July 12, 1938. F. H. REAM 2,123,802

MECHANICAL STOKER

Filed April 27, 1936 2 Sheets-Sheet 1

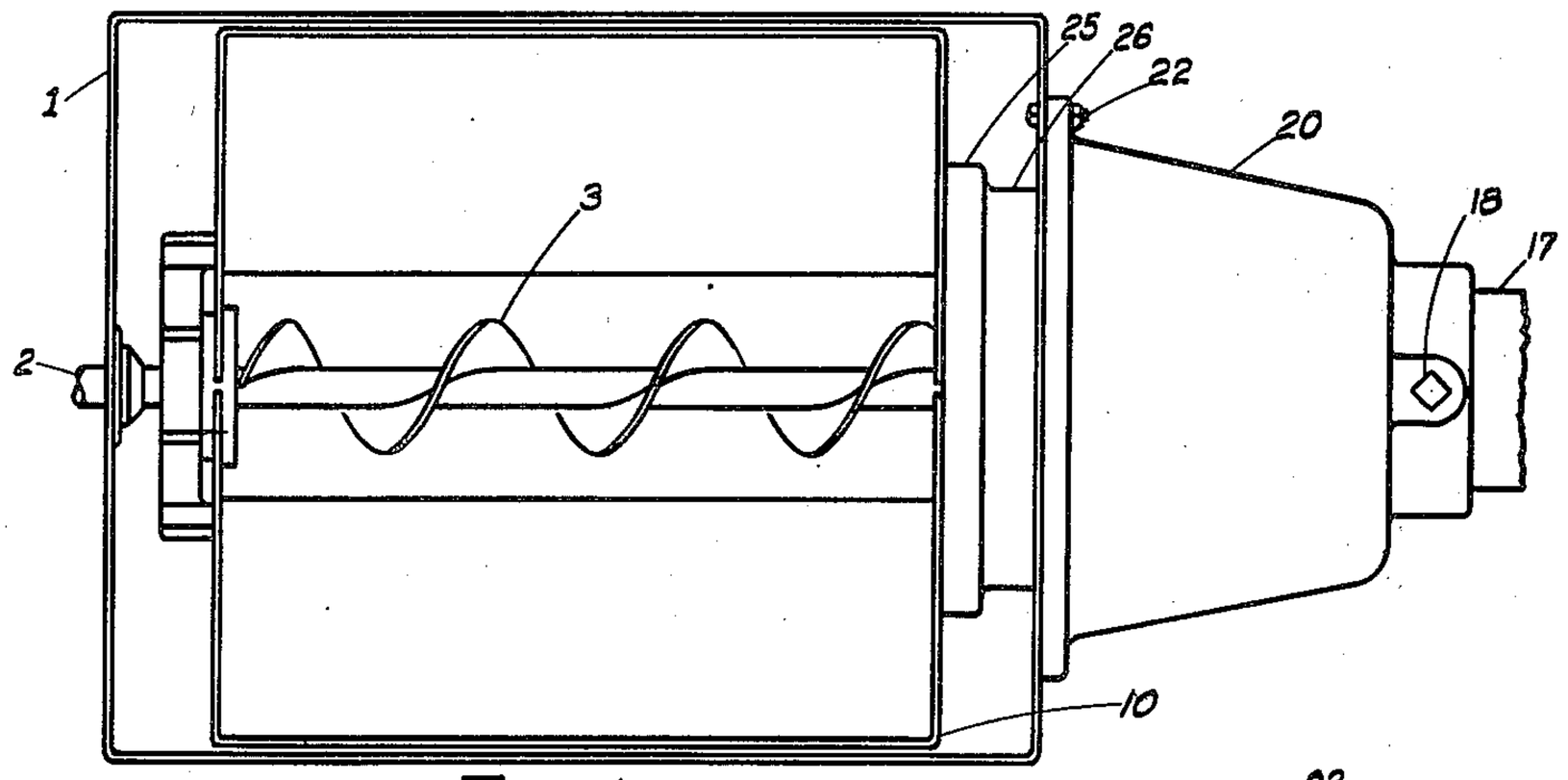

Fig. 1.

