G. B. RAIT.

MECHANICAL STOKER.

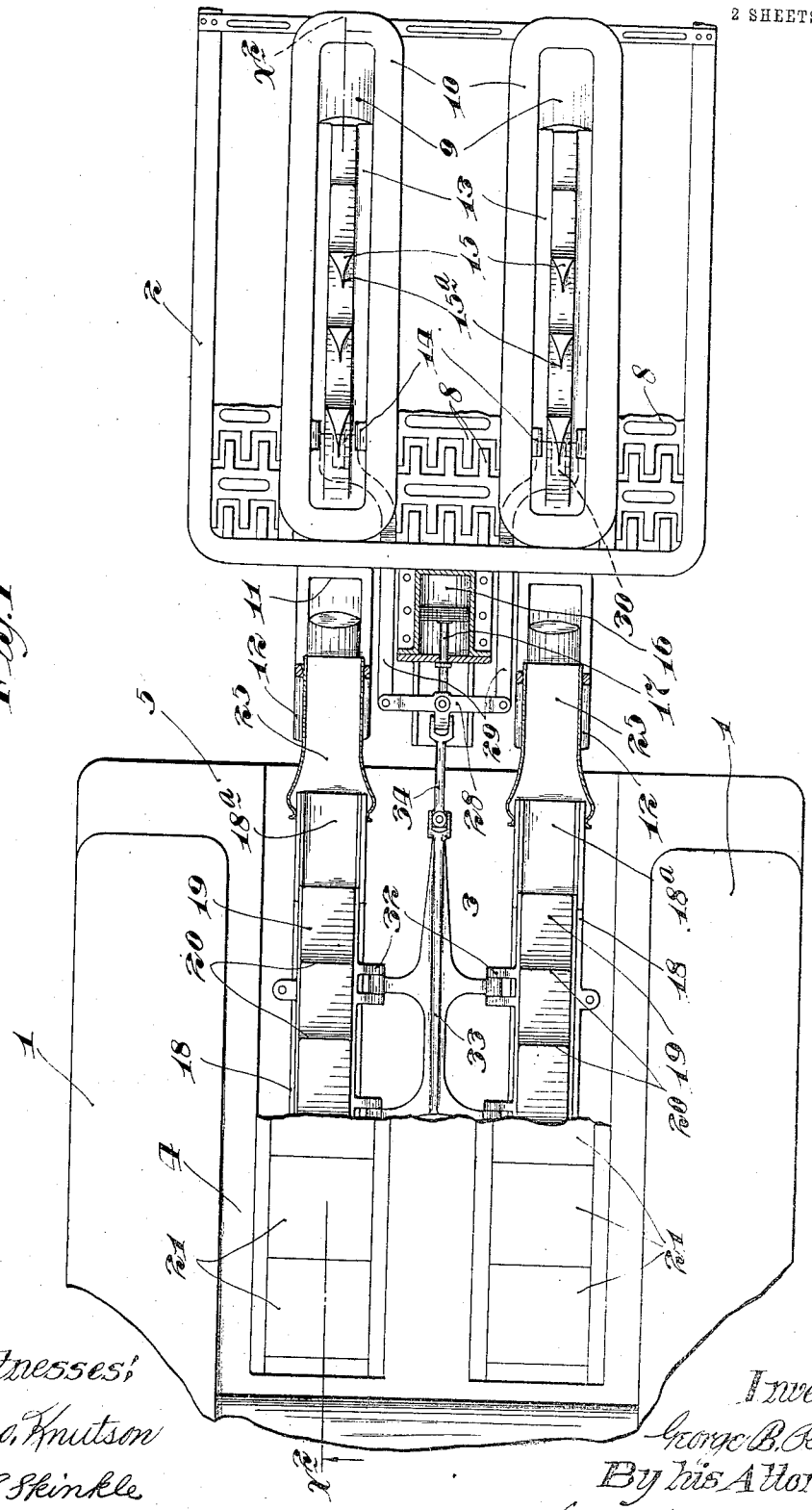
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1,085,630.

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2 SHEETS—SHEET 1.

