No. 662,731. Patented Nov. 27, 1900.

R. LEE.

MINING ELEVATOR.

(Application filed May 10, 1900.)

(No Model.) 5 Sheets—Sheet 1.

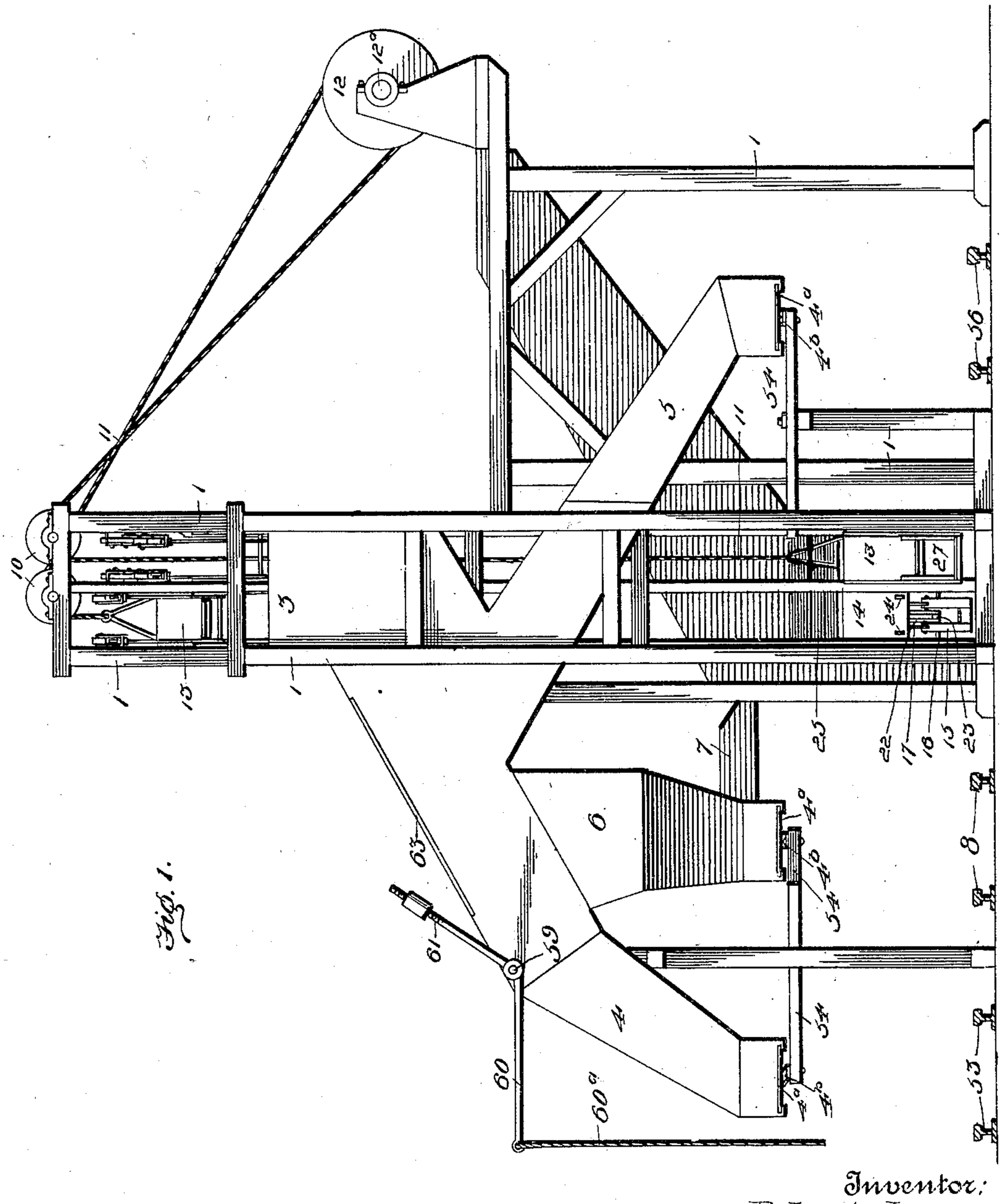

Fig. 1.

Witnesses
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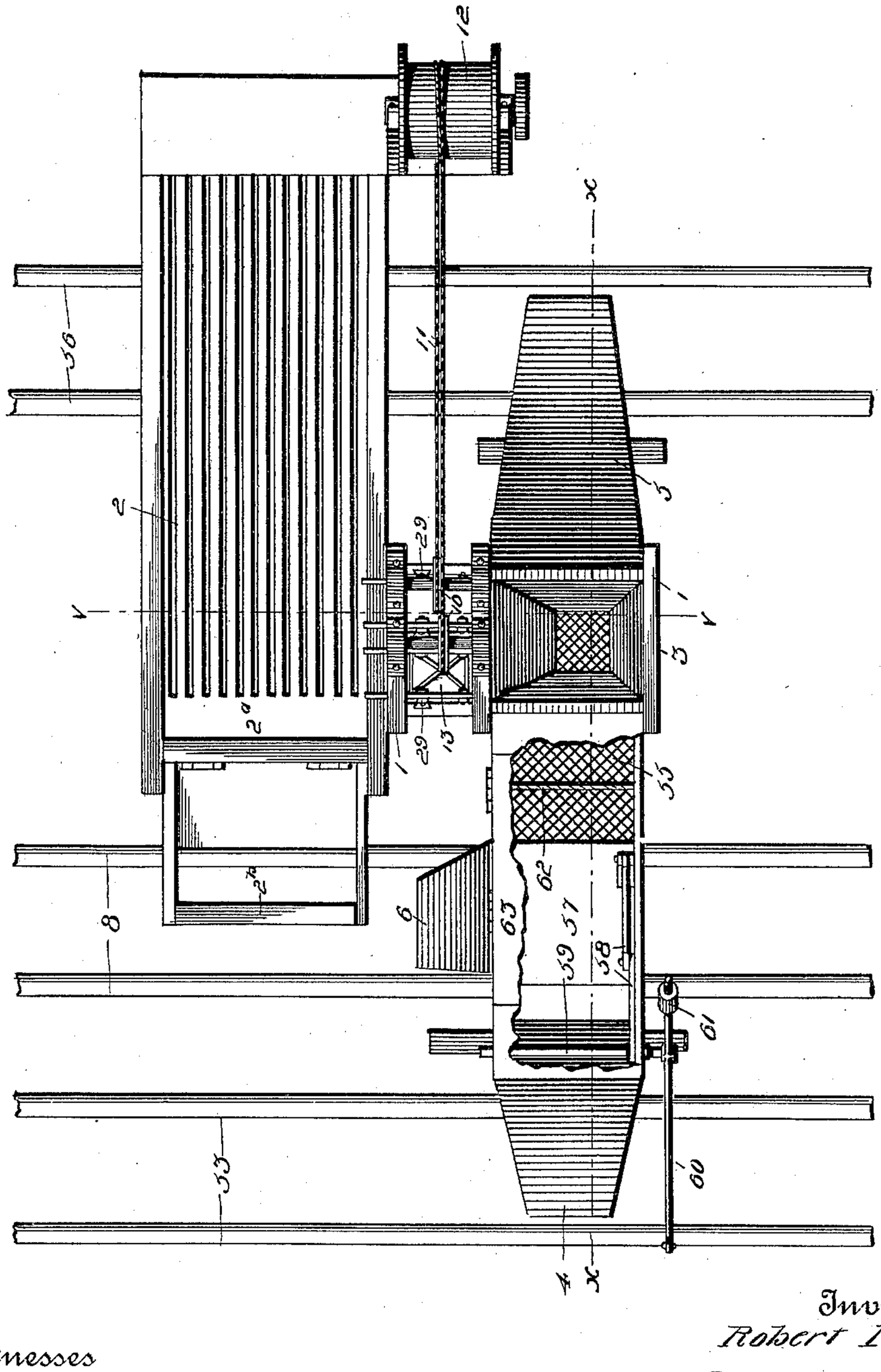
(No Model.) 5 Sheets—Sheet 2.