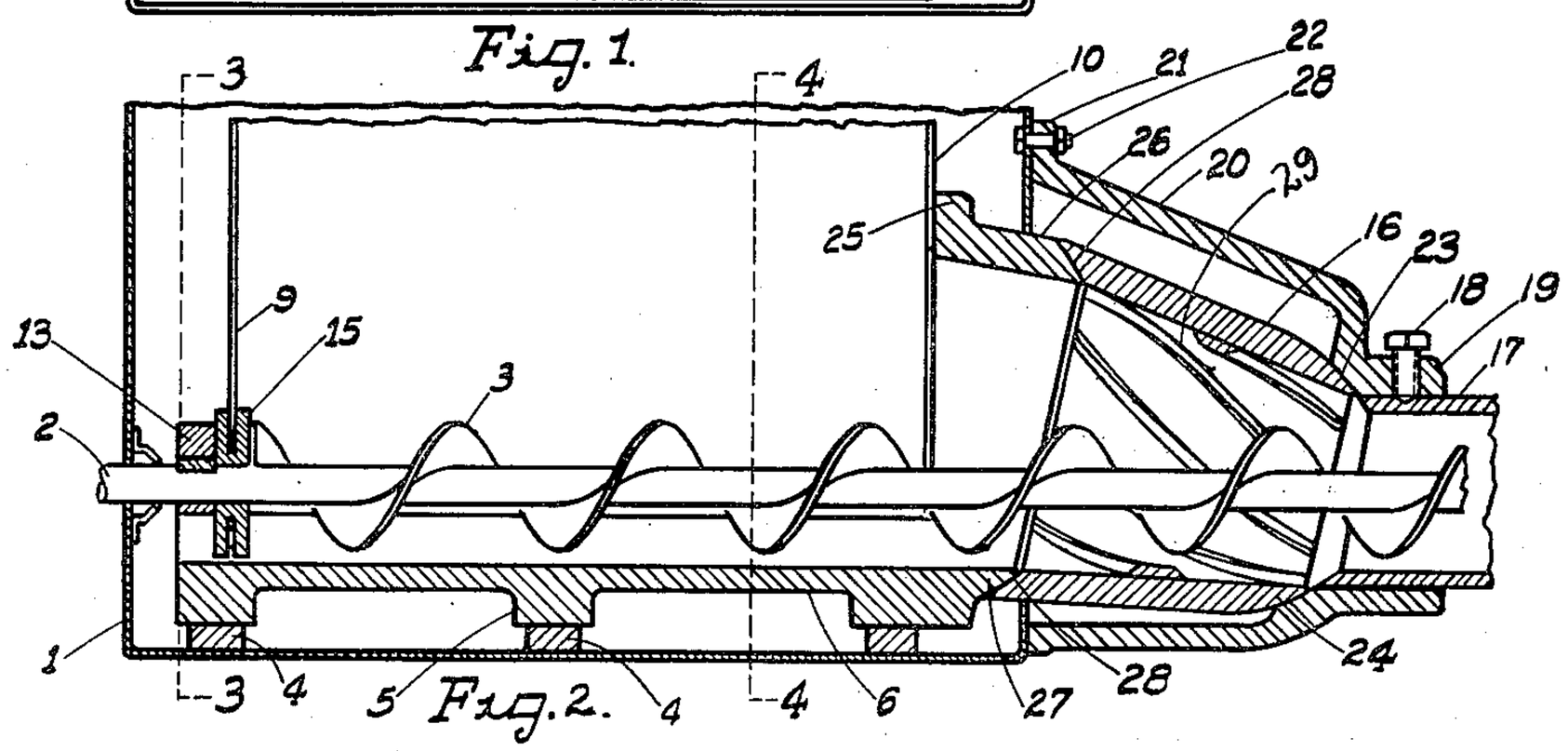

Fig. 2.

