Oct. 10, 1933. J. HUNT 1,930,239

ELEVATOR SYSTEM

Filed Dec. 30, 1931 5 Sheets-Sheet 1

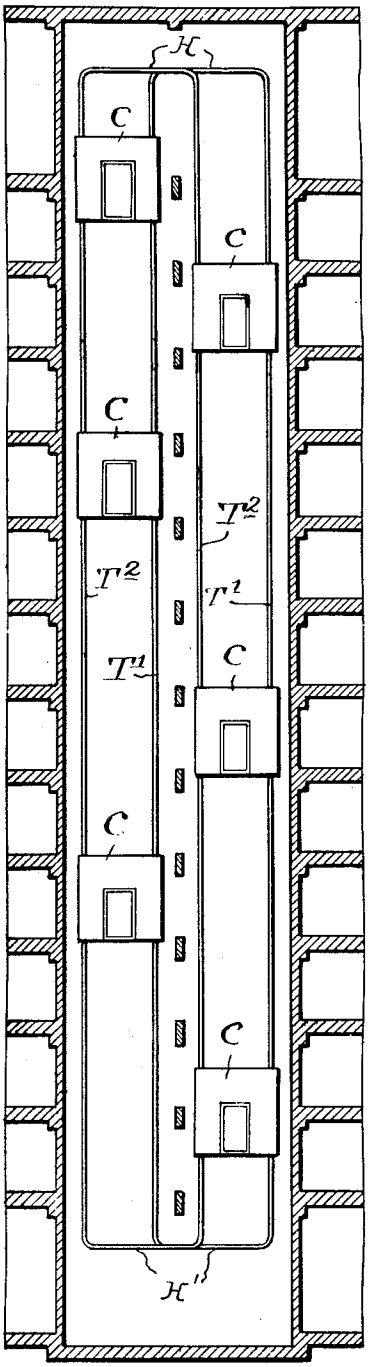


Fig. 1

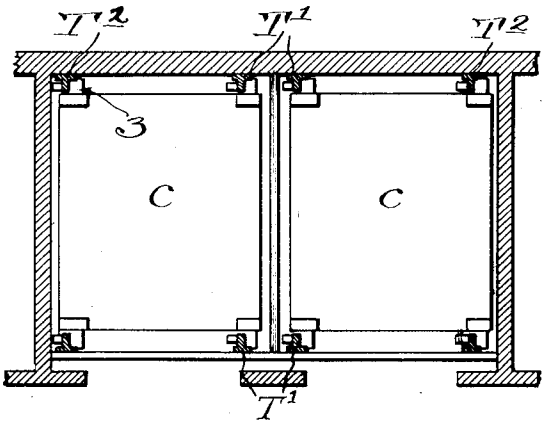


Fig. 2

Witness:
Chas. L. Sounds

Inventor,
Jarvis Hunt,
Offield, McCulloch, Scott & Hook,
Attys.

