

[54] **DUPLEX COUNTERWEIGHTLESS SHUTTLE ELEVATOR SYSTEM**

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[51] Int. Cl. **B66b 9/00**

[58] Field of Search. **187/16, 20, 94; 214/16.1 B**

References Cited

UNITED STATES PATENTS

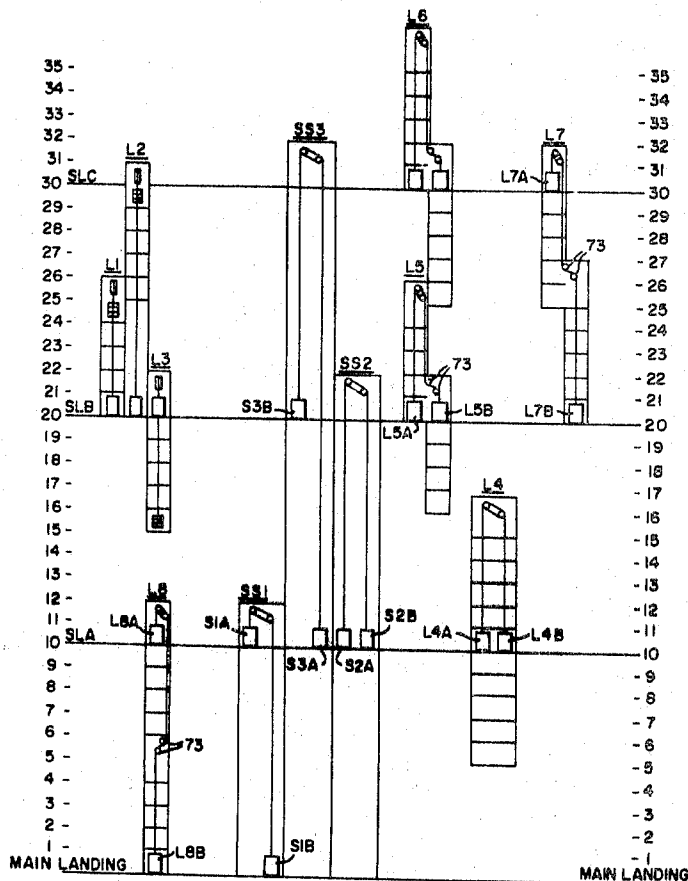
1,943,119 1/1934 James 187/16

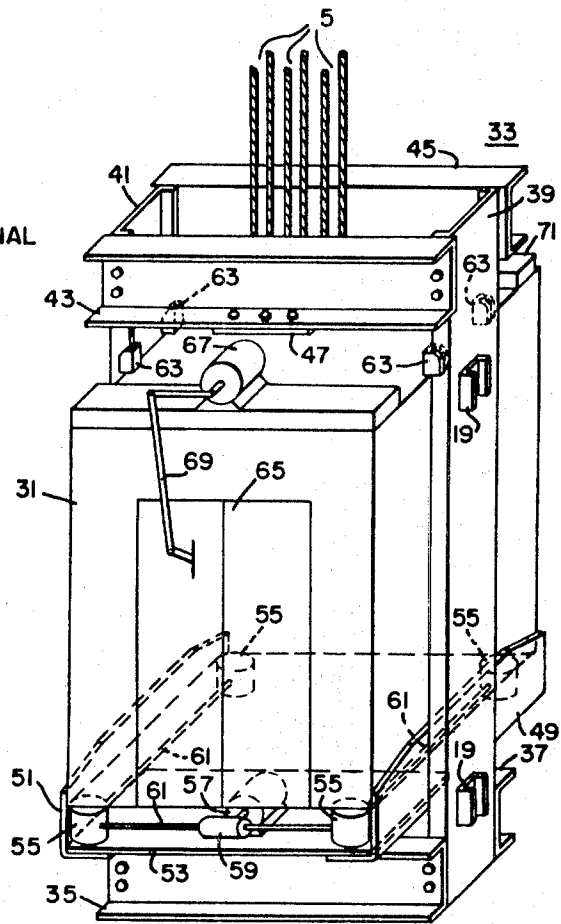
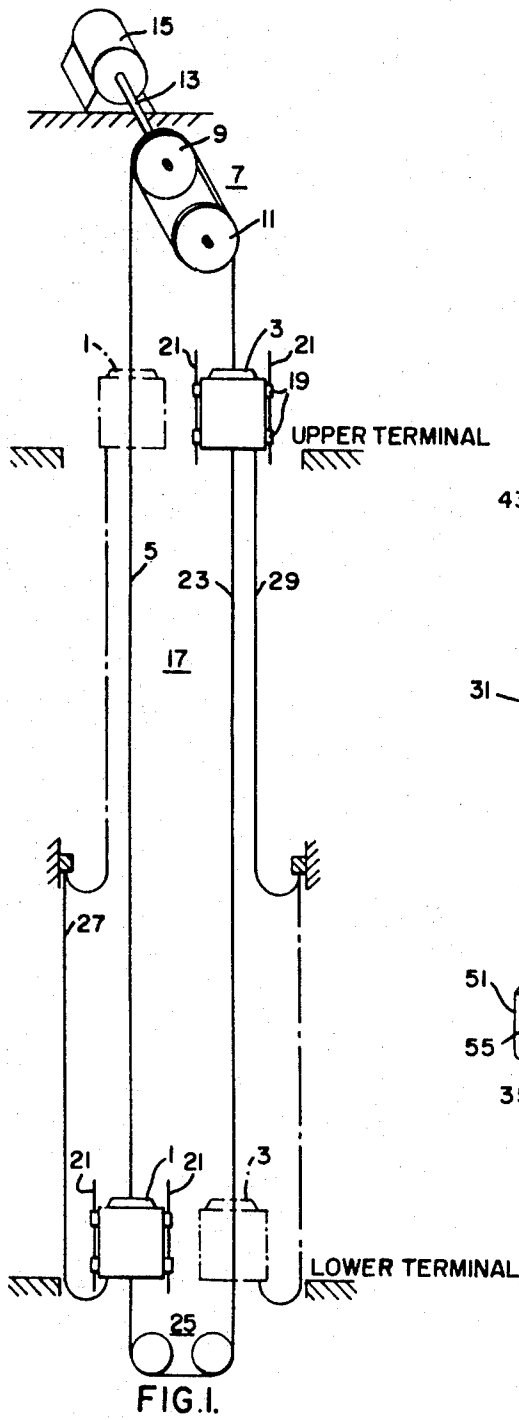
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[57] **ABSTRACT**

Elevator cars suspended from opposite ends of a traction driven hoist cable counterbalance each other and provide ideal spacing between cars serving two terminal floors such as a main floor and a sky lobby. A leveling device on one or both cars provides for adjustment of the position of the associated car relative to the hoist cable to accommodate for cable stretch and settling of the building so that each car can be brought into exact registry with the adjacent landing. The cars can be arranged to stop at pairs of intermediate floors located equal distances from the two terminal floors and can be further arranged to distribute load in opposite directions from a third terminal located halfway between the first and second terminals. The counterbalanced cars can be combined with a second elevator system, either a conventional system or a counterbalanced system, for sky lobby operation with the counterbalanced car system providing either the shuttle service, the local service or both.

