

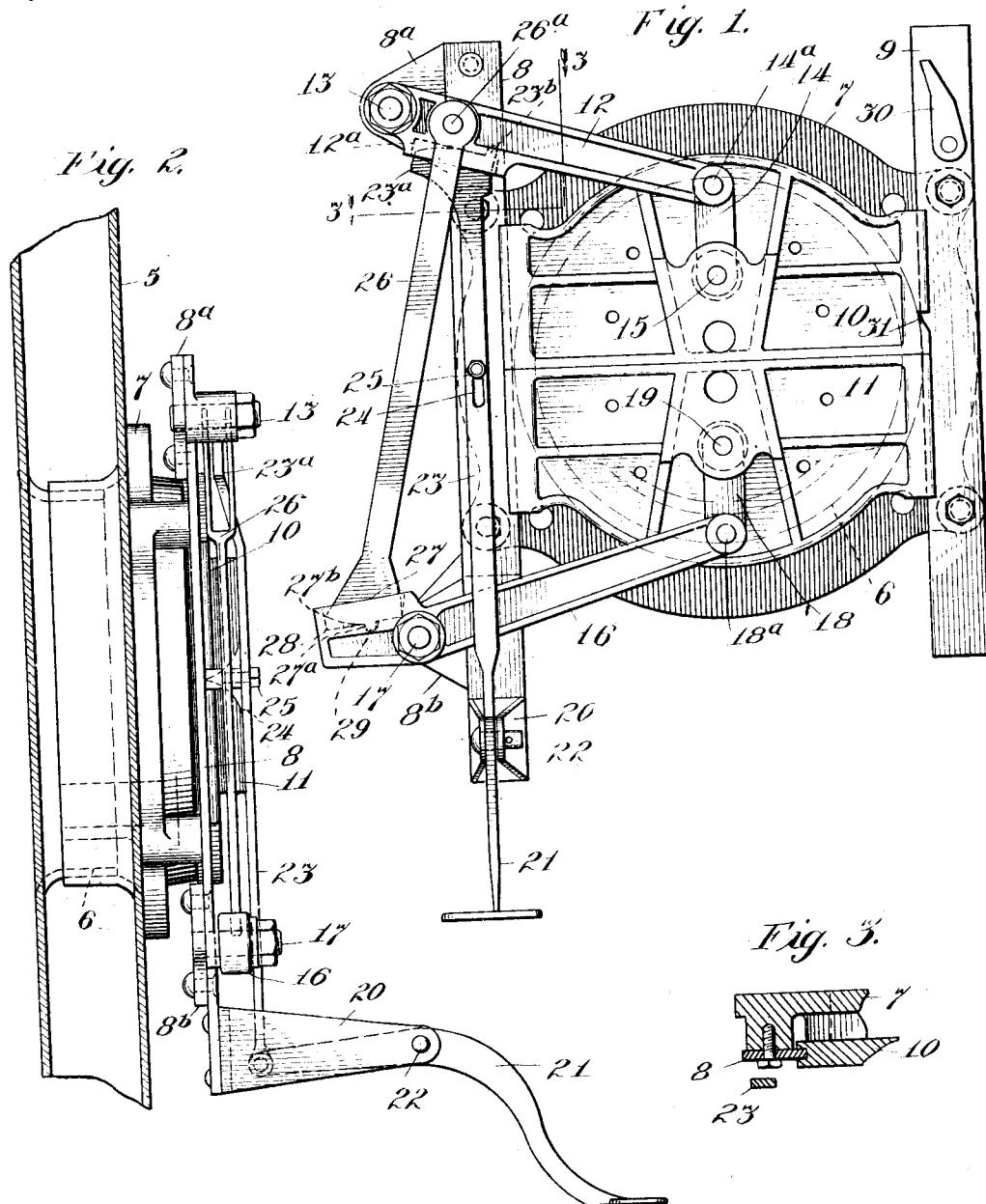
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DOOR OPERATING MECHANISM.

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DOOR-OPERATING MECHANISM.

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To all whom it may concern:

Be it known that we, GEORGE W. BASHAW, WILLIAM O. COOK, and PAUL C. WITHROW, citizens of the United States, and residents of Denver, in the county of Denver and State of Colorado, have invented a certain new and useful Improvement in Door-Operating Mechanism, of which the following is a description, reference being had to the accompanying drawing, which forms a part of our specification.

