(No Model.)

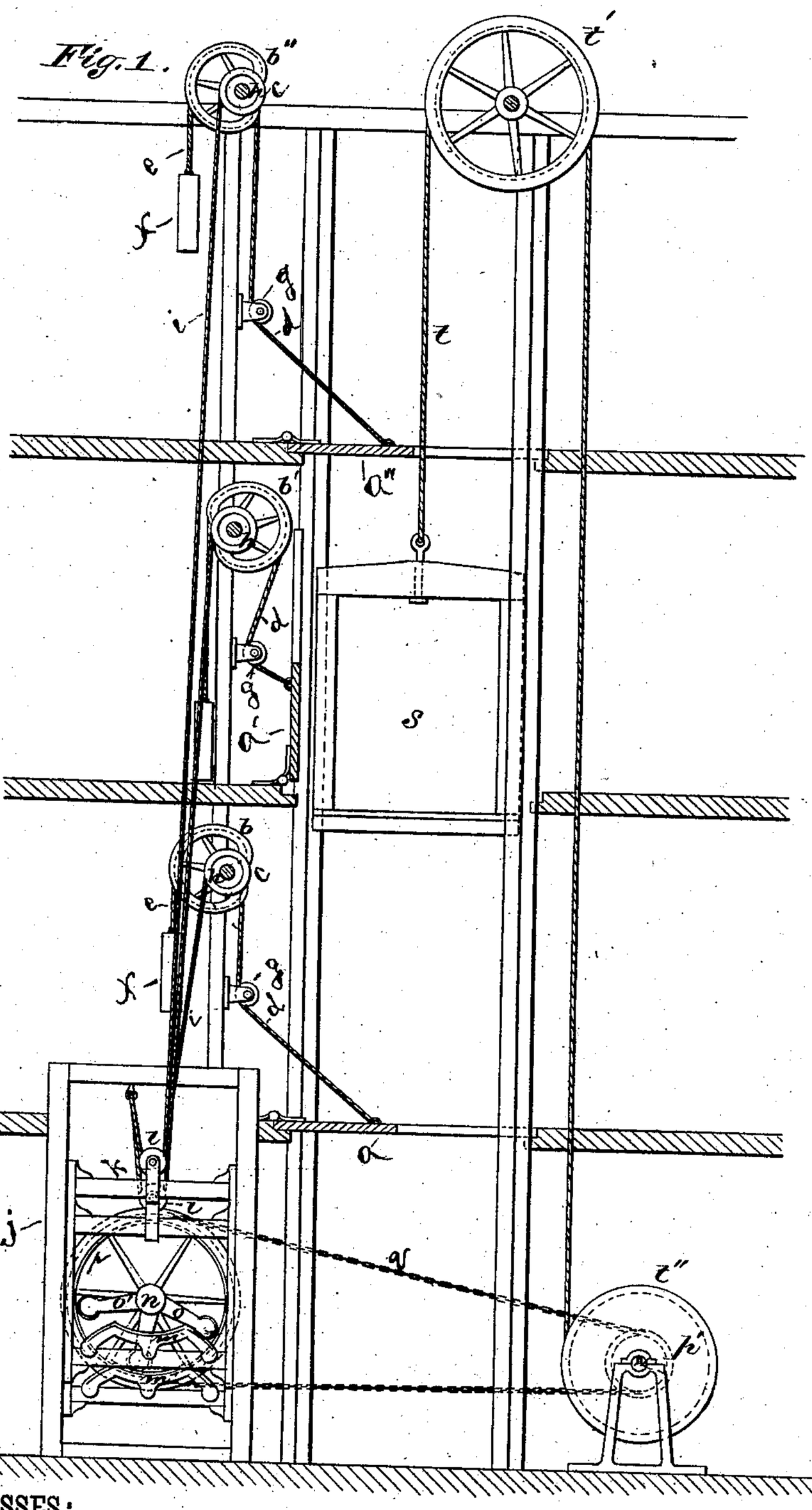
5 Sheets—Sheet 1

E. M. HACKETT.

AUTOMATIC HATCHWAY DOOR.

No. 260,675. Patented July 4, 1882.

Fig. 1.



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(No Model.)

5 Sheets—Sheet 2.

E. M. HACKETT.

AUTOMATIC HATCHWAY DOOR.

No. 260,675. Patented July 4, 1882.

Fig. 2.

