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ELEVATOR SYSTEM

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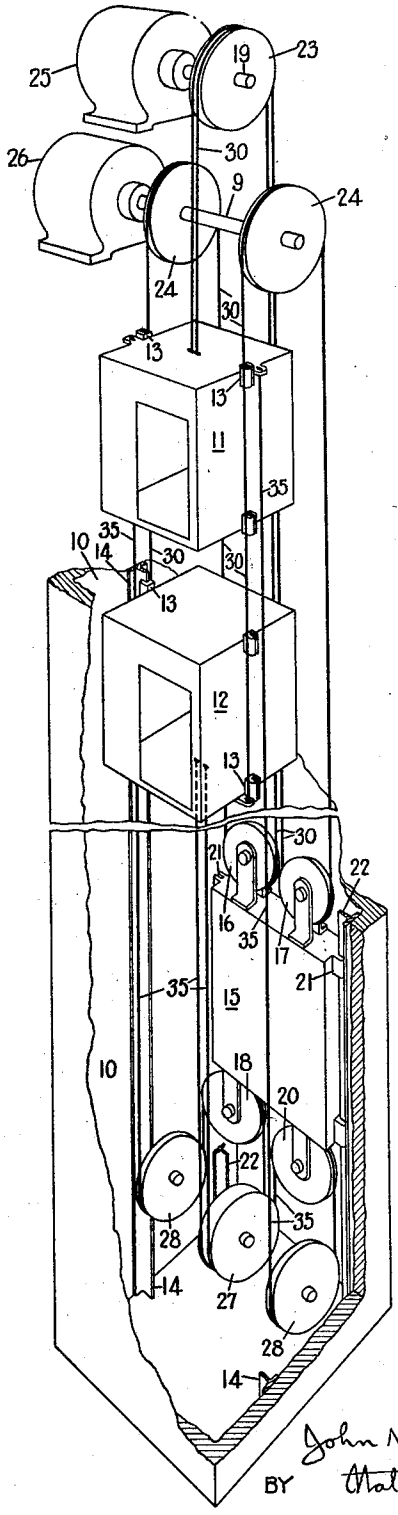

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ELEVATOR SYSTEM

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The present invention relates to elevator installations and particularly to elevator installations in which a plurality of elevator cars are arranged to operate in the same hatchway.

One feature of the invention is to reduce the amount of space and material for an elevator installation in which a plurality of elevator cars are arranged to operate in the same hatchway and to reduce the initial cost and upkeep of such installation.

Another feature resides in counterbalancing two elevator cars, independently operable in the same hatchway, by one counterweight common to both of the cars.

Another feature resides in the arrangement of the roping for two elevator cars independently operable in the same hatchway.

Other features and advantages will be apparent from the following description and appended claims.

The invention involves the provision of one counterweight for two independently operable elevator cars in the same hatchway, with the counterweight connected to both cars in such manner as to provide the desired counterbalancing effect. The invention further involves arranging the hoisting roping and compensating roping for the cars in such manner that the unbalanced weight of the hoisting roping is properly counterbalanced for all positions of the cars in the hatchway.

In carrying out the invention, according to the preferred arrangement, both the hoisting roping and the compensating roping are common to both of the elevator cars. The hoisting roping is connected to the top of the upper car from where it extends upwardly and around the hoisting sheave for that car at the top of the hatchway, down to and around sheaves secured to the top of the counterweight, up to and around the hoisting sheaves for the other car at the top of the hatchway and down to the lower car. The compensating roping is arranged in a similar manner, being connected to the bottom of the lower car from where it extends downwardly to and around the compensating sheave for that car at the bottom of the hatchway, up to and around sheaves secured to the bottom of the counterweight, down to and around the compensating sheave for the upper car at the bottom of the hatchway, and up to the upper car.

For purposes of illustrating the invention, one embodiment thereof is shown in the accompanying drawing in which the single figure is a schematic representation in perspective of an elevator installation in which two elevator cars are independently operable in one hatchway and in which the counterweight and roping system is arranged in accordance with the principles of the invention.

Referring to the drawing, the hatchway for the two cars is designated by the numeral 10. The upper car is designated 11 and the lower car 12. Each car is provided with guide shoes 13 for cooperating with guide rails 14 secured to the walls of the hatchway. These guide rails are preferably common to both elevators cars, as illustrated, but separate guide rails may be provided if desired. The guide shoes 13 are preferably mounted approximately midway of the sides of their respective cars and, in case of a guide rail common to both cars, are in the same vertical line. The cars 11 and 12 are preferably constructed so as to have approximately equal capacities and to be of approximately equal weight.

A single counterweight 15 is provided for counterbalancing the weight of both cars. The counterweight is provided with guide shoes 21 cooperating with a pair of guide rails 22 secured to the walls of the hatchway 10. The guide rails are so positioned that the counterweight operates in a plane adjacent and parallel to the back walls of the elevator cars. The weight of the counterweight is twice that required for one of the cars which amounts to the sum of the weights of the cars, plus approximately forty per cent of the sum of the weights of their rated loads, plus one-half the sum of the weights of the travelling cables for the two cars.

