June 5, 1934.

W. T. HANNA

1,961,215

STOKER CONSTRUCTION

Original Filed April 5, 1929 2 Sheets-Sheet 1

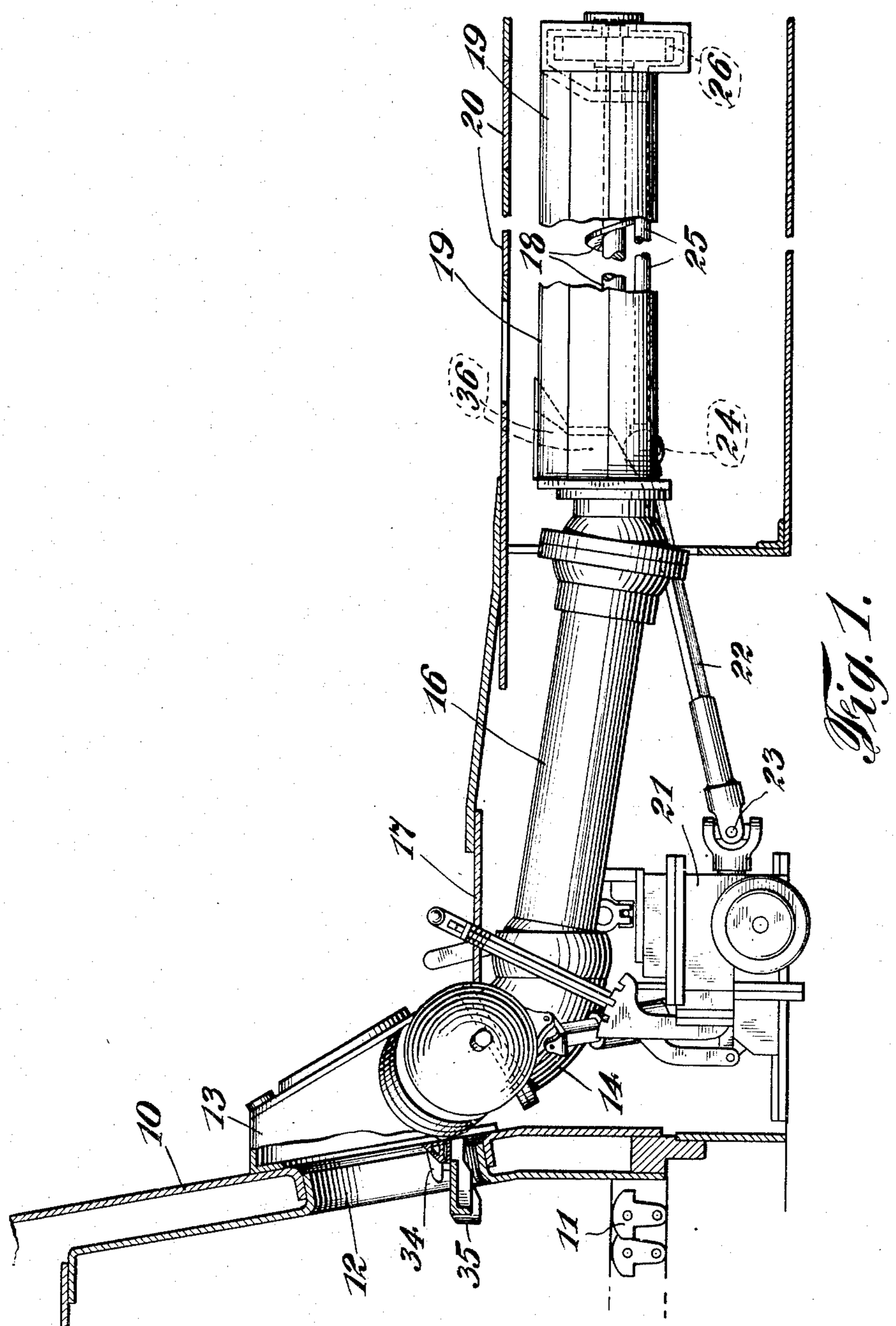

Fig. 1.