Fig. 2.



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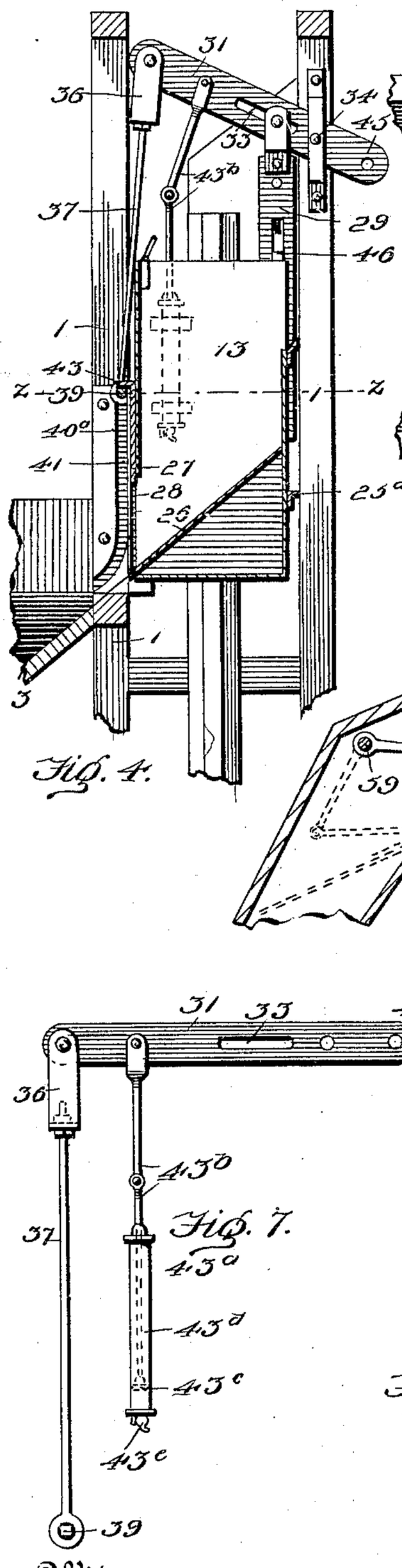
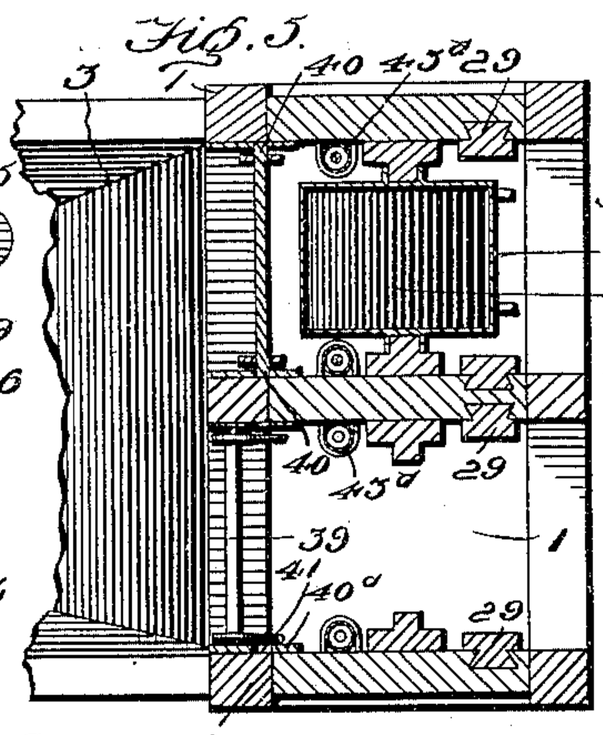


Fig. 4.



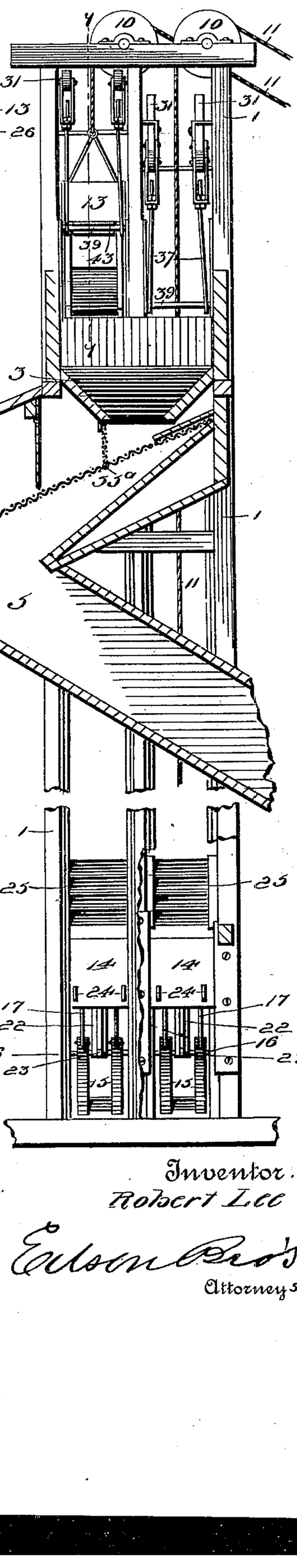


Fig. 3.

Fig. 7.

