A. HORTON.

CUSHIONING DEVICE.

APPLICATION FILED OCT. 13, 1911.

1,069,333.

Patented Aug. 5, 1913.

2 SHEETS—SHEET 1.

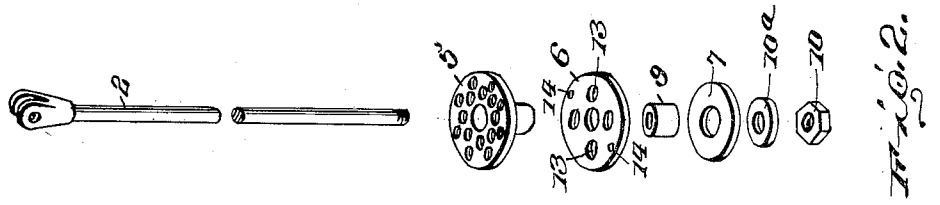

Fig. 2.

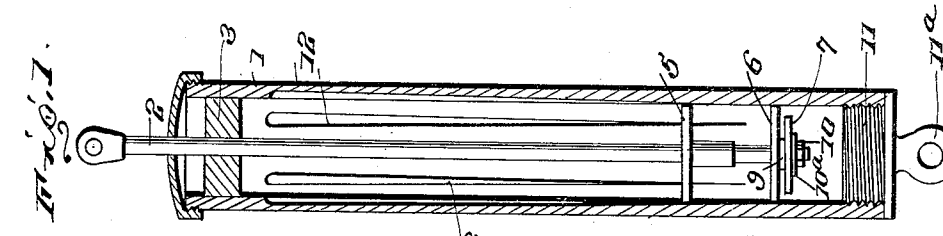

Fig. 1.

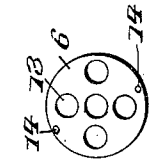

Fig. 3.

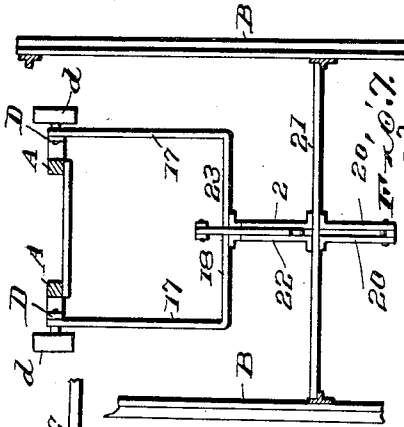

Fig. 4.

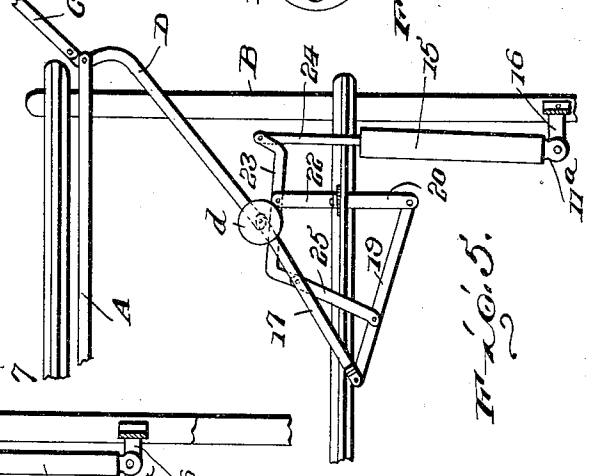

Fig. 5.

Witnesses

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2 SHEETS—SHEET 2.

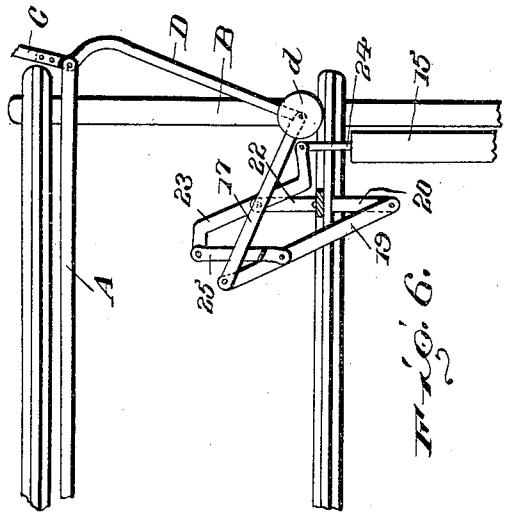

FIG. 6.

