

FIRE ESCAPE.

Patented July 16, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

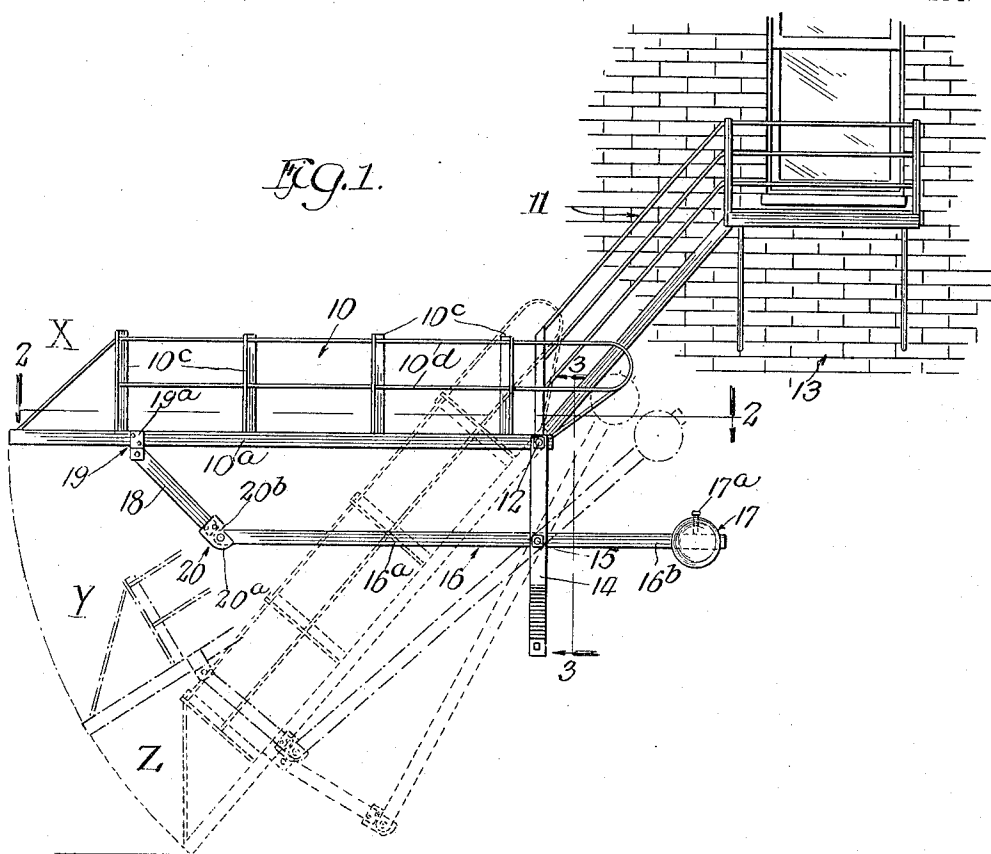


Fig. 2.

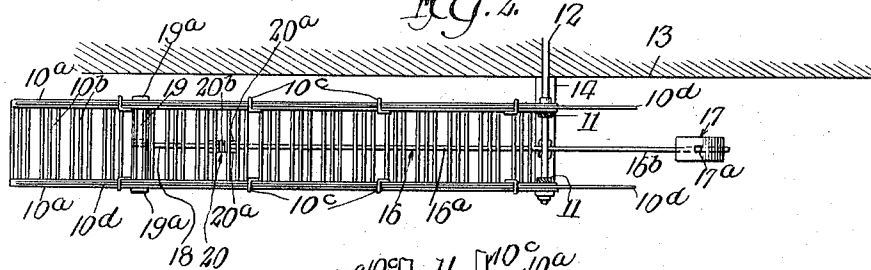
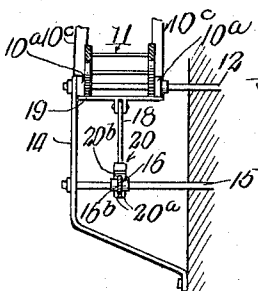


Fig. 3.



