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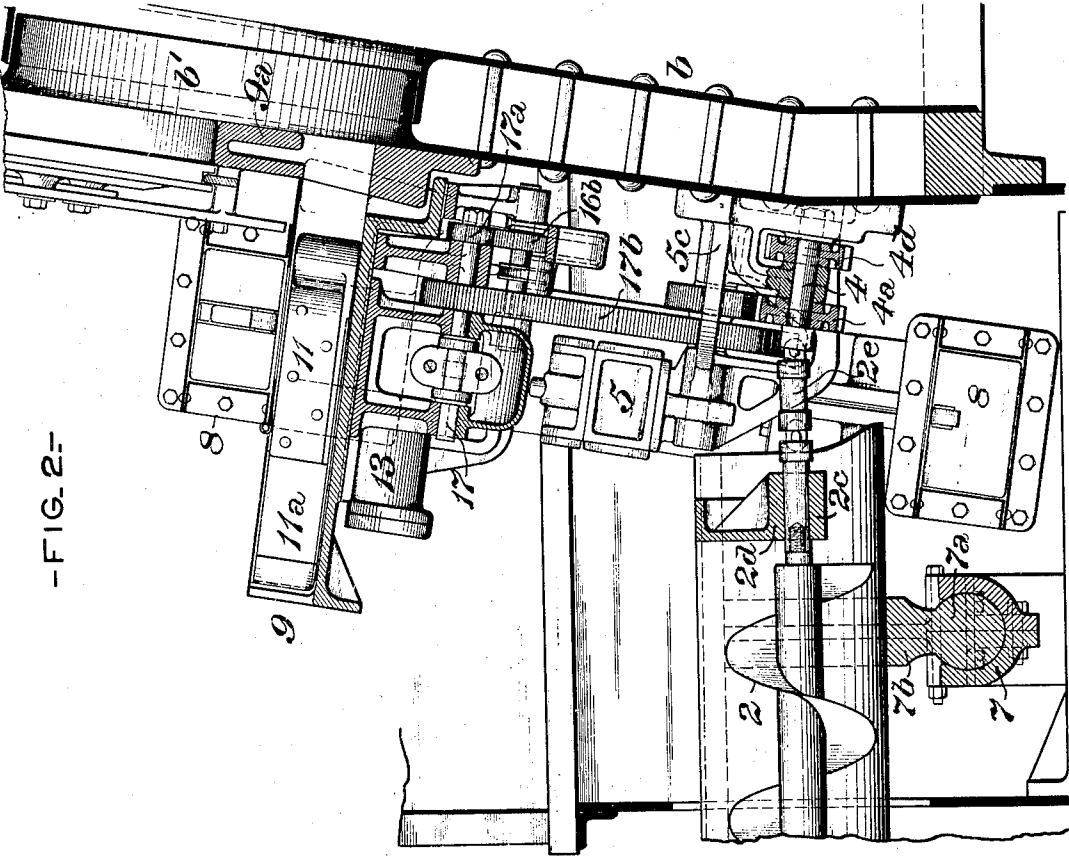


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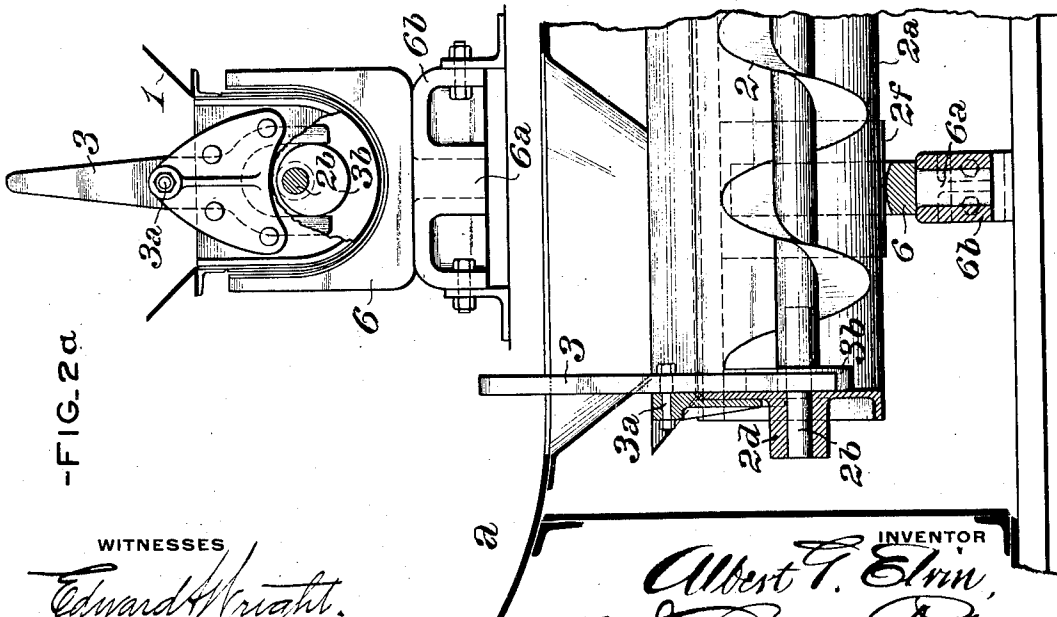
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-FIG. 2-



-FIG. 2a



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6 SHEETS—SHEET 3.

