Nov. 18, 1924. 1,515,834

A. CAMPBELL

DOOR OPERATING MECHANISM

Filed Feb. 16, 1923 3 Sheets-Sheet 1

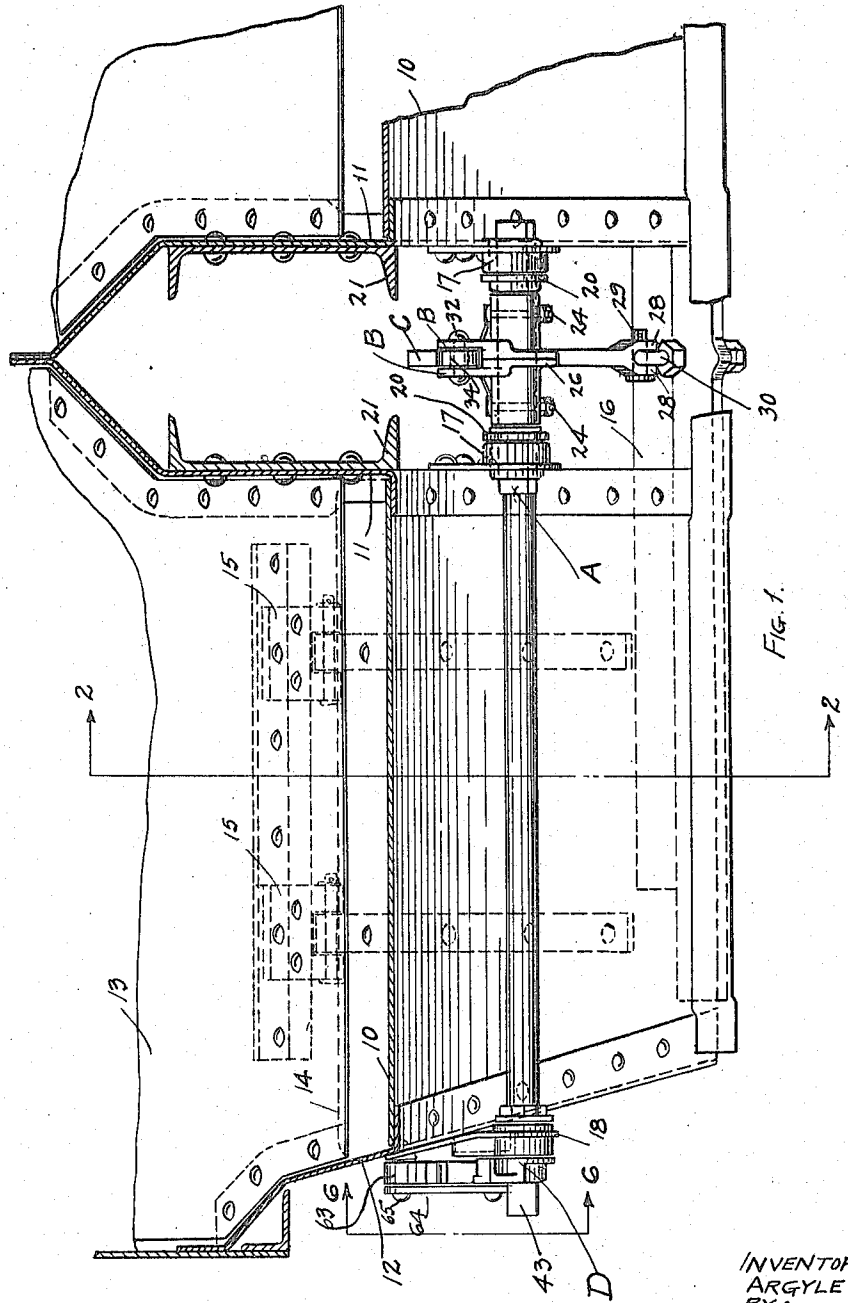


FIG. 1.