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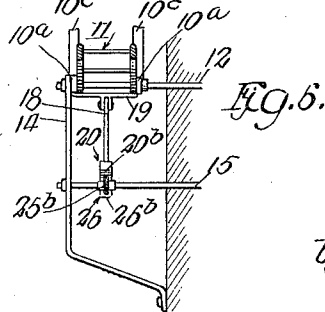
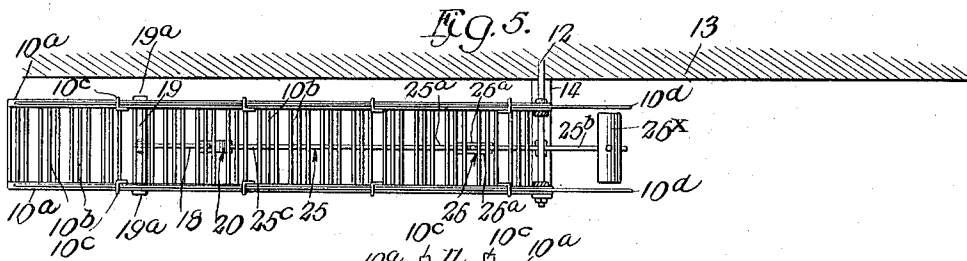
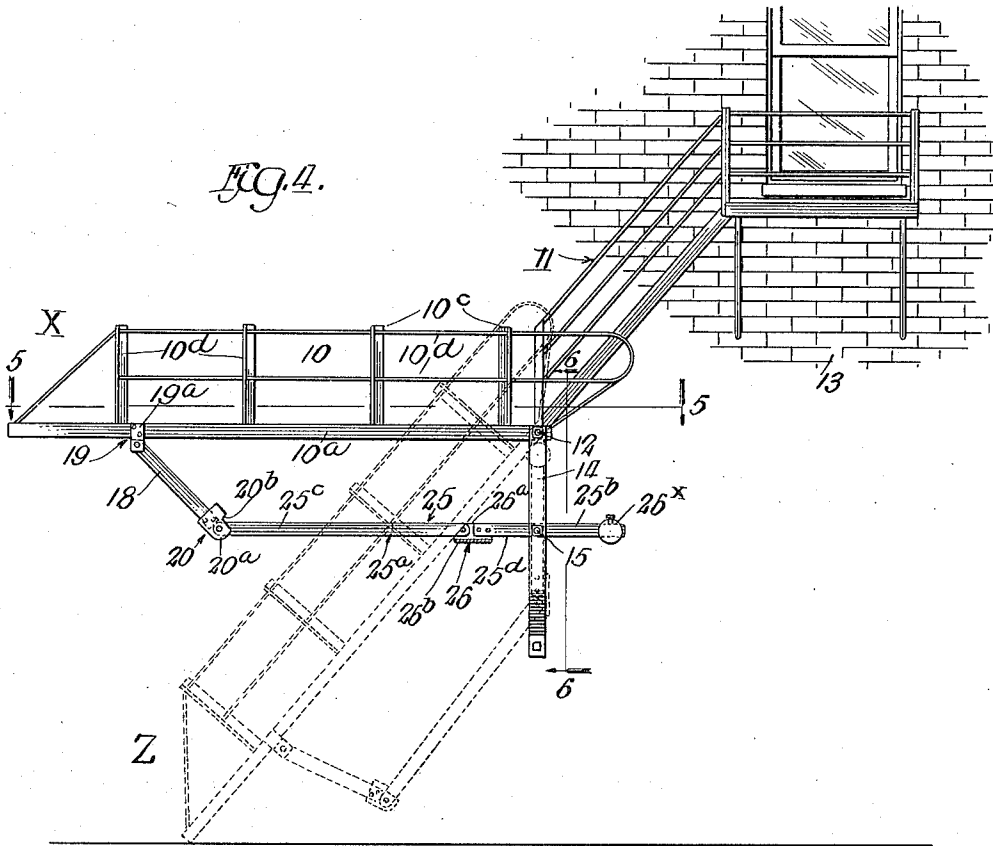
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FIRE ESCAPE.

APPLICATION FILED APR. 27, 1911.

1,032,665.

Patented July 16, 1912.

