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No. 762,696.

PATENTED JUNE 14, 1904.

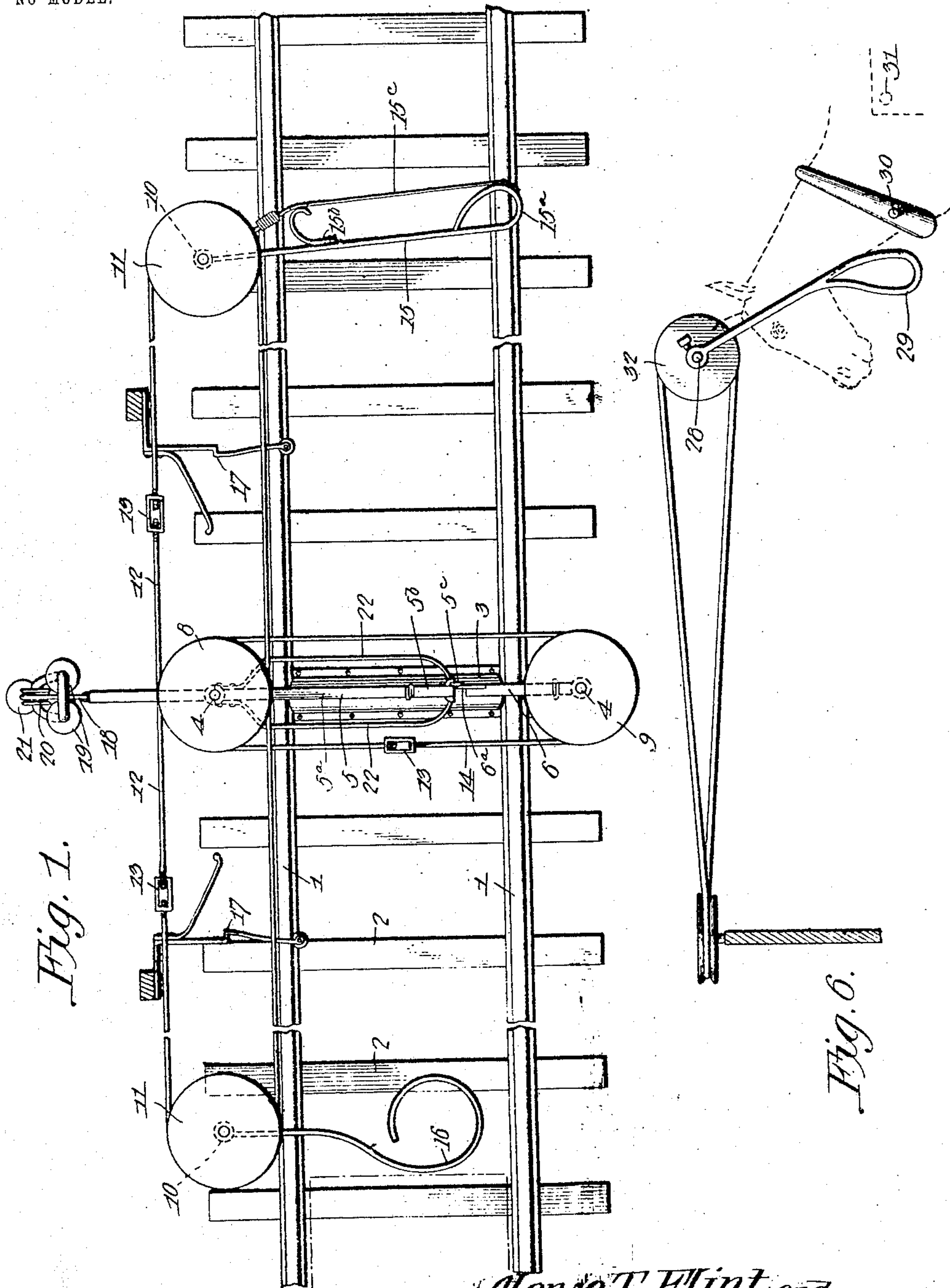
A. T. FLINT & I. WHITNEY.

MINE TRAP DOOR AND OPERATING MECHANISM THEREFOR.

APPLICATION FILED JUNE 12, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses  
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Attorneys