Fig. 1



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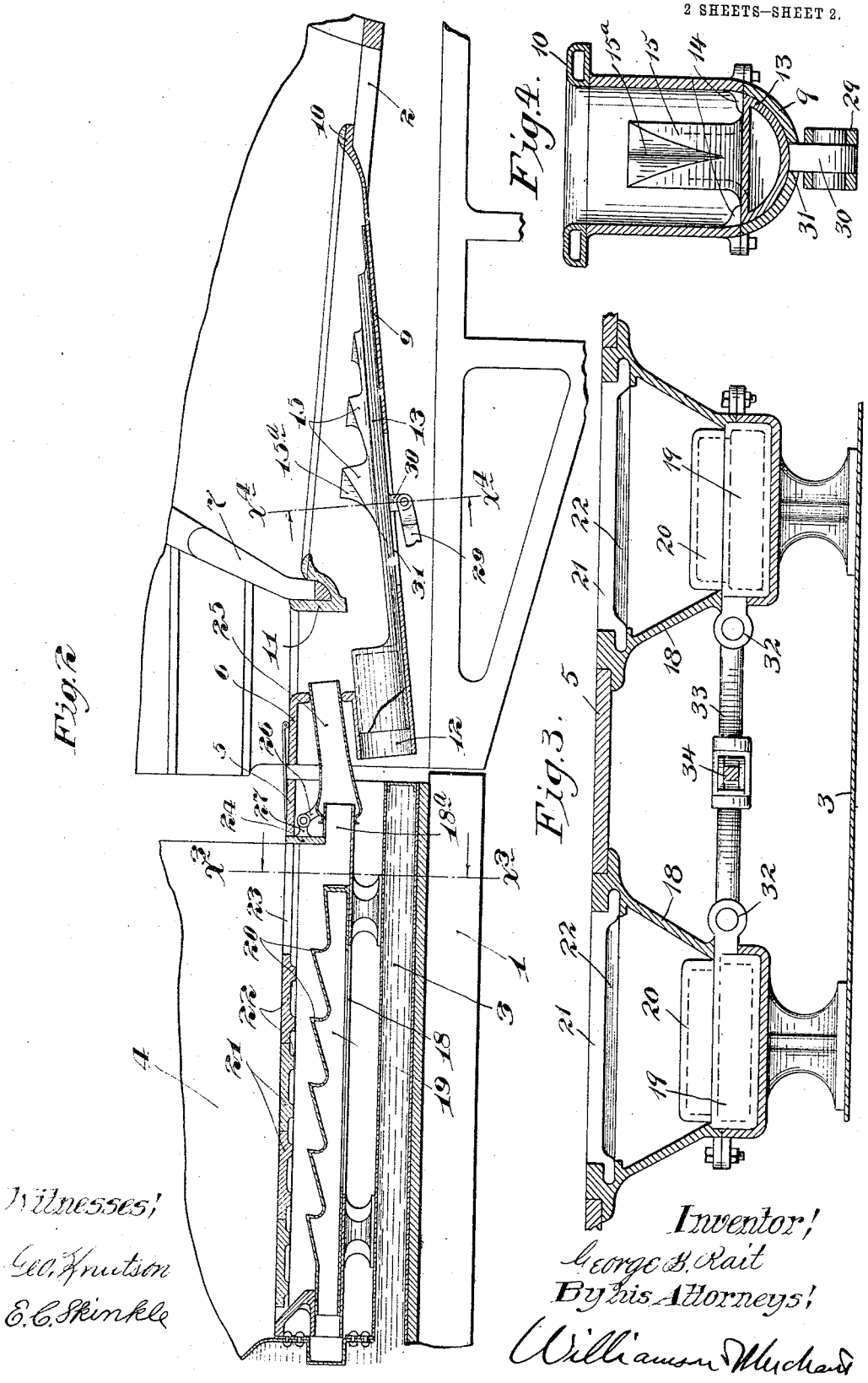


Fig. 2

Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE.

GEORGE B. RAIT, OF MINNEAPOLIS, MINNESOTA.

MECHANICAL STOKER.

1,085,630. Specification of Letters Patent. Patented Feb. 3, 1914.

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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 certain new and useful Improvements in Mechanical Stokers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to provide an improved underfed mechanical stoker, and to such ends, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

The invention involves certain novel features adapted for use in mechanical stokers for stationary, as well as for locomotive and other portable boilers, but it involves other novel features which are especially adapted for use in connection with locomotive boilers.