3 SHEETS—SHEET 2.



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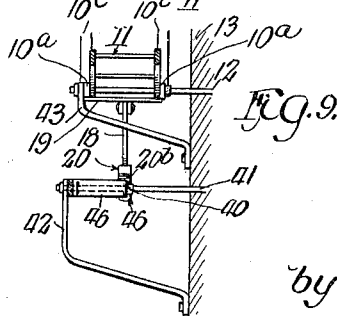
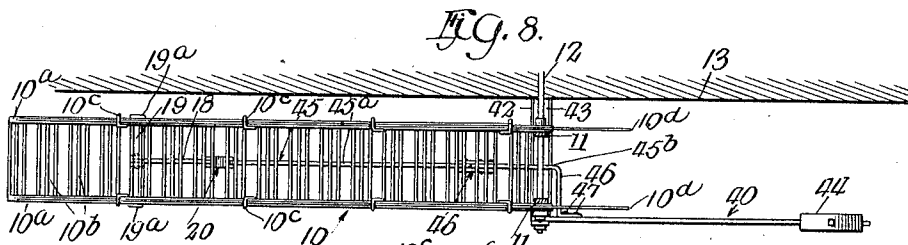
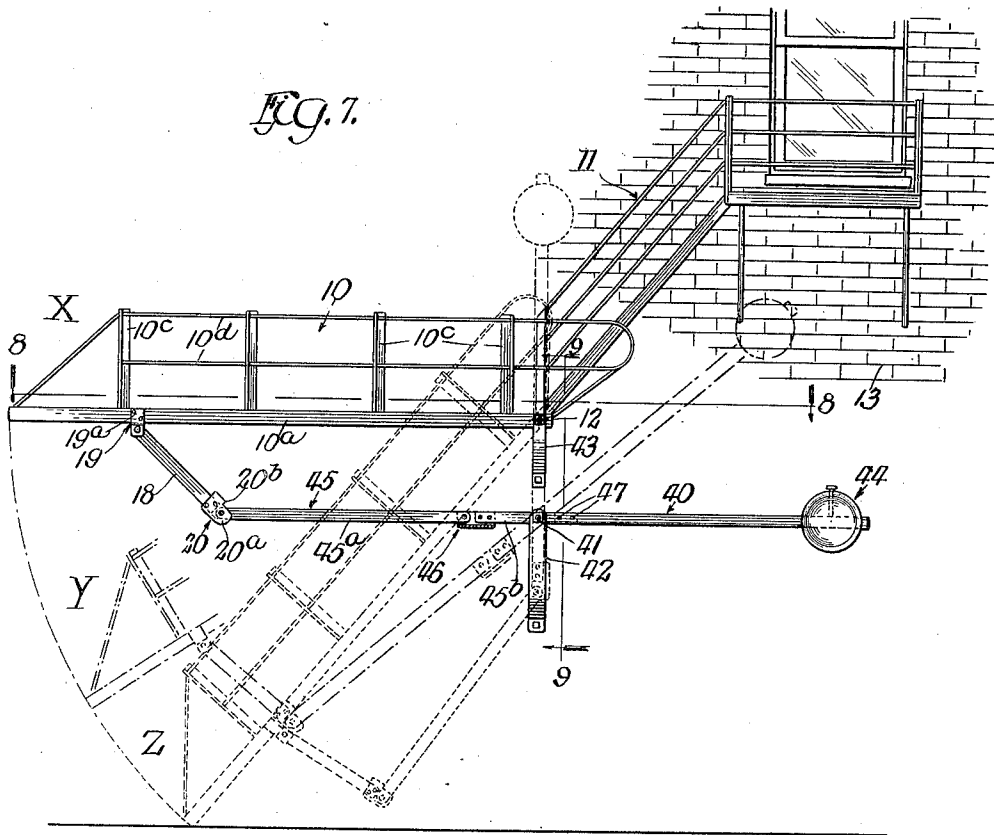
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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

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FIRE-ESCAPE.

1,032,665.

Specification of Letters Patent.

Patented July 16, 1912.

Application filed April 27, 1911. Serial No. 623,724.

To all whom it may concern:

Be it known that I, MILLARD GILMORE, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fire-Escapes; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in counterbalanced stairs or ladders more particularly adapted for use in connection with fire escapes and consists of the matters hereinafter described and more particularly pointed out in the appended claims.