Our invention relates to an improvement in door operating mechanism which is more especially intended for use in connection with the doors of locomotive fire-boxes.

The object of our invention is the provision of means, adapted to be manually operated, whereby the doors, arranged to slide or move substantially parallel with the wall of the fire-box, may be easily and quickly operated and which will allow the doors to automatically move to closed position without, however, permitting them to come together with a jar or material striking force.

A further object of the invention is to provide a construction wherein the door sections will be substantially in balance when in closed position, a shifting leverage is provided whereby the desired power will be obtained at the initial point of the opening operation without great exertion on the part of the operator and without much foot travel or movement on the part of the operator, and wherein the doors and mechanism will be shifted to an unbalanced position so as to induce a quick closure of the doors as soon as the mechanism is released by the operator, as will be more fully understood from the following detailed description.

In the drawing:—Figure 1 illustrates our invention in elevation as the same would be applied to the wall of a fire-box. Fig. 2 is a side elevation showing the invention applied to the wall of a fire-box, the latter being shown in section. Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 1.

In the exemplification of our invention, 5 represents a portion of the water-jacket of a fire-box provided with the usual opening 6 extending therethrough for the purpose of introducing fuel into the fire-box. The wall of the fire-box is preferably pro-

vided with a frame or ring 7 secured about the opening 6 in any suitable manner; the frame or ring 7, it being understood, is made so as not to interfere with or restrict the opening into the fire-box.

Secured to the frame or ring 7 and at opposite sides of the fire-box opening are a pair of vertically extending guides or slideways 8 and 9, which may be properly secured to the frame or ring 7 or to the wall of the fire-box as desired. The vertically extending members 8 and 9 are intended to form slideways for the door-sections or members 10 and 11; the section 10 being adapted to move upwardly from the closed position shown in Fig. 1 while the section or member 11 is intended to move downwardly from the position shown in Fig. 1, when it is desired to open the doors or uncover the opening for the purpose of introducing the fuel.

The vertical member 8 is preferably provided with the extended portion or lobe 8^a at its upper end to which a lever 12 is pivotally secured at 13; the opposite end of lever 12 being pivotally secured to a link 14 which in turn is pivotally secured at 15 to the door member or section 10.

The lower end of vertical member 8 is shown provided with an extension or lobe 8^b to which a lever 16 is pivotally secured at the point 17; the inner end of lever 16 being pivotally secured to a link 18 which in turn is pivotally secured to the lower member or section 11 at the point 19. The lower end of vertical member 8 is also shown provided with a bracket 20, see Fig. 2, which may be either made integral with or suitably secured thereto; and a foot-lever or treadle 21 is pivotally secured at the point 22 to the outer extremity of the bracket. The inner end of foot-lever or treadle 21 is pivotally secured to a vertically extending rod or push member 23, which is provided with a suitable slot at 24 through which a stud or bolt 25 extends whereby the rod is slidably secured or supported on the vertical member 8. The upper end of rod 23 is provided with a cam 23^a which extends into a cam-socket formed at 12^a in lever 12. In the construction shown, the upper end of rod 23 is slightly off-set or bent so as to bring the upper or cam end of the rod beneath the lever 12.

more clearly shown in Fig. 2. The cam 23^a is shown provided with a heel or lug 23^b preferably at one side thereof which heel or lug extends into a similarly formed socket in lever 12 so as to permit a rolling movement of the cam or lever 12 without allowing the cam to slip away from proper working position. Pivotaly secured to lever 12 is a diagonal strut or rod 26; the upper end of rod 26 being shown bifurcated, see Fig. 2, sufficiently to allow the cam 23^a to extend between as shown. The lower end of strut 26 is provided with a cam 27 which extends into the cam-socket 28 formed in the outer end of lever 16, namely in the free or unconnected end of the lever extending from the side of the pivotal point 17 opposite to that on which the doors are located. The cam 27 is also preferably provided with a heel or lug 29 which extends into a similarly formed depression in the bottom of the socket 28 at the end of the lever, so as to prevent the cam slipping from proper position during the rolling movement of the cam.