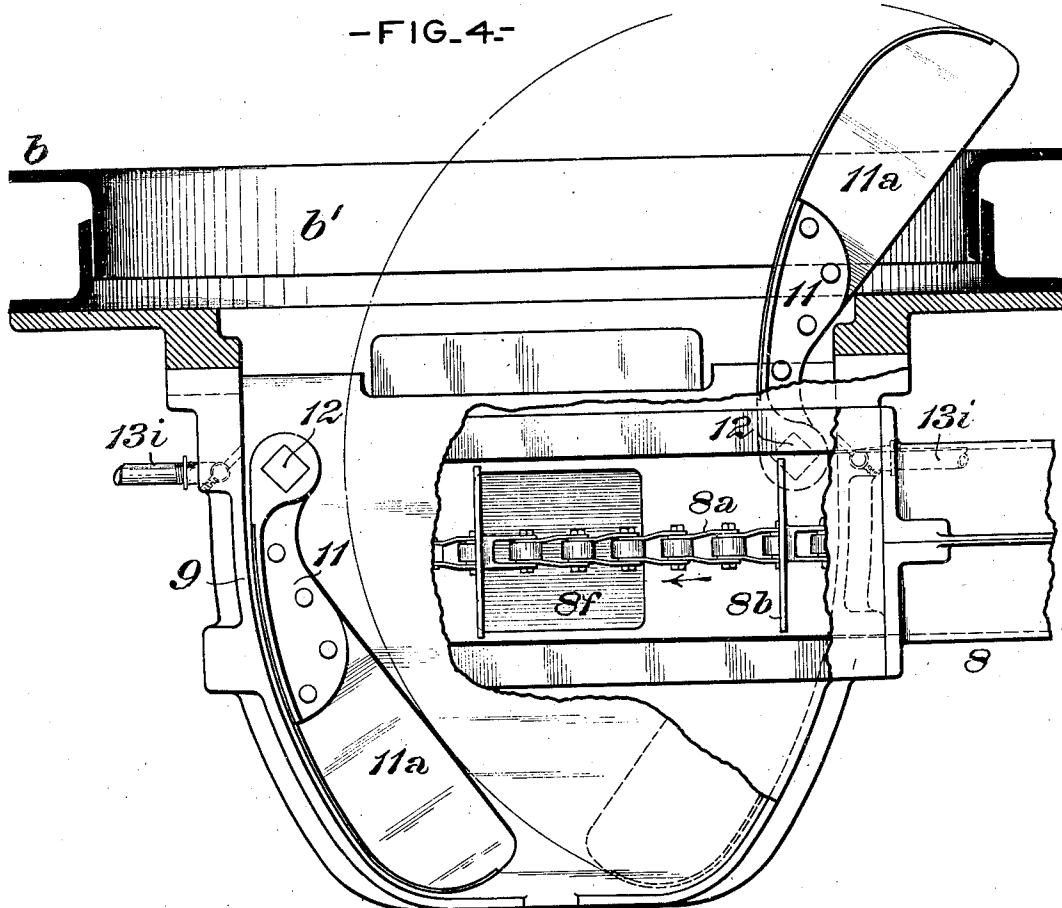
WITNESSES

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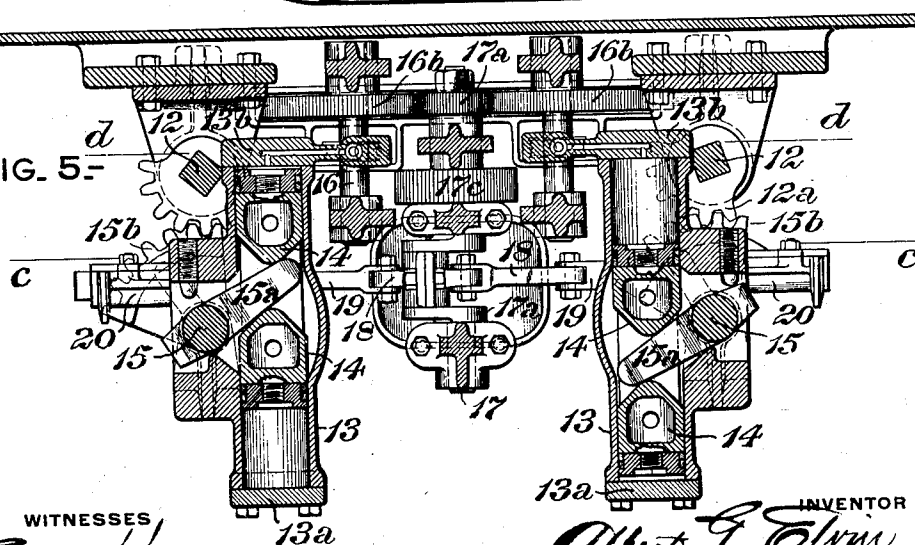
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-FIG. 4-