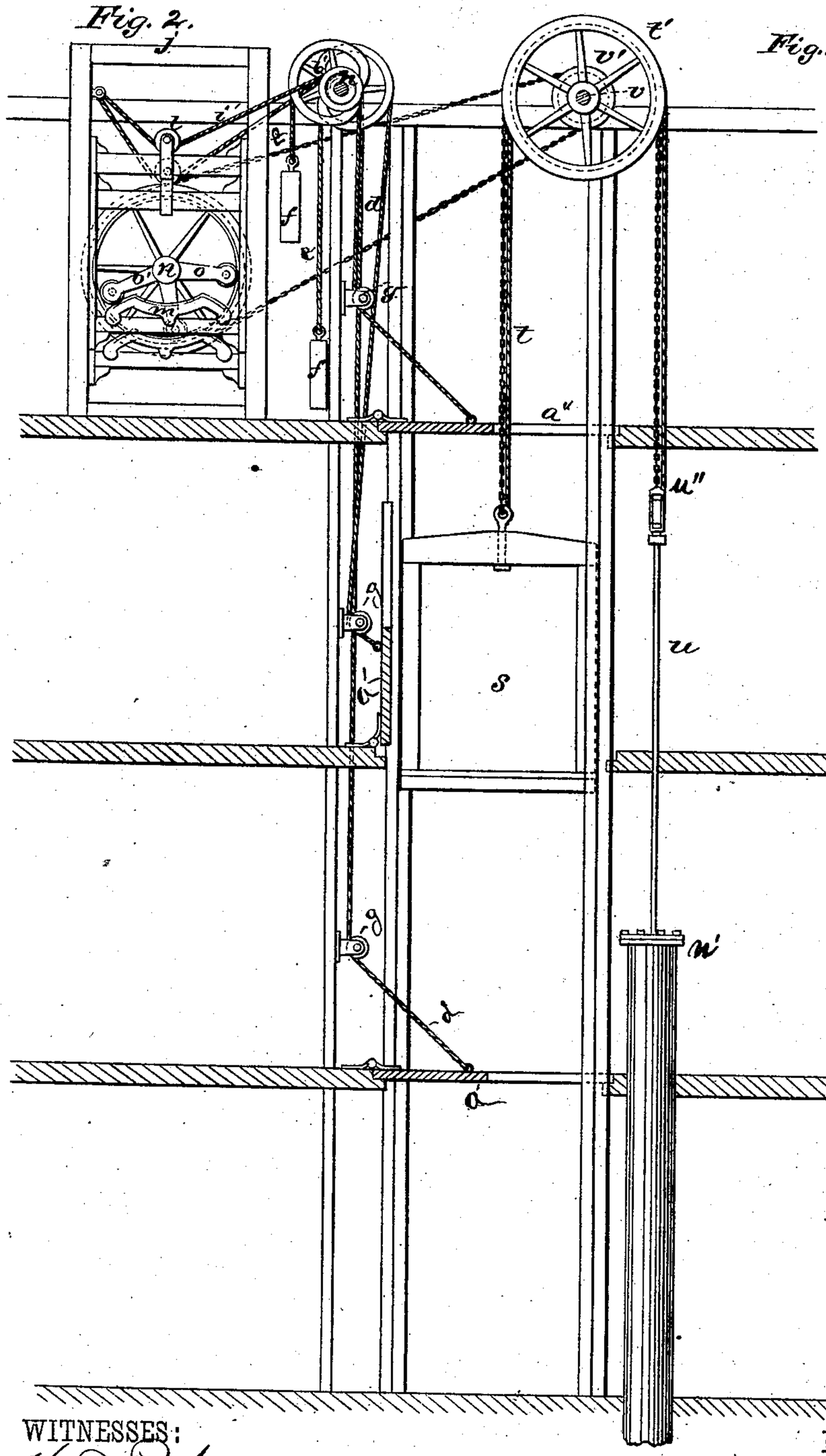
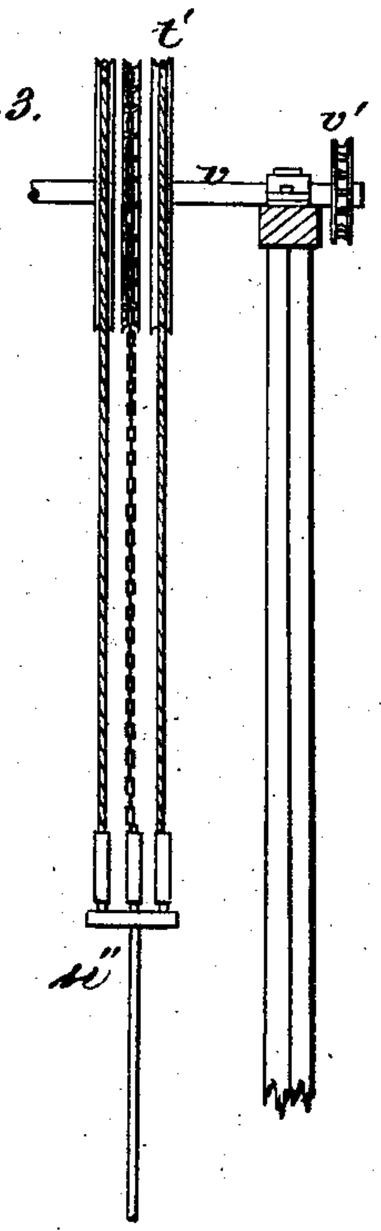


Fig. 3.



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(No Model.) 5 Sheets—Sheet 3.

E. M. HACKETT.

AUTOMATIC HATCHWAY DOOR.

No. 260,675. Patented July 4, 1882.

Fig. 4.

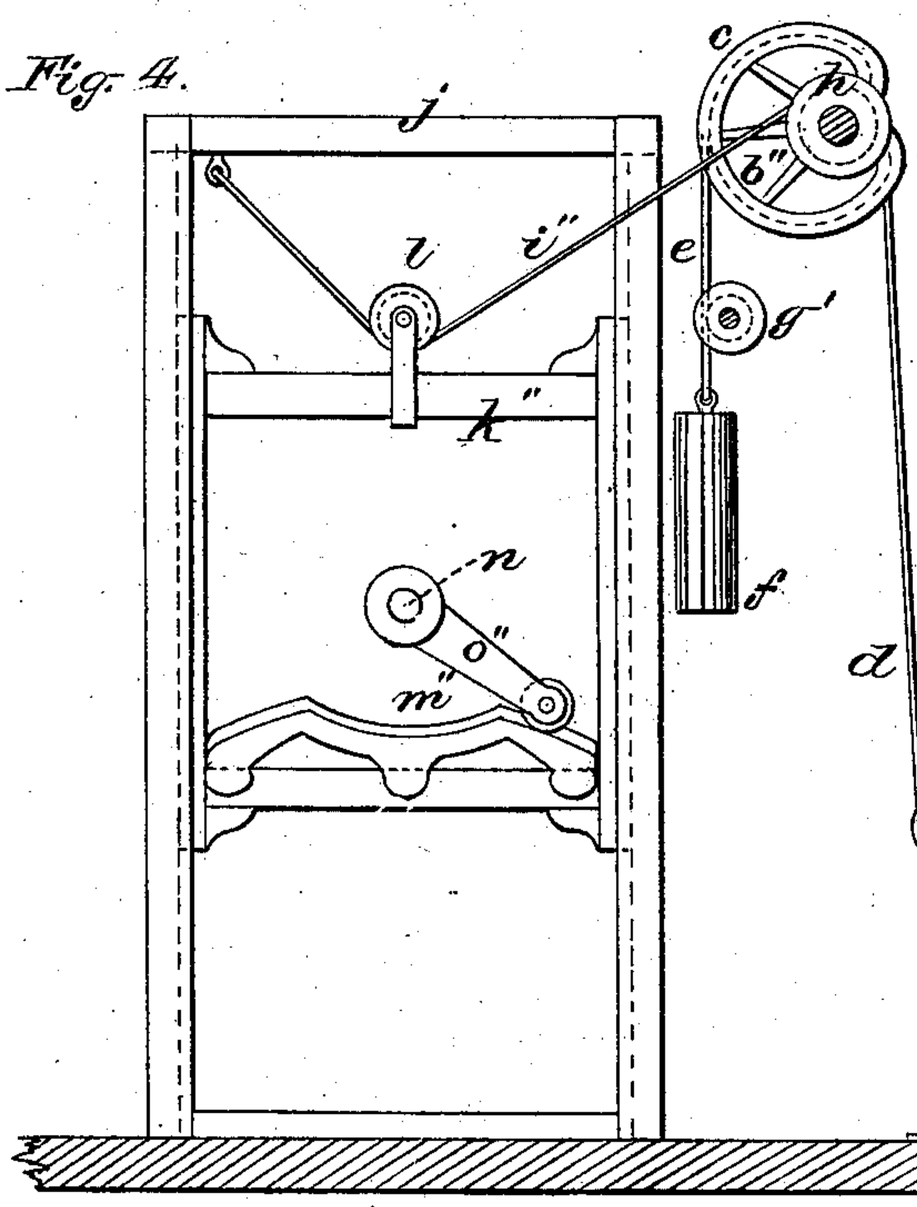


Fig. 7.