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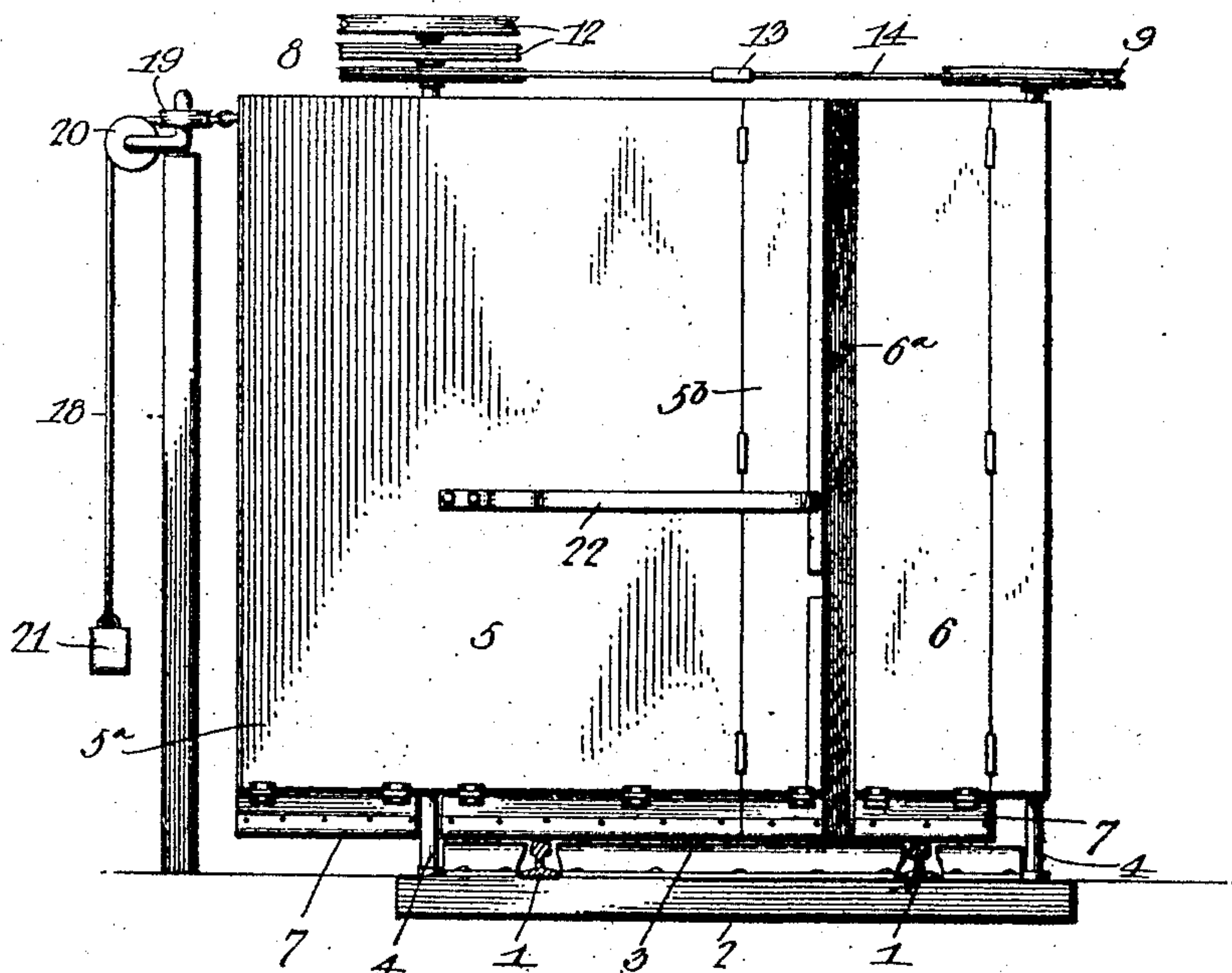


Fig. 2.