In the operation of our improved mechanism, foot lever or treadle 21 is depressed, thereby moving rod 23 upward, which in turn will move lever 12 upward and draw the upper door member or section 10 with it. The cam 23^a is preferably arcuated so that the portion or side provided with the heel or protruding portion 23^b will normally be in contact with lever 12, and as this point is considerably removed from the pivotal point 13, it is evident that less power need be exerted at the initial point of opening the doors. As the lever 12 is moved upward, and with it door member or section 10, the contact point between cam 23^a and the lever shifts or moves toward the pivotal point 13. By reason of the shifting or rolling contact between cam 23^a and lever 12, instead of a fixed or constant relation, less upward movement of rod 23 is necessary and consequently less downward movement of the free end of lever or treadle 21 is necessary, with the result that the operator's foot need move a very short distance; in practice, the lever or treadle 21 being so formed that the heel or toe of the operator need only be employed while the balance of the foot may remain on the deck of the engine thus maintaining the operator's balance, which is quite desirable during the rolling or swaying movement of the locomotive. During the elevation of lever 12, diagonal strut or member 26 is moved upward therewith, thus relieving its downward pressure on the outer end of lever 16, allowing lever 16 together with the door-section or member 11 to move downwardly. The cam 27 at the lower end of diagonal member 26 is also arcuated so that its inner end or side will be in contact with lever 16 at a point in proximity to the pivotal point 17 of lever

16 during the normal position of the parts, and, therefore, at the beginning of the opening operation, where a slight movement is quite effective. The continued upward movement of lever 12 and upper door-section 10, and therefore of diagonal strut or member 26, will shift or bring the outer end of cam 27 into contact with a point on the lever 16 farthest removed from the pivotal point 17 thereby increasing the leverage for strut 26 and causing the downward pressure to be more effective when the door is to be closed. This moment of contact occurs when the door-sections have been moved or opened to their fullest extent; the moment of contact between what may be termed the outer end of cam 23^a and lever 12 (namely the point nearest the pivotal point 13) occurs at the same time. It is evident from the construction therefore that the differential leverage resulting when the door-sections have been moved apart to their fullest extent will cause the upper door member or section 10 together with its lever 12 and strut 26 to overbalance the lower door member or section 11 and its lever 16. With the outer end of cam 27 in engagement with a point on the free end of lever 16, somewhat removed from its pivotal point 17, when the door-sections have been opened to their fullest extent, the releasing of foot lever or treadle 21, which in turn releases the pressure of cam rod 23 on lever 12, will cause the combined weight of upper door-section 10, its lever 12, together with diagonal member or strut 26, to be brought to bear on the outer end of lever 16, causing the outer end of lever 16 to be pressed downward, thereby bringing the inner end of lever 16 and the door-section 11 upward to closed position. During the closing movement of the door-sections, the cam contact shifts or changes and permits the two door-sections to substantially balance each other, thereby maintaining them in closed position.

Where the downward movement of the lower door-section or member is not limited by reason of the deck of the engine, or for some other cause, the two door-sections are preferably made symmetrical and from the same pattern. In such instance, the distance from pivotal point 13 to 26^a on lever 12 should be the same as the distance between pivotal point 17 and the point 27^a on lever 16 while the doors are in closed position; and the distance from 13 to 14^a is slightly longer than the distance from 17 to 18^a, so that the two door-sections will practically be in balance when the sections are in closed position. As the points 13, 26^a, and 14^a on the upper lever 12, and the points 17 and 18^a on lower lever 16 are fixed, the distances between the points 13, 26^a, and 14^a, as well as the distance between 17 and 18^a remain the same when the door-sections have been

moved to open position; the distance between pivotal point 17 and the point of contact between cam 27, however, has rolled or shifted from the point 27^a to the outer edge or point 27^b of cam 27, whereby the two door-sections become unbalanced in favor of the upper door-section to such an extent that the advantage in leverage will induce a closing movement of the door-section as soon as foot treadle or lever 21 has been released.