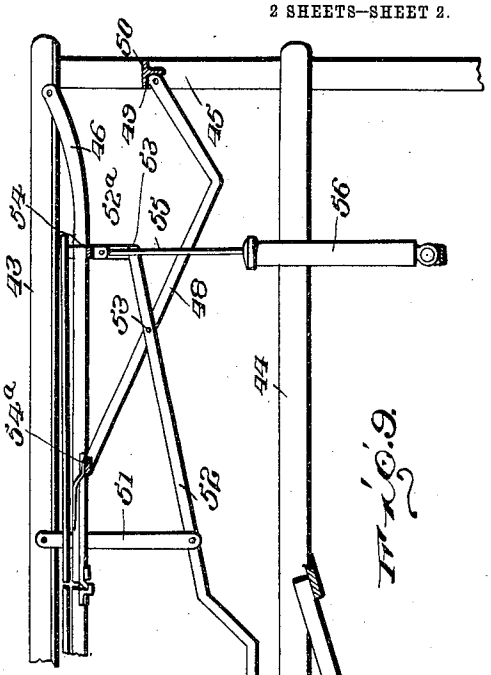

FIG. 9.

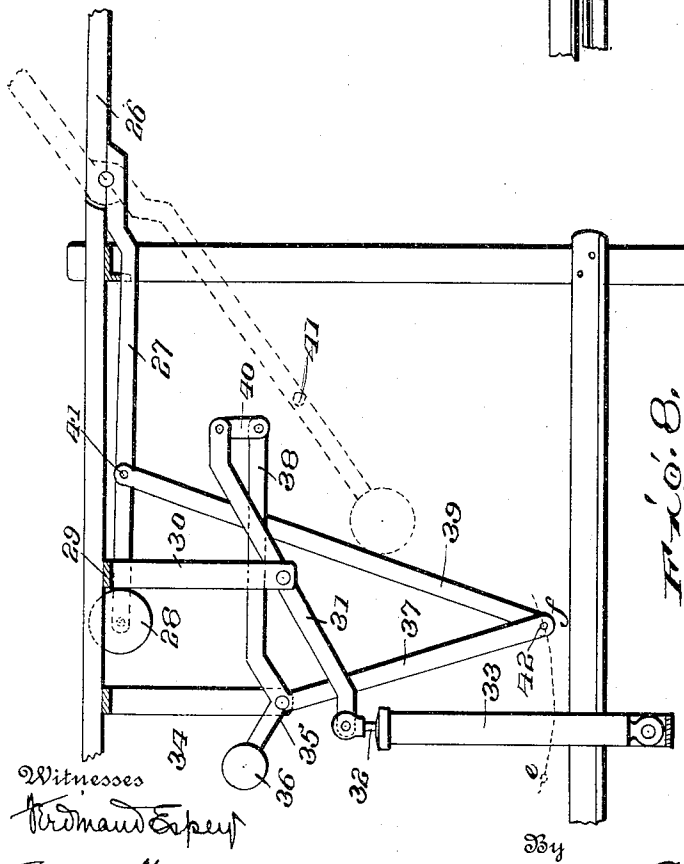

FIG. 8.

Witnesses

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CUSHIONING DEVICE.

1,069,333. Specification of Letters Patent. **Patented Aug. 5, 1913.**

Original application filed April 21, 1911, Serial No. 622,850. Divided and this application filed October 13, 1911. Serial No. 654,525.

To all whom it may concern:

Be it known that I, AARON HORTON, citizen of the United States, residing at Coleman, in the county of Midland and State of Michigan, have invented certain new and useful Improvements in Cushioning Devices, of which the following is a specification.

My invention relates to cushioning devices such as are used for checking moving parts such as doors, gates, drawbridges, etc., and particularly to cushioning devices which include in their organization a cushioning cylinder and a coacting piston acting to compress fluid within the cylinder and so check the movement of the piston.

The primary object of my invention is to provide a very simple and effective cushioning device in which the piston is gradually cushioned to a constantly increasing degree as it nears the end of its travel in one direction, but is relatively freely movable in a reverse direction.