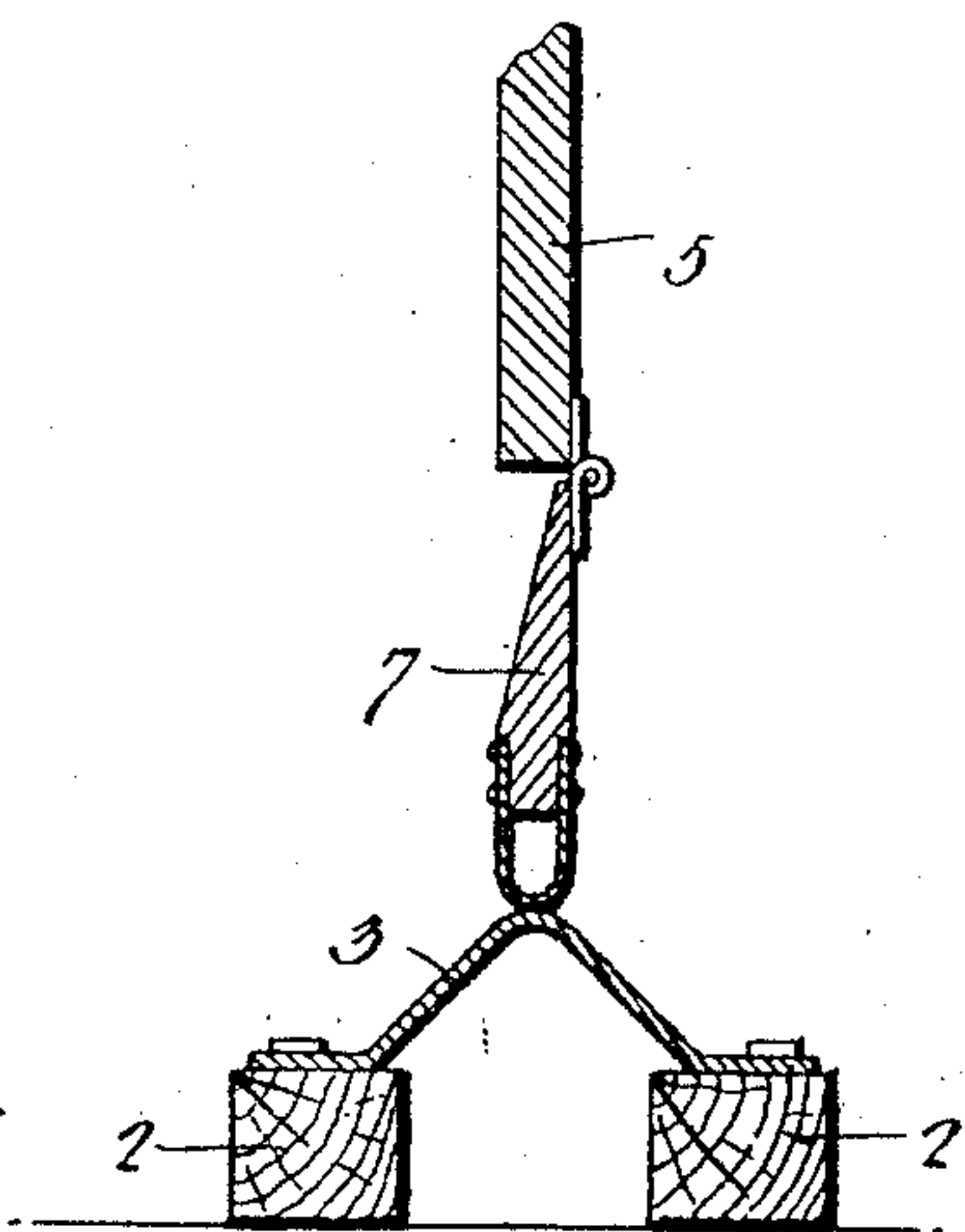


Fig. 4.

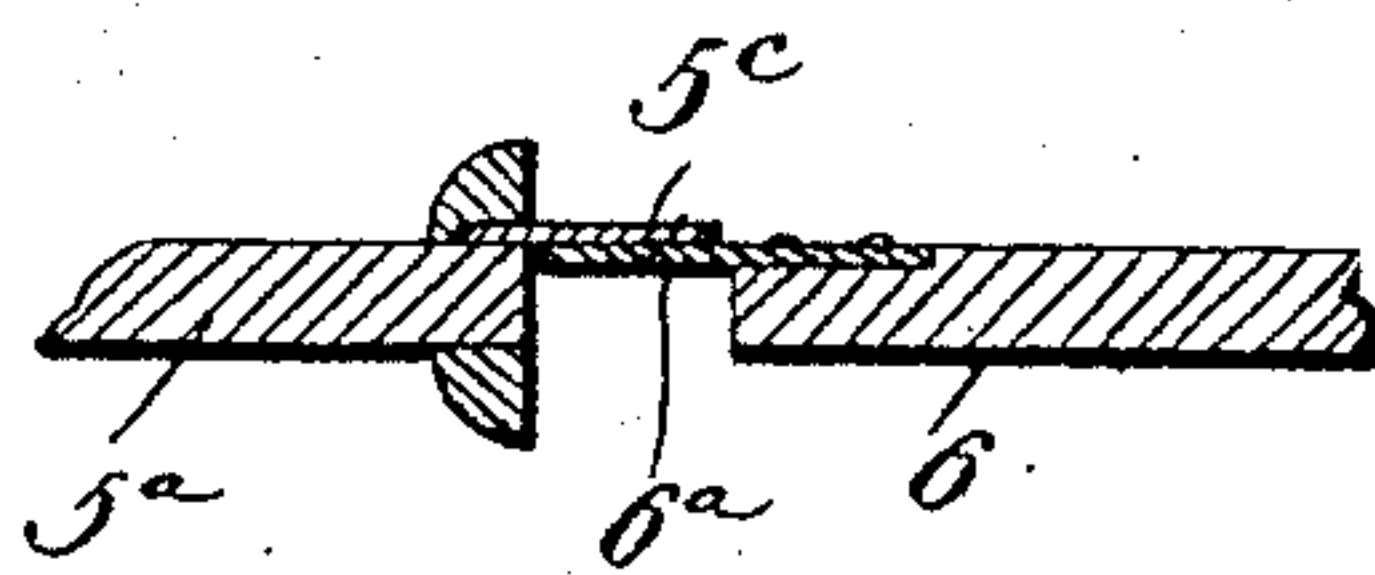


Fig. 5.