Oct. 10, 1933. J. HUNT 1,930,239

ELEVATOR SYSTEM

Filed Dec. 30, 1931 5 Sheets-Sheet 2

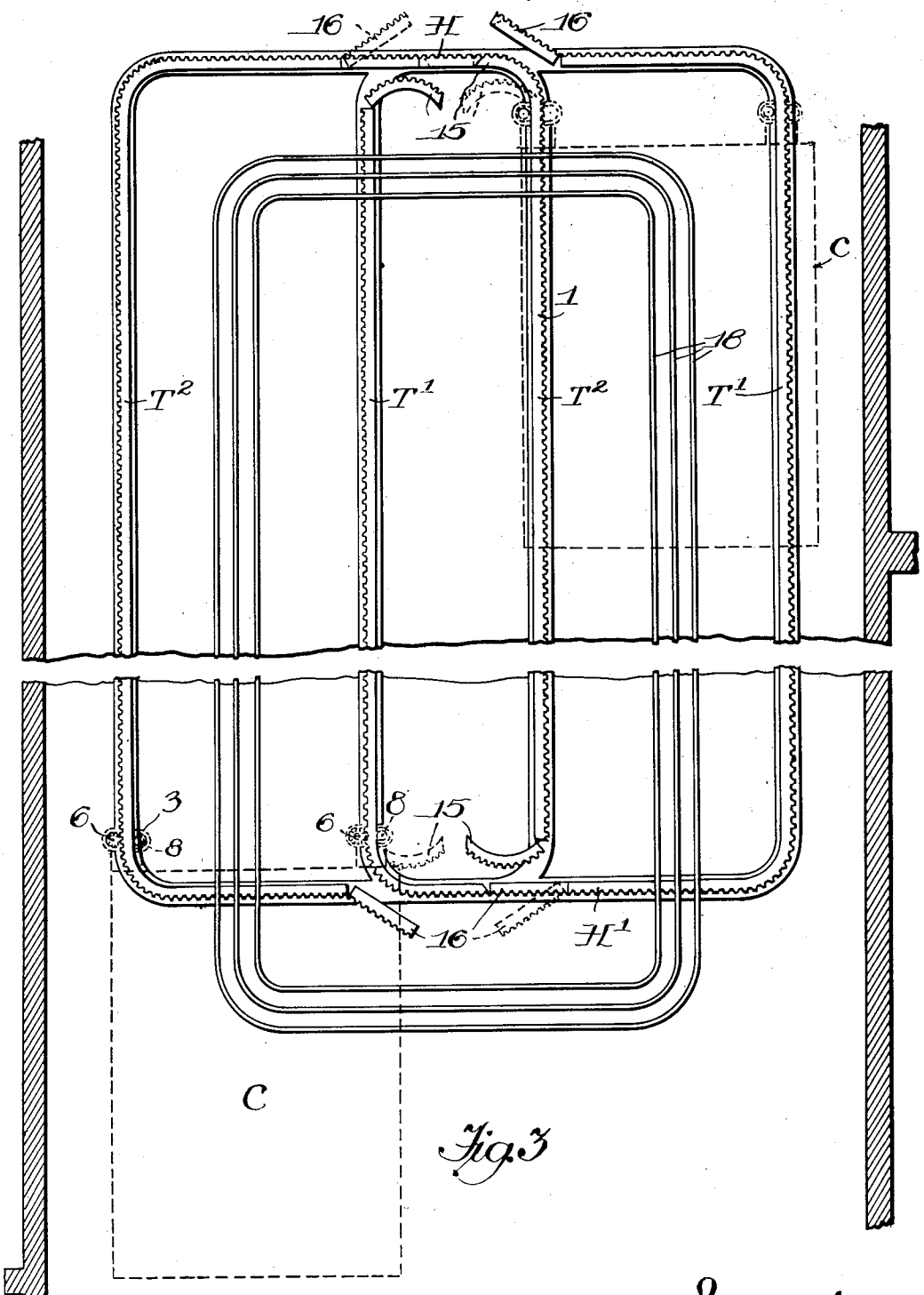


Fig. 3

Witness:
Chas. L. Tourish.

Inventor
Jarvis Hunt
by Fiels, Mollhade, Scott & Poole
Attys.

