

March 14, 1944.

H. A. HOKE

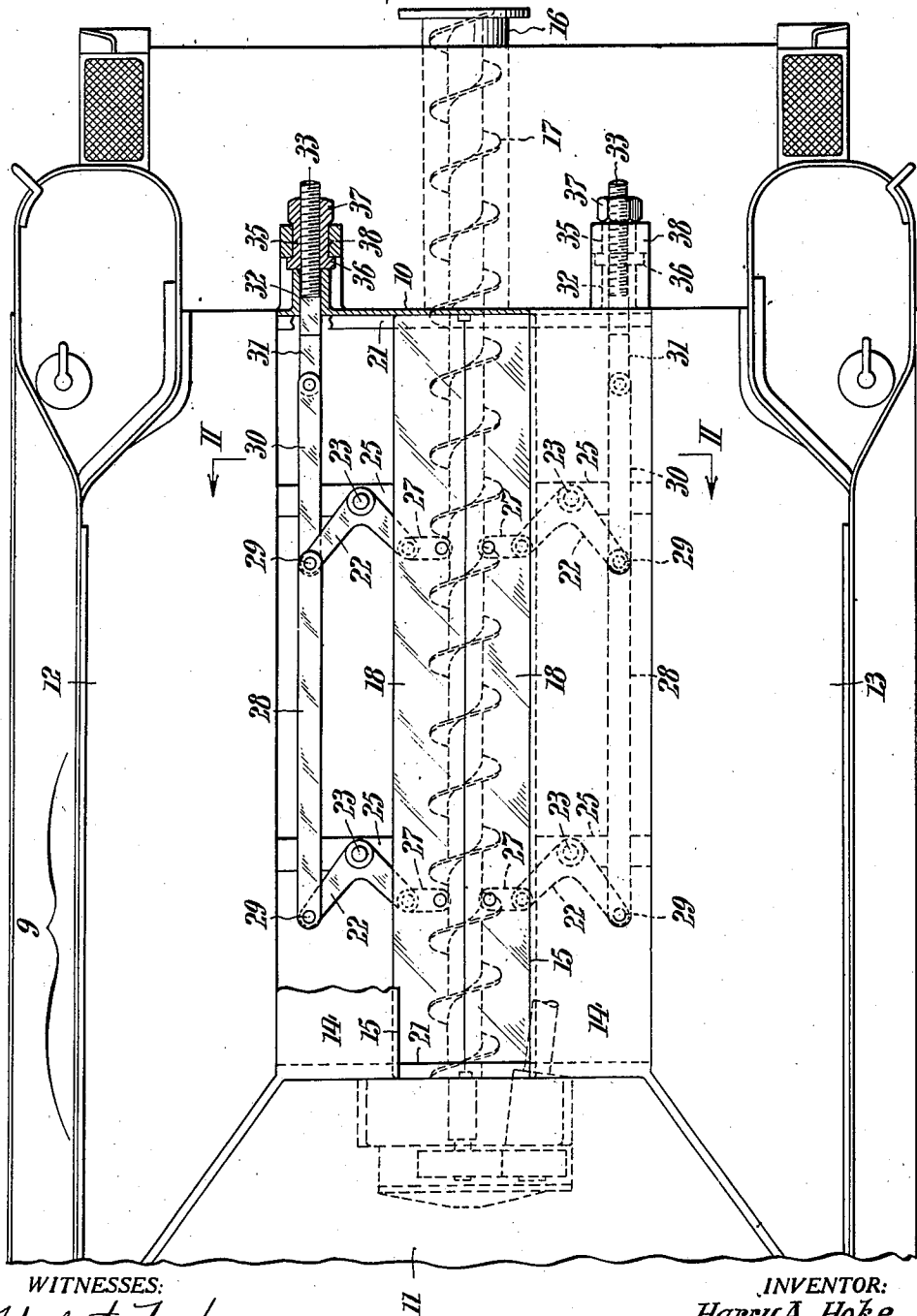
2,344,040

HOPPER GATE ADJUSTING MEANS

Filed Jan. 19, 1942

4 Sheets-Sheet 1

FIG. 1-



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**2,344,040**