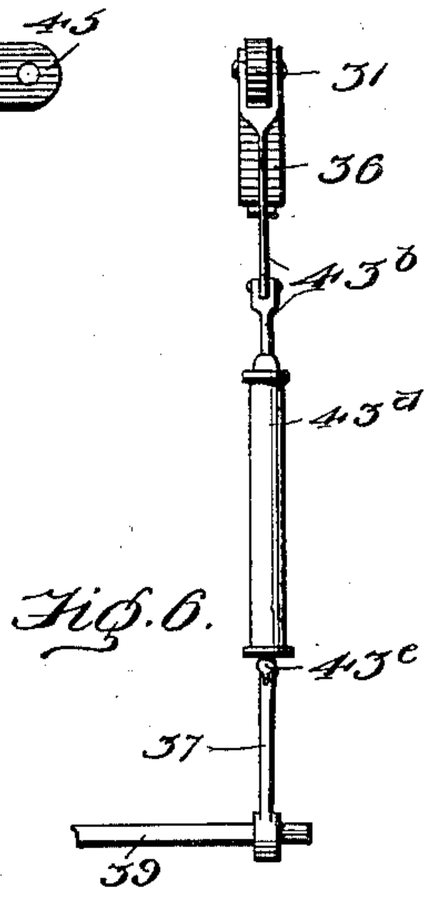


Fig. 6.

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(No Model.) 5 Sheets—Sheet 4.

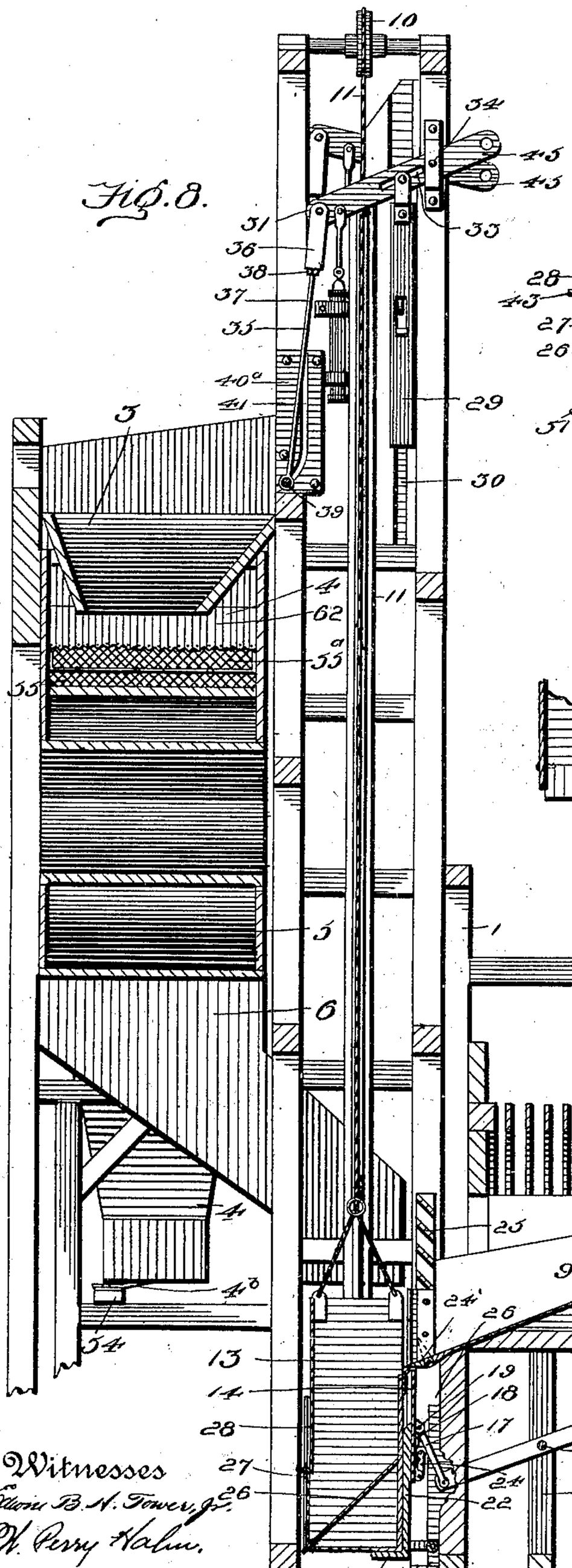


Fig. 8.

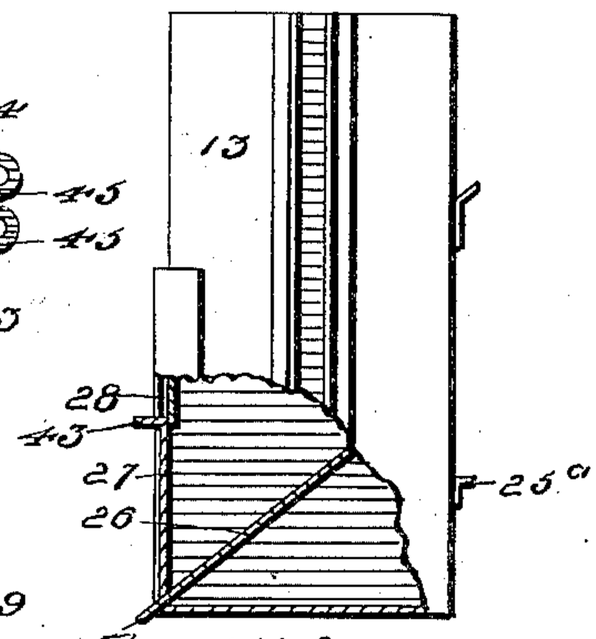


Fig. 9.

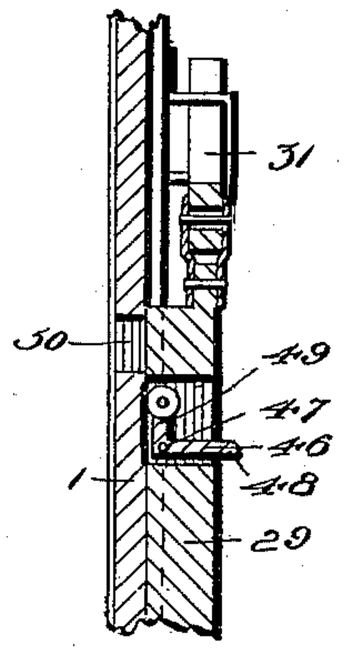
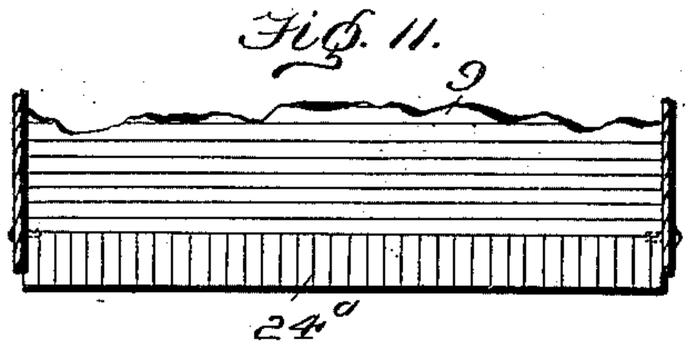


Fig. 10

Fig. 11.