INVENTOR
ARGYLE CAMPBELL
BY George W. Haight
HIS ATTORNEY

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A. CAMPBELL

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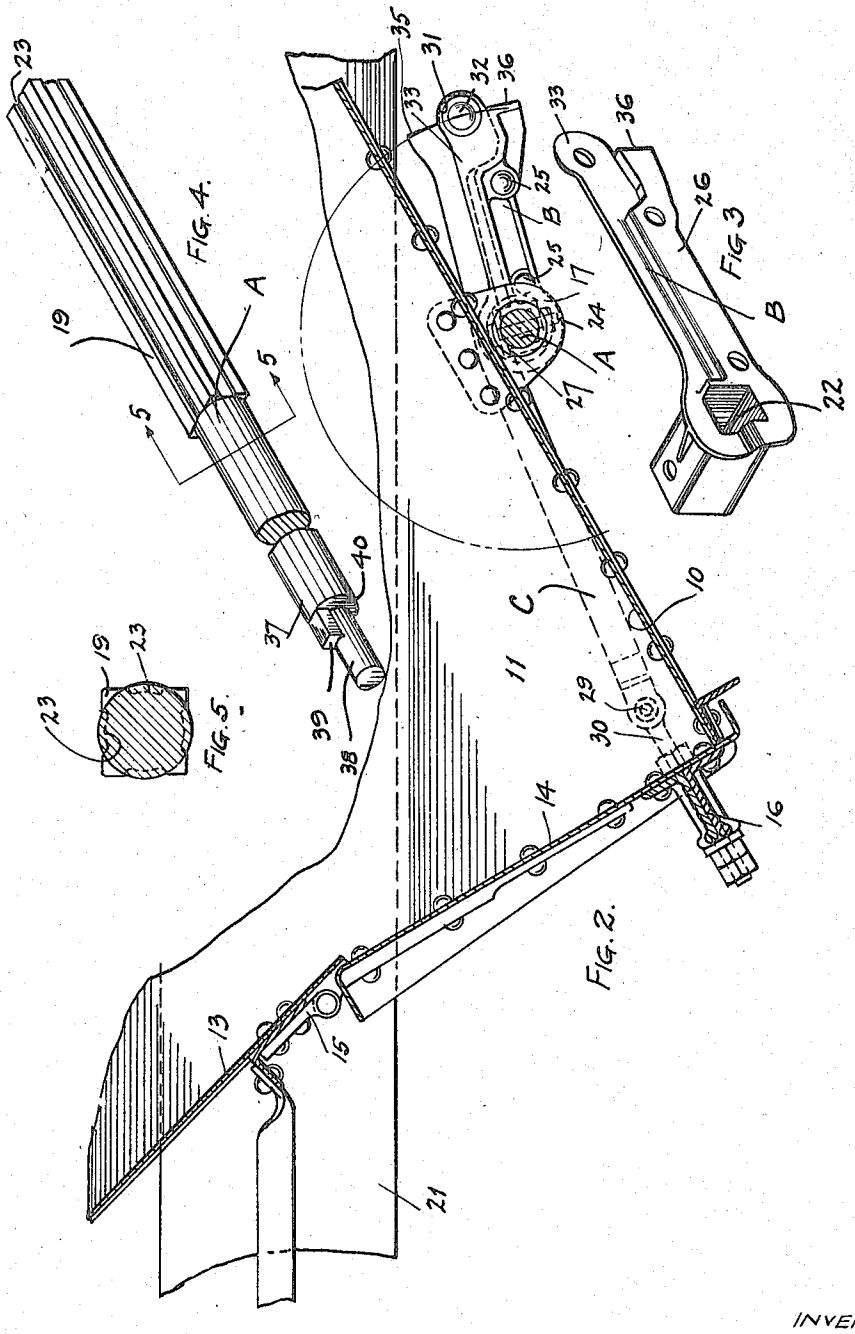


FIG. 4.

FIG. 5.

FIG. 3

FIG. 2.