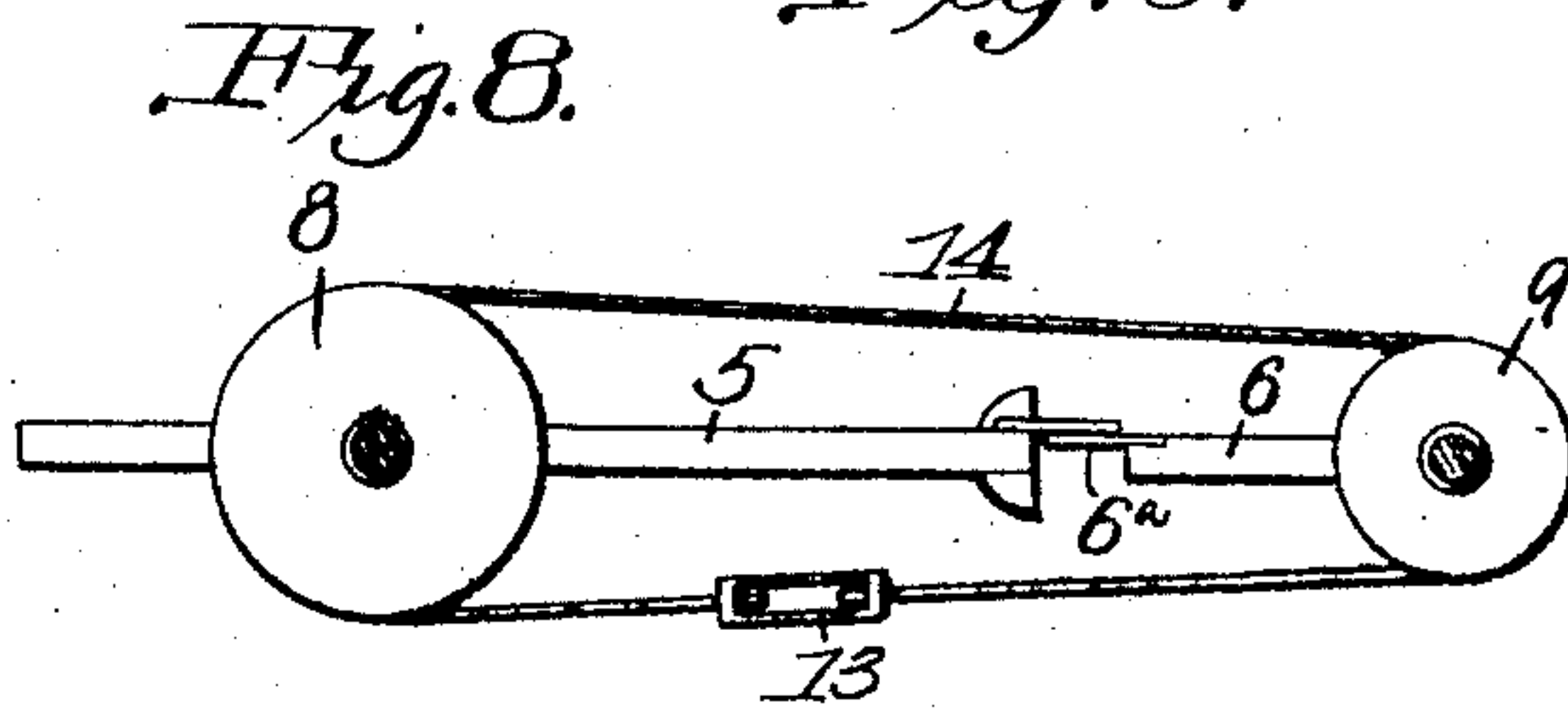


Fig. 8.

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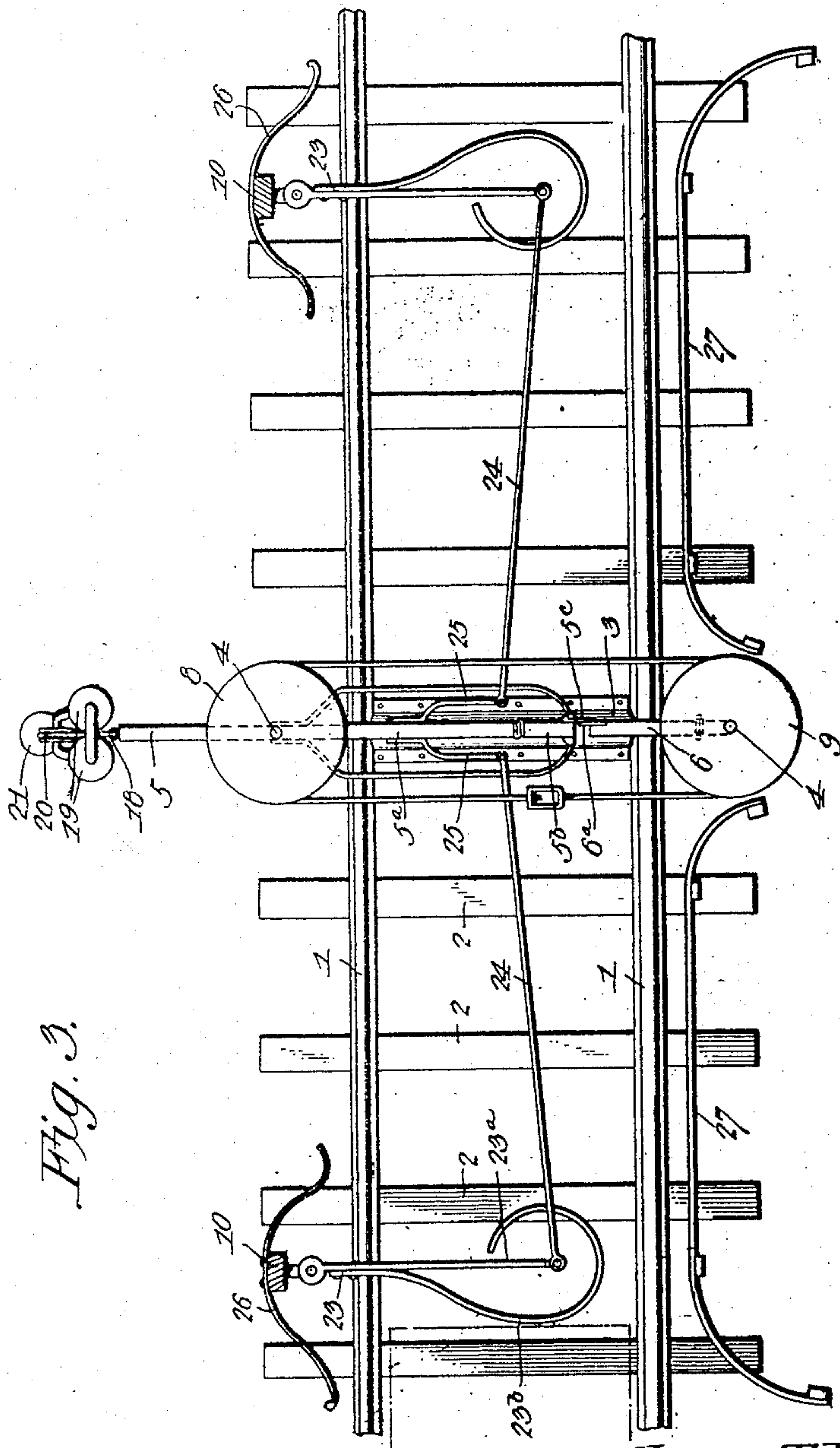


Fig. 3.

