(No Model.) 4 Sheets—Sheet 1.

E. B. COXE.

LOCOMOTIVE ENGINE.

No. 536,373. Patented Mar. 26, 1895.

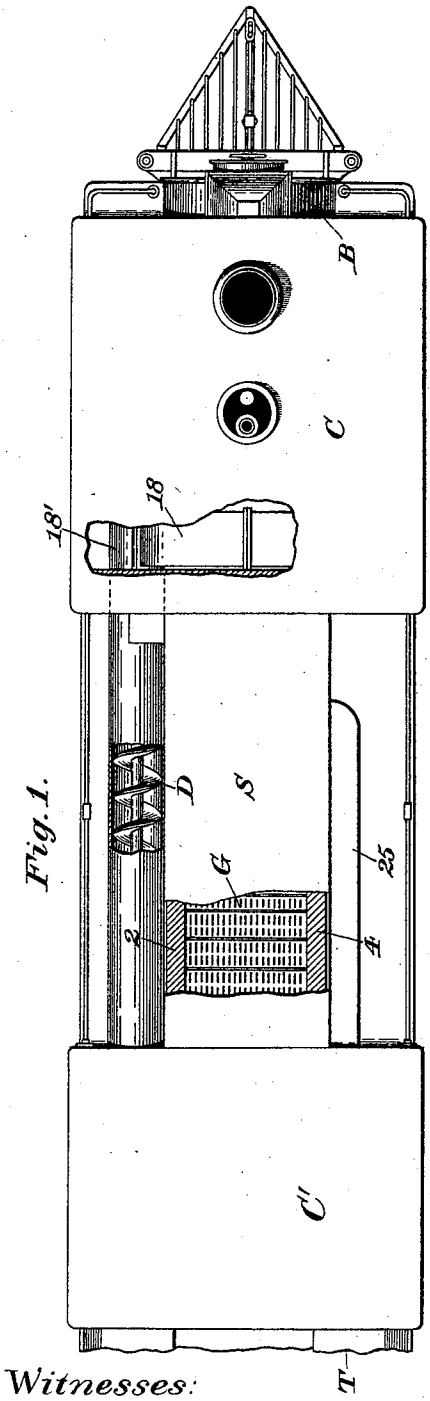

Fig. 1.

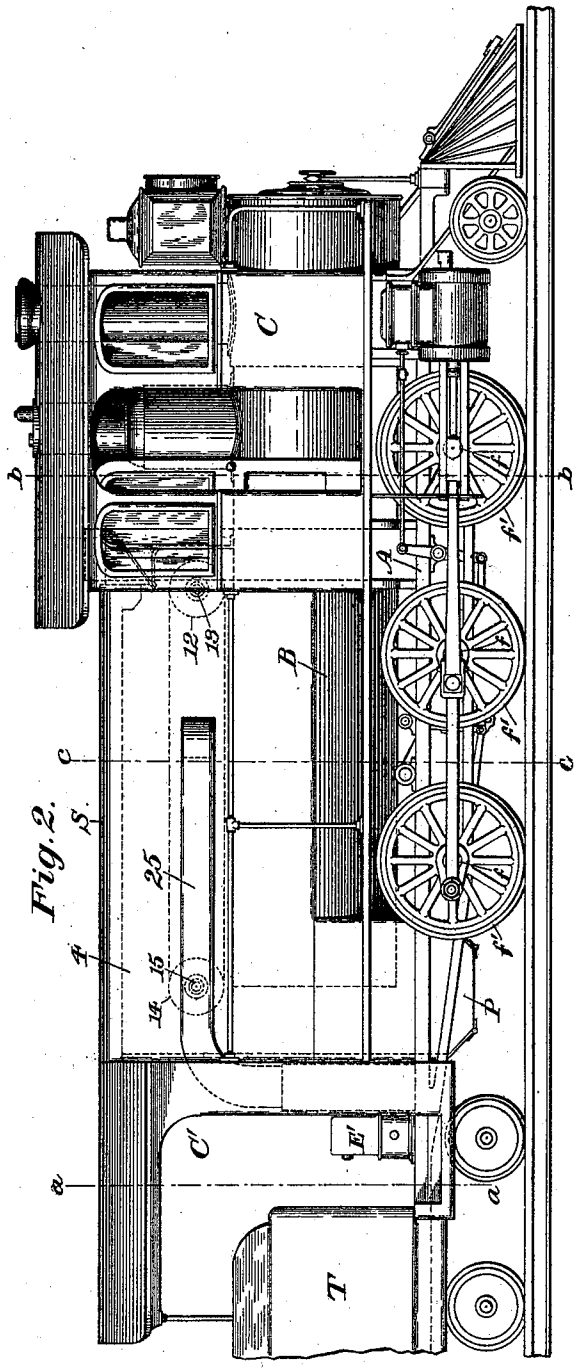

Fig. 2.

