Feb. 6, 1934. E. A. TURNER 1,946,044

LOCOMOTIVE STOKER

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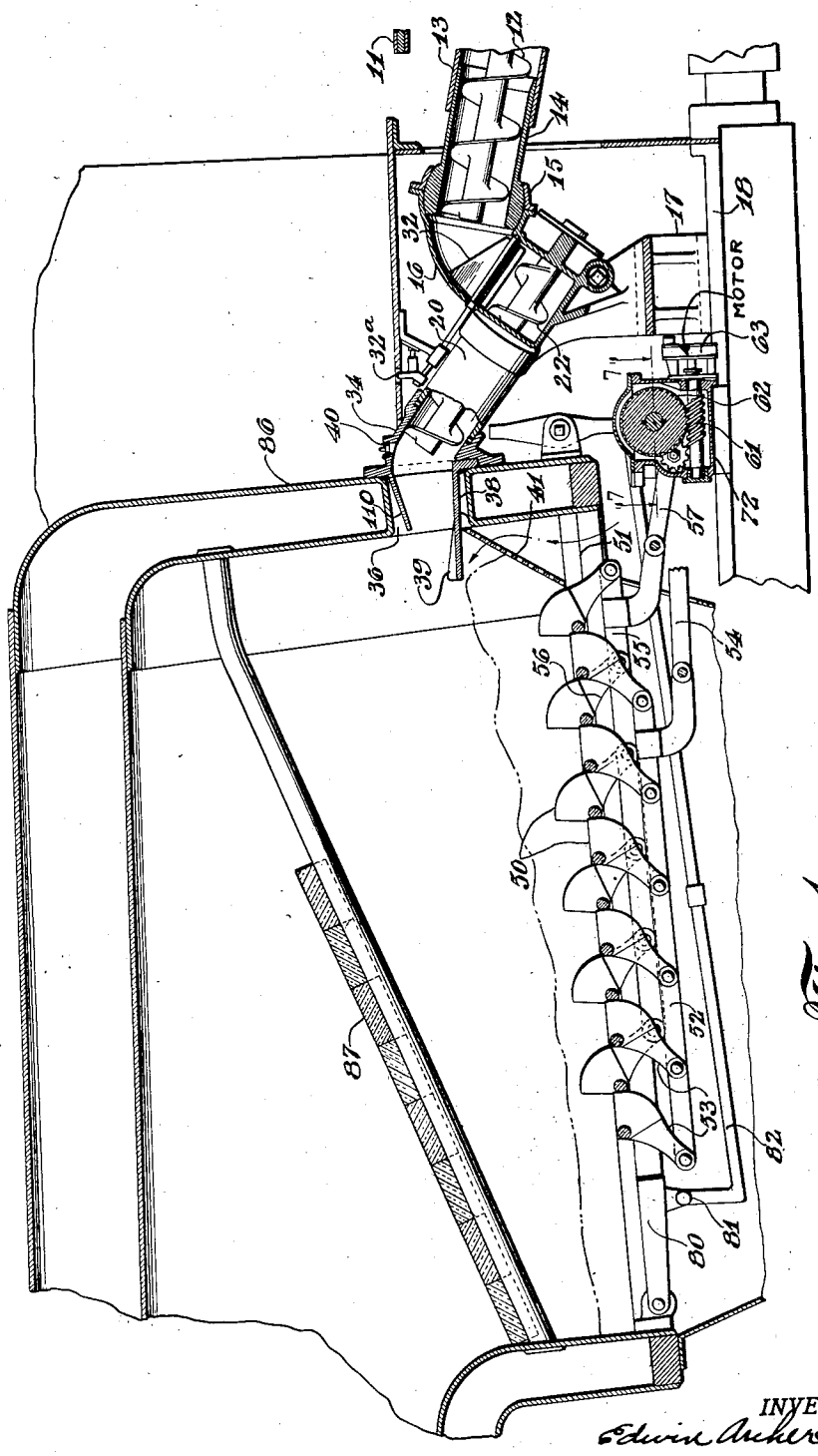


Fig. 1.

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Fig. 2.

