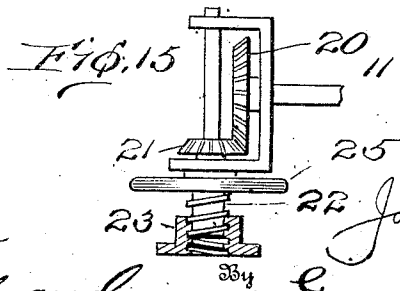
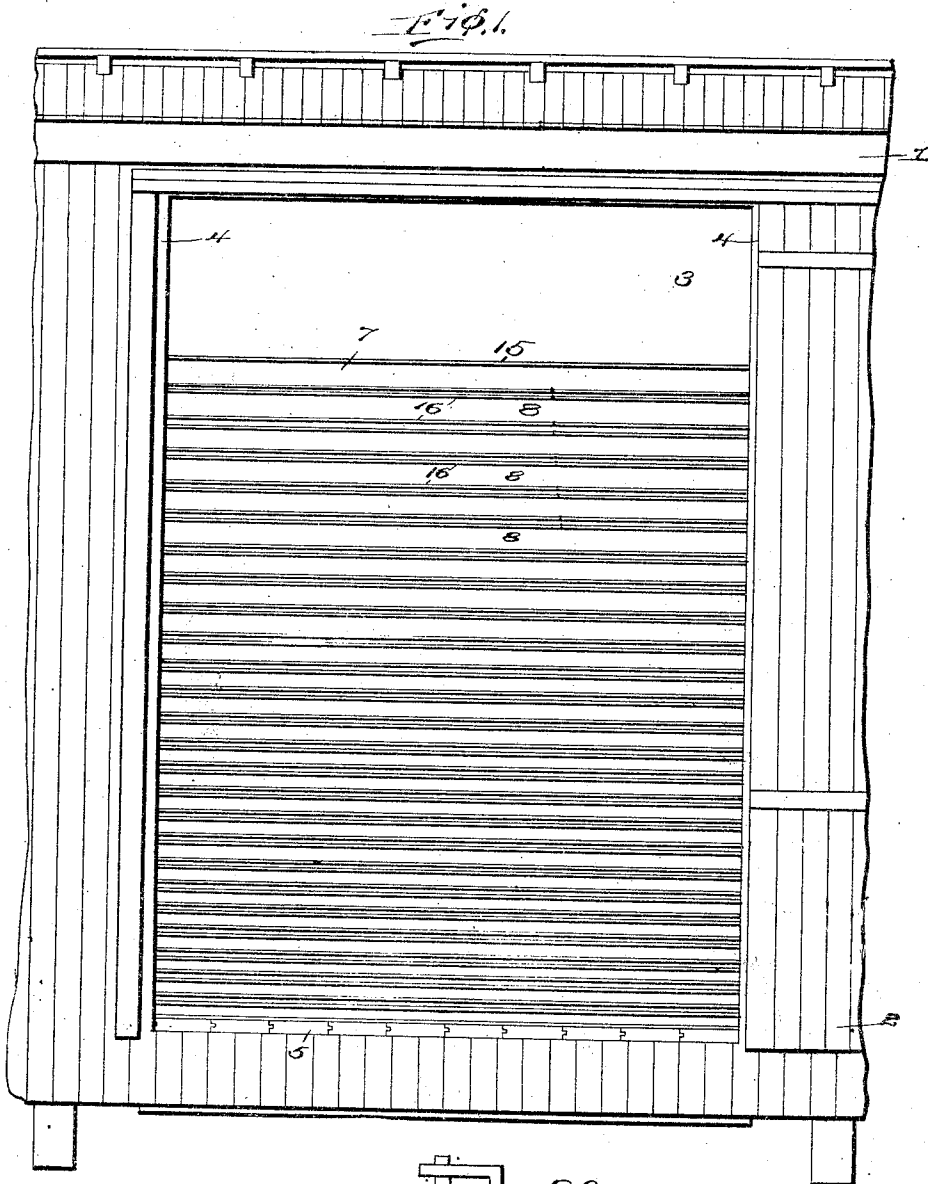


J. MORAVEC.
GRAIN DOOR FOR RAILWAY CARS.
APPLICATION FILED APR. 3, 1909.

1,063,997.

Patented June 10, 1913.

