

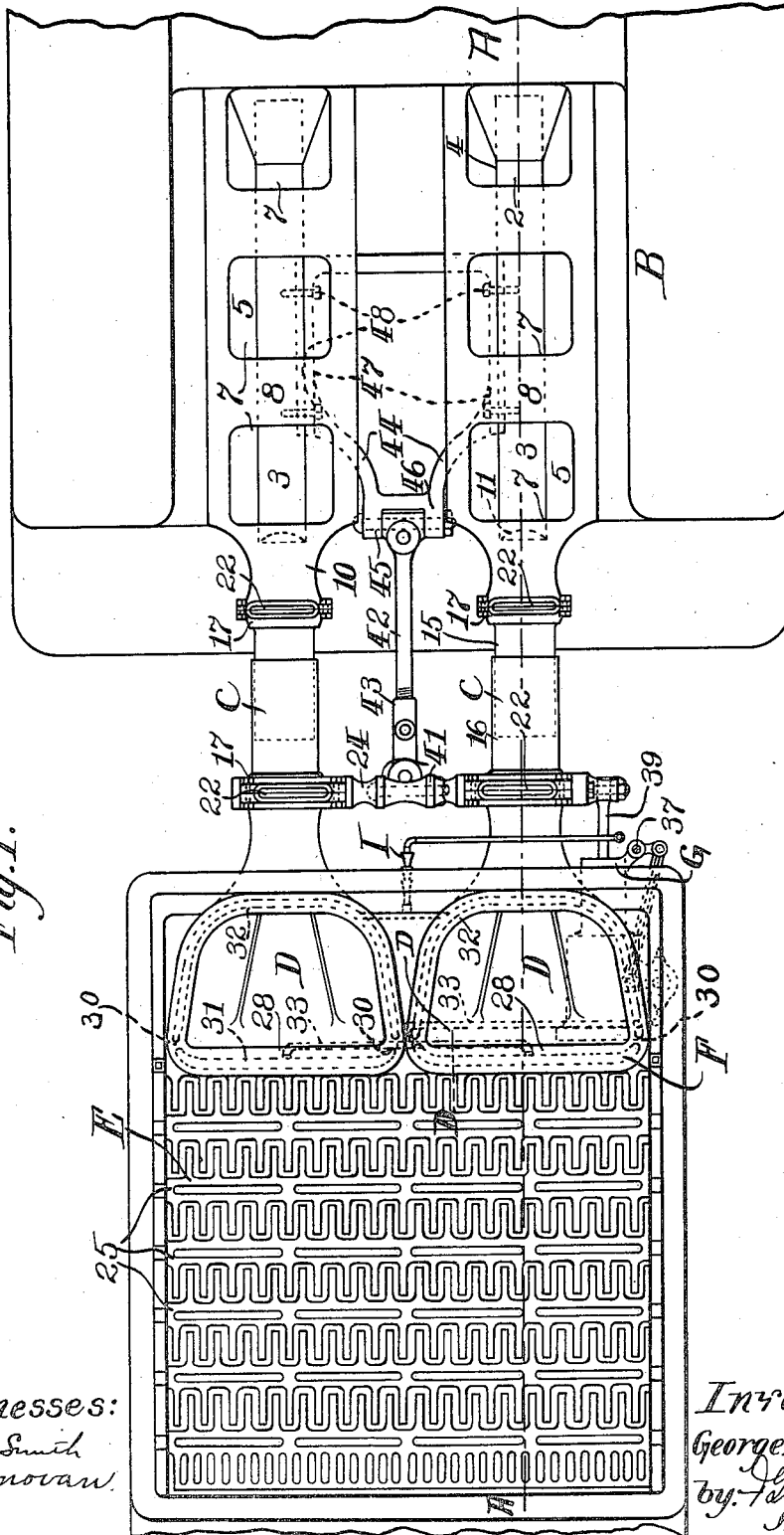
1,017,170.