INVENTOR
ARGYLE CAMPBELL
BY
George I. Haight
HIS ATTORNEY

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A. CAMPBELL

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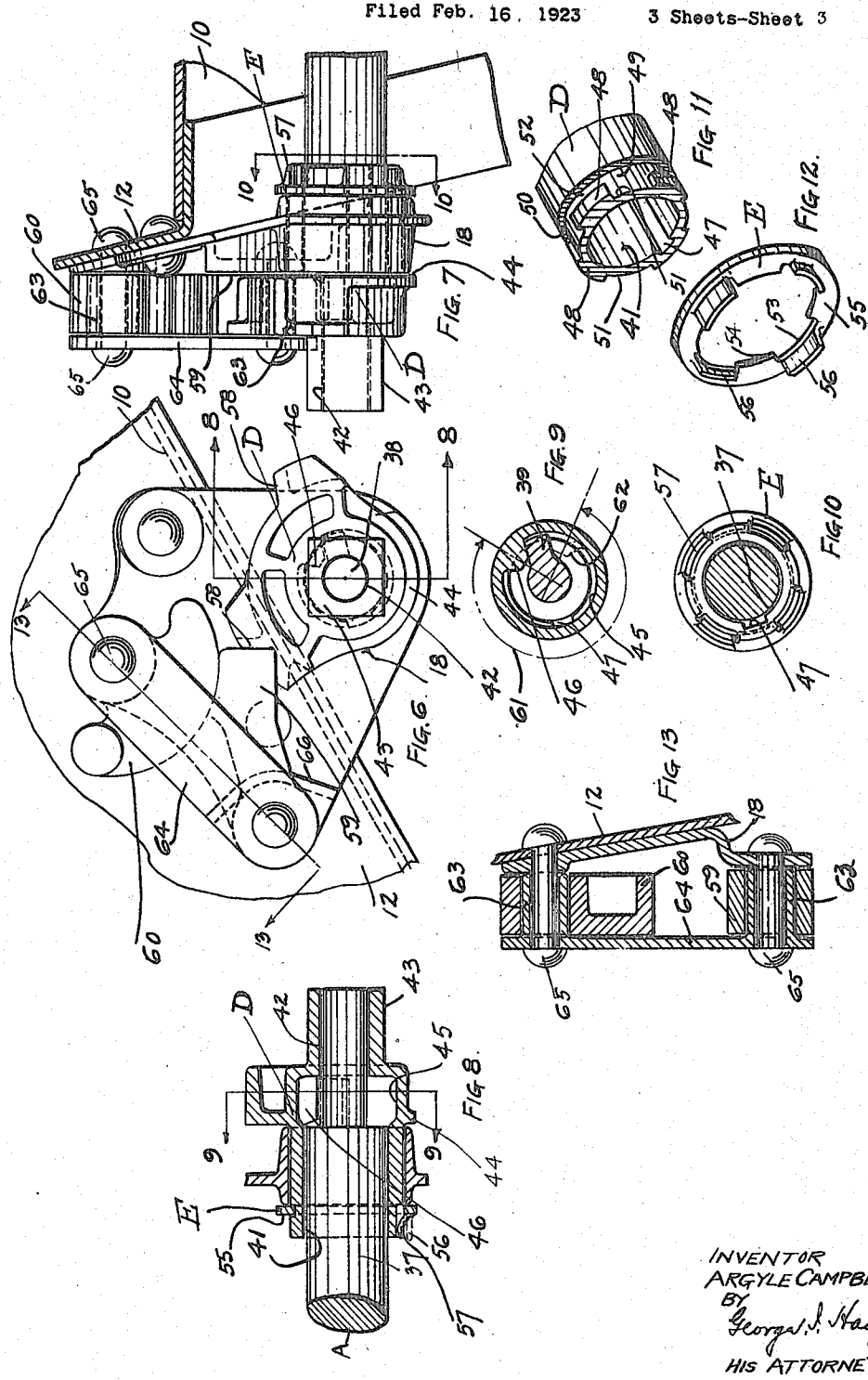

INVENTOR
ARGYLE CAMPBELL
BY George J. Knight
HIS ATTORNEY

Patented Nov. 18, 1924. 1,515,834

# UNITED STATES PATENT OFFICE.

ARGYLE CAMPBELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO ENTERPRISE RAILWAY EQUIPMENT COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## DOOR-OPERATING MECHANISM.

Application filed February 16, 1923. Serial No. 619,366.