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June 5, 1934. W. T. HANNA 1,961,215

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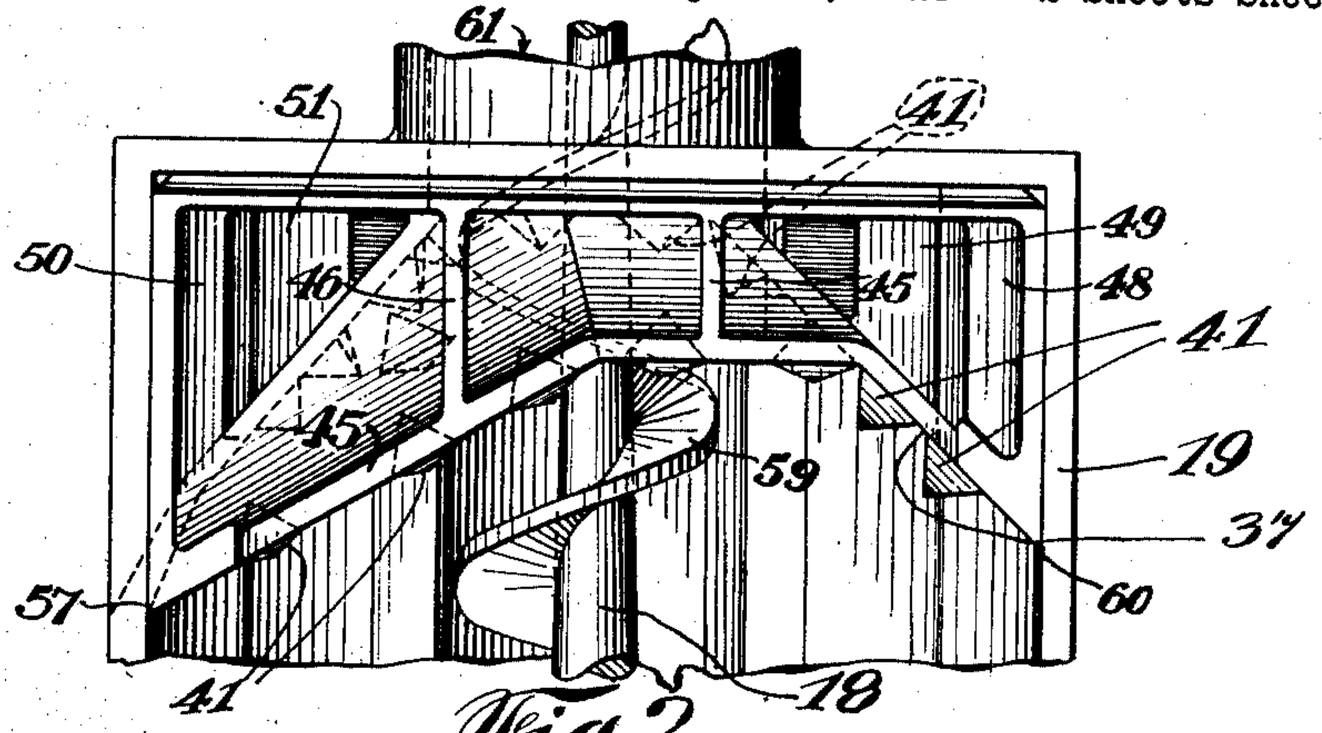

Fig. 2.

