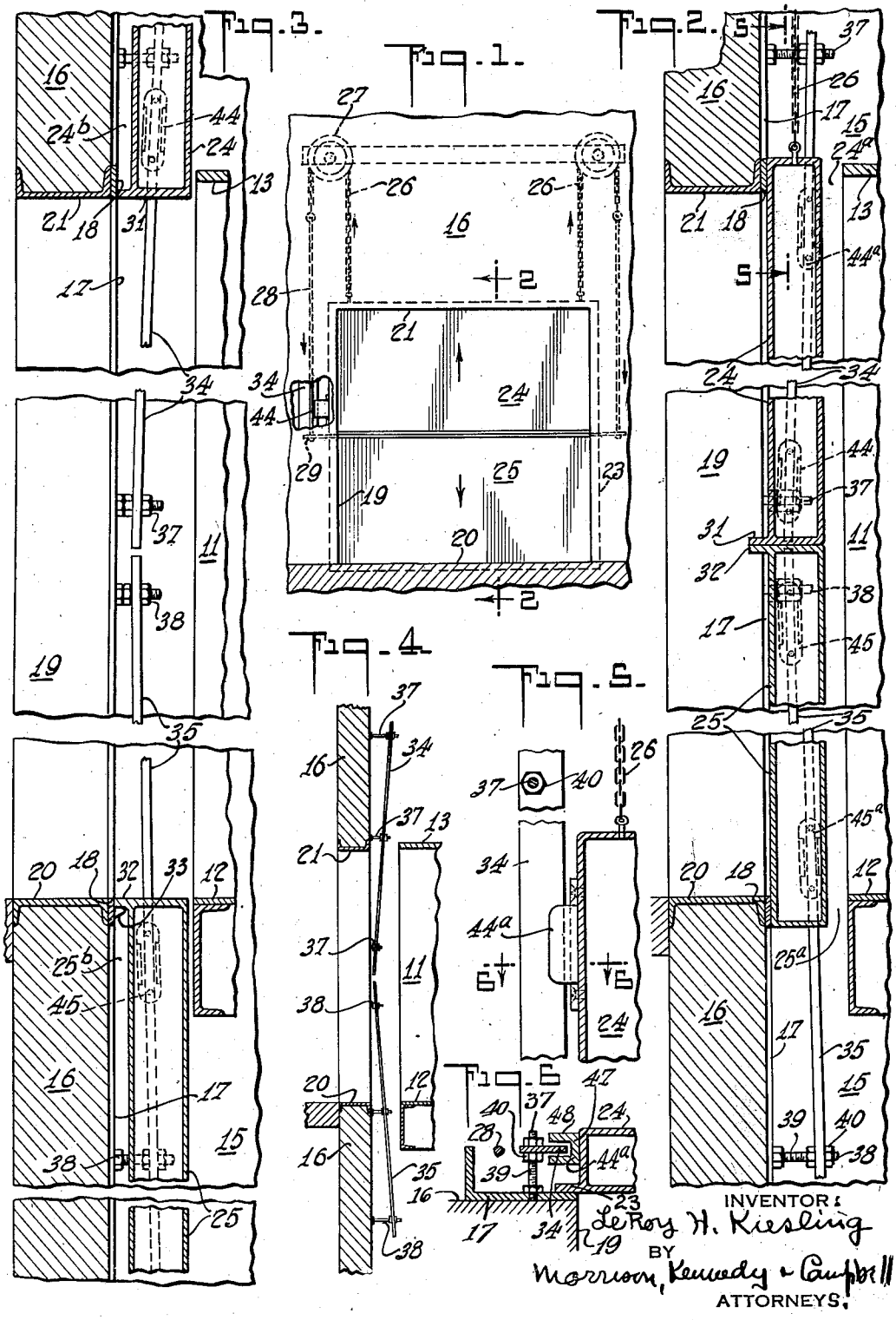
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ELEVATOR DOOR MECHANISM

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ELEVATOR DOOR MECHANISM

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This invention relates to elevator door mechanism, referring to the arrangements for operating the doors of elevator cars moving within vertical shafts from floor to floor of a building, namely, vertically slidable upright doors located at each floor to open and close the doorway at the front side of the shaft. The invention is of utility for the vertically slidable doors of elevators of various kinds, including dumbwaiters; and may be employed for example in an installation wherein a single door closes each doorway and is shiftable upwardly or downwardly to open it, although herein the invention is shown as embodied in the well known type of installation known as biparting doors wherein, for each doorway, are upper and lower doors, movable respectively upwardly and downwardly to open the doorway and reversely to close it.