4 Claims, 3 Drawing Figures





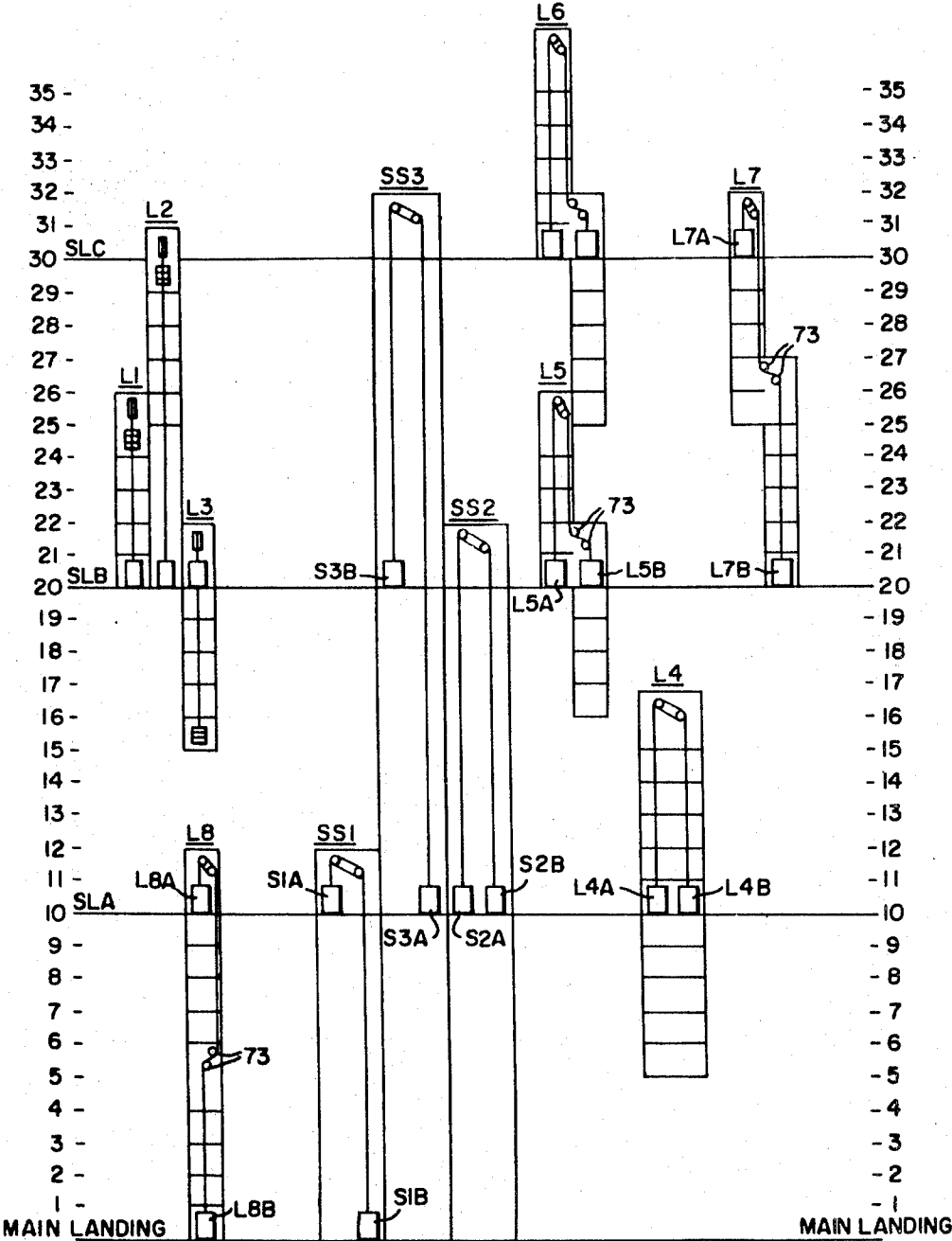


FIG. 3.

DUPLEX COUNTERWEIGHTLESS SHUTTLE ELEVATOR SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 30,375, filed Apr. 21, 1970, now U.S. Pat. No. 3,651,893 which is assigned to the same assignee as the present application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to elevator systems and more particularly to traction driven elevator systems. 2. Prior Art

The traction drive has been used in the elevator field for many years. According to this system, the car is supported by a hoist cable which passes over a sheave having a U-shaped groove in its periphery. The car is counterbalanced by a counterweight connected to the other end of the hoist cable. The weight of the car plus its load acting on one end of the hoist cable and the weight of the counterweight acting on the other end, apply a force to the hoist cable which is translated into a traction force between the cable and the sheave. Therefore, when a rotational force is applied to the sheave, the car is caused to move up and down in a hoistway. Since the counterweight is conventionally made equal to the weight of the empty car plus 40 percent of the load capacity of the car, this system has the advantage that only enough torque sufficient to drive the difference in load need be provided. In addition, the system has an inherent safety feature in that when the car over travels in the up direction the counterweight will strike the bottom of the hoistway so that the traction force is lost and the sheave can slip before the car is drawn into the machinery. The disadvantage of the system is the extra apparatus required. The counterweight like the car needs a guide rail system in addition to a buffer and takes up space in the hoistway. Of course, a separate drive motor is required for each elevator car.

Various schemes have been proposed for developing more efficient elevator systems. The combination for use in high-rise buildings of a shuttle system to transport passengers from the main lobby directly to upper lobbies from which they are transported to the desired floor by a local elevator system, was disclosed in U.S. Pat. No. 1,967,832. Apparatus useful in coordinating the movement of the shuttle cars and the local cars was disclosed in U.S. Pat. No. 3,467,223.