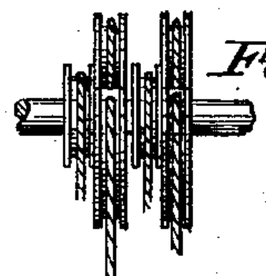


Fig. 8.

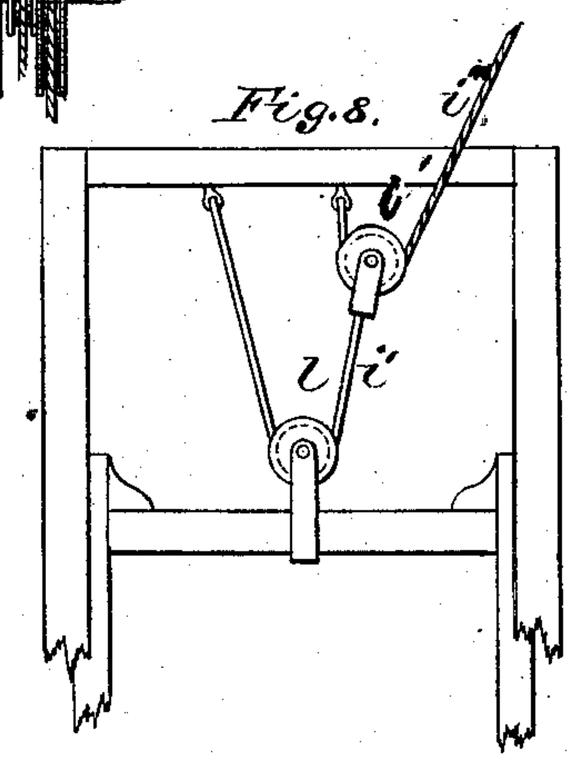


Fig. 5.

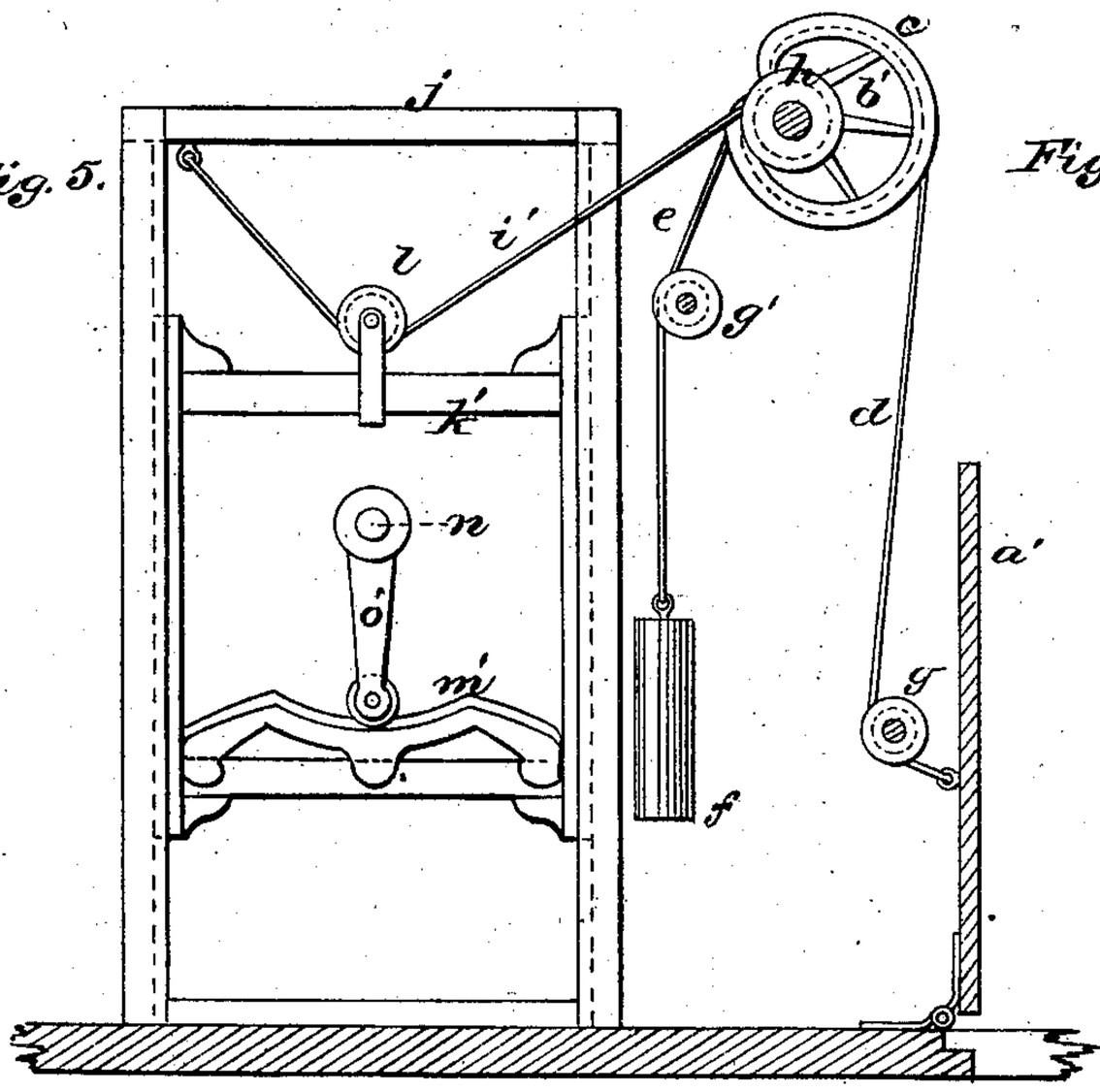
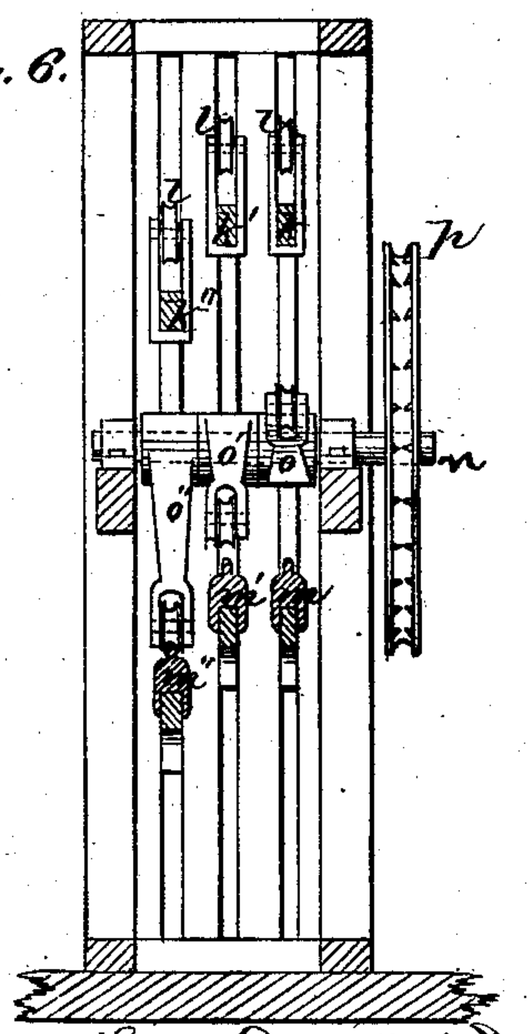


Fig. 6.