Although the invention is applicable to installations employing various types of drives, such as installations in which the elevator car is raised and lowered by drum machines, it is particularly applicable to installations in which the cars are raised and

lowered by traction machines. A traction drive installation has been illustrated. Double wrap traction drives are particularly suitable but single wrap drives are also suitable, and single wrap drives have been shown for convenience of illustration. Each elevator car has its own hoisting machine in order to provide for independent operation. The hoisting machine for the upper car is illustrated as arranged on a level above that for the lower car but it is to be understood that both hoisting machines may be arranged on the same level as by the use of idler sheaves or proper positioning of the secondary sheaves in case of double wrap traction installations. The hoisting machine for the upper car comprises a hoisting sheave 23 mounted on a shaft 19 driven by a hoisting motor 25. As a result of the arrangement of roping, the hoisting machine for the lower car comprises two spaced hoisting sheaves 24 mounted on shaft 9 driven by hoisting motor 26.

A compensating sheave 27 for the lower car and compensating sheaves 28 for the upper car are mounted at the bottom of the hatchway. These sheaves are mounted in guides, not shown, and each may be arranged to have only a limited upward movement.

The hoisting cables are common to both elevator cars and are designated 30. They are secured at one end to the top of the upper car 11 from where they extend upwardly to and around hoisting sheave 23, thence downwardly to sheaves 16 and 17 secured to the top of the counterweight 15. The hoisting cables divide at this point, half of them passing around sheave 16 and the other half passing around sheave 17. From the two sheaves 16 and 17, these groups of hoisting cables extend upwardly, to and around the hoisting sheaves 24 for the lower car, and thence downwardly past the upper car to lower car 12, to which the other ends of the cables are secured.

The compensating cables are also common to both elevator cars and their arrangement is substantially identical with that of the hoisting cables. The compensating cables, designated 35, are secured at one end to the bottom of the lower car 12 from where they extend downwardly to and around the compensating sheave 27 for the lower car and thence upwardly to the sheaves 18 and 20 secured to the bottom of the counterweight. At this point the compensating cables divide, half of them passing around sheave 18 and the other half around sheave 20. From there, the compensating cables extend downwardly to and around compensating sheaves 28 for the upper car, and thence upwardly past the lower car to upper car 11, to which the other ends of the cables are secured.

Only two hoisting cables and two compensating cables are illustrated. This is done merely for convenience of illustration and it is understood that the number of hoisting cables and compensating cables employed are in accordance with the requirements of the particular installation. In order to provide exact compensation for the unbalanced weight of the hoisting cables alone, the number of compensating cables should be the same as the number of hoisting cables, assuming that the same size cables are employed. In case of different size cables, the total weight of the compensating cables should be substantially equal to that of the hoisting cables. However, the weight of the compensating cables may be varied to allow for the partial compensating effect of the travelling cables for the cars 11 and 12, as by varying the number of compensating cables employed.

With the arrangement of roping as above described, upon movement of the upper car 11 while the lower car 12 is stationary, the counterweight 15 moves in a direction opposite to that of the upper car at one-half the speed of that car. Similarly, the counterweight 15 moves at half the speed of lower car 12 in the direction opposite to that of lower car 12 when the lower car moves at a time when the upper car is stationary, If both cars are moving in the same direction, the counterweight moves in the opposite direction at one-half the sum of the speeds of the two cars. If the cars are moving in the opposite direction, the counterweight moves at one-half the difference of the speeds of the two cars and in a direction opposite to that of the faster moving car. If the two cars are moving in opposite directions at the same speed, the counterweight remains stationary.

The hoisting ropes and compensating ropes may be maintained vertical by any suitable arrangement. In case of double wrap traction drives, the hoisting ropes may be maintained vertical by a proper positioning of the hoisting sheaves and secondary sheaves. In case of single wrap traction drives, idler sheaves may be employed or, in case of proper diameter hoisting sheaves for the lower car, by the use of one idler sheave associated with the outer one of the driving sheaves. In case of the compensating sheaves, the desired positions of the compensating cables may be obtained by proper diameters and locations of the compensating sheaves, or one or more idler sheaves may be provided if desired.

With a counterweight common to both of the elevator cars and a system of roping as above described, the amount of space and material for the elevator installation is reduced. Also, the initial cost of the installation and the cost of its up-keep is reduced.

Various parts of the elevator installation are not shown in the drawing, these parts

being omitted in order that the invention may be more clearly seen from the drawing. The travelling cables and idler sheaves have also been omitted from the drawing to render the drawing more readily understood.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An elevator installation comprising, two superposed elevator cars in the same hatchway, each operable from one floor to another independently of the other, and means common to both of said cars for counterbalancing the weight of said cars.

2. An elevator installation comprising, two superposed elevator cars independently movable in the same hatchway, and a counterweight movable in said hatchway, said counterweight being common to both of said cars.

3. An elevator installation comprising, two superposed elevator cars in the same hatchway, each of said cars being operable from one floor to another independently of the other car, and a single counterweight movable in said hatchway, said counterweight being connected to both of said cars.

