

Oct. 24, 1933.

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1,931,997

ELEVATOR APPARATUS

Filed April 16, 1932

4 Sheets-Sheet 1

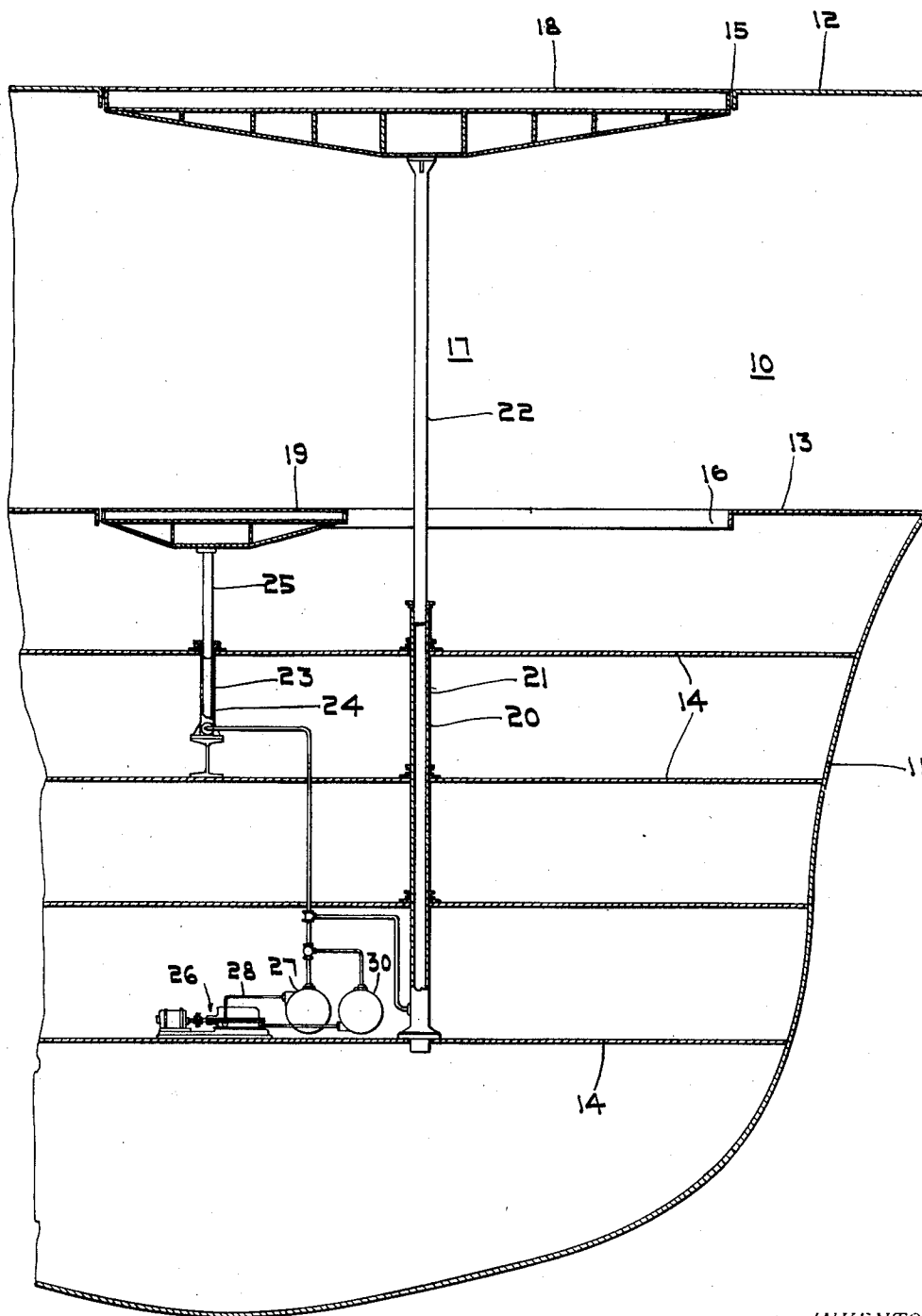


FIG. 1.