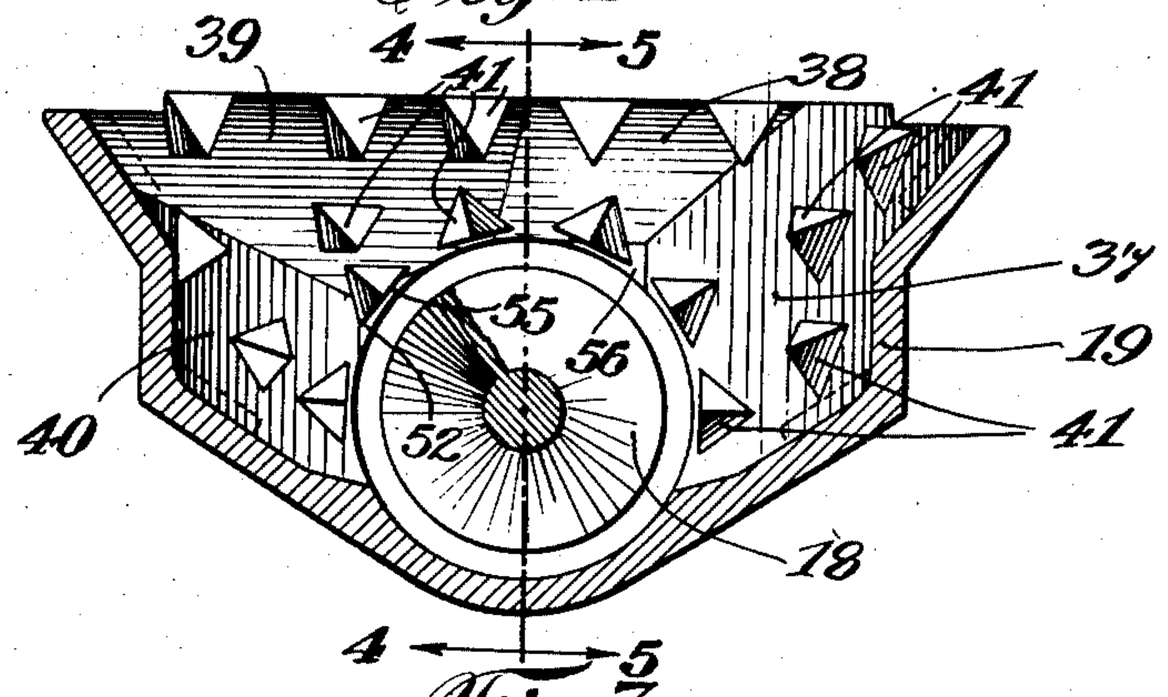

Fig. 3.

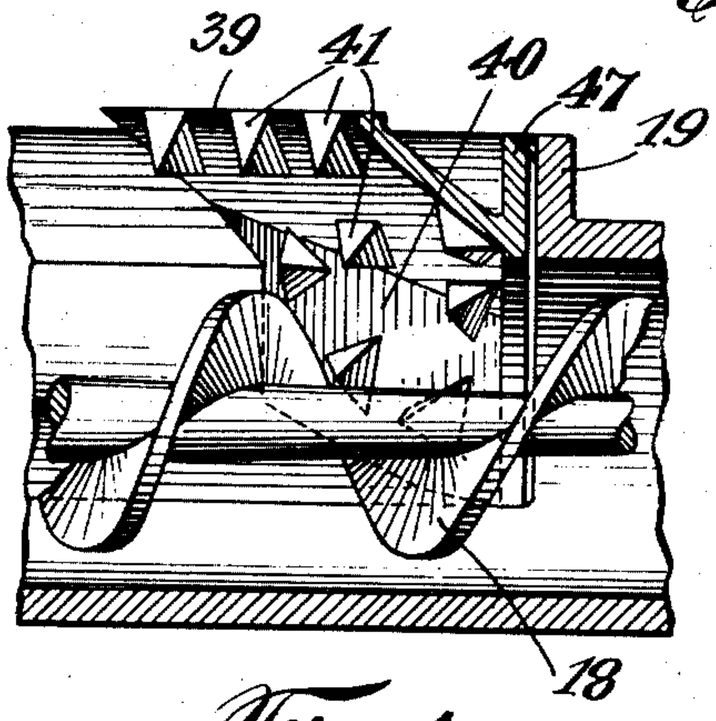

Fig. 4.

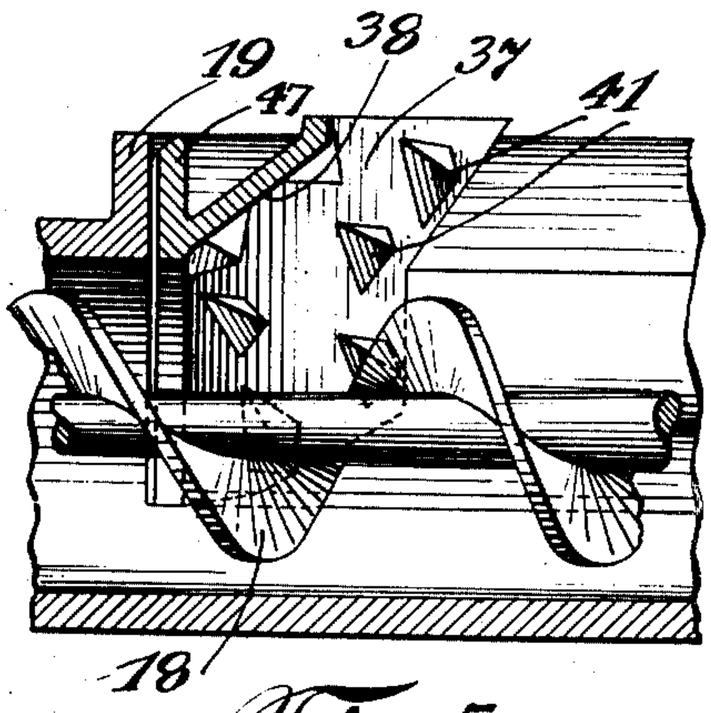

Fig. 5.