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(No Model.) 5 Sheets—Sheet 5.

Fig. 14.

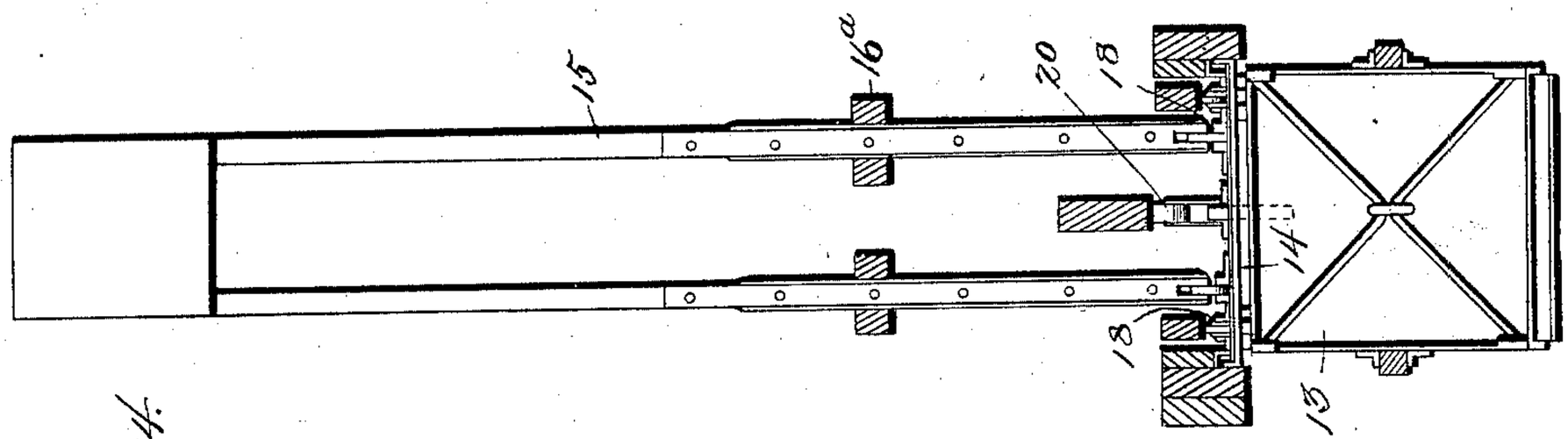


Fig. 15.

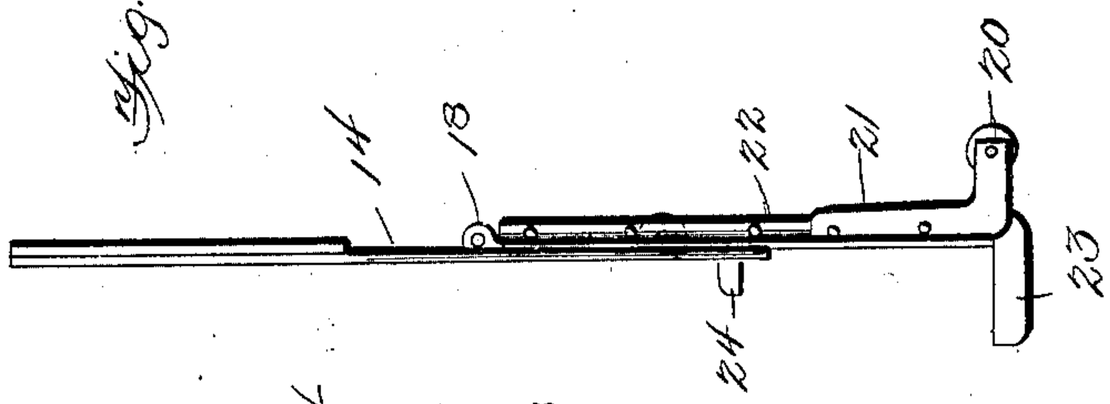


Fig. 13.