4. An elevator installation comprising, a hatchway, two superposed elevator cars in said hatchway, each of said cars being operable from one floor to another independently of the other car, a single counterweight movable in said hatchway, and hoisting roping suspending said counterweight, said roping being connected at one end to one of said cars and at the other end to the other of said cars.

5. An elevator installation comprising; a hatchway; two superposed elevator cars independently operable in said hatchway; a single counterweight movable in said hatchway; a hoisting sheave for the upper of said cars; spaced hoisting sheaves for the lower of said cars; idler sheaves secured to said counterweight; and hoisting roping connected at one end to the upper car, passing at least partially around the hoisting sheave for that car, the idler sheaves and the hoisting sheaves for the lower car, and connected at the other end to the lower car.

6. An elevator installation comprising; a hatchway; two superposed elevator cars independently operable in said hatchway; a hoisting sheave for the upper of said cars; two spaced hoisting sheaves for the lower of said cars; means for driving the hoisting sheave for the upper car; means for driving the hoisting sheaves for the lower car; a single counterweight movable in said hatchway; a pair of sheaves secured to the top of the counterweight; and hoisting roping secured at one end to the upper car, extending upwardly to and at least partially around the hoisting sheave for the upper car, downwardly to said sheaves secured to the counterweight, dividing and a portion of said roping passing partially around one of said counterweight sheaves, thence extending upwardly to and at least partially around one of said hoisting sheaves for the lower car and thence downwardly past the upper car and secured at its other end to the lower car, and the other portion of said roping passing partially around the other of said counterweight sheaves, thence extending upwardly to and at least partially around the other of said hoisting sheaves for the lower car and thence downwardly past the upper car and secured at its other end to the lower car.

7. An elevator installation comprising, a hatchway, two superposed elevator cars independently operable in said hatchway, a single counterweight movable in said hatchway, hoisting roping connected to said counterweight and to each of said cars, and compensating roping connected to said counterweight and to each of said cars.

8. An elevator installation comprising, a hatchway, two superposed elevator cars independently operable in said hatchway, a single counterweight movable in said hatchway, hoisting sheaves for said cars, hoisting roping suspending said counterweight, passing over said sheaves and connected at one end to one of said cars and at the other end to the other of said cars, compensating sheaves for said cars, and compensating roping suspended from said counterweight, passing under said compensating sheaves and connected at one end to one of said cars and at the other end to the other of said cars.

9. An elevator installation comprising; a hatchway; two superposed elevator cars independently operable in said hatchway; a single counterweight movable in said hatchway; a hoisting sheave for the upper of said cars; spaced hoisting sheaves for the lower of said cars; idler sheaves secured to the top of the counterweight; hoisting roping connected at one end to the upper car, passing at least partially around the hoisting sheave for that car, the idler sheaves, and the hoisting sheaves for the lower car, and connected at the other end to the lower car; a compensating sheave for the lower car; spaced compensating sheaves for the upper car; idler sheaves secured to the bottom of said counterweight; and compensating roping connected at one end to the lower car, passing at least partially around the compensating sheave for that car, the lower idler sheaves for the counterweight and the compensating

sheaves for the upper car, and connected at the other end to the upper car.

10. An elevator installation comprising; a hatchway; two superposed elevator cars independently operable in said hatchway; a hoisting sheave at the top of the hatchway for the upper of said cars; two spaced hoisting sheaves at the top of the hatchway for the lower of said cars; means for driving the hoisting sheave for the upper car; means for driving the hoisting sheaves for the lower car; a single counterweight movable in said hatchway; a pair of sheaves secured to the top of the counterweight; hoisting roping secured at one end to the upper car, extending upwardly to and at least partially around the hoisting sheave for the upper car, downwardly to said sheaves secured to the counterweight, dividing and a portion of said roping passing partially around one of said counterweight sheaves, thence extending upwardly to and at least partially around one of said hoisting sheaves for the lower car and thence downwardly past the upper car and secured at its other end to the lower car, and the other portion of said roping passing partially around the other of said counterweight sheaves, thence extending upwardly to and at least partially around the other of said hoisting sheaves for the lower car and thence downwardly past the upper car and secured at its other end to the lower car; a compensating sheave at the bottom of the hatchway for the lower of said cars; two compensating sheaves at the bottom of the hatchway for the upper of said cars; a pair of sheaves secured to the bottom of the counterweight; and compensating roping secured to the lower car, extending downwardly to and at least partially around the compensating sheave for the lower car, upwardly to said sheave secured to the bottom of the counterweight, dividing and a portion of said compensating roping passing partially around one of said sheaves secured to the bottom of the counterweight, thence extending downwardly to and at least partially around one of said compensating sheaves for the upper car and thence upwardly past the lower car and secured at its other end to the upper car, and the other portion of said compensating roping passing partially around the other of said sheaves secured to the bottom of the counterweight, thence extending downwardly to and at least partially around the other of said compensating sheaves for the upper car and thence upwardly past the lower car and secured at its other end to the upper car.

In testimony whereof, I have signed my name to this specification.

JOHN NORMAN ANDERSON.