G. B. RAIT.
MECHANICAL STOKER.
APPLICATION FILED JULY 29, 1910.

Patented Feb. 13, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



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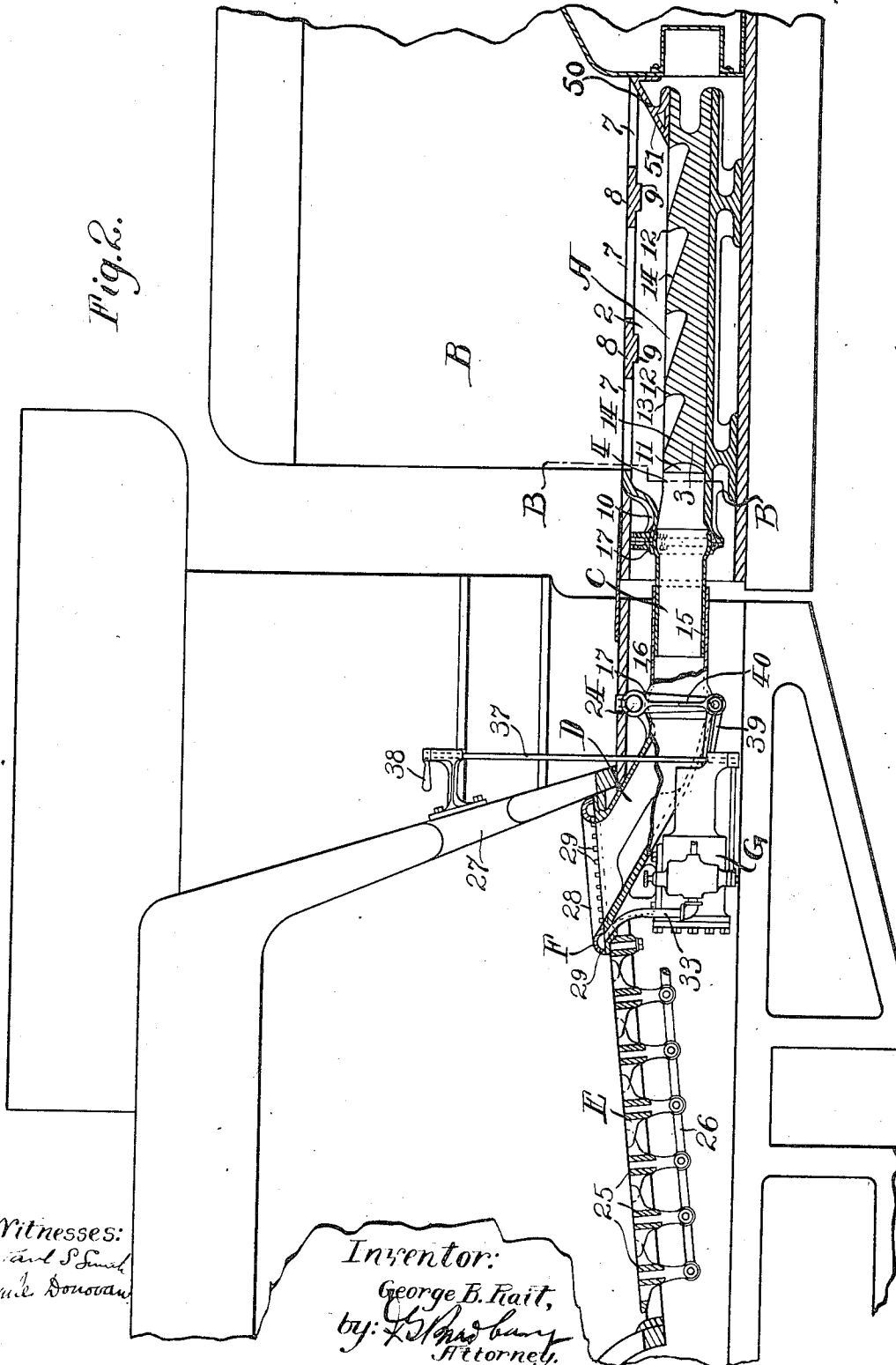
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4 SHEETS—SHEET 2.