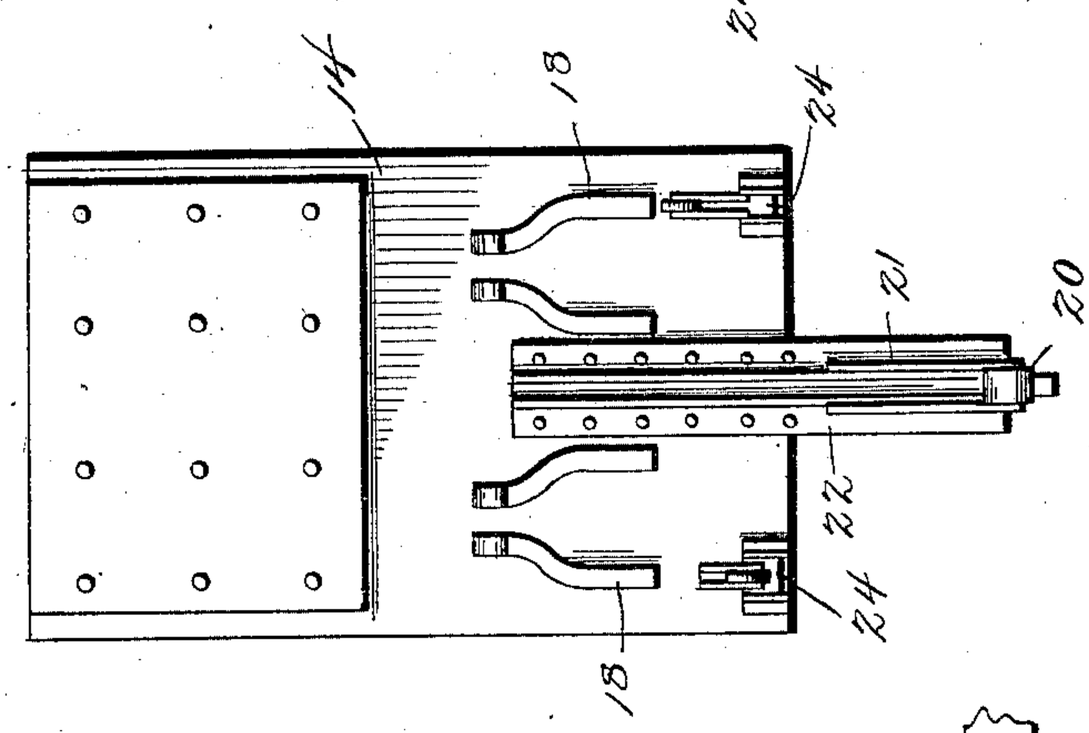
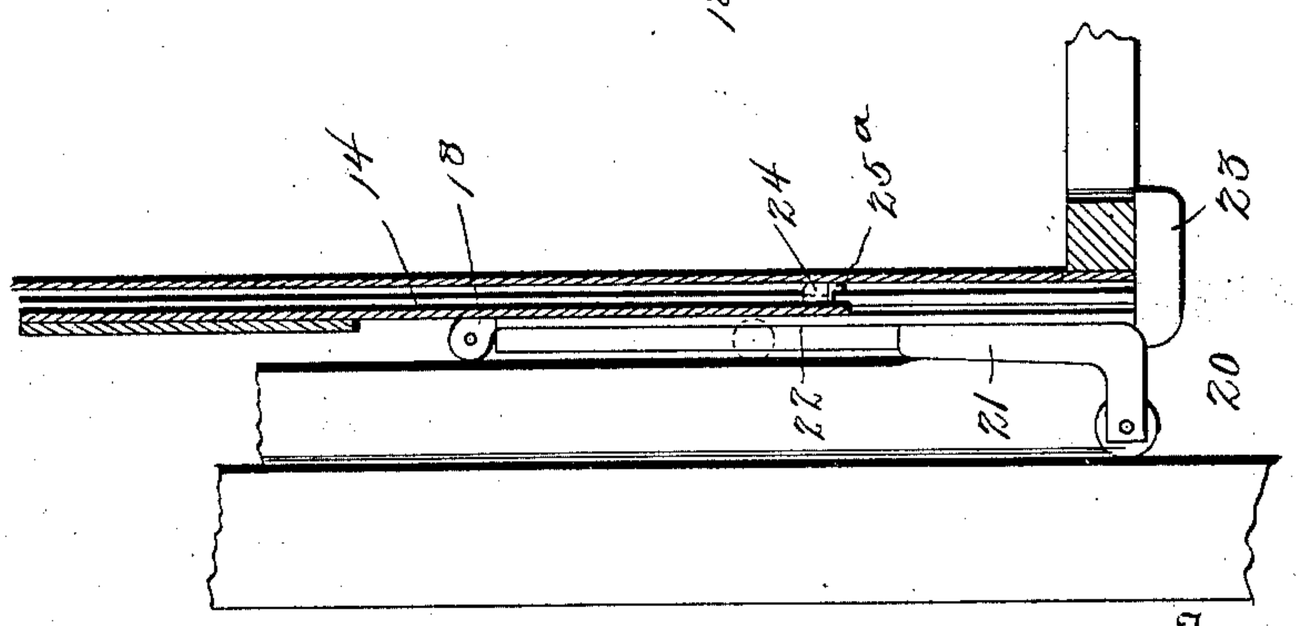


Fig. 12.



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UNITED STATES PATENT OFFICE.

ROBERT LEE, OF SHERRARD, ILLINOIS.

MINING-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 662,731, dated November 27, 1900.

Application filed May 10, 1900. Serial No. 16,212. (No model.)

To all whom it may concern:

Be it known that I, ROBERT LEE, a citizen of the United States, residing at Sherrard, in the county of Mercer and State of Illinois, have invented certain new and useful Improvements in Mining-Elevators; 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 present invention relates to improvements in elevators for mining purposes, more particularly upon the subject-matter of Letters Patent No. 318,757, granted to me May 26, 1885.

It has for its object to increase utility and facilitate the operation of the parts and simplify the construction and arrangement thereof.

It consists of improved means for actuating the lower chute-gate by the elevator-buckets, for the retention and securing in position of said gate, so as to close the delivery or discharge end of said chute by the action of said bucket or means thereon, for securing said gate in its lowered position away from said end of said chute, for overcoming pounding by the bucket-gate would otherwise be subjected to as it drops into its closed position, for reducing frictional contact, &c., of the chute-closing gate, and for effecting the proper separation of different grades or kinds of coal after the removal of the same from the mine, all substantially as hereinafter more fully disclosed, and specifically pointed out by the claims.

In the accompanying drawings, illustrating the preferred embodiment of my invention, Figure 1 is a side elevation thereof. Fig. 2 is a broken plan view. Fig. 3 is a broken sectional elevation on the line *x x* of Fig. 2. Fig. 4 is a detailed sectional view on the line *y y* of Fig. 3. Fig. 5 is a cross-section on the line *z z* of Fig. 4. Fig. 6 is a detached side view of the bucket-gate air-cushion or retarder. Fig. 7 is a rear view thereof. Fig. 8 is a sectional elevation on the line *v v* of Fig. 2. Fig. 9 is a broken enlarged detailed view of one of the elevator-buckets. Fig. 10 is a broken enlarged detailed section taken on the line *w w* of Fig. 8. Fig. 11 is an enlarged plan view of the pivoted apron or bridge at the delivery or discharge end of the shaft-chute. Fig. 12 is an enlarged detail view showing more especially the chute-gate with its angle-brackets 21 and their adjunctive parts. Fig. 13 is a like view showing more particularly the angle-brackets 24 and their adjunctive parts. Fig. 14 is an enlarged detailed plan view of the chute-gate-counterbalancing levers, and Fig. 15 is a side view of the parts shown in Fig. 13.

Latitude is allowed herein as to details, as they may be changed without departing from the spirit of my invention and the same yet remain intact and be protected.

In carrying out my invention I erect, as in my patent above referred to, a suitable upright structure or framework 1 in the mine-shaft, with a screen 2 arranged upon one side, near the base thereof. Upon the other side of said framework or structure I arrange, approximately midway the height thereof, a hopper 3, from which branch or fork off a series of (preferably three) chutes 4, 5, and 6 for the passage therethrough of "nut" or "lump" coal and slack, further described hereinafter.

The screen 2, upon which is dumped the coal after elevation from the mine, is suitably inclined to pass the larger lumps thereover into a car or other suitable receptacle at the lower end thereof.

The screen 2 has a stop or guard 7 hinged to its lower end at 2^a and provided with a cross-bar 2^b to prevent the coal from being carried by its velocity over and beyond the car standing upon a track 8. Said guard or stop hangs slightly above the level of the top of an ordinary coal-car, the hinges thereof permitting it to be swung up out of the way to allow a car of greater height or a locomotive to pass the foot of the screen.