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(No Model.) 5 Sheets—Sheet 4.

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AUTOMATIC HATCHWAY DOOR.

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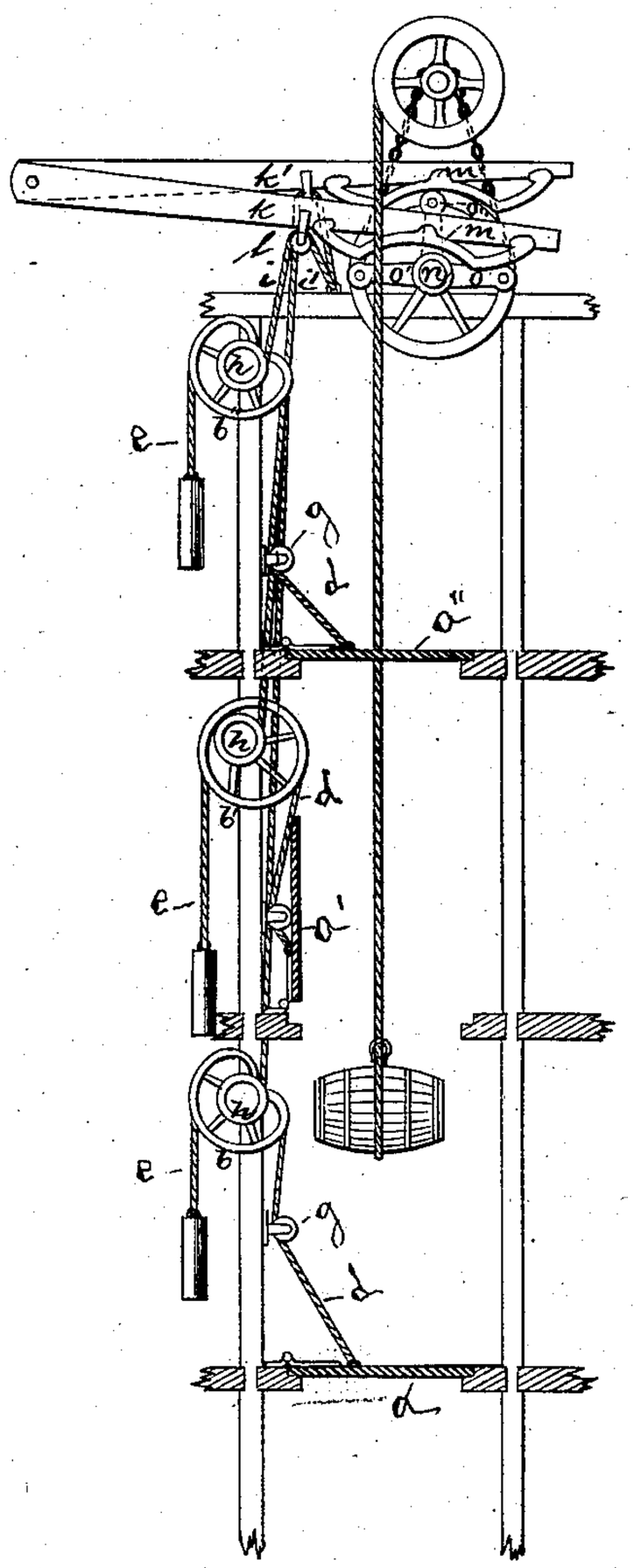
Fig. 9.



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AUTOMATIC HATCHWAY DOOR.

No. 260,675. Patented July 4, 1882.

Fig. 10.

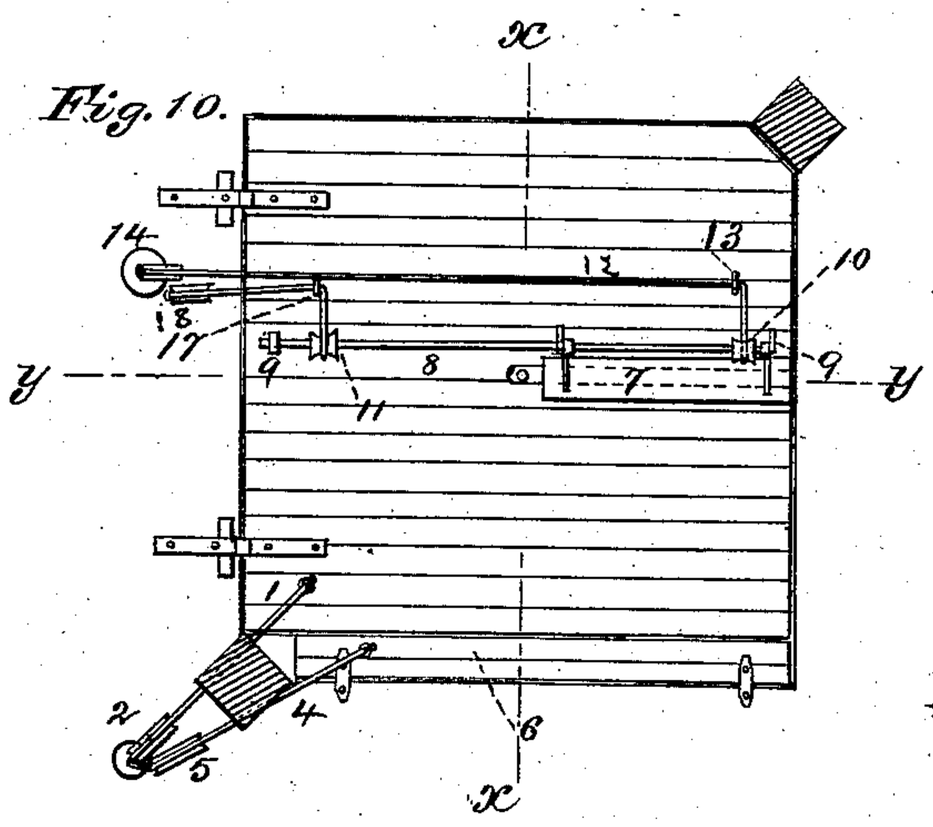


Fig. 11.