Where the downward movement of the bottom door-section or member 11 is restricted or limited by reason of the proximity of the deck of the cab to the fire door, so that it would be impossible to secure a complete opening of the door-sections if the two sections were made symmetrical or of the same size and dimension, the door should be split below the center line of the fire-box opening so that the lower section or member is of less vertical width than the upper door-section or member. This necessitates the lower door-section to travel a less distance to entirely uncover the lower part of the opening in the fire-box than would be the case where the two sections are identical in width as shown in the drawing. Where this condition arises the point 27^a will have to be moved a somewhat greater distance from the fulcrum point 17, in order to impart a relative greater travel to the door-section or member 10 than is imparted to the lower door-section 11. In a construction of this kind the lower door-section or member 11 is also preferably made proportionately heavier than the top door-section or member 10 in order to compensate for the difference in size of the sections and the leverage made necessary to induce the greater distance of travel or movement of the top door-section 10. In a construction of this kind, as well as in the one previously described, the door-sections and arrangement of levers is such that the two door-sections will be very nearly balanced when in closed position, while the movement of the sections to a complete opened position will sufficiently unbalance the sections in favor of the upper door-section, to cause the automatic closing of the doors when the operator releases the treadle or foot lever 21.

It has been found in practice that if a construction were employed where the over-balance of the door-sections (that is in favor of the top door-section, in order to induce the closing of the doors) is a constant quantity, and not variable as in our improved construction, it is impracticable to secure a foot pressure on the treadle or lever sufficiently light to come within the capacity of the fireman or operator for frequent operation, unless the length of the lever from its fulcrum point 22 to the free end thereof is greatly increased. By increasing the length of the lever or treadle in this manner neces-

sitates a corresponding increase of travel of the free end of the foot-treadle or lever; which makes the operation such that the fireman or operator is compelled to lift his foot a considerable distance from the deck of the engine, often causing him to lose his balance and hence increase his danger during the jolting or tossing about of the engine. With our improved construction, however, where the door sections are substantially balanced in closed position, that is the position from which the fireman must start the opening movement, he is enabled to impart a sudden velocity at the initial point of movement by the lever 12, due to the cam construction of rod 23 as previously described. The velocity, thus imparted at the initial point of operation, is sufficient to carry the doors to a complete open position without, however, increasing the foot pressure; and when the doors reach the open position, the outer edge or end of cam 23^a nearest pivotal point 13, will be in contact with lever 12, while the foot lever or treadle will have reached its lowest point of travel, which may be arranged to be substantially parallel with or on the deck of the engine, when a considerable portion of the fireman's weight will be resting on the lever, without requiring exertion of energy on the part of the fireman to maintain the doors in open position. It has been found desirable in practice to bring the outer edge of the cam 23^a as near the pivotal point 13 and with as little distance normally between the working surfaces of the cam and the lever, as is possible, so that the foot travel or movement of the free end of the foot lever 21 will be as little as possible, thus permitting of the operation of the foot lever or treadle by the toe or heel of the operator without the necessity of raising his entire foot from the engine-deck. Furthermore, in order to insure the proper working of the door-sections, and so that the pulling action of the levers will be exerted as near the vertical axes of the sections as possible throughout the travel of the sections, the pivotal points 13 and 17 should be located on a horizontal line half way between the closed and open positions of the points 14^a and 18^a respectively, thereby preventing any tendency of the doors sticking or wedging themselves while open or increasing the friction between the door-sections and the guides 8 and 9 during operation.

In order to maintain the doors in open position, when it is desired to clean out the fire-box or for any other reason, we provide the pawl 30, pivotally secured to guide 9 at a point above the normal position of the upper door-section 10, so that it may engage in the notch 31 with which door-section 10 is provided. It is evident that when the door-sections are moved to open position, the

free end of the pawl 30 may be moved into the notch 31 and maintain the door-sections open.

We have shown and described what we believe to be the simplest and best form of our invention, wherein an overbalanced condition is obtained after the door-sections have been separated or moved to open position, sufficient to overcome any friction of the working parts as well as that caused by the pull of the fire-draft to induce the closing movement of the sections; but the construction may be varied in certain details without, however, departing from the spirit of the invention.

What we claim is:—

1. Door operating mechanism, comprising an upper and a lower door-section arranged to move vertically in opposite directions, a lever for each door section, each lever pivotally secured at one end to one of the door sections and provided with a fixed fulcrum near the other end, the fulcrum point of the lever secured to the lower door-section being arranged intermediate of the ends, a member pivotally secured to the lever of the upper door-section and having shifting engagement with the free end of the lever of the lower door-section, said member, levers, and door-sections being so arranged that a substantially balanced condition is maintained when the sections are in closed position, and means adapted to engage with the lever of the upper door-section whereby the door sections are moved to open position and an unbalanced condition obtained whereby automatic closing of the door-sections is induced.