In the drawings—Figure 1 is a view representing a side elevation of my improved counterweighted stairway or ladder. Fig. 2 is a view representing a section through the same in a plane indicated by the line 2—2 of Fig. 1. Fig. 3 is a view representing a transverse section through the ladder or stair in a plane indicated by the line 3—3 of Fig. 1. Fig. 4 is a view representing a side elevation of a modified form of the invention. Fig. 5 is a view representing a section through the same in a plane indicated by the line 5—5 of Fig. 4. Fig. 6 is a view representing a transverse section in a plane indicated by the line 6—6 of Fig. 4. Fig. 7 is a view representing in side elevation, still another modified form of the invention. Fig. 8 is a view representing a section through the same in a plane indicated by the line 8—8 of Fig. 7. Fig. 9 is a view representing a section of the modification shown in Fig. 7, in a plane indicated by the line 9—9 of Fig. 7.

Referring now in detail to the drawings and particularly to that embodiment of my invention illustrated in Figs. 1, 2 and 3, 10 indicates a stair or ladder adapted for use with a fire-escape 11 and forming the bottom movable member of the system of ladders or stairs constituting said fire-escape. As is usual in such construction, the ladder or stair 10 is hinged on a horizontal rod 12 anchored in the vertical wall of the building on which the fire-escape is located and projecting outwardly from the face of said wall. A bracket-arm 14 is secured to the

wall below the rod 12 and is connected to the outer end of said rod to provide vertical support for the same. The ladder 10 is of familiar construction and is shown in the drawing as comprising longitudinally extending, laterally spaced bars 10^a, 10^a and transversely extending rods 10^b, which are secured at longitudinally spaced intervals between the bars 10^a and constitute the steps of the ladder or stair. Angle-bars 10^c secured to the bars 10^a project upwardly therefrom at right angles and carry hand-rails 10^d, 10^d, located on each side of the ladder or stair. The bars 10^a are pivoted at their upper ends on the rod 12 which also provides a bottom support for the lowest fixed section of the fire-escape 11. Means for counterweighting the ladder or stair is provided as follows: 15 indicates a horizontal rod located vertically below the rod 12, anchored in the wall 13 and projecting outwardly therefrom in a direction parallel to said rod 12. The outer end of said rod is given vertical support by the bracket arm 14. 16 indicates a lever pivotally mounted on the rod 15 and adapted to swing in the vertical plane containing the longitudinal median line of the ladder 10, that is to say, the line parallel to the lateral bars 10^a and located half way between the two. The lever 16 has a supporting arm 16^a extending substantially parallel to the stair or ladder to a point near the free end thereof, and an arm 16^b extending in the opposite direction. To the latter arm 16^b is secured a counterweight 17 which is capable of longitudinal adjustment on the lever arm to vary the moment of said weight about the fulcrum of the lever, a set-screw 17^a being provided for locking said weight in the desired position on the lever arm. At the free end of the lever arm 16^a is carried a compression member or strut 18 which has pivotal connection at its lower end with the lever arm 16^a and has pivotal connection at its upper end with the ladder 10 at a point midway between the lateral bars 10^a thereof near their ends. The point of pivotal connection of the strut 18 with the ladder is located in a position nearer the free end of the ladder than a line drawn through the point of pivotal connection of the strut with the lever arm 16^a at right angles to the longitudinal axis of the ladder, or in other words, the

upper end of the compression member is located intermediate the free end of the ladder and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of the ladder. As shown in the drawings the pivotal connection of said strut with the ladder is made at a point distant from the free end of the ladder a distance substantially equal to one-fourth of the total length of the ladder. 19 indicates a transverse bar having upturned ends 19^a rigidly connected to the lateral bars 10^a of the ladder and having depending spaced ears at its middle which embrace the upper end of the strut 18 and with which said strut has pivotal connection. To the lower end of said strut is secured a block 20 having laterally spaced ears 20^a embracing the end of the lever arm 16^a and having pivotal connection therewith. Said block 20 has a transverse shoulder 20^b adapted for engagement with the upper edge of the lever 16^a when, in its downward swing, the ladder has reached a predetermined position as will presently appear.