Other approaches to increasing the efficiency of elevator systems includes the operation of two cars in the same hoistway. U.S. Pat. No. 1,837,463 discloses such a system wherein the two independently operated cars share a common counterweight whereas in the system disclosed in U.S. Pat. No. 1,911,834 a separate counterweight is provided for each car. Still another approach has been the utilization of double-decker and even triple-decker cars such as those shown in U.S. Pat. Nos. 1,693,651, 1,997,260 and 1,199,174. One difficulty with the multiple cabin cars is achieving accurate registry of each cabin with the adjacent landing. U.S. Pat. No. 1,199,175 discloses a system wherein although both cabins move in a common sling and share a common counterweight they are driven by separate motors through separate cabling systems so that the cars can be independently leveled. U.S. Pat. No. 1,490,271 has suggested that inaccuracies in leveling a single freight

car could be compensated for by tilting a section of the flooring of the elevator or the building to facilitate the loading and unloading of wheeled vehicles.

In order to provide elevator service in the upper portion of the Eiffel Tower, an elevator system was developed wherein one car which is driven by a direct acting hydraulic ram operates between the top of the tower and a mid-station. A second car suspended from a cable connected to the first car operates in a parallel shaft between the midpoint and a lower terminal. Passengers transfer between cars at the mid-station in order to go all the way to the top. This system is described in the 1969 annual issue of Elevator World, Volume XVII, No. 10 dated October, 1969 chapter 3.

SUMMARY OF THE INVENTION

According to this invention two elevator cars suspended from opposite ends of a hoist cable driven by a traction sheave act as counterweights for each other thereby eliminating the need for separate counterweights and their associated equipment. In this manner, a single machine only slightly larger than each of the machines required to drive two elevator cars in the conventional arrangement is sufficient to supply the torque required for the maximum out of balance condition that will be encountered. The elimination of separate counterweights reduces the cross-sectional hoistway area required for each car on the order of 15 percent thereby freeing more space in the building for other purposes.

Another feature of the invention is the leveling means which permits adjustment of the position of one or both cars relative to the hoist cable to compensate for cable stretch caused by variations in the loading of the cars so that both cars may be brought into exact registry with the adjacent landing simultaneously. In the exemplary embodiment of the invention disclosed, this adjustment is achieved through utilization of a rectangular array of four interconnected jacks which vary the vertical position of the associated car relative to the car sling.

The counterbalancing cars can be operated reciprocally between two terminals. This arrangement is particularly useful for shuttle service between a lower terminal and a sky lobby in a high-rise building. The reciprocal action of the cars provides ideal separation between the cars for this type of service. The system can be arranged for serving pairs of floors located between the terminal floors with one floor in each pair located the same distance from one terminal that the other landing in the same pair is from the other terminal. The cars can also be arranged to simultaneously serve an intermediate landing located halfway between the two terminals. When additional landings located equal distances above and below said intermediate landing are provided, the system can be utilized to distribute load simultaneously above and below the intermediate landing.

The counterbalancing cars can be combined with a second elevator system to provide shuttle and local service in a high-rise building. For instance, the counterbalancing cars can serve as shuttle cars to deliver load to one or more sky lobbies from which other elevator systems provide local service. When used for the local banks of elevators, the counterbalancing cars can distribute load simultaneously above and below a sky

lobby located at the above-mentioned intermediate landing of the local elevator rise.

In order to minimize hoistway space when the cars operate in opposite directions from an intermediate landing, the hoistway for the car serving the upper landing need only extend from the intermediate landing to the drive sheave, while the hoistway for the car serving the floors below the intermediate landing need only extend from slightly above the intermediate landing to the lowest floor. The portion of the hoist cable supporting the lower car can be routed down the hoistway for the upper car and then aligned with the lower hoistway by deflecting sheaves located slightly above the intermediate terminal. Alternatively, the two cars can be operated in the upper and lower portions of a common hoistway by similar deflecting sheaves.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, reference may be had to the preferred embodiments, exemplary of the invention, shown in the accompanying drawings in which:

FIG. 1 is a schematic view in elevation of an elevator system embodying the invention;

FIG. 2 is an isometric view of an elevator car illustrating details of an exemplary embodiment of the invention; and

FIG. 3 is a schematic view of exemplary arrangements of elevator systems according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, elevator cars 1 and 3 are suspended from opposite ends of a hoist cable 5. The hoist cable 5 is reeved over traction sheave means 7 including a drive sheave 9 and a secondary sheave 11. A hoist rope 5 rides in U-shaped grooves in the periphery of the sheaves 9 and 11. The weight of the cars acting on opposite ends of the hoist cable provides the traction force between the cable and the U-shaped grooves which permits the cars to be raised and lowered when the drive sheave 9 is rotated by the shaft 13 connected to the elevator machine 15. This type of traction drive is in common use in conventional elevator systems wherein the elevator car is connected to one end of the hoist cable and a counterweight is connected to the opposite end.