Underneath the screen 2 is arranged an inclined pocket or chute 9, with its delivery end terminating in the plane of the shaft-frame 1. In the upper end of the framework 1 are suitably arranged or hung pulleys 10, compassed by a rope or chain 11 for raising and lowering the elevator-buckets, hereinafter described, said rope or chain also compassing and secured to a drum 12, mounted upon a shaft 12^a, suitably driven.

Buckets 13 are suitably arranged and

guided between guideways of the shaft-frame or structure 1 and suitably attached to the hoisting rope or chain 11.

Opposite the lower end of the pocket or chute 9 at each side of the structure 1, near its bottom, is arranged a gate 14, two gates thus being provided, adapted to slide in vertical ways or guides in the framework or structure 1 to effect the opening and closing of said end of chute or pocket. Each gate 14 has connected to it, preferably, two connected levers 15 15, each fulcrumed upon a pivot 16, suitably secured in and between uprights 16ª, which may be the supports for the outer or upper end of the chute or pocket 9, said levers having their outer longer arms exerting sufficient leverage to offset the weight of the gates and their inner ends connected to links 17, respectively, in turn connected to said gate. The connections between said links and gate may be in the form of eye-ended plates 18, secured to the gate and adapted to receive into their eyes pintles or pivots 19 from said links. The purpose of this arrangement is to effectively counterbalance the weight of the gate, especially when made very heavy, as desirable in handling or removing what is known as "lump" or "heavy" coal. Each gate is also provided near its lower edge with frictional rolls 20 to counteract back pressure of the gate-engaging hooks, presently described, hung in angle-brackets 21 thereon and adapted to travel against or along the guideways of the structure or framework 1 to reduce friction. The gates are also provided each with pendent arms or bars 22, having suitably fixed thereto preferably heavy right-angled brackets or hooks 23, adapted to engage or permit the bottom of the respective bucket to rest thereon, as shown, in its descent, and thus provide for the lowering or opening of the gate by the movement of the bucket past the chute 9.

Suitably hung or pivoted upon the door are roller-provided angular brackets or levers 24, with their rollers adapted to incidentally travel upon the guideways for the door in the shaft frame or structure 1 and engaged by lugs 25ª upon the bucket in its ascent. The engagement with said angular roller-carrying brackets of said lugs will tilt or move the roller-bearing ends of said brackets when they arrive opposite slots 26, provided in the guideways at a certain point into said slots, and thus provide for the retention of the gate in its elevated position opposite and closing the delivery end of the chute 9 in a positive manner and by counterbalancing-levers before described. The free or engaging ends of said angular brackets having thus been released from the lugs of the buckets, by thus assuming a position out of alinement with said lugs the bucket will be permitted to continue its ascent uninterruptedly. Upon the descent of the bucket it will engage at a certain interval in such descent the hooked or angular brackets 23 at the lower ends of the bars 22 of the gate, and thus drawing or acting upon said gate effect the outward tilting or dislodgment of said roller-bearing brackets or levers 24 at a point below the lugs on said bucket ready to be again engaged by the bucket-lugs upon the next ascent of the bucket.

An apron or bridge 24ª in the form of a stout or heavy plate is hinged or pivoted to the delivery or lower end of the chute 9 to provide for the passage of the coal or material therefrom into the buckets without the fine portions thereof sifting down between the chute and the buckets. Said hinged or pivoted apron or bridge will readily yield upward, as shown, as the buckets ascend after being filled and return to or assume its previous position as the buckets descend empty ready for use again in refilling the buckets. In filling a bucket or chute from the pocket, as above described, owing to the large quantity of coal which the pocket contains more coal passes from the pocket than the bucket can hold, it being banked up on that side of the bucket toward the pocket. In order to return this surplus to the pocket, I arrange above the mouth of the pocket, closed by its sliding gate, a series of inclined plates 25, having their outer edges higher than their inner edges, with spaces between them, substantially as shown in Fig. 8 of the drawings. It will be seen that as the bucket rises the surplus coal, being on that side of the bucket toward the pocket, will pass through the spaces between the inclined plates and fall back into the pocket, thereby preventing any loss, while at the same time the inclination of the said plates is such as to prevent the coal in the pocket from passing out between the plates. By reason of this device I supply the bucket with just sufficient coal to fill it, any surplus being automatically returned to the pocket and not allowed to fall upon the ground and be lost. Each bucket 13 is provided with an inclined bottom 26, at the lower end of which is formed an opening in the side of the bucket, closed by a gate 27, sliding in suitable ways 28, provided therefor. The bottom 26 projects somewhat to form a stop for the gate at the lower end of its travel, and on the side of the bucket above the opening therein are arranged two projections 26ª, forming stops to limit the upward motion of the gate, as hereinafter described, two of these stops being shown in the present instance, though more or less than that number may be employed.

It will be observed that from the inclination of the bottom of the bucket the contents of the bucket will be discharged as soon as the gate is raised. In order to effect this when the bucket has reached the end of its upward travel, I arrange at the upper end of the shaft-framework 1 a mechanism for automatically opening the said gate and discharging the contents of the bucket. On each side

of the path of the bucket is arranged a slide 29, moving on a suitable way attached to a support 30, secured on or forming a portion of the framing. This slide is pivotally connected at its upper end to a lever 31, the pivot-bolt passing through a slot 33 in the lever in order to allow of the necessary play between the two parts, since the slide moves in a straight line, while the lever moves in the arc of a circle. Each lever 31 is pivoted at or near one end at 34, its other end being pivotally connected to a lifting-arm 35. Each lifting-arm is preferably constructed in two pieces, the upper portion consisting of a stirrup 36, pivoted to the outer end of the lever 31, while the lower portion 37, which forms the body proper of the lifting-arm, is screw-threaded at its upper end to receive nuts 38, arranged above and below the stirrup at the point where said lower portion passes through the said stirrup. By means of this construction the length of the lifting-arm can be readily adjusted by unscrewing one of said nuts and screwing up the other one to a corresponding extent. The lower ends of each pair of lifting-arms are connected by means of a cross-bar 39, the ends of which project slightly at each side, as shown at 40 in Fig. 6. These projections are arranged to slide in guide-grooves 41, formed in plates 40[a], arranged on each side of each half of the elevator-shaft.

It is obvious that the projections 40 may be formed independently of the cross-bar 39 and also that the guide-grooves 41 may be formed in the framework of the structure itself instead of in a separate plate, although I prefer the construction shown. The guide-grooves are straight for the greater portion of their length, their lower ends, however, being curved outward, substantially as shown in Figs. 4 and 8 of the drawings.