-FIG. 5-



WITNESSES

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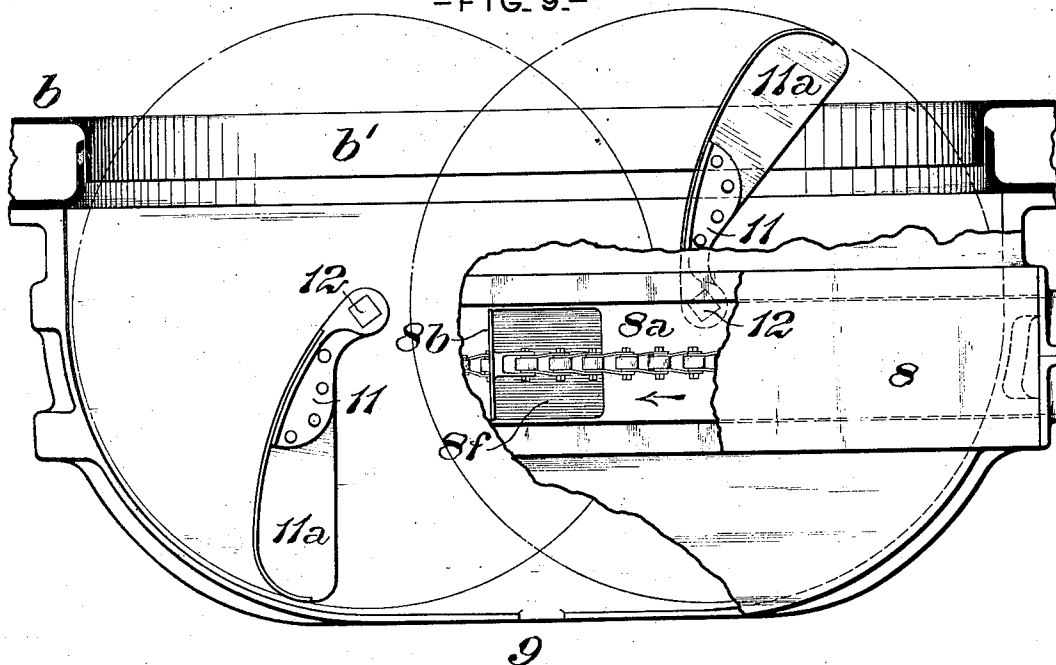
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Patented Apr. 8, 1913.

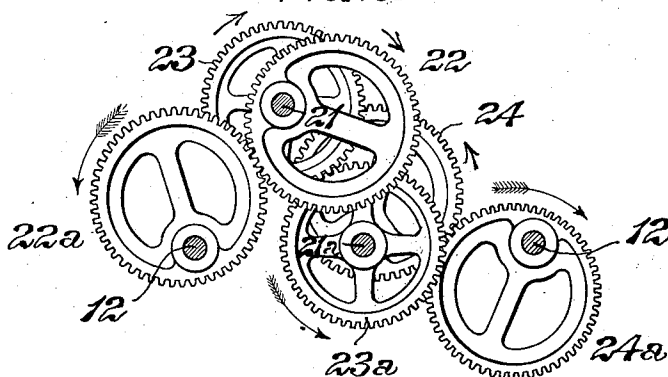
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6 SHEETS-SHEET 6.

-FIG. 9.-



-FIG. 10.-



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UNITED STATES PATENT OFFICE.

ALBERT G. ELVIN, OF SOMERVILLE, NEW JERSEY.

MECHANICAL STOKER.

1,058,356.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed October 23, 1912. Serial No. 727,338.

To all whom it may concern:

Be it known that I, ALBERT G. ELVIN, of Somerville, in the county of Somerset and State of New Jersey, have invented a certain new and useful Improvement in Mechanical Stokers, of which improvement the following is a specification.

My invention relates more particularly to appliances for feeding fuel to locomotive and other steam boiler furnaces, of the overhead and so-called "scatter" type, in which the fuel is mechanically projected into the furnace, above its grate, and distributed over the surface thereof, through the momentum imparted to successively supplied quantities of fuel by the movements of power actuated members with which they are brought into contact. Certain of its features are however, equally applicable in mechanical stokers of other types.