The general object of the present invention is to afford an elevator door mechanism for doors of the kinds referred to which will be simple and rugged in construction and efficient and smooth working in operation. It is a particular object to provide an arrangement of tracks or guides at the opposite sides of the shaft cooperating with followers or shoes at the opposite sides of each door, so constructed and arranged that when each door is moved into its closed position, upwardly or downwardly, it will at the same time be caused to shift frontwardly snugly against or adjacent to the shaft wall at the front, to seal effectively the doorway; and when the door is moved oppositely to open it it is shifted away from the shaft front wall, namely rearwardly into close adjacency to the front edge of the platform of the elevator car. Various contrivances have been employed to give front and back shifting movements to opening and closing elevator doors, but these have usually involved substantial complication of structure and operation; and as stated it is an object of this invention to afford the desired actions in a new and efficient manner by a simple and smooth working mechanism.

In the case of biparting doors it is an object hereof to provide the aforesaid advantages in each of the upper and lower doors by substantially opposite and symmetrical movements thereof in opening and closing.

Other and further objects and advantages of the present invention will be explained in the hereinafter following description of an illustrative embodiment thereof or will be understood to those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel elevator door mechanism and the novel features of operation, combination, arrangement and construction herein illustrated or described.

In the accompanying drawing Fig. 1 is a small scale front elevation showing a typical elevator door arrangement, in this case there being upper and lower doors movable oppositely in the opening or closing of the doorway.

Fig. 2, on a much greater scale, is a vertical fore-and-aft section taken on the line 2—2 of Fig. 1, but greatly condensed in the vertical dimension by omitting substantial vertical portions of the structure; the doors being shown closed in this figure.

Fig. 3 is similar to Fig. 2, but showing the doors shifted to open position.

Fig. 4 is a small scale vertical section view similar to Figs. 2 or 3, but with the doors omitted and showing that the door guiding tracks are of continuous construction, this not appearing on Figs. 2 and 3 owing to their fragmentary showing.

Fig. 5 is a detail vertical section taken on the line 5—5 of Fig. 2 showing the relation of one of the doors, its follower or shoe, and the guide or track.

Fig. 6 is a horizontal section view taken on the line 6—6 of Fig. 5.

As will be more particularly described the elevator car in its traveling movements has its front side spaced away from the shaft front wall sufficiently to accommodate the thickness of the doors, with substantial clearance so that, while the car is stationary, each door may be moved upwardly or downwardly for opening or closing and during such movement shifted frontward toward the shaft front wall while closing and rearward from the wall and toward the car in opening. In this well known situation the present invention comprises door guiding means for each door which consists, at one or both sides of the shaft, of a fixed track means which is inclined gradually or continuously throughout its operative length, while at each side edge of the door there are upper and lower followers or shoes both engaging with said track means and both maintaining such engagement throughout the movements of the door; there being preferably only a single track means at each side, the followers being so positioned relatively to each other, preferably one of them being offset toward the front, that the door remains upright while undergoing its opening and closing movements and its shifting toward and from the shaft front wall. In referring to upper and lower followers

it is to be understood that there may be intermediate followers as well, and indeed a single long follower at each side of the door would serve the purpose, the upper and lower portions of which may be considered as upper and lower followers. When each door or the doors are moved to closed position, and at the same time shifted snugly against the shaft front wall, this forms a secure closing adapted to reduce air flow and fire hazard.

The elevator or car 11, with its platform or floor 12 and its ceiling 13, is sufficiently indicated in Figs. 2, 3 and 4. The shaft side wall 15 at the far side appears in the same figures and the shaft front wall 16 in these figures and in Fig. 1. At the rear face of the shaft front wall is shown a metal plate or strip 17 mounted firmly upon the wall; this for example being a stout vertical strip arranged for supporting the door track brackets to be described.

At each floor is indicated an opening or doorway 19, shown in Figs. 1, 2, 3 and 5, and in front of the doorway the floor is provided with a steel sill 20, for example an inverted channel, the rear flange of which is flush with the shaft front wall. The top edge or lintel 21 of the doorway is similarly formed by a steel channel.