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4 Sheets-Sheet 2

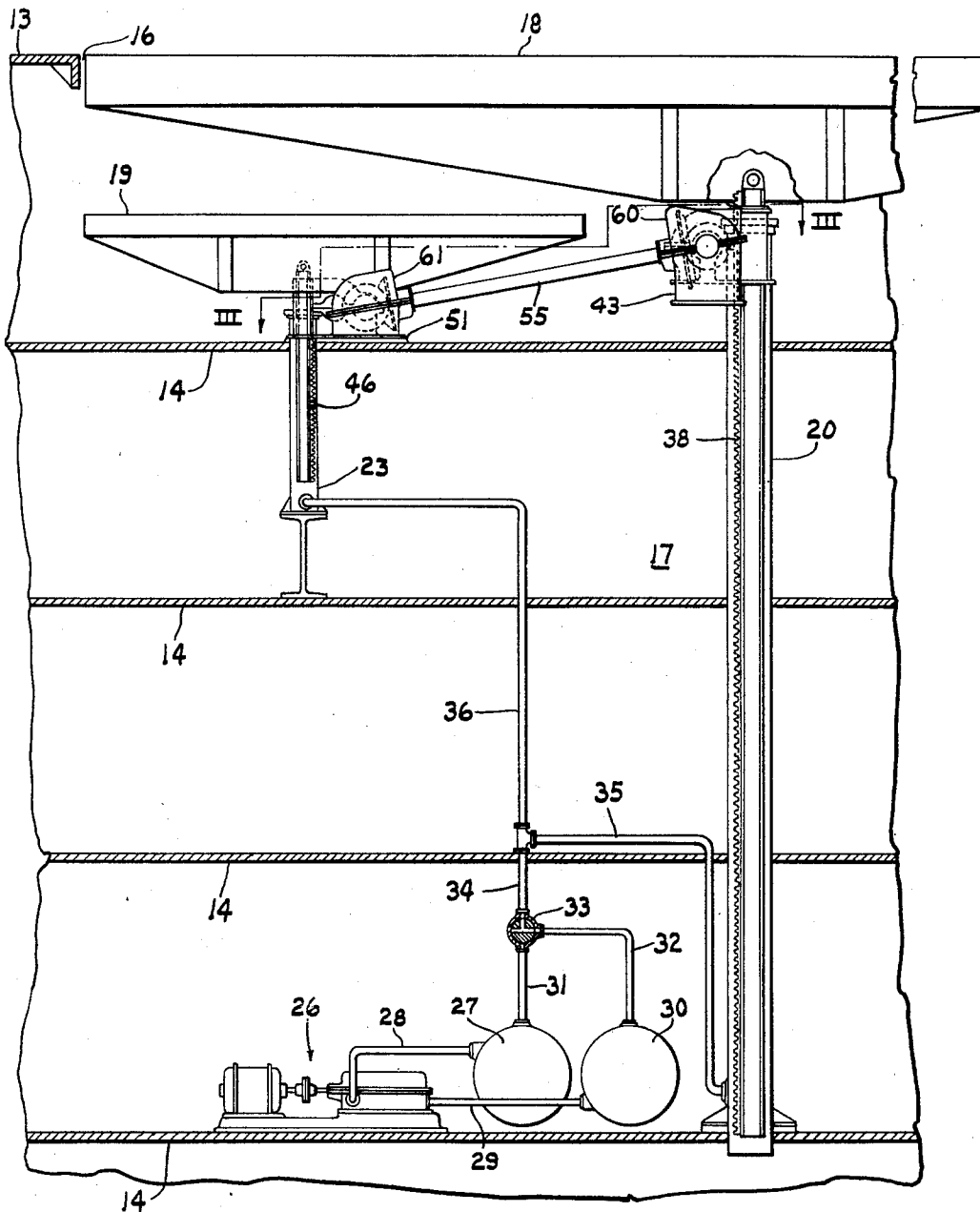


FIG. 2.