A further object is to provide in connection with the cylinder and piston of the character described a mechanism whereby the piston will cushion upon a full movement from a middle point in either direction of a movable member to which it is operatively connected.

A further object is to provide a cushioning mechanism which is peculiarly adapted to certain switches, gates and other like parts forming part of the automatic transportation system disclosed in my pending application, Serial No. 622,850, filed April 21, 1911, of which case this is a division.

My invention is illustrated in the accompanying drawings wherein:

Figure 1 is a longitudinal section of a cushioning cylinder and piston constructed in accordance with my invention. Fig. 2 is a perspective view of the parts of the piston detached from each other. Fig. 3 is a plan view of the piston head proper. Fig. 4 is a side elevation of a section of a transportation system showing my invention applied thereto, the parts being in the position taken when the movable element is in a horizontal position. Fig. 5 is a like view to Fig. 4 but showing the parts in the position when the movable member is at midway of its travel. Fig. 6 is a like view to Figs. 4 and 5 but showing the parts in the position when the movable element is in a vertical position or at right angles to the opening it is designed to close. Fig. 7 is a section on the line 7—7 of Fig. 4. Fig. 8 is a side elevation of a section of track and supports showing my invention applied thereto but with another form of mechanism. Fig. 9 is a side elevation of a section of track showing another manner in which my cushioning device may be applied to cushion a movable element.

Corresponding and like parts are referred to in the following description and indicated in all the views of the accompanying drawings by the same reference characters.

I will first describe the detailed construction of the cushioning cylinder and then the mechanism whereby the cushioning cylinder is operated.

Referring to Figs. 1 to 3, 1 designates a cylinder of any suitable length and diameter, within which operates a piston rod 2. One end of the cylinder 1 is closed by a head 3 through which passes the piston rod and by a cap 4. The other end of the cylinder is closed by a head 11 and by a cap having thereon a pivot lug 11^a. Mounted upon the piston rod 2 is the piston 6 which is provided with a plurality of relatively large openings 13 and with a plurality of relatively small openings 14. As illustrated, the large openings 13 are arranged in a circle around the piston rod and the openings 14 are placed diametrically opposite each other and near to the margin of the piston. Disposed upon the piston rod 2 above the piston 6 is a perforated dash-plate 5 formed with a central hub which loosely surrounds the piston rod 2. On the side of the piston opposite to the dash-plate 5 is a valve 7 which as shown is annular in form and of less diameter than the piston 6 but of such diameter that when the valve is forced into position against the adjacent face of the piston, the valve will close the openings 13. The valve 7 plays freely up and down on a collar 9. It is to be particularly noted that the valve does not close the openings 13 at any time. Disposed at the end of the piston rod is a nut 10 and between the nut and the valve 7 is a washer 10^a.

The inside face of the cylinder is formed with a plurality of longitudinally extending tapering grooves 12 cut in the wall of the barrel. These grooves do not extend the full length of the barrel but terminate a short distance from the bottom thereof. The grooves are preferably cut quite deep near

the top and not only become shallower as they near the bottom of the cylinder but also become narrower. These grooves 12 are for the purpose of allowing the piston to have a free action near the top of the cylinder or at the beginning of the stroke and yet gradually retard the motion of the piston as it moves downward, the piston being fully cushioned near the bottom of the cylinder after the piston passes by the lower ends of the grooves 12. At this point the oil or other fluid which is contained within the cylinder has no other escape except through the small ports 14 in the outer margin of the piston. These grooves also secure a much quicker action of the piston by allowing the oil to freely pass around the piston at the beginning of the stroke, but gradually retarding the motion of the piston as it nears the end of its stroke without any sudden jar during the stroke. Upon the up stroke of the piston the valve 7 lowers and allows the oil in the upper portion of the cylinder to pass through the ports 13 to the lower portion of the cylinder, thus allowing the piston to move relatively easily from the bottom of the cylinder toward the top thereof. Upon a downward movement of the piston, as stated before, the valve 7 is forced upward against the piston and closes the ports 13.

The dash-plate 5 slides freely up and down on the piston rod and is perforated so as not to materially retard the upward stroke of the piston. On the downward stroke of the piston, however, the dash-plate partially floats and the oil that rushes around and above the piston dashes against this plate and the plate prevents the oil from dashing against the top head 3 and out around the central opening in the head for the passage of the piston rod.

