Feb. 13, 1934. F. V. McPEAK 1,946,982

ELEVATOR SYSTEM

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FIG. 2.

FIG. 1a

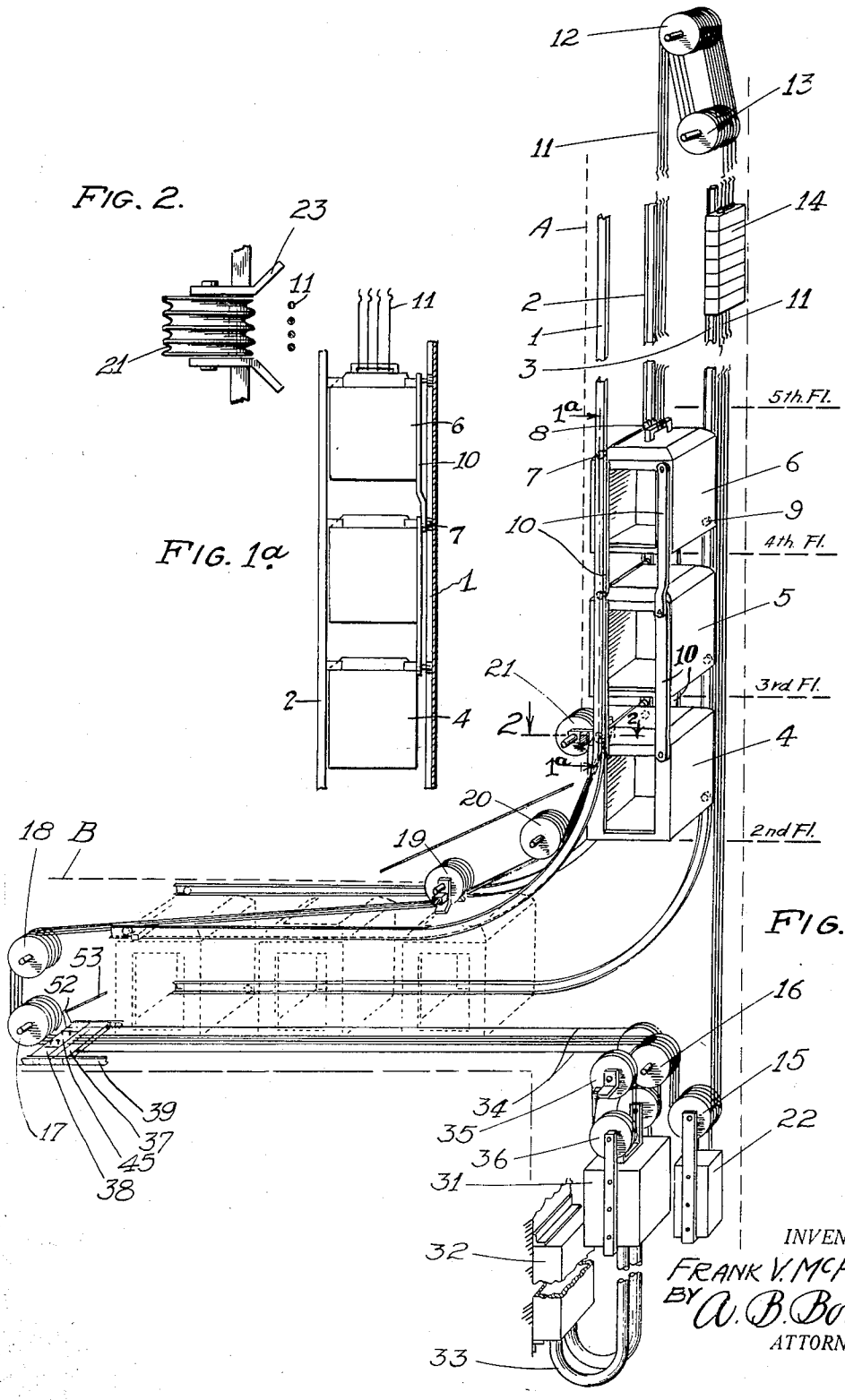

FIG. 1.