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4 Sheets-Sheet 3

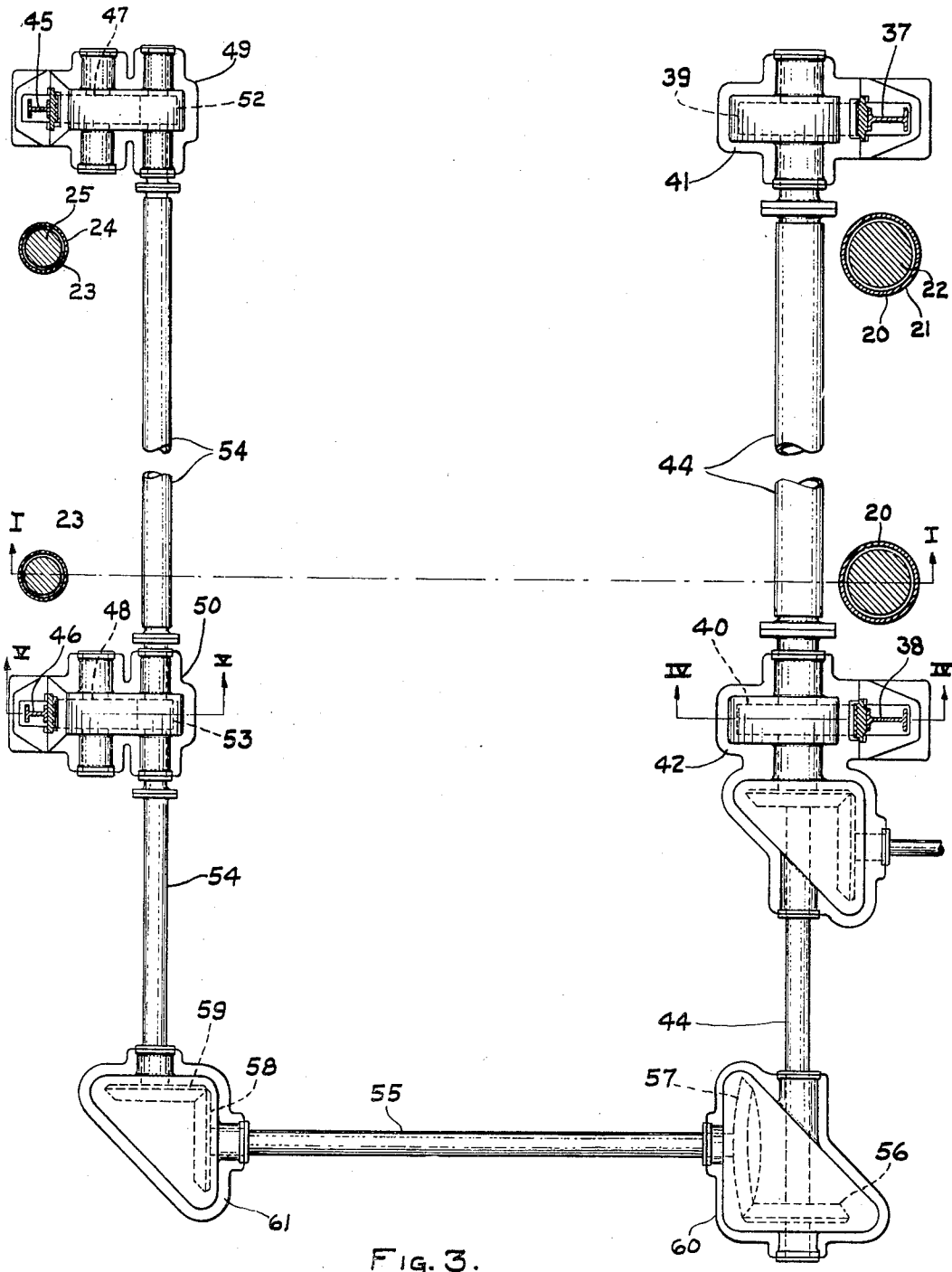


FIG. 3.