5 SHEETS—SHEET 1.



Inventor

Witnesses
J. M. Fowler
E. O. Hildebrand

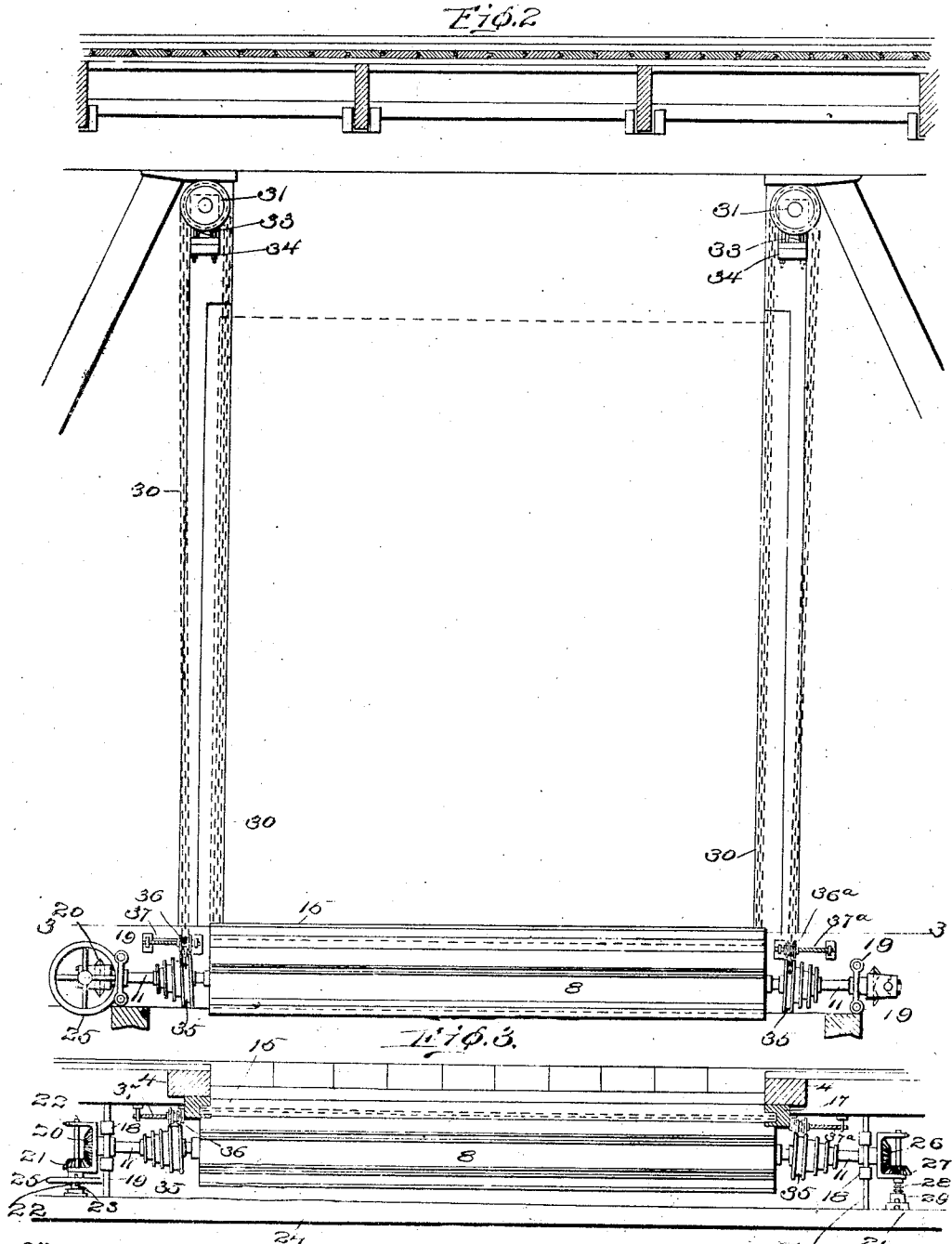
John Moravec
By George T. Massie
Attorneys

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5 SHEETS—SHEET 2.



Witnesses
J. M. Fowler Jr.
E. O. Hildebrand

Inventor
John Moravec
George Massey
Attorneys

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5 SHEETS-SHEET 4.