## HOPPER GATE ADJUSTING MEANS

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*FIG. 2.*

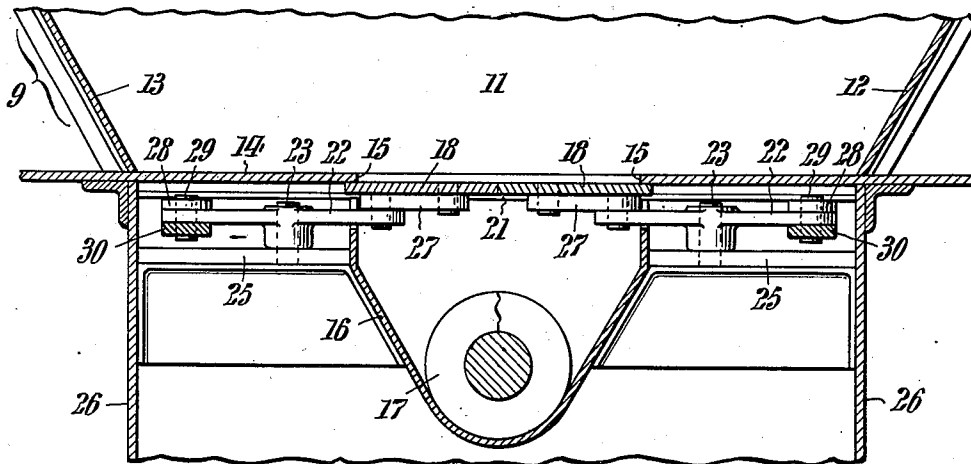
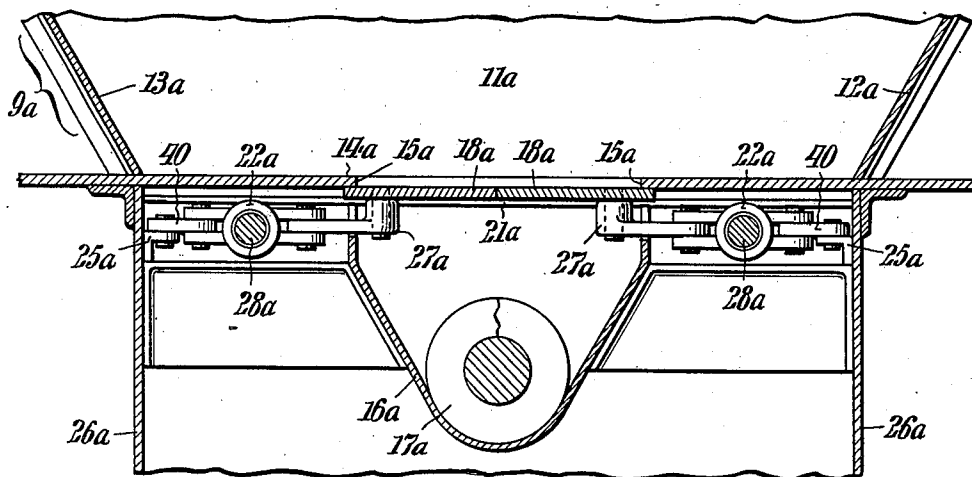