In many respects, the present invention may be treated as an improvement on the stoker disclosed and claimed in my prior Patent No. 1,017,170, of date, February 13th, 1912, but the present invention modifies and improves the device disclosed in the said prior patent, especially in point of an improved action in the so-called charging mechanism, and also in the delivery mechanism, which latter device effects a more positive and better distribution of the fuel on the grate.

In the accompanying drawings which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a view partly in plan, partly in horizontal section and partly in diagram, some parts being illustrated and some parts being broken away, showing the invention applied, as already indicated, for delivery of coal from the tender to the grates of a locomotive; Fig. 2 is a vertical section taken approximately on the line x^2 x^2 on Fig. 1, some parts being broken away; Fig. 3 is a transverse section taken approximately on the line x^3 x^3 on Fig. 2; and Fig. 4 is a transverse section taken approximately on the line x^4 x^4 on Fig. 2.

The numerals 1 and 2, respectively, indicate the engine tender and the walls of the fire box of the locomotive, which parts are indicated diagrammatically.

The numeral 3 indicates the water bottom, the numeral 4 the coal space, and the numeral 5 the deck of the tender. The tender deck 5, as usual, approximately alines with the cab deck 6 of the locomotive.

The numeral 7 indicates the rear water space or leg of the locomotive fire box, and the numeral 8 indicates the fire box grates which may be of the usual or any suitable construction.

So far as the broad features of my invention are concerned, the coal may be delivered up through the bottom of the grates through one or more delivery conduits, but I have shown, and prefer the use of two such delivery conduits with their associated or cooperating devices. In applying this duplex feed device, I deliver the coal up through the grates, through two laterally spaced so-called delivery troughs 9 that are nearly as long as the grates, have rearwardly inclined bottoms and terminate in flanged upper edges 10 that overlie the grates at their sides and rear end, and at their front end, abut against the front water leg 7. Just at the rear of the said water leg 7, these delivery troughs 9 are formed with upwardly extended receiving hoppers 11 that preferably open through the floor of the engine cab, but are adapted to be closed, when desired, by any suitable cover plates, not shown. The bottoms of the troughs 9 are formed with sleeve-like plunger guides 12 that extend rearward of the hoppers 11.

Working within each delivery trough 9 is a so-called delivery bar or plunger 13. The rear ends of these delivery bars 13 are preferably made cylindrical and work in the sleeves 12, but the bottom portions thereof are made approximately semi-cylindrical, as best shown in Fig. 4, and their flat upper edges underlie guide ribs 14, formed on the inner walls of the troughs 9. On their upper faces, the said delivery bars are formed with ratchet-like teeth or feed lugs 15 which progressively decrease in height and size in a direction from the rear toward the front ends of the grates. This is done for an important purpose, to-wit, the first tooth at the rear must, as is evident, feed all of the coal which is delivered to the grate through the corresponding delivery trough, while the second tooth from the rear will handle con-

siderably less coal, but must pass the coal onto the teeth farther in front. Thus, it will be seen that less and less work is required of each tooth from the rear toward the front, so that the last tooth will feed only a light amount required to be supplied at the front portion of the grate. By proper proportioning of these several teeth, the desired graduated delivery of coal longitudinally of the grates is accomplished in a very simple and efficient way. The coal forced upward by the teeth or lugs of the delivery bars 13 will be crowded over the rims 10 onto the grates, but partial combustion takes place before the coal reaches the grates, and will be finished on the grate. Otherwise stated, a sort of coking action takes place in the delivery troughs, and the combustion of coked coal will be completed on the grates. This is a desired action because it tends first to burn the gases and then completes the combustion without producing smoke. Hitherto, coal has been delivered up through the bottom of the grate by the action of reciprocating plungers, but so far as I am aware, a single plunger with a plurality of graduated teeth having differential feeding actions, is a broadly new feature, and, in fact, I am not aware that any single delivery plunger has hitherto been provided with a plurality of delivery teeth of any character. The highly important features are, however, the delivery trough with rearwardly inclined bottom and the delivery bar or plunger with teeth or feed lugs decreasing in size from the rear toward the front end of the fire box and grate. Also, it is highly important that these teeth or feed lugs have a sort of a ratchet-like action, so that they will positively feed or deliver coal upward and forward on the grate, but will slip or escape under the coal when retracted or moved rearward. These ratchet-like teeth, however, in some instances, will be provided on their rear inclined faces with plow-shaped tips 15ª which, under rearward movement of the delivery bar, will simply crowd the coal laterally and spread the same. Reciprocating movements are imparted, preferably, simultaneously, to the two delivery bars 13, from a cylinder and piston engine 16—17 suitably mounted under the deck of the engine.