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(No Model.) 4 Sheets—Sheet 2.

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LOCOMOTIVE ENGINE.

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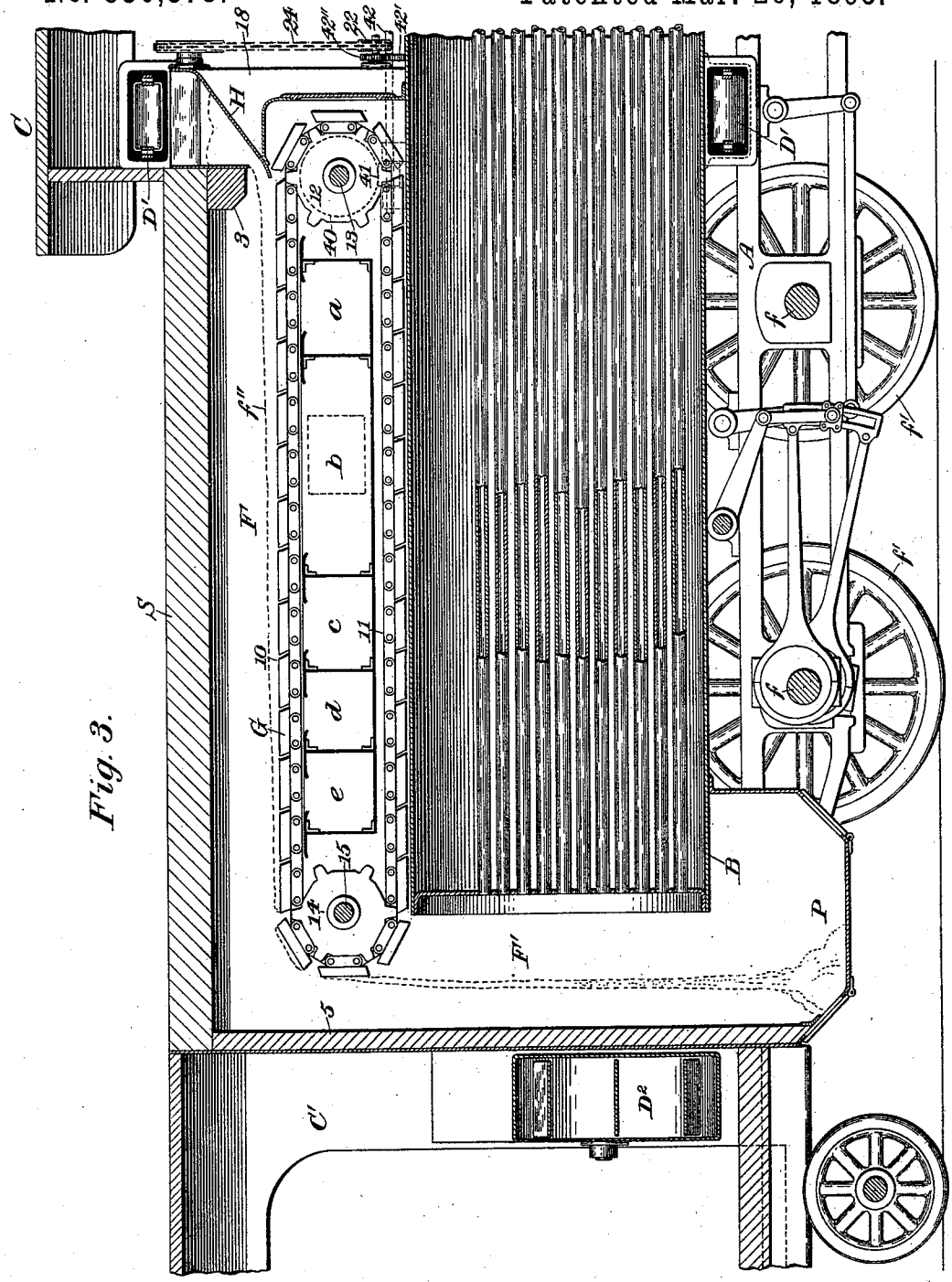

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

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LOCOMOTIVE ENGINE.