*To all whom it may concern:*

Be it known that I, ARGYLE CAMPBELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Door-Operating Mechanisms, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to improvements in door operating mechanism.

One object of the invention is to provide an improved and simplified method of actuating an operating shaft in connection with the opening and closing of dumping doors used on railway freight cars and the like.

Another object of the invention is to provide an improved and simplified safety clutch device between the operating shaft securing the doors in their closed position and the part adapted to be actuated by the operator for the purpose of effecting rotation of the shaft and consequent opening of the dumping doors. I am aware that various devices embodying a clutch or loose connection in car door operating mechanisms are now in use but these are generally of a complicated nature and lacking in stability and it is the purpose of my invention to remedy such deficiencies.

Another specific object of the invention is to provide a door operating shaft of maximum strength combined with light weight and which may be easily manufactured and easily applied to the car.

My invention further resides in the novel combination of parts and details of construction as will more clearly appear from the description hereinafter following.

In the drawings forming a part of this specification, Figure 1 is a vertical transverse sectional view of a W-type hopper car showing my improved door operating mechanism applied thereto, a little more than one half of the width of the car being disclosed. Figure 2 is a longitudinal sectional view corresponding substantially to the section line 2—2 of Figure 1. Figure 3 is a perspective view of one of the hub arms. Figure 4 is a perspective view of the operating shaft. Figure 5 is a sectional view through the shaft taken on a line corresponding substantially to the section line 5—5 of Figure 4. Figure 6 is a broken, side elevational view, on an enlarged scale, of the improved clutch device and shaft locking arrangement as viewed on a line corresponding substantially to line 6—6 of Figure 1. Figure 7 is a broken, transverse sectional view of the clutch device and shaft locking arrangement and also forms an elevational view of Figure 6. Figure 8 is a sectional view taken through the clutch mechanism and on a line which corresponds substantially to line 8—8 of Figure 6. Figure 9 is a sectional view of the clutch mechanism taken on a line corresponding substantially to line 9—9 of Figure 8. Figure 10 is a sectional view taken through a line corresponding substantially to line 10—10 of Figure 7 and illustrates the retaining washer in assembled relation with the clutch member. Figure 11 is a perspective view of the inner end of the clutch member illustrating the formation of the interlocking projections thereof used in connection with the clutch retaining washer. Figure 12 is a perspective view of the clutch retaining washer. Figure 13 is a sectional view through the locking pawl and locking cam taken on a line corresponding substantially to line 13—13 of Figure 6.

I have shown my improvements as applied to a hopper car of that type wherein the bottom walls slope downwardly from the ends of the car toward the center, the car having a central transverse ridge and formed with hoppers, arranged in pairs transversely of the car. As shown, each hopper is defined by a sloping bottom hopper sheet 10, a vertical inner side hopper sheet 11, an outer inwardly sloping side hopper sheet 12 and a part of the transverse ridge as indicated at 13 in Figures 1 and 2. The opening of the hopper is adapted to be closed by a hopper door indicated at 14, the same being hinged to the underside of the ridge sheet 13 as by means of the hinge butts 15, thus adapting the door to swing about its upper edge on an axis extending trans-

versely of the car. As customary in this type of car, the two doors of the transversely alined pair of hoppers are adapted to be operated simultaneously and to this end a crossbrace is secured near the free edges of the doors near their lower ends, as indicated at 16, it being understood that said crossbrace passes from one door to the other below, and bridging the space between the center sill construction.