*FIG. 4.*



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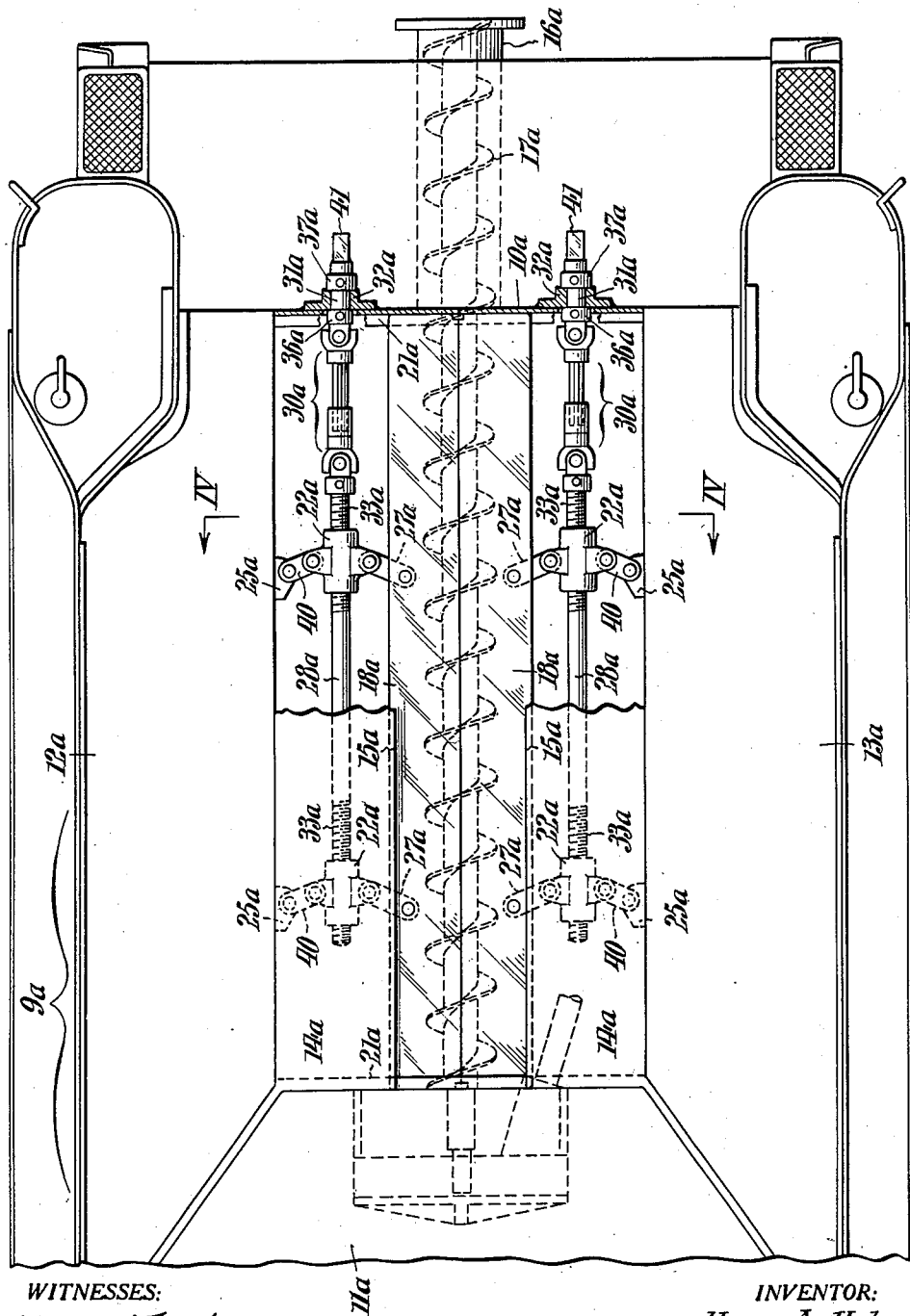
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FIG. 3