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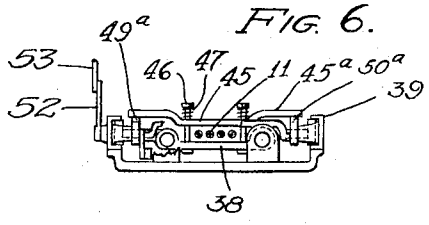
FIG. 6.



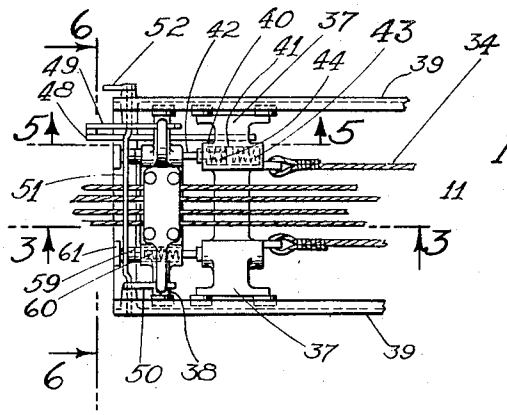


FIG. 4.

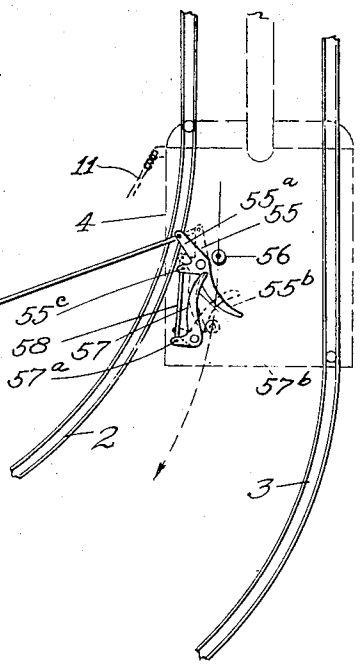
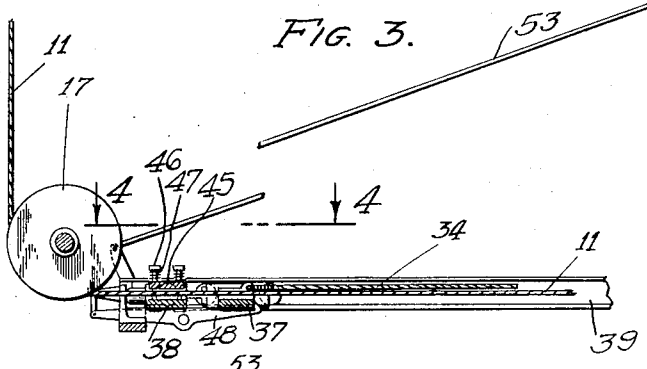


FIG. 3.



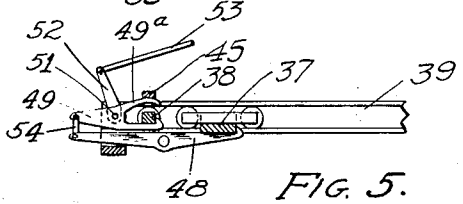


FIG. 5.