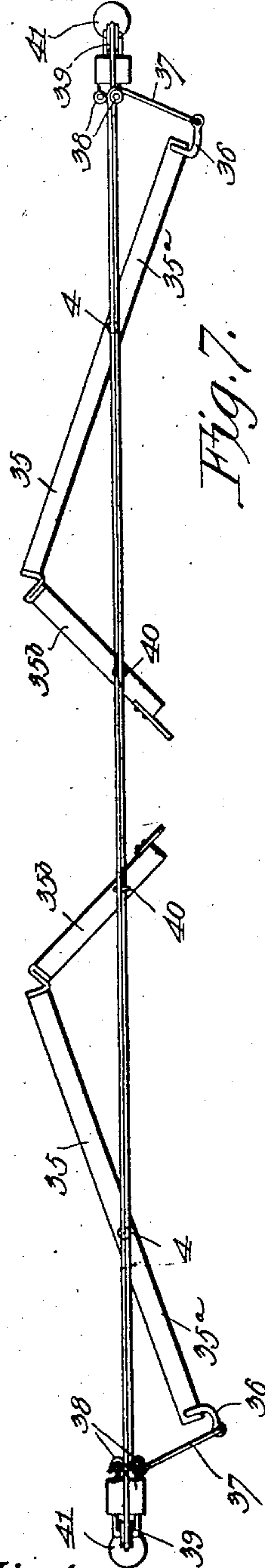


Fig. 7.

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## UNITED STATES PATENT OFFICE.

ALONZO THOMAS FLINT AND ISAAC WHITNEY, OF OSKALOOSA, IOWA.

## MINE TRAP-DOOR AND OPERATING MECHANISM THEREFOR.

SPECIFICATION forming part of Letters Patent No. 762,696, dated June 14, 1904.

Application filed June 12, 1903, Serial No. 161,242, (No model.)

*To all whom it may concern:*

Be it known that we, ALONZO THOMAS FLINT and ISAAC WHITNEY, citizens of the United States, residing at Oskaloosa, in the county of Mahaska and State of Iowa, have invented a new and useful Mine Trap-Door and Operating Mechanism Therefor, of which the following is a specification.

This invention relates to mine trap-doors and operating mechanism therefor.

The object of the invention is to provide a perfectly air-tight door for coal or other mines that may be easily operated by hand or by means of operating devices, as hereinafter described.

A further object of the invention is to construct the door in such manner that it will not be prevented from opening or closing by coal or other objects which may lie on the track adjacent to the door.

Another object of the invention is to arrange the sections or leaves of the door in such manner that the door will not be opened by wind-pressure and so that the opening or closing of the door will not be prevented by the action of wind thereon.

Other objects of the invention are to provide means for holding the door in open or closed position and yet make the opening or closing of the door a matter of little difficulty; to construct the door in such manner as to make it perfectly safe for the passage of trains, animals, or persons therethrough, and, finally, to provide mechanism for opening mine-doors with a minimum of shock and jar and for automatically closing the door after the passage of cars, draft-animals, or persons.

In the attainment of the objects above stated we make use of the novel construction and combination of parts of a mine-door and operating mechanism therefor hereinafter more fully described, illustrated in the accompanying drawings, in which corresponding parts are designated by the same characters of reference in the several views in which they appear, and having the novel features thereof particularly pointed out in the appended claims.

In the drawings, Figure 1 is a plan view of one form of door and operating mechanism

therefor. Fig. 2 is a view in elevation of the door shown in Fig. 1, together with the devices for closing the door. Fig. 3 is a plan view of a door of the type illustrated in Figs. 1 and 2, but with a modified form of operating mechanism. Fig. 4 is a detail view, in vertical section, through the lower part of the door and the door-sill. Fig. 5 is a detail view in horizontal section, showing the overlapping flexible strips on adjacent margins of the door-leaves. Fig. 6 is a detail view showing a modification in the door-opening mechanism. Fig. 7 is a detail view in plan of a modified form of door and door-closing mechanism. Fig. 8 is a plan view of the door with another modified form of closing mechanism.

Referring to the drawings by reference characters, 1 1 designate the rails of a track of the ordinary type leading out of a mine-shaft and laid upon cross-ties 2 of ordinary construction.

3 designates a door-sill made of any suitable material and presenting on the upper surface a pair of oppositely-disposed inclines, as shown, to prevent the accumulation on the surface of the sill of small lumps of coal or other rubbish which might interfere with the opening or closing of the door. As shown in Fig. 4, the sill 3 is formed, preferably, of a plate of iron bent on the median longitudinal line and secured to two of the cross-ties by spikes or other suitable means. At either end of the sill 3 is mounted a rotatable standard 4, and to each of the standards 4 is secured one of the leaves of the door. One of the leaves, 5, is made, preferably, of larger size than the other leaf, 6, and the larger leaf 5 comprises a main section 5<sup>a</sup> and a small section 5<sup>b</sup>, connected by spring-hinges, which normally hold the two sections in alinement, but which permit them to be thrown out of alinement by swinging the smaller section in either direction upon its hinges. The main section 5<sup>a</sup> of the leaf 5 is secured to one of the pivotal standards 4 at points preferably nearly midway between the vertical sides of the section, for reasons that will hereinafter appear. The small section 5<sup>b</sup> of leaf 5 is provided at its free margin with a strip of flexible material 5<sup>c</sup> to overlap another strip of flexible material 6<sup>a</sup>, secured to the smaller door-leaf 6. The leaf