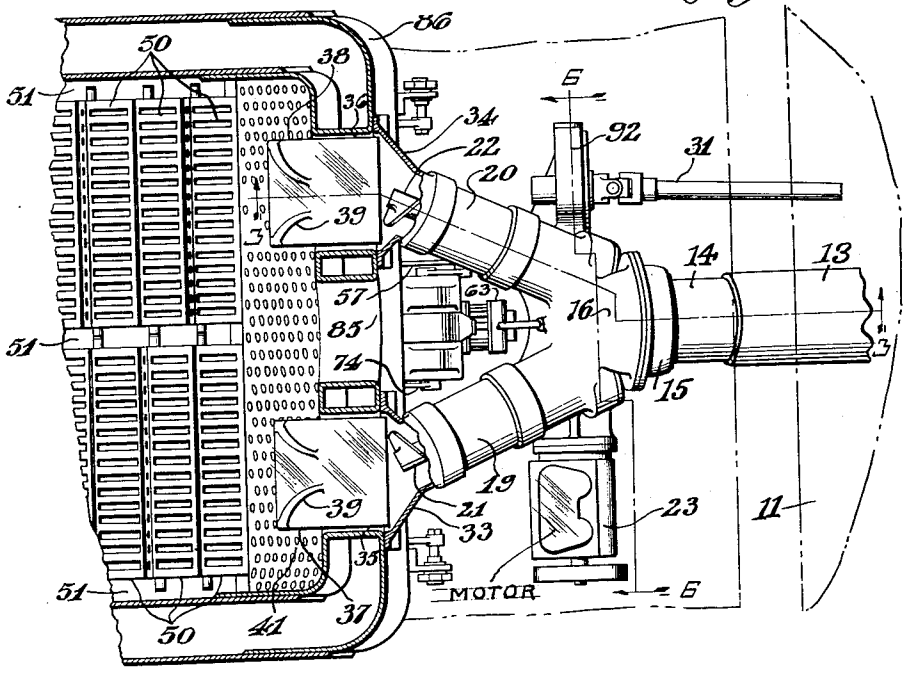
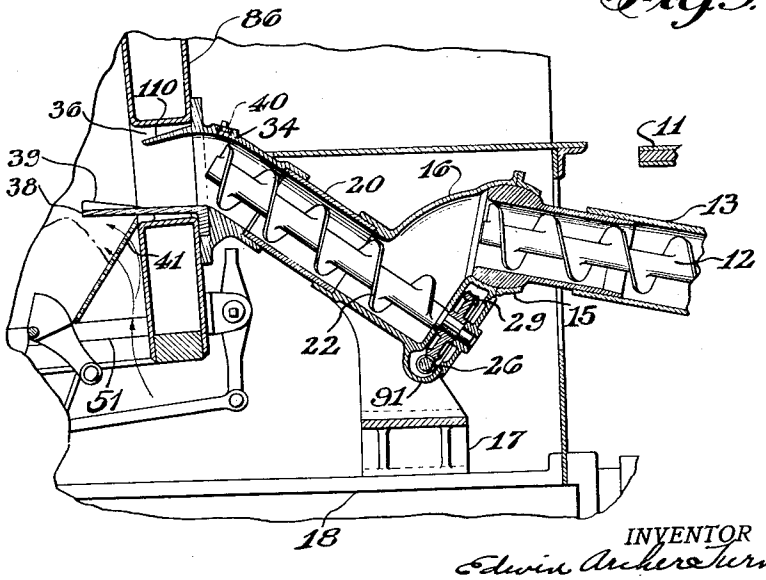


Fig. 3.



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Fig. 4.