In carrying out my invention, I employ a transversely extending horizontal operating shaft A mounted in suitable bearing castings 17—17 secured to the inner vertical side hopper sheets 11—11 and in a bearing 18 secured to the outer, inwardly sloping hopper side sheet 12. Said shaft A, which preferably consists of a circular bar, is preferably extended to one side of the car only where it is provided with a safety clutch device as hereinafter described. The other end of the shaft is distorted from its circular section to a preferably rectangular shape as indicated at 19 in Figure 4, and terminates just beyond the plane of the far side of the center still construction, the shaft being fitted with bushings 20—20 whereby the shaft is adapted to turn freely in the bearings 17—17. Applied to the shaft A at a point thereon between the center sills 21—21 are hub arms designated by the reference letters B—B. Said hub arms B—B are formed of right and left construction respectively and are slipped over the shaft A and held rigidly therewith against rotation preferably by means of the non-circular formation 19 of the shaft and the correspondingly shaped opening in the hub arms as indicated at 22 in Figure 3. In order to obtain the most satisfactory results, it is desirable that the transformation of the shaft from a circular to a non-circular section should be accomplished without the necessity of upsetting the original portion of the shaft while at the same time securing a non-circular section of sufficient size and strength to withstand relative twisting between the hub arms B and the said shaft A. I accomplish the desired result by fluting the sides of the non-circular portion 19 of the shaft as indicated at 23. This is accomplished by reducing the cross-section of the circular portion of the shaft as indicated at 23 and forcing the metal outwardly to form a section of polygonal shape, preferably in the form of a square as indicated in the drawings.

The hub arm sections B may be held against longitudinal movement with respect to the car body by any suitable means such as the bolts 24. The hub arm sections are held in relation to each other by means of bolts or rivets 25—25 passing through flanges 26 of the respective hub sections B. Operative connection between the arms B and the door is effected by an elongated rigid link C. Said link C is deflected or bent intermediate its ends where it passes across the shaft as indicated at 27, the link being adapted to rest on the shaft. At its end adjacent the door, the link C is forked as shown at 28—28, the forks being perforated to accommodate a heavy pivot-pin 29 which connects it to the eyebolt 30, the latter being in turn rigidly, but adjustably secured to the pair of doors by means of cross-brace 16. At its opposite end the link C has a rounded terminus as indicated at 31, which is perforated to accommodate a heavy pivot preferably in the form of a rivet 32 extending through the flanges 33 of the respective hub arms and carrying a ferrule 34 which effectively spaces the said arms B from each other. Said rivet 32 forms an additional means securing the hub arm sections B together. The link C is provided also with a radial shoulder 35 on its upper side which is adapted to engage shoulder forming flanges 36 provided on the hub arm sections B at the end of the full opening movement of the door to thereby limit the relative swinging movement of the link C and the hub arms B and prevent the pivotal connection from falling down below a pre-determined point. The total angular movement of the hub arm from the door closed position to the fully opened position thereof is approximately 180° and it will be seen that this total angular movement is positively controlled and cannot be exceeded.

As a precaution against injury to the operator in opening of the door, a safety clutch arrangement is applied to the end of the shaft. This arrangement comprises a clutch member or housing D rotatably mounted in bearing 18 and within which the end of the circular portion of the shaft A indicated at 37, is extended. Said shaft, at the outer end thereof, is formed with a circular portion 38 of reduced diameter constituting a journal on which said clutch member D is adapted to rotate. Intermediate said circular portions 37 and 38 respectively, there is a radially disposed lug 39 formed on the shaft and preferably integrally therewith. The difference between the two diameters of the respective bearings 37 and 38 is indicated by the wall 40 with which the lug 39 is integrally formed and consequently resistance of the said lug to shearing is very great inasmuch as it is secured to the shaft in the plane of rotation thereof and also at right angles thereto.

The other main element of the safety tevice is the clutch member D formed with inner bearings 41 and 42 cooperating with circular portions 37 and 38 of the shaft A. The outer end of the clutch member D is formed in such a manner as to receive a claw-bar or other suitable tool and in this instance

a square section 43. The clutch member D is inserted in the bearing 18 from the outside of the car and inward movement thereof relative to the bearing is prevented by means of guiding flange 44. It will be noted that the lug 39 extends outwardly a limited distance beyond the periphery of bearing portion 37 of the shaft A and in order to compensate therefor the inside diameter of the clutch member, in the plane of the lug 39, is slightly enlarged as indicated at 45 and on the inner periphery of such enlarged portion of the clutch member a radially inwardly projecting lug 46 is formed, this lug 46 being in the same vertical plane as the lug 39 on the shaft A. The clutch member is formed with slot 47 in the face of the inner bearing 41 for the passage of the projecting portion of the lug 39 during the assembling of the shaft A and clutch member D.