The secondary sheave 11 permits another wrap around the drive sheave 9 to increase the traction and also permits horizontal separation between the ends of the hoist cable 5 so that the elevator cars 1 and 3 can be suspended in the hoistway 17 side-by-side without interference. As is the general practice in the elevator field, cars 1 and 3 are guided in their vertical travel through the hoistway by guide shoes 19 which ride on guide rails 21 mounted to the walls of the hoistway.

As is common practice in high-rise elevator systems, a compensation rope 23 connected to the bottom of each car accommodates for variations in suspended load imposed on either end of the hoist cable 5. For instance, as shown in FIG. 1 with the elevator car 1 located adjacent a lower terminal and the elevator car 3 located adjacent an upper terminal, most of the weight of the hoist cable 5 is imposed on the side of the drive system supporting the elevator car 1. As the elevator car 1 travels up in the hoistway and the elevator car 3 travels downward this load due to the weight of the

hoist cable 5 shifts from the elevator car 1 to the elevator car 3 thereby causing variations in torque requirements. With the compensation rope 23 similar in unit weight to the hoist cable 5, the combined weight due to the hoist cable and the compensation rope imposed on either side of the drive system remains constant. As is usual, a compensator 25 located at the bottom of the hoistway guides the compensation rope and prevents it from lashing about. Although the hoist cable 5 and the compensation rope 23 are shown as single strands for the sake of simplicity, it is to be understood that they may be composed of multiple steel ropes as is conventional in heavy duty elevator systems. Control cables 27 and 29 connect cars 1 and 3, respectively with the elevator supervisory control (not shown).

It is evident from FIG. 1 that as the machine 15 is energized, the drive sheave 9 is rotated thereby causing the elevator cars 1 and 3 to reciprocate in the hoistway 17. It is also clear from FIG. 1 that when the elevator car 1 is at the lower terminal the elevator car 3 is at the upper terminal, and as shown in the dotted lines, when the elevator car 1 is at the upper terminal the elevator car 3 is adjacent the lower terminal. This arrangement, therefore, inherently provides ideal spacing between the two cars operating between the lower and upper terminals.

If one of the elevator cars such as the elevator car 3 is replaced by a counterweight, the system disclosed in FIG. 1 is similar to the conventional elevator system now widely in use. According to this invention, however, the conventional dead load counterweight is replaced by another elevator car which can do useful work. This is especially significant in high-rise installations where the ratio of the useful payload to the total suspended load becomes less and less as the weight of the hoist cable and compensation ropes increases.

When viewed from another perspective, the invention contemplates a two car installation with a substantial reduction in the amount of machinery required. For instance, the two counterweights and their associated guide rail systems are eliminated completely. In addition, only one hoist cable, one compensation rope, one compensator, one traction sheave device, one elevator machine and one controller is required thereby eliminating duplicates of each of these items as required in the conventional two car system. Since it is the usual practice to make the counterweight equal to the weight of the car plus 40 percent of the load capacity of the car, the machine used in the duplex system will have to be slightly larger to supply sufficient torque for the 100 percent load out of balance condition. However, it is estimated that only about 10 percent more torque would be required and less additional torque would be required the higher the rise since in those installations the payload is a proportionally smaller percentage of the suspended load. Through the elimination of much of the apparatus, the duplex system greatly reduces the load that must be supported by the building for two car elevator service. In addition, the elimination of the counterweights and their guide rail systems reduces the hoistway cross-sectional area required for each car by approximately 15 percent, which means that more space is available for rental or other purposes.

With the higher rise elevators, hoist cable stretch becomes a significant problem. Cable stretch has two components, structural stretch which is the permanent stretch experienced by a new cable and elastic stretch

which is a temporary stretch and is a function of the load imposed on the cable. Great strides have been taken to reduce structural stretch. Rope suppliers are now providing prestressed rope for a nominal charge and approximately one half the structural stretch can be eliminated by going to independent wire rope center ropes. The structural stretch, which is initially the largest component, can be taken care of by adjustable hitches on one or both cars.