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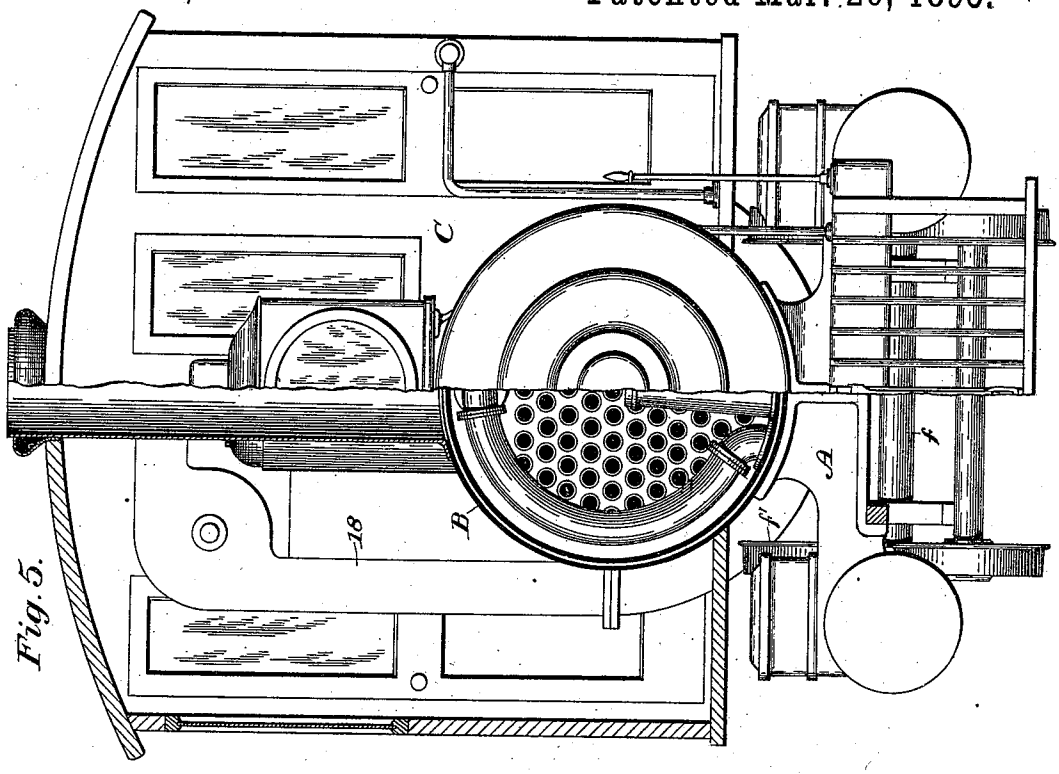

Fig. 5.