Outward movement of the clutch member with respect to the bearing 18 is prevented by means of a retaining washer plate E adapted to be fixed relatively to the clutch member D on the inner side thereof. The washer, which is in the form of a perforated disk of comparatively bendable metal is adapted to assume a position between the bearing 18 and projections 48 formed on the periphery of the clutch member D where it is formed of reduced diameter as indicated at 49 in Figure 11. Adjacent the periphery of the reduced portion 49 there is a continuous shoulder indicated at 50 formed by the larger diameter section of the clutch member and which forms one side of a channel 52, the other side of the channel being provided by the projections 48. Between each of said projections 48, openings in the form of notches as indicated at 51 are formed and are preferably slightly greater in extent than the projections. The inner periphery of the retaining washer E presents an irregular appearance, being formed of a series of notches 53 and segmental portions 54 alternately disposed. The notches 53 and the segmental portions 54 are so disposed on the washer as to permit the disk to be slipped on the inner end of the clutch member D and to slide freely longitudinally thereof when the notches 53 in the disk and the projections 48 on the clutch member are in alignment. Adjacent the notches 53 on the wall 55 of the washer are outwardly extending flanges 56 of a size adapted to fit within openings 51 of the clutch member D. In order to lock the retaining washer E in place on the clutch member D, said washer is brought into position with the notches 53 thereof registering with the projections 48 of the clutch member D and the washer moved longitudinally of the clutch member until such time as the washer is in the plane of the channel 52 when a partial rotation is given to the disk to bring the segmental portions 54 in line with the projections 48. It will be understood that the flanges 56 are spaced a sufficient distance from the axial center of the shaft A to clear the periphery of the projections 48 and in order to prevent turning of the washer E relatively to the clutch member D, the flanges 56, which are of bendable material and are now in alignment with the notches 51, are depressed by bending to a position in the notches as indicated at 57 in Figures 7, 8 and 10. While the bending of any one of the flanges in this manner is sufficient to lock the washer against turning movement it is desirable to have a number of these flanges to guard against breakage of one or more and, in the contingency of repairing cars when it might be necessary to remove a safety device and in the course of bending back the flanges, there is liability of breakage.

The periphery of the clutch member D is formed with a series of approximately radially extending shoulders 58 with which is adapted to cooperate a pivoted locking pawl 59, the locking pawl being held in operative position by a pivoted cam 60. In the drawings, I have shown the pawl 59 engaging that shoulder which indicates the fully closed position of the door and the remaining shoulders 58 will be used temporarily to hold the doors in partly closed position. The position of the parts as indicated in Figure 6 represents the locked position of the mechanism. In said figure, the segmental lug 46 on the clutch member engages the lug 39 on the shaft and consequently rotation of the shaft in an unlocking direction is prevented as the pawl 59 secures the clutch member in position.

Assuming the parts in locked position as viewed in Figure 6, the unlocking operation is carried out as follows. Locking cam 60 is swung in a clockwise direction clear of the pawl 59 which is then swung in a counter-clockwise direction and out of engagement with the locking shoulders 58 of the clutch member D. A wrench or bar is then applied on the square position 43 of the clutch member D and rotation thereof effected in a counter-clockwise direction, the clutch members rotating independently of the shaft A through an arc as indicated at 61 in Figure 9 of slightly in excess of three-quarters of a revolution, until such time as the segmental lug 46 of the clutch member engages the reverse face of the lug 39 of the shaft, assuming the position indicated by dotted lines at 62 in Figure 9. The motion of the clutch member D is then communicated to the shaft A and both members will then rotate in unison until such time as the door operating mechanism proper becomes unlocked and the load on the doors exerts a rotating pull or torque on the operating shaft A which then rotates independently