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4 Sheets-Sheet 4

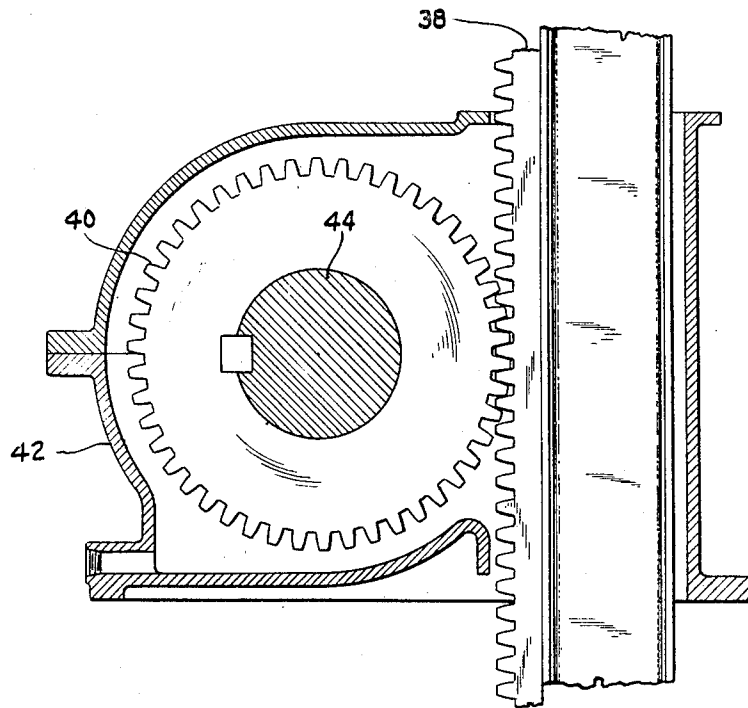


FIG. 4.

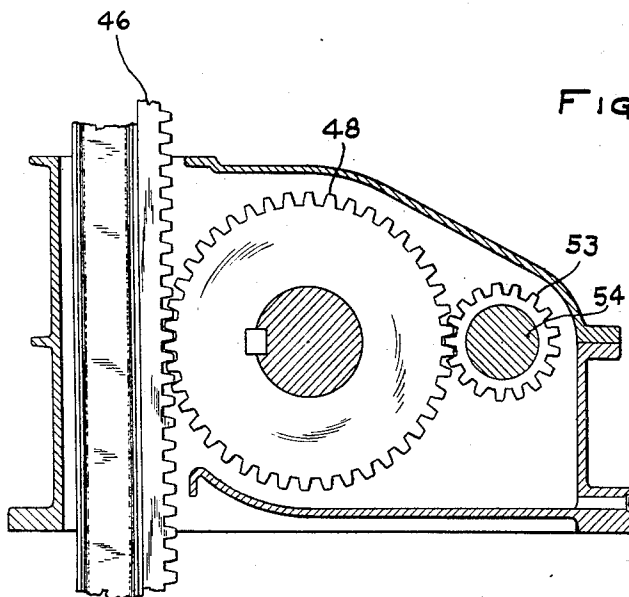


FIG. 5.

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ELEVATOR APPARATUS

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Application April 16, 1932. Serial No. 605,727

8 Claims. (Cl. 187—66)

My invention relates to elevator apparatus and more particularly to large heavy-duty elevators for use in ships, warehouses, etc.

In general, this type of structure comprises a main platform for carrying the load and means for raising and lowering the platform, and an auxiliary platform adapted to be raised, when the main platform is in raised position, in order to close, at least partially, the opening in the lower floor and thereby prevent accidents and provide additional maneuvering space. When the main platform is in lowered position, the auxiliary platform is adapted to be lowered out of the way. It is an object of this invention to provide an improved means for securing predetermined relative movements of the main and auxiliary platforms.

Heretofore, this type of apparatus has been extremely costly due to the duplication of mechanism required to operate the platforms, and due to the complicated character of the apparatus thought necessary for smooth and even operation. It is a further object of this invention to do away with these difficulties and disadvantages by providing apparatus of this character which consists of few parts, is simple in construction, and one which may be easily controlled.