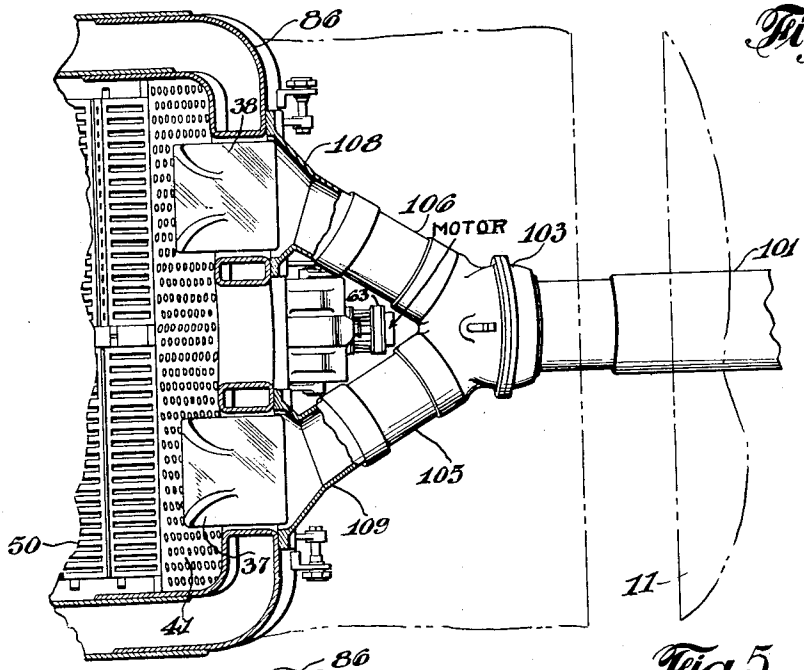


Fig. 5.

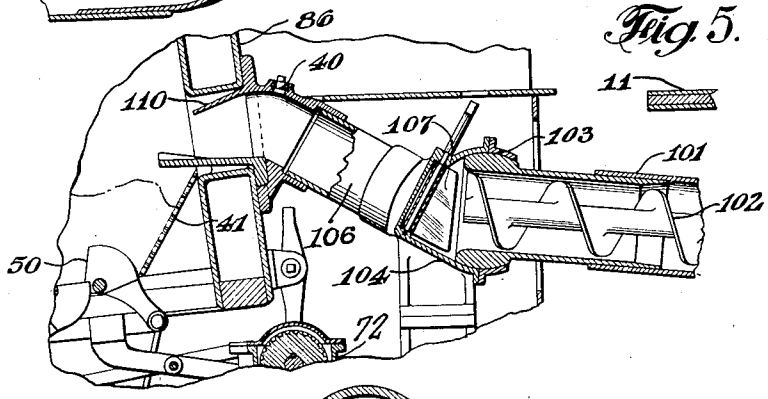
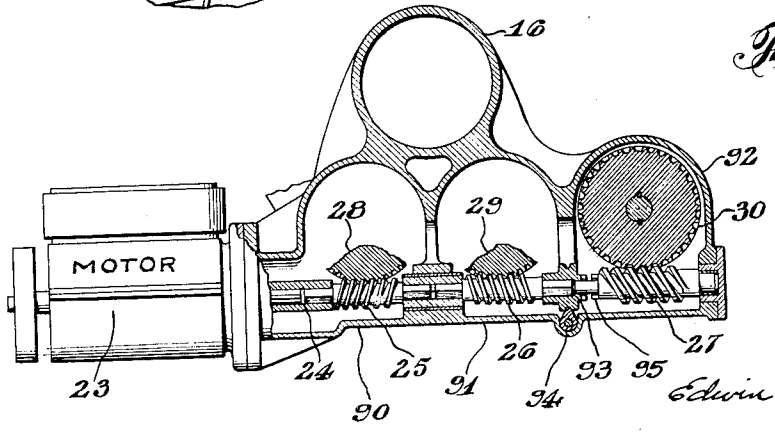


Fig. 6.



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Fig. 7.