The amount of elastic stretch is a continuously varying factor. It not only depends upon the load in the car, but also the length of the cable on which that load is acting. For instance, if the elevator car 1 is in exact registry with the lower terminal and then the car becomes fully loaded, the car will sink lower below the level of the lower terminal than it would if it became fully loaded when adjacent the upper terminal. In highrise buildings this elastic stretch can reach as much as 2 to 3 inches causing a serious tripping hazard for passengers entering and leaving the car. In the conventional elevator system the car is merely releveled by slow speed operation of the hoist motor. This of course also repositions the counterweight. However, since the position of the counterweight is not critical this method of releveing is entirely satisfactory in those systems.

It is obvious, however, in the system disclosed in FIG. 1 that if the elevator car 1 is in exact registry with the lower terminal and the elevator car 3 is in exact registry with the upper terminal and then the elevator car 1 becomes fully loaded thereby causing it to sink 2 inches below the level of the lower terminal due to elastic stretch, operating the hoist motor 15 to bring the elevator car 1 up to the level of the lower terminal will cause the elevator car 3 to be displaced below the level of the upper terminal thereby causing a tripping hazard for passengers entering and leaving elevator car 3.

In order to overcome this difficulty it is contemplated by this invention that at least one of the elevator cars be provided with at least a limited amount of movement with respect to the hoist cable 5. For instance, in the example just discussed if the elevator car 3 is movable with respect to the hoist cable 5, then when the hoist motor 15 is operated to releve the elevator car 1 the adjusting means can be operated to move the elevator car 3 up with respect to the hoist cable 5 thereby maintaining it level with the upper terminal. If on the other hand, it is the car equipped with the adjusting means which must be releveled due to a change in the loading of the car, the hoist motor would not be activated since the adjusting means would make the adjustment necessary. Alternatively, both cars could be provided with the adjusting means and could be independently operated without affecting the other car.

An exemplary means for providing adjustment between the positioning of the elevator car and the hoist cable is shown in FIG. 2 wherein the car is supported by a sling identified by the general reference character 33. The sling is composed of two lower horizontal channel members known as safety channels 35 and 37, two vertical members known as stiles 39 and 41 and two upper channel members 43 and 45. The sling forms a vertical rectangular frame which surrounds the cab 31. The sling is connected to the hoist cable 5 (shown in FIG. 2 as being composed of six separate wire ropes) through a hitch (not shown) on a plate 47 fastened to the upper horizontal channel members 43 and 45.

The guide shoes 19 mentioned earlier which cooperate with the guide rails in the hoistway to guide the car in its upward and downward travel are connected to the stiles near their upper and lower extremities. Two horizontal angle members 49 and 51 are connected to the safety channels 35 and 37 near the stiles. A cross member 53 is supported by the horizontal arms of the angles 49 and 51. Four Duff-Norton worm gear jacks 55 are arranged in a rectangular array near the extremities of the angle members 49 and 51. All four jacks are driven by a motor and controller 57 mounted on the cross member 53 through a reducer 59 and connecting shafts 61. The cab 31 is supported by the four jacks through appropriate resilient mountings (not shown). Operation of the motor 57 causes the cab 31 to be raised and lowered relative to the sling, and therefore the hoist cable 5, in a level attitude through the coordinated operation of the jacks 55. Since it is desirable that the adjusting speed be on the order of 2 feet per minute, the power requirements for the motor 57 would be less than 1 horse power.

Guide shoes 63 cooperate with flanges on the inside of the stiles 39 and 41 to guide the upper portion of the cab while adjustments are being made. The entire cab 31 including the door operator 67 which operates the car door 65 through the well known linkage 69 is moved by the adjusting means. The auxiliary equipment 71, such as the inductor relays which cooperate with apparatus in the hoistway to determine the position of the car relative to the landing, etc., is also mounted on the cab 31 and is therefore raised and lowered by the adjusting means. It is obvious that the means for adjusting the position of the cab with respect to the hoist cable 5 could take many other forms.

In addition to accommodating for cable stretch, the adjusting mechanism is also useful in correcting for the settling of the building in which the elevator is installed. Of course, where the duplex elevator only operates between an upper and a lower terminal, the adjustment for settling of the building could be taken up by the hitch. However, where the duplex system serves a number of intermediate landings the adjustment means provide ideal accommodation for the variations in the settling of the building at the different landings.