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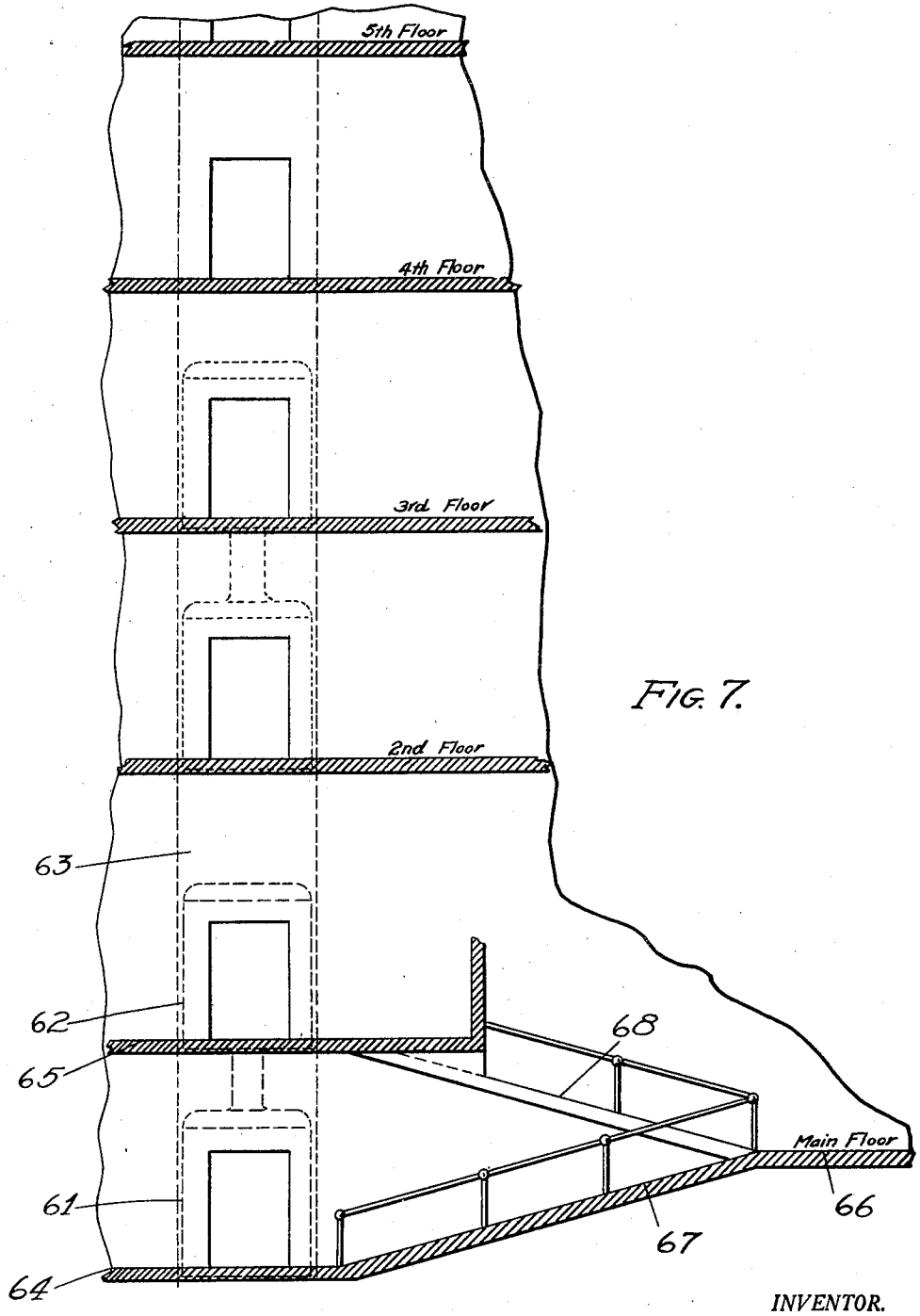

FIG. 7.

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Patented Feb. 13, 1934 1,946,982

UNITED STATES PATENT OFFICE

1,946,982

ELEVATOR SYSTEM

Frank V. McPeak, Los Angeles, Calif., assignor, by mesne assignments, to Patrick J. Campbell, New York, N. Y.

Application October 10, 1929. Serial No. 398,793

18 Claims. (Cl. 187—16)

My invention relates to elevator systems, and particularly to a new system in which elevator cages are coupled together and propelled or conveyed as a train or unit.