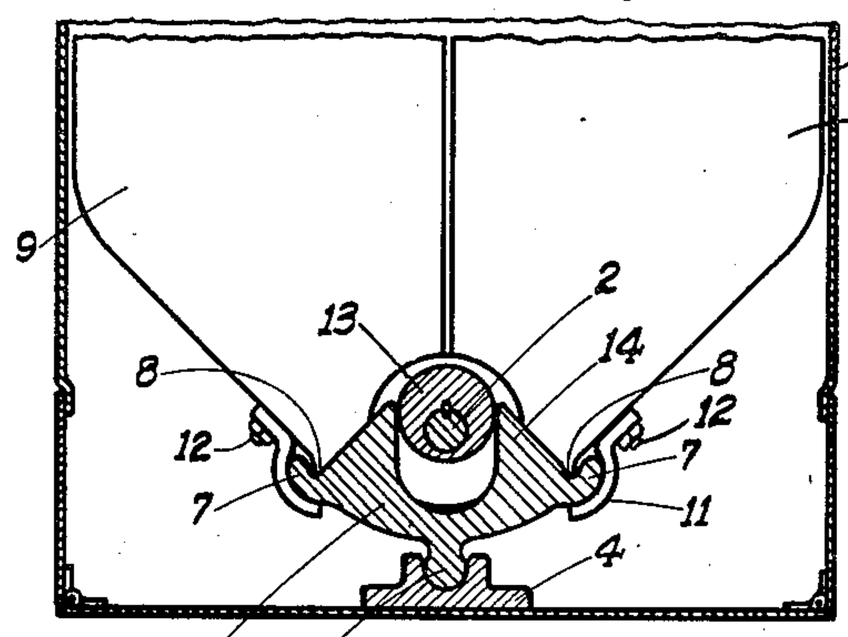

Fig. 3.

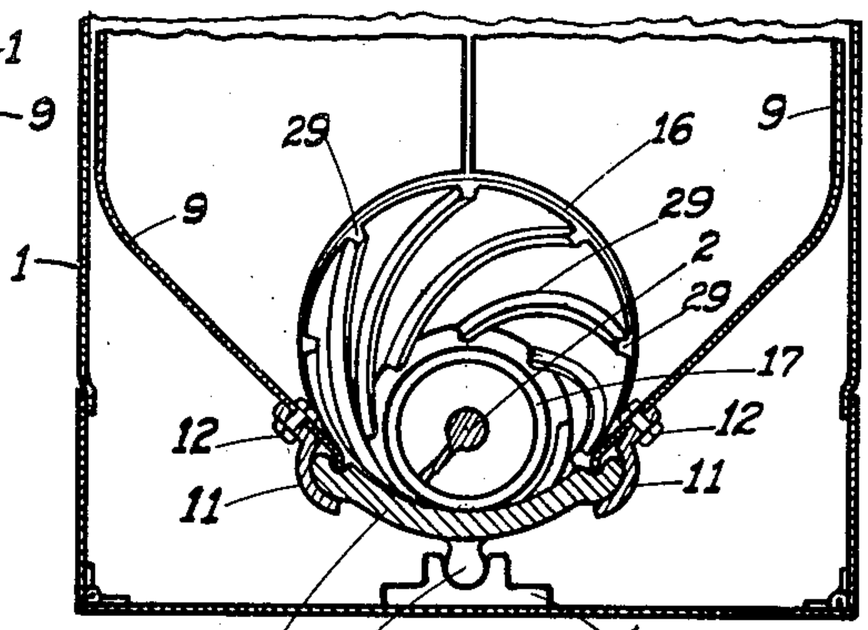

Fig. 4.

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MECHANICAL STOKER

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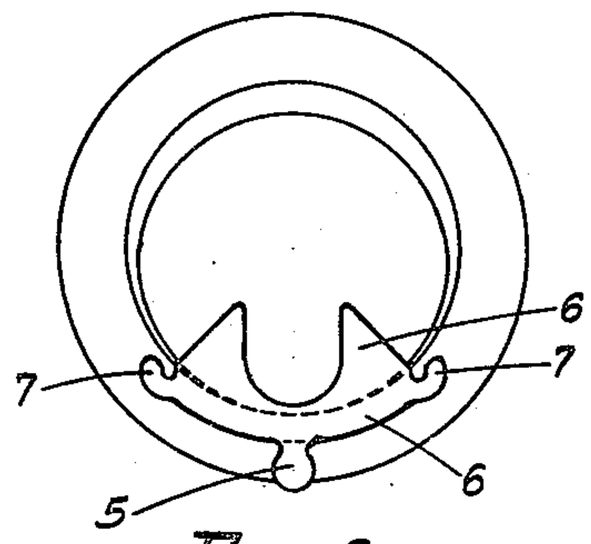