It will be obvious that the cushion can be made to cushion equally as well upon the up stroke as upon the down stroke by simply reversing the grooves 12 in the cylinder wall so that the grooves taper upwardly instead of downwardly, and by reversing the position of the valve 7 so that it will rest upon the upper face of the piston and not upon its lower face. Where the cushion is to be used with air as a cushioning medium, the size of the grooves 12 in the cylinder are reduced and the ports somewhat modified.

As before stated, one of the main objects of my invention is to provide mechanism whereby the piston of the cushioning cylinder above described may be shifted to its cushioning position upon the full actuation of a movable member in either direction. While my mechanism may be used in connection with any member which is movable backward and forward through a predetermined distance, and may be used for cushioning doors, gates, platforms and other reciprocatory elements which it is desired to cushion at the extremities of their movement in either direction, I have particularly designed the construction for use with a transportation system in which is provided an elevated track, this track being interrupted at intervals. In these intervals and connecting the two sections of the track are disposed a variety of switches or gates fully illustrated in the pending application before referred to.

Certain of the switches are normally held in a vertical position but may be turned to a horizontal position or to a position slightly below the horizontal. Certain of the other switches remain normally in a horizontal position but may be depressed below a horizontal position to permit the shunting of a vehicle from an upper track to a lower track. These switches are relatively heavy and when a car is on the switch and the switch drops from one position to another, it is obvious that provision must be made for cushioning the switch so as to prevent any jar to the switch, the car or the contents. Further, the switches are counterweighted so that when the car passes from the switch they will rise to their normal position. It is obvious that means must be provided for cushioning the switch or gate under these circumstances. It will further be seen that it is particularly necessary in the construction referred to that means be provided for cushioning the switch or gate both upon a downward movement and upon an upward movement, and in order to obviate the necessity of using two cushioning devices opposed to each other, I have provided a double acting cushioning mechanism, that is, a mechanism which will act upon a movement from a middle position in either direction to force the cushioning piston from its initial position to a final or cushioning position.

In Fig. 4 I show a portion of a track supporting structure and a gate or switch such as described in my prior application before referred to. As illustrated, there is an upper track designated A which is supported upon vertical standards B. Pivotally connected to the projecting ends of the rail A is a member C which constitutes a continuation of the track A, and which bridges a gap between the track A and a track not shown, when the member C is turned to an approximately horizontal position. This member C which consists of two oppositely disposed, parallel rails has the rearwardly extending arms D, these arms being counterweighted as at *d*. Mounted upon the standard B is the cushioning cylinder 15 which is pivoted at its lower end by means of the lug 11^a to a bracket 16 projecting from the standard B. This pivotal support for the lower end of the cylinder 15 allows a slight motion of the upper end of

the cylinder. The rear ends of the arms D are connected by means of a transverse bar, and pivotally connected to this transverse bar and depending therefrom are the oppositely disposed rods 17. The lower ends of these rods are connected by a cross bar 18, and pivoted to this bar is the downwardly extending link 19 which at its lower end is pivotally mounted in the lower end of a depending bracket 20 supported from the main structure by any suitable means as by the cross bar 21. Projecting upwardly from the cross bar 21 is the standard or bracket 22. Pivoted intermediate its ends to the upper end of the standard 22 is the lever 23 which is pivotally connected at one end to the piston rod 24 of the cushioning cylinder 15, and at its other end is pivotally connected to a link 25 which extends vertically downward and is pivoted to the link or connecting rod 19 intermediate its ends. It will be seen that the rod 19 and the lever 23 are parallel to each other and that the members 17 and the links 25 are normally parallel. In its normal position, the gate C is horizontal as shown in Fig. 4, and as it is raised and when it has reached the middle of its travel, the parts assume the position shown in Fig. 5. The depression of the rear or counterweighted end of the member C acts to depress the link 17 and to depress the free end of the link 19, which through the link 25 draws downward on one end of the lever 23 and raises the piston.