Fig. 2.



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Fig. 3.

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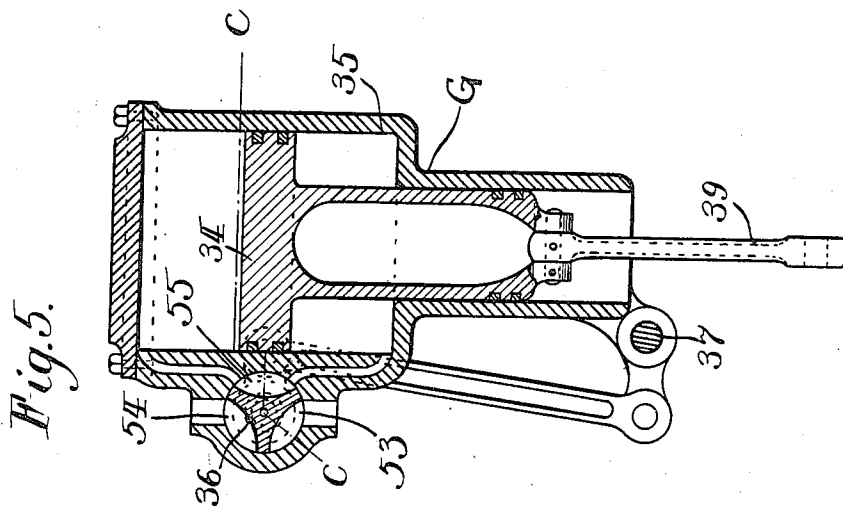
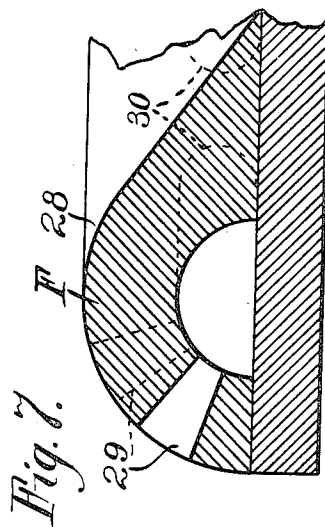
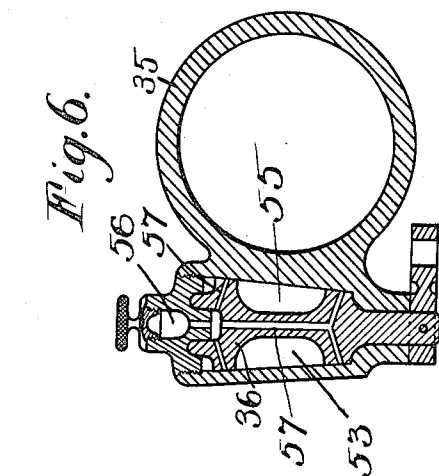
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

GEORGE B. RAIT, OF MINNEAPOLIS, MINNESOTA.

MECHANICAL STOKER.

1,017,170.

Specification of Letters Patent.

Patented Feb. 13, 1912.

Application filed July 29, 1910. Serial No. 574,463.

To all whom it may concern:

Be it known that I, GEORGE B. RAIT, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented a new and useful Improvement in Mechanical Stokers, of which the following is a specification.

My invention relates to improvements in mechanical stokers and the application of mechanical stoking to railway locomotives.

My principal objects in this invention are to improve the regularity and efficiency of the charging mechanism, to secure a better distribution of the fuel upon the fire grate and to improve the flexible conductors connecting the engine and tender. These results are secured without complicating my device.

This application is an improvement upon the mechanism set forth in my companion application Serial Number 518,971, filed on September 22nd, 1909, for improvement in locomotives.

In the drawings with which I have illustrated my invention and which form part of my specification, Figure 1 is a plan view of my device in connection with the framework of an engine and tender; Fig. 2 is a section on the line A—A, Fig. 1; Fig. 3 is an enlarged detail of a section on the line B—B, Fig. 2; Fig. 4 is a sectional elevation of my flexible conveying tube showing its connection to the adjacent parts; Fig. 5 is a sectional view of the engine which I use in operating my device; Fig. 6 is a section on the line C—C, Fig. 5, and Fig. 7 is a partial section on the line D—D, Fig. 1.