The objects of this invention are: first, to provide an elevator system which will minimize the usual elevator space in buildings; second, to provide an elevator system whereby the expense of constructing and operating an extended elevator system will be reduced to a minimum; third, to provide an elevator system of this class whereby a single train of several elevator cages coupled together will serve the purpose of a multiplicity of separately operated cages in separate shafts and which will provide conveyance from the lower to the higher floors with at least equal facility to the old systems; fourth, to provide an elevator system of this class in which one of the cages of each train stops at each floor, but in which the train makes only a limited number of stops in covering all of the floors, the number of stops of the train being dependent upon the number of cages in each train; fifth, to provide an elevator system of this class in which the cages of the train are novelly arranged and readily accessible for loading the passengers or freight thereon; sixth, to provide an elevator system of this class in which the cages of the train are arranged in superimposed relation when passing from floor to floor, and in side by side or horizontal relation at the main or loading and unloading floor; seventh, to provide novel means in connection with an elevator system of this class for guiding the cages from a horizontal to a vertical direction and from a vertical to a horizontal direction, and also novel means for steading the cages during such travel; eighth, to provide novel unitary means for propelling the train of elevator cages either in a vertical or a horizontal direction and from one direction to the other; ninth, to provide novel cable take up means in connection with a unitary cage propelling means in a system of this class; tenth, to provide novel means for varying the counterbalance of and for the cages when the same pass from a vertical path to a horizontal path, or from a horizontal to a vertical path, to provide a novel varying counterbalance means which may be readily connected to the propelling means when the cages change their direction of travel from a vertical to a horizontal or from a horizontal to a vertical direction; eleventh, to provide novel clutch or connecting means for connecting the variable secondary counterbalance means to the propelling means or the cages so as to reduce to a minimum the shock when connecting or disconnecting the secondary counterbalance means to or from the propelling means or the cages; twelfth, to provide as a whole a novel elevator system; and, thirteenth, to provide an elevator system of this class which is relatively simple and economical of construction and operation proportional to its function, efficient, and which will not readily deteriorate or get out of order.

With these and other objects in view as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon which form a part of this application in which:

Figure 1 is a fragmentary perspective view of my new elevator system in one form; Fig. 1*a* is a fragmentary side elevational and partial sectional view taken at 1*a*—1*a* of Fig. 1; Fig. 2 is a fragmentary view thereof taken at 2—2 of Fig. 1, showing particularly the means for directing the carrying and propelling cables toward the sheaves when the cages change direction of travel; Fig. 3 is a fragmentary view on a slightly enlarged scale showing the clutch means for connecting the secondary counterbalance means to the propelling means, and also the means for releasing and locking the same; Fig. 4 is a fragmentary plan view thereof taken at 4—4 of Fig. 3; Fig. 5 is a fragmentary sectional view thereof taken at 5—5 of Fig. 4; Fig. 6 is a fragmentary sectional view thereof taken at 6—6 of Fig. 4, and Fig. 7 is a fragmentary sectional elevation through a building and showing my elevator system in a slightly modified form incorporated therein.

Like characters of reference refer to similar parts and portions throughout the views of the drawings.

In the elevator system shown in Figs. 1 to 6, inclusive, the cages move from floor to floor in a vertical shaft, designated A in Fig. 1, and in a horizontal shaft, designated B, for loading and unloading the cages. In these shafts are provided three tracks 1, 2 and 3 for guiding the cages designated here as 4, 5 and 6, in their passage through the shafts, and for supporting the cages when in the horizontal shaft. The tracks in each shaft merge with each other in gradual curves, as shown in Figs. 1 and 3. The tracks 1 and 2, in this instance, which are arranged at the side of the shaft A toward which the shaft B is directed, and are also arranged at

the upper portion of the horizontal shaft B. I have provided the third track or rail 3 in such relation to the other rails for steadying the cages in the passage through the shaft so as to prevent the same from swaying. Each of the cages 4, 5 and 6 is provided with three rollers 7, 8 and 9, arranged at the corners of the cages, as shown in Fig. 1 so that the same may ride on or in the tracks or rails 1, 2 and 3, which in this instance are channel shaped rails.

The cages of the elevator system disclosed may be substantially in the form of the ordinary elevator cage now in use and of substantially the dimensions thereof and provided with an opening at one, or if desired, at two sides. When the cages are all positioned in the vertical shaft, they are superimposed and spaced apart from each other from the floor of one elevator cage to the floor of the other a distance equal to the distance between the floors of the building above the second floor thereof. These cages are positively and permanently coupled together by links 10 at the front and rear sides of the elevator cages as shown in Fig. 1, there being two sets of links at the front sides of the cages, one set at each side of the openings therein, and one set at the rear sides of the cages. These links are preferably pivotally connected to the cages near the upper portions of the cages so as to clear the ingress and egress openings thereof when the cages are in the horizontal shaft and are also arranged in such position relative to the cages as to avoid the upper tracks 1 and 2 in the horizontal shaft.