The operation of the construction, as shown in Figs. 1 to 3, inclusive, is as follows: In Fig. 1, the stairway and weight are shown in three different positions, X, Y and Z,—X indicating the normal position of the stair and counterbalance when in raised position, Z indicating the position of the stair and counterbalance when in lowered position with the lower end of the stair in engagement with the sidewalk or street, and Y an intermediate position. When the stair is in its normal position, it is apparent that the moment of the counterbalance weight 17 about the rod 15 must be equal to the moment of the vertical support given the stair by the strut 18 about said rod, which is necessarily greater than the moment of the stair about the rod 12 in order that said stair may be supported in horizontal position and be prevented from rotating downwardly about its fulcrum rod 12. When one coming down the fire-escape steps upon the stair 10, and by his weight causes the moment of said stair about the rod 12 to be increased so as to be greater than the moment of the counterbalance 17 about the rod 15, or when a fireman, by means of a hook reached up from below, imparts a downward pull on the free end of the stair thereby increasing the moment of the stair about its fulcrum, the stair is caused to swing downwardly on its fulcrum rod 12. This produces a like downward swing of the arm 16^a of the lever 16, but by reason of the pivotal connection of said arm 16^a with the strut 18 which in turn is pivotally connected with the stairway, the position of said strut is made to approach a position at right angles to the longitudinal axis of the ladder so as to increase the distance

between the end of the arm 16^a and the ladder, thus causing the lever 16 as a whole to swing at a greater angular rate of movement than the angular rate of movement of the stair 10. Thus the moment arm of the counterweight 17 about the rod 15, which is the horizontal projection of the distance measured along the counterbalance arm between said weight and the fulcrum rod 15, decreases more rapidly than the moment arm of the stair, that is to say, the horizontal projection of one-half the length of the stair, about its fulcrum rod 12. At a predetermined point, the transverse shoulder 20^b of the block 20 connecting the strut 18 with the lever arm 16^a, engages the top of said arm, thus preventing any further angular movement of the lever 16 with reference to the strut 18, whereupon, during the further swinging movement downward of the stair, the said lever descends at an angular rate equal to that of the descent of the stair 10. In practice, the transverse shoulder 20^b of the block 20 is so arranged that it will engage the top of the lever arm 16^a at a predetermined position of the ladder in its rotative descent and in the rotative rising movement of the counterweight when the moment of the counterweight about the fulcrum rod 15 has fallen somewhat below the moment of the stair about its fulcrum rod 12, so that in the further descent of the ladder there will be a differential moment on the side of the ladder. The parts of the apparatus are so proportioned that this predetermined position of the ladder will correspond with a position in which its free end is about five or six feet above the ground, so that the differential moment on the side of the ladder will not cause the ladder to acquire an excessive speed when dropping through the small distance from this position to the ground. The end of the ladder is thus caused to drop slowly and gradually without a jar when it strikes the ground, the excess moment of the stair being but little more than sufficient to overcome the friction of the parts, even with the added weight of a person on the stair. When the stairway has reached the position with its lower end resting on the ground, it is held downward by its own weight, the counterweight, by reason of the shortness of its moment arm about its fulcrum rod 15, in comparison to the moment arm of the stairway about its fulcrum rod 12, having no effect to raise the stair.

It will be noted that, by the arrangement of the lever arm 16 and of the strut 18 in the vertical plane containing the median line of the ladder, the support given the ladder by the strut 18 is equally imparted to both lateral bars 10^a thereof, so that there is no tendency for either of said bars to sag with reference to the other. In addition, by

reason of the fact that the ladder has not only the support given it by its fulcrum rod 12, but also the support provided by the strut 18, a lighter construction of ladder is made possible.

In Figs. 4 to 6, inclusive, I have shown a modified form of the invention in which the counterbalance lever is so constructed that the moment arm of the counterbalance weight is rapidly diminished to zero after the stairway, in its downward swing, has passed through a certain point, preferably that point in which its lower end is four or five feet above the ground. In said figures, 25 indicates the lever having an arm 25^b on which a counterweight 26* is adjustably mounted, as in the first case described. 25^a indicates the arm of said lever, which has pivotal connection at its free end to the strut 18 pivotally connected to the stairway, as before, near its free end. The lever arm 25^a in this case is made in two parts,—a part 25^c pivotally connected to the block 20, and a part 25^d made rigid with the arm 25^b. The parts 25^c and 25^d are pivotally connected to each other by means which will prevent the part 25^c from swinging downwardly with reference to the part 25^d, but will permit it to swing upwardly with reference thereto. As shown in the drawings, said pivotal connection is made by a block 26 having lateral ears 26^a, which embrace and are rigidly connected to the member 25^d and which embrace and are pivotally connected to the member 25^c. The transverse member 26^b of said block, extending beneath the lower edge of the member 25^c prevents the same from swinging downwardly with reference to the part 25^d of said arm. In this construction, a relatively heavier counterweight 26* is provided so that the arm 25^b of the lever 25 may be short enough to pass below the upper hinged end of the ladder when the ladder is in its lowered position, as shown by dotted lines in Fig. 4. In this case, when the ladder swings downwardly on its fulcrum rod 12, the lever arm 25^a swings, as a whole, on its fulcrum 15 as a rigid lever arm, exactly as in the first case described, until at a predetermined point, that is to say, when the ladder end is four or five feet above the ground, the transverse shoulder 20^b strikes the upper edge of the member 25^c of said lever whereupon the strut 18 and the member 25^c are locked and swung as one member, thus causing the other end of the member 25^c to swing on its connection with the member 25^d, thereby greatly accelerating the rate of angular travel of the counterweight 26*, the moment arm of which decreases to zero when the ladder has reached the position indicated by dotted lines. In this case, the counterweight, when the ladder is down, has absolutely no effect upon the ladder, which