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UNITED STATES PATENT OFFICE

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STOKER CONSTRUCTION

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Application April 5, 1929, Serial No. 352,760
Renewed July 8, 1933

4 Claims. (Cl. 83—52)

This invention relates to stokers in general but more particularly to stokers for use on locomotives and the like.

One of the objects of the invention is to provide a simple, compact and sturdy stoker mechanism which will effectively convey the fuel from the coal hopper in the tender to the fire box of the locomotive and advantageously distribute it therein.

Another object is to provide a simple and effective means for crushing abnormally large lumps of fuel within the stoker mechanism.

Another object is to provide a crushing device of the character above described which operates smoothly, and with a minimum amount of power.

Another object is to provide a crushing device of the character above described which is uniform in operation and in which excessive pressures do not build up.

Another object is to provide a crushing device of the character described which is durable, inexpensive, simple and economical to manufacture. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangements of parts which will be exemplified in the mechanism hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings is shown one of the various possible embodiments of the invention in which:

Fig. 1 is a side elevation partially in section of a stoker mechanism embodying my invention.

Fig. 2 is an enlarged plan view of a portion of the tender hopper shown in Figure 1 with a transfer conveyer therein.

Fig. 3 is a vertical section taken on line 3—3 of Figure 2.

Figs. 4 and 5 are sectional views on the lines 4—4 and 5—5 respectively of Fig. 3.

As conductive to a more intelligent understanding of certain of the features of this invention, it is pointed out that crushing structures of the type wherein the material to be crushed is moved against and past crushing plates by screw conveyers have many serious disadvantages. For example, oftentimes, the material being crushed becomes clogged in the region of the crushing plates, and in the event of such a clogging in a crushing structure located in a fuel conveyer for a fuel stoker, the fuel supply to the stoker is, of course, cut off. It has been customary to remedy or remove such clogging by reversing the screw conveying mechanism and in this way clear the crusher and relieve the excessive pressure. Such operation, however, requires a resetting of the throttle for the stoker engine and in general causes trouble and loss of time. Further, clogging of this nature in a crushing device results in the creation of excessive pressures on the crushing structure and subjects the stoker engine and screw conveyer to undue strain. These excessive pressures strain and/or break crushing plates and other parts of the stoker mechanism and materially shorten the life of the stoker. It is another object of this invention to overcome such difficulties as those described above, as well as many others, in a thoroughly practical, dependable and economical manner.

Referring more particularly to Figure 1, 10 represents the back head of a locomotive fire box having the usual grate bars 11 and firing opening 12. Embracing this opening and rigidly mounted on the outer face of the back head is a fuel supply housing 13 which carries, at its lower end, an extension 14. This extension encompasses the delivery end of a transfer conveyer 15 (shown in dotted lines) which is rotatively supported in a cylindrical conduit 16. The forward end of the conduit 16 is provided with a universal connection with the extension 14 below a deck 17 of the locomotive. The extension 14 feeds the fuel supplied to it from the conduit 16 to the fuel supply housing 13 whence it is delivered to the firing opening 12 on to fuel distributing means comprising a blast chamber 34 and a distributing plate 35. These fuel distributing means may be of any known construction and serve to scatter fuel over the fire by means of blasts of steam emitting from the jets of the blast chamber 34 associated with the fuel distributing plate 35.

The conveyer 15 has an operative connection (not shown) with a screw conveyer 18 mounted for rotation within the tender hopper 19 below the tender deck 20. The conveyer 18 in turn is operatively connected with a power device 21, located on the locomotive and this connection comprises a telescopic shaft 22, universally connected at 23 with the power device and at 24 with a shaft 25. This shaft 25 is journaled upon the tender hopper and has at its rear end a gear (not shown) which meshes with a gear 26 (shown in dotted lines) secured to the rear end of the conveyer 18.