It will be seen from the above description that upon the ascent of the bucket when it comes into contact with the slides 29 or with a suitable projection thereon arranged in the path of the bucket the slides will move upward, carrying with them the lever 31, thereby raising the lifting-arms and causing the cross-bar 39 to move in the guide-grooves 41. It will be seen that as the lifting-arms are attached to the levers at their extremities, while the slides are connected to them near their fulcra, the rate of motion of the lifting-arms will be considerably greater than that of the slides or of the bucket by which they are actuated. As the lifting-arms begin to move, being in their normal or lowest position, they are first carried inward along the curved portion of the guide-grooves 41 until the cross-bar 39 comes in contact with the side of the bucket at a point just below a projection 43 on the gate, which closes the opening in the bucket. As the bucket continues to move upward the cross-bar 39, moving in the straight portion of said guide-grooves and at a higher speed than the bucket itself, as hereinbefore pointed out, will engage the projection 43 and carry the door upward along with it, thereby uncovering the opening in the bucket and allowing the contents thereof to be discharged. When the bucket-gate is fully opened, the bucket has reached the highest point of its travel and, being emptied, begins with the unwinding of the elevating-rope to descend. Upon this descent of the bucket the weight of the levers, slides, and cross-bars is as a rule sufficient to cause these parts to return to their normal position, as shown in Fig. 8 of the drawings, thereby allowing the bucket-gate to close automatically by its own weight; but in order to overcome any tendency these parts might have to remain in an elevated position after being raised I have provided the projections 44 (see Fig. 9) hereinbefore mentioned, which engage with the upper end of the bucket-gate and cause the latter as the bucket descends to positively return the lifting-arms, levers, and slides to their original position. These stops 44 may as a rule, however, be dispensed with, the weight of the parts being generally sufficient, as hereinbefore pointed out, to return them to their normal position. The projecting ends of the levers 31, as shown at 45 in Fig. 8 of the drawings, may be provided with counterweights, if necessary, in order to properly balance the slides and lifting-arms, so as to reduce the weight necessary to be lifted by the bucket when in contact with the slides to the minimum. In order to overcome pounding by the gates of the buckets 13 as they descend to their closed position, I provide an air-cushion retarding device 43[a]. This device comprises parallel jointed or sectional piston-rods 43[b], suitably connected to the levers 31 for suspending the bucket-doors in position and having their pistons 43[c] engaging air-cushion cylinders 43[d], suitably secured in position upon the shaft-framework 1, the action of which will be readily understood, exhaust air-cocks 43[e] being attached at the lower ends of said cylinders.

In practice it has been found somewhat difficult to stop the bucket precisely at the proper point at the upper end of its travel, and as any excess of movement of the bucket in this direction would be liable to damage the mechanism just described for automatically opening the bucket-gate I have provided the combined safety catch and stop shown in Fig. 10. This consists of a bell-crank lever 46, pivoted at 47 within each slide 29, one arm of the said bell-crank lever projecting out beyond the slide, as shown at 48, while the other end 49 is provided with an antifriction-roller which bears normally against the support or framework 1, as shown in Fig. 10 of the drawings. This antifriction-roller may of course be dispensed with; but I deem its use preferable. The projecting end 48 of the lever 46 is arranged in the path of the bucket, the upper edge of which engages therewith as the bucket ascends, and owing to the resistance offered

by the other end of the bell-crank lever, which is in contact with the support or framework 1, the lever cannot turn and the end 48 will remain in the position shown in Fig. 10 of the drawings, thereby causing the slide to be carried upward by the upward motion of the bucket.

At a suitable point in the support 1 is formed a slot or recess 50, arranged in the line of travel of the end 49 of the lever 46. It will be seen that if the bucket continues to move upward beyond the point where it should stop the end 49 of the bell-crank lever 46 will come opposite the recess 50, and owing to the pressure of the bucket against the opposite end 48 of the lever the end 49 will be thrown into the said recess, thereby permitting the bell-crank lever to turn upon its pivot and withdraw the end 48 within the plane of the outer surface of the slide, when the bucket may continue its upward motion without any corresponding motion of the slide. It is obvious that by reason of this construction upon the hoisting of the bucket too far, either by accident or otherwise, the upward movement of the slides, levers, and lifting-arms will be prevented and any breakage of these parts thereby obviated.

The shaft upon which is mounted the drum 12, around which the hoisting-rope is coiled, is connected with any suitable motor capable of imparting to it a rotary motion in either direction, so that as the said drum revolves one of the buckets ascends while the other descends, and while one of the buckets is being automatically filled at the bottom of the elevator, as hereinbefore described, the other one automatically discharges its contents at the top of the elevator. Upon reversing the motion of the shaft 12^a and drum 12 the filled bucket ascends and the empty one descends, when they are respectively emptied and filled once more, the operation being continued indefinitely, the only supervision necessary being that involved in the reversal of the movement of the drum.

It will be observed that each bucket has its inclined bottom 26 provided at the lower front edge thereof with a downward and forward inclined projection 51, with the same transverse area as said bottom of the bucket, filling the space between the said bucket and the receptacle into which it discharges its contents, thereby preventing any waste or loss of material.

The hopper 3, hereinbefore referred to, discharges into the chute 4, while said chute may be put into communication with the chute 6 to provide for directing either nut-coal or lump-coal through either of said chutes. The screenings, or "slack" so called, passing from the chute 4 enter and are conducted away through the chute 5, as presently more fully explained. The lower end of the chute 4 is closed by a slide 4^a, and below this end of the chute is arranged a track 53 to receive the cars which are loaded at this point. The slide 4^a, which closes the end of the chute, is operated by means of a lever 54, connected to said slide by the pivoted link 4^b, so that by actuating said lever the slide may be withdrawn to open the delivery end of said chute or slid back into position to close said end.

At the upper end of the chute 4, near the hopper 3, the bottom of the chute is cut away, and the opening thus formed is covered by a screen 55, arranged just above the chute 5, extending in the opposite direction from the chute 4 and terminating over a track 56. The lower end of the chute 5 is also provided with a slide or gate 4^a for closing said end and means for actuating said gate, as in the case of the chute 4.

In the chute 4 is arranged a sliding door 57, spanning the upper end of the chute 6, thus providing for closing or shutting off communication from the chute 4 to the chute 6 for cutting off passage of the coal to said chute 6 when desired.

The door or slide 57 has attached or connected to its upper side near the forward edge preferably two jointed or sectional arms 58, fixed to an axial cross rod or bar 59, bearing in the sides of the chute 4. To the axial cross rod or bar 59 is secured outside of said chute 4 an actuating-lever 60, with a depending line or chain 60^a for its convenient manipulation in opening or closing the door or slide 57, and to said axial rod is fixed a counterbalancing weighted arm 61 to facilitate the operation of the parts. The weight on the arm 61 is adjustable thereon as may be required, as shown. As the lever 60 is depressed it will be seen that the sectional or jointed arms 58 will be straightened, thus moving the slide or door over the receiving end of the chute 6 and shutting off communication therewith. This condition of things will continue as long as strain is exerted upon the lever 60. As soon as pull upon the lever-operating rope 60^a is relaxed the arms 58 will "buckle" or flex inward, as shown, under the weight or action of the counterbalancing weighted arm 61, thus automatically opening or sliding the door 57 from over the receiving end of the chute 6 to permit lump-coal to pass into said chute.