6 is hinged to one of the pivoted standards 4 by means of spring-hinges which have springs of sufficient stiffness to hold the leaf 6 normally in one position, but which will permit the leaf to swing in either direction upon its hinges when the pivotal standard is held stationary and pressure is applied to the leaf. The strip 6<sup>a</sup> of flexible material, above mentioned as secured to the leaf 6, is possessed of some stiffness, so that when the strips of material at the free margins of the door-leaves overlap the wind-pressure will not open them backward to effect a passage between the door-leaves.

Each of the leaves 5 and 6 is provided at the bottom with a pendent hinged member 7. The hinged members 7 are provided to come into contact with the central ridge of the door-sill to form a practically air-tight joint therewith, and the members are hinged to the door-leaves in order that the presence of lumps of coal or other obstructions on the track may not prevent the closing of the door, as the hinged members may ride over the obstructions and permit the doors to swing to their position of closure regardless of any obstruction of ordinary size.

A weather-strip of the form shown at the bottom of the hinge-section at the lower margin of the doors may be placed at the top and sides of the door-sections, if necessary, to completely exclude air.

One object of making the door-leaves in sections of different sizes and arranging the sections as above explained is to prevent the variation of the wind-pressure against the door from in any way interfering with the opening or closing thereof. It will have been noted that of the main section 5<sup>a</sup> of the larger door-leaf 5 a considerable portion lies upon one side of the pivotal standard, on which the leaf is mounted, and the remainder lies on the opposite side. The small leaf 6 is of such width that its area about equals the difference in area between the two portions of door-leaf 5, which lie on opposite sides of the pivotal standard, to which the leaf 5 is attached. By means of operating devices to be hereinafter described the door-leaves 5 and 6 are simultaneously opened in opposite directions and are so connected that whenever one leaf is opened by means of the operating devices the other leaf must of necessity swing in the opposite direction. In consequence of this arrangement the pressure of the wind upon one leaf of the door which tends to open it is balanced by the pressure of the wind on the other leaf to close it. Another reason for making the leaf 6 considerably narrower than the leaf 5 is to cause the leaf 6, which swings toward the approaching car or draft-animal when the door is opened, to swing entirely out of the way before the car or draft-animal reaches the door. In order to insure the complete opening of the leaf 6 before the car or draft-

animal reaches the door, it is sometimes desirable to provide means for swinging the leaf 6 at a more rapid rate of angular movement than the leaf 5, and the means whereby this is accomplished will presently be explained.

In the preferred form of operating mechanism for the door-leaves pulleys 8 and 9 are rigidly secured to the standards 4, the pulley 8, which comprises a plurality of sheaves, all of which are rigidly connected, being provided on the standard supporting the leaf 5 and the pulley 9, comprising a single sheave, being attached to the standard supporting the leaf 6. On the same side of the track as the pulley 8 are provided two posts or standards 10, each of which has at the top thereof a pulley 11. Passing around the pulleys 11 and the pulley 8, as shown in Fig. 1, are ropes or cables 12, each of which is provided with a tension-link 13, by means of which the tension of the pulleys or cables may be adjusted. The rope or cable 14, also provided with tension-links 13, passes around one of the sheaves of the pulley 8 and around pulley 9, so connecting the pulleys 8 and 9 that any movement of one will be communicated to the other and impart to it an equal amount of angular movement in the opposite direction. Attached to the standards 10, which are pivotally supported in suitable bearings, are operating-arms 15 and 16. The operating-arm 15, which is especially designed to be engaged by a draft-animal hauling a train of cars, is provided with curved projections 15<sup>a</sup> and 15<sup>b</sup>, to which is attached a strap 15<sup>c</sup>, placed, as shown, upon the side of the arm 15 which is directed toward the approaching car or draft-animal. The projections 15<sup>a</sup> and 15<sup>b</sup> are of resilient character and together with the strap 15<sup>c</sup> form a yielding cushion against which the animal may strike without injury even when going at a tolerably rapid rate.

While it is intended that the arm 15<sup>a</sup> will be engaged ordinarily by a draft-animal, it is obvious that it may be engaged by a mine-car and operated equally as well, the yielding projections and strap serving in the same way to take up the shock of contact and operating the door with a minimum of jar.

The standard 10, which lies on the outer side of the door, has attached thereto the operating-arm 16, which is designed to be engaged by a mine-car, and hence is differently constructed from the arm 15, already described. The arm 16 is composed merely of a bowed member of resilient material, which extends only partly across the track and which presents a convexity to an approaching car.