With this arrangement of parts, fuel may be conveyed in a continuous stream from the tender hopper 19 through the conduit 14 into the fuel

supply housing 13, and thence on to the distributor plate 35 and into the fire box.

Coal for commercial use in fire boxes for locomotive boilers, steamboat boilers, and other large boilers, contains large lumps of coal and/or foreign matter. Such lumps, although able to move along hopper 19, cannot pass readily through conduits 16 and 14 of a stoker mechanism such as shown in Figure 1. Oftentimes, such lumps are either carried into and caught in these conveying conduits 16 and 14 or in some other way effectually stop the operation of the stoker. To overcome this clogging caused by large lumps in the fuel, the practice is to provide the delivery end of the tender hopper 19 with a crushing device such as 36 (shown in dotted lines in Figure 1) which coacts with the conveying screw 18 in the hopper to crush large lumps of fuel in the fuel moving to the conveyors 16 and 14.

But these crushing devices heretofore used in connection with the feeding mechanism of a tender hopper are only partially successful in overcoming complete clogging caused by lumps collecting in conduits 16 and 14 or otherwise stopping the flow of fuel because the crushing device frequently causes clogging of the fuel at the crushing device itself. This clogging results in complete stoppage of the flow of fuel from the conveyer and tends to create such excessive pressures in the feeding mechanism as to strain and/or break the crushing device, the conveyer 18, the engine operating the conveyer and other parts of the stoker.

In the present invention, I have overcome such difficulties as the above pointed out by providing at the delivery end of the tender hopper 19 a powerful and effective crushing device 36, the structure of which is arranged in the form of a plurality of crushing surfaces or planes 37, 38, 39 and 40 within the hopper and partially encompassing the delivery end of the conveyer 18.

The crushing device as shown in the present embodiment is preferably cast in a single piece and essentially comprises the aforementioned crushing surfaces 37, 38, 39 and 40 which converge on the conveyer 18 to form in effect a hood shaped structure flaring outwardly against the direction of the advance of fuel in the tender hopper 19. The plane surfaces 37, 38, 39 and 40 thus converging on the conveyer 18 intersect a back supporting structure or wall 47 of the crusher device 36. The intersection for the most part is as indicated at 52 circular and in a single vertical plane. However, inasmuch as the surfaces 37, 38, 39 and 40 are in four separate planes, they do not form, with the back wall 47, a completely circular intersection which lies in a single plane. To make the intersection 52 circular, I provide additional planes 55 and 56 between surfaces 37 and 38, and 39 and 40 respectively. As shown in Figure 3, the intersection 52 partially encircles the conveyer 18.

The crushing surfaces 38 and 39 are reenforced by ribs 45 and 46 respectively, extending from the surfaces to the rear wall 47. Likewise, the crushing surface 37 is re-enforced by ribs 48 and 49; the crushing surface 39 is re-enforced at the top portion thereof by a rib 50; and, the crushing surface 40 is re-enforced by a rib 51. The wall 47 provides further support for the surfaces 37, 38, 39 and 40 at the intersection 52.

This arrangement of the crushing surfaces of crushing device 36, in a single casting and reenforced by suitable ribs, accomplishes many new and highly advantageous results, and provides a crushing structure which is scientifically designed to withstand terrific pressures, and which is durable and efficient in operation.

The planes are disposed at varying angles converging on the conveyer and this angular disposition has been found to be most efficient for crushing abnormally large lumps of fuel.

Further, with the peculiar arrangement of the planes 37, 38, 39 and 40, shown, and to be hereinafter described, I provide a crushing device in which excessive pressures do not build up during crushing and feeding operation, and which is substantially fool proof in operation, the possibility of clogging being reduced to a minimum.