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ELEVATOR SYSTEM

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Fig. 4

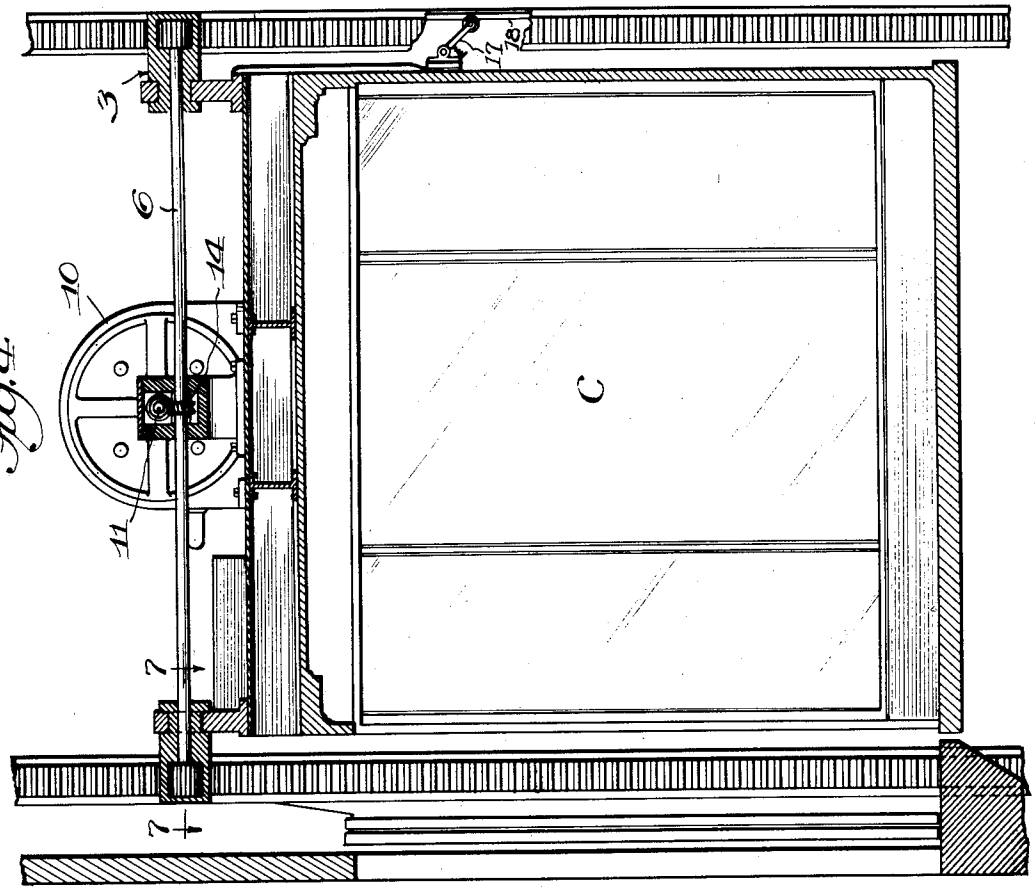
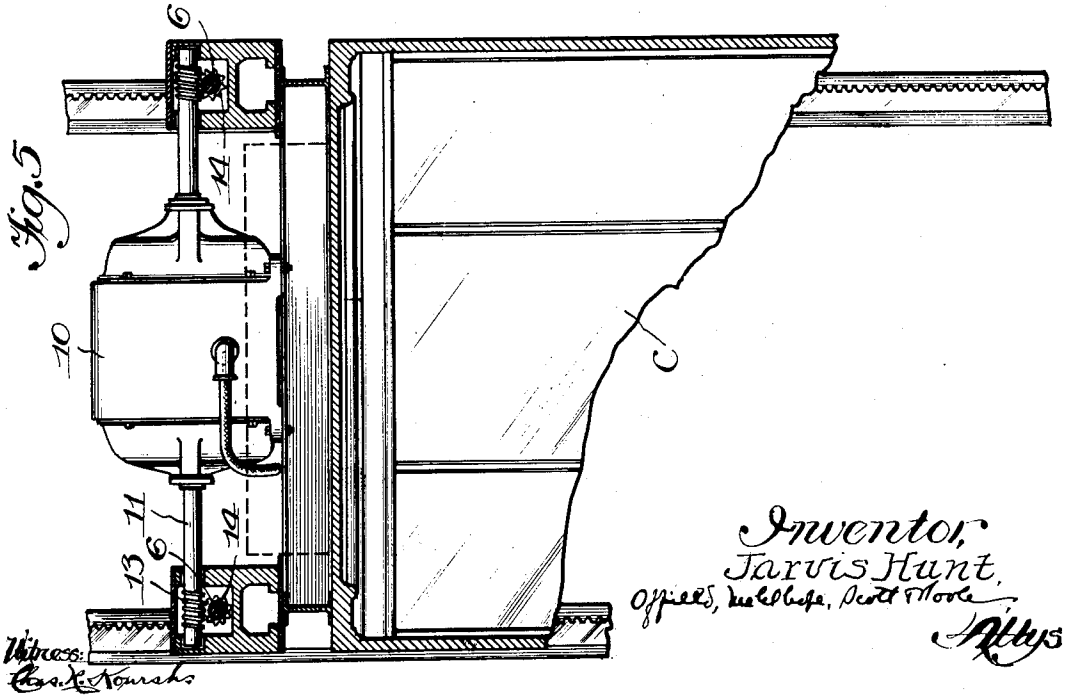