According to a preferred embodiment of my invention, I accomplish these objects by providing main and auxiliary platforms; in raising and lowering the platform by a fluid under pressure, preferably from a single source; and in connecting the platforms by speed-reducing gearing, so that, when the main platform moves the distance between landings the auxiliary platform only moves a proportionately smaller distance to close, at least partially, the opening in the lower landing. By reason of this construction, both platforms are controlled from a single point and one mechanism is all that is required to raise and lower the elevators the proper distance. Furthermore, as the auxiliary platform moves only a short distance, little space is required as head room for this platform.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a fragmentary transverse sectional view through a ship of the airplane-carrier type with my improvement installed therein, the section being taken on the line I—I of Fig. 3, and showing both elevator platforms in raised position;

Fig. 2 is an enlarged fragmentary view of the apparatus, shown in Fig. 1, the elevator platforms being shown in their lowered position;

Fig. 3 is an enlarged horizontal sectional view taken on the line III—III of Fig. 2 and illustrating the speed-reducing mechanism for connecting the platforms;

Fig. 4 is an enlarged fragmentary vertical section taken on the line IV—IV of Fig. 3, and illustrating one of the sets of rack and pinion gears for the main platform; and,

Fig. 5 is a vertical section taken on the line V—V of Fig. 3, the view being on approximately the same scale as Fig. 4 and illustrating one of the sets of rack and pinion gearing for the auxiliary platform.

Referring now in detail to the construction illustrated and particularly to Figs. 1 and 2, it will be observed that I have shown my improvement as applied to a ship of the airplane carrier type. The ship is indicated in general by the reference numeral 10 and comprises a hull 11, a flying deck 12, a storage deck 13, and a plurality of lower decks 14.

The flying deck 12 and storage deck 13 are provided with vertically-aligned openings or hatches 15 and 16, respectively, which are for accommodating portions of an elevator apparatus indicated in general by the reference numeral 17. The elevator apparatus is for the purpose of transferring airplanes to and from the storage and flying decks, as will be readily appreciated.

The elevator apparatus comprises a main platform 18 which serves to transport the airplanes, and an auxiliary platform 19 which is adapted to be raised to lie flush with the storage deck 13, when the main platform is in raised position, for closing at least partially the opening 16 so as to provide additional maneuvering space for the airplanes on the storage deck and to prevent, at least to some degree, any accidents which might occur. The auxiliary platform 19 is adapted to be lowered out of the way when the main platform is moved to its lowered position.

Means are provided for raising and lowering the platforms simultaneously. This means is preferably hydraulic and is controlled from a single point. The main platform 18 is supported and moved by a plurality of fluid motors 20, each comprising a vertically-arranged cylinder 21 rigidly secured to the ship structure and a piston 22 fitting the cylinder and secured at its upper end to the underside of the main platform 18.

Similarly, the auxiliary platform 19 is supported by a plurality of fluid motors 23, each of which

comprises a cylinder 24 carried by the ship structure and a piston 25 secured at its upper end to the auxiliary platform. It will be observed that fluid motors 23 are much shorter than the fluid-motors 20. The reason for this is, as stated, that for a full movement of the main platform, the auxiliary platform moves a relatively shorter distance.

In order to operate the fluid motors 20 and 23, I provide a source of fluid under pressure, preferably a motor-driven pump 26, the exhaust of which is connected to a pressure tank 27 by means of a pipe 28 and the intake of which is connected by a pipe 29 to a discharge tank 30. Pipes 31 and 32 connect into a manually-operated three-way valve 33 at spaced points and serve to connect such valve with the pressure and discharge tanks 27 and 30, respectively. A pipe 34 is also connected to the valve 33 and this pipe serves in conjunction with pipes 35 and 36 to connect the valve with the fluid motors 20 and 23. By a simple manipulation of the valve, either the pressure tank 27 or the discharge tank 30 may be connected with both of the fluid motors 20 and 23, thus providing for simultaneous up and down movement of the platforms.