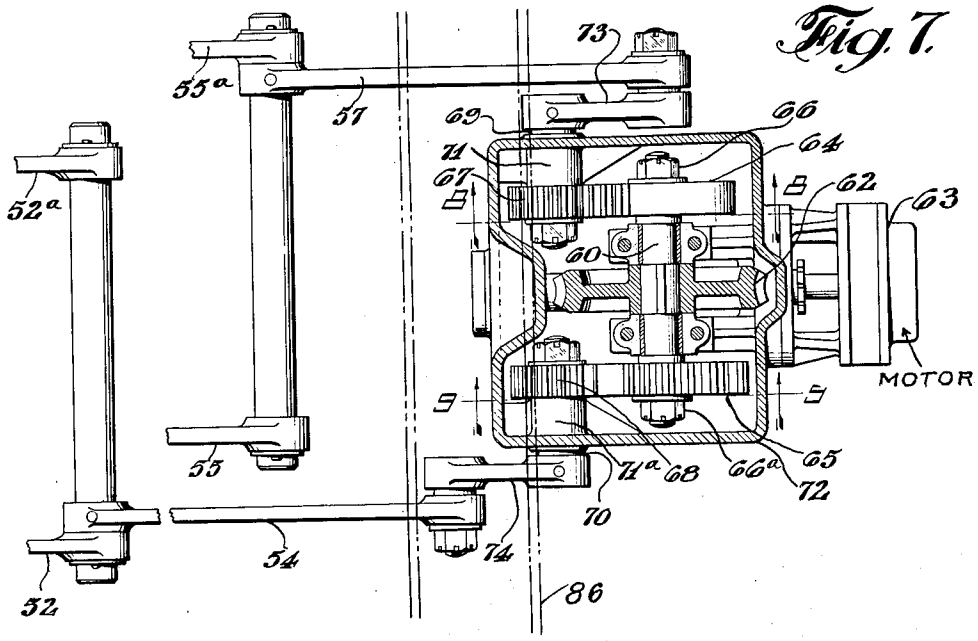


Fig. 8.

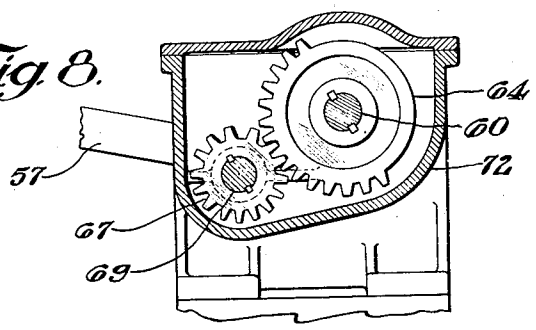
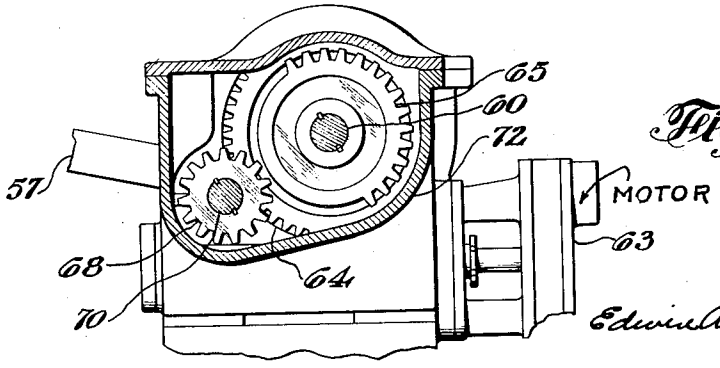


Fig. 9.



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UNITED STATES PATENT OFFICE

1,946,044

LOCOMOTIVE STOKER

Edwin Archer Turner, New York, N. Y., assignor to The Standard Stoker Company, Incorporated, a corporation of Delaware

Application June 5, 1929. Serial No. 368,490

7 Claims. (Cl. 110—101)

My invention relates to mechanical stokers for the supply of fuel from the tender to the locomotive and the burning of the fuel in the firebox.

The principal object of the invention is to provide a stoker which will carry the fuel from the tender to the rear of the locomotive firebox and feed the fuel gradually forward in the firebox while it is first coking and then burning and being reduced to ash.

Another object is the provision of a simplified highly efficient mechanism for conveying the fuel from the tender to the locomotive firebox, there the fuel to be spread laterally and uniformly across the rear portion of the firebox only onto grates which function to move the fuel forward through the combustion chamber while being consumed.

A further and more specific object of my invention is to provide a fuel supply system for feeding fuel from the tender to one or more spreader plates disposed in the firebox backwall and spreading the fuel uniformly across the rear portion only of the firebox without the necessity of employing projecting means.

Further objects and advantages of the invention will be apparent in the arrangement and combination of the parts as shown on the drawings, in which

Fig. 1 is a partial sectional view of a locomotive and tender provided with stoking mechanism illustrating one embodiment of the invention;

Fig. 2 is a plan view of same with parts in section;

Fig. 3 is a partial vertical sectional view on line 3—3 of Fig. 2;

Figs. 4 and 5 are views corresponding to Figs. 2 and 3, but illustrating a modification of the invention;

Fig. 6 is a partial sectional transverse view on the irregular line 6—6 of Fig. 2;

Fig. 7 is a section in horizontal plane taken on the line 7—7 through the grate actuating mechanism of Fig. 1;

Fig. 8 is a vertical section on the line 8—8 of Fig. 7; and

Fig. 9 is a similar section on the line 9—9 of Fig. 7.