The doorway 19 is shown as closed by upper and lower doors 24 and 25, respectively, rising and lowering to open the doorway; although the improvement hereof could be applied to a single large door which opens by rising or lowering in the shaft. The two doors may be of hollow metal construction of any improved character, located at the front of the shaft between the front wall 16 and the path of the elevator 11. The door movements are well indicated by comparison of Figs. 2 and 3, and when two doors are used they may be caused to counterbalance each other, as is common with biparting doors. Thus, at each side a flexible connection or chain 26 is shown extending over an overhead pulley 27, Fig. 1, with the chain replaced by a suspension rod 28 where it does not need to travel over the pulley. The opposite suspension rods have their lower ends connected to a cross bar 29 attached to the lower door 25 at a convenient point not interfering with other parts of the mechanism.

The horizontal shiftings of each door as it opens or closes are indicated by the relative positions shown in Figs. 2 and 3. Thus, in Fig. 2 with the doors closed, there is shown a substantial gap 24^a between the upper door 24 and the ceiling 13 of the elevator, and there is a corresponding gap 25^a between the lower end of the door 25 and the platform 12 of the elevator, the doors in this position being snugly applied or engaged against the face of the shaft front wall 16. To complete the snug and air-tight fit the vertical strip 17 adjacent the vertical side edges of the doorway may be supplemented by upper and lower horizontal strips 18; and each door may have a flat flange 23 around three sides, as shown in Figs. 1 and 6, lapping the doorway. When on the contrary the doors are opened, as in Fig. 3, each door is moved away from the shaft wall, rearwardly toward the car, and substantial gaps 24^b and 25^b are shown between the respective doors and the shaft front wall.

It is desirable to close the gaps 24^b and 25^b existing between the respective doors and the front wall 16 when the doors are open. For this purpose the lowest edge of the upper door is shown widened or formed as a closing plate 31, which extends frontwardly beyond the normal thickness of the door, constituting for example a flange bridging the gap 24^b. Similarly the upper edge of the lower door has a closing plate 32 bridging the gap 25^b. In this latter case, the door which opens by lowering is brought to a position where its closing plate 32 may be flush with the door sill 20 and elevator platform 12, and in this position it may take the load of persons or material moved across between the sill and the car; and to fortify the door for this purpose, the closing or trucking plate 32 may be caused in its lowered position to rest upon a fixed stop or abutment 33, or one such abutment at each side, sufficiently beyond the doorway so as not to interfere with the door rising into its closed position shown in Fig. 2. This device 33 is representative of any convenient means of taking from the chain 26 the trucking load upon the opened lower door 25.

The track means at each side consists of a track or guide along which the door travels while opening or closing and the track determining the extent of horizontal shift. Thus, a track 34 is shown for the upper door 24 and a track 35 for the lower door 25. Each track is mounted fixedly in the shaft, for example upon the metal strip or plate 17 adjacent to each vertical side of the doorway. Each track is shown as an elongated strip or bar of metal but may take different forms, for example that of a channel, or having a slot or groove, so that the track can cooperate with the followers or shoes on the doors. Whatever cross sectional form the track takes it is arranged with a gradual or continuous incline, as best shown in Fig. 4, so that as each door moves up and down it progressively shifts with a horizontal component, as already described.

Assuming the guide as being in the form of a simple flat strip of metal, this is shown as mounted in the shaft as follows. The upper track 34 is mounted by a series of brackets 37 outstanding from the plate or strip 17 of the front wall. Similarly the lower door track 35 is mounted by means of a series of brackets 38. Each of the brackets 37 or 38 is shown as consisting of a bolt 39 outstanding from the strip 17, substantially rigidly, with a pair of threaded nuts 40 thereon between which the track is clamped. This affords a ready means of adjustment in installing the doors, the upper and lower brackets for each track being adjusted separately to give to the door its desired position when raised or lowered.