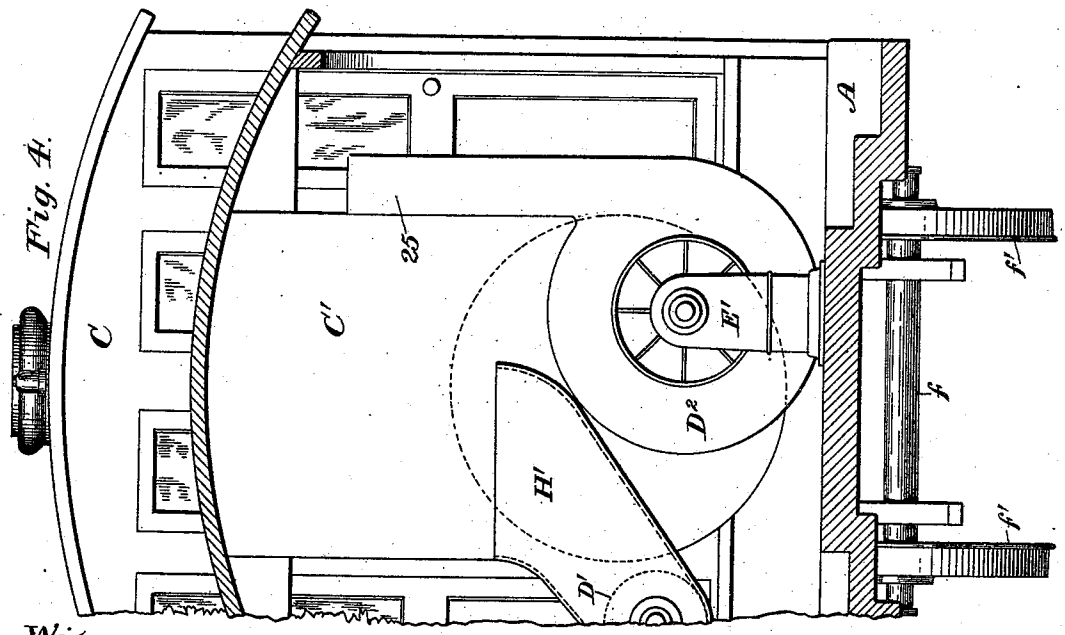

Fig. 4.

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LOCOMOTIVE ENGINE.

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Fig. 7.

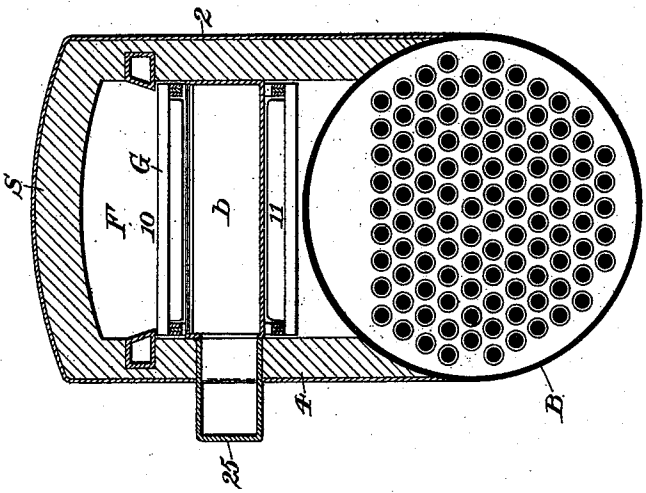


Fig. 8.

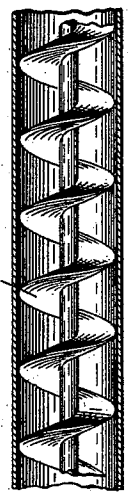
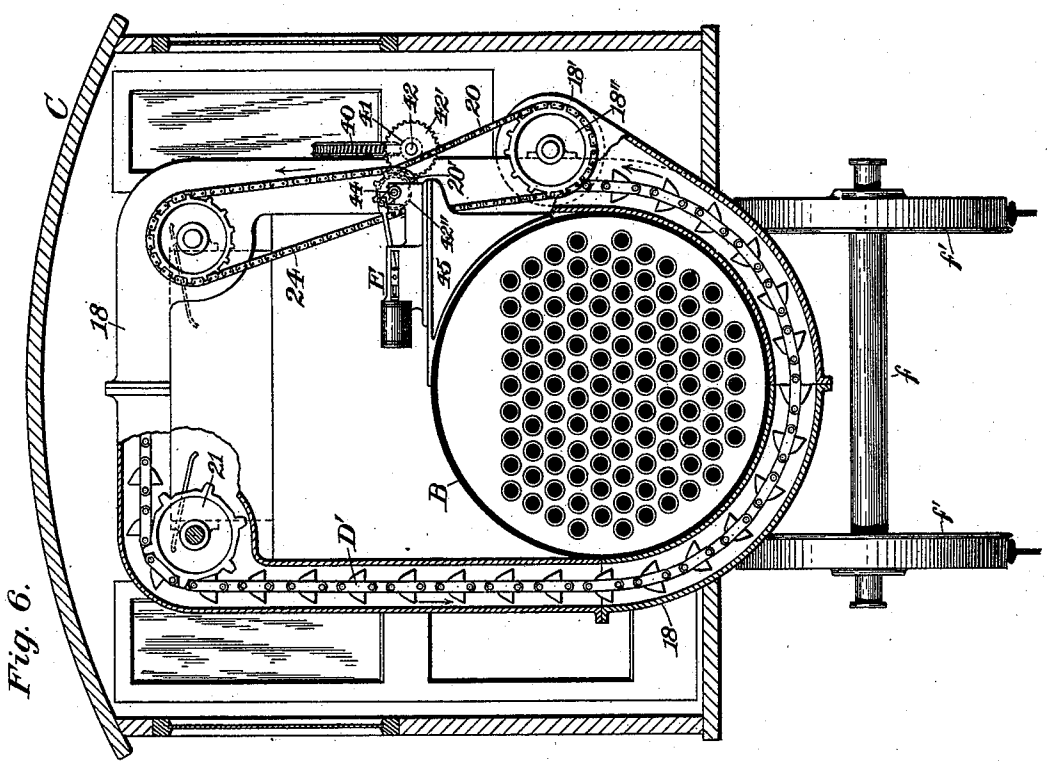


Fig. 6.