It will be readily understood from the foregoing description and from an inspection of the drawings that when either of the operating-arms 15 or 16 is engaged by a draft-animal or car approaching the door the leaf 6 will be swung toward the approaching car



or draft-animal and the leaf 5 will be swung in the opposite direction. The door when opened may be held open by suitable devices provided especially for that purpose and comprising in the preferred form of the invention a pair of spring-catches 17, mounted at the side of the track in position to engage the leaf 5 when swung open in either direction. The spring-catches 17 are unnecessary except when the operating-arms 15 and 16 are placed at a considerable distance from the door, for when the operating-arms are near the door the passage of the operating-arms along the side of the car or draft-animal will keep the door open until the car or draft-animal has passed through it; but when the operating-arms are at a considerable distance from the door, if no means be provided to engage the door-leaves and hold them open after the action of the operating-arms in opening the leaves, the leaves will be swung to closed position before the passage of the car or draft-animal through the door by the action of closing devices, which will presently be described. Hence it is necessary when the operating-arms are at a considerable distance from the door to provide some sort of catch to engage one or both of the leaves to hold the door open, and if it is desired to prevent the sliding of the operating-arms along the sides of the car or of the draft-animal the catches may be provided when the operating-arms are near the door. The catches 17 are so proportioned that the end of each catch projects into the path of the cars just far enough to be engaged by the front car of a train and thrown out of operative engagement with the edge of door-leaf 5. After one of the latches 17 is thrown out of operative engagement with the edge of door-leaf 5 by engagement of the front car of a train with the latch the door-leaf 5 will be held open by the passing cars until the last car of the train has passed, and then the door-leaf will be allowed to swing into its normal closed position under the action of the closing mechanism. The preferred form of closing means comprises a rope 18, attached to the outer margin of section 5<sup>a</sup> of door-leaf 5, passing between guide-rolls 19 over pulley 20 and having attached to the free end thereof a weight 21, which is just heavy enough to close the door gradually and without shock.

In order to facilitate the opening of the door in case the operating mechanism hereinbefore described should fail to work for any reason, bows 22, of resilient material, are attached to the leaf 5 on either side, as shown in Fig. 1, and these bows keep the leaf out of contact with the car or draft-animal and open the door directly without any great degree of shock when the operating devices fail to act as stated.

In the form of embodiment of the invention illustrated in Fig. 3 instead of the arms 15

and 16, as above described, we employ operating-arms 23, each comprising a rigid member 23<sup>a</sup> and a resilient curved member 23<sup>b</sup>. The arms 23 are attached to the standards 10; but instead of the pulleys 11 and the ropes 12 to constitute connections between the standards 10 and the door-leaf 5 links or connecting-rods 24 are pivoted to the rigid members 23<sup>a</sup> of the operating-arms and to springs 25, attached to the main section 5<sup>a</sup> of the door-leaf 5, and in order to facilitate the closing of the doors for the passage of a car or draft-animal a spring 26 is attached to the support of one of the standards 10 in such position that one end thereof will be engaged by the operating-arm 23 whenever the door is opened to its full extent. As soon as the car or draft-animal passes through the door the elasticity of the spring 26 tends to throw the operating-lever 23 back to its normal position, thus closing the door. In this form of embodiment of the invention the operating-arms 22 do not extend entirely across the track as does the operating-arm 15 in the preferred form of the invention. Hence in order to prevent the draft-animal from sliding off the track, and thus avoiding contact with one of the operating-arms, curved guide-rods 27 are supported at the side of the track opposite the arms 23, thus making it impossible for the animal to avoid contact with the arm.

Another modification of the operating mechanism is illustrated in Fig. 6, in which the operating-arm is supported upon a horizontal instead of a vertical shaft. The horizontal shaft 28 extends across the track at such height that a draft-animal may pass readily under it, and extending downward from the shaft is an operating-arm 29, of resilient material, which is adapted to be engaged by the front end of a car or by a projecting pin mounted either on some portion of the harness of the draft-animal or upon the car itself. The various positions of the pin are designated at 30 and 31 in dotted lines. When a horizontally-disposed shaft is used, pulleys 32, disposed in a vertical plane, take the place of pulleys 11, used in the preferred form of the invention; but otherwise the operating mechanism is the same.

A modified form of closing mechanism is illustrated in Fig. 7, in which the door is shown as composed of similar leaves 35, each comprising a main section 35<sup>a</sup> and a smaller section 35<sup>b</sup>, similar to the sections 5<sup>a</sup> and 5<sup>b</sup> on the large leaf 5 in the preferred form of door. Each of the leaves 35 has projecting from the outer margin thereof a short arm 36, to which is attached a cord or rope 37, which passes between guide-rolls 38, suitably supported at the side of the track, then crosses the track and passes over the pulley 39. The cords 37 are attached to pivot-pins 40, provided on the upper edges of sections 35<sup>b</sup> of the leaves 35, and have attached at their free ends



weights 41. When so arranged, the weights 41 serve not only to return the main section of each leaf to the normal closed position, but to swing the smaller sections into alignment therewith, thus making spring-hinge for connecting the leaf-sections unnecessary.

The operating mechanism employed with the form of door and closing devices just described may be of any of the forms already described, and separate description thereof is therefore regarded as unnecessary.

When it is desired to cause the leaf 6 of the door to move open more rapidly than the larger leaf 5, the pulleys 8 and 9 are not made of the same diameter, as shown in Fig. 1, but of different diameters, as will be obvious, the pulley 9 being smaller than the pulley 8, so that when door-leaf 5 is swung with its supporting-standard and the pulley 8 turns therewith the pulley 9, from which motion is imparted to the door-leaf 6, will be caused to move through a greater angle, thus insuring the complete opening of the leaf 6 before the arrival of the draft-animal or car at the door.

It will be readily observed from the foregoing description that the door can be opened with very slight effort, only sufficient effort being required to overcome the inertia of the structure and to raise the weight which serves to close the door. It will also be noted that owing to the resiliency of the operating-levers the door will be opened without an appreciable amount of jar and that it will open and close readily in strong drafts from any direction, as the action of the wind upon one leaf of the door is counterbalanced by the action upon the other.