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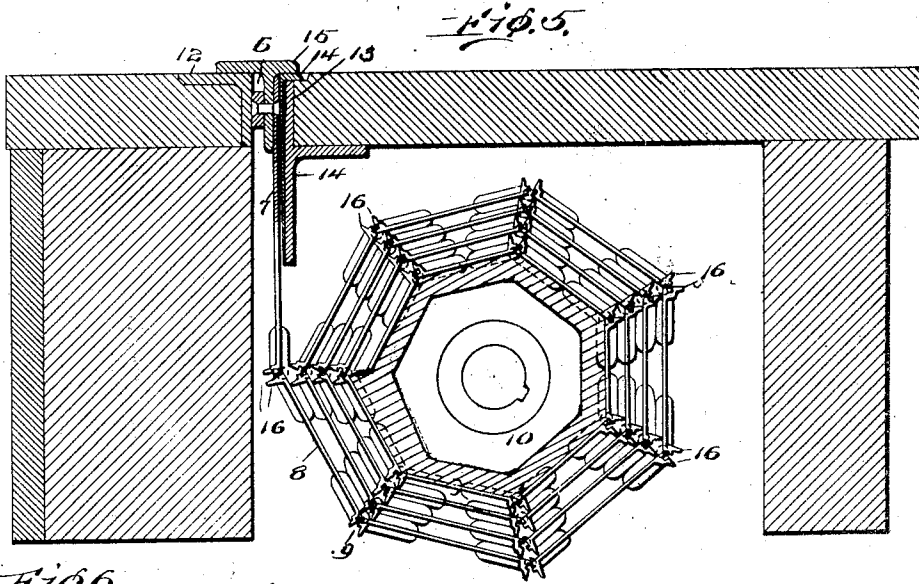


Fig. 6.

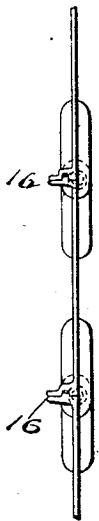


Fig. 7.

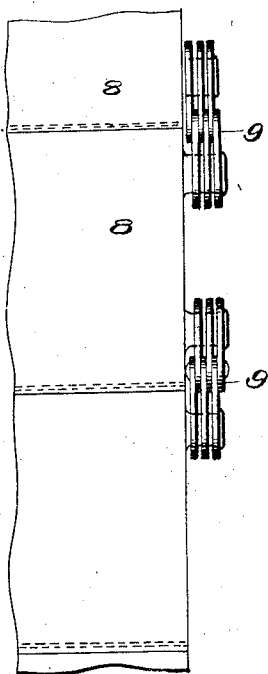
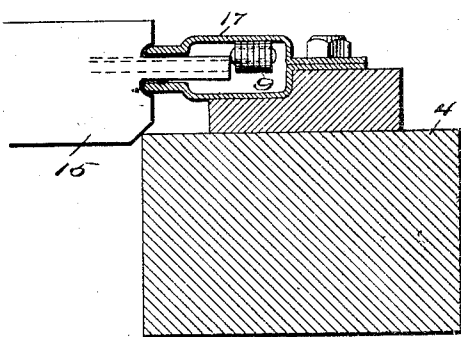


Fig. 8.