It will be seen from Fig. 5 that the piston, when the gate is half way through its travel, is fully retracted, and it will be further seen from Fig. 6 that as the gate moves to a vertical position, the links 17 will be drawn forward, thus pushing upward again on one end of the lever 23 and depressing the piston. As the piston is depressed within the cylinder 15, the piston will be cushioned toward the end of its travel. A depression of the gate from a vertical position to a horizontal position acts in precisely the same way. When the gate has reached the middle position shown in Fig. 5, the piston will be fully retracted. When the gate reaches the horizontal position, the parts will be in the position shown in Fig. 4 and the piston will be forced downward. It will thus be seen that the piston is cushioned just before the gate reaches either its fully horizontal position or its fully vertical position, and hence that the cushion is double acting, that is, the piston of the cushion is fully drawn out and then fully closed by one full motion of the gate or other pivoted member, either by opening this gate or member or closing the same, and it will thus be seen that the gate is cushioned just before it is fully opened, the same as it is just before the gate is fully closed, though the cushioning devices do not start to act until the gate is partially opened or partially closed and then act very lightly at the beginning of the downward stroke of the piston but gradually retarding the motion until near the end of the stroke when a full cushioning is secured.

In Fig. 8 is shown another form of my invention, that is, another system of levers and links whereby a movable member such as a gate or door may be connected to a double acting cushion. I have shown for the sake of illustration this combination of levers as applied to such a gate as that before described, but I of course do not wish to be limited to this application of the invention. In this figure, 26 designates the gate having a rearwardly extending arm 27 carrying a counterweight 28. Extending downward from any suitable support adjacent to the rail, as for instance a cross bar 29, is a bracket 30, on the lower end of which is pivoted a lever 31. One end of this lever is connected to the piston rod 32 of the cushioning cylinder 33 which is of precisely the same form as that previously described and which is pivotally supported at its lower end. Also depending from the structure and supported in any suitable manner is a bracket 34 upon which is mounted the two-armed lever 35 which is preferably counterweighted as at 36. The arms 37 and 38 of the lever are angularly arranged with relation to each other and the extremity of the depending arm 37 is connected by means of a link 39 to the arm or arms 27 which form the extension of the gate 26. The arm 38 of the two-armed lever is connected by a link 40 to the forward extremity of the lever 31. The operation of this arrangement of levers is precisely the same as that before described. When the gate 26 is raised from a horizontal position or lowered from a vertical position to a point midway in its travel, as indicated by dotted lines, the pivotal point 41, that is, the point of connection of the link 39 to the arm or arms 27 will take the position shown in dotted lines, and link 39 will extend in alinement with the arm or arms 27. This will cause the pivot 42 which connects the link 39 and the arm 37 to swing along an arc *e*—*f*, thus rotating lever 35 on its pivot which will draw downward on the link 40, rotating the lever 31 and drawing up on the piston rod 32 of the cushioning cylinder 33. When the parts have reached the position shown in dotted lines, it will be seen that the piston rod 32 is drawn out to its fullest extent and any movement up or down from the middle position shown in dotted lines will cause a depression of the piston rod, and the piston rod will be fully depressed when the gate 26 is fully opened in a vertical position or when the gate is fully closed as shown in full lines.

While I have referred above to the gate moving in a vertical plane from a vertical position to a horizontal position, I want it distinctly understood that the gate or other pivotal movable member might move in a horizontal plane without any change in the mode of operation.

I do not wish to limit myself to the use of the cushioning cylinder and piston shown in Figs. 1 and 2 in combination with any particular system of levers whereby the double cushioning effect may be produced, as in many instances only a single cushioning effect is desired.

