Aug. 12, 1930. T. OHNO 1,773,059

SASH BALANCE

Filed July 25, 1927

FIG. 3.

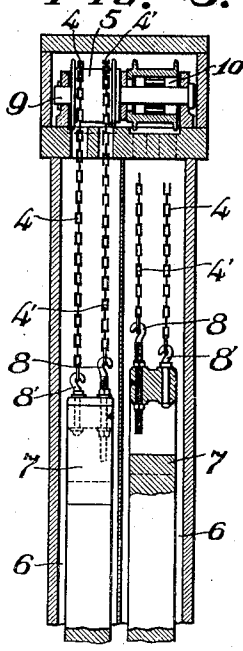


FIG. 1.

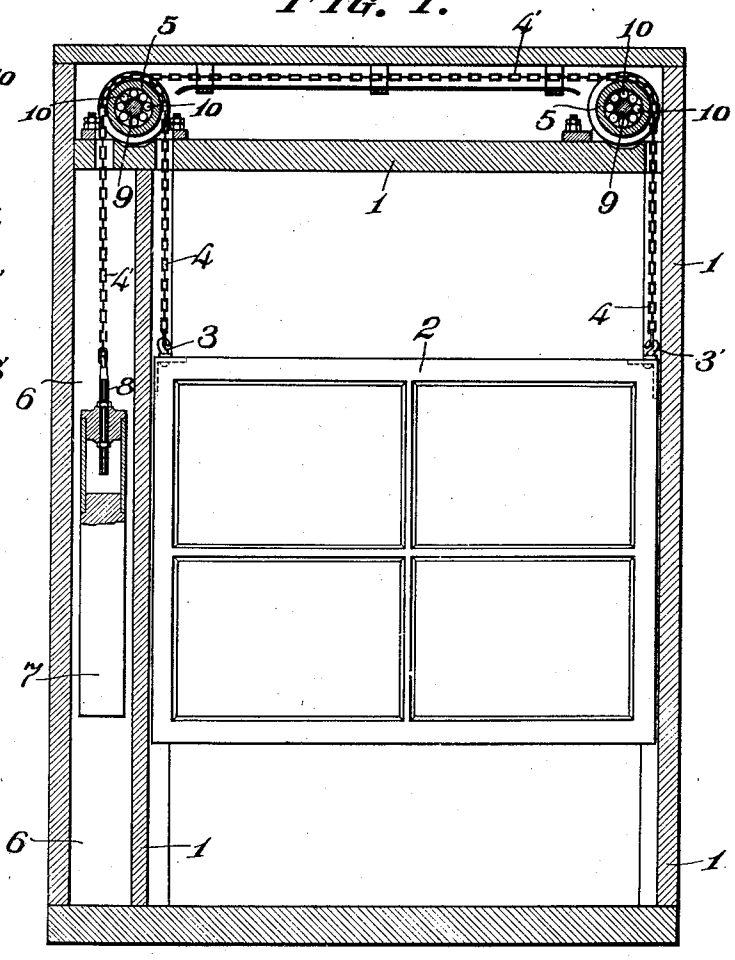
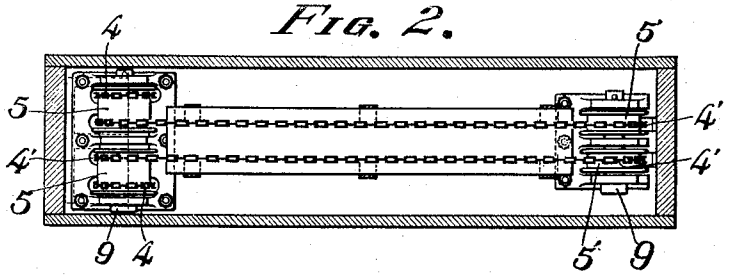


FIG. 2.



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SASH BALANCE

Application filed July 25, 1927. Serial No. 208,397.

My invention relates to improvements in windows or doors of the type provided with a counter balance and vertically sliding in the frame. The object of the invention is to provide windows or doors characterized in that both sides of the door are automatically kept parallel to the grooves of the frames irrespective of the point of application of force so that the operation of the door or window may be rendered easy and smooth.

According to the present invention chains or ropes attached at both sides of the door are lead to one side of the frame through guide pulleys of possible minimum friction and the other ends of said chains or ropes hanging parallel each other are fastened separately to a counter balance at two points each of which being equally apart from the vertical centre of said counter balance. By properly adjusting the length of one of said chains or ropes the balancing forces acting respectively on both sides of the window or door while at rest are rendered equal so that the operation of the door may be kept easy and smooth.