The object of my invention is to provide a mechanical stoker, of the class above described, which shall present the advantages of comparatively simple and inexpensive construction; ready applicability in connection with the furnaces of locomotives of any of the present standard types, freedom from interference with ordinary hand firing, should such operation become necessary or desirable; and capability, in operation, of closely approximating the results, as to proper distribution of the fuel over the entire area of the grate, of the manual labor of a competent fireman.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a view, partly in side elevation and partly in section, of the adjoining portions of a coupled locomotive engine and tender, illustrating an application of my invention; Fig. 2, a vertical longitudinal central section through a mechanical stoker embodying my invention, and through the rear water wall of the firebox of a locomotive engine, and a portion of the tender on which it is applied; Fig. 2^a, a transverse section through the conveyer casing, showing the fuel agitator; Fig. 3, a rear view, partly in section, of the apparatus, with the screw conveyer removed; Fig. 4, a plan view of the shovel box and a portion of the elevator casing; Fig. 5,

a horizontal section, on the line *a a* of Fig. 3; Fig. 6, a view, partly in plan, and partly in horizontal section on the line *b b* of Fig. 3; Fig. 7, a view, partly in rear elevation and partly in vertical transverse section, on the line *c c* of Fig. 5; Fig. 8, a vertical transverse section, on the line *d d* of Fig. 5; Fig. 9, a view, similar to Fig. 4, illustrating a structural modification; and, Fig. 10, a plan view of the gearing for actuating the shovels of the construction shown in Fig. 9.

Referring first to Figs. 1 to 8 inclusive of the drawings, my invention is herein exemplified in connection with a locomotive engine (indicated as a whole by B) and a tender (indicated as a whole by A) which are coupled together for service, in the ordinary manner, by a draw bar C, my invention being applied, for the purpose of mechanically conveying fuel from the coal space, *a*, of the tender, to the firing door opening, *b'*, of the firebox, *b*, of the locomotive, and intermittently projecting apportioned quantities of the fuel through said opening into the firebox. To this end, I provide (a), a fluid pressure motor, which actuates, in appropriate relation and sequence, as hereinafter described, the following operating instrumentalities, to wit: (b), a conveyer by which fuel is transferred from the coal bin of the tender to the vicinity of the firebox of the locomotive; (c), an elevator to which fuel is delivered by the conveyer and by which it is raised to the proper level for firing; (d), a shovel box or receptacle to which fuel is delivered by the elevator; (e), a swinging shovel by which fuel is carried from a location of deposit in the shovel box and projected into the firebox; and (f), intermediate mechanism through which said shovel is actuated by the motor.

In the practice of my invention, I provide, at the front end of the coal space, *a*, of the tender, a supply hopper, 1, through which the fuel is supplied by gravity to the rear end of a longitudinal casing, 2^a, in which there extends a screw conveyer, 2, having end journals, 2^b, 2^c, which are mounted in bearings, 2^d, in the casing. An agitator, 3, in the form of a vertically extending arm is journaled on a pin, 3^a, at the rear end of the casing, said agitator

extending upwardly into the coal space. The lower end of the agitator is forked and fits a cam or eccentric, 3^b, on the rear journal, 2^b, of the conveyer, by the rotation of which the agitator is vibrated about the axis of the pin, 3^a, so as to stir up the fuel above it and prevent it from clogging in the hopper, 1. The forward journal of the conveyer is coupled, by a universal joint, 2^a, to the shaft, 4, of a sprocket wheel, 4^a, which is rotated by a chain, 4^b, engaging the teeth of said wheel and of a similar wheel, 5^b, fixed on the driving shaft, 5^a, of a fluid pressure motor, 5, supported on a bracket, 5^c, fixed to the back head of the firebox. The motor, 5, does not, in and of itself, form part of my present invention, and may be of any suitable and preferred construction, many forms of which are familiar to those skilled in the art, and it will not therefore be herein in detail described. As indicated in the drawings, the motor, 5, accords substantially with that which is set forth in Letters Patent of the United States No. 1,050,528, granted and issued to me under date of January 14, 1913, this construction being specially desirable for application in the apparatus of my present invention.

The conveyer casing, 2^a, is supported, near its rear end, in a yoke, 6, which is provided with a downwardly extending pin, 6^a, journaled in a bearing, 6^b, fixed to the tender frame. The conveyer casing is fitted with a shoe, 2^c, which bears on the upper face of the yoke, 6, said face being curved in the direction of the length of the casing, as shown in Fig. 2, so as to admit of a limited degree of sliding movement of the casing. The forward end of the casing is supported in a spherical socket bearing, 7, fixed to the framing of the locomotive, said bearing receiving a ball member, 7^a, on the lower end of the yoke, 7^b, secured to the conveyer casing. By reason of the swiveling movement of the casing permitted by the bearings above described, all relative movements of the locomotive and tender are compensated for, and the normal operative relation of the conveyer and motor is at all times maintained.