Fig. 5



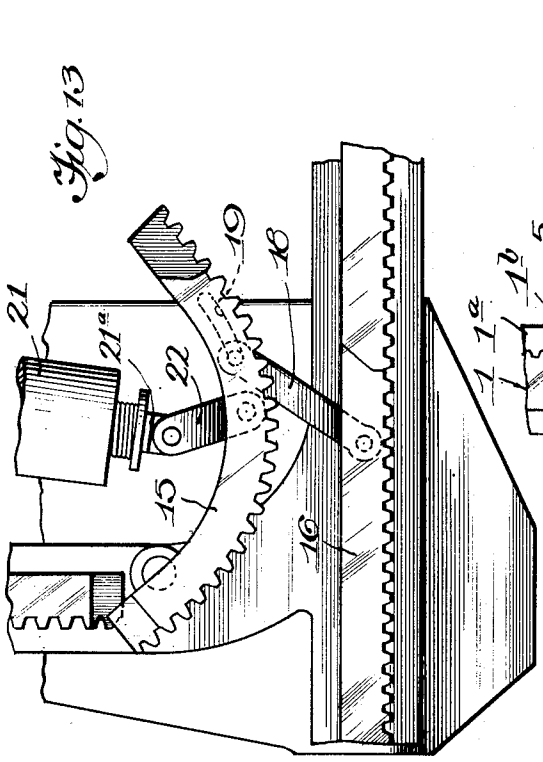
Witness:
Chas. K. Nourse

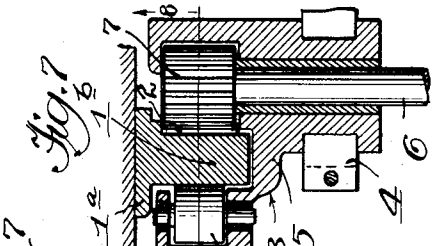
Inventor,
Jarvis Hunt,
Offield, McCullough, Scott & Moore
Attys