Witnesses

J. M. Fowler

E. O. Hildebrand

By

John Moravec
George Massie

Inventor

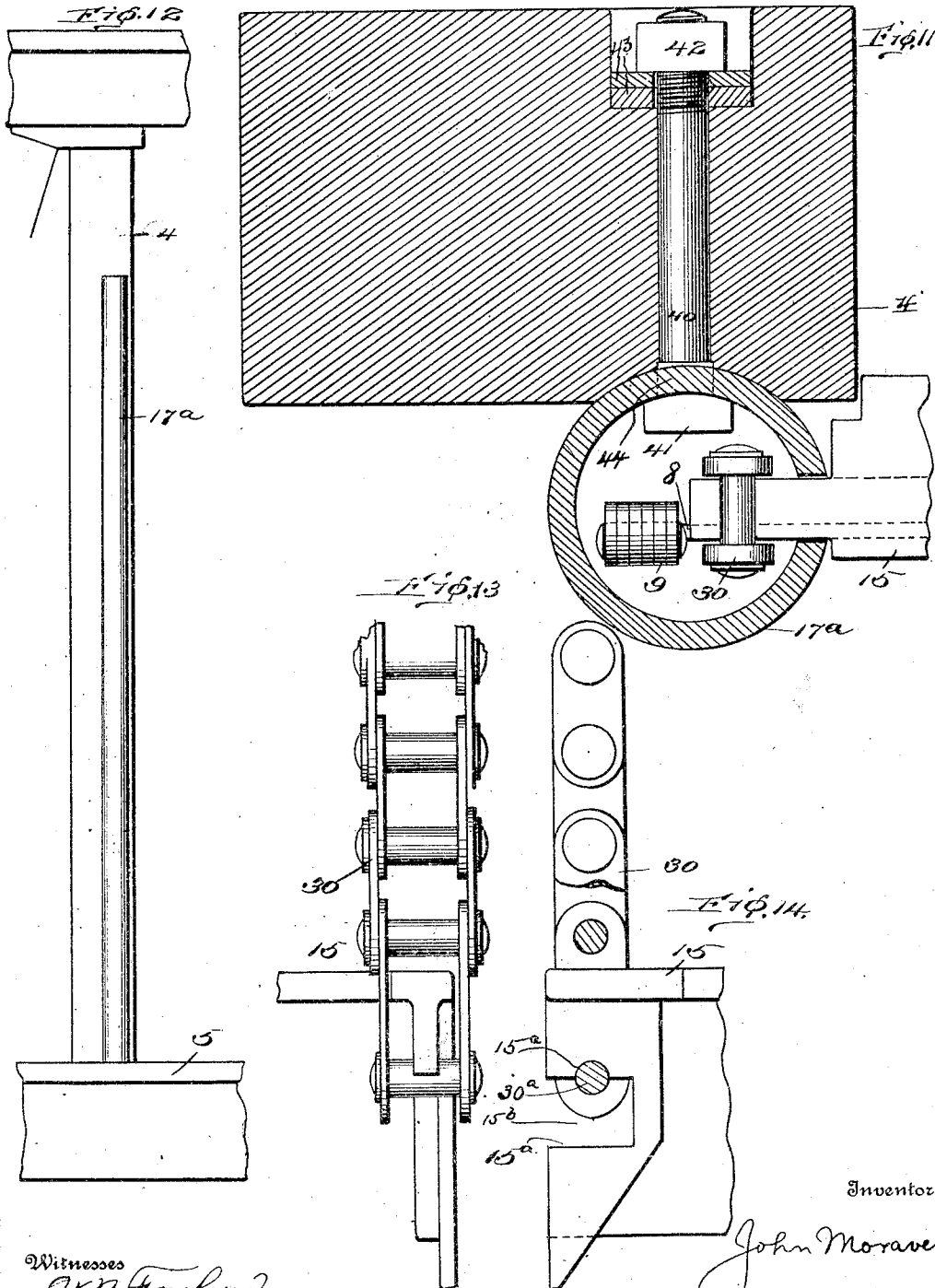
Attorneys

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5 SHEETS—SHEET 5.

1,063,997.



Witnesses

J. N. Fowler
E. O. Heidebraun

Inventor

John Moravec

by *Georgii Massie*
Attorneys

UNITED STATES PATENT OFFICE.

JOHN MORAVEC, OF DETROIT, MICHIGAN.

GRAIN-DOOR FOR RAILWAY-CARS.

1,063,997.

Specification of Letters Patent. Patented June 10, 1913.

Application filed April 3, 1909. Serial No. 487,753.

To all whom it may concern:

Be it known that I, JOHN MORAVEC, citizen of the United States of America, residing at Detroit, Michigan, have invented certain new and useful Improvements in Grain-Doors for Railway-Cars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to grain doors for railway cars and has for its object the provision of an adjustable door arranged to be withdrawn wholly or partially beneath the car floor.

The invention resides further in detailed features of construction which will be hereinafter more fully described and which cooperate to produce a grain door of the type described having the highest efficiency and convenience of operation.

The invention as particularly set forth in the claims will be readily understood from the following description taken in connection with the accompanying drawings, wherein is illustrated a preferred and also a modified embodiment of the invention.

In these drawings Figure 1 represents a side elevation of a portion of a railway car with the grain door closed. Fig. 2 is a view from within partially in section, showing the door open and the operating parts; Fig. 3 is a horizontal section through Fig. 2 on the line 3—3 with the floor removed; Fig. 4 is a transverse vertical section through the car showing the device in end elevation; Fig. 5 is a detail sectional view of the door wound upon its reel; Figs. 6 and 7 are details in side and edge elevation respectively, showing certain of the door elements of Fig. 5; Fig. 8 is a detail showing the door guide; Fig. 9 is a detail sectional view illustrating a modified form of door element; Fig. 10 is a detail of the door elements taken from Fig. 9; Fig. 11 is a full size horizontal section through the door-casing and one form of guide rail; Fig. 12 is an elevation of the same on a reduced scale; Fig. 13 is a side elevation of the door hoisting chain showing its attachment to the door; Fig. 14 is an edge elevation of Fig. 13; and Fig. 15 is a detail view of the gearing and means for giving a transverse displacement illustrated at the left hand part of Fig. 3.

In the drawings the reference numeral 1

represents an ordinary freight car having a sliding door 2 covering the opening 3, which opening is formed within the door casing 4. The floor 5 of the car is provided in the plane of the door opening with a slot 6 within which the grain door 7 is arranged to be withdrawn.

