(No Model.) 2 Sheets—Sheet 1.

F. H. RICHARDS.

TRAVELING GRATE FURNACE.

No. 527,451. Patented Oct. 16, 1894.

Fig. 1.

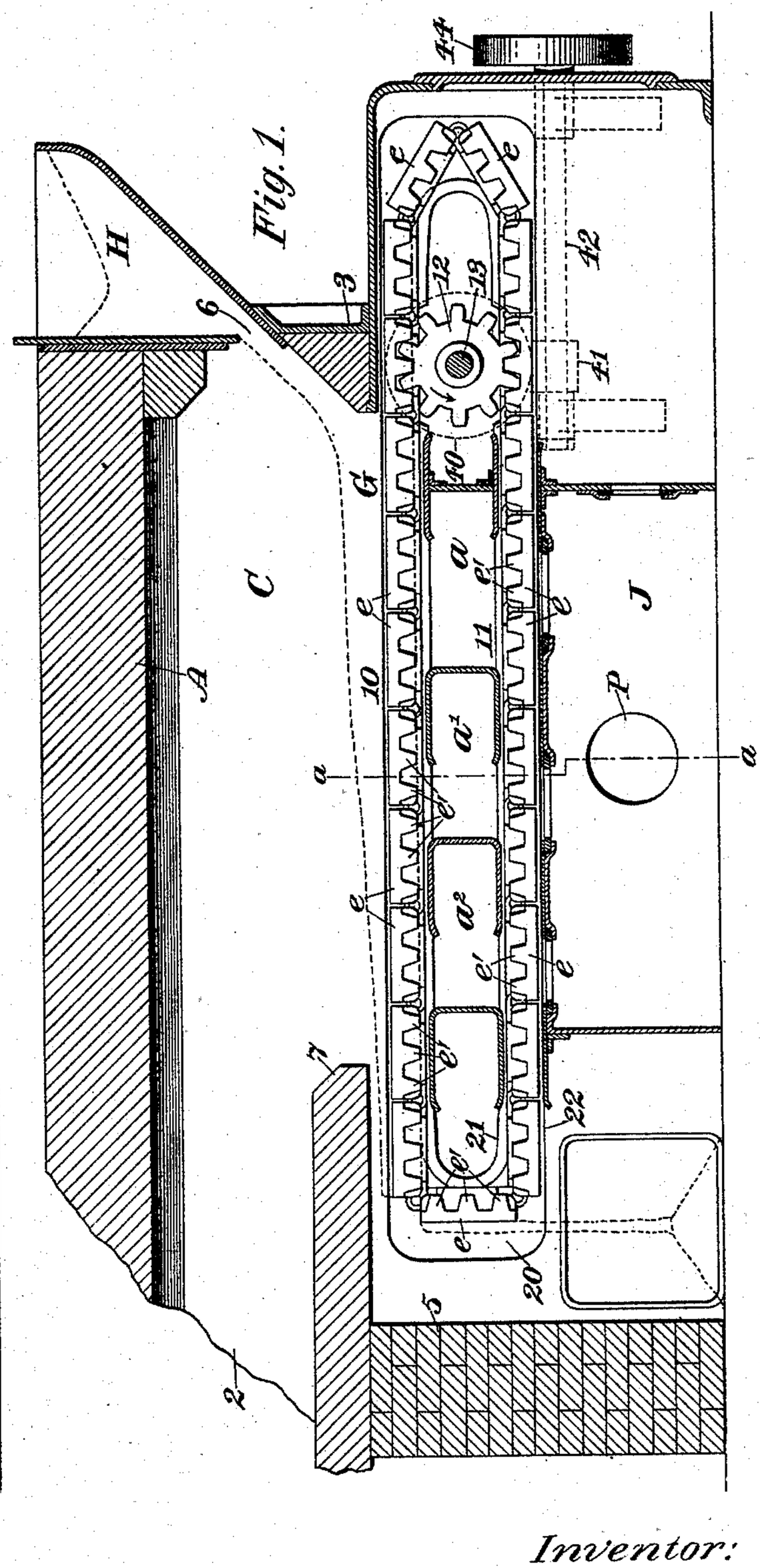
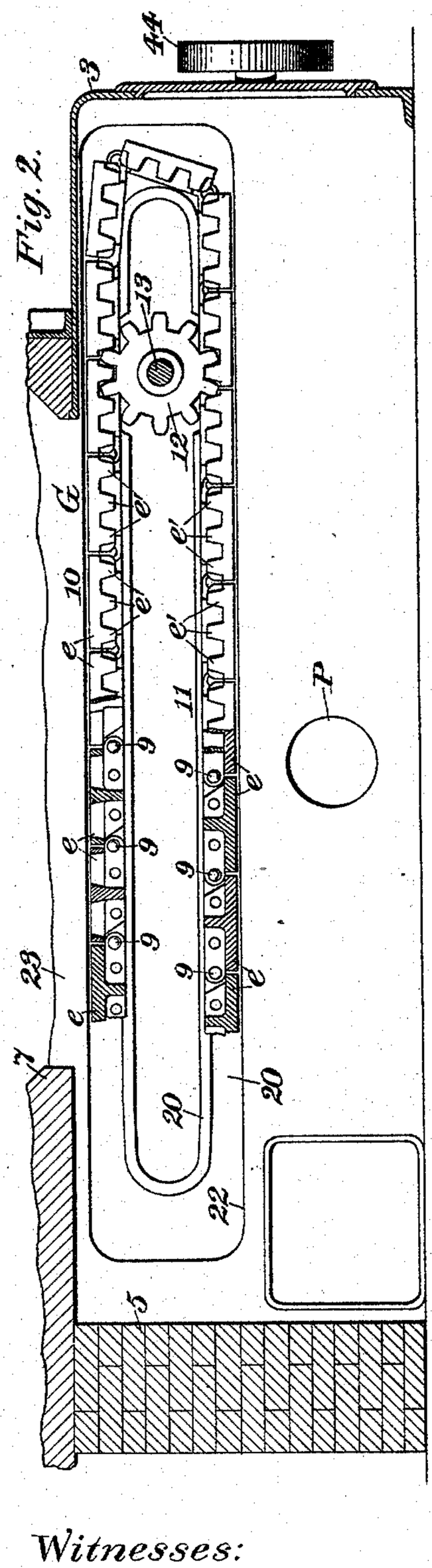