Fig. 8

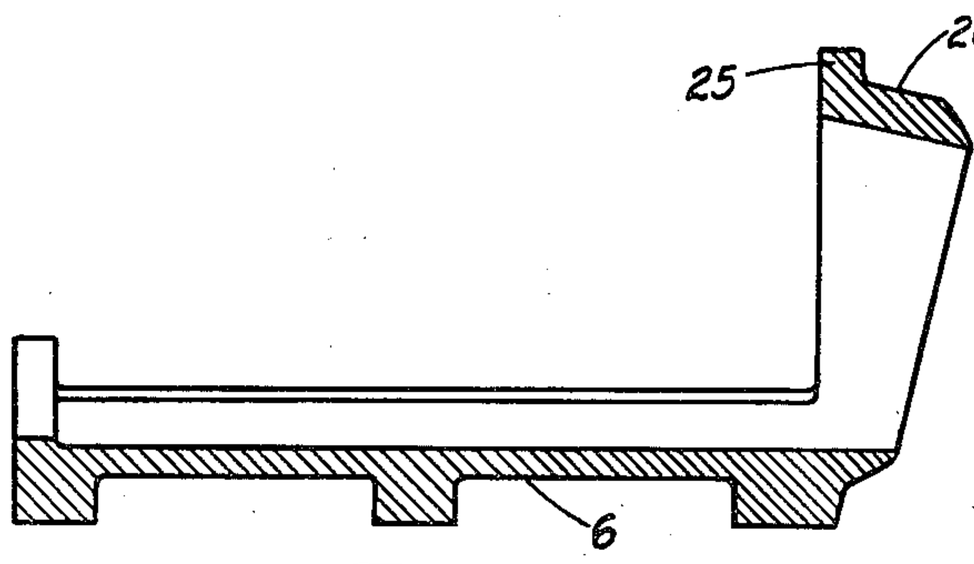

Fig. 7.

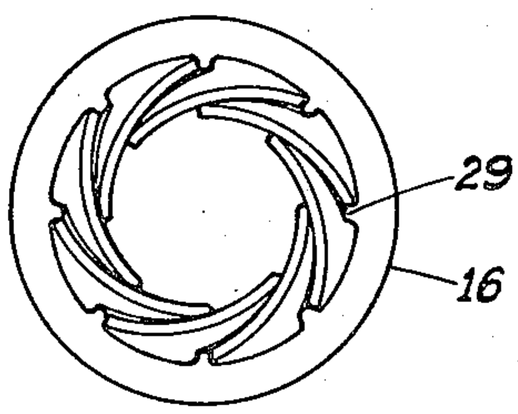

Fig. 6.

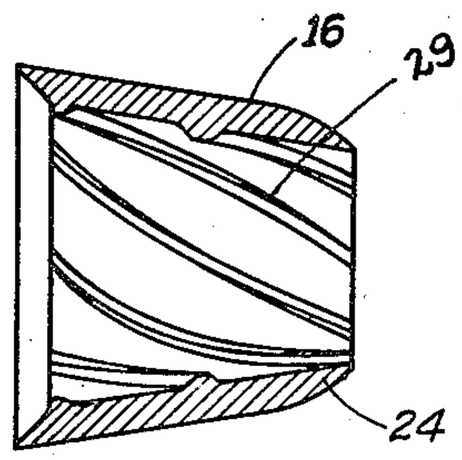

Fig. 5.