In order to stabilize and prevent tipping of the platforms 18 and 19, during movement thereof, I provide for each platform two or more spaced sets of rack and pinion gearing, the racks being secured to their respective platform and the pinions being supported by suitable stationary structure and rigidly connected together for synchronous rotation.

As shown, a pair of racks 37 and 38 are pivotally connected at their upper ends, at spaced points, to the underside of the main platform 18. Pinions 39 and 40 mesh with the racks 37 and 38 respectively, and are disposed within housings 41 and 42, which latter are carried by suitable supporting structure 43. The pinions 39 and 40 are connected together for synchronous rotation by a shaft 44 extending between and journaled within the housings 41 and 42. It will thus be seen that by reason of this arrangement of racks, pinions, and shaft, both sides of the platform can move only in unison, and, therefore, there can be no tipping of the platform.

Similarly, a pair of spaced racks 45 and 46 are pivotally connected to the underside of the auxiliary platform 19 and these racks mesh respectively with idler pinions 47 and 48 supported for rotation within suitable bearings located in housings 49 and 50. The housings are supported by suitable stationary structure 51. Meshing with the idler pinions 47 and 48 and disposed within the bearings 49 and 50, respectively, are pinions 52 and 53 secured to a common shaft 54 which extends between and is journaled within the housings. It will thus be seen that by this means the spaced rack and pinion sets of auxiliary platform are connected together for synchronous rotation.

An important feature of my improvement is the provision for proper proportional movement between the main and auxiliary platforms. To this end, the shaft 44 is connected to the shaft 54 by means of a shaft 55, sets of bevel gears 56, 57, 58 and 59 serving to connect the adjacent ends of the shafts (see Figs. 3, 4 and 5). The bevel gears 56 and 57 are mounted within a housing 60, and the bevel gears 58 and 59 within a housing 61, these housings being carried by the supporting structures 43 and 51, respectively.

The pinions and gears are so constructed as

to provide for a speed reduction between the platforms, that is to say, for each unit distance of movement of the main platform 18, the auxiliary platform 19 moves a proportionately shorter distance. This is provided for by the difference in size between the pinions 39 and 40 and the pinions 52 and 53 and the difference in size between the bevel gear 56 and the bevel gear 57. For a single rotation of the pinions 39 and 40, the bevel gear 56 will also complete a revolution. As the bevel gear 57 is slightly larger than the bevel gear 56, the latter will rotate slightly less than a revolution. The bevel gears 58 and 59 will also rotate slightly less than a revolution, as will the pinions 52 and 53. As the pinions 52 and 53 are of considerably less diameter than the pinions 39 and 40, a relatively small degree of movement will be transmitted to the idler pinions 47 and 48 and racks 45 and 46. The drawings are approximately to scale and the gearing is so designed that for movement of the main platform the complete distance between storage and flying decks which is in the neighborhood of twenty-six feet, the auxiliary platform will move approximately five feet.

From the above, it will be readily seen that I have provided a simple and efficiently operating elevator apparatus, the operation of both platforms being controlled from a single point, and which by reason of the speed-reducing gearing provides for the proper proportional movement of the platforms. A further advantage is the combination of the speed-reducing connection with the arrangement for preventing the tipping of the platforms, the latter being accomplished by providing two or more rack and pinion sets for each platform and in connecting the pinions of each platform for synchronous rotation.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In elevator apparatus, the combination of a movable main platform; a movable auxiliary platform; means for raising and lowering the platforms; and toothed gearing means positively interconnecting the platforms whereby provision is made for movement of the platforms in amounts proportional to the ratio of the gearing.

2. In elevator apparatus, the combination of a movable main platform; a movable auxiliary platform; hydraulic means for raising and lowering the platforms including a cylinder and a plunger for each platform; and speed reducing toothed gearing positively connecting the two platforms together whereby upon movement of the main platform for a certain distance, the auxiliary platform moves a distance proportionally smaller dependent upon the ratio of the gearing.