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

F. H. RICHARDS.

TRAVELING GRATE FURNACE.

No. 527,451. Patented Oct. 16, 1894.

Fig. 3.

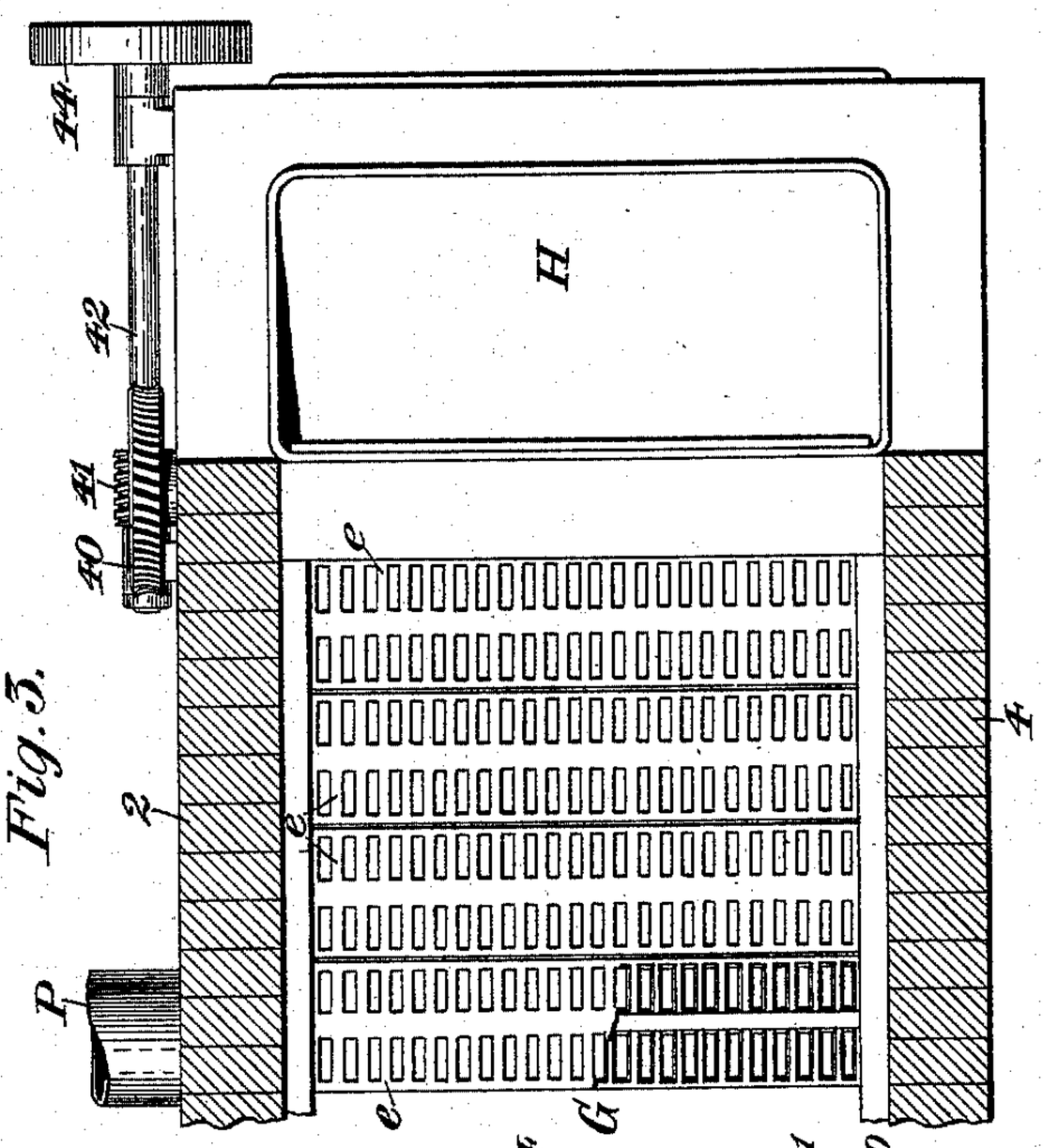
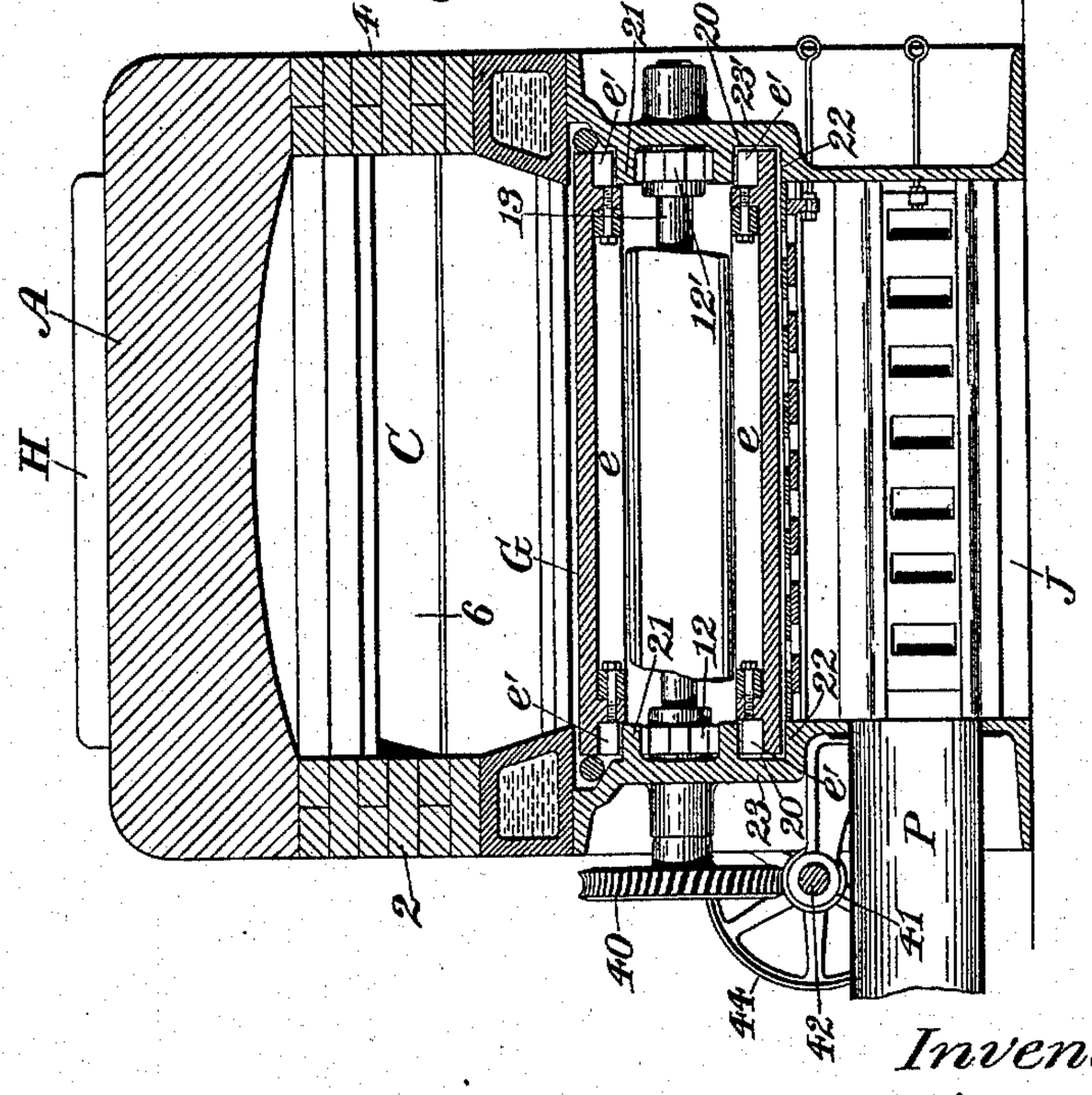


Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

TRAVELING-GRATE FURNACE.

SPECIFICATION forming part of Letters Patent No. 527,451, dated October 16, 1894.

Application filed July 12, 1894. Serial No. 517,300. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Traveling-Grate Furnaces, of which the following is a specification.

This invention relates to traveling-grate furnaces; the object of my present invention being to provide, in connection with a furnace of this class, traveling-grate-mechanism in which the traveling grate will be supported upon suitable ways and will be operated without the use of driving-shafts and chain-wheels at opposite ends of its fuel-supporting run; also to provide improved and effective mechanism for simultaneously imparting a sliding movement to the upper and lower runs of the grate in opposite directions, respectively, and to so construct and organize said mechanism as to permit these runs to be placed relatively near together so as to reduce the vertical space required for the grate-mechanism and thereby render the grate applicable to furnaces wherein only a small vertical space is available therefor.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional side elevation of a portion of a furnace embodying my present improvement, said figure showing the endless traveling grate in one of the positions it assumes during the traveling movement thereof, and also showing means for supplying air to the fuel carried upon the upper fuel-carrying run of the grate. Fig. 2 is a similar sectional side elevation of a portion of the furnace, the air-supply apparatus being removed, a portion of the traveling grate being broken away and another portion of the grate being shown in section, said figure showing another position assumed by the grate during its traveling movement. Fig. 3 is a sectional plan view of the forward end of the furnace, a portion of the upper run of the traveling grate being broken away. Fig. 4 is a transverse vertical section of the furnace, taken in line *a*—*a*, Fig. 1, and looking toward the right hand in said figure, a portion of the air-pressure chambers between the upper and lower runs of the grate being broken away to more clearly show the grate-actuating mechanism.

Similar characters designate like parts in all the figures.

In the preferred embodiment thereof herein shown and described, my improved furnace has an endless internally-toothed fuel-carrying grate comprising an upper and lower run supported for simultaneously sliding movements longitudinally of the furnace-chamber in opposite directions, respectively, and made up of a series of transversely-disposed grate-sections pivotally connected together; fixed slide-ways or guides for supporting and directing the movements of the upper and lower runs of the grate, a revoluble driver in engagement with the upper and lower runs at a point remote from the ends thereof and adapted for imparting a sliding movement to the upper and lower runs of the grate simultaneously in opposite directions, respectively, and means for rotating said driver, all of which will be hereinafter more fully described.

For illustrating the application and mode of operation of my present improvements, I have shown the same applied to a furnace similar to that shown and described in Letters Patent of the United States No. 499,716, granted to Eckley B. Coxe June 20, 1893, to which reference may be had. In the present instance, however, the furnace-chamber C is shown covered for a considerable portion of its length by a reverberatory roof, A.

The furnace-chamber is inclosed at the sides and ends thereof by the usual side-walls, 2 and 4, and the front and rear end-walls, 3 and 5. At the rearward end of the furnace-chamber is the usual bridge-wall, 7, and at the forward end of said chamber is the usual fuel-hopper, H, from which fuel is supplied to the grate supported in the furnace-chamber through the usual chute or opening, 6, in a well-known manner.

The furnace-floor proper consists of the upper run 10 of a traveling grate, which grate, as a whole, is designated in a general way by G, and is inclosed, together with the appliances for supporting and actuating the same, by the side and end walls of the furnace-chamber C.