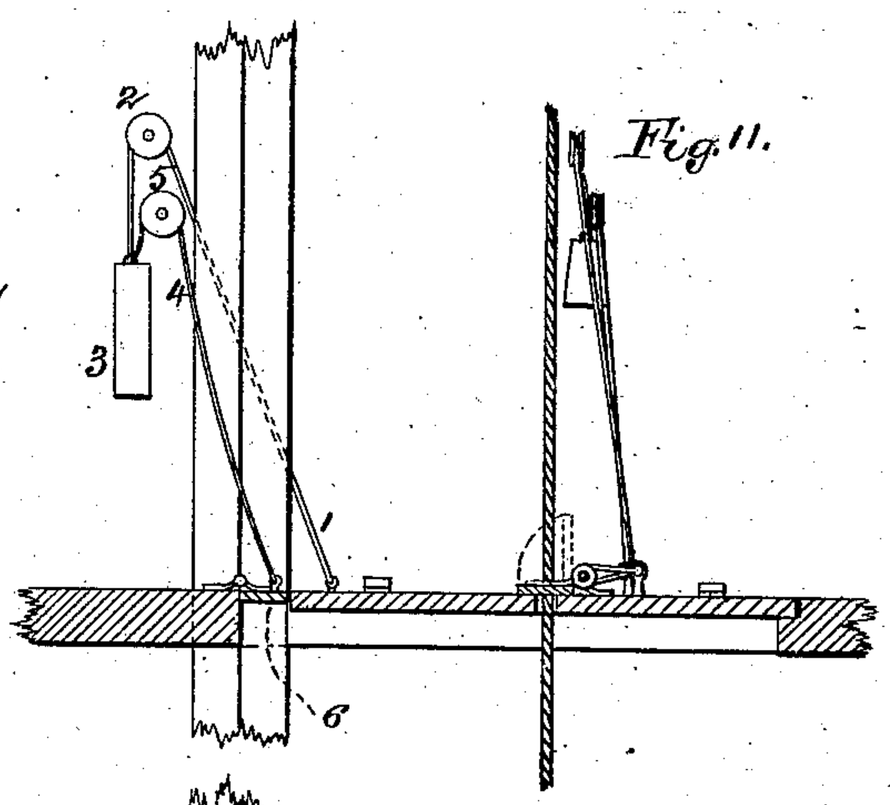


Fig. 12.

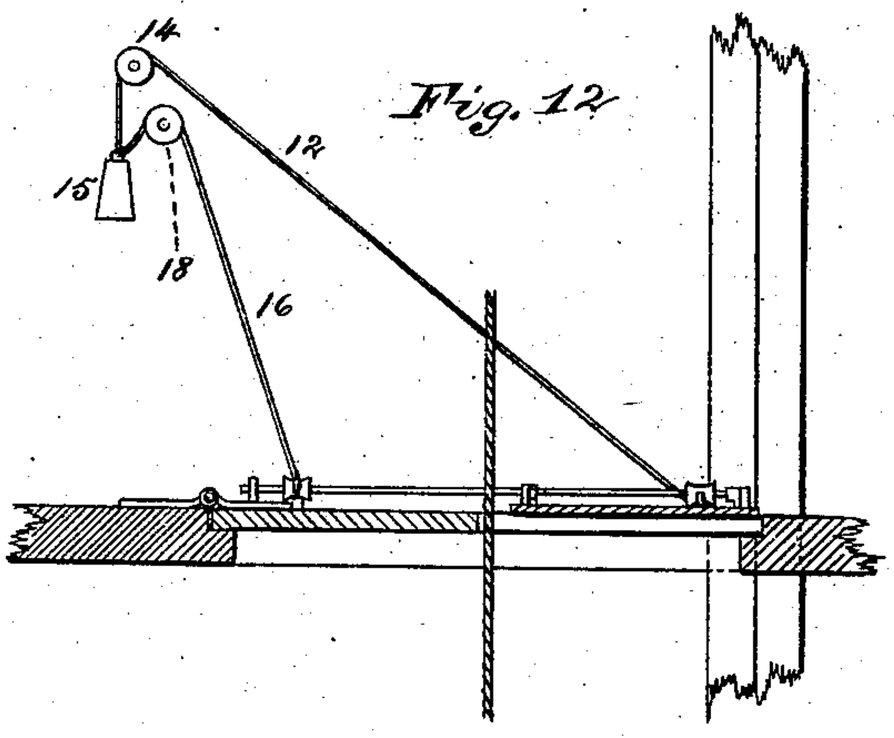


Fig. 13.