The grain door comprises a plurality of door elements 8, each consisting of a channeled steel sheet of uniform length slightly greater than the door opening and of varying width. These sheets are hinged together at 9 in order to give flexibility to the door as a whole and permit the same to be wound upon a reel 10, mounted horizontally beneath the floor of the car parallel to and at one side of the plane of the door opening, upon a shaft 11. This reel may consist of a polygonal drum or of a plurality of polygonal spiders.

In the embodiment shown I have illustrated the polygonal reel as heptagonal, the distances of the sides of the polygon from the center of the reel increasing successively, a jog or rabbet 10' being formed between the beginning of the first and the end of the last side, as shown. One of the door-members 8^a is firmly fixed to the first side of the polygonal reel. By means of this form of the reel, which may be termed a polygonal spiral form, it is possible to coil or assemble the door-members, whose width, as shown, increases for each turn of the coil solidly together so as to resist the vibration of the car when in motion.

The slot 6 beneath the door opening is provided with marginal angle iron reinforcements 12 and 13, the former of which overlies the edge of the floor and the latter of which underlies the car floor and projects downwardly therefrom. The inner side of the slot may also be fitted with a spring strip 14 secured to the marginal reinforcement 13 for a purpose to be hereinafter explained. To the upper edge of the door is bolted a T-bar 15, which, when the door is withdrawn beneath the floor, bridges the slot and serves as a door strip to prevent the entry of foreign matter within the slot when the door is open. When the door is drawn into an elevated closed position the flanges 16 of the door members bearing against the marginal iron 12 hold the smooth sides of the door members snugly against the marginal iron 13 or the yielding

spring strip 14 so as to prevent the dropping of grain or other matter within the slot.

In the vertical movement of the door, its members are guided by the engagement of their ends within the guide rails 17 bolted on the door casing 4, which prevent the displacement of the door laterally by the pressure of grain against the same. It will also be observed that while the difference in width of the door members enables the same to be wound uniformly upon a reel progressively increasing in size, yet this variation in width of the members also serves a valuable function in that the larger the load of grain in the car and the higher the door is consequently raised, the greater will be the stiffening of the door members due to the nearness together of the flanges 16 at a position near the floor of the car where the greatest outward pressure of the grain is exerted.

The operation of the door is as follows: The reel shaft 11 is journaled at each end in a cross head 18 sliding upon two steel bars 19, securely fixed in the floor beams of the car and providing ways upon which the reel may be displaced in a direction transversely to its length. This shifting becomes necessary in order that as the door is wound up or unwound its members shall leave the reel at a point directly beneath the slot, notwithstanding the progressively changing distance between such leaving point and the axis of the reel as the latter increases and decreases in size. If this provision were not made, intolerable friction would result between the door members and the marginal piece 13 when the door was nearly unwound from the reel. The rotation of the shaft and its transverse displacement upon the ways is accomplished in the following manner: At one end the shaft 11 is provided with a beveled gear 20 meshing with a beveled gear 21 whose shaft 22 is formed as a spindle with a right hand thread and has a threaded bearing in a flanged nut 23 secured to the floor beam 24 of the car. Upon this spindle is keyed the hand wheel 25. At the opposite end the shaft 11 is provided with a beveled gear 26 meshing with a beveled gear 27, whose shaft 28 is formed as a spindle with a left hand thread having a threaded bearing in a flanged nut 29 likewise secured to the floor beam 24. The result is that as the hand wheel is turned to unwind the door from the reel the latter will gradually move toward the side of the car at a rate calculated to maintain its periphery immediately below the slot 6, and as the hand wheel is turned to wind the door upon the reel the latter will be given a transverse movement away from the side of the car to compensate for the progressive increase in the size of the reel, so as to main-

tain the same relation between the slot and the reel periphery. The door strip 15 bolted to the upper door member 8 has attached thereto at its ends chains 30 extending upwardly within the guide rails 17 and over pulleys 31, journaled in blocks 32 which in turn rest upon flat spiral springs 33 carried by hangers 34, this latter to absorb vertical jars incident to the handling of the car. The other end of each chain 30 extends downwardly and is secured to the largest periphery of a helical pulley 35 fixed on the shaft 11. The pulley 35 at one side of the door has a right hand helix and that on the other side a left hand, and the chain is guided on to the one helix by a guide pulley 36 rotating in threaded engagement with a spindle 37 having a right hand thread, while the chain is guided on to the other helix over a similar pulley 36^a rotating over a spindle 37^a having a left hand thread. As the shaft 11 is rotated by the hand wheel 25 to unwind the door upon the reel, the peripheral speed of the reel and consequently of the door gradually decreases, owing to the lessening diameter of the reel and consequently the chains 30 should gradually move slower and slower, this result being accomplished by the winding of said chain upon the gradually decreasing diameter of the helix. On the other hand, as the door is wound upon the reel, its speed of movement will increase and the corresponding increased movement of the chain is attained by the unwinding of the same from a portion of the helix having an increasing diameter.