In the specific embodiment of the invention shown in Figs. 1, 2, and 6 the coal is fed forward from the tender 11 by conveyer screw 12 in conveyer 13 passing the coal into the tube 14 universally jointed at 15 to the casing 16 supported by bracket 17 from the frame 18 of the locomotive. The casing 16 is divided to feed the coal to the two diverging upwardly inclined branch conduits 19, 20 containing feed screws 21, 22. A driving engine 23 has its rotary shaft coupled at 24 to drive worms 25, 26 and 27 meshing with the gears 28, 29 and 30 for the conveyer feed screws 21, 22 and 12 respectively. The gears 28 and 29 are keyed directly on the shafts of screws 21 and 22 and gear 30 is connected to drive screw 12 through rod 31 having a universal joint at each end and connected through its rear universal joint to the usual drive gears for the tender conveyer screw 12. When engine 23 is running, all of the feed screws 12, 21, 22 are continuously driven, the fuel being fed forward to casing 16 by screw 12 and dropped down between the lower ends of screws 21 and 22. The adjustable distributing vane 32 is mounted as shown in the casing 16 in position to control the feed of fuel, guiding more or less to either conveyer 21, 22 and thus delivering the desired amount of coal fed to each side of the firebox. The vane 32 may be set in adjusted position by the fireman by handle 32*a*.

The conveyers 21, 22 deliver the fuel to upper casings 33, 34 of generally tubular form flanged to fit the openings 35, 36 in the backhead and at the lower portions of these openings are provided the plates or coking shelves 37, 38 protruding into the firebox. Ribs or deflectors 39 formed on these plates divert or spread the fuel as it moves forward and thus give a more evenly distributed feed of the coal as it drops off the coking shelves. From another aspect of the invention the plates 37, 38 function as spreader plates to distribute the fuel uniformly across the rear portion only of the firebox.

The grate receiving and burning the coked coal may be of any desired construction adapted to provide for the feeding of the coal forward as it is burned. In the specific example shown in the drawings the grate is divided into parts, right and left, and each part comprises a series of transversely pivoted grate sections, 50, the whole grate being slightly inclined forward at an angle substantially the same as that of the usual locomotive grate. The grate sections 50 are pivotally supported by longitudinal bars 51, alternate sections being tipped together in one set by links 52 and 52*a* connected to the arms 53 of the sections and moved forward and rearward by the operating rod 54 and similarly the intermediate alternate sections 50 are tipped together in another set by links 55 and 55*a* connected to their arms 56 and moving forward and rearward by the operating rod 57. The operating rods 54 and 57

are moved alternately to tip first one set of sections and then the other and thus feed the burning fuel forward step by step.

Any desired means may be provided for operating these rods 54 and 57 to alternately tip their respective sections. In the specific design shown, referring to Figures 1, 7, 8 and 9, a shaft 60 is revolved at a suitable rate of speed from the speed reducing worm and worm wheel 61 and 62, by the driving engine 63. The gears 64 and 65, having a predetermined number of teeth around portions of their periphery only, are keyed to the shaft 60 and held thereon by suitable fastening means such as threaded nuts 66 and 66a. In mesh with the gears 64 and 65 are the pinions 67 and 68 mounted on the shafts 69 and 70, respectively, these shafts rotating in the members 71 and 71a of the gear-box casing 72, crank arms 73 and 74 having crank pins at the ends thereof are fastened respectively to the shafts 69 and 70, and freely mounted on the crank pins are the operating rods 54 and 57.

The several units of the tipping mechanism are so assembled that when the gears 64 and 65 are in the relative positions shown, in Figures 8 and 9, the grate sections 50 controlled by the operating rod 57 are in their maximum tipping position, while the sections 50 controlled by rod 54 are level with the bars 51. As the gear 64 revolves it drives the pinion 67 thereby turning shaft 69 which rotates the crank arm 73. This arm 73 then moves rod 57 forwardly so that the sections 50 linked to it gradually approach the level of the plane of the fire grate bars. At the same time gear 65 is revolving but not having its teeth engaging with the pinion 68, the sections 50 linked to rod 54 remain level with the bars 51. As the teeth of gear 64 come out of mesh with pinion 67, the teeth of gear 65 mesh with pinion 68, and, when the teeth of gear 65 come out of mesh with pinion 68, the teeth of gear 64 mesh with pinion 67. This periodic alternating engaging and non-engaging of the gears and pinions thus provides the desired alternate tipping of the grate sections. It should be understood that means for operating the grate sections of each side of the firebox independent of each other by employing independently actuating operating rods may be substituted for the above described form if found preferable.