While it has been assumed in the description of the door and the operating mechanism therefor that it will be preferred to have the door-sections swing in opposite directions in order to have the action of the wind upon one portion of the door counterbalanced by its action upon the other, it is obvious that by crossing the rope connecting the pulleys 8 and 9 both sections may be caused to open in the same direction.

While the door and operating mechanism have been described and illustrated in the various preferred forms of embodiment of the invention, it is obvious that certain changes may be made in the form and proportions of the parts and in their exact mode of assembly without departing from the spirit of the invention or sacrificing any of its advantages, and we do not desire to be limited to the forms shown, but reserve the right to make such changes therein as lie within the scope of the appended claims.

While the spring-catches for holding door-leaf 5 in open position have been shown only in connection with one form of door-opening mechanism, it is to be understood that said catches may be employed with any one of the several types of door-opening devices shown

and described. It is also to be understood that the various forms of door-closing devices disclosed may be used interchangeably without regard to the character of the door-opening devices, each type of door-opening means being adapted for use with any one of the forms of door-closing devices disclosed.

Having thus described the construction and operation of our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a mine-door, the combination with a pair of pivotal supports, of door-leaves carried by said supports, one of said door-leaves comprising a section rigidly secured to the support, and a section connected with said rigidly-attached section by means of spring-hinges, said rigidly-attached section being secured to the support intermediate of its edges and the other door-leaf being attached to its pivotal support by means of spring-hinges and comprising a single section only.

2. In a mine-door, the combination of two pivotally-mounted door-leaves of different widths, connections between said door-leaves whereby the movement of either leaf in one direction will cause the opposite movement of the other leaf, and operating devices adapted to swing the wider door-section away from an approaching object.

3. In a mine-door, the combination with two pivoted leaves each having on the inner margin thereof a flexible strip and said flexible strips being adapted to overlap, of connections between said door-leaves whereby the movement of either leaf will produce a simultaneous and opposite movement of the other.

4. In a mine-door, the combination with a pair of pivotal standards, of door-leaves of different widths rigidly attached to said standards, a pulley rigidly secured to each of said standards, a rope traveling over said pulleys and so arranged that the movement of either leaf will produce an opposite movement of the other, and means operated by a body approaching the door to swing the door-leaf of greater width in the direction of movement of the approaching body.

5. In a mine-door, the combination with a pair of pivotal standards, of door-leaves rigidly attached to said standards, pulleys of different sizes rigidly secured one on each standard, a rope running over said pulleys and forming means whereby the movement of one of said leaves will produce an opposite movement at a different rate of speed in the other leaf, and means operated by a body approaching the door for swinging the slow-moving door-leaf in the direction of movement of the approaching body.

6. The combination with a mine-door comprising swinging door-leaves, of opening devices comprising resilient levers disposed across the path of an approaching object, connections between said members and one of said



door-leaves, and connections between the door-leaves whereby the movement of one leaf will be accompanied by a simultaneous movement of the other.

5 7. The combination with a mine-door comprising pivoted door-leaves, of resilient opening-levers disposed in the path of objects approaching said door, springs attached to one of said door-leaves, rigid connections between  
10 said springs and said levers, and connections between said door-leaves whereby the movement of one will produce a simultaneous movement of the other.

15 8. The combination with a mine-door comprising a swinging door-leaf, of an opening-lever disposed transversely of the path of objects approaching the door, a spring attached to the door-leaf, and a rod connecting said lever and said spring.

20 9. The combination with a mine-door comprising a swinging door-leaf, of a pivoted lever arranged in the path of objects approaching the door, a spring mounted on said door-leaf, and a rigid member pivotally connected  
25 with said spring and with said lever.

10. The combination with a mine-door comprising a swinging leaf, of operating devices actuated by objects approaching the door to open the same, and spring-catches arranged  
30 in position to engage the free edge of the door when open to its fullest extent, said catches having extensions disposed in the path of objects moving away from the door whereby said catches may be released after the passage  
35 of objects through the door.

11. The combination with a mine-door comprising a swinging leaf, of mechanism actuated by objects approaching the door to open the same, a spring-catch arranged in position to

be engaged by the free edge of the door when  
40 open to its fullest extent and a spring disposed adjacent to said spring-catch to close the door when released from engagement with the catch.

12. The combination with a mine-door dis- 45 posed across a track, of operating devices comprising members disposed over the track and adapted to be engaged by objects approaching the door by traveling along said track, and  
50 guards at the side of said track to insure the contact of approaching objects with said pivoted operating members.

13. The combination with a mine-door comprising a swinging leaf, of an operating-lever comprising an arm having resilient projec- 55 tions upon one side thereof and a strip supported on said resilient projections, and connections between said operating-lever and said swinging leaf.

14. The combination with a mine-door com- 60 prising a swinging leaf, of an operating-lever disposed in the path of objects approaching said door, connections between said lever and said swinging leaf and a spring supported in  
65 such position that the operating-lever will contact therewith when the door is fully open and be returned to its normal position after the passage of an object through the door by the action of said spring.

In testimony that we claim the foregoing as 70 our own we have hereto affixed our signatures in the presence of two witnesses.

ALONZO THOMAS FLINT.  
ISAAC WHITNEY.

Witnesses:

NEWTON COX,  
JOHN N. MOSHER.