In the structure shown in Fig. 1, the cages move as a permanent train of flexibly connected cages and are propelled in the different directions through the vertical and horizontal shafts by a unitary propelling means which in this instance consists of a series of cables 11. These cables are secured at one end to the top and central portion of the upper cage 6 and extend around the operating or propelling drum 12 which is connected to a suitable motor or other propelling means, then around an idler 13, then around the propelling drum 12, then over the idler drum again, and secured at the other end to the permanent counterbalance weight 14 for counterbalancing the cages in the train. To the lower end or side of the counterbalance weight 14 are secured other cables 11 which for the purpose herein may be considered extensions of the cable secured to the upper end or side of the counterbalance weight 14. The cable 11 extends down the vertical shaft A to one side of the cages around a take up drum 15, then around an idler drum 16, substantially in line with the shaft A, then around idler drums 17 and 18 positioned at the far end of the horizontal shaft B from the vertical shaft, and then around a multiplicity of idlers 20, 21 and 22 located at the curved juncture of the two shafts, or intermediate the two tracks 1 and 2 at their curved portions. The other end of these cables 11 are secured to the lower cage 4 of the train at the sides thereof, as shown in Figs. 1 and 3. The axis of the idler 13 is fixed, but that of the idler 15 is movable up and down depending upon the lengthening and shortening of the cables as the cages in the train move from one shaft to the other. The idler 15 is weighted by a heavy weight 22 so as to retain the cables taut at all times and also sufficient friction that the operating drum 12 will draw the cages into the horizontal shaft by the portion of the cables passing over the idler. The cables passing over and between the idlers 16 and 17 are positioned below the path of the cages in the horizontal shaft. The portion of the cable between the idlers 18 and 19 is positioned substantially above the path of the cages in the horizontal shaft by reason of the necessity of the placing of the idlers 19, 20 and 21 outside of the path of the cages. It will be here noted that the idlers 19, 20 and 21 do not function at all times and engage the cables at different times. As the cages enter and ascend the vertical shaft, the cables engage successively the drums 19, 20 and 21 with the end of the cables connected to the lower cage 4 and remain in engagement with said idlers until the lower cage has substantially entered the horizontal shaft. By the time the lower cage has substantially entered the horizontal shaft, the upper cage 6 will have left the vertical shaft and will have been drawn to one side in the direction of the horizontal shaft, causing the end of the cables 11, connected to the upper cage 6, to be drawn to one side of the vertical shaft in engagement with the idler 21 and then in engagement with the idler 20 until all of the cages are in the horizontal shaft. During such shifting of the cables there is a slight lengthening and shortening thereof which is taken up by the weighted idler 15. It will be here noted that at the opposite sides of the idlers 19 and 21, and, if desired, on the idler 20, are cable directing members 23, as shown in Figs. 1 and 2, for positively directing the cables 11 into the grooves of the idler drums.

It will be here noted that my construction is not limited to the coupling of only three cages, but the same is equally applicable to trains of two or any reasonable number more than three cages.

It will be noted that when the cages are in the horizontal shaft B, the floors of the cages in the train are placed on a level with the main floor of the building or the floor thereof adapted for loading and unloading the cages with passengers and freight. When the cages are in the vertical shaft, they are so arranged that when the cage 4 is stopped on the level with the second floor, the cages 5 and 6 will be on a level with floors 3 and 4, thus eliminating the necessity of stops by each cage at each of the floors. The next stop by the train is then made with the floor of the lower cage 4 on a level with the fifth floor of the building, and so on. It will be here noted, however, that in order to minimize the stopping of the train and arrange the discharge of passengers as stated, namely, those going to the second floor from cage 4, those to the third floor from cage 5, and etc., it is necessary to seggregate the passengers and freight on the main floor of the building when the cages are in the horizontal shaft B.

When the cages are in the horizontal shaft, the load, by reason of the cages, is taken off the cables 11 and transferred to the rails. However, the tension remains on the cables by reason of the counterbalance 14. Thus, the load upon the propelling drum 12 would be materially increased unless the counterbalance 14 were again counterbalanced as the cages pass from the vertical into the horizontal shaft and as the weight thereof is taken from the cables. I have provided such counterbalance means which I have termed a secondary counterbalance means which is variable. This secondary variable counterbalance means consists essentially of a tank 31 which is adapted to be lowered in substantially direct proportion to the decrease of the load on the cables by the cages as the cages pass from the vertical to the horizontal shaft. This lowering of the tank