The two forms of door member illustrated are essentially the same, differing only in the particular contour of the channeled sheets and the manner of connecting together. The form of flexible connection may be varied without departing from the broad idea of the invention, although the forms shown have been found to possess decided advantages. The resilient strip 14 may be dispensed with as shown in Fig. 9, depending, for the holding of the door members against the reinforcement 13, entirely upon the positive engagement of the links 38 against the sill 39, and the marginal piece 12. In either form of construction the marginal piece 13 extends downwardly far enough to include between its lower end and the top of the car floor a space sufficient to receive at the same time two of the joints of the door members, whereby the door member cannot spring away from the face of the marginal piece 13 at the instant one of the joints leaves the slot as would otherwise be the case.

In Figs. 11 and 12 is shown a preferred form of guide rail consisting of a steel pipe 17^a slotted and secured to the door casing 4 at intervals by means of a bolt 40 having its

square head 41 bearing on the inside of the pipe and its length extending through the casing and tightened in a recessed portion thereof by a nut 42 with suitable wear washers 43, the bolt, adjacent its head 41 and at the joint of passing through the pipe, having a squared shoulder 44 to prevent turning. The rails 17^a on the two sides of the door have each a longitudinal opening or slot facing toward the door, and within this slot is guided the ends of the door members 8 hinged together at 9 and also the hoisting chains 30, connected to the ends of the door strips 15 by one of the link bolts 30^a lying in a notch 15^a in the upper wall of a recess 15^b.

Having thus fully described my invention, what I claim is:—

1. The combination, with a car having a door opening, and provided with a slot in the floor substantially in the plane of the opening, of a reel mounted beneath the car floor, a flexible door composed of channeled metal members of gradually varying width hinged together, one of the narrowest members forming one end of the door secured to the reel and the other members arranged to pass to and fro through the slot to control the door opening, and a guiding connection between the flexible door and the sides of the door opening.

2. The combination, with a car having a door opening, and provided with a slot in the floor substantially in the plane of the opening, of a reel mounted beneath the car floor, a flexible door composed of channeled metal members of gradually varying width hinged together, one of the narrowest members forming one end of the door secured to the reel and the other members arranged to pass to and fro through the slot to control the door opening, a guiding connection between the flexible door and the sides of the door opening, and a bar secured to the free end of the door and arranged to bridge the slot when the door is withdrawn beneath the floor.

3. The combination, with a door frame providing an opening, ways arranged transversely of the plane of the door opening, cross heads sliding on the ways, a reel journaled in the cross heads at one side of the plane of the door opening, a flexible door wound upon the reel and arranged to cover the opening, and means actuated by the movement of the reel to progressively shift the reel on the ways to maintain the periphery of the reeled door substantially in the plane of the door opening.

4. The combination, with a door frame providing an opening, ways arranged transversely of the plane of the door opening, cross heads sliding on the ways, a reel journaled in the cross heads at one side of the plane of the door opening, a flexible door

wound upon the reel and arranged to cover the opening, a threaded connection between the cross heads and a fixed portion of the structure, gears connecting the reel and said connection, and means to rotate the reel to wind and unwind the door and simultaneously to shift the same laterally on the ways to maintain the periphery of the reeled door substantially in the plane of the door opening.

5. The combination, with a door frame providing an opening, ways arranged transversely of the plane of the door opening, cross heads sliding on the ways, a reel journaled in the cross heads at one side of the plane of the door opening, a flexible door wound upon the reel and arranged to cover the opening, screw spindles extending from the cross heads at right angles to the reel axis into threaded engagement with fixed supports, gears connecting the reel with the screw spindles, and means to drive the reel and spindles to wind and unwind the door and simultaneously to shift the same laterally on the ways to maintain the periphery of the reeled door substantially in the plane of the door opening.

6. The combination, with a car having a door opening and a slot in the floor substantially in the plane of the opening, a reel mounted upon a shaft beneath the car floor at one side of the plane of the opening and slot, the shaft journaled at each end in a cross head sliding upon ways transverse to the reel axis, right and left hand screw spindles projecting from the cross heads at right angles to the reel axis into threaded engagement with fixed supports, gears connecting the reel shaft with the screw spindles, a flexible door wound upon the reel and having its free end extending through the slot to control the door opening, and means to drive the spindles and reel shaft to wind and unwind the door and simultaneously to progressively shift the reel on the ways to maintain the periphery of the reeled door substantially in the plane of the slot and opening.