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HOPPER GATE ADJUSTING MEANS

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FIG- 5-

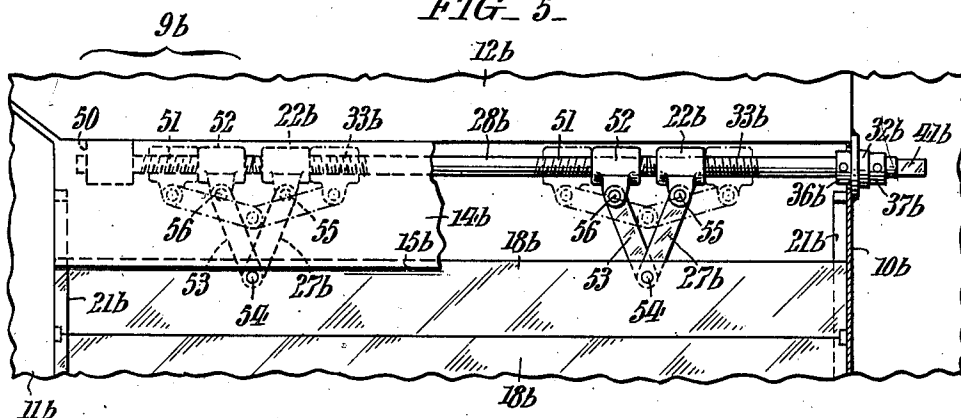


FIG- 6-

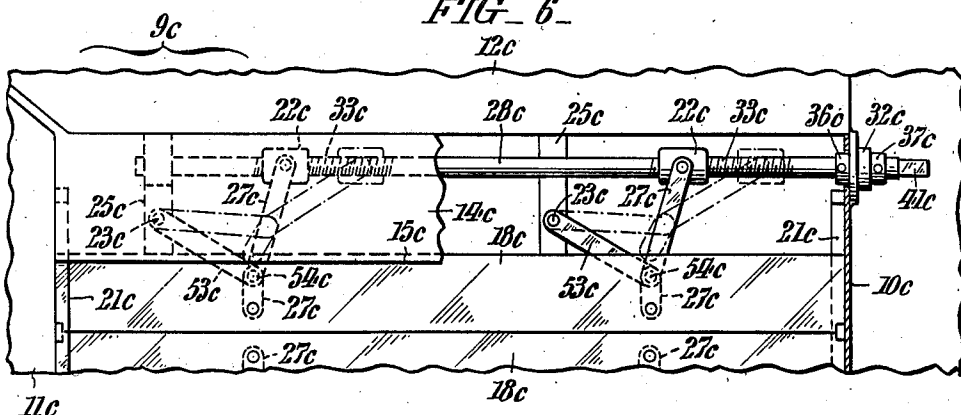
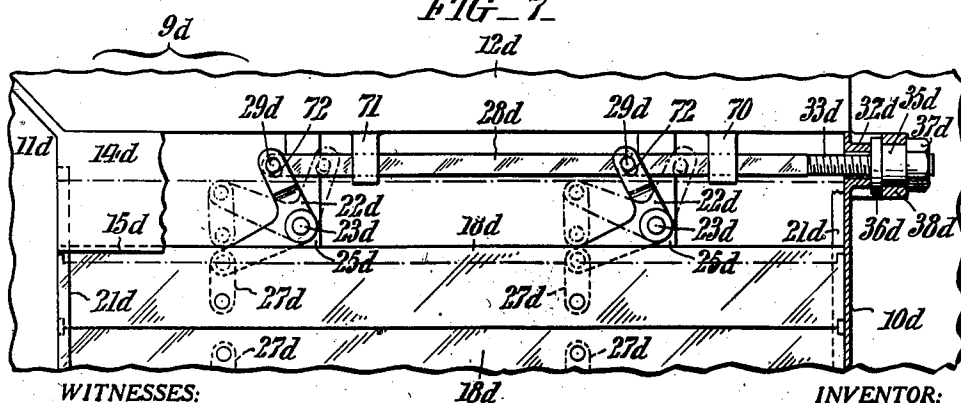


FIG- 7-



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## UNITED STATES PATENT OFFICE

2,344,040

## HOPPER GATE ADJUSTING MEANS

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Application January 19, 1942, Serial No. 427,225

14 Claims. (Cl. 105—234)

This invention relates to gate adjusting means for gravity discharge hoppers and the like, and it has reference more especially to gate adjusting mechanism for the coal hoppers of automatic locomotive boiler feed stokers.

In connection with such gate adjusting mechanism for hoppers of the kind mentioned, I aim to secure the advantages of manufacturing economy resulting from simplified construction; and to insure against the possibility of accidental displacement of the gates in adjusted positions. Another object of my invention is to attain the above desiderata in gate adjusting mechanism which is immune against derangement or clogging in the presence of dust or grit, so that it may be relied upon to function properly under all conditions of service in the event that regulation of coal flow through the hopper outlet should become necessary or desirable.

How the foregoing and other important objects and advantages may be readily realized in practice will appear from the following detailed description of the attached drawings, wherein, Fig. 1 is a fragmentary plan view of a locomotive coal tender with hopper gate adjusting mechanism conveniently embodying my invention in one form, portions of the hopper structure being broken away and shown in horizontal section to expose underlying parts of the adjusting mechanism.

Fig. 2 is a fragmentary view in cross section taken as indicated by the angled arrows II—II in Fig. 1.

Figs. 3 and 4 are views like Figs. 1 and 2 showing an alternative embodiment of my invention; and

Figs. 5, 6 and 7 are views corresponding to Figs. 1 and 3, showing other forms of my invention.

The locomotive tender illustrated in Figs. 1 and 2 for convenience of exemplifying one form of my improved adjusting mechanism is generally of conventional construction, the coal storage portion thereof having the configuration of a hopper 9 with a vertical front end wall 10, a rear end wall 11 and side walls 12 and 13, which rear end and side walls all slope downwardly and inwardly toward the floor 14 of said hopper. Extending longitudinally of the bottom of the hopper is a central slot-like discharge opening 15 by way of which the coal gravitates into an underlying conduit 16 with a stoker feed screw 17 therein for conveying the coal to the fire box (not shown) of the locomotive boiler. For the purpose of controlling the amount of coal passing through the opening 15, there is illustrated a divided gate consisting in this instance of two components 18, 18 which underlie the hopper floor 14 and which are supported for lateral sliding movement toward and away from each other in a common horizontal plane in guideways 21

secured to the underside of said hopper floor. In Figs. 1 and 2 the gates are shown in fully closed position with their contiguous inner edges abutting.