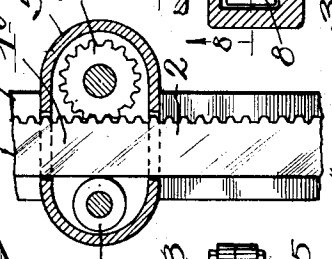
Oct. 10, 1933. J. HUNT 1,930,239

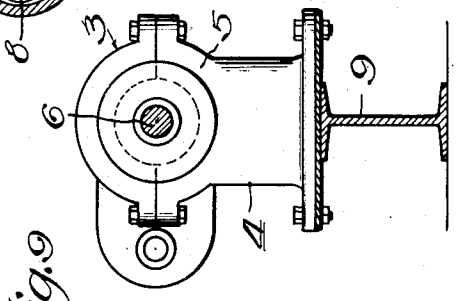
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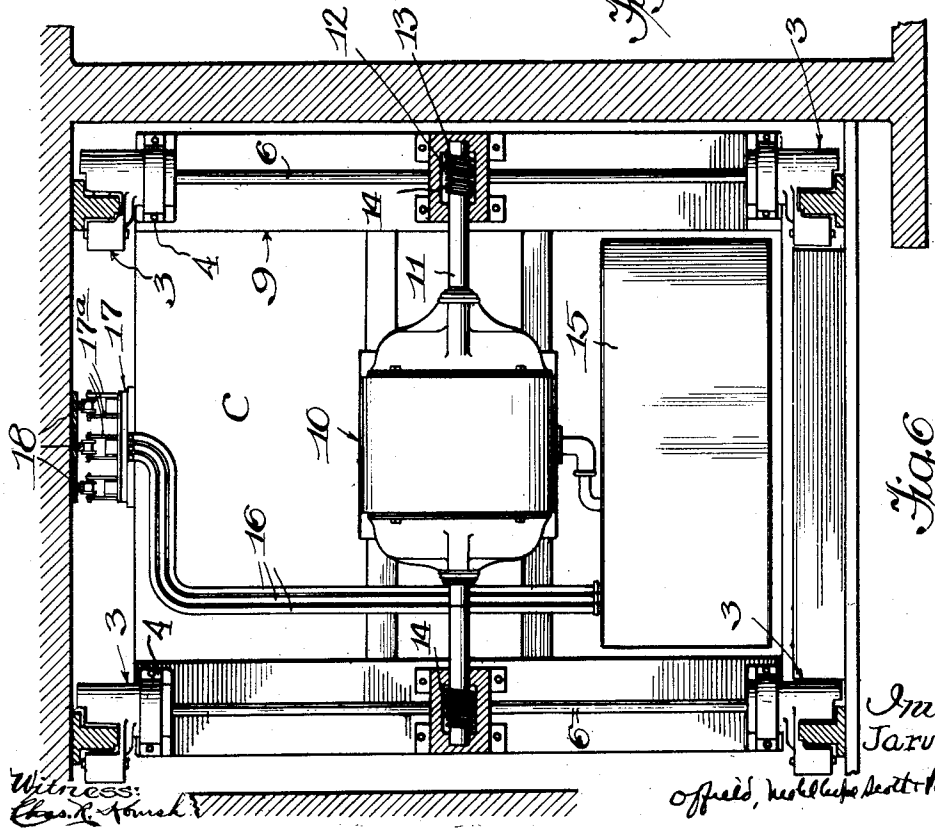
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Witness:
Chas. L. Tonsh