In Fig. 9 I show an arrangement wherein a moving member, in this case a switch such as is fully illustrated in my prior application, is cushioned upon its descent, but when released is free to rise under the action of the counterweights without any cushion. In this figure, 43, 44 and 45 designate the structure upon which the switch is mounted. The switch rails are designated 46. The rails, only one of which is shown, are supported upon cross bars 54, 54ª. The cross bar 54ª is supported by means of an angular link 48 which is pivoted at 49 to a cross bar 50 carried by the vertical standards 45. Depending from the longitudinal angle iron 43 is a link 51, to the lower end of which is pivoted a lever 52 counterweighted at one end and at its other end pivotally connected as at 53 to the link 48. The rear end of the lever 52 is in turn pivotally connected to a depending link 52ª which extends down from the cross bar 54. It will be obvious that the counterweight on lever 52 acts to hold the rails in their raised position but that when a sufficient weight comes upon the rails, the rails will be depressed bodily. Pivotally attached to the cross bar 54, which in turn is attached to the links 52ª is the piston rod 55 carrying a piston which fits within the cushioning cylinder 56 which is of precisely the same form as previously described. In this arrangement when the switch is lowered by the weight of a car, the piston rod in the cushion cylinder moves downward and, as before explained, the piston moves freely at the beginning of the stroke but gradually retards the motion as the piston moves downward and fully cushions the load after the piston has passed by the ends of the longitudinal grooves cut in the inner face of the cylinder. The oil or other fluid passes freely around the piston at the beginning of the stroke through the grooves in the cylinder wall, and as these grooves gradually get smaller as the piston lowers, the cushioning fluid will not pass through as fast from the space below the piston to the space above the piston and, therefore, the motion will be retarded. After the piston passes the lower ends of the grooves in the cylinder wall, the cushioning fluid will have no further escape except through the small holes in the outer edge of the piston. By this arrangement there is no cushioning action upon the up stroke of the piston but the upward movement of the piston is somewhat retarded, however, by the action of the cushioning fluid which prevents too quick a lift of the switch. The cushion attached to the switch as shown in Fig. 9 has a single downward stroke for the downward movement of the switch and, therefore, may be termed a single acting cushion in contradistinction to the cushioning mechanism heretofore described.

While I have designed this cushion especially for the transportation system set forth in my prior application, I do not wish to be limited to this use as the cushion and its actuating mechanism may be modified to suit a large variety of different uses.

What I claim is:

1. A cushioning device including a cylinder having longitudinally extending grooves in its wall, a piston rod, a piston mounted on the rod and operating within the cylinder, said piston having relatively large openings disposed around the center and relatively small openings on its margin, a shiftable valve on the piston rod having a diameter large enough to close the relatively large openings but not the small openings, and a disk slidably mounted upon the piston rod on the face opposite from the valve, said disk being formed with a plurality of openings.

2. A cushioning device of the character described including a cylinder having longitudinal grooves extending from one end of the cylinder nearly to the opposite end, said grooves tapering from the first named end to the last named end, a piston rod within the cylinder, a piston thereon formed with a plurality of relatively large centrally disposed openings and a plurality of relatively small marginal openings, a valve slidably mounted on the piston rod and having such diameter that the valve will close the relatively large openings in the piston when the piston is moving in one direction but not the small openings thereof, and a disk oppositely disposed to the valve and slidably mounted on the piston rod, said disk having a spacing member preventing contact between the disk and the piston, said disk being perforated.

3. A cushioning device including a cylinder, a piston therein cushioning upon a movement in one direction within the cylinder, an element movable in two directions, and mechanism operatively connecting the movable element and the piston and acting to draw the piston away from the cushioning end of the cylinder upon a movement of the said movable element in either direc-

tion to a middle position but forcing the piston toward the cushioning end of the cylinder when said element is moved from its middle position to either end of its travel.

4. A cushioning device including a cylinder, a piston therein cushioning upon a movement in one direction, an element movable in two directions, a lever connected to the piston, and mechanism interposed between and connecting the movable element and the piston, causing a movement of the piston away from the cushioning end of the cylinder upon a movement of the movable element from either end of its travel to a middle position, and causing a movement of the piston toward the cushioning end of the cylinder upon a movement of the movable element from its middle position toward either end of its travel.

5. A cushioning device of the character described, a cushioning cylinder, a piston operating therein and having a piston rod, an element movable in opposite directions, an arm carried by the movable element and movable therewith, a lever connected at one end to said piston rod, and links operatively connecting the arm with said lever acting to shift said lever from one extreme of its movement to the other upon a movement of the movable member from either extreme of its movement to a middle position thus shifting the piston away from the cushioning end of the cylinder and acting upon a further movement of the movable element from its middle position to an extreme position to reverse the movement of the lever and the piston connected thereto and force the piston toward the cushioning end of the cylinder.

In testimony whereof I affix my signature in presence of two witnesses.

AARON HORTON. [L. S.]

Witnesses:
JOSEPH M. DOHERTY,
JOHN P. LEE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."