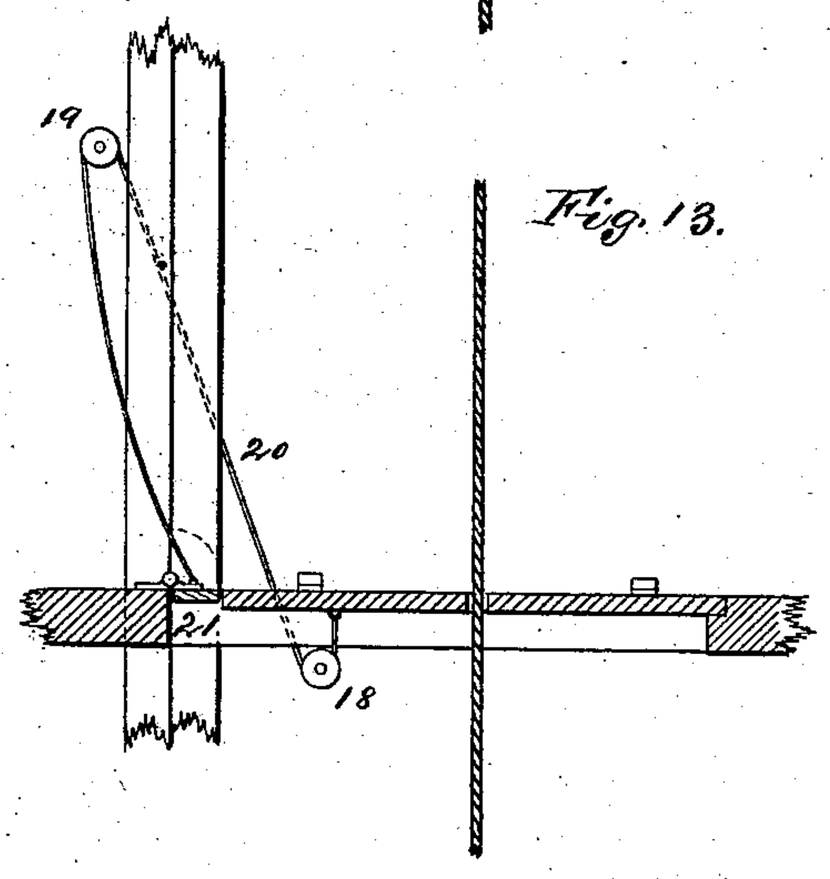
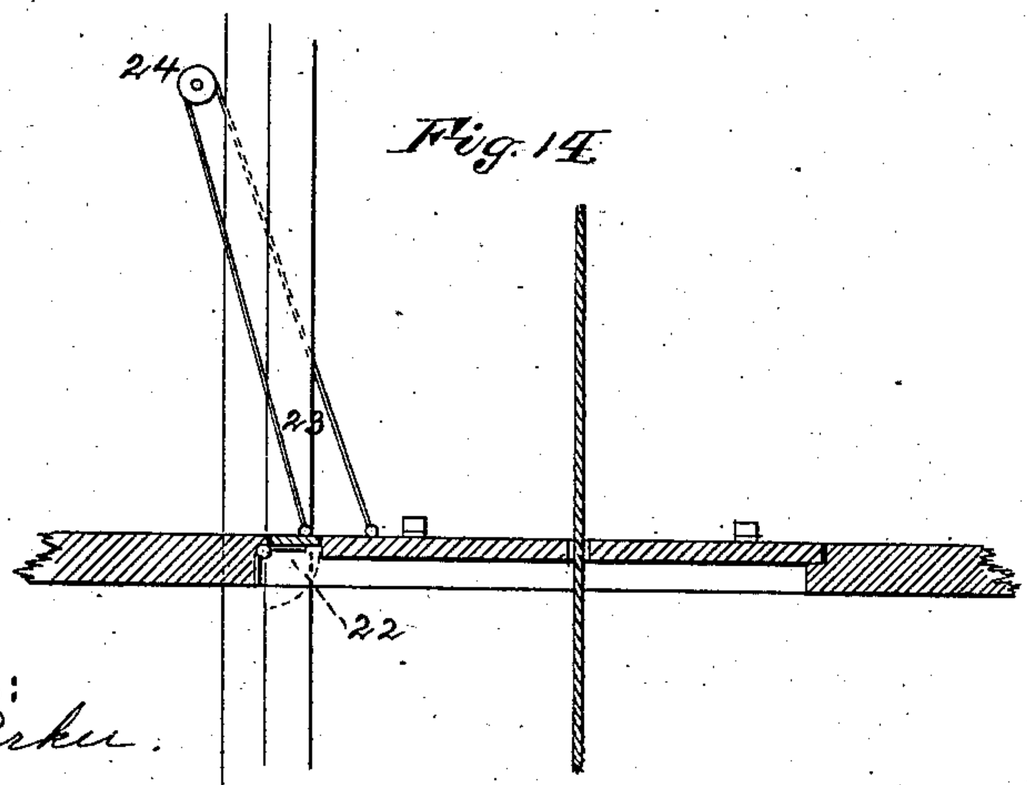


Fig. 14.



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UNITED STATES PATENT OFFICE.

EDWARD M. HACKETT, OF NEW YORK, N. Y.

AUTOMATIC HATCHWAY-DOOR.

SPECIFICATION forming part of Letters Patent No. 260,675, dated July 4, 1882.

Application filed August 1, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HACKETT, of the city, county, and State of New York, have invented certain new and useful Improvements in Automatic Hatchways; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the drawings accompanying and forming part of this specification.

These improvements consist, first, in mechanism whereby the hatchway-doors may be opened with gradual and easy movement, whether the elevator-car be running fast or slow; second, in improved means for opening and closing the small doors situated in the jogs and on the rope-slot of the hatchway-doors; third, in certain details of mechanism connected with the foregoing features.

In the drawings, Figure 1, Sheet 1, is a vertical central section of a hatchway containing my improvements situated in a building of three floors and basement. Fig. 2, Sheet 2, is a similar view, except that my improvements are shown attached to a hydraulic elevator, and with the whole of the improved apparatus placed on the top floor of the building, instead of a portion thereof in the basement and the rest distributed on the various floors, as seen in Fig. 1. Fig. 3, Sheet 2, is a detached view of the drum-shaft and the elevator-connection thereto when my improvements are applied to a hydraulic elevator. Fig. 4, Sheet 3, is a detail view and side elevation of the door opening and closing mechanism, also of the door-balancing mechanism. Fig. 5, Sheet 3, is a similar view to Fig. 4, except that the hatchway-door is shown open instead of closed, as in Fig. 4. Fig. 6, Sheet 3, is a detail view and end elevation, partly in section, of the door opening and closing mechanism. Fig. 7, Sheet 3, are views of the cams and cam-shaft, to which the ropes or chains from the doors and the balance-weight ropes, also the ropes from the cam-frame, are fastened. Fig. 8, Sheet 3, is a detail view and modification of the segmental cam-frame rope. Fig. 9, Sheet 4, is a vertical central section of a hatchway, showing a modification of the segmental cam and cam-lever-operating mechanism. Fig. 10, Sheet 5, is a plan view of one of the hatchway-doors, showing the method of opening and closing the side and central sections thereof. Fig. 11, Sheet 5, is a vertical central section thereof, taken through the line *x x* of Fig. 10. Fig. 12, Sheet 5, is a vertical central section thereof, taken through the line *y y* of Fig. 10; and Figs. 13 and 14, Sheet 5, are modifications of the operative mechanism for these side doors, shown in vertical central section.

In these drawings, *a a' a''* are the hatchway-doors for the first, second, and third floors. *b b' b''* are pulley-blocks, one for each of the said named floors, each of which has an eccentric portion, *c*. In the groove at one side of this eccentric portion is attached the rope *d*, such rope being connected at its other end to its hatchway-door, and in the groove on the other side of this eccentric portion is connected the cord *e*, carrying the door-balancing weight *f*.

g is a guide-pulley to the rope *d*. *g'* is a guide-pulley to the rope *e*. Each of these eccentric pulley-blocks has also a circular sheave, *h*, attached to and over which is run a rope, *i*. Each of these last-referred-to ropes is attached to the top of a large square frame, *j*, carrying a number of sliding frames, *k k' k''*, one for the doors of each floor, each of these sliding frames having a sheave-block, *l*, fastened in its top bar, and through each of these sheave-blocks passes one of these ropes *i i' i''*. In the lower bar of each of these frames is a segmental cam, *m m' m''*. *n* is a horizontal shaft running across and within this series of sliding frames, to which shaft are keyed the cam-levers *o o' o''*, and so arranged thereon that each lever will operate on its respective segmental cam *m m' m''*, to bear down the sliding frames *k k' k''*, and thus operate the eccentric cams, and thus, through the frames *k k' k''* and the ropes *i i' i''*, open, hold open, and close and hold closed the doors *a a' a''*, as the parts may be timed. These cam levers I can arrange upon this cam-lever shaft *n*, so that any number of doors may be opened and closed within one revolution of the said shaft.