The described construction also affords a compact arrangement in that the flexible chain 26 or its connected rod portion 28, where extending down to the projecting bar 29 of the lower door 25, may easily be and is shown accommodated adjacent to the track mounting, namely in the space between the upper track brackets 37 and the rearward flange of the plate 17. The track as already described is a simple steel strip, spaced away from the front bounding wall 16 of the shaft, and this is mounted by simple outstanding brackets in the form of bolts 39, leaving an ample space between the bracket 37 and the plate flange, for the accommodation of the chain or rod 28, which passes through such space and thence to the projection or bar 29 of the lower door. This structure permits substantial compactness in regard to the necessary total space or dimension between the side edge of the doors and the side wall 15 of the shaft, at each side, since without this arrangement the chain

must be, and customarily has been, accommodated between the plate flange and the shaft side wall. This saving of space is important in building construction, permitting either a reduction in the allowance of space beyond the door at each side, or, if preferred, a considerably wider door and doorway, other factors being the same.

In the biparting door arrangement shown the lowering of the upper door and the rising of the lower door to close the doors occur preferably symmetrically so that as the doors approach they shift horizontally frontward against the front wall. To secure this motion the tracks 34 and 35 are substantially symmetrically arranged as best appears in Fig. 4, their adjacent ends being near the shaft front wall and their far ends being adjusted to a substantial distance therefrom, giving the desired symmetrical slants to the two tracks such that as the doors are opened or closed they will gradually shift horizontally toward their final positions. By this arrangement the lower end of the upper track and the upper end of the lower track may stand in adjacent alinement, so that the two tracks if desired be formed of a single long strip or bar, bent at the midheight of the doorway, but preferably straight thereabove and therebelow.

Coming now to the track following means on the doors, at each side of each door are shown two or more followers or shoes, for example for the upper door a lower shoe 44 and an upper shoe 44a, and for the lower door an upper shoe 45 and a lower shoe 45a. These shoes or followers may take any form, with or without rolling means, but for illustration are shown as comprising an attaching plate 47 with outstanding parallel flanges 48 arranged to embrace the guide track 34 or 35; see Fig. 6. Of course this arrangement could be reversed and a double flange track employed engaged by a single flange or projection acting as a shoe sliding therein.

The particular arrangement shown permits the same fixed, inclined, straight track 34 or 35 to serve as the guide for both of the followers or shoes on the door 24 or 25. Thus, in reference to the upper door 24 it will be noticed that the shoes 44 and 44a are relatively offset, the shoe 44 being near the front side of the door, the shoe 44a being near the rear side; each shoe being adapted to engage the inclined track, and a line connecting the shoes having a slant corresponding with the incline of the track. By this arrangement each door is held upright by its shoes as they slide up and down the track and bring about the horizontal components for shifting frontwardly or rearwardly the door.

In the biparting or two-door arrangement, as shown, the system of tracks and followers for one door is preferably a symmetrical inversion of that for the other door. This simple mechanism gives to each door a smooth sliding movement at a gradual incline, the two doors moving always in mutual alinement while remaining vertical and shifting frontward during approach, and vice versa.

The principles hereof may be variously embodied. The continuously gradually inclined tracks, while shown as continuous metal strips, as preferred, could be intermittent in a sense, e. g. a continuous inclined series of studs or rollers replacing the strip, assuming adequate length of engaging shoe to afford the same gradual horizontal shift during opening or closing. The track means may comprise parallel tracks at each side, one for each shoe, giving the same resulting motions as one track for both shoes and permitting central location of both shoes on the door edge.

I claim:

1. In an elevator door mechanism, in combination with the elevator car spaced from the shaft front wall sufficiently to accommodate the door with substantial clearance, and for each doorway one or two constantly upright doors each movable upwardly or downwardly for opening or closing the doorway; door guiding means for each door comprising at each side of the shaft a continuously inclined fixed single track, and at each side edge of the door upper and lower followers or shoes continuously both engaging said single track, one follower being positioned on the doorway edge in offset relatively to the other follower toward the front in correspondence with the incline of said track; whereby a line drawn from follower to follower at each door edge stands at an incline to the plane of the door and the door remains upright during its opening and closing movements and shifts with a continuous trend toward the shaft front wall during closing and toward the car during opening movement.

2. In an elevator door mechanism, in combination with the elevator car spaced from the shaft front wall sufficiently to accommodate the door with substantial clearance, and for each doorway one or two constantly upright doors each movable upwardly or downwardly for opening or closing the doorway; door guiding means for each door comprising at each side of the shaft a fixed track means nearly vertical and inclined gradually throughout its entire operative length, and at each side edge of the door upper and lower followers or shoes both engaging said single track means and both maintaining such engagement throughout the movements of the door, and said followers being both inclined to the plane of the door and so positioned relatively to each other and to the track that the door remains substantially upright during its opening and closing movements and throughout such movements shifts toward the shaft front wall in closing and toward the car in opening.