While on the coking shelves the coal is subjected to the heat of the firebed and the lighter volatiles are driven off and burned, air streams for this combustion of the lighter volatiles being provided through the adjustable openings 40 of casings 33, 34 above and through the perforated back plate 41 below. As the coal moves to the edges of the shelves and drops down at the rear of the firebed on the grate it is subject to higher heat and heavier volatiles are driven off and burned at the rear of the firebox to further complete the coking of the coal before it reaches the grate.

At the front end of each part of the grate is a drop plate 80 on which the final burning of coal and accumulation of ash takes place. This plate is pivoted at 81 and is dropped by forward movement of the rod 82 to dump the final ashes into the ash pit.

By control of the driving engine 23 the fireman can supply fuel when desired and regulate the rate at which the fuel is fed and by vane 32 he can control the relative amounts passing to the two sides of the firebox. He observes the condition of the fire through the central observation and hand firing door 85 in the back leg 86 of the boiler and then manipulates his controls to feed the coal in proper rate and amount on to the shelves 37, 38. During the progress of the coal over these shelves or while it is retained there it is subjected to the heat of the fire and dried and coked thereby and air is supplied through opening 40 above and the perforations in plate 41 below to burn the volatile gases passing off. These streams of air pass forward into the fire chamber and then upward along the back leg and the coal on the shelves while coking thus has its volatiles efficiently burned without tendency to carry away unconsumed particles in the draft to the stack.

The movement of the fuel through the firebox is independent of its delivery to the firebox. The volume of fuel delivered to the firebox depends upon the speed of the engine 23 and its associated driving mechanism whereas the movement of the fuel through the firebox is in direct proportion to the movement of the grate sections 50 operable from the motor 63 which as, clearly shown by the drawings, is operated independently of the driving engine 23.

The coal at least partially coked drops from the shelves 37, 38 and is distributed across substantially the entire width of the rear of the firebox forming a pile on and in front of the perforated back plate 41. The feeding of the coal across the coking shelves and the spreading of the coal thereon moves and stirs it so as to keep it broken and present changing portions to the direct heat of the fire. The dropping of the coal continues this stirring action and the coking is continued at the rear of the firebox while air is supplied through the back plate 41 to burn the heavier volatiles now being driven off. These currents of burning gases pass upward along the rear wall of the firebox mingling with the burning gases of the lighter volatiles and the air streams from the openings 40 so that across the entire width of the rear portion of the fire chamber are the rising burning gases from the coking of the coal.

This coking coal dropped from the shelves 37, 38 is in direct contact with the burning firebed itself, and the whole mass is freely burning in the air streams passing upward through the grates. As the alternate grate sections are oscillated the firebed is broken up and moved step by step forward, the fireman watching and regulating the progress and burning of the fuel to give the best effect on each side and over the entire firebed.

The air passing through the forward portions of the grates is deflected backward by the baffle or arch 87 so that as the burning coal progresses forward the hot burning gases pass backward and mingle with the burning volatiles at the rear portion of the fire chamber. At no point in the feeding, coking and burning of the coal is there any excessive drafting or projection of the finer particles into rapidly rising currents of gases likely to carry them unconsumed out through the stack. The coal is pushed and stirred and kept in broken up condition throughout its entire travel through the firebox and until it is reduced to final ash but at no time is this movement excessive or is there any feeding of green coal in a manner to cause the lighter particles to be separated and carried in the air streams without burning.

The result is not only a very efficient and easily controlled burning of all of the consumable con-

stituents of the coal but also avoidance of stack loss which has been a particularly troublesome problem with locomotive fires. Such stack loss, avoided in the stoker of this invention, not only means loss of a considerable portion of the fuel but the presence in the stack discharge of the soot and cinders so common and so objectionable on railway trains.