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UNITED STATES PATENT OFFICE.

ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

LOCOMOTIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 536,373, dated March 26, 1895.

Application filed December 13, 1894. Serial No. 531,658. (No model.)

To all whom it may concern:

Be it known that I, ECKLEY B. COXE, a citizen of the United States, residing at Drifton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Locomotive-Engines, of which the following is a specification.

This invention, which appertains to locomotive-engines, relates more particularly to those features of the engine which directly effect the combustion of the fuel and upon which depends the effective generation of steam.

The object of my present invention is to furnish a locomotive-engine of improved construction and organization having a combustion-chamber in the rear of the boiler and having the fire-box, proper, and its grate-mechanism located above and extending longitudinally over the major portion of the length of said boiler; also to provide means for deflecting the products of combustion, and cause them to descend around the rearward end of the boiler and pass through the flues thereof at points below the grate-mechanism; also to provide in connection with the grate, which constitutes a part of the grate-mechanism, means for supplying air to successive fuel-supporting areas thereof at successively varying pressures, respectively, and also to provide improved means for automatically feeding the fuel to the forward end of the grate from a point in the rear of the boiler.

In the drawings accompanying and forming part of this specification, Figure 1 is a plan view, partially in section, of a locomotive-engine and tender, constructed in accordance with, and embodying my present invention, said figure being drawn on a relatively small scale. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical longitudinal section, on a relatively large scale, of a locomotive-engine taken in line *a*—*a*, Fig. 2, looking toward the right hand in said figure. Fig. 4 is a sectional, rear elevation, on a relatively large scale, of a portion of a locomotive engine as seen from the left-hand in Fig. 2, the section being taken in line *a*—*a*, of said figure. Fig. 5 is a front-elevation, on a relatively large scale, of a locomotive-engine as seen from the right hand in Fig. 1, parts thereof being shown in cross-section. Fig. 6 is a vertical cross-section of a portion of a locomotive-engine, on a relatively large scale, taken in line *b*—*b*, Fig. 2, looking toward the left hand in said figure. Fig. 7 is a cross-section view of a boiler fire-box or furnace-chamber, and grate-mechanism, on a relatively large scale, taken in line *c*—*c*, Fig. 2, as seen from the right hand in said figure, and Fig. 8 is a sectional side-elevation of a portion of one of the feed-conveyers of the fuel.

Similar characters designate like parts in all of the figures.

In the drawings, only so much of a locomotive-engine and its tender is shown as is deemed necessary for clearly illustrating the application and mode of operation of my improvements.

In the form thereof herein shown, the boiler B, which may be of the usual multi-flue variety, is supported in the usual manner by the frame-work, designated in a general way by A, which, in turn, is supported by the axles *f* which carry the locomotive-wheels, *f'*.

The driving-mechanism of the locomotive, which includes the locomotive-wheels and their axles, and actuating machinery, may be of any usual construction and organization.

In the drawings I have shown the locomotive-engine provided with two cabs, C and C'; respectively, the one C of which, (which is the engineer's cab) is shown located near the extreme forward end of the boiler, and the one C' of which (which is the stoker's cab) is located in the rear of said boiler, adjacent to the tender T.

For convenience, the inclosed areas above and at the rear end of the boiler, which areas constitute the fire-box F and combustion-chamber F', respectively, will, as a whole, be hereinafter referred to as the furnace-chamber. This furnace-chamber, which is of inverted L-shape, is inclosed at its sides and ends by the side-walls 2 and 4, and end-walls 3 and 5, and is provided at its upper side with a heat-deflecting roof, S. At the lower rearward end of the furnace-chamber, this is shown provided with an ash-pan, P, and at the upper forward end of said furnace-chamber, this is shown provided with a fuel-supply hopper, H, the delivering end of which hopper extends into said furnace-chamber. The walls of the furnace-chamber, including, of

course, the roof, will, in practice, be preferably constructed of heat-resistant material, such as fire-brick, so that the same may be heated to a high state of incandescence for the purpose of facilitating combustion, in a manner well known in the art to which this invention appertains.