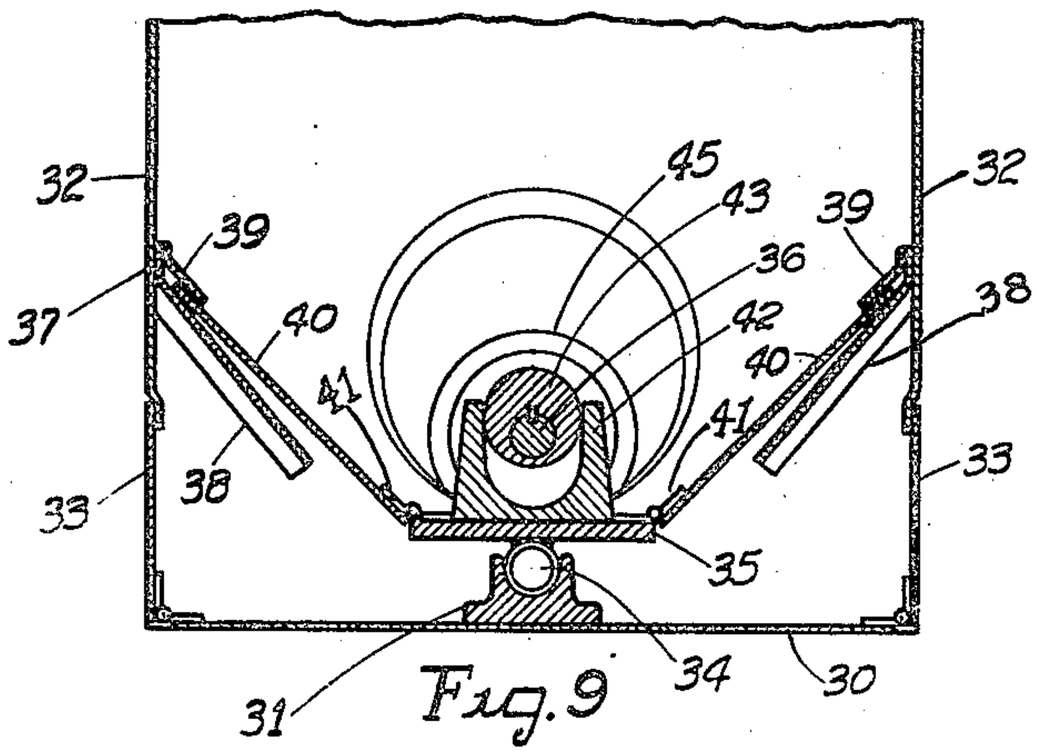

Fig. 9

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Patented July 12, 1938 2,123,802

UNITED STATES PATENT OFFICE

2,123,802

MECHANICAL STOKER

Fred H. Ream, near Dayton, Ohio, assignor of forty-five percent to Perle L. Sagebiel, Dayton, Ohio

Application April 27, 1936, Serial No. 76,651

12 Claims. (Cl. 83—52)

This invention relates to mechanical stokers, and more particularly to mechanism in automatic fuel stokers of the under feed type which will prevent the coal from packing in the throat of the hopper when fine or damp coal is used, and also to a means of crushing and feeding coarse or lump coal.

Frequently in automatic coal stokers of the underfeed type, in using fine, damp or dirty coal, or coal having roots, leaves or other foreign matter intermixed therein, such material packs in the throat of the hopper, thereby bridging over, and shutting off the supply of such material, to the feed screw. The result is a diminished or suspended supply of such material to the retort, with attendant discomfort and annoyance.

Similar interruptions necessarily ensue in the normal delivery of material to the retort by the feed screw in the case of lump coal, when lumps which are too large to pass through the feed tube become numerous around the feed screw, thereby bridging over the latter and restraining any finer material which might lie above the lumps from reaching the feed screw.

One object of my invention is the provision of means to be removably attached to the usual feed worm shaft in mechanical stokers, to serve as the operating element for agitator mechanism within the outside hopper, thereby providing a simple and efficient means of keeping the material in constant agitation throughout the hopper. More particularly this means constantly maintains a seam or cleavage in the material in a vertical plane extending longitudinally with the axis of the feed screw, and directly above the same, whereby such material, embodying loose particles, will gravitate without hindrance directly into the path of the feed screw.

A further object of my invention is the provision of means for maintaining and actuating a rocking bottom, removably and pivotally attached to the inner surface of the bottom of an outer hopper of a mechanical stoker. This rocking bottom longitudinally extends with the axis of the feed screw, and is actuated by certain means connected thereto for oscillation from side to side, directly beneath said feed screw upon detachable pivots. On a projecting shelf on each side of said rocking bottom rests the lower, inwardly extending end of a half section of the inner hopper, which is preferably in two nearly equal sections. When one section of the inner hopper is raised and drawn in toward the center by this rocker bottom, the other section will be lowered and thrown out, causing one-half of the material carried by the hopper to rise and become distorted while the remaining half descends, the clearage being directly above the feed screw.

A further object of my invention is the provision of a two-section inner hopper, or portion or portions of a sectional hopper, acting in conjunction with the rocking bottom, with means provided for actuating the same to give it an oscillating vertical movement, alternately raising and lowering the sections of the hopper, or portions of the same. This movement thereby transmits to the material carried in the hopper an undulating agitation that breaks the material loose from the sides and bottom of the hopper and causes it to gravitate directly into the path of the feed screw.

A further object of the invention is the provision of a rotary crusher cone interposed between the feed tube and the rocking bottom of the inner hopper. This cone is rocked by that bottom to assist in causing lumps of coal or other material to be forced through the cone, where it is crushed to proper size for passage through the feed tube.

A further object of my invention is the provision of spiral fins on the inside of the oscillating rotary cone crusher. These fins rotatably decline spirally from the mouth of the cone to a point near its discharge end, whereby they will progressively engage the lumps of coal or other coarse material, causing the same to move forward into the cone. These lumps of coal, being impinged between the fins on the feed screw and the spiral fins in the cone, will be divided into smaller pieces since the cone and screw both turn in eccentric relation with each other, thereby facilitating further crushing of the material as it passes on through the smaller portion of the cone.