5 The means which I have illustrated in Figs. 1 and 2 for shifting each gate component 18 in accordance with my invention, includes a pair of bell crank levers 22 which are spaced lengthwise of the hopper 9 and which are fulcrumed to swing about fixed pivots 23 respectively. As shown, these pivots 23 are supported by bars 25 which extend crosswise between pendent side plates 26 of the hopper structure. The inner arms of the bell cranks 22 are connected by means of short links 27 to the gate component 18, while the outer arms of said bell cranks are connected to a longitudinally extending link 28 through pivots 29. One of these pivots 29, i. e., the right hand one in Fig. 1, is in turn coupled by a shorter longitudinally extending link 30 with the inner end of a slide bar 31 which extends outwardly through a guide bearing 32 on the front end wall 10 of the hopper. The cylindric outer end of the slide bar 31 is threaded as at 33 and engaged by a nut sleeve 35 having heads 36 and 37 at its opposite ends which engage a fixed stop member 38 in which the sleeve is supported for rotation. Adjustment of the gate 18 is effected by rotation of the sleeve 35 in one direction or the other by means of a suitable tool or wrench applied to the polygonal head 37 of said sleeve. Depending upon the direction of rotation of the sleeve 35, the link 28 is moved endwise either to the right or to the left to open or close the gate component 18 through swinging motion concurrently imparted to the bell cranks 22 in a manner readily understood from Fig. 1. Due to the interposition of the short link 30, the longer link 28 can move laterally slightly to accommodate the motion of the bell cranks 22, while the links 27 compensate for the angular movement of the inner arms of said bell cranks, so that no binding can take place during the adjustment of the gate component. The above description and operation of course apply equally to the duplicate adjusting means for the companion gate component 18.

The alternative form of gate adjusting mechanism shown in Figs. 3 and 4 includes for each gate component 18a, a spindle 28a which is provided with screw threads 33a at opposite ends thereof. Engaging the screw threads 33a are nut sleeves 22a which through links 27a and 40 are respectively connected to the gate component 18a and to the pivot bearings 25a affixed to the lower side plates 26a of the hopper structure. Through a universal jointed link 30a, the front end of each screw spindle 28a is coupled with a short shaft 31a journaled for rotation in a bearing 32a at the front wall 10a of the hopper. The short shaft

31a is restrained against endwise movement in the bearing 32a by means of stop collars 36a and 37a, and has its outer end fashioned to polygonal configuration at 41. The adjustment of each gate component is effected by rotation of the corresponding shaft 31a in one direction or the other as required to open or close the gate component 18a to accomplish which a wrench applied to the squared front end 41 of said shaft may be employed. Rotation of the short shaft 31a is communicated through the link 30a to the screw spindle 28a with the result that the nut sleeves 22a are shifted either forward or backward depending on the direction of shaft rotation. As the nut sleeves 22a are so moved, the links 27a and 40 will allow for lateral shifting of the spindle 28a with impartation at the same time of corresponding movement to the gate component 18a. All the other elements in Figs. 3 and 4 not specifically mentioned but having their counterparts in Figs. 1 and 2 are identified by the same reference numerals previously employed with the addition of the letter a in each instance for convenience of distinction.

In the form of my invention illustrated in Fig. 5, the spindle 28b is journaled in fixed bearings 32b and 50 held from shifting axially by collars 36b and 37b which engage the opposite ends of the bearing 32b. At its outer end beyond the front wall of the hopper the spindle 28b is fashioned to polygonal configuration at 41b for actuating wrench application, and at spaced points intermediate its ends provided with contiguous right and left threaded portions 33b and 51 which are respectively engaged by nut sleeves 22b and 52. As shown, the nut sleeves of each pair are coupled by means of links 27b and 53 with the corresponding gate component 18b, the links of each pair having a common pivotal connection with the gate component at 54. Thus, with this arrangement, as the spindle 28b is turned in one direction or the other, the nut sleeves 22b and 52 of the respective pairs either approach each other or separate with the result that either thrust or pull is induced in the links 27b and 53 to shift the corresponding gate component 18b toward or away from its mate. For convenience of assembling the structure of Fig. 5, the nut sleeves 22b and 52 are preferably split axially and their component halves held together by the pivot bolts at 55 and 56. Here again all the elements not specifically referred to but having their counterparts in Fig. 1 are identified by the same reference numerals previously employed with the letter b added in each instance.