The stoking means of this invention thus makes the burning of the fuel by the locomotive more efficient and cleaner and the structural parts of the stoker are readily applied to existing types of locomotives. The feed from the tender is substantially entirely beneath the cab deck leaving ample space for the control and operation of the grate sections and at the same time giving a positive feed of the fuel to each side of the fire as desired. This division of the fuel takes place in the casing 16 specially formed to provide the universal end connection 15 and the chamber beyond this wherein the coal is divided for the feeds to the respective sides of the fire. This casing 16 also carries the casings 90, 91, 92 for the gears 28, 29 and 30, and the worm drives for these gears.

As indicated in Fig. 6 a sliding clutch 93 rotating with worm 26 may be moved by an actuator 94 to engage with or disengage from the cooperating teeth 95 of the worm 27, thus permitting the branch screws to be driven independently of the main feed screw 12 and is particularly useful in case of any tendency of the fuel to pack and join in the casing 16. The continuation of the branch screws without the main screw will relieve any such tendency and loosen up the fuel so that the feed from the main screw will meet with no resistance.

Where the conditions of installation and character of fuel permit it the branch screws 21, 22 may be omitted and the coal forced up through the branch conduits by the pressure of the main feed as indicated, for instance, in Figs. 4 and 5. Here the main conveyer 101 from the tender has the fuel fed through it by screw 102 and is connected by universal joint 103 to the casing 104 on the locomotive which casing is divided into branches leading to tubes 105, 106 and has the dividing vane 107 to control the amount of coal passing to each branch. At the openings into the firebox the conveyer tubes 105, 106 lead into casings 108, 109 similar to casings 33, 34 so that the coal forced into the Y elbow casing 104 divides therein and passes up through the branch conduits and casings and onto the coking shelves 37, 38.

As shown in Figs. 1 and 5 the currents of air passing through windows 40 may be directed downward by the deflectors 110 causing the entering air to pass close to the coking coal and mingle with the volatile gases from the coal so that these light volatiles and air mix thoroughly and burn together in currents ascending along the rear wall of the firebox.

In both the feeding means of Figs. 1 to 3 and Figs. 4 and 5 the combined cross sectional areas of the branch conduits are greater than the cross sectional area of the main conveyer so that the fuel stream is widened as it branches into the conveyers passing upward to the firedoor openings and contraction of the fuel stream is avoided at the portion of the feed where jamming is most likely to occur.

The resulting smooth unobstructed feeding of the coal to the firebox avoids pulverizing of the coal and minimizes the amount of fine particles or dust in the fuel as it reaches the firebox and this combined with the proper coking of the green coal and the progressive feed of the firebed by the movement of the sectional grates attains a most efficient and clean burning of the fuel and avoidance of the tendency toward excessive stack loss, so objectionable in locomotive stoking.

I claim:

1. The combination with a locomotive and a tender, the locomotive having a firebox with a back leg provided with a plurality of openings, of a stoking means therefor comprising means for feeding fuel forward from the tender to and for forcing the same through the plurality of openings in the back leg of the locomotive firebox, means at the rear of the locomotive firebox supporting the fuel above the fire level for coking the same, said last named means being provided with deflectors for spreading the fuel laterally across substantially the entire rear portion only of the firebox, means for supplying air to burn the volatile gases given off during said coking, and separate means for progressively moving said coked fuel forward from the rear to the front of the firebed in said firebox and supplying air to burn it to ash during said movement, said means for feeding fuel from the tender to the openings in the back leg of the locomotive firebox constituting the sole means for advancing the fuel over the means at the rear of the locomotive firebox supporting the fuel above the fire level for coking the same.

2. The combination with a locomotive and a tender, the locomotive having a firebox with a back leg provided with a plurality of openings, of a stoking means therefor comprising means for feeding fuel forward from the tender to the locomotive firebox comprising a main conveyer, a branched casing dividing the fuel, and branch conveyers leading the fuel to the openings in the back leg of the locomotive boiler, means at the rear of said firebox supporting the fuel above the fire level for coking the same, said last named means being provided with deflectors for spreading the fuel laterally across substantially the entire rear portion only of the firebox, means for supplying air to burn the volatile gases given off during said coking, and separate means for progressively moving said coked fuel forward from the rear to the front of the firebed in said firebox and supplying air to burn it to ash during said movement, said means for feeding fuel from the conveyer to the locomotive firebox constituting the sole means for advancing the fuel over the means at the rear of said firebox supporting the fuel above the fire level for coking the same.