is locked in its downward position by its own weight, and is absolutely unaffected by the counterweight.

In Figs. 7, 8 and 9, is shown a modification of the construction illustrated in Figs. 4 to 6, inclusive, by means of which a lighter counterweight may be used. In said figures, 40 indicates the counterbalance arm hinged on a horizontal rod 41, which projects outwardly from the wall 13 in a direction parallel to the rod 12 and which is supported by a bracket 42, a separate bracket 43 being in this case used for the support of the outer end 12, by reason of the fact that the rod 41 extends outwardly beyond the plane of the outer lateral bar 10^a of the ladder. 44 indicates the counterweight which is adjustably mounted on the counterweight arm 40. 45 indicates a compound arm pivotally connected at its forward end to the block 20 connected to the strut 18, as before, and at its other end pivotally mounted on the rod 41 at a point intermediate its ends, and nearer the wall 13 than the counterweight arm 40, which swings in a plane outside of the outer lateral bar of the ladder. Said arm 45 has a projection 46 bent at right angles to the main length of the arm 45 and rigidly secured to the arm 40 by rivets 47. Said arm 45, as in the second case above described, comprises members 45^a and 45^b, which are pivotally connected together by a block 46, in such manner that the member 45^a may swing upwardly with reference to the member 45^b, but is locked against downward swinging movement with reference thereto. The operation of the device is, in this case, substantially identical with that of the construction shown in Figs. 4 to 6, inclusive, except that the counterbalance arm, by reason of its location, swings in a plane outside of the ladder, so that it may swing into vertical position without striking said ladder, even though in that position it extends above the upper end of said ladder. Thus, the counterbalance arm may be lengthened so as to make the use of a smaller counterweight possible. Here, as in the second case described, when the stairway is in its lowered position, it is absolutely held down by its own weight without any action of the counterweight tending to counteract the effect of the weight of said stairway. It will be noted that in this last case, although the counterweight arm is located outside of the plane of the ladder, the arm 45 which supports the ladder is arranged to swing in the plane of the median line thereof, so that the support given thereby to the lateral bars of the ladder will prevent one of the same from sagging with reference to the other.

I claim as my invention—

1. In combination with a vertically swinging device, means providing pivotal support

for one end of said vertically swinging device, a lever fulcrumed at a point below the pivotal support of said vertically swinging device, said lever having a counterbalance arm on one side of its fulcrum and a supporting arm on the other, a compression member having pivotal connection at its lower end with said supporting arm and at its upper end with said vertically swinging device, the upper end of said compression member being located intermediate the free end of the vertically swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said vertically swinging device, and a counterbalance carried by said counterbalance arm.

2. In combination with a vertically swinging device, means providing pivotal support for one end of said vertically swinging device, a lever fulcrumed at a point below the pivotal support of said vertically swinging device, said lever having a counterbalance arm on one side of its fulcrum and a supporting arm on the other, a compression member having pivotal connection at its lower end with said supporting arm and at its upper end with said vertically swinging device, the upper end of said compression member being located intermediate the free end of the vertically swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said vertically swinging device, means adapted to lock said compression member against pivotal movement with respect to said supporting arm when said swinging device reaches a predetermined position, and a counterweight carried by said counterbalance arm.