As shown in Figure 2, the conveyer 18 in moving fuel forward toward a delivery end 56 of the hopper 19 rotates in a counterclockwise direction; and with this particular motion of the conveyer 18 there is a tendency for fuel moving toward the delivery end of the tender hopper 19 to rotate around the conveyer in a counterclockwise direction and to pile up higher in the left hand side of hopper 19 than on the right hand side. Because of this tendency of the fuel to pile up or to be forced over to the left hand side of the hopper 19 and for other reasons, I position the crushing surface 39, which for purposes of description 1 shall call the upper crushing surface, in the left hand forward corner of the hopper 19. As shown in Figures 2, 3 and 4, this upper crushing surface 39 extends over the top of conveyer 19 and slopes forwardly, downwardly and laterally, converging toward conveyor 18 from a point 57 at the side of the hopper 19. I find it advantageous to make plane 39 relatively long and wide whereby fuel moving laterally with respect to, and away from the screw conveyer 18, is crushed or broken by contact with the crushing surface 39.

I have further found it advantageous to position plane 39 in such a way that it is substantially parallel to a portion 59 of the conveyer 18 as the vane of the conveyer 18 moves into the position shown in Figure 2. This parallel arrangement between the conveyer portion 59 and the surface 39 increases the efficiency of crushing device 36 by bringing about a more direct crushing action between the surfaces 59 and 39.

Positioned on the opposite side of the conveyer 18 from the upper crushing surface 39 is what I may term a side crushing surface 37 positioned in a vertical plane projecting toward conveyer 18 from a point 60 at the side of the hopper 19. This surface 37 serves to crush fuel moving axially with respect to the conveyer 18 as well as that moving perpendicularly away from the conveyer from the broom of the hopper 19.

As shown in Figures 2, 3, 4 and 5, the plane 39 does not extend to intersect with plane 37, and in the space left therebetween there is provided the crushing surface 38 which, for purposes of description, I shall term the outlet crushing surface. The surface 38 is relatively small in area, and has a short, relatively steep slope toward the conveyor 18. By thus positioning and forming the crushing surfaces 37, 38 and 39 so that the top edges thereof form a notch 45 which lies above and slightly to the rear of the delivery opening 61, I limit the effective crushing area disposed over the conveyer 18, and so accomplish many new results. For example, the limited effective crushing area over the delivery opening 61 of the conveyer 19 provides for the escape of fuel upwardly in the event of clogging of the system, for when clogging occurs and the flow of fuel from the delivery opening 61 is slowed up or stopped, the fuel which continues to move to-

ward the delivery opening under the action of conveyer 18 escapes upwardly and past the plane 38. In this way excessive pressure is prevented from building up in the crushing structure.

Completing the crushing surfaces around the conveyer 18, the fourth crushing surface 40 is placed contiguous to the upper crushing surface 39 in a vertical plane sloping forwardly and laterally toward the conveyer 18.

I further increase the efficiency and capacity of my crushing device 36 by providing the planes of the crusher 36 to 40 inclusive with a plurality of teeth or projections as 41 extending therefrom at varying angles to the planes. The teeth 41 provided on the various planes make the planes effective to crush fuel which is not only moving perpendicular to the plates, but also that which may be moving laterally with respect to the planes and in contact therewith.

From the above description of my crushing device 36, it is clear that with it I accomplish many new and highly advantageous results. Fuel moving from the tender floor 20 into the hopper 19 is conveyed to the delivery end of the tender hopper 19 by means of conveyer 18. Fuel which is small enough to lie within the vane of conveyer 18 is carried on through the delivery opening without necessarily contacting with any part of the crushing device 36. But, lumps which are too large to lie within the periphery of the vane of the conveyer 18 are pushed upwardly from the conveyer 18 in the direction of the upper plane 39 and sidewardly to the plane 37, where they are effectually crushed to such sizes as may pass through the delivery opening of the conveyer 18. However, if for one reason or another the fuel becomes clogged in the delivery opening, or for some other reason, is not able to pass through the delivery opening, fuel continuing to move forward toward the delivery opening under the action of conveyer 18, tends to pack within the bounds of the crushing structure and excessive pressures immediately begin to build up. But, with my novel construction, whenever such a clogging occurs, the fuel coming from the rear of the hopper 19 escapes up the short small outlet plane 38. In other words, the moment fuel ceases to flow from the delivery opening 61, even though the conveyer 18 continues to operate, the fuel "boils" upwardly past the outlet plane 38, and thus terrific pressures which were heretofore caused by such a clogging are offset.