In separating the coal as it comes from the mine and sorting it into sizes it is sometimes found desirable to separate that size of coal known as "pea-coal" from the slack proper, while at times this separation is not made, the whole being put on the market as slack. In the structure which I have described the screen 52 is of such dimensions as to allow both the pea-coal and the slack to pass through together, and in order to separate them it is necessary that they should be screened once more. In order to effectuate this, as the pocket 9 is not of a sufficient height above the surface of the ground to allow of another screening at this point by gravity alone, I employ the elevator hereinbefore described to hoist the coal to a sufficient height to re-

screen it. Upon discharging the coal into the hopper 3 it falls into the chute 4 and passes over the screen 55. While passing over this screen the smaller fragments thereof, which form the slack proper, will pass through the screen and fall into the chute 5, while the larger fragments, which form the pea-coal, cannot pass through the screen and will descend through the chute 4. The slides 4ª, which close the lower ends of these chutes, allow me to make the operation of hoisting a continuous one and render it unnecessary to stop the hoisting apparatus when a car has been filled at either chute and to wait until another car has been brought up to receive the contents of the buckets. From the foregoing it will be seen that when it may be desired to put the nut-coal into the car containing cleaned lump-coal it is then run into chute 6 by suitably manipulating the slide 37, as in mixing said nut-coal with screened or cleaned lump-coal or any portion or percentage thereof. This is a very valuable and important feature of my invention.

With my construction the hoisting operations may be continuous, the chutes filling up while the lower ends thereof are closed and being opened when it is desired to fill a car or other receptacle and closed again when it is filled until it is desired to fill another.

In case it be desired to render the separation of the pea and slack coal very thorough I employ a device for retarding the motion of the coal while it passes through the screen 55. This device is shown as consisting in the present instance of one or more depending plates 62, capable of yielding either by the natural elasticity of the material of which they are constructed—such as sheet-iron, for instance—or by means of a hinged joint, as shown. It is obvious that as the coal descends it will come in contact with these depending plates, so that its movement will be retarded and none of the finer fragments of the coal will be carried by their velocity over the screen without falling through the same, while at the same time the plates are so constructed as to yield to the pressure of the coal to a sufficient extent to allow the larger fragments to pass beneath them and prevent any choking of the chute.

In case it be found desirable for any reason not to separate the pea-coal from the slack proper, but to put both upon the market together, I provide means whereby the coal may be discharged into the chute 5 in the condition in which it comes from the buckets of the elevator. The upper end of the screen 55 is made capable of flexure at a point, 55ª, some little distance below its upper edge either by a hinged joint or otherwise, so that the portion of the screen above the said joint may be detached and bent up out of the way, as shown in dotted lines in Fig. 3 of the drawings, thereby leaving an aperture through which the coal may pass directly from the hopper 3 into the chute 5 without any screening to separate the pea-coal from the slack. This result may also be effected by constructing the upper end of the screen separately, so that it may be removed entirely. That portion of the top of the chute 4 which is immediately above the screen 55 may be provided with a hinge or otherwise-removable section 63. By raising this section the screen may be inspected, cleaned, or repaired, as may also the retarding-plates 62.

Although I have shown and described my improved elevator as applied in an apparatus for the purpose of elevating and delivering slack, I do not wish to be understood as limiting myself to this particular application thereof, for it is obvious that it may be used in various ways and for various purposes. For instance, it may be applied directly to the shaft of a mine or it may be employed for hoisting other materials than coal, being adapted for use in the mining of certain kinds of ore and in the handling of different substances. It is also obvious that various mechanical modifications may be made in the details of construction without departing from the principle of my invention. For instance, although I have shown two sets of slides, levers, and lifting-arms employed in conjunction with each bucket-shaft, it is obvious that a single slide, lever, and lifting-arm may be employed, although I prefer the construction hereinbefore set forth and shown in the drawings as being more simple and effective in operation. I do not, therefore, wish to be understood as limiting myself strictly to the precise details of construction hereinbefore set forth and shown in the drawings, reserving the right to make such changes as may fairly be considered as coming within the scope of my invention.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an elevator of the character described, the shaft-gate arranged to open and close a chute or pocket, having a pendent angular extension adapted to be engaged by the bottom of the elevator-bucket in its descent, substantially as set forth.

2. In an elevator of the character described, the shaft-gate having outstanding frictional rollers adapted to engage the guideways in the shaft framework or structure, substantially as set forth.

3. In an elevator of the character described, the shaft-gate arranged to open and close a chute or pocket, having a pendent angular extension adapted to be engaged by the elevator-bucket in its descent, and frictional rollers outstanding from said gate and adapted to engage the guideways of the shaft-framework, substantially as set forth.

4. In an elevator of the character described, the shaft-gate having hung or pivoted thereon angular brackets or levers adapted to be tilted

or moved into openings or slots in the shaft-framework, by the ascent and engagement of the elevator-bucket with said brackets or levers, substantially as set forth.

5. In an elevator of the character described, the shaft-gate having hung or pivoted thereon angular arms or levers adapted to engage slots or openings in the framework of the shaft, and right-angled pendent arms or brackets applied to said gate and adapted to be engaged by the elevator-bucket, substantially as specified.

6. In an elevator of the character described, a shaft-gate having parallel connected-together counterbalancing-levers, with their inner ends connected to links attached to or carried by said gate, said levers being suitably pivoted or fulcrumed in position independent of said gate, substantially as specified.

7. In an elevator of the character described, a series of chutes for graduating different kinds of coal, with a hopper adapted to deliver its contents thereinto, and a slide or door, one of said chutes having its upper or receiving end adapted to be closed by said slide or door, substantially as set forth.

8. In an elevator of the character described, a series of chutes, with a feeding-hopper, one of said chutes having its receiving end adapted to be closed by a slide or door, and a counterbalancing-lever, having its axial rod or fulcrum provided with flexing or jointed arms connected by said door or slide, substantially as set forth.

9. In an elevator of the character described, the combination, with the bucket-gate and means for actuating it, of the air-cushion retarding device comprising sectional or jointed piston-rods connected to said gate-actuating means, and air-cushion cylinders adapted to be engaged by said piston-rods, substantially as set forth.

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

ROBERT LEE.

Witnesses:
GUST HARTMAN,
THOS. DAVISON.