The fuel which is carried, by the rotation of the conveyer, from the tender to the forward end of the conveyer casing, is dropped therefrom into a hopper, 8^a, the bottom of which is opened to the lower transverse member of an elevator casing, 8, of substantially rectangular form, with properly rounded corners, within which there is fitted to traverse, an elevator chain, 8^a, provided with a plurality of flights or blades, 8^b, which fit freely within the casing, 8, and are spaced at equal intervals apart on the elevator chain, which chain is

carried on guide sprocket wheels, 8^c. Longitudinal movement within the casing, in the direction of the arrows, Fig. 3, is imparted by the motor, 5, to the elevator chain and connected flights, through a chain, 4^c, passing around a sprocket wheel, 8^d, on the shaft, 8^e, of one of the guide sprocket wheels, and around a sprocket wheel, 4^a, on the shaft, 4, which as before described, is rotated by the motor, 5. The speed of the screw conveyer is such that only sufficient fuel will be dropped into each of the spaces between the flights to fill approximately one half of said space, in order to prevent fuel being dropped from the elevator casing into the shovel box hereinafter described, while one of the shovels is in its forward position.

A discharge passage, 8^f, is formed centrally in the upper member of the elevator casing, 8, immediately above, and establishing communication with, a shovel box, 9, which is fixed to, and supported by, a bracket, 9^a, secured to the rear head of the firebox, 6. The forward side of the shovel box is fully open to the firing door opening, 7^c, of the fire box, near the lower side thereof, so as to leave as much as possible of the upper portion of said opening unobstructed, said upper portion being closed by firing doors, 10, of the ordinary construction. By the usual manipulation of said doors by a hand lever, 10^a, manual firing can be operated, if it should, at any time, become necessary or desirable to intermit the operation of the mechanism of my invention.

The fuel which is raised in the elevator casing, 8, and carried to the discharge passage, 8^f, by each of the flights, 8^b, drops through the discharge opening into the shovel box, 9, from which the successive portions or charges contained in the spaces between the flights, are projected, alternately, into the firebox, by swinging movements of one or the other of two fuel carrying and throwing shovels, each comprising a stock or body, 11, and a blade, 11^a, of stout sheet metal, which is curved longitudinally, and also curved or bent transversely, as shown in Figs. 2, 3, 4, and 9, thereby enabling it to receive and carry, in its movements, a charge of fuel, in the manner of an ordinary fireman's shovel or scoop. The shovels 11, 11^a, are fixed upon the squared upper ends of two shovel shafts, 12, the axes of which are located on opposite sides of the shovel box, in a common plane which is substantially parallel with the back head of the firebox, and therefore either vertical, or, as in the instance shown, slightly forwardly inclined. The outward or feeding traverses of the shovels, in each of which they carry a charge of fuel, are effected by fluid pressure mechanism, by which they are

swung comparatively rapidly in said outward or feeding traverses, and in their inward or return traverses, they are actuated mechanically and more slowly, by gearing driven by the motor, 5, which operates the conveyer and elevator hereinbefore set forth. The mechanism by which the shovels are operated in the manner above recited, will now be described.

Two fluid pressure cylinders, 13, 13, the axes of which are located in a plane at right angles to that of the shovel shafts, 12, are suitably supported below the shovel box, 9, each of said cylinders adjoining, at one end, one of the shovel shafts. The rear ends of the cylinders are closed by removable heads, 13^a, and their forward ends by heads, 13^b, in which are formed supply and exhaust ports hereinafter described. Each cylinder is fitted with a piston, 14, in the middle portion of which there is formed a transverse slot having oppositely inclined bearing faces which abut against an arm, 15^a, fixed upon a gear shaft, 15, the axis of which is located in a plane coincident or parallel with the axial plane of the adjacent shovel shaft, 12. The arm, 15^a, passes freely through, and swings in, a slot formed in one side of the cylinder, all as clearly shown in Fig. 5. A segment gear, 15^b, fixed on each of the gear shafts, engages a corresponding pinion, 12^a, on the adjacent shovel shaft, 12, which, by such engagement will be swung in its bearings coincidently with the longitudinal movement of the piston, 14, whether such swinging movement is effected by the movement of said piston, as in the outward or feeding traverses of the shovel, or by the application of power from the motor, 5, as in the inward or return traverses.

The movements of the pistons, 14, by which they actuate the shovel shafts, in the feeding traverses of the shovels, are effected by fluid under pressure, preferably compressed air, which is admitted, from a suitable source of supply, to the forward ends of the cylinders, 13, through supply ports, 13^c, to admission ports, 13^d, controlled by supply valves, 13^e, which are fixed upon stems, 13^f, and are normally held seated by the pressure above them and by springs, 13^g. The motive fluid is preferably discharged from the exhaust ports through discharge pipes, 13^h, leading into the shovel box, adjacent to the shovel shafts, in order to prevent the accumulation of particles of fuel on the outer sides of the shovels. The stems, 13^f, are peripherally recessed below the supply valves, and the portions of their peripheries below the recesses, perform the functions of exhaust valves governing exhaust ports, 13^a. The stems, 13^f, bear on the peripheries of cams, 16^a, fixed on cam shafts,

16, journaled in bearings below the cylinders, by the rotation of which shafts the supply and exhaust valves are alternately unseated, said valves being alternately seated by the pressure above them and the springs, 13^g, as the raised portions of the peripheries of the cams pass clear of the stems.