In this instance of my invention the upper and lower runs 10 and 11, respectively, of the grate G are made up of a series of transversely-disposed grate-sections, *e*, pivotally-connected together, as shown at 9, and supported for sliding movement longitudinally of the furnace-chamber preferably in channels or guide-ways, 20, at opposite ends thereof, which channels are located between inner and outer tracks, 21 and 22, respectively. These tracks, in practice, will usually be continuous, as most clearly shown in Figs. 1 and 2, the upper portion of the inner tracks 21 constituting a guiding support for the fuel-carrying run of the grate, and the lower portion of the outer tracks 22 constituting a guiding support for the lower run of the grate, said tracks being usually in the nature of laterally projecting flanges formed upon the side-plates, 23 and 23′, of the furnace-chamber, as will be readily understood by reference to Fig. 4 of the drawings. The grate-supporting portions of the tracks 21 and 22, will, in practice, be located in relatively close proximity, sufficient space only being left between said portions to receive and permit the actuation of the grate-actuating mechanism.

The grate-sections *e* are shown provided at their under side, at opposite ends, with teeth, *e′*, adapted to be engaged for imparting a sliding movement to the upper and lower runs of the grate in opposite directions, by drivers, as will be hereinafter described.

In the form thereof herein shown, the grate-actuating mechanism consists of a pair of revoluble drivers, 12 and 12′, carried by a transverse shaft, 13, journaled in bearings in the framework, said drivers being in the nature of pinions, the teeth of which engage the teeth of the upper and lower runs of the grate at opposite ends thereof, as most clearly shown in Figs. 1 and 4, and being located intermediate to, and remote from, the ends of the grate-supporting portions of the tracks 21 and 22. As a means for driving the shaft 13, said shaft will usually be provided at one end thereof with a worm-wheel, 40, driven by a worm, 41, carried upon a driving shaft, 42, journaled in bearings upon the framework, which shaft will be provided with a driving-wheel, 44, which may be driven by a belt (not shown) from any suitable source of power.

In practice, the upper and lower portions of the inner track 21 of each set of tracks will be a distance apart substantially equal to the width of one of the grate-sections which will permit the traveling grate to make a circuit in a relatively narrow space, the sections making short angular turns at opposite ends of the furnace-chamber.

In operation the upper fuel-carrying run of the grate is pushed toward the rear end of the furnace-chamber by means of the revoluble drivers 12 and 12′, and the lower run of the grate is simultaneously pushed toward the forward end of the furnace-chamber by said drivers, the movement of the upper run tending to assist the lower run, and the movement of the lower run tending to assist the movement of the upper run, the grate-sections in traveling from the lower run position to their upper run position assuming the angular positions illustrated in Figs. 1 and 2 during certain portions of the traveling movement and at other times intermediate to the positions shown in Figs. 1 and 2, the channels at the forward and rearward ends of the inner and outer tracks being of sufficient width to permit the unobstructed movement of the grate-sections. It will be noticed by reference to Figs. 1 and 2 that the end-portions of the inner tracks 21 act as fulcrums upon which the grate-sections oscillate in their traveling movement from their lower run positions to their upper run positions, various portions of one or more grate-sections being in contact with the ends of said tracks at various times while other portions thereof are out of contact therewith at the same time.

By this construction and arrangement of grate-mechanism said mechanism is rendered applicable to furnaces in which relatively small space is available, and another advantageous feature of this construction is that at the end of the combustion period the resultant cinder will be carried over the delivering end of the grate by the section upon which it is supported and will be delivered directly therefrom into the ash-pit without dropping from one grate-section to another as the sections are passing from their upper to their lower run position at the delivering end of the grate as is customary in furnaces of this class employing traveling grates, thus, in a great measure, preventing ash deposits between the upper and lower runs of the grate and maintaining a cleanliness very desirable.

As a means for supplying air to the fuel upon the upper run of the traveling grate, I have provided an air-supply apparatus, which in the form thereof herein shown consists of a series of air-pressure chambers, *a*, *a′* and a^2, located between the upper and lower portions of the inner track 21 and having inlet and outlet openings contiguous to the lower and upper runs of the grate, respectively, and an air-supply chamber, J, located below the lower run of the grate and having an outlet opening in communication with each air-chamber *a*, *a′* and a^2, respectively, said outlet openings being provided with perforated slide-valves adapted for regulating the effective areas of the outlet openings and the consequent air-pressure in the several chambers *a*, *a′* and a^2. By this means air is supplied to the air-pressure chambers through the lower run of the grate and from thence to the fuel through the upper run of the grate, the pressure in the air-chambers being so regulated relatively to each other as to supply air to the fuel at varying pressures at suc-

cessive points in the length of the furnace-chamber. The air-supply chamber J will be supplied with air from a pipe, P, which receives its supply from an air-pump or blower (not shown) in a well known manner.