p is a wheel with a grooved periphery, within which periphery are projecting pins at short intervals, so that the chain *q*, connecting back to a similar but smaller wheel, *p'*, on the drum-shaft *r*, can, on the operation of the drum-shaft, give a reduced motion to the cam-lever shaft *n*.

s is the elevator-car.

t is the rope passing over the drum-pulley

t' at top of building down to and over the drum t'', connected with the hoisting-engine situated in the basement of the building. In Sheet 2, Fig. 2, the hoisting-rope is shown attached to the piston u of a hydraulic cylinder, u'. This hoisting-rope is represented at w'' in Fig. 3 as terminating in three divisions where it passes over the pulley-wheel at the top of the building. In this arrangement the reduced motion is obtained by gearing the cam-wheel shaft to the shaft v of the pulley-wheel of the hoisting-rope, in which application of my invention the door opening and closing mechanism, as well as the eccentric pulleys and their weights, is located on the upper floor of the building.

The operation of my improvements so far described is as follows: The elevator-car is shown as passing up through the middle floor, the hatchway-door of that floor having been opened by the operation of the cam-lever o' on the segmental cam m', and retained in an open position by the movement of the cam-lever along the concave surface of the segmental cam. The range of this movement is timed to and corresponds with the movement of the elevator-car through the hatchway-opening in the floor through which the car is passing. The frame k' effects this opening of the door by drawing on the rope i', which, being attached to the sheave h of the eccentric-pulley b', causes the counterbalancing-weight f to descend and the rope d to pull up the hatchway-door, and to hold such door open while the frame k' is being pressed down by reason of the cam lever o' pressing onto the segmental cam m', as before stated. As soon as such lever o' leaves the edge of the segmental cam m' the door closes by reason of the rising up of the frame k' and the weight f and the cord e. As the cam-lever o' leaves the segmental cam m' the cam-lever o'' approaches the segmental cam m'', and as soon as it is in contact the hatchway-door of the third story will commence to open by reason of the downward movement of the frame k'', and the drawing down of the rope e and the consequent downward movement of the weight attached to the wheel b'', thereby serving to pull the rope e over onto the eccentric portion c of the wheel b'', and to draw up the hatchway-door. The reverse of these operations takes place on the downward movement of the elevator, including the opening and closing of the hatchway-door on the first floor, which operations need not be described from what has been above stated respecting the opening and closing the hatchway-doors on the second and third floors. It will thus be seen that while the elevator-car is passing through any one floor the hatchway-doors to all the other floors are closed. After the elevator-car has passed through all the floors in descending, and is in the basement, all of the hatchway-doors are closed by reason of leaving on the cam-lever shaft between the first and the last of the series of cam-levers sufficient space so that at this position of the elevator-car none of such cam-levers will bear upon any of the segmental cams. This results in all of the hatchway-doors being closed.

The principle of the counterbalancing of the hatchway-door for each floor is as follows: While the door is closed the whole weight of it has to be counterbalanced. Consequently the connecting-rope d is brought close to the center of the shaft of the eccentric pulley-block, and the weight f in this position of the door is suspended on the extreme or greatest distance of the periphery of the eccentric pulley-block away from such center. Now, as the door opens up, its weight coming up toward the vertical plane, such weight gradually decreases. Correspondingly the rope d, attached to the door, rides on the eccentric portion of the pulley-block, increasing its length of radius, taking the pulley-block shaft as a center, and the cord e rides off of the greatest eccentricity of the said pulley-block, thereby decreasing its radius gradually as the other rope increases its radius. Thus, as seen at the middle floor in Fig. 1, the hatchway-door of that floor being open, the weight-rope e is close to the center of the cam-shaft, and the door-rope d is on the greatest eccentricity of the pulley-block, while the door itself is in a vertical position. Now, as soon as the cam lever o' rides off of the segmental cam m, the weight of the door will begin to make itself felt and close by gravity. As it falls into place the approach of its rope d toward the center of the pulley-block cam-shaft and the increasing of the power of the counterbalancing-weight f, by reason of its rope increasing its distance from the center of the said shaft by riding up onto the greatest eccentricity of the cam, will permit the door to gradually seat itself by being at all points of its movement nearly counterbalanced. The frames k, k', and k'' aid, together with the weights $f\,f\,f$, to counterbalance these hatchway-doors.

The principle of reducing the motion of the hoistway-drum or its equivalent—which equivalent, in the case of the hydraulic elevator shown in Fig. 2, Sheet 2, would be the wheel t—and thereby modifying the power for opening the hatchway-door in the same ratio, is seen to be as follows: The cam-lever shaft n is operated by the chain q passing over the wheels $p\,p'$. The ratio between the circumferences of these two wheels being, for the three floors, shown as one to eight, so that in seven revolutions of the drum-shaft to either carry up or to lower the elevator-car the whole length of the hatchway, the speed is reduced to about two-thirds of one revolution of the cam-lever shaft n. This reduced motion permits, by properly gaging the cam-levers to the segmental cams, of opening all the hatchway-doors in a hatchway, and yet have at one interval all of the said doors closed and within one revolution of the cam-lever shaft, irrespective of the number of doors there are in the hatchway.

It will also be seen, as before stated gener-

ally that when taking the power from a hydraulic engine the reduced motion is acquired at the revolving pulley at top of building, as seen in Fig. 2, Sheet 2. In a hoisting-engine run wholly by steam-power the reduced motion can be taken from either the hoisting-drum shaft in the basement or at the pulley-shaft at top of the building, in case the pulley on such shaft is not too small. When the pulley is small the revolutions are so many that intermediate gearing is required, if it is from any cause desired to take the reduced motion at that point.

By means of the mechanism hereinabove described the doors may be opened with a gradual and easy movement and in time to permit of the passage of the elevator-car through the respective openings, no matter how fast the elevator-car may be running.

The great objection to automatic-door structures in hatchways heretofore has been the slamming action in opening and closing the doors when the elevator was run with fair speed. To avoid this, attempts have been made to catch the door well out from the hinges, not nearer than the center. This gives the door time to open and shut, but the trouble has been to connect proper mechanism therewith which would take up and let out the door-rope with a steady, even, and reliable motion.