The invention is more particularly described with reference to the accompanying drawing in which:—

Fig. 1 is a sectional elevation of the invention as applied to a window.

Fig. 2 is a sectional plan view of same.

Fig. 3 is a sectional side elevation at the part of the counter balance.

Referring to the drawing the window frame (1) is provided at both sides with vertical grooves and doors (2) (2) are slidably fitted therein. Said door (2) is provided at its upper side with hooks (3) and (3') and chains (4) (4') are attached thereto at one end. The other end of said chains or ropes are lead vertically upward and one of them (4) passing on a guide pulley (5) of a possible minimum friction is hung to a balance weight chamber (6) formed at one side of the frame (1). The other chain or rope (4') passing on guide pulleys (5') and (5) is also lead to said chamber (6) to be hung parallel to said chain (4). One of said chains, for instance (4), is directly connected at its lower end to a counter balance (7) and the other (4') is adjustably connected by means of a screwed hook (8) to the same counter balance (7). Said chains (4) and (4') are separately connected to the top of the counter balance at two points in such a manner that each of said points are equally apart from the vertical centre of the counter balance so that equal weights may be distributed to the chains while the door is at rest. By properly adjusting the length of one of the chains for instance (4') the door may be suspended by the counter balance equally at both sides.

In the ordinary window or door of the type hitherto in use the door is suspended by counter balances at both sides arranged irrespective of each other. When opened or closed the door is apt to be inclined according to the point of application of force and alternately strikes at the bottom of the groove which causes the door to creak unless carefully operated by both hands or precisely at its centre. The operation of the door can not be made smooth even for a narrow one.

The present invention is characterized in comparison with those windows or doors hitherto known in that chains or ropes connected at both sides of the door are fastened at the other ends to a counter balance separately at two points equally off the vertical centre of said counter balance so that the door is always balanced horizontally and may be raised or lowered smoothly irrespective of the position where the force is applied. For instance the door is raised or pressed upward at its left side end. At the instant of being raised the chain (4) at this side is slackened and the door becomes inclined in some degree. The counter balance is thereby inclined owing to the slackness of the chain (4) in such a manner that the centre of gravity of the counter balance is brought nearer to the extension of the tight side chain (4'). The tensions of the chains (4) and (4') caused by the weight of the counter balance (7) which has been distributed equally while at rest are now diminished on the slack side and increased on the tight side. This increased tension of the chain (4') overcoming the frictional resistance of the guide pulley (5') acts on the

window to lift it at the right side and said tension increases until it becomes equal to the manual force applied at the left side of the door. When these forces are rendered equal on both sides the door recovers substantially parallel to the groove and is raised vertically without causing any creak. Thus the door may be continuously raised keeping said manner of the counter balance and chains.

The door becomes inclined at the instant of being raised at one side due to the frictional resistance of the guide pulleys. It is therefore necessary for carrying out the present invention that the friction of guide pulleys (5) and (5′), especially the latter (5′) are possibly minimized. Further, the guide pulleys are preferably not lubricated to avoid the adhesion of dust. In these views steel rollers (10) are arranged on the axles (9) of the guide pulleys (5) and (5′) so that the balancing action is rendered active and practical to obviate the inclination of the door at the instant of operation.

According to the present invention the door is raised or lowered vertically irrespective of the part where the force is applied by appropriate balancing forces caused automatically by the inclination of the counter balance. The window or door may therefore be opened and closed very lightly and smoothly by one hand and at any part without need of special attention. As the counter balance is connected at its top to two chains separately, said chains are hung parallel to each other so that the balance mechanism is adapted to be arranged in a comparatively narrow space of the balance chamber. The counter balance being hung at two points it can be inclined but prevented from swinging and a periodical fluctuation of balancing force which may be caused by the pendulum action of the counter balance is avoided. The invention may be applied to all kinds of vertical sliding doors and is especially adapted for broad windows and doors.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. A counterbalance for a slidable element mounted in a frame defining an opening, having a compartment formed at one side thereof comprising a pulley mounted over said compartment, a counterweight in said compartment, and separate flexible means passing over said pulley each secured at one end to one of the opposite sides of said slidable element and to said counterweight, the points of attachment of said flexible means to the counterweight being on opposite sides of a vertical median plane of said counterweight whereby a vertical movement of the slidable element is effected by the automatic inclination of the counterweight irrespective of the point where the force is applied to the slidable element.

2. A counterbalance as claimed in claim 1 in which the means for securing one of the flexible means to the counterweight is adjustable.

3. A counterbalance as claimed in claim 1 in which the points at which the flexible elements are secured to counterweight are at equal distances from the vertical median plane of the counterweight.

In testimony whereof I have affixed my signature.

TADASHI OHNO.