7. The combination, with a car having a door opening and a slot in the floor substantially in the plane of the opening, a reel mounted upon a shaft beneath the car floor at one side of the plane of the opening and slot, the shaft journaled at each end in a cross head sliding upon ways transverse to the reel axis, right and left hand screw spindles projecting from the cross heads at right angles to the reel axis into threaded engagement with fixed supports, gears connecting the reel shaft with the screw spindles, a flexible door wound upon the reel and having its free end extending through the slot to control the door opening, a bar secured to the free end of the door and arranged to bridge the slot when

the door is withdrawn beneath the floor, and means to drive the spindles and reel shaft to wind and unwind the door and simultaneously to progressively shift the reel on the ways to maintain the periphery of the reeled door substantially in the plane of the slot and opening.

8. The combination, with a car having a door opening and a slot in the floor substantially in the plane of the opening, a reel mounted upon a shaft beneath the car floor at one side of the plane of the opening and slot, the shaft journaled at each end in a cross head sliding upon ways transverse to the reel axis, right and left hand screw spindles projecting from the cross heads at right angles to the reel axis into threaded engagement with fixed supports, gears connecting the reel shaft with the screw spindles, a flexible door wound upon the reel and having its free end extending through the slot to control the door opening, a guiding connection between the flexible door and the sides of the door opening, a bar secured to the free end of the door and arranged to bridge the slot when the door is withdrawn beneath the floor, and means to drive the spindles and reel shaft to wind and unwind the door and simultaneously to progressively shift the reel on the ways to maintain the periphery of the reeled door substantially in the plane of the slot and opening.

9. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the door opening, a reel mounted beneath the car floor at one side of the plane of the opening, a flexible door carried by the reel and having its free end passing to and fro through the slot to control the opening, and means secured to the free end of the door to raise and lower the same as the door is wound and unwound from the reel, the reel shaft journaled in a cross head sliding upon horizontal ways transverse to its axis, right and left hand screw spindles extending from the cross head parallel to said ways into threaded engagement with fixed supports, gears operatively connecting the screw spindles and reel shaft, means to drive the spindles and reel shaft to rotate the reel to wind and unwind the door and simultaneously to shift the reel transversely to its axis to maintain the periphery of the reeled door substantially in the plane of the slot and opening, and means to automatically vary the speed of the raising and lowering means to correspond to the varying rate of movement of the door as the reel diameter changes.

10. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the door opening, a reel mounted beneath the car floor at one side of the plane of the opening, a flexible

door carried by the reel and having its free end passing to and fro through the slot to control the opening, and means secured to the free end of the door to raise and lower the same as the door is wound and unwound from the reel, the reel shaft journaled in a cross head sliding upon horizontal ways transverse to its axis, right and left hand screw spindles extending from the cross head parallel to said ways into threaded engagement with fixed supports, gears operatively connecting the screw spindles and reel shaft, a helical pulley mounted upon the reel shaft, a flexible member constituting the door raising and lowering means having one end secured to the door and the other arranged to be wound upon the helical pulley, and means to drive the reel shaft to rotate the reel to wind and unwind the door and simultaneously to shift the reel transversely to its axis to automatically maintain the periphery of the reeled door in substantially the plane of the slot and opening and to vary the speed of the door raising and lowering member to correspond to the varying rate of movement of the door as the reel increases and decreases in diameter.

11. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the door opening, a reel mounted beneath the car floor at one side of the plane of the opening, a flexible door carried by the reel and having its free end passing to and fro through the slot to control the opening, and means secured to the free end of the door to raise and lower the same as the door is wound and unwound from the reel, the reel shaft journaled in a cross head sliding upon horizontal ways transverse to its axis, right and left hand screw spindles extending from the cross head parallel to said ways into threaded engagement with fixed supports, gears operatively connecting the screw spindles and reel shaft, a helical pulley mounted upon the reel shaft, a flexible member constituting the door raising and lowering means having one end secured to the door and the other arranged to be wound upon the helical pulley, a yieldingly mounted idler pulley arranged above the door opening and transversely by the flexible door raising and lowering member intermediate its connection with the door and with the helical pulley, a guide pulley traversed by the said flexible member adjacent to the helical pulley, said guide pulley rotating upon a threaded shaft to properly guide the flexible member on to the helical pulley, and means to drive the reel shaft to rotate the reel to wind and unwind the door and simultaneously to shift the reel transversely to its axis to automatically maintain the periphery of the reeled door in substantially the plane of the slot and opening and to vary the speed of

the door raising and lowering member to correspond to the varying rate of movement of the door as the reel increases and decreases in diameter.

12. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the opening, and a yielding plate forming the inner boundary of said slot, of a reel mounted beneath the car floor at one side of the plane of the slot and opening, a flexible grain door carried by the reel with its free end passing to and fro through the slot to control the opening, said door comprising a plurality of hinged sheet metal members having on their outer face flanges or ribs and of a cross section substantially equal to the width of the slot whereby said ribs pressing against the outer wall of the slot serve to maintain the smooth face of the members snugly against the yielding plate to prevent the entrance of foreign matter into the slot.

13. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the opening, and a yielding plate forming the inner boundary of said slot, of a reel mounted beneath the car floor at one side of the plane of the slot and opening, a flexible grain door carried by the reel with its free end passing to and fro through the slot to control the opening, said door comprising a plurality of hinged sheet metal members having on their outer face flanges or ribs and of a cross section substantially equal to the width of the slot, whereby said ribs pressing against the outer wall of the slot serve to maintain the smooth face of the members snugly against the yielding plate to prevent the entrance of foreign matter into the slot, and a T-bar secured to the free end of the flexible door to overlie the slot when the door is withdrawn beneath the floor.

14. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the door, a reel mounted beneath the floor at one side of the plane of the opening and slot, a flexible grain door carried by the reel and having its free end passing to and fro through the slot to control the opening, said door comprising a plurality of channeled sheet steel members progressively increasing in width from the reel end and with their flanges of a height corresponding substantially to the width of the slot, a plate forming the inner boundary of the slot and projecting downward for a distance exceeding the width of the widest door member, a guiding connection between the flexible door and the sides of the door opening, a bar secured to the free end of the door and arranged to bridge the slot as the door is withdrawn beneath the floor, and means to raise and lower the door as the latter is wound upon the reel

comprising a pair of flexible members secured to the free end of the same on each side of the door opening, of means to automatically shift the reel transversely to its axis to maintain the periphery of the reeled door substantially in the plane of the slot and opening and to vary the speed of the door raising and lowering elements as the rate of the door movement increases and decreases as the diameter of the reel changes, said means comprising cross heads formed as bearings for the two ends of the reel shaft, horizontal ways extending transversely to the reel shaft and traveled by the cross heads, right and left hand screw spindles journaled in the cross head and extending parallel to the ways into threaded engagement with fixed supports, gears connecting the spindles and each end of the reel shaft, right and left hand helical pulleys mounted on the reel shaft on each side of the door opening, guide pulleys mounted to rotate adjacent to the helical pulleys upon shafts provided with right and left hand threads, yieldingly mounted idler pulleys arranged above the door opening on each side, the flexible door opening and closing members extending from their connection with the door over the respective idler pulleys and guide pulleys to the helical pulleys, and a hand wheel fixed upon one of the screw spindles.

15. The combination, with a car having a door opening and a slot in its floor substantially in the plane of the door, a reel mounted beneath the floor at one side of the plane of the opening and slot, a flexible grain door carried by the reel and having its free end passing to and fro through the slot to control the opening, said door comprising a plurality of channeled sheet steel members progressively increasing in width from the reel end and with their flanges of a height corresponding substantially to the width of the slot, a guiding connection between the flexible door and the sides of the door opening, a bar secured to the free end of the door and arranged to bridge the slot as the door is withdrawn beneath the floor, and means to raise and lower the door as the latter is wound upon the reel comprising a pair of flexible members secured to the free end of the same on each side of the door opening, of means to automatically shift the reel transversely to its axis to maintain the periphery of the reeled door substantially in the plane of the slot and opening and to vary the speed of the door raising and lowering elements as the rate of the door movement increases and decreases as the diameter of the reel changes, said means comprising cross heads formed as bearings for the two ends of the reel shaft, horizontal ways extending transversely to the reel shaft and traveled by the cross heads, right

and left hand screw spindles journaled in the cross head and extending parallel to the ways into threaded engagement with fixed supports, gears connecting the spindles and
5 each end of the reel shaft, right and left hand helical pulleys mounted on the reel shaft on each side of the door opening, guide pulleys mounted to rotate adjacent to the helical pulleys upon shafts provided
10 with right and left hand threads, yieldingly mounted idler pulleys arranged above the door opening on each side, the flexible

door opening and closing members extending from their connection with the door over the respective idler pulleys and guide pulleys to the helical pulleys, and a hand wheel
15 fixed upon one of the screw spindles.

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

JOHN MORAVEC.

Witnesses:

A. J. PETERSMARCK,

A. E. LARK.