The coal is delivered to the lower rearward ends of the delivery troughs 9 through the hoppers 11 thereof, and it may be here stated, that the mechanism so far described, is adapted for use, either in connection with a locomotive or with a stationary engine. In both instances, however, the so-called delivery bar delivers the coal to the grates by a forward and upward movement, and its teeth are cleared from the coal under the retracting or return movement, by a downward and rearward receding movement. This gives the most positive kind of delivery and is the surest way of obtaining a clearing action in the return movement.

In the locomotive type of structure, I provide on the tender a so-called charging mechanism which is much on the lines of that disclosed and claimed in my said prior patent, but which involves certain important improvements thereon, and which will now be described in its preferred and illustrated form.

Set into the floor of the tender and depending therefrom and resting on the water bottom 3 is a pair of parallel longitudinally extended so-called charging hoppers 18, the bottoms of which are preferably rectangular, and in which work so-called charging plungers 19, preferably also of rectangular cross-section. Also, the said plungers 19 are preferably made hollow. On their upper faces, the said plungers 19 are formed with ratchet-like teeth 20, the faces of which are preferably flat and project above the rectangular bodies of the said plungers and up into the flaring portions of the said hoppers 18.

As an important feature of the present invention, the charging hoppers 18 are provided with a cover made up of sliding sections 21, held for longitudinal movements in grooves formed in the sides of the upper portions of the said hoppers. These sliding cover sections 21, on their under surfaces, are provided with shearing ribs 22 which perform an important function, presently to be noted. In number, the said cover plates 21 are less than sufficient to completely close the tops of the said hoppers. In Fig. 2, the said cover plates are shown adjusted for an initial feeding action, that is, are in the position in which they would stand when commencing to feed from the fuel or coal in the tender, and when thus positioned, there is an opening 23 between the front cover plate and a depending stop flange or plate 24, formed on the upper front portion of the hopper 18. The extreme front end of each hopper 18 terminates in a tubular delivery end 18ª which may be either rectangular or round and is telescoped into a flexibly connected spout 25 telescoped over the same and projected into the coöperating hopper 11 of the corresponding delivery trough 9. This spout 25, as shown, is provided with a lug 26 pivoted to a lug 27 on the stop plate 24. The said flexible tubes 25, as is evident, permit the relative movements of the engine tender in respect to each other.

Both of the so-called delivery bars 13 and both of the so-called charging plungers 19 are simultaneously reciprocated from the same engine 16—17, and, as shown, this is accomplished through the following connections: A cross head 28 is connected to the rod of the piston 17 and the projecting ends

thereof are connected by links 29 to lugs 30 that depend from the respective delivery bars 13 and work through slots 31 in the bottoms of the delivery troughs 9. The charging plungers 19 are provided with laterally projecting lugs 32 that work through slots in the inner sides of the hoppers 18 and are connected to a coupling yoke 33 which, in turn, is connected by a rod 34 to the cross head 28 of the engine piston. The engine 16—17 may be of any suitable construction and may be controlled in any suitable way, as, for instance, by the means disclosed in my said prior patent.