Inventor
Jarvis Hunt,
by Fields, Middleton, Scott, Porter & Hibbs

Oct. 10, 1933. J. HUNT 1,930,239

ELEVATOR SYSTEM

Filed Dec. 30, 1931 5 Sheets-Sheet 5

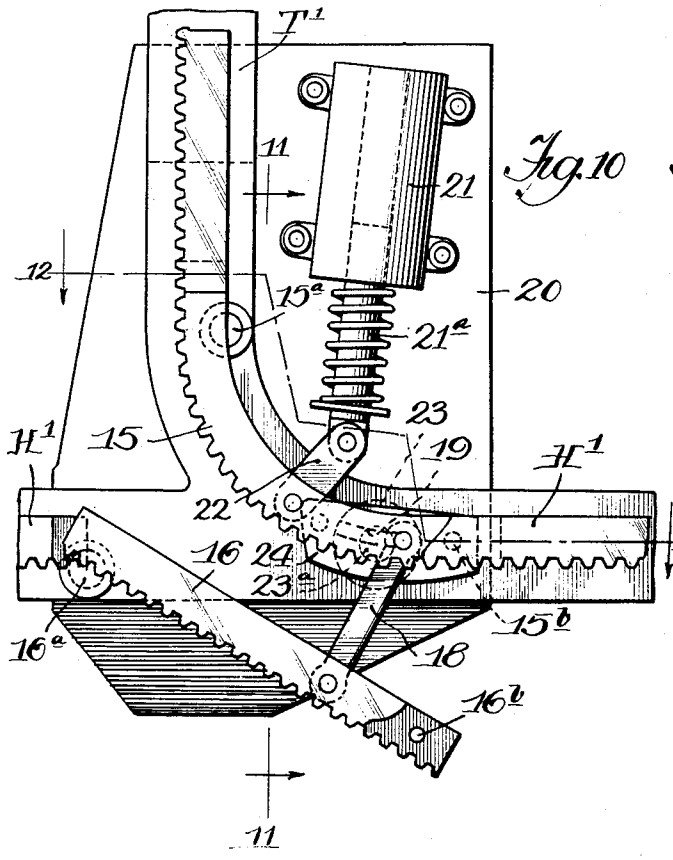


Fig. 10

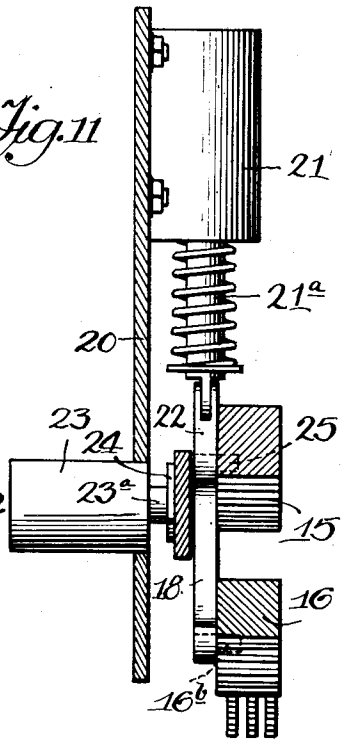


Fig. 11

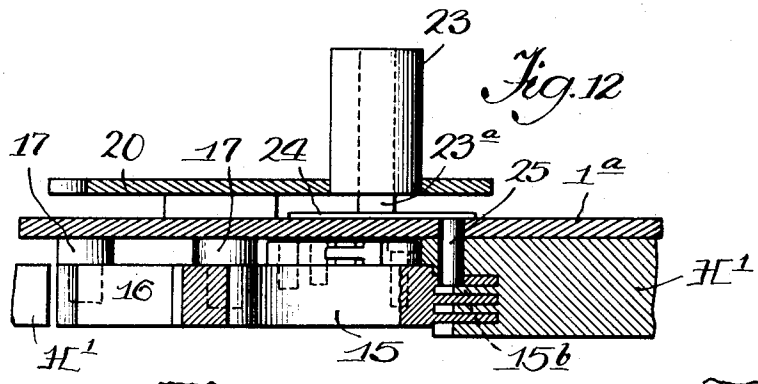


Fig. 12

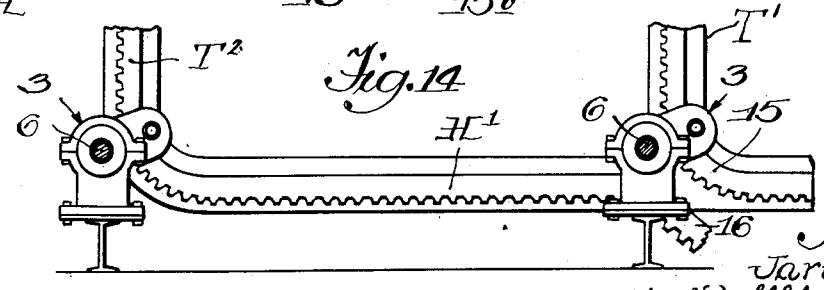


Fig. 14

Witness:
Chas. L. Hoursl.

Inventor,
Jarvis Hunt,
Offield, Mellette, Scott & Poole.
Attys.

Patented Oct. 10, 1933 1,930,239

UNITED STATES PATENT OFFICE

1,930,239

ELEVATOR SYSTEM

Jarvis Hunt, Chicago, Ill.

Application December 30, 1931
Serial No. 583,843

9 Claims. (Cl. 187—16)

This invention relates to elevator systems for office and other buildings requiring continuous and extensive elevator service between floors.

The object of the invention is primarily to provide an elevator system wherein a number of cars travel in a vertical loop or circuit ascending in one shaft and descending in an adjacent shaft with crossovers at the top and bottom, to the end that the entire system may be operated within the space occupied by two shafts.

The underlying purpose of such a system is essentially one of economy of space, thus doing away with the considerable amount now given over to elevator shafts in the modern office building which otherwise could be utilized as productive rental space.

Any practical system embodying the idea of a car travelling in a vertical circuit must necessarily include the means and mechanism for accomplishing the results, the chief of which would appear to be the transfer of the car from one shaft to the other when it reaches the top or bottom of its vertical travel, and to do so in such manner that the transverse movement becomes a continuation of the vertical movement.