My device consists in general of a charging mechanism A which delivers fuel from the tender B to a flexible conveying tube C lying between the tender and engine, an expanded tube or coking chamber D which receives the fuel from the flexible conveyer, a grate E on which the fuel is distributed, and the blowing mechanism F for distributing the fuel on the grate. An engine G driven by steam from the locomotive boiler, operates the charging mechanism.

The charging mechanism A, consists of an elongated hopper chamber 2 sunk in the platform of the tender and having a plunger 3 reciprocating in a cylindrical groove 4 in its bottom. The hopper 2 has sloping lateral walls 5 and a top or cover 6 flush with

the platform of the tender. In this cover 6 are a series of rectangular openings 7 permitting the fuel from the tender to drop through into the path of the reciprocating plunger 3. These openings are sufficiently large to receive coal of the ordinary size and are separated by bridges 8 having reinforcing bars 9 lying underneath them. The edges of the bridges 8 and of the reinforcing bars 9 beneath them, are formed with sharp corners adapting them to crush the coal forced against them by the plunger 3. At its forward end 10, the hopper chamber 2 is reduced to a tubular form, connecting to the flexible conveying tube. At its rearward end the wall of the chamber is formed with a lug 50 having an inclined upper surface 51. This lug acts as a guide for the rear portion of the plunger and fitting down closely upon it prevents the fuel from working back behind the plunger. The forward end 11 of the plunger 3 is slightly hollowed, fitting it to engage the fuel in front of and above the plunger and carry it forward during its stroke.

The upper portion of the plunger 3 lying above the groove 4 in the hopper chamber, is divided by depressions into a series of forwardly pointing teeth 12 which have abrupt front faces, sharp edges 13 and gradually sloping back faces 14.

The series of depression and forwardly pointing teeth 12 in the top of the plunger, form a conveyer adapted to gradually advance the fuel received at any point in the hopper chamber until it drops down in front of the plunger and is forced forward through the flexible conveying tubes C to the engine. The advancement of the fuel is accomplished by the teeth of the plunger during its forward stroke by means of their abrupt front faces engaging the particles and lumps of fuel and moving them toward the front of the hopper chamber. As the plunger reverses its motion, the lumps of fuel thus moved forward encounter the resistance of the fuel lying above them and wedged against the bridges of the hopper chamber and remain substantially in the position they have reached, allowing the sloping faces 14 of the teeth 12 of the plunger to move out from beneath them until its reverse stroke is completed, when a new forward movement of the fuel may take place by operating the plunger. In this

way the fuel is moved forward step by step from all parts of the hopper chamber. When lumps of fuel too large to be accommodated by the hopper chamber, drop into one of the openings 7 in its cover, their lower edges are caught by the advancing teeth of the plunger and crushed between the sharp edges of the teeth and the sharp corners on the bridges 8 and their reinforcing bars. This crushing action will be repeated with each forward motion of the plunger until the refractory lumps are reduced to suitable dimensions. If the supply of fuel from one of the openings 7 is temporarily checked by this crushing process, the other openings will afford a more than sufficient supply. In this way a constant stream of uniform fuel is moved forward into the flexible conveying tubes C. The reciprocating movement of the plungers is secured by the drive engine G operating through suitable mechanism which will be described later in detail.

The form of the plunger may vary so long as it preserves the feature of a series of forwardly projecting teeth having depressions between them together with abrupt faces and sloping backs. Thus a plunger of rectangular cross-section, continuous lateral sides, and transverse teeth as described, would be within the meaning of this specification.