Another object of my invention is the provision of a supporting collar which is demountably attached to the outer hopper. This collar is also demountably attached to the end of the feed tube nearest the hopper to encase the rotary crusher cone, thereby forming a housing unit which provides a rigid connection between the hopper and the feed tube, that receives the end thrust of the crusher cone. Being demountably attached both to the hopper and the feed tube, it can be easily demounted therefrom and slipped back over the feed tube, thereby permitting the rotary crusher cone also to be telescoped over the feed tube and leaving the feed screw exposed to enable the ready removal of obstructions finding their way into the crusher cone.

A further object of my invention is the provision of means for easily disengaging and removing the sectional inner hopper from the outer hopper for inspection, with means provided in the side of the outer hopper for the removal of any material spilled or sifted into it during the operation or removal of sectional hopper or other moving parts.

While my invention is more particularly designed for use in connection with an automatic stoker to insure the proper and constant feeding of the material from the hopper thereof, it is apparent that the invention as a whole is equally applicable to the feeding of any material from the hopper, as in the majority of instances such material under feeding conditions shows a more or less decided tendency to stick to the side walls of the hopper. It is, therefore, to be distinctly understood that the invention is designed for assisting the feeding of material from a hopper for any and all purposes, notwithstanding the specific description and illustrations herein, and is not limited to its use in connection with automatic fuel stokers.

In the accompanying drawings illustrating the forms of embodiment of my invention therein disclosed, Figure 1 is a top plan view of the hopper and crusher cone of an automatic underfeed stoker provided with my fuel agitating mechanism and other attachments. Figure 2 is a longitudinal sectional view taken through the same. Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2, showing the rocker bottom for the inner hopper. Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 2, looking toward the cone end of the stoker. Figure 5 is a side view of the crusher cone. Figure 6 is an end view of the cone. Figure 7 is a side view of the rocking inner hopper bottom and the integrally connected cone seat. Figure 8 is a view of the driving end of the rocker bottom. And Figure 9 is a cross-sectional view taken through a modified form of my rocker mechanism.

Referring to the accompanying drawings for a detailed description of the forms of embodiment of my invention disclosed therein, the numeral 1 designates the hopper of an automatic, underfeed stoker. Passing through the lower portion of this hopper 1, which will hereinafter be designated the outer hopper, is a feed screw shaft 2, upon which is mounted a conventional fuel feed screw 3.

Supported upon the bottom of the outer hopper 1, directly below the feed screw 3 and extending longitudinally with the axis of the latter, is a row of pivot blocks 4 having concave top portions that receive cylindrical bosses 5 on a rocking bottom 6.

The rocking bottom 6 preferably comprises an elongated trough-shaped casting provided with the integral bosses 5 which detachably fit in the top recessed portions of the pivot blocks 4.

On each side of the rocking bottom 6 there is formed a projecting shelf 7 that is provided with a recess to receive the lower, inwardly extending end 8 of a half section 9 of an inner hopper 10. Curved clamps 11 secured to the bottoms of the inner hopper sections 9, 9 by bolts 12, engage the rounded outer surfaces of the projecting shelves 7, 7 on the rocking bottom 6 to assist in hingedly securing the inner hopper sections thereto. (See Figures 3 and 4.)

For the purpose of rocking the bottom 6 of the inner hopper 10 simultaneously with the feed screw shaft 2, I have provided the following means, although other suitable means may be employed for this purpose if desired. In the present structure there is secured to the shaft 2 in the hopper 1, an eccentric 13 which turns within a deep slot in a flange 14 on one end of the rocker bottom 6.

Surrounding the shaft 2 adjacent the inner face of the eccentric 13 is a collar 15 formed with a peripheral groove to receive the lower ends of the inner hopper sections 9, 9. This collar prevents the material within the inner hopper 10 from sifting into the outer hopper.

It will now be seen that when the bottom 6 is rocked by the feed screw shaft 2, each half section 9 of the inner hopper, resting as it does upon its respective projecting shelf 7 on said bottom, will be given a vertical, reciprocable movement through an arc defined by the movement of the shelf. In addition to its vertical reciprocable movement, each hopper section 9 receives a horizontally reciprocating movement by virtue of the arc traversed by its respective shelf, so that when one section is raised and drawn in toward the center, the other section is lowered and thrown out. This movement of the inner hopper sections causes one half of the material carried by the hopper to be raised and distorted while the other half descends, effecting a cleavage of the material directly above the feed screw 3.

The feed screw 3 projects from the outer hopper 1 through a rotary crusher cone 16 into a feed tube 17 which feeds the coal or other material in the hopper to a furnace or other receiving means not shown. To the end of the feed tube 17 nearest the hopper there is demountably secured by a screw 18, the reduced end 19 of a collar or sleeve 20 that surrounds the crusher cone 16. This collar 20 is provided at its rear end with a flange 21 that is detachably secured by bolts 22 to the outer hopper 1.