3. In elevator apparatus, the combination with a pair of vertically-spaced floors having vertically-aligned openings; of a main elevator platform adapted to be raised and lowered to fit within the openings and thereby lie flush with their respective floors to facilitate loading and unloading; an auxiliary platform for at least partially closing the opening of the lower floor when the main platform is raised, and adapted to be low-

ered out of way when the main platform descends and closes the opening of the lower floor; means effective to raise and lower the platforms independently; and speed reducing means including toothed gearing for positively interconnecting the platforms, whereby, when the main platform is raised and lowered the distance between floors, the auxiliary platform is moved a substantially less distance to its raised and lowered position dependent upon the ratio of the gearing.

4. In elevator apparatus, the combination with a pair of vertically-spaced floors having vertically-aligned openings; of a main elevator platform adapted to be raised and lowered to fit within the openings and thereby lie flush with their respective floors to facilitate loading and unloading; an auxiliary platform for at least partially closing the opening of the lower floor when the main platform is raised, and adapted to be lowered out of the way when the main platform descends and closes the opening of the lower floor; fluid pressure means capable of raising and lowering the platforms independently; and speed-reducing means including toothed gearing for positively interconnecting the platforms and providing, during movement of the main platform between floors, for the movement of the auxiliary platform a substantially less distance to its raised and lowered position as determined by the ratio of the gearing.

5. In elevator apparatus, the combination with a pair of vertically-spaced floors having vertically-aligned openings; of a main elevator platform adapted to be raised and lowered to fit within the openings and thereby lie flush with their respective floors to facilitate loading and unloading; an auxiliary platform for at least partially closing the opening of the lower floor when the main platform is raised, and adapted to be lowered out of the way when the main platform descends and closes the opening of the lower floor; fluid pressure means for raising and lowering the platforms; and speed-reducing means interconnecting the platforms and providing during movement of the main platform between floors, for the movement of the auxiliary platform a substantially less distance to its raised and lowered position, said speed-reducing means comprising a set of spaced racks carried by each of the platforms, pinions meshing with the racks of each set and carried by stationary supporting structure, and means connecting the pinions of one platform with the pinions of the other platforms and providing for synchronous rotation thereof.

6. In elevator apparatus, the combination with a pair of vertically-spaced floors having vertical-

ly-aligned openings; of a main elevator platform adapted to be raised and lowered to fit within the openings and thereby lie flush with their respective floors to facilitate loading and unloading; an auxiliary platform for at least partially closing the opening of the lower floor when the main platform is raised, and adapted to be lowered out of the way when the main platform descends and closes the opening of the lower floor; a source of fluid under pressure; fluid motors connected to the source and to the platforms for raising and lowering the latter; a single means for controlling the flow of fluid to and from the motors of both platforms; and speed-reducing means connecting the platforms and providing during movement of the main platform between floors, for the movement of the auxiliary platform a substantially less distance to its raised and lowered position.

7. In elevator apparatus, the combination of a movable main platform; a movable auxiliary platform; stationary supporting structure; and speed-reducing means connecting the two platforms whereby for movement of the main platform a certain distance, the auxiliary platform moves a proportionately smaller distance; said speed-reducing means comprising a rack carried by the main platform, a rack carried by the auxiliary platform, a pinion carried by the supporting structure and meshing with the rack of the main platform, a second pinion carried by the supporting structure and meshing with the rack of the auxiliary platform, and means connecting the two pinions for synchronous rotation.

8. In elevator apparatus, the combination of a movable main platform; a movable auxiliary platform; stationary supporting structure; and speed-reducing means connecting the two platforms whereby for movement of the main platform a certain distance, the auxiliary platform moves a proportionately smaller distance; said speed-reducing means comprising a plurality of racks carried by the main platform at spaced points, a plurality of pinions carried by the stationary supporting structure and meshing respectively with the racks, means connecting the pinions for synchronous rotation, a plurality of racks carried by the auxiliary platform at spaced points, a plurality of pinions carried by the stationary supporting structure and meshing respectively with the racks of the auxiliary platform, means connecting the last-named pinions for synchronous rotation, and means connecting the last-named pinion with the first-named pinions for synchronous rotation.

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