31 causes water or other liquid in a stationary tank 32 to pass gradually from the tank 32 through flexible conductors or hoses 33, secured to the lower end of the tank 32, into the tank 31 from the lower side thereof. The inverse action takes place as the tank 31 is raised. To the opposite sides of the tank 31 are connected the ends of cables 34, but by a block and tackle system of sheaves 35 and 36, the former being arranged on a fixed axis and the latter on a vertically shiftable axis fixed with respect to the tank 31. The cables 34, which are arranged at the opposite lateral sides of the cables 11, pass around one of the sheaves 35 at the opposite sides of the cables 11, then around one of the sheaves 36 at the opposite sides of the cables 11, then around other sheaves 35, then around other sheaves 36, and then secured to a fixed support relative to the axis of the sheaves 35.

The opposite ends of the cables 34 are secured to a clutch means shown best in Figs. 3, 4, 5 and 6. The clutch means is embodied in a pair of carriages 37 and 38 mounted on horizontal rails 39 at opposite lateral sides of the cables 11. These carriages are permanently but yieldably connected by plungers 41, connected by plunger rods 42 to the adjacent sides of the carriages 38, and which plungers are reciprocally mounted in cylinders 40 carried by the carriage 37. These cylinders 40 are preferably pneumatic cylinders but there are also provided springs 43 and 44 at the outer and inner sides of the plungers 41 to insure centering of the plungers within the cylinders 40. On the carriage 38 is mounted a clamping plate 45 which is reciprocally mounted on bolts 46 and adapted to be forced downwardly toward the carriage 38 by compression springs 47 positioned around the bolts 46 against the upper side of the plate 45. The cables 11 extend through the space between the plate 45 and the carriage 38 and are clamped therebetween as the plate 45 is forced downwardly against the carriage 38. This clutch means is held in the far end of the horizontal shaft or tunnel B, when the cages are in the vertical shaft, by a plurality of pawls 48, 49 and 50, the pawl 48 holding the carriage 37 in position and the pawls 49 and 50 holding the carriage 38 in position. The latter pawls 49 and 50 are provided with cam arms 49*a* and 50*a* which, when the pawls 49 and 50 engage the carriage 38, engage the under sides of extended arms 45*a* of the clamping plate 45 for holding the same against the compression of the springs 47 and in disengaged relation with respect to the cables 11, as shown in Figs. 5 and 6. In the structure shown, the pawl 49 is mounted on a rockshaft 51 to one end of which is secured an arm 52 to the outer end of which is pivotally connected an operating rod 53. The rockshaft 51 extends to the opposite side of the mechanism to the pawl 50 and operates the pawls 49 and 50 simultaneously. The pawl 48 is also connected with the pawl 49 by a link 54 so that the pawl 40 is also operated simultaneously with the others. The rod 53 extends to the vertical shaft and is connected to an arm 55*a* of a cam lever 55 having a cam portion 55*b* which is so arranged that when a roller 56 at the back side of the lower cage 4 engages the upper side of the same, the same is shifted gradually to the position shown by dotted lines in Fig. 3. This cam lever 55 is also provided with another arm 55*c* which is connected by a link 58 to an arm 57*a* of a second cam lever 57 which is normally in an out of the way position when the cam portion 55*b* is in the path of the roller 56. As the cam portion 55*b* is shifted to the dotted line position, the cam portion 57*b* of the other cam lever 57 is shifted to the dotted line position shown in Fig. 3 in the path of the roller 56 as the train enters and ascends the vertical shaft.