2. Door operating mechanism, comprising a pair of door sections arranged to move in opposite directions, a lever for each door section, each lever pivotally secured at one end to one of the door sections and provided with a fixed fulcrum near the other end, a foot-lever, a slidably mounted member adapted to be controlled by said foot-lever and having a moving engagement with one of said first mentioned levers, and a second member pivotally secured to said lever and having a shifting engagement with the other of said pair of levers whereby the door-sections are placed in an overbalanced condition and closure thereof automatically induced.

3. Mechanism of the class described, comprising a pair of vertically movable door-sections, a lever for each door section, each lever being flexibly connected at one end to one of the door sections and provided with a fixed fulcrum near the other end, with the fixed fulcrum of the lever secured to the lower door-section being arranged intermediate of the lever ends, a diagonally arranged member pivotally secured to the lever connected with the upper door-section and having rolling engagement with the free

end of the lever connected with the lower door-section, and means having shifting engagement with the lever connected to the upper door-section whereby both door-sections are moved to open position.

4. Door operating mechanism, comprising a pair of vertically movable door-sections, a lever for each door section, each lever being flexibly connected at one end to one of the door sections and provided with a fixed fulcrum near the other end, the fulcrum point of the lever secured to the lower door-section being arranged intermediate of the ends of said lever, means pivotally secured to the lever of the upper door-section and having shifting contact with the lever secured to the lower door-section whereby the position of the upper door-section controls the position of the lower door-section, and means in shifting engagement with the lever of the upper door-section whereby the door-sections are moved to open position and an overbalanced relation in favor of the upper door-section is induced.

5. Mechanism of the class described, comprising an upper and a lower door-section adapted to move vertically in opposite directions and arranged to be substantially in balance when in closed position, means flexibly connected to each door-section and provided with fixed fulcrum points, and means operatively engaging with the first mentioned means whereby the door-sections are separated, a portion of the last mentioned means shifted from its normal engaging position in the first mentioned means and an unbalanced relation between the door-sections obtained whereby the automatic closing of the sections is induced.

6. Mechanism of the class described, comprising a pair of vertically movable door sections, a lever for each door section, each lever flexibly connected at one end to one of the door sections, and provided with a fixed fulcrum near the other end, with the fulcrum of the lower lever being arranged intermediate of its ends, a member pivotally secured to the lever connected with the upper door-section, a cam secured to the lower end of said member and having shifting engagement with the free end of the lever connected with the lower door-section, and means having shifting contact with the lever connected with the upper door-section whereby both door-sections are moved to open position and an unbalanced condition of the door-sections induced.

7. Mechanism of the class described, comprising a pair of vertically movable door-sections, a lever for each door section, each lever flexibly connected at one end to one of the door sections, and provided with a fixed fulcrum near the other end, with the fulcrum of the lower lever being arranged intermediate of its ends, a member pivotally

secured to the lever connected with the upper door-section, the lower end of said member being provided with a cam portion having rolling engagement with the free end of the lever connected with the lower door-section, means whereby the operative relation between the cam portion and the free end of the lever is maintained, and means having shifting engagement with the lever connected with the upper door-section whereby the upper door-section and said member are lifted, allowing the lower door-section to move downwardly and producing a differential leverage.

8. Mechanism of the class described, comprising an upper and a lower lever adapted to move in vertical directions and having fulcrum points arranged at unequal distances from the opposite ends of each lever, a cam-rod pivotally secured to the upper lever and in rocking engagement with the lower lever, and means having operative engagement with the upper lever, the engagement of said means being adapted to shift toward the fulcrum point of the upper lever during upward movement of the lever and thereby rock the engagement of said cam-rod away from the fulcrum point of the lower lever, in combination with a pair of door-sections with which said opposite ends of the two levers are flexibly connected.

9. Mechanism of the class described, comprising an upper and a lower lever adapted to move in vertical directions and having fulcrum points arranged at unequal distances from the opposite ends of each lever, a cam-rod pivotally secured to the upper lever and in rocking engagement with the lower lever, and a vertically movable member adapted to have a rocking contact with said upper lever whereby the levers are operated and the engagement between the member and upper lever shifted toward the fulcrum point of the latter, in combination with a pair of door-sections with which said opposite ends of the two levers are flexibly connected.