A preferred embodiment of the invention will now be described in connection with the accompanying drawings, in which

Figure 1 is a diagrammatic view in vertical section representing the system as installed in a building;

Figure 2 is a general view in vertical section through the portion of the building occupied by the system;

Figure 3 is a diagrammatic view of the system showing the arrangement of the tracks and switches;

Figure 4 is a view in vertical section through a car and the adjacent portion of the shaft;

Figure 5 is a view in vertical section through a car as taken on line 5—5 of Figure 4;

Figure 6 is a top plan view of the car with positions of the driving mechanism shown in section;

Figure 7 is an enlarged detail view of one of the hangers which support the elevator cab, as taken on line 7—7 of Figure 4;

Figure 8 is another detail view of the hanger as taken on line 8—8 of Figure 7;

Figure 9 is a view of one of the hangers in end elevation;

Figure 10 is an enlarged detail view of one of the switch units;

Figure 11 is a view in vertical section taken on line 11—11 of Figure 10;

Figure 12 is a detail view in horizontal section taken on line 12—12 of Figure 10;

Figure 13 is a view similar to Figure 10 showing the track sectors in reversed position; and

Figure 14 is a view showing the manner in which an elevator cab negotiates a change of direction.

The elevator system herein shown is designed to be installed in any building requiring elevator service, although no attempt has been made to indicate the capacity of the building. In other words, a single unit system of elevators has been shown, the number being increased as the size of the building requires. Thus locating the space for the elevators, a single unit consists of two vertical shafts preferably located in close proximity, although they may be removed somewhat from each other. Moreover, the shafts may be arranged "back to back" or "side by side", meaning that the "up" and "down" entrances from the floors face in opposite directions or in the same direction and adjacent each other. The latter arrangement is used in the present disclosure.

And finally, the shafts are connected at top and bottom by transverse tracks or cross-overs, so that a car travels upwardly in one shaft, shifts laterally on reaching the top, and thence downwardly in the other shaft and back to the ascending shaft when it reaches the bottom. A car thus follows a circuituous path, always traveling in the same direction, so that it becomes possible to increase the number of cars and thus maintain service at regular intervals, the number of cars in service depending on the traffic that can be handled efficiently by one unit. For obvious reasons, one kind of service would be maintained in one unit, since express and local stops could not very well be made, although it would be possible to provide an intermediate or "shunt" cross-over one-half the way up, so that certain cars would operate between the lower floors and others would handle traffic from all floors. Manifestly a system of block signals would have to be put into effect and the operation of the cars carried on according to schedule in order to avoid confusion and delay. Generally speaking, the mode of operation of a car may be likened to a vertical cogway, that is, the cars operate between vertical tracks having teeth on one face after the manner of a vertical rack, while the car carries pinions meshing with the teeth and driven by a motor mounted atop the car and controlled by the operator.

The cars or cabs are of the same type as are in

common use in other present day systems, and the tracks are mounted in the shafts in much the same manner as those which serve as guideways for the cable hoist operated cars, although by preference there are four tracks, one in each corner of each shaft which may be either divisions of one large shaft or separate shafts, in either case being connected at their upper and lower ends by transverse passages, as clearly shown in Figures 1, 2 and 3. For convenience, each pair of tracks along the outer and inner sides of the shafts are designated T^1 and T^2, respectively.

Each track is made up of structural steel members 1 of T-section, having a base flange 1^a and a relatively thick track flange 1^b projecting at right angles from the base flange. On one side face of the track flange 1^a is a rack 2 having teeth of any suitable type, while the opposite side face is plain and forms a track as will presently be seen. It will be noted particularly that the track members in the same shaft are installed so that their racks face in the same direction, namely, to the right in the right-hand shaft, and to the left in the left-hand shaft (Figure 3) which will be designated as the "up" and "down" shafts, respectively.

On the top of each car and near the corners are mounted the hangers 3, which embody the driven track engaging members consisting generally of four bearing standards 4 mounted at each of the four corners of the top structure of the car, and rotative bearing blocks 5 journalled to revolve freely in bearing standards and about the axes of parallel counter shafts 6 having their end portions journalled in the bearing blocks 5 and having pinions 7 mounted at their extreme ends which mesh with the racks 2 on the vertical faces of the track members. Offset radially from the pinion 7 is a roller 8 also carried by and journalled in each bearing block 5, the outer portions of which immediately adjacent the pinion and the roller being cast in the form of an oval-shaped casing or housing in which the pinion and roller are enclosed, and with the intermediate portion removed to receive the track flange which is engaged on one side by the pinion, and on the opposite face by the roller 8, as shown in Figures 7 and 8.