My apparatus, it will be perceived, catches the rope *i'* in such manner at the rear of the eccentric-cam that every pull on it makes a double pull on the door-rope *d*. Thus, for illustration, if the pulley *l*, bearing on the rope *i'*, draws it eighteen inches, the door-rope *d* will be moved three feet. The pull through the cam-lever shaft, cam-levers, segmental cams, and frames on these ropes is a short motion, and consequently steadier and more reliable. By reason of the increase or double pull on the door-rope such door-rope can be caught farther out and still make a more even and easy upward pull of the door. In case of very large doors or greater number of floors and the close proximity of the cam-levers, a short pull can still be made available when the doors are caught farther out by reducing the pull on rope *i'* by the intermediate pulley, *l'*, and rope *i''*. (Shown in Fig. 8 of Sheet 3 of the drawings.)

In the case of taking the reduced motion from the wheel *t'* of a hydraulic hoisting-engine, as shown in Fig. 2, Sheet 2, of the drawings, to avoid the effect of the slip of such wheel on my apparatus in effecting the reduced motion, I propose to put an additional wheel, *v'*, on the shaft *v*, and have a chain pass over projections on the periphery of such wheel *v'*, so as to make its movement positive and always correspond with the movement of the chain or rope passing over it.

Where sliding hatchway-doors are used the frames *k*, *k'*, and *k''* should be constructed in their upper interior portions with segmental cams, the same in form with those shown on their lower portions, so that cam-levers keyed on the cam-lever shaft would in their action on such segmental cams serve to move upward the frame *k*, *k'*, and *k''*, and thus by a positive motion in both directions operate the hatchway-doors to both open and close them. In Fig. 9, Sheet 4, will be seen a modification of this portion of my improvements. The segmental cams *m*, *m'*, and *m''* (the curves of which are graduated from their inner to their outer ends to different radii—that is to say, the inner end is of greater radius than the outer end,) are affixed on the under side of a series of levers, *k*, *k'*, and *k''*, one to each lever, instead of on vertically-sliding frames, such levers being pivoted at their ends at some convenient point in the upper story of the building. Sheave-blocks *l*, *l'*, and *l''* are placed on the under side of these levers, one for each lever, and through each sheave-block there passes one of the ropes *i*, *i'*, and *i''*. The operation of the segmental cams and cam-levers is substantially the same in this modification as hereinbefore described.

My method of opening and closing those portions of the hatchway-doors which are in the jogs caused by the existence in the hatchway of the vertical guide-posts is by means of small ropes or chains.

1 is a rope connected at one end to the top part of the hatchway-door and passing over a pulley, 2, fixed at the side or rear of one of the guide-posts, and having a weight, 3, attached to its other end. 4 is another small rope connected at one end to the top surface of the sectional or jam door, and passing over another pulley, 5, in the side wall just below pulley 2, and having its other end attached to the same weight, 3. The relative lengths of these ropes are such that when the large hatchway-door is closed the rope 1, connected therewith, is taut, holding the weight 3 while the cord 4 is slack. Now, when the hatchway door opens upward the rope 1 becomes slack by reason of its greater radius over rope 4, and rope 4 becoming taut from the weight 3, the smaller door 6 is drawn up. On the lowering of the main door the reverse of this operation takes place—namely, the rope 1 becomes taut, taking the weight 3 off of rope 4, which latter rope then becomes slack, and the door 6 falls by its own gravity into its place. The small door 7 over the central opening is opened and closed upon the same principle. This door is hinged to a rod, 8, such rod being supported in bearings 9 9. 10 11 are two spools placed on the rod 8. The rope 12, with the longer radius, is attached to and passes under the spool 10 through a staple, 13, over a pulley, 14, and has a weight, 15, connected with its other end. The rope 16, with the shorter radius, passes over the spool 11 through a staple, 17, over a pulley, 18, at the side or rear of one of the guide-posts, and has its other end connected to the same weight, 15. The

weight 15, when the larger door is closed, causes the rope 12 to be taut by reason of its having the pull of the weight 15, and the rope 16 is slack. When the large door opens upward the rope 12 becomes slack and the rope 16 taut, which causes a pull on the spool 11, rotating the rod 8 in its bearings, and through it throwing back the attached door 7. On the downward movement of the large door the rope 16 again becomes slack and the rope 12 taut, which latter rope rotates, through the spool 10, the small door in the opposite direction, thereby closing it.

Sometimes the weight may be dispensed with, (see Fig. 13, Sheet 4,) a pulley, 18, being inserted at the side of the hatchway below the large door, and another pulley, 19, at the side or rear of one of the guide-posts, and there being attached one end of the rope or cord 20 to the under side of the large door, then over the pulley 18, up through the door, and over pulley 19, and down to and having its other end attached to the top of the small door.

It will be seen that with the large door closed the cord 20 will be slack and the small door 21 in place by the force of gravity. When the large door opens the rope 20 becomes taut and draws the small door 21 up out of its horizontal position. In some places this small door must of necessity open downward instead of upward—for instance, when a passage-way is to be had on the level of the floor directly into the elevator from the side on which this small door is placed. In Fig. 14 will be seen a slight modification of the construction shown in the other figures to meet this necessity.

22 is the small door. 23 is a small rope leading from its upper surface over a pulley, 24, placed at the side or rear of one of the guide-posts and down to the top surface of the large door. When the large door is closed the rope 23 is taut and holds up the door 22 in a horizontal position. When the large door is raised upward the cord 23, slackening, permits the small door 22 to pass downward out of the path of the elevator-car.

I claim—

1. The series of eccentrics, each connected with the door on the one side and with a balancing-weight, *f*, on the other side, substantially as herein described and set forth.

2. The combination of the cam-levers *o o′ o″* with the cam-lever shaft, the cams, and the series of hatchway-doors, whereby the latter may be opened and closed within one revolution of the cam-lever shaft, substantially as described.

3. The series of cam-levers *o o′ o″* and cam-lever shaft, in combination with segmental cams *m m′ m″* and the series of hatchway-doors, and chain-gear connecting said cam-lever shaft, substantially as described.

4. In an automatic hatchway, the series of frames *k k′ k″*, carrying segmental cams *m m′ m″*, in combination with the cam-shaft levers and the series of hatchway-doors, substantially as described.

5. The series of frames containing segmental cams, in combination with the cam-shaft levers, and with the eccentrics connected to said frames and to the hatchway-doors, substantially as herein described and set forth.

6. The supplemental wheel *v′*, containing projections on its periphery, with a chain passing over such periphery, in combination with the multiple hoisting ropes and pulleys of the elevator-car, the elevator-car, and with the cam-shaft and elevator-door-operating mechanism, substantially as described.

7. The slack and taut ropes, in combination with the small doors placed in jogs of the hatchway-doors, substantially as herein described and set forth.

8. The slack and taut ropes, in combination with the small doors placed over the rope-slots of the hatchway-doors, substantially as herein described and set forth.

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Witnesses:
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