In the preferred organization thereof herein shown and described, the grate is located above, and in parallelism with, the flues of the boiler. This grate, which is designated in a general way by G, and which may be of any suitable construction and organization for imparting a traveling movement to the fuel, is herein shown of the endless chain grate variety, it comprising the upper and lower runs 10 and 11, and being carried, at the opposite ends of its circuit, upon chain-wheels 12 and 14, which are carried upon shafts 13 and 15, respectively, journaled in suitable bearings (not shown) at their ends. The upper run 10 of the traveling-grate, which upper run constitutes the furnace-floor proper, is supported for traveling movement approximately midway of the fire-box, F, the forward end thereof being adjacent to and extending under the discharge end of the supply hopper. This upper or fuel-carrying run of the grate travels in the direction of the length of the boiler and toward the rearward end of the fire-box or upper portion of the furnace-chamber, it receiving fuel at the forward end of said fire-box, and discharging the residue or unconsumed portions of the material, such as the ash and cinder, over the rearward end of the circuit of the grate into the combustion-chamber where it falls into the ash-pan, P, located at the bottom of said combustion-chamber.

As a convenient means for imparting a traveling movement to the grate G, I have shown the shaft 13 provided, at one end thereof, with a worm-wheel, 40, which meshes with a worm, 41, upon a driving-shaft, 42, which is journaled in suitable bearings (not shown) on the frame-work of the cab, C, which driving-shaft 42 is shown provided at one end with a gear-wheel, 42′, which meshes with and is driven by a relatively small gear-wheel, 42″, upon the power-shaft 44 of a reciprocating engine, designated in a general way by E, which is shown supported upon a bracket, 45, which in turn is or may be supported in any ordinary manner, preferably, within the cab and above the boiler. It will be understood that other grate-actuating means than that herein shown and described may be employed without departure from my invention.

In the present construction and organization of mechanism herein shown and described, it will be seen that the fuel is fed to the grate near the forward end of the boiler, and at a point above said boiler, whereas, in locomotive-engines of ordinary construction it is customary to feed the fuel to the grate at a point in the rear of and below the upper edge of said boiler, and, in consequence of this construction and organization, special apparatus is required to facilitate the supply of fuel to the grate. As a convenient means for automatically feeding the fuel from a point in the rear of the boiler to the ignition area of the grate at the forward end of the furnace-chamber, I have provided two fuel-conveyers, designated in a general way by D and D′, respectively, the one D of which will be herein referred to as the horizontal conveyer-screw and the other one of which will be herein referred to as the elevator or endless-conveyer. These two conveyers are transversely disposed relatively to each other, as will be understood by reference to Figs. 1, 2, 3, 4 and 6, of the drawings.

In the organization thereof herein shown and described, the conveyer-screw, D, which is journaled in suitable bearings (not shown) at its ends, is located at one side of the boiler B, preferably the left hand side in looking toward the forward end of said boiler, as shown in Figs. 1 and 4, and extends in parallelism with said boiler terminating at its forward or discharging end contiguous to the trough, 18, of the endless elevator D′, and being adapted for carrying fuel from a point in the rear of the furnace-chamber to, and discharging the same into, the elevator trough 18 as will be readily apparent by reference to Fig. 6 of the drawings. If desired, however, the conveyer-screw might intersect the plane of travel of the endless elevator, but be located one side of the path of movement thereof. In the present instance it is preferable to terminate the conveyer-screw slightly in the rear of the trough 18, and connect the casing or tube of said conveyer-screw by a chute, 18′. (See Figs. 1 and 6.) At the rearward end of the conveyer-screw D is shown a hopper H′, which is located in the rear wall of the furnace-chamber, the discharge end of said hopper communicating with the interior of a casing or tube of the conveyer-screw. As a convenient means for revolving the conveyer-screw the shaft thereof which extends forward of the screw-blades and terminates in the interior of the cab C is provided with a sprocket-wheel 18″, which is operatively connected with the power-shaft of the engine E by a sprocket-chain 20 extending over a sprocket wheel 20′ carried upon said shaft, said screw being operated by said engine.