The duplex elevator system can be arranged in a number of configurations to provide a wide variety of elevator service. FIG. 3 illustrates a number of exemplary arrangements. This Figure is not intended to illustrate a specific arrangement for a particular building but rather shows in composite form a variety of arrangements for the duplex system.

FIG. 3 illustrates a 36 story building having a main landing serving 35 landings numbered consecutively from the landing just above the main landing. The sky lobbies SLA, SLB and SLC are provided at the tenth, twentieth and thirtieth floors respectively. The sky lobbies are transfer floors at which passengers transfer from express or shuttle cars from the main landing to local cars for the floor desired. The sky lobby SLA is served by shuttle system SS1 comprising the counterbalancing duplex cars S1A and S1B. These two cars reciprocate between the main landing and sky lobby SLA in a manner which will be clear from the previous discussion.

Sky lobby SLB is served by shuttle system SS2 comprising the counterbalancing cars S2A and S2B which reciprocate between main landing and the sky lobby

SLB again in a manner which will be evident from the above discussion. In addition, since the sky lobby SLA is located mid-way between the main landing and SLB, the cars S2A and S2B may be stopped at SLA simultaneously. In this manner, the shuttle system SS2 may be utilized to serve both SLA and SLB if desired.

The sky lobby SLC is served by the shuttle system SS3 as the cars SSA and SSB reciprocate between the main landing and SLC. Since the sky lobby SLA is the same distance above the main landing that the sky lobby SLB is below SLC, the car S3A will be adjacent the sky lobby SLA when the car S3B is adjacent the sky lobby SLB and vice versa. It is evident then that the shuttle system SS3 may be utilized to serve just the sky lobby SLC or all of the sky lobbies. Of course with the combination of shuttle systems illustrated in FIG. 3, during peak hours the shuttle system SS1 can be arranged to serve the sky lobby SLA, while the system SS2 serves only the sky lobby SLB and the system SS3 serves only the sky lobby SLC. During light traffic hours the systems SS1 and SS2 could be shut down and the system SS3 could serve all of the sky lobbies.

The shuttle elevator systems which provide service between the main landing and the sky lobbies can be combined with second elevator service for providing local service to the floors adjacent the sky lobbies. The local elevator cars can be either the duplex counterbalancing cars or conventional counterweighted cars. Conventional counterweighted cars can be arranged in many ways to provide local service from a sky lobby. For instance, all of the local service cars can be arranged to serve all of the floors between the sky lobby being served and the next higher sky lobby. Alternatively a single car or a group of cars can be arranged to serve certain of the floors between the sky lobby being served and the next higher sky lobby and a second car or second group of cars can be arranged to serve another group of floors between the sky lobby being served and the next higher sky lobby. Such a system is shown in FIG. 3 where the conventional counterweighted elevator system L1 serves the sky lobby SLB and floors 21 through 24 while the local car L2 serves the sky lobby SLB and floors 25 through 29.

In yet another arrangement, the local cars can be arranged to serve floors above and below the associated sky lobby. For instance, in FIG. 3 the elevator system L1 serves the floors halfway between sky lobbies SLB and SLC while the elevator system L3 serves the floors halfway between sky lobby SLB and sky lobby SLA. Of course in practice the local bank of elevators would be located closer to the shuttle system serving the common sky lobby.

As mentioned above, the second elevator system providing local service can also take the form of the duplex counterbalancing system described in detail above. For instance, the local system such as L4 comprising the counterbalancing cars L4A and L4B can be arranged to provide local service above and below the sky lobby SLA. With both of the cars simultaneously adjacent sky lobby SLA, one car can be loaded with passengers desiring service to floors 11 through 15 while the other car is simultaneously loaded with passengers desiring service to floors five through nine. With the landings nine and 11, eight and 12, seven and 13, six and 14, and five and 15 being equal distances below and above sky lobby SLA, respectively, when one of the cars of system L4 is adjacent one of the landings in each pair the

other car is adjacent the other landing so that both of the cars may be transferring passengers to the local floors simultaneously.