In Fig. 6, the spindle 28c has screw portions 33c with threads extending in one direction only and engaged by single nut sleeves 22c as in Fig. 3, the spindle being however confined against axial movement as in Fig. 5. A further difference to be noted in Fig. 6 is that while two links 27c and 53c are here employed with each nut sleeve 22c, one of each such pairs of links is pivotally connected at 23c to a fixed portion 25c of the hopper structure, and that the common pivotal connection 54c for each pair of the links is coupled by means of a short link 27c with the corresponding gate component 18c. With the arrangement of Fig. 6 it will be apparent that upon turning of the spindle 28c in one direction, the nut sleeves 22c and the links 27c and 53c will be caused to assume the positions shown in dot and dash lines to shift the corresponding gate component 18c to open position. Turning of the spindle 28c in the opposite direction will ob-

viously be attended by shifting of such gate component toward closed position. As in the other modifications, all corresponding elements not specifically referred to in Fig. 6 are identified by the same reference numerals with the letter c added in each instance.

The modification shown in Fig. 7 is like that of Fig. 1 except that here the link 28d is confined to endwise movement in fixed guides 70 and 71 and itself formed with a screw threaded end 33d which extends through the front wall of the hopper for engagement by an actuating nut sleeve 35d which is held against axial shifting by the parts 32d and 38d. Binding at the pivots 29d is precluded through provision of clearance slots 72 in the outer arms of the bell cranks 22d. In all other respects it will be noted that the modification of Fig. 7 is identical with the first described embodiment of my invention featured in Fig. 1.

It is to be particularly noted that the various forms of my invention here illustrated are all extremely simple in their construction and can therefore be very economically manufactured and applied. In each instance, a screw device is employed as the adjusting means so that the gates cannot accidentally be displaced from adjusted positions through jars or vibrations incident to travel of the tender over irregularities in the track rails. By employing screw means and simple linkage devices as herein shown in lieu of gearing, I preclude derangement of the adjusting means by dust or grit, so that adjustments may be made from time to time without difficulty as conditions of use may require.

Having thus described my invention, I claim:

1. Gate adjusting mechanism for the coal hopper of a locomotive tender having a bottom outlet and a gate which is shiftable laterally to control flow into an underlying stoker feed conduit, said mechanism including a screw element movable endwise in a direction at right-angles to the direction of gate movement; interposed connections for translating the endwise movements of said element into lateral movements of the gate to shift said gate to open or closed position; and operating means for the screw element rotatively supported on the wall of the hopper at the front end of the tender.

2. Gate adjusting mechanism for the coal hopper of a locomotive tender having a bottom outlet and a divided gate with two components which are shiftable laterally toward and away from each other to control flow into an underlying stoker feed conduit, said mechanism comprising a screw element for each gate component which is movable in a direction at right-angles to the direction of gate movement, and operating means for said screw element rotatively supported on the wall of the hopper at the front end of the tender; and interposed connections for translating the endwise movements of each screw-actuated element into lateral movement of the corresponding gate component to shift such component to open or closed position.

3. Adjusting mechanism for a laterally shiftable hopper outlet gate comprising a link which is movable endwise in a direction at right-angles to the direction of gate movement; screw means confined to axial movement for moving the link as aforesaid and to which the link is pivotally connected at one end; and interposed connections for converting the endwise movements of the link into lateral movements of the gate to shift it to open or closed position, including a bell crank lever having one of its arms coupled

with the gate and its other arm pivotally coupled with the other end of the link.

4. Adjusting mechanism for a laterally shiftable hopper outlet gate comprising a link which is movable endwise in a direction at right-angles to the direction of gate movement; a threaded shaft coupled with the link; a nut sleeve confined against axial movement and engaging the threads of the shaft to shift the link endwise; and interposed connections for translating the endwise movements of the link into lateral movements of the gate to shift it to open or closed position, including a bell crank which is fulcrumed to rock on a fixed pivot, said bell crank having one of its arms coupled with the gate through a short link and its other arm coupled directly with the first mentioned link.