In the preferred form thereof herein shown and described, the endless conveyer, D′, which may be of any usual bucket variety, is carried at the upper end of its circuit upon chain-wheels, 21 and 21′, journaled in suitable bearings within the trough or casing thereof, and extends, at the lower end of the circuit around the under side of the boiler B in the path of the discharge of the conveyer-screw D; said elevator being adapted for carrying the fuel discharged from the conveyer-screw D upward in the direction of the arrow shown in Fig. 6, to a point above and in alignment with the receiving end of the hopper, H, and

discharging said fuel into said hopper whence it is delivered to the ignition end of the upper run of the grate G, the lower side of the upper portion of the elevator case or trough adjacent to the hopper H being cut away to form the discharge opening for the elevator D'. By this construction and arrangement of the fuel feeding apparatus it will be seen that the fuel deposited in the hopper H' at the rearward end of the furnace-chamber, is carried along continuously and discharged into the lower portion of the elevator casing 18, whence it is carried upward by the elevator D', to a point above and discharged into the grate-supply hopper at the forward end of the furnace-chamber.

As a convenient means for imparting a traveling movement to the endless conveyer or elevator D', one of the shafts of the chain-wheels thereof, herein shown as the one 21', is provided at one end with a sprocket-wheel and is connected to a sprocket-wheel 22 upon the shaft of the engine E by a sprocket-chain 24. It will be understood that the particular means herein shown and described, for actuating the elevator may be modified without departure from my invention.

As a means for supplying air to the fuel upon the upper run of the traveling-grate at varying pressures at successive points in the length thereof, which fuel is represented by dotted line, f'', in Fig. 3, I have provided an air-blast apparatus which is located, in part, underneath the fuel-carrying run of said grate and above the boiler B. This air-blast apparatus, in the form thereof herein shown, and described, comprises a series of air-supply chambers, *a*, *b*, *c*, *d* and *e*, having outlet openings contiguous to the upper run of the traveling-grate, a blower, D^2, having an air-conduit 25, communicating with one of said chambers, and means (herein shown as an independent engine E') in connection with and adapted for actuating said blower. This blower D^2, and its actuating engine are herein shown as supported upon the platform of the cab, C', in the rear of the rear wall of the furnace-chamber, and the blower has its conduit, 25, extending along outside the side-wall of said furnace-chamber with its discharge end projected through said side-wall, as seen in Figs. 2 and 7 and communicating with one of the air-blast chambers, preferably the one *b*. This engine for actuating the blower may be of the ordinary Westinghouse high-speed engine, and will, in practice, be supplied with steam direct from the boiler B by means of an induction-pipe (not shown) and the engine E, which actuates the fuel-conveyers and traveling-grate may be of any desired variety and will, in practice, be supplied with steam in the same manner as the engine E' hereinbefore mentioned.

As a means for regulating the supply of air to secure varying pressures at successive fuel-supporting areas of the grate, the communicating openings between the successive chambers *a*, *b*, *c*, *d* and *e* may be of different areas, or said openings may be provided with regulating valves (not shown) to control the admission of air to the successive chambers.

Having thus described my invention, I claim—

1. A locomotive engine, having a flue-boiler; a furnace, carried on the upper side of said boiler, and having a roof, separate from, and independent of, said boiler; and a fuel-traveling grate supported between said incandescent roof and the upper side of said boiler, substantially as described, and for the purpose set forth.

2. In a locomotive engine, the combination with the boiler thereof; of a furnace carried on the upper side of the boiler, and having a roof remote from, and independent of, said boiler, and adapted to be heated to a high state of incandescence; a fuel-traveling grate, supported for movement, longitudinally of the boiler and directly over said boiler, and between said boiler and the roof of the furnace; and means in connection with, and adapted for, imparting a traveling movement to said fuel-traveling grate, substantially as described, and for the purpose set forth.

3. In a locomotive engine, the combination with the boiler thereof; of an independent furnace, carried on the upper side of said boiler, and having a roof separate from the boiler and independent thereof, and adapted to be heated to a high state of incandescence; an endless grate, supported for traveling movement, longitudinally of said boiler, between the incandescent roof of the furnace and the upper wall of said boiler; means for imparting a traveling movement to said grate, and means for supplying air to the upper run of said grate, substantially as described, and for the purpose set forth.

4. In a locomotive engine, the combination with the flue-boiler thereof; of an independent furnace, having a horizontally-disposed roofed portion, extending over, and carried on, the upper side of said boiler, and a vertically-disposed down-draft portion, in communication with the flues of the boiler and with the horizontally-disposed portion; and a fuel-traveling grate, carried for movement longitudinally of said boiler within the horizontally-disposed portion of the furnace, and between the roof of said furnace and the upper side of said boiler, substantially as described, and for the purpose set forth.