The tubes C afford a flexible conveying means between the tender and engine taking up slack motion and changes in elevation in the parts of the locomotive. My device designed for this purpose consists of two telescoping tubes 15 and 16 each joined to its respective part of the stoker, by a spherical joint 17 allowing universal angular motion. The spherical joint at the tender end of the tube C consists of a cup like enlargement 18 of the tubular end of the hopper chamber into which fits the partly spherical shell 19 at the end of the telescoping tube. Over this part of the tube fits a ring 20 having a spherical inner face, and bolts 21 joining it to the cup 18, by means of which a tight joint is made between the cup and the spherical end of the tube. The spherical shape of these adjacent parts permits the movement of the tube in all directions through a considerable angle, and its backward end has a beveled edge 52 lying behind the shoulder of the cup 18 in all positions of the tube C thus preventing the forcing of particles of fuel between the edges of the shell 19 and the cup 18. Between the edge of the cup and the flange of the ring, an oil cup 22 is formed admitting oil to the joint between the two parts and thus lubricating the spherical joint. The spherical joint 17 at the engine end of the tube C is similar to that at the tender end but the flanges of the cup and ring forming the exterior of the joint, also form a split bearing 23 for the

rocker shaft 24 through which the plungers of the charging mechanism are operated. By the combined action of the two spherical joints and the telescoping joint between the two parts of the tube, the tube C is accommodated to any possible motion between the tender and engine frames.

The forward end of the tube C opens into a tubular chamber continuous with the coking chamber D. The chamber D lies below the level of the fire grate E and slopes upward to the rear end of the grate, forming an underfeed chamber in which the fuel is gradually brought to the temperature of the fire grate, and in which the light gases of the fuel are driven off, allowing them to be consumed by the incandescent material lying above upon the fire grate E. As the fuel is advanced by the charging mechanism, it rises above the coking chamber in the form of a mound from which it is distributed to the grate by a mechanism F which will be described in detail later.

The grate E used in connection with my improved device, is of the ordinary finger bar type made up of a series of grate bars 25 lying transversely of the engine, having interlocking fingers supporting the fire, and fitted with a rock bar 26 by which they can be oscillated at pleasure through a small arc. The grate is inclined forward and supported on the engine frame in the usual manner. A fire door 27 is provided of the usual type and the entire locomotive is adapted to hand stoking in case the mechanical stoker fails to operate at any time.

The distribution of the fuel over the grate is accomplished by a blower F connected to the rim of the coking chamber D and immediately above the level of the grate at that point. It consists of a blowing ring 28 surrounding the opening of the coking chamber D and having a number of twyer openings 29 directed upward and forward to which blasts of steam and air are supplied for the purpose of blowing the partially coked fuel forward upon the grate and to air in the combustion of the mass of fuel in the chamber D. Partitions 30 divide the blowing ring into forward and rear segments 31 and 32 respectively. The forward segment is supplied with exhaust steam through the pipe 33 from the engine G which operates the charging mechanism. In this segment of the ring, the twyer openings 29 are directed partly upward and partly forward and the blast through them distributes the fuel particles uniformly over the surface of the grate. The rear segment of the ring is supplied with live steam direct from the boiler of the locomotive passing through a pipe and air injector I and thence to the ring. The air injector may be of any suitable form introducing a mixture of live steam and air into the mass of partly coked

coal. The twyer openings 29 in this part of the ring are directed forward aiding in the combustion of the smoke gases and in the distribution of the fuel supplied through the rear portion of the coking chamber. The entire arrangement of the twyer openings and their blast supplies is fitted to distribute the partially coked fuel uniformly over the fire grate, to consume as far as possible the smoke gases arising from the coking process and to drive these gases forward through the incandescent fuel upon the fire grate for their further combustion, thus producing complete and uniform consumption of the fuel, with the most intense heat near the boiler and a minimum of resultant smoke.