As already stated, the feeding action is begun when the cover plates 21 of the charging hoppers are forced rearward, as shown in Fig. 2. Under the repeated reciprocatory movements of the charging plungers 19, the coal which falls through the openings 23 will fall in front of the front ends of the said plungers and will be thereby directly forced into the spouts 25, and from thence, through the hoppers 11 into the delivery troughs 9. Larger particles of coal caught by the forward teeth of the said plungers will be forced forward against the stop plate 24 and will be crushed into such size that it will fall in front of the plunger when the latter has made a return or changed movement. When, by this action, all the coal has been fed to the fire box that will readily fall through the opening 23, the first cover plate 21 will be drawn forward against the stop plate 24, and this has the effect of shifting the opening 23 farther rearward, and under the reciprocating movements of the plungers which follow, the teeth thereof will engage the coal and force such thereof as is properly crushed, forward until it falls in front of the plungers. Any chunks of coal too large to be fed, as stated, will, by the teeth of the plungers, be forced against the shearer ribs 22 of the forward cover plate 21, and will be crushed and reduced to the proper size for subsequent feeding action. From time to time, as the coal is fed from the tender, the successive cover plates will be moved forward, one after the other, so as to shift the opening 23 farther and farther rearward, and each forwardly shifted cover plate, in succession, stands in a position for coöperation with the teeth and the prongs to crush such coal as is too large to be fed forward by the plungers. This improved action is highly important. It gives the most natural kind of feeding action and eliminates all danger of bridging off the coal and leaves the feed openings always in view of the fireman and where, if, in extreme cases, large chunks of coal should not be properly handled by the feed plungers, they may be easily broken with a coal pick. In this improved action, it is necessary not only that the cover plates be movable, but they should be shiftable or forwardly and rearwardly adjustable while held in working position, or in other words, so held that they cannot be raised from working position by a crowding action of coal thereunder, produced by the teeth of the charging plungers. Cover plates loosely laid over the plungers and capable of being lifted would not, therefore, do the work. Furthermore, the shearing ribs on the under surfaces of the cover plates are very important. Obviously, the cover plates 21, while longitudinally adjustable in their grooves or guides, are positively held down so that they cannot lift under the crowding action of the coal between the same and the plungers.

The coal delivered into the hoppers 11 of the delivery troughs 9 will be fed forward and up through the bottoms of the grates in a manner already clearly described.

What I claim is:

1. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging member working in said hopper, and a hopper cover made up of sections, mounted for sliding movements but held in working position and against rising movements, for coöperation with the teeth of said charging member to crush the coal, the said sections covering only a portion of the hopper so as to form a fuel delivery passage and being movable in succession to shift the delivery passage from said fuel receptacle into said hopper.

2. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging member working in said hopper, and a hopper cover made up of sections, mounted for sliding movements but held in working position and against rising movements, for coöperation with the teeth of said charging member, the said sections being movable in succession to shift the delivery passage from said fuel receptacle into said hopper, and having shearing ribs on their undersides, coöperating with the teeth of said charging member to crush lumps of coal of excessive size.

3. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging plunger working in said hopper, and a hopper cover made up of sections held against rising movement but mounted for sliding movements in longitudinal grooves formed in the upper side portions of said hopper, which cover sections cover only a portion of said hopper, cooperate with the teeth of said plunger and crush the coal, and are movable in succession to shift the delivery passage from said fuel receptacle into said hopper.

4. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging member working in said hopper, and a hopper cover made up of sections that cover only a portion of said hopper, mounted for sliding movements but held in working position and against rising movements, for coöperation with the teeth of said charging member to crush the coal, the said sections being movable in succession to shift the delivery passage from said fuel receptacle into said hopper, and the said hopper, at its front end portion having a stop flange located above the delivery end of said plunger and against which the front cover section is adapted to be moved.

5. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging member working in said hopper, and a hopper cover made up of sections, mounted for sliding movements but held in working position and against rising movements, for coöperation with the teeth of said charging member, the said sections being movable in succession to shift the delivery passage from said fuel receptacle into said hopper, the teeth of said plunger having flat faces and the said cover sections having shearing ribs on their undersides, coöperating with the teeth of said charging member to crush lumps of coal of excessive size.

6. In a mechanical stoker, the combination with a fuel receptacle and a charging hopper at the bottom thereof, of a toothed charging member working in said hopper, and a hopper cover made up of sections, mounted for sliding movements but held in working position and against rising movements, for coöperation with the teeth of said charging member, the said sections being movable in succession to shift the delivery passage from said fuel receptacle into said hopper, and the said hopper, at its front end portion having a stop flange located above the delivery end of said plunger and against which the front cover section is adapted to be moved, the teeth of said plunger having flat faces and the said cover sections having shearing ribs on their undersides, coöperating with the teeth of said charging member to crush lumps of coal of excessive size.

7. The combination with a locomotive and tender, of a charging hopper in the bottom of the fuel chamber of said tender, said hopper having a cover made up of sections that cover only a portion of said hopper, mounted for sliding movements but held in working position and against rising movements, a toothed reciprocating charging plunger working in said hopper and coöperating with said cover sections to crush the coal, and means for delivering the fuel from said charging hopper into the fire box of said locomotive.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE B. RAIT.

Witnesses:
HARRY D. KILGORE,
F. D. MERCHANT.