5. In a locomotive engine, the combination with a flue-boiler; of an independent furnace, comprising a horizontally-disposed roofed fire-box portion extending over, and carried on, the upper side of said boiler, and a vertically-disposed down-draft portion carried in the rear of said boiler, and extending from a point above, to a point below, said boiler, and communicating with the flues of said boiler and with the horizontally-disposed fire-box portion of the furnace; an ash-pit located at the lower end of said vertically-disposed down-

draft portion of the furnace; a fuel-traveling grate supported within the horizontally-disposed fire-box portion of the furnace, and between the roof thereof and the upper side of the boiler, and having the discharge end thereof terminated in the vertically-disposed down-draft portion of the furnace; and means in connection with, and adapted for, imparting a traveling movement to said grate, substantially as described, and for the purpose set forth.

6. In a locomotive-engine, the combination with the boiler and with the furnace-chamber, of a fuel-traveling grate supported above and having a traveling movement longitudinally of said boiler, and an air-blast apparatus in connection with and adapted for supplying air to successive fuel supporting portions of said grate at varying pressures, substantially as described and for the purpose set forth.

7. In a locomotive-engine, in combination a flue-boiler, a combustion-chamber located in the rear of said boiler and communicating with the flues thereof, a fire-box communicating with the upper end of said combustion chamber and extending above and longitudinally of the boiler, a fuel-traveling grate supported for traveling movement within the fire-box, means for supplying fuel to said grate, means for actuating said grate to impart a traveling movement to the fuel, and an air-blast apparatus in connection with and adapted for supplying air to the fuel-supporting portion of said grate at varying pressures at successive points in the length thereof, substantially as described and for the purpose set forth.

8. In a locomotive-engine, the combination with the boiler and with a furnace-chamber having a roof separate from the boiler, and independent thereof, and adapted to be heated to a high state of incandescence; of a fuel traveling-grate supported in parallelism with and the boiler, and having its receiving-end near the forward end of said boiler, and having its discharging-end in the rear of said boiler; a fuel-supply hopper having its discharge-end in close proximity to the receiving-end of the grate; means for actuating said grate, to impart a traveling movement to the fuel; and means for supplying air to the fuel-supporting areas of said grate, substantially as described, and for the purpose set forth.

9. In a locomotive-engine, the combination with the boiler and with the furnace-chamber, of a traveling-grate supported above said boiler and adapted for carrying the fuel from the forward end of said boiler toward the rearward end thereof, means for imparting a traveling movement to said grate and means for supplying air at varying pressures at successive points in the length thereof, substantially as described and for the purpose set forth.

10. In a locomotive-engine, the combination with the boiler and with the furnace-chamber, of a fuel-traveling grate supported above said boiler with its receiving end at the forward end of the furnace-chamber in advance of the rearward end of said boiler, fuel-conveyers in position and adapted for automatically conveying the fuel from a point in the rear of the furnace-chamber to a point above the receiving end of the grate, at the forward end of said furnace-chamber and means for actuating said grate to carry the fuel from the forward to the rearward end of the furnace-chamber, substantially as described and for the purpose set forth.

11. In a locomotive-engine, the combination with the boiler and furnace-chamber, and with the grate supported above the boiler, with its receiving end at the forward end of the furnace-chamber, of an endless conveyer or elevator, supported for traveling movement in a circuit around the furnace-chamber and transversely thereof and having the receiving end of the circuit thereof below the boiler and having the delivering end of the circuit thereof adjacent to and above the receiving end of the grate, means for imparting a traveling movement to said endless conveyer to carry the fuel from a point below the boiler to a point above the grate, and means for supplying fuel to the receiving end of the circuit of said conveyer, substantially as described and for the purpose set forth.

12. In a locomotive-engine, the combination with the boiler and furnace-chamber, and with the grate supported above the boiler, with its receiving end at the forward end of the furnace-chamber, of a vertically disposed fuel-conveyer having its receiving end at one side of the boiler in approximate vertical alignment with the receiving end of the grate, and having its discharge end above the receiving end of said grate, a horizontally disposed fuel-conveyer having its discharge end contiguous to the receiving end of the vertically disposed conveyer and having its receiving end located in the rear of the furnace-chamber, means for simultaneously actuating said two conveyers to feed the fuel to the forward end of the grate from a point in the rear of the furnace-chamber, substantially as described and for the purpose set forth.

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