As the cam lever 55 is shifted to the dotted line position, the pawls are tilted, releasing simultaneously the carriages 37 and 38. The carriage 37 will be drawn at a speed approximately equal to the acceleration of gravity in the direction of the arrow shown in Fig. 4, but the carriage 38 will be given an initial impact when released by reason of spring actuated rubber bumpers 59 which are mounted on the carriage and in the side thereof opposite the carriage 37, as shown best in Fig. 4. These plungers 59 are forced outwardly by springs 60 and engage, with the springs 60 in compressed relation, bumpers 61. Thus, when the carriage 38 is released, the same is forced by the action of the springs 60 toward the carriage 37, but the shock is taken up by the springs 43. As the carriage 38 is forced away from the bumpers 61, and as the pawls 49 and 50 are tilted, the clamping plate 45 is lowered, clamping the cables 11 between the same and the carriage 38. As the speed of the carriage 37 is accelerated, the same will catch up with the speed of the cables 11 and tend to surpass the speed of the cables but the springs 44 will take up the shock of the increased speed of the carriage 37 and will hold the carriage 37 in check as the secondary counterbalance is lowered and gradually increased. As the cages leave the horizontal shaft, the secondary counterbalance is raised, decreasing the action thereof by the emptying of the liquid therein back into the stationary tank 32. As soon as the lower cage 4 engages the cam portion 57*b* of the cam lever 57, the pawls are again tilted to positively engage the carriages 37 and 38 but only after such carriages have been shifted to the positions shown, substantially simultaneously with the shifting of the carriages to the positions shown, the clamping plate 45 is disengaged from the cable, thus disconnecting positively the secondary counterbalance means from the propelling cable.

In the modified structure, shown in Fig. 7, I have shown a pair of cages 61 and 62 permanently connected together and moving in a vertical shaft only, the vertical shaft being designated 63. The cages 61 and 62 may be loaded by stopping the cages with the floor of one cage on a level with the main floor and then the floor of the second cage on the level with the main floor, but in Fig. 7 of the drawings I have shown separate loading and unloading platforms, designated 64 and 65 which are spaced vertically a distance equal to the spacing between the floors above the second floor and equal to the distance between the floors of the connected elevator cages. These loading and unloading platforms or floors are connected to the main floor, designated 66, by any suitable means such as ramps 67 and 68, shown in Fig. 7. It will be noted that in this construction the passengers and freight are also segregated so that the passengers and freight desired to be unloaded on floors 2, 4, 6, etc., are loaded on the lower loading platform on floor 64, while the freight and passengers desired to be discharged on the odd number of floors are loaded in on the upper platform or floor 65.

Though I have shown and described a particular construction, combination and arrangement of parts and portions, and a certain modification

thereof, I do not wish to be limited to this particular construction, combination and arrangement, nor to the modification, but desire to include in the scope of my invention the construction, combination and arrangement substantially as set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the lower end of the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, a counterbalance for the unit of cages, and means for varying the counterbalancing load for the cages as the same enter or depart from the horizontal shaft.

2. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a single series of closely connected cages adapted to move as a unit in both of the shafts and from one to the other, a counterbalance for the unit of cages, a secondary counterbalance, and means for connecting the latter counterbalance to the cages as the same enter the horizontal shaft.

3. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, a counterbalance for the unit of cages, and a secondary varying counterbalance and means for connecting the latter counterbalance to the cages as the same enter the horizontal shaft around said curve.

4. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, unitary means for propelling the unit of cages in both shafts, a fixed counterbalance for the train of cages, a fixed liquid tank, a vertically movable liquid tank connected at its lower end to the lower end of the fixed tank, and means adapted to connect the movable tank to the train of cages as the same enter the horizontal shaft.

5. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, unitary means for propelling the unit of cages in both shafts, a fixed counterbalance for the train of cages, a secondary counterbalance, a clutch means for connecting the latter to the propelling means, and trip means adapted to be actuated by one of the cages for releasing and actuating the clutch means.

6. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, unitary means for propelling the unit of cages in both shafts, a fixed counterbalance for the train of cages, a second counterbalance, a clutch means for connecting the latter to the propelling means, trip means adapted to be actuated by one of the cages for releasing and actuating the clutch means, means for imparting initial movement to the clutch, and means yieldably connecting the clutch to the secondary counterbalance.

7. In an elevator system, the combination with a building having a vertical shaft connecting the floors of the building, and a horizontal shaft merging in a gradual curve with the vertical shaft, of a plurality of connected cages adapted to move as a unit in both of the shafts and from one to the other, said cages being simultaneously accessible from a single floor when in the horizontal shaft.

8. In an elevator system, an L-shaped shaft comprising a horizontal portion and a vertical portion merging in a gradual curve one into the other, and a plurality of connected cages arranged to travel in said shaft, said cages being simultaneously accessible from a common level when in the horizontal shaft portion, and simultaneously accessible from superposed levels when in the vertical shaft portion.