Having thus described my invention, I claim—

1. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless internally-toothed fuel-carrying grate comprising an upper and lower run supported for simultaneous movement longitudinally of the furnace in opposite directions, respectively, and consisting of a series of grate-sections pivotally-connected together and having air-supply openings therethrough, fixed guide-ways for supporting and directing the movement of the upper and lower runs of the grate, revoluble drivers supported intermediate to and remote from the ends of the guide-ways and engaging the upper and lower runs of the grate, means for rotating said drivers to simultaneously impart a traveling movement to the upper and lower runs of the grate in opposite directions, respectively, and means for supplying air through both runs of said grate to the fuel carried upon the upper run thereof substantially as described.

2. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless traveling grate comprising a series of transversely-disposed perforated grate-sections pivotally connected together and having integral internal teeth at opposite ends thereof, longitudinally parallel tracks supporting the upper and lower runs of said grate and located at a distance from one another substantially equal to the width of one of the grate-sections, revoluble toothed drivers in engagement with the teeth of the opposite grate-sections and carried by a shaft remote from the grate-sections at the extreme end of said tracks, means for rotating said drivers to impart a traveling movement to the upper and lower runs of the grate in opposite directions, respectively, and means for supplying air through both runs of said grate to the fuel supported upon the upper run thereof substantially as described.

3. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an inner and outer continuous track located at each side of the furnace-chamber and adapted for supporting the upper and lower runs, respectively, of a traveling grate, an endless internally-toothed traveling grate comprising an upper and lower run consisting of a series of perforated grate-sections pivotally-connected together and supported for traveling movement at opposite ends between the inner and outer tracks at each side of the furnace-chamber, revoluble drivers each of which is in engagement with the teeth of both the upper and lower runs of the traveling grate at points remote from the forward ends of the tracks, means for rotating said drivers to impart a traveling movement in opposite directions to the upper and lower runs, respectively, of the traveling grate, and for imparting an oscillating or rocking movement to the successive grate-sections as they pass from their lower run to their upper run position, and means for supplying air through the perforations of both the upper and lower runs of the grate to the fuel supported upon the upper run thereof, substantially as described.

4. In a furnace of the class specified, in combination, an endless traveling grate comprising an upper and lower run consisting of a series of pivotally-connected grate-sections having air-supply openings therethrough, means substantially as described for supporting the upper and lower runs of the grate in relatively close proximity and for effecting a rocking movement to the grate-sections as they pass from their lower run positions to their upper run positions during the traveling movement thereof, means substantially as described for imparting a traveling movement to the upper and lower runs of the grate simultaneously in opposite directions, respectively, and means for supplying air through the air-supply openings in both the upper and lower runs of the traveling grate, to the fuel supported upon the upper run thereof substantially as described.

5. In a furnace of the class specified, in combination, an endless traveling grate comprising an upper and lower run, each consisting of a series of pivotally-connected-grate sections, means substantially as described for supporting the upper and lower runs of the grate in relatively close proximity and for effecting a rocking movement to the grate-sections as they pass from their lower run positions to their upper run positions during the traveling movement thereof, means substantially as described for imparting a traveling movement to the upper and lower runs of the grate simultaneously and in opposite directions, respectively, and means for supplying air to the fuel carried by the grate at varying pressures at successive points in the traveling movement thereof, which consists in a series of air-pressure chambers located between the lower and upper runs of the grate and having inlet and outlet openings contiguous to said lower and upper runs, respectively, an air-supply chamber located below the lower run of said grate and having valve regulated outlet openings in communication with the air-pressure chambers located between the two runs of said grate, and means for supplying air to said air-supply chamber, substantially as described and for the purpose set forth.

6. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of two endless tracks or guide-ways secured one to each side wall of the furnace-chamber, an internally-toothed end-

less fuel-carrying grate comprising an upper and a lower run consisting of a series of pivotally-connected transversely-disposed perforated grate-sections supported at their opposite ends by the tracks or guide-ways, a revoluble driver supported intermediate to and engaging the teeth of both the upper and lower runs of the traveling grate, means for rotating said driver, a series of air-supply chambers having inlet and outlet openings and located between the upper and lower runs of the endless grate, and an air-supply chamber located below the lower run of said grate and adapted for supplying air through the lower run of the grate to the series of air-supply chambers located between the upper and lower runs of the grate and through the upper run to the fuel supported upon said grate, substantially as described and for the purpose set forth.

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