The engine G which operates the reciprocating plungers 3 of the charging mechanism A and supplies exhaust steam to the blowing rings 28, consists of a differential piston 34 working in a horizontal cylinder 35 attached to the chamber D and has a three-way valve 36 operated by a valve rod 37 and a hand lever 38 situated near the fireman's seat, by means of which the charging mechanism A can be operated at pleasure by the fireman. The three-way valve 36 has a live steam port 53, an exhaust port 54 and a by-pass 55. A grease cup 56 and passages 57 provide for the lubrication of the valve. A connecting rod 39 is pivoted upon the piston and connects with the crank 40 and rock-shaft 24 on which a bell crank 41 is mounted. To the head of this bell crank is pivoted a connecting rod 42 having a swivel joint 43 and attached to a drive yoke 44 by a universal joint 45. This combination of pivot and threaded joints allows complete flexibility between the engine and tender frames, without interfering with the operation of the drive yoke. The drive yoke 44 is illustrated in connection with two stoking units lying side by side and delivering fuel to the two lateral sides of the fire grate. The drive yoke is formed with a body 46 and two arms 47, each attached to a plunger by a tenon mortised into the side of the plunger and fastened by two stud bolts 48. The arms slide in guide slots 49 in the side of the hopper chamber.

When the fireman of the locomotive has supplied fuel for the charging mechanism, he turns the hand lever 38 supplying steam to the engine G and causing the forward movement of the plunger 3. Reversing the hand lever retracts the plunger and this process is kept up as long and frequently as the coal supply on the grate requires.

In accordance with the patent statutes I have described the principles of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof but I desire to have it understood that the construction shown is only illustrative and that the invention can

be carried out by other means and applied to uses other than those above set forth within the scope of the following claims.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:—

1. In a mechanical stoking device, a reciprocating plunger, a series of forwardly pointing transverse teeth on said plunger adapted to engage and move forward fuel lodged on said teeth, a transverse bar above said teeth having a sharp rearward corner adapted to coöperate with said teeth, and means for operating said plunger, whereby lumps of fuel fed to the stoker are adapted to be crushed between said teeth and bar and to be advanced by the succeeding teeth of said plunger.

2. In a mechanical stoker, an elongated hopper chamber having a grooved bottom and bridges across its top dividing the top into a series of openings having sharp corners, a plunger reciprocating in said groove, a plurality of forwardly pointing teeth on said plunger adapted to coöperate with the sharp corners of said bridges in breaking up lumps of coal caught between them, and means for actuating said plunger.

3. A mechanical stoker for locomotives, comprising, in combination, a tender, a fire grate for said locomotive, a charging mechanism on the tender, an underfeed coking chamber below the firegrate of said locomotive, and a flexible tubular connection from said charging mechanism to said coking chamber, the charging mechanism being formed with a reciprocating plunger adapted to advance fuel from the tender through said flexible connection and coking chamber to said grate, a twyer element lying at the rear of the opening of said coking chamber on the grate and having openings directed forward across said chamber opening, a second twyer element lying at the front of said chamber opening and having blast openings directed upward and forward across the grate, and means for supplying live steam and air to said rear twyer and exhaust steam to said front twyer, whereby the draft and the combustion of gases in said coking chamber may be promoted and the fuel advanced along the grate.

4. In a mechanical stoker for locomotives, an underfeed coking chamber opening into said locomotive, a force feed of fuel connected thereto, a segmental twyer ring in connection with said coking chamber, having a segment lying to the rear of the opening of said coking chamber and adapted to pass a constituent into the fuel coking therein to promote combustion, and a second segment lying in front of the opening of said coking chamber and adapted to supply a distributing blast for the distribution of the coked fuel within said locomotive.

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5. In a mechanical stoker for locomotives,
an engine, a fuel distributor thereon, a
tender, an elongated hopper chamber there-
on, having a grooved bottom, a bridge across
5 said chamber having a sharp corner, a plun-
ger reciprocating in said groove, a plurality
of forwardly pointing teeth on said plunger
adapted to cooperate with said sharp corner
on said bridge in breaking lumps of fuel, a
10 tube connecting said hopper chamber and
said fuel distributor, a universal joint inter-

posed in said tube between its ends, and
means for operating said plunger and said
distributor.

In testimony whereof, I have signed my 15
name to this specification, in the presence of
two subscribing witnesses.

GEORGE B. RAIT.

Witnesses:

GUSTAVUS LOEVINGER,
F. G. BRADBURY.