5. Hopper gate adjusting mechanism according to claim 4, including multiple bell cranks and short links between the first mentioned link and the gate.

6. Gate adjusting mechanism for a hopper having a bottom outlet and a divided control gate for the outlet with two components which are shiftable laterally toward and away from each other, said mechanism comprising, for actuating each gate component, a link which is movable endwise in a direction at right-angles to the direction of gate movement; screw means confined to axial movement for moving the link as aforesaid and to which the link is pivotally connected at one end; and interposed connections for translating the endwise movements of the link into lateral movements of the gate component to shift it to open or closed position, including a bell crank lever whereof one arm is coupled with the gate and the other arm is pivotally coupled with the other end of the link.

7. Gate adjusting mechanism for a hopper having a bottom outlet and a divided gate with two components which are shiftable laterally toward and away from each other to control flow through said outlet, said mechanism comprising for actuating each gate component, a link which is movable endwise in a direction at right-angles to the direction of gate movement; a threaded shaft coupled with the link, a nut sleeve confined against axial movement and engaging the threads of the shaft for shifting the link endwise; and interposed connections for translating the endwise movements of the link into lateral movements of the corresponding gate component to shift it to open or closed position, including a bell crank lever which is fulcrumed to rock on a fixed pivot, said bell crank lever having one of its arms coupled to the gate by means of a short link and its other arm coupled directly with the first mentioned link.

8. Gate adjusting mechanism for a hopper having a bottom outlet and a laterally shiftable gate to control flow through said outlet, said mechanism comprising a rotatable spindle which is disposed at right-angles to the direction of gate movement and confined against axial movement; a nut sleeve engaging screw threads on the spindle; and interposed connections for translating the endwise movements of the nut sleeve into lateral movements of the gate to shift it to open or closed position, including a pair of links whereof one is connected to the nut sleeve and to the gate and the other is connected to the nut sleeve and to a fixed portion of the hopper structure.

9. Gate adjusting mechanism for a hopper having a bottom outlet and a laterally shiftable gate to control flow through said outlet, said mechanism comprising a spindle disposed at right-angles to the direction of gate movement and confined against axial movement; means for rotating the spindle including a shaft confined to rotation in a fixed part of the hopper structure, and a coupling link having universal connections respectively with the spindle and the shaft; a nut sleeve engaging a screw thread on the spindle; and interposed connections for translating the endwise movements of the nut sleeve into lateral movements of the gate to shift it to open or closed position, including a pair of links, whereof one connects the nut with the gate and the other connects the nut with a fixed portion of the hopper structure.

10. Adjusting mechanism according to claim 9, in which nut sleeves are duplicated at intervals along the spindle and each coupled by links respectively with the gate and the fixed portion of the hopper structure.

11. Gate adjusting mechanism for a hopper having a bottom outlet and a divided gate with two components which are shiftable laterally toward and away from each other to control flow through said outlet, said mechanism comprising a screw spindle for each gate component extending at right angles to the direction of gate movement; means whereby the spindle may be rotated; a nut engaging the threads on each spindle; and interposed connections for converting the endwise movements of the nut sleeve into lateral movements of the corresponding gate component to shift the latter to open and closed positions, including a pair of links, one connecting the nut sleeve with the gate component and the other connecting said sleeve with a fixed portion of the hopper structure.

12. Gate adjusting mechanism for a hopper having a bottom outlet and a laterally shiftable gate to control flow through said outlet, said mechanism comprising a rotatable spindle which is disposed at right-angles to the direction of gate movement and which has right and left-hand threaded portions; nut sleeves respectively engaging the right and left-hand threaded portions of the spindle; and means connecting the nuts and the gate and operative to translate the relative movements of the nuts axially away from or toward each other as the spindle is rotated in one direction or another to shift the gate to open or closed position.

13. Gate adjusting mechanism for a hopper having a bottom outlet and a laterally shiftable gate to control flow through said outlet, said mechanism comprising a rotatable spindle which is disposed at right-angles to the direction of gate movement and which has right and left-hand threaded portions; nut sleeves respectively engaging the right and left-hand threaded portions of the spindle; and links respectively connected at one end with the nut sleeves and having their other ends connected to a common pivot on the gate.

14. Gate adjusting means according to claim 13, in which the spindle has multiple right and left-hand threaded portions along its length, and in which the associated nut sleeve and the links are correspondingly duplicated.

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