The collar 20 which is demountably attached to the hopper and the feed tube by the aforementioned or other suitable means, provides a rigid connection between these two members of the stoker assembly. Within this collar there is an end-thrust bearing seat for the small end of the rotary cone 16. This seat comprises an inner spherical surface 23 at the front end of the collar to receive the small end of the cone, which has a beveled peripheral surface 24 that conforms to the bearing surface 23 of the collar.

The bearing seat 23 rotatably supports the crusher cone with its bottom in a nearly horizontal position, or substantially parallel with the axis of the feed screw 3. However, the axis of the cone is inclined to the axis of the feed screw, which rocks the crusher cone through the connection now to be described between the cone and the rocker bottom 6.

For connection to the large end of the crusher cone 16, the rocker bottom 6 has formed at its outer end a flange 25. Extending outwardly from this flange is a sleeve 26 which has formed on its outer end a beveled seat 27 that engages an inner beveled surface 28 on the large end of the crusher cone. Through this connection with the rocker bottom 6, the crusher cone 16 is actuated by the latter in an oscillating motion about the bearing 23, with the small end of the cone held in concentric relation to the hopper end of the feed tube 17.

The before described form of suspension of the crusher cone 16 enables it to revolve upon its own inclined axis if so impelled by friction of the

material in engagement with it. The force transmitted to this material by the rotation of the feed screw in conjunction with the oscillating movement imparted to it in the hopper by the oscillating motion of the rocker bottom, will cause this material, notwithstanding its lumpy, coarse, fine or damp nature, to be forced into the mouth of the crusher cone.

In the present instance I have provided on the inner surface of the crusher cone **16**, integral spiral fins **29** that decline spirally from the mouth of the cone to a point near its discharge end as shown in Figure 4. When the crusher cone is oscillated by the rocker bottom **6**, these fins progressively engage the lumps of coal or other coarse material, causing the same to be moved forward through the cone, and coacting with the feed screw to divide it into smaller pieces. Since the cone and screw both turn in eccentric relation to each other, this material will be thoroughly crushed by them as it passes through the smaller portion of the cone into the feed tube **17**.

In Figure 9 I have shown a modification of my rocker bottom structure. Here the numeral **30** designates a stationary hopper bottom upon which pivot blocks **31** are mounted in a manner similar to the mounting of the pivot blocks **4** on the bottom of the hopper **1**. Cleanout openings in the sides **32**, **32** of the hopper are closed by doors **33** which are hingedly secured to the hopper bottom.

Fitted in the concave top portions of the pivot blocks **31** are cylindrical projections **34** on the bottom of a flat member or bar **35** below, and longitudinally extensive with, a feed screw shaft **36**.

Welded or otherwise secured to the hopper sides **32**, **32** are the flanged ends **37** of downwardly inclined guide members **38**, **38**. To the flanged upper ends **37** of these guide members, the flanged ends of short guide members **39**, **39** are welded or otherwise attached. Longitudinally movable between the guide members **38** and **39** on each side of the hopper, is an inclined material-supporting member **40** whose lower end portion is connected by a hinge **41** to the bottom member **35**.

The bottom member **35** is rocked by means similar to those employed for rocking the bottom **6** in Figures 2 and 3. In Figure 9 there is secured to the bottom member **35** a U-piece **42** which receives an eccentric **43** keyed to the feedscrew shaft **36**. When the latter is rotated, the eccentric will rock the bottom member **35**, and through it impart a reciprocating side-wise movement to the inclined material supporting members **40**, **40** between their respective guides **38** and **39**, to constantly maintain a seam or cleavage in the material in a vertical plane extending longitudinally with, and directly above, the axis of the feed screw **45** on the shaft **36**.

I do not wish to be limited to the details of construction and arrangement herein shown and described, and any changes or alterations may be made herein within the scope of the subjoined claims.

Having described my invention, I claim:

1. A mechanical stoker comprising a hopper, a feed screw within said hopper, means for rotating said feed screw, a rocking bottom below said feed screw and extending longitudinally with the axis thereof, and mechanical means controlled by the feed screw for rocking said bottom.

2. A mechanical stoker comprising a hopper, a feed screw within said hopper, means for rotating said feed screw, a rocking bottom below said feed screw and extending longitudinally with the axis thereof, and means operated by the feed screw for rocking said bottom.