of the clutch member D. It will thus be seen that the clutch member has a lost motion slightly in excess of 270° plus the further slight angular movement necessary to move the arms B sufficiently to release the locking arrangement between the link C and the arms B whereas the shaft A only moves through an arc of substantially 180° from closed to open position thereby assuring the operator a margin of safety in excess of 90°. Furthermore the clutch mechanism as illustrated is very simple, consisting of very few parts and possesses an unusual degree of stability inasmuch as the inner end of the clutch member is supported in the bearing 18 and the outer end of the clutch member is supported on the shaft extension constituting the bearing 38. It will also be noted that I minimize the possibility of the parts becoming disassembled inasmuch as the interlocking of the parts is affected by the washer E and clutch member D and I do not depend upon screws or bolts or cotters for retaining the parts in assembled relation. The closing of the door is a reversal of the opening operation in so far as the operations are concerned with the exception that the clutch member D moves independently of the shaft through an arc slightly in excess of 90° before the shaft A and housing D move in unison.

The pivots for the locking pawl 59 and locking cam 60 are preferably formed of bosses 63 formed integral with a strap 64 extending from one to the other and the connection with the car structure is made by bolts or rivets 65 passing through the bosses. In the case of the rivet securing the boss passing through the pawl 59, the rivet passes through the flange of the bearing 18 with the head of the rivet lying between said flange and car side wall 12.

I have herein shown and described what I now consider the preferred embodiment of my invention, but the same is merely illustrative and I contemplate all changes that come within the scope of the claims appended hereto

What I claim is:

1. In a car door operating mechanism, a door operating shaft having adjacent bearing portions of different diameters and having a clutch acting element rigid therewith; a bracket secured to the car structure; a clutch member rotatably mounted in said bracket and on one of the said bearing portions of the shaft, said clutch member having a cooperating clutch element adapted to engage with said clutch element of the shaft.

2. In a car door operating mechanism, the combination with an operating shaft having a lug integral therewith; of a bearing secured to the car structure; and a clutch member rotatably mounted in the aforesaid bearing, said clutch member having a lug formed integrally therewith adapted for engagement with the lug on the shaft.

3. In a car door operating mechanism, the combination with a bearing secured to the car structure; of a clutch member rotatably mounted in the said bearing and having inner bearings formed at either end thereof; of a shaft journalled in the said inner bearings; and lugs fixed to the shaft and clutch member respectively and disposed in the same plane of rotation intermediate the surface of the smaller of said bearings.

4. In a car door operating mechanism, the combination with a bearing rigidly secured to the car structure; of a clutch member rotatably mounted therein and having an enlarged central portion having a lug formed on the inner face thereof; and a shaft rotatably mounted in the said clutch member formed with a lug adapted to engage the lug on said member.

5. In a car door operating mechanism, a door operating shaft having two circular bearing portions of different diameters and an operating clutch lug formed integrally with the end wall of the larger of said bearings and also formed integrally with the surface of the smaller of said bearings.

6. In an operating mechanism for a door, the combination with a shaft having a multiple part, fabricated arm rigid with the shaft and extending radially therefrom, the parts of said arm being rigidly connected; of means connected to said arm and to the door for effecting operation of the latter.

7. In a car door operating mechanism, the combination with an operating shaft having a clutch lug rigidly secured thereto; of a bearing secured to the car structure; and a clutch member rotatably mounted in the aforesaid bearing, said clutch member having a lug formed integrally therewith adapted to have engagement with the lug on the shaft and having also a squared end by which the said member may be rotated and through which the shaft extends.

8. In a car door operating mechanism, the combination with a bearing secured to the car structure; of a clutch member rotatably mounted therein and having a portion extending outwardly from the bearing formed with an operating head adapted to receive a tool and be rotated thereby, said member having a clutch lug formed therein; and an operating shaft rotatably mounted in the aforesaid member and formed with a lug adapted to have engagement with the aforesaid lug formed in the clutch member, the said shaft being extended through the aforementioned operating head to support the same.

9. In a car door operating mechanism, the combination with an operating shaft having a clutch lug formed thereon; of a

bearing secured to the car structure; a clutch member rotatably mounted in the aforesaid bearing, said clutch member having a lug formed therein adapted to have engagement with the lug on the shaft, said clutch member also having radially extending shoulders with which a pivoted pawl coperates to lock the clutch member against rotation and provided also with a squared end by which rotation thereof may be effected and through which the operating shaft extends.