10. Mechanism of the class described, comprising a pair of pivotally mounted levers arranged one above the other so as to swing in opposite vertical directions, and means whereby said levers may be simultaneously controlled, a portion of said means having operative relation with both levers but on opposite sides of the respective pivotal points of said levers, with the relation between said portion of the means and the lower lever adapted to move toward and away from the fulcrum point of said lever during operation and induce a differential leverage, while the other portion of said means has operative relation with the upper lever, said relation being adapted to shift toward and away from the pivotal point of the upper lever during operation, in com-

bination with a pair of door-sections with which the long arm of each of said pair of levers is flexibly connected.

11. Mechanism of the class described, comprising a pair of fulcrumed levers arranged the one above the other so as to swing in opposite vertical directions, means whereby said levers may be simultaneously controlled, a portion of said means having operative relation with both levers but on opposite sides of the respective fulcrum points of said levers, with the relation between said portion of the means and the lower lever adapted to move toward and away from the fulcrum point of said lever during operation and induce a differential leverage, while the other portion of said means has operative relation with the upper lever, said relation being adapted to shift toward and away from the fulcrum point of the upper lever during operation, and means whereby operative relations between both portions of said first mentioned means and the respective levers is maintained, in combination with a pair of door-sections with which the long arm of each of said pair of levers is flexibly connected.

12. Mechanism of the class described, comprising a pair of levers arranged one above the other and pivotally secured so as to swing in opposite directions, the pivotal point of the lower lever being intermediate of the ends thereof, the short arm of said lever being provided with a cam-socket, a rod pivotally secured to the upper lever and provided with a cam at its lower end engaging in said cam-socket, a foot treadle, and a vertically movable rod intermediate of the treadle and the upper lever of said pair of levers, the rod having a shifting operative engagement with said lever, in combination with an upper and a lower door-section, and means intermediate of the levers and the door-sections whereby the power of the levers will be exerted substantially at the vertical axes of said sections.

13. In combination with a pair of door-sections arranged one above the other and substantially in balance while in closed position, a pair of levers whose respective fulcrum points are arranged above and below the normal position of said sections, the fulcrum point of the one lever being arranged intermediate of the ends of said lever, the long arm of each lever being secured to one of said door-sections, a member secured to the long arm of one of said pair of levers and in shifting engagement with the short arm of the other of said pair of levers, a push rod having shifting engagement with the lever to which said member is secured, and a foot treadle operatively engaging said push rod whereby the latter is moved vertically and the upper door-section with its lever and said member are moved into un-

balanced relation with the lower door-section and the lever secured thereto.

14. In combination with a pair of door-sections arranged one above the other and substantially in balance while in closed position, a lever flexibly connected to each door-section, the lever secured to the upper door-section being fulcrumed at its opposite end while the lever secured to the lower door-section is fulcrumed at a point intermediate of its ends, a rod pivotally secured intermediate of the ends of the lever connected to the upper door section and having shifting engagement with the short arm of the lower lever, the engagement between said rod and the short arm of said lever being adapted to move toward or away from the fulcrum point of the lower lever when the door-sections are moved to closed or open position respectively, a push rod slidably mounted and in shifting engagement with the upper lever, the engagement of said rod with said lever shifting toward the fulcrum point of the lever during the opening operation of the door sections, and a foot treadle operatively connected with said push rod.

15. Mechanism of the class described, comprising a pair of vertically movable door-sections, a lever for each door section, each lever being flexibly secured at one end to one of the door sections and provided with a fixed fulcrum near the other end, with the

fulcrum point of the lever secured to the lower section being arranged intermediate of the ends of said lever, a diagonally arranged member pivotally secured to the lever connected with the upper door-section and having rolling engagement with the short arm of the lower lever, a vertically slidable member having shifting engagement with the upper lever, a foot treadle operatively connected with said vertically slidable member, and means whereby the door-sections may be maintained in open position.

16. Door operating mechanism, comprising a pair of door sections arranged to move in opposite directions, a lever for each door section, each lever connected at one end to one of the door sections, and provided with a fixed fulcrum near the other end, a foot lever mechanism having a shifting leverage engagement with one of said levers, and a member connecting the said mentioned pair of levers, whereby sufficient initial velocity is imparted to the door members to carry them to the open position, and a diminishing travel of the foot lever is obtained as the opening movement progresses.

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