9. In an elevator system, the combination with a building, of an L-shaped shaft comprising a horizontal portion extending along the main floor of the building and a vertical portion extending to the other floors thereof, said vertical and horizontal portions merging in a gradual curve one into the other, and a plurality of connected cages arranged to travel in said shaft, said cages being simultaneously level with and accessible from the main floor of the building when in said horizontal portion of said shaft.

10. In an elevator system, the combination with a building of an L-shaped shaft comprising a horizontal portion extending along the main floor of the building and a vertical portion extending to the other floors thereof, said vertical and horizontal portions merging in a gradual curve one into the other, a plurality of cages arranged to travel in said shaft, link means connecting said cages for arranging said cages in a spaced relation equal to the distances between the different floor levels of the building whereby said cages are simultaneously level with and accessible from adjacent superposed floors of the building when in the vertical shaft portion, said cages also being simultaneously level with and accessible from the main floor of the building when in said horizontal shaft portion.

11. In an elevator system, an L-shaped shaft comprising a horizontal portion and a vertical portion merging in a gradual curve one into the other, a plurality of connected cages arranged to travel in said shaft, said cages being simultaneously accessible from a common level when in the horizontal shaft portion, and simultaneously accessible from superposed levels when in the vertical shaft portion, a counterbalance for the cages, and means for varying the counterbalancing load for the cages as the same enter or depart from the horizontal shaft portion.

12. In an elevator system, the combination with a building, of an L-shaped shaft comprising a horizontal portion extending along the main floor of the building and a vertical portion extending to the other floors thereof, said vertical and horizontal portions merging in a gradual curve one into the other, a plurality of connected cages arranged to travel in said shaft, said cages

being simultaneously level with and accessible from the main floor of the building when in said horizontal portion of said shaft, a counterbalance for the cages, and means for varying the counterbalancing load for the cages as the same enter or depart from the horizontal shaft portion.

13. In an elevator system, the combination with a building, of an L-shaped shaft comprising a horizontal portion extending along the main floor of the building and a vertical portion extending to the other floors thereof, said vertical and horizontal portions merging in a gradual curve one into the other, a plurality of cages arranged to travel in said shaft, link means connecting said cages for arranging said cages in a spaced relation equal to the distances between the different floor levels of the building whereby said cages are simultaneously level with and accessible from adjacent superposed floors of the building when in the vertical shaft portion, said cages also being simultaneously level with and accessible from the main floor of the building when in said horizontal shaft portion, a counterbalance for the cages, and means for varying the counterbalancing load for the cages as the same enter or depart from the horizontal shaft portion.

14. In an elevator control system, a series of elevator cars, a single shaft serving all said cars, said shaft having a single vertical section, a curved section, and a single horizontal section, guide rails along each of said sections, and means on said elevator cars to maintain said cars in engagement with all sections of said guide rails in succession.

15. In an elevator control system, a series of elevator cars, a single shaft serving all said cars, said shaft having a single vertical section, a curved section, and a single horizontal section, and means for causing said cars to pass from either of said sections to the next section while remaining in substantially normal, upright positions despite the curve of approximately ninety degrees in the said shaft.

16. Means for handling elevator traffic in multistory buildings comprising a shaft having a horizontal portion at one end and a vertical portion at the other end, curved guide rails connecting said end portions, a series of cars coupled together and provided with means adapted to run along said guide-rails, and a single hoisting mechanism to actuate said cars in unison.

17. In an elevator system, a series of elevator cars coupled together, a single shaft for said cars, said shaft having a vertical section, a curved section, and horizontal section, and means for causing said cars to pass from the horizontal section, through the curved section to the vertical section, and means for constructing and coupling cars so as to maintain clearance between adjacent cars during passage through each of said section of said shaft.

18. In a system of the class described, the combination with a plurality of floors, a vertical runway extending past said floors, a horizontal runway extending along one of said floors in parallelism with said floor for a distance considerably greater than the distance between any pair of adjacent floors, a curved section joining said vertical and horizontal runways, a plurality of cars movable along said runway, a hoisting mechanism connected to the first of said cars, a plurality of links connecting the remaining cars to said first car for movement in unison therewith, and means for pivotally mounting said links on the respective cars whereby said cars may align themselves along either the vertical or the horizontal runway.

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