Each of the cam shafts, 16, carries a spur gear, 16^b, said spur gear engaging a corresponding pinion, 17^a, fixed on a crank shaft, 17, which is journaled in bearings between the cylinders, 13. The crank shaft, 17, is rotated by the motor, 5, through a chain, 17^b, passing around a sprocket wheel, 5^a, on the shaft of the motor, and around a corresponding wheel, 17^c, on the crank shaft. By means of the construction above described, the shovels are swung outwardly with comparative rapidity, to feed the fuel into the firebox, by the rearward movements of the pistons, 14, and the rear ends of the cylinders, 13, being closed by the heads, 13^a, the cylinder spaces adjacent to said heads act as cushion chambers, which serve to reduce the speed of the shovels as they approach the outward terminals of their traverse, and thereby to correspondingly reduce the strain on the operating mechanism.

The inward or return traverses of the shovels are effected, at a lower rate of speed than their outward traverses, by intermediate mechanism actuated by the crank shaft, 17, which, as before explained, is rotated by the motor, 5. A double crank, 17^d, having a crank pin, 17^e, is formed on the crank shaft, 17, and the crank pin is coupled by oppositely extending links or connecting rods, 18, to two slide bars, 19, which are fitted to reciprocate in guides, 20, formed on or fixed to the lower portions of the cylinders, 13. An arm, 15^c, is fixed on each of the gear shafts, 15, said arm passing freely through a slot in the side of the adjacent guide, 20, and extending thereinto in position to be contacted with by a transverse bearing face, 19^a, on the slide bar, 19, which moves therein. In the rotation of the crank shaft, 17, the gear shafts, 15, will be alternately swung in their bearings by the contact of the slide bars, 19, with the arms, 15^c, in direction to impart inward or return traverse to the shovels, through the gears, 15^b and 12^a, and will, through the contact of the arms, 15^a, with the pistons, 14, coincidently return the pistons to position for commencing their strokes which impart the outward or feeding traverse to the shovels, *i. e.*, the position shown on the left of Fig. 5.

It will be seen from the proportions of the gearing, that the speed of rotation of the crank shaft, 17, is about four times as great as that of the cam shafts, 16, the object of

this difference in speed being to enable each of the slide bars, 19, to move sufficiently quickly to effect the return of the shovel which it actuates, to its rearward position, which it actuates, to its rearward position, that is to say, the position in which it receives a charge of fuel, before the supply valve of the fluid pressure cylinder of the opposite shovel has been opened by its cam shaft, to impart outward or feeding traverse to said shovel.

Figs. 9 and 10 illustrate a structural modification in which the shovels swing completely around their axial lines in making their alternate outward and inward traverses, instead of swinging alternately forwardly and backwardly, through arcs of circles, as in the instance before described. In this construction, the fluid pressure mechanism for moving the shovels outwardly is dispensed with, and both their outward and inward traverses are effected, at relatively greater and lesser speeds, by gearing actuated by the motor, 5, as indicated diagrammatically in Fig. 10. To this end, two shafts, 21, and 21^a, either one of which may, as preferred, be rotated by appropriate connections, of ordinary known form, with the motor, 5, are journaled in bearings intermediate of the shovel shafts, 12, 12, and substantially parallel therewith. An eccentric gear, 22, fixed on the shaft, 21, engages a similar gear, 22^a, on one of the shovel shafts, 12, and a concentric gear, 23, also fixed on the shaft, 21, engages a similar gear, 23^a, on the shaft, 21^a, which carries an eccentric gear, 24, engaging a similar gear, 24^a, on the other shovel shaft, 12. By this disposition of the intermediate shafts and gearing, and the proper relative adjustment of the eccentric gears, the two shovel shafts are swung in opposite directions, and their outward or feeding traverses are effected at higher speeds than their inward or return traverses, as in the instance first described.

In the operation of a mechanical stoker embodying my invention, the fuel which is transferred from the coal bin of the tender to the locomotive, by the screw-conveyer, 2, drops from the forward end thereof, through the hopper, 8^s, into the elevator casing, 8, within which it is raised, in successive portions or charges, by the flights, 8^b, connected to the elevator chain, and the charges of fuel are moved through the upper horizontal member of the casing, and successively delivered through the discharge passage, 8^c, thereof, into the shovel box, 9. When one of the flights, 8^b, has reached the right hand side of the discharge passage, the entire charge of fuel in front of this flight will have been delivered to the shovel box, in front of one of the shovels, as, say, the left hand one, which is then standing at the rear terminal of its traverse, the other shovel, as,

