof and inclosing the inner surface thereof, said ash pan having an air inlet opening and gradually decreasing area rearwardly from said air inlet opening, as set forth.

22. In a furnace, the rotary drum-shaped grate provided with the ash pan box inclosing the under surface of the upper portion thereof, the open end of the ash box having a damper and gearing and mechanism extending to the interior of the furnace whereby said damper can be raised or lowered, substantially as described.

23. In a furnace the combination of the hollow shaft, the rotary grate rotatable on said shaft independently thereof, the ash pan rigid with the shaft and having the air inlet opening, the damper controlling the opening into said ash pan and having the arms extending into the hollow shaft and having teeth within the hollow shaft, the shaft within the hollow shaft having gear wheels engaging said arms to move the same, and thereby control the damper and having means extending to the exterior of the furnace whereby said inner shaft can be rotated, as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

THOMAS R. BUTMAN.

Witnesses:
M. L. ALLEN,
J. E. ENGLAND.