3. In combination with a vertically swinging device, means providing pivotal support for one end of said vertically swinging device, a lever fulcrumed at a point below the pivotal support of said vertically swinging device, said lever having a counterbalance arm on one side of its fulcrum and a supporting arm on the other, and a compression member having pivotal connection at its lower end with said supporting arm and at its upper end with said vertically swinging device, the upper end of said compression member being located intermediate the free end of the vertically swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said vertically swinging device, means adapted to lock said compression member against pivotal movement with respect to said supporting arm when said swinging device has reached a predetermined position, means providing a hinge in said supporting arm intermediate its fulcrum and said compression member adapted to yield in one direction but to be locked

against movement in the opposite direction, and a counterweight carried by said counterbalance arm.

4. In combination with a vertically swinging device, including laterally spaced longitudinal members, and means providing pivotal support for said longitudinal members at one end of said swinging device, means for counterbalancing said device comprising a lever fulcrumed at a point below the pivotal support for said longitudinal members, and adapted to swing in the vertical plane in which the line midway between said longitudinal members swings, said lever having a counterbalance arm and a supporting arm, a compression member pivotally connected at its lower end with the free end of the supporting arm, means providing pivotal connection of said compression member at its upper end with said swinging device at a point spaced midway between said longitudinal members and located intermediate the free end of the said swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said swinging device, and a counterweight carried by said counterbalance arm.

5. In combination with a vertically swinging device, including laterally spaced longitudinal members, and means providing pivotal support for said longitudinal members at one end of said swinging device, means for counterbalancing said device comprising a lever fulcrumed at a point below the pivotal support for said longitudinal members, said lever having a counterbalance arm and a supporting arm and being adapted to swing in a vertical plane in which the line midway between said longitudinal members swing, a compression member pivotally connected at its lower end with the free end of said supporting arm, means providing pivotal connection of said compression member at its upper end with said swinging device at a point spaced midway between said longitudinal members and located intermediate the free end of the said swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said swinging device, and a counterweight carried by said counterweight arm.

6. In combination with a vertically swinging device, including laterally spaced longitudinal members, and means providing pivotal support for said longitudinal members at one end of said swinging device, means for counterbalancing said device comprising a lever fulcrumed at a point below the pivotal support for said longitudinal members and adapted to swing in a vertical plane in which the line midway between said longitudinal members swing, said lever having a counterbalance arm and a supporting arm,

a compression member pivotally connected at its lower end with the free end of said supporting arm, means adapted to lock said compression member against swinging movement with reference to said supporting arm when said swinging device has reached a predetermined point, means providing pivotal connection of said compression member at its upper end with said swinging device at a point spaced midway between said longitudinal members, and located intermediate the free end of the said swinging device and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said swinging device, and a counterweight carried by said counterweight arm.

7. In a fire escape, in combination with a hinged stair, means for counterbalancing said stair, comprising a lever fulcrumed below the fulcrum of said stair, said lever having an arm adapted to swing in the vertical plane in which the median line of said stair swings, a compression member having its lower end pivotally connected to the free end of said arm and its upper end pivotally connected to said stair at a point in the median line thereof, the upper end of said compression member being located intermediate the free end of the stair and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said stair, said lever having a counterbalance arm, and a counterbalance secured to said arm to oppose the weight of said ladder.

8. In a fire escape, in combination with a

hinged stair, means for counterbalancing said stair comprising a lever fulcrumed below the fulcrum of said stair, said lever having a supporting arm adapted to swing in the vertical plane in which the median line of said stair swings and a counterbalance arm laterally spaced from said supporting arm and adapted to swing in a plane outside the limits of said stair, a compression member having its lower end pivotally connected to the free end of said supporting arm and its upper end pivotally connected to said stair at a point in the median line thereof, the upper end of said compression member being located intermediate the free end of the stair and a line drawn through the lower end of said compression member at right angles to the longitudinal axis of said stair, means adapted to lock said compression member against pivotal movement with respect to said supporting arm when said stair has reached a predetermined point, means providing a hinge in said supporting arm intermediate its fulcrum and said compression member adapted to yield in one direction but to be locked against movement in the opposite direction, and a counterweight on said counterbalance arm.

In testimony that I, claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 18th day of April A. D. 1911.

MILLARD GILMORE.

Witnesses:

GEORGE R. WILKINS,
T. H. ALFREDS.