3. The combination with a locomotive and a tender, the locomotive having a firebox with a back leg provided with openings, of a stoking means therefor comprising means for feeding fuel forward from the tender to the locomotive firebox including a main conveyer, a branch casing having adjustable means dividing the fuel, and branch conveyers leading the fuel to the openings in the back leg of the locomotive firebox at a height above the normal level of the fire, means at the rear of said firebox supporting the fuel above the fire level for coking the same, comprising shelves in said openings having deflecting means adapted to deliver the fuel across substantially the full width of the rear portion only of the firebox, means supplying air to burn the volatile gases given off during said coking, and a plurality of separate grates for progres-

sively moving said coked fuel forward from the rear to the front of the firebed in said firebox and supplying air to burn it to ash during said movement, said grates being operated and controlled independently of the means for feeding fuel forward from the tender to the locomotive firebed.

4. The combination with a locomotive and a tender, the locomotive having a firebox with a rear wall provided with openings on opposite sides of the medium plane of the firebox, of a stoking means therefor comprising means for feeding fuel forward from the tender to said openings in the rear wall of the locomotive firebox, said openings disposed at a height above the normal level of the fire, means at the rear of said firebox supporting the fuel above the fire level for coking the same, comprising shelves mounted in said openings, said shelves being provided with deflectors for spreading the fuel laterally across substantially the entire rear portion only of the firebox, means for supplying air above and below said shelves to burn the volatile gases given off during said coking, the burning gases rising substantially vertically along the rear wall of said firebox, grate means for progressively moving the coked fuel forward from the rear to the front of the firebed in said firebox and supplying air to burn it to ash during said movement, and deflecting means for carrying the hot air currents rising from said firebed backward toward the air currents burning said volatile gases.

5. In combination, a locomotive and a tender, the locomotive having a firebox with an upstanding backwall, a grate in said firebox comprising means for progressively advancing the fuel, a plurality of openings in said backwall at a height above the normal level of the firebed maintained on said grate, a perforated plate extending across the rear of the firebox and inclined downwardly and forwardly from the backwall to said grate, a fuel spreader member in each of said openings arranged to permit fuel passing thereover to be uniformly spread across the rear portion only of the firebox upon said grate and upon said perforated plate, mechanical means for delivering fuel from the tender to each of said members comprising a single transferring conveyer extending from the tender to said locomotive, said means forcing the fuel over the spreader member and a plurality of feeding conduits receiving from said transfer conveyer, each feeding conduit delivering to a spreader member in one of said openings.

6. In combination, a locomotive having a firebox with an upstanding backwall, a progressive feed grate in said firebox, a pair of openings in said backwall at a height above the normal level of the firebed maintained on said grate, a perforated plate extending entirely across the rear of the firebox and inclined downwardly and forwardly from the backwall at a point adjacent the lower marginal edges of said openings to said grate, a fuel spreader member in each of said openings arranged to permit fuel passing thereover to be uniformly spread across the rear portion only of the firebox and upon said perforated plate, mechanical means for delivering fuel to each of said members, and said grate arranged to advance the fuel from the perforated plate to the front of the firebox, the fuel first coking as it passes over the spreader members, then passing by gravity to the perforated plate where it is subjected to a supply of secondary air to assist in consuming the volatile gases passed off during the coking process, and the fuel then being advanced, the firebed broken up, and the fuel consumed to ash in its travel on the grate to the front of the firebox.

7. In combination, a locomotive having a firebox with an upstanding backwall, a progressive feed grate in said firebox, a pair of openings in said backwall at a height above the normal level of the firebed maintained on said grate, a perforated plate extending entirely across the rear of the firebox and inclined downwardly and forwardly from the backwall and at a point adjacent the lower marginal edges of said openings to said grate, a fuel spreader plate in each of said openings arranged to permit fuel passing thereover to be uniformly spread across the rear portion only of the firebox and upon said perforated plate, mechanical means for delivering fuel to each of said spreader plates, said means forcing the fuel over the spreader plates from which it drops by gravity upon said perforated plate, and said grate arranged to advance the fuel from the perforated plate to the front of the firebox.

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