say, the right hand one, then standing at the forward terminal of its traverse. The speed of the cam shafts, 16, which, as before explained, are rotated by the motor, 5, and the adjustment of the cams, 16^a, thereon, are so regulated that the supply valve, 13^s, of the left hand fluid pressure cylinder, 13, will be opened when one of the flights has reached the right hand side of the discharge opening and the charge of fuel in front of it has been delivered to the shovel box. The piston, 14, of the left hand cylinder, 13, will thereupon be moved rapidly to the rear terminal of its stroke, and will, through its connections with the left hand shovel shaft, 12, swing the left hand shovel, with comparative rapidity, to the outward terminal of its traverse, said shovel thereby gathering, upon the horizontal portion of its blade, the charge of coal in front of it, carrying said charge forwardly, and throwing it into, and toward the left side of, the firebox. When this outward terminal has been reached, the cam of the left hand cylinder has moved sufficiently far to permit the supply valve to be closed and pressure to be cut off from the left hand cylinder. The right hand shovel shaft, 12, is then, through its connections with the adjacent slide bar, 19, turned in the opposite direction, and its shovel is swung backwardly, at comparatively slow speed, to the rear terminal of its traverse, it being free to move in the direction of the curved line in Fig. 4, by reason of the left hand shovel then standing to the left of said line. The right hand shovel will then be in position behind the charge of fuel delivered by the next succeeding flight, and will, when said charge is delivered, be actuated by the piston of the right hand fluid pressure cylinder, in a similar manner to that above described, and will carry and throw this charge forwardly into, and toward the right hand side of, the firebox, after which it will be returned similarly to the left hand shovel.

It will be seen that by reason of the capability of the horizontally swinging shovels, of picking up, holding, and carrying throughout their traverses, successive charges of fuel, and of being projected, through the door opening in the rear wall of the firebox, partially into the latter, they will, at the concluding portions of their forward traverses, throw the portions of fuel then remaining upon them, toward the rear corners of the firebox. This is a function of prime importance in firing locomotive boilers, in which, unlike the cylindrical furnaces of boilers of the Scotch and Cornish types, the firebox is of very much greater width than the door opening, and is a function which is not within the capacity of swinging, rotating, or reciprocating blades,

paddles, or plungers, whether the same are formed with plane or with curved surfaces.

A leading and characteristic feature of my invention, and one by which it is, so far as my knowledge and information extend, differentiated from the prior art, consists in the form, means of operating, and relation, to other members, of a "shovel" as herein set forth, which term I define, as meaning herein, a mechanically movable fuel carrying and throwing member, of hollowed or angular transverse section, adapted to pick up, hold, transport, and project in different directions, a charge of fuel, said member being connected with means whereby it is swung, in a horizontal plane, within a fuel receptacle, toward and from an opening in a furnace, into which it successively delivers the charges of fuel which it receives, in different directions, during different portions of its traverse toward said opening. A shovel, as above defined, differs both structurally and operatively, from the instances exemplified in the prior art, of revolving plates or disks, upon which fuel is dropped, and from which it is discharged by centrifugal force, and oscillating, rotating, or reciprocating wings, blades, or plungers, by which fuel is pushed, in substantially one direction only, into a furnace.

I claim as my invention and desire to secure by Letters Patent:—

1. In a mechanical stoker, the combination of a receptacle into which fuel is deliverable, a fuel carrying and throwing shovel adapted to traverse in said receptacle, between positions in rear and in front, respectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, and power actuated means for imparting horizontally swinging movements to said shovel.

2. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of a fuel carrying and throwing shovel mounted on a vertical shaft and having a horizontal swinging movement for projecting the fuel through the opening and distributing the same over the furnace grate, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse.

3. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of means for depositing fuel upon the receptacle, and a horizontally swinging fuel carrying and throwing shovel for scraping up and carrying the fuel and projecting it through the opening into the furnace.

4. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of a fuel carrying and throwing shovel mounted on a

vertical shaft and adapted to pick up the fuel and swing horizontally through said opening to project the fuel over the grate.

5. In a mechanical stoker, the combination with a receptacle adapted to communicate with a furnace opening, of a fuel carrying and throwing shovel having a horizontal inward and outward swinging movement for picking up and projecting the fuel through said opening, and mechanism for turning said shovel rapidly through its outward traverse and more slowly through its inward traverse.

6. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of a fuel carrying and throwing shovel mounted in said receptacle and having a horizontal swinging movement forwardly and backwardly through said opening for picking up and projecting the fuel over the furnace grate.

7. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of a fuel carrying and throwing shovel in said receptacle mounted on a vertical shaft and having a backward and forward horizontally swinging movement for picking up and projecting the fuel through said opening, and means for automatically depositing a charge of fuel within the receptacle after each backward traverse of the shovel.

8. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of two fuel carrying and throwing shovels mounted on vertical shafts at opposite sides of the receptacle, and having horizontal swinging movements through said opening and toward opposite sides of the furnace for picking up and distributing the fuel over the grate.

9. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of two fuel carrying and throwing shovels mounted on vertical shafts in said receptacle, said shovels being adapted to pick up and carry charges of fuel in their forward traverses, and means for imparting horizontal swinging movements to said shovels alternately.

10. In a mechanical stoker, the combination with a fuel receptacle adapted to communicate with a furnace opening, of two fuel carrying and throwing shovels mounted on vertical shafts in said receptacle, said shovels being adapted to pick up and carry charges of fuel in their forward traverses, mechanism for imparting horizontal swinging movements to said shovels alternately, a portion of the receptacle being common to the traverse of each shovel, and means for depositing successive charges of fuel at said portion of the receptacle.

11. In a mechanical stoker, the combina-

tion of a receptacle into which fuel is deliverable, a fuel carrying and throwing shovel adapted to traverse in said receptacle, between positions in rear and in front, respectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor, and intermediate mechanism, actuated by said motor, for horizontally swinging said shovel in alternately opposite directions, across the avenue of fuel delivery.

12. In a mechanical stoker, the combination of a receptacle into which fuel is deliverable, a fuel carrying and throwing shovel adapted to traverse in said receptacle between positions in rear and in front, respectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, and power actuated means for horizontally swinging said shovel, in alternately opposite directions, and at alternately higher and lower speeds, across the avenue of fuel delivery.

13. In a mechanical stoker, the combination of a receptacle into which fuel is deliverable, a fuel carrying and throwing shovel adapted to traverse in said receptacle, between positions in rear and in front, respectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor, imparting horizontally swinging movement to said shovel from rear to front, across the avenue of fuel delivery, and a fluid pressure motor imparting swinging movement to said shovel, at lower speed, from front to rear, across the avenue of fuel delivery.

14. In a mechanical stoker, the combination of a receptacle into which fuel is deliverable, a fuel carrying and throwing shovel adapted to traverse in said receptacle, between positions in rear and in front, respectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor imparting horizontally swinging movement to said shovel, from rear to front, across the avenue of fuel delivery, and a fluid pressure motor controlling the movements of said first specified motor and imparting swinging movement to said shovel from front to rear, across the avenue of fuel delivery.

15. In a mechanical stoker, the combination of means for supplying fuel to a locomotive, means for elevating the supplied fuel to a level proper for firing, a receptacle into which fuel is delivered by said elevating means, a fuel carrying and throwing shovel adapted to traverse in said receptacle, between positions in rear and in front, re-

spectively, of the avenue of fuel delivery thereto, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, and power actuated means for imparting horizontally swinging movements to said shovel.

16. In a mechanical stoker, the combination of means for supplying fuel to a locomotive, means for elevating the supplied fuel to a level proper for firing, a receptacle into which fuel is delivered by said elevating means, a fuel carrying and throwing shovel adapted to swing horizontally in said receptacle, between positions in rear and in front, respectively, of the avenue of fuel delivery, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor, and intermediate mechanism, controlled by said motor, for effecting the feeding and return traverses of said shovel at relatively higher and lower speeds.

17. In a mechanical stoker, the combination of a fuel receptacle adapted to communicate with a furnace opening, a horizontally swinging fuel carrying and throwing shovel mounted in said receptacle for projecting the fuel through said opening, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor for swinging said shovel through its outward traverse, another motor and connecting mechanism for swinging said shovel through its return traverse, and valve means operated by said second motor for controlling the supply of fluid to the first motor.

18. In a mechanical stoker, the combination of a fuel hopper on the locomotive, a conveyer casing discharging into said hopper and extending beneath the fuel space on the tender, a conveyer mounted in said casing, an elevator for raising the fuel from said hopper to the level for firing, a horizontally swinging fuel carrying and throwing shovel for projecting the fuel into the furnace, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, and power mechanism for operating the conveyer, elevator and shovel.

19. In a mechanical stoker, the combination of a fuel receptacle adapted to communicate with a furnace opening, a horizontally swinging fuel carrying and throwing shovel mounted in said receptacle for projecting the fuel through said opening, said shovel being adapted to pick up and carry a charge of fuel in its forward traverse, a fluid pressure motor for actuating said shovel, and an exhaust connection from said motor discharging into the receptacle adjacent to the shovel shaft.

20. In a mechanical stoker, the combination of a fuel receptacle adapted to commu-

5 nicate with a furnace opening, and a horizontally swinging shovel having a transversely bent blade for picking up, carrying, and projecting fuel from the receptacle into the furnace opening.

21. In a mechanical stoker, the combination of a fuel receptacle adapted to communicate with a furnace opening, and a shovel mounted in said receptacle and adapted to

swing horizontally through the furnace opening, said shovel having a transversely bent and longitudinally curved blade for picking up, carrying, and projecting the fuel.

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Witnesses:

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EMILY L. MYERS.