As arranged in FIG. 3, the cars L4A and L4B can each serve all of floors five through 15. This duplication of effort is not necessary, however, and the car may be alternatively arranged so that one car serves only the landings above the associated sky lobby while the other car serves only the landings below the associated sky lobby. For instance, in the system L5 shown in FIG. 3 the car L5A can only serve sky lobby SLB and floors 21 through 24 since the hoistway for that car does not extend below the sky lobby SLB. On the other hand, the car L5B can only serve the sky lobby SLB and floors 16 through 19 since its hoistway does not extend to the 24th floor. The end of the hoist cable supporting the car L5B is routed down the side of the hoistway for the car L5A and then is aligned with the center of the hoistway for the car L5B by deflection sheaves 73. Of course, the hoistway for the car L5B must extend slightly above the sky lobby SLB to provide room for the deflecting sheaves. The net result is that the hoistway spaced required is reduced to a minimum. Remembering that with the duplex system the cross-sectional area of each hoistway is reduced by approximately 15 percent due to the elimination of the counterweight, this arrangement releases the maximum amount of space for other useful purposes.

Another local duplex system L6 similar to the system L5 but serving the sky lobby SLC illustrates how the local systems can be combined to provide service to all the floors between sky lobbies.

The local system L7 shows yet another possible arrangement for the duplex counterbalancing cars. In this system the car L7A serves sky lobby SLC and floors 25 through 29 while the car L7B serves sky lobby SLB and floors 21 through 25. In this arrangement the cars can load and unload at their associated sky lobbies simultaneously. It should also be observed that according to this arrangement if the sky lobbies were an odd number of floors apart, the cars would not have to duplicate service to the common intermediate floor.

The system L8 shows yet another exemplary arrangement of the duplex counterbalancing cars. In this system the cars operate in a common hoistway with the car L8A serving the sky lobby SLA and floors six through nine while the car L8B serves the main landing and landings one through four. Of course according to this arrangement neither car can serve the fifth floor since that space is occupied by the deflection sheaves 73, however, this space could be occupied by a service floor containing heating and air conditioning equipment as is common in modern buildings.

As mentioned above the specific arrangements illustrated are meant to be illustrative only since it is obvious that an infinite variety of arrangements could be conceived within the scope of the invention. For instance, the system L4 or L5 which operates from a certainly located lobby could be adapted for use in unconventional buildings such as those built on a hillside where the main landing is located at the center of the structure.

I claim as my invention:

1. In an elevator system a structure having first and second landings vertically displaced along a hoistway, two elevator cars, traction sheave means mounted at the top of the hoistway, a hoist cable reeved over said

traction sheave means, said elevator cars being suspended from opposite ends of said hoist cable in counterbalancing relation so that when one car is adjacent one landing the other car is adjacent the other landing, drive means connected to said traction sheave means and operative to raise and lower the counterbalancing cars in opposition to each other to serve the landings, third and fourth landings located between said first and second landings with said third landing being the same distance from said first landing as the fourth landing is from said second landing, and deflecting sheave means located between said third and fourth landings for deflecting one side of said hoist cable so that the car suspended from said one side of said hoist cable reciprocates in said hoistway directly below the other car, whereby the two cars operate along a common vertical axis with said one car being adjacent the first landing when said other car is adjacent the second landing and said one car is adjacent the third landing when said other car is adjacent the fourth landing.

2. In an elevator system a structure having first, second, and third landings vertically displaced in ascending order, first and second elevator cars, first and second hoistways for said first and second elevator cars, respectively, traction sheave means mounted at the top of the first hoistway, a hoist cable reeved over said traction sheave means, said elevator cars being suspended from opposite ends of said hoist cable in counterbalancing relation so that when one car is adjacent the first landing the other car is adjacent the third landing, drive means connected to said traction sheave means and op-

erative to raise and lower the counterbalancing cars in opposition to each other to serve the landings, said first hoistway extending from said third landing to said second landing with said second hoistway being parallel to and adjacent said first hoistway and extending from substantially said second landing to said first landing, the side of said hoist cable supporting said first car being routed down said first hoistway, and including deflection sheave means above said second landing for guiding said hoist cable so that said second car is suspended in said second hoistway, whereby said first car operates between said second, and third landings while said second car operates between said second and first landings.

3. The system of claim 2 including additional pairs of landings with one landing of each pair being located in said first hoistway substantially the same distance above said second landing as the other landing in the same pair is located below said second landing in the second hoistway, whereby when the first car is adjacent one landing in each pair the second car is substantially adjacent the other landing in that same pair of landings.

4. The elevator system of claim 3 including adjusting means associated with at least a first one of the elevator cars and operative to adjust the position of said first car relative to the hoist cable whereby both cars can be brought into exact registry with the adjacent landing simultaneously despite stretch of the hoist cable caused by variations in the loading of the cars and despite settling of the structure.

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