3. A mechanical stoker comprising a hopper, a feed screw within said hopper, a shaft on which said feed screw is mounted, means for rotating said shaft, a rocking bottom below said feed screw shaft and extending longitudinally with the axis thereof, a slotted flange on the rocker bottom, and an eccentric on the feed screw shaft for engagement with said flange to rock said bottom.

4. A mechanical stoker comprising an outer hopper, a feed screw within said hopper, a rocker bottom below said feed screw and extending longitudinally with the axis thereof, means for rocking said bottom and rotating the feed screw, and an inner hopper comprising two parts pivotally mounted on said bottom to maintain a cleavage of material within the hopper directly above the feed screw when the rocker bottom is oscillated.

5. A mechanical stoker comprising an outer hopper, a feed screw within said hopper, a rocker bottom pivotally mounted on the bottom of the outer hopper, and extending longitudinally with, and directly below, the axis of the feed screw, means for rotating the latter and oscillating said bottom, and an inner hopper comprising two sections pivotally mounted on the margins of the rocker bottom to maintain a cleavage of material within the hopper directly above the feed screw when the rocker bottom is oscillated.

6. A mechanical stoker, comprising an outer hopper, a feed screw within said hopper, a rocker bottom pivotally mounted on the bottom of the outer hopper, and extending longitudinally with, and directly below, the axis of the feed screw, means for rotating the latter and oscillating said rocker bottom, a ledge on each margin of said rocker bottom, an inner hopper comprising two equal sections, and clamping means for removably and pivotally mounting said sections upon the ledge portions of said rocker bottom to maintain a cleavage of the material within the hopper directly above the feed screw when the rocker bottom is oscillated.

7. In a mechanical stoker, a hopper, a feed tube, a feed screw for forcing material from said hopper to the feed tube, a rocker bottom below said feed screw, means for simultaneously rotating said screw and rocking said bottom, and a rotary crusher cone interposed between said rocker bottom and the feed tube and connected to said rocker bottom for oscillation by the latter.

8. In a mechanical stoker, a hopper, a feed tube, a feed screw for forcing material from said hopper to the feed tube, a rocker bottom below said feed screw and extending longitudinally with the axis thereof, a rotary crusher cone, interposed between the rocker bottom and the feed tube, a housing in which the small end of said cone is revolubly mounted, means for simultaneously rotating said feed screw and rocking said bottom, and means for connecting the hopper end of the crusher cone with the rocking bottom for oscillation by the latter.

9. In a mechanical stoker, a hopper, a feed tube, a feed screw for forcing material from said hopper to the feed tube, a rocker bottom below said feed screw and extending longitudinally with the axis thereof, means for simultaneously rotating said feed screw and rocking said bottom, a crusher cone, a housing surrounding said cone and having a bearing seat for the small end of the cone and maintaining it in concentric engage-

ment with the hopper end of the feed tube, and a connection between the outer end of the rocker bottom and the hopper end of the crusher cone to oscillate said end of the cone when said bottom is rocked.

10. In a mechanical stoker, a hopper, a feed tube, a feed screw for forcing material from said hopper to the feed tube, a rocker bottom below said feed tube and extending longitudinally with the axis thereof, means for rotating the feed screw and rocking said bottom, a rotary crusher cone connected at its large end to said bottom for oscillation thereby, a collar surrounding said cone, demountably attached to the hopper and the feed tube, and an end-thrust bearing seat in said collar for the small end of said cone.

11. In a mechanical stoker, a hopper, a feed tube, a feed screw for forcing material from said hopper to the feed tube, a rocker bottom below said feed screw, means for rotating said feed screw and rocking said bottom, a rotary crusher cone interposed between said rocker bottom and the feed tube and connected to said rocker bottom for oscillation by the latter, and spiral fins on the interior surface of said cone, said fins declining spirally from the mouth of the cone to its discharge end, to co-act with the feed screw in crushing lump and coarse material for passage in fine particles into the feed tube.

12. A mechanical stoker comprising an outer hopper, a feed screw within said hopper, a rocker bottom pivotally mounted on the bottom of the outer hopper, and extending longitudinally with, and directly below, the axis of the feed screw, means for rotating the latter and oscillating said bottom, an inclined inner hopper, bottom side member pivotally secured to each margin of the rocker bottom, and a guide carried by the adjacent side of the outer hopper, to receive the upper end of each inclined bottom member for a reciprocable longitudinal movement therein when the rocker bottom is oscillated.

FRED H. REAM.