10. In a car door operating mechanism, the combination with an operating shaft having a lug secured thereto; of a bearing rigidly secured to the car structure; and a clutch member rotatably mounted therein, said clutch member having a lug secured thereto adapted for engagement with the lug on the shaft and being also provided with an integral flange disposed adjacent the bearing to limit movement of the clutch member lengthwise of the shaft.

11. In a car door operating mechanism, the combination with an operating shaft and a cooperating clutch member rotatably mounted in a bracket secured to the car structure; of means for preventing relative transverse movement between the clutch member and the bracket, said means comprising flanges fixed relatively to the clutch member and disposed on either side of the bracket.

12. In a car door operating mechanism, the combination with an operating shaft and a co-operating clutch member rotatably mounted in a bracket secured to the car structure; of means for preventing relative transverse movement between the clutch member and the bracket, said means comprising flanges fixed relatively to the clutch member and disposed on either side of the bracket, one of the aforesaid flanges being removably mounted on the clutch member.

13. In a car door operating mechanism, the combination with an operating shaft; of a bearing secured to the car structure; a clutch member loosely connected to said shaft and removably mounted in the bearing; and a retaining washer disposed in a groove adjacent the bearing to prevent transverse movement of the clutch member, said washer being retained in position by bending of a portion of the metal thereof.

14. In a car door operating mechanism, the combination with an operating shaft; of a bearing secured to the car structure; a clutch member removably mounted in the bearing; a retaining washer disposed in a groove adjacent the bearing to prevent transverse movement of the clutch member, one side of said groove being formed of alternately disposed notches and projections and the retaining washer being also formed with notches and projections, the insertion of the washer in the groove being accomplished by aligning the notches on the washer with the projections on the clutch member and thereafter giving the washer a partial turn to bring the projections on the clutch member in alignment with the projections on the retaining washer; and means for locking the washer against turning movement relatively to the clutch member.

15. In an operating mechanism for a pivoted door, the combination with a shaft having a plurality of arms extending radially therefrom and rigid therewith, of a link disposed between the said arms and pivotally connected to the free ends of said arms and to the door, said arms being formed with flanges disposed side by side and secured to each other.

16. In a hopper car having a sloping hopper bottom sheet and a hopper door pivotally mounted to swing about its upper edge, the combination with a shaft extending transversely of the car and parallel with the door, said shaft having one end thereof extended to the side of the car, and there provided with a lug formed integrally therewith; a bearing mounted on the car structure; a clutch member rotatably mounted in the bearing and having a lug formed thereon adapted to have engagement with the lug on the shaft, said member being provided also with a squared end by which the same may be rotated and through which the shaft extends; an arm extending rigidly from the shaft; and a link pivotally connected to the outer end of said arm and to the door.

17. In a safety door operating mechanism, the combination with a bracket provided with a journal bearing; of a clutch member rotatably mounted within said bearing and provided with an interior concentric journal bearing; a shaft rotatably mounted within said journal bearing of the clutch member; and cooperating clutch elements on said clutch member and shaft arranged for a predetermined amount of rotative lost motion therebetween.

18. In a device of the character described, the combination with a bracket having a journal bearing therein; of a clutch member rotatably mounted in the journal bearing of said bracket; and means for preventing accidental movement of said clutch member lengthwise within the journal bearing, said means comprising, integral portions on the clutch member engaging the bearing bracket at one end of the bearing, and a detachable washer mounted on the opposite end of said clutch member and interlocked therewith, said washer engaging the bearing bracket at the opposite end of the journal bearing.

19. In an operating mechanism for a door, the combination with a shaft having a non-circular section included therein; of an arm, said arm comprising a multiple of pieces,

each of which has a hub-section and an interior opening of a cross-section to fit said non-circular cross-section of the shaft whereby the arm is made rigid with the shaft, said arm extending radially from the shaft and the parts being rigidly united; and operative connections between said arm and the door.

In witness that I claim the foregoing I have hereunto subscribed my name this 13th day of February 1923.

ARGYLE CAMPBELL.

Witnesses:
FRANCES SAVAGE,
HARRIETTE M. DEAMER.