3. In an elevator door mechanism, in combination with the elevator car spaced from the shaft front wall sufficiently to accommodate the door with substantial clearance, and for each doorway a constantly upright door movable downwardly for opening and upwardly for closing the doorway; door guiding means for each door comprising at each side of the shaft a single and continuously inclined straight fixed track, and at each side edge of the door upper and lower followers engaging continuously said single track, the upper follower being positioned on the doorway edge in offset relatively to the lower follower toward the front in correspondence with the incline of said track; whereby a line drawn from follower to follower at each door edge stands at an incline to the plane of the door and the door remains substantially upright during its movements and shifts progressively toward the shaft front wall throughout its rising and toward the car throughout its lowering movement.

4. In combination with, or for, an elevator movable in a vertical shaft from floor to floor; a vertically slidable constantly upright door for closing the doorway at each floor and shiftable from a raised or closed position adjacent the front wall of the shaft to a lowered or open position substantially rearward of its closed position and adjacent to the front edge of the elevator plat-

form; the shaft front wall and elevator front edge being spaced apart to accommodate the door and its frontward and rearward movements; a door guiding means comprising at the shaft side walls a pair of fixed tracks, one at each side, each continuously inclined from a high point adjacent to the plane of the shaft front wall to a low point substantially rearward of such plane, and fixed to each vertical side edge of the door and continuously engaging the track at that side an upper shoe and a lower shoe, the upper shoe being substantially nearer to the front side of the door than the lower shoe, so that a line connecting the shoes is at an incline to the plane of the door, whereby to maintain upright the door throughout its opening and closing movements.

5. A door mechanism as in claim 3 and wherein each track is a substantially straight continuous track progressively inclined throughout its height and engaged continuously by both the upper and lower followers of the door; and having mountings comprising shaft wall brackets of adjustable dimension, permitting ready initial adjustment of the track incline.

6. A door mechanism as in claim 3 and wherein the upper and lower followers at each side of the door are separate shoes slidingly engaging the inclined track, arranged in a plane at an angle to the vertical position of the door.

7. A door mechanism as in claim 2 and wherein are cooperating upper and lower doors for each doorway with symmetrically inverted arrangement of track means and followers, whereby the two doors always stand in the same vertical plane during their shiftings.

8. In an elevator door mechanism, in combination with the elevator car spaced from the shaft front wall sufficiently to accommodate the doors with substantial clearance, and for each doorway upper and lower constantly upright doors cooperatively movable respectively upwardly and downwardly for opening the doorway and vice versa; door guiding means for each of the two doors comprising at each side of the shaft a single fixed track means substantially straight and nearly vertical but inclined gradually throughout its operative length, and at each side edge of each door upper and lower followers both engaging said straight track means and both maintaining such engagement throughout the movements of the door, and said followers being so positioned relatively to each other and to the track means that a line drawn from follower to follower at each door edge stands at an incline to the plane of the door and each door remains substantially upright throughout its opening and closing movements and shifts continuously toward the shaft front wall in closing and toward the car in opening.

9. A biparting door mechanism as in claim 8 and wherein the opposite tracks and followers for the upper door are substantially symmetrical inversions of those for the lower door, whereby the doors remain not only vertical but in mutual alinement as they approach each other and shift frontward simultaneously in closing, and vice versa.

10. In an elevator door mechanism, in combination with the elevator car spaced from the shaft front wall sufficiently to accommodate the doors with substantial clearance, and for each doorway two upright doors, one above the other, each movable upwardly and downwardly for mutual approach for closing the doorway and mutual separation for opening the same; door guiding means for each door comprising at each side of the shaft a fixed inclined track and at each side edge of each door shoes engaging said track, said shoes on each door being in a common plane of the door whereby the door remains constantly vertical, and said tracks having supporting brackets outstanding from the shaft front wall, spaced from the door, a flexible chain connection extending from the upper door at each side, upwardly over a pulley and thence downwardly at an interior position between the shaft front wall and the upper door track and between the track brackets and the edge of the door, and thence to the lower door, and a projection or bar at each side of the lower door to which the lower end of said chain at that side is attached.

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