From the foregoing it is evident that my crushing device greatly improves flow of fuel from the floor 20 of the tender to the fire box, or back-head 10. Thus in the operation of this stoker mechanism the coal passes through the deck 20 of the tender into the trough of the tender hopper 19 and is moved therein by means of the conveyer 18, into the crushing device 36 wherein the abnormally large lumps of fuel are cracked and broken up to normal size without any tendency to pack and create excessive pressures, and before discharge from the tender hopper. The fuel is then delivered to the transfer conveyer 15 by which it is transported and delivered into the ascending conduit formed by the housing extension 14 and the lower portion of the housing 13. From the housing 19 it flows to the blast chamber 34, from whence it is distributed over the fire bed.

Another feature of my invention, and as shown most clearly in Figures 4 and 5, is the increased pitch in the conveyer 18 in the vicinity of the crushing structure 36. By thus increasing the pitch of the conveyer 18, I accomplish many new and valuable results. For example, I increase the capacity of the conveyer at this point and so accelerate the flow of fuel through the hopper at this point, and in this way materially reduce the possibility of any clogging in the region of the crushing surfaces and in the region of the delivery end.

It will thus be seen that there is provided a construction of an essentially practical nature in which the several objects of the invention are attained.

While I have shown and described a particular construction embodying the novel features of the invention, it is to be understood that the same is for illustration only and it will be obvious that the construction and arrangement of parts may be variously modified and altered without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. In a fuel crushing and feeding mechanism, a hopper, a screw conveyer located in the said hopper, a crushing structure associated with said hopper and having a passage therethrough with a discharge opening, said crushing structure including an upper crushing surface slanting forwardly, downwardly and laterally toward said conveyer, a substantially vertical side crushing surface on the opposite side of the conveyer from said upper surface and slanting forwardly toward said conveyer, and a third crushing surface disposed above said conveyer and between said upper and side surfaces and having a relatively steep slope forwardly and towards said conveyer to form a fuel relief passage, the top edges of the three surfaces forming a notch located above and slightly to the rear of the discharge opening whereby the flow of fuel up past said third surface prevents excessive pressure.

2. In a fuel crushing and feeding mechanism, a hopper, a screw conveyer located in the said hopper, a crushing structure associated with said hopper and having a passage therethrough with a discharge opening, said crushing structure including an upper crushing surface slanting forwardly, downwardly and laterally toward said conveyer, a substantially vertical side crushing surface on the opposite side of the conveyer from said upper surface and slanting forwardly toward said conveyer, and a third crushing surface disposed above said conveyer and between said upper and side surfaces and having a relatively steep slope forwardly and toward said conveyor to form a fuel relief passage, the top edges of the three surfaces forming a notch located above and slightly to the rear of the discharge opening whereby the flow of fuel up past said third surface prevents excessive fuel pressure from occurring during crushing operation; and the pitch of said screw conveyer increasing within the confines of the crushing structure whereby the flow of fuel is proportionately accelerated in the confines of said crushing structure.

3. In a fuel crushing and feeding mechanism, a hopper, a screw conveyer located in said hopper, a crushing structure associated with said hopper and having a passage therethrough with a discharge opening, said crushing structure including an upper crushing surface slanting forwardly, downwardly and laterally toward said conveyer, a side crushing surface on the opposite side of the conveyer from said upper surface and slanting forwardly toward said conveyer, and a third crushing surface disposed above said conveyer

and between said upper and side surfaces, having a relatively steep slope forwardly toward said conveyer to form a fuel relief passage, the top rear edges of the three surfaces forming a notch located above and slightly to the rear of the discharge opening whereby the flow of fuel up past said surface prevents excessive fuel pressure during the crushing operation.

4. In a fuel crushing and feeding mechanism, a hopper, a screw conveyer located in said hopper, a crushing structure associated with said hopper and having a passage therethrough with a discharge opening, said crushing structure including a plurality of crushing surfaces located above said discharge opening and conveyer and other crushing surfaces located on either side of said conveyer and discharge opening, and said surfaces converging on said conveyer and discharge opening and forming a crushing zone encompassing the sides and top of that portion of said coneveyer located within said crushing zone; the uppermost rear edges of the overlying crushing surfaces together with the uppermost rear edges of side surfaces on one side of said conveyer forming a notch having its apex located above and slightly to the rear of said discharge opening, said notch forming a top edge of a generally V-shaped fuel relief passage formed by said crushing surfaces and extending upwardly from said discharge opening, said fuel relief passage serving as an outlet whereby excess fuel supplied to said crushing zone may pass out of said crushing zone.

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