The car is preferably surmounted by a superstructure or frame 9 made up of I-beams arranged to provide a support or platform for the hangers 3, as well as the driving mechanism consisting of a motor 10 mounted at the center of the platform, a main drive shaft 11 forming extensions of the armature shaft of the motor which, as arranged, extends crosswise of the cab and at right angles to the counter-shafts 6, 6. The ends of the drive shaft 11 are journalled in bearing boxes 12, 12 and have worms 13 mounted thereon which mesh with worm wheels 14, 14 carried by the counter-shafts 6, 6 which also pass through the bearing boxes, but beneath and at right angles to the drive shaft. (Figures 5 and 6.)

A control box 15 is also mounted on the top of each car and from which lead the current supply conductors 16 to the rear edge and thence downwardly along the back wall of the car to a current pick-up fixture 17 having a series of short trolley poles 17^a which contact with a current supply wire 18 mounted on the wall of the shaft and following the path of the cab throughout the entire circuit of the system. Cables extend from the control box to the motor and also to the controller lever in the cab by which the same is controlled by the operator.

Referring now to Figures 1 and 3, it will be seen that the two groups of vertical track members T^1 T^2 are mounted within two adjacent shafts or, as already stated, within one shaft enlarged or extended in one direction sufficiently to accommodate an "up" and "down" group of tracks, each group being connected with the other group by horizontal connecting tracks. Moreover, these horizontal connecting tracks join their respective vertical tracks through the medium of curved track sectors, although there are junction points where a system of switches has to be inserted in order to permit the hangers to properly follow each other to and from the horizontal portions of the track system.

Perhaps it would be well to discuss at this point the problem that presents itself in shifting the cars transversely after reaching the top or bottom of the shaft. Manifestly the cars must remain in an upright position at all times, so that provision must be made for changing directions and also for allowing the cars to travel crosswise on the same set or pair of horizontal tracks H. To illustrate (Figure 3): the car C shown at the upper end of the right-hand shaft is assumed to be moving upwardly and about to be transferred laterally and to the left into the left-hand or "down" shaft. Now the vertical tracks T^1, T^2 in the "up" shaft are just reversed in the "down" shaft, that is, outermost track T^1 in the "up" shaft becomes or connects with the innermost track T^2 in the "down" shaft, and vice versa. Consequently, in order that the hanger traveling on the outer vertical track in the "up" shaft can shift to the inner vertical track in the "down" shaft, it has to travel over the same horizontal track H previously traveled by the hanger engaging the inner "up" tracks. This means then that after the leading hanger has traversed the curved track sector 15 and reached the horizontal or cross-over track H, this curved sector must be replaced by a straight sector 16 over which the trailing or following hanger can pass to reach the portion of the horizontal track beyond the gap. Likewise, after the leading hanger has passed onto the cross-over track it travels on to the outer "down" track, but in so doing must pass over the junction point with the inner "down" track, this being accomplished by another set of shiftable curved and straight track sectors 15 and 16, but operating in reversed order so that the straight sector is in place until the leading hanger has passed over it and then it is replaced by the curved sector so that the trailing hanger on reaching this same junction point will follow a downward curved path to reach the inner "down" track T^1.

The same provision is made at the bottom of the shaft for transferring the cars from the "down" shaft over to the "up" shaft, and operating in the same manner. Thus referring to Figure 3 once more, the car C on reaching the bottom of the "down" shaft, the hanger which trailed at the top cross-over now leads as the car passes onto the lower cross-over track H^1 following a curved track sector 15 as before, which is then lifted to the dotted line position and the straight sector 16 is raised into position to bridge the gap for the trailing hanger.

Except for a reverse either in the order of operation or the position of the curved and straight track sectors at each of the four junction points, the switches are quite the same and hence the description of one will be applicable to all, bearing in mind that the units are grouped in pairs

and operate as such, since the hangers are also in pairs.

Referring to Figures 10 to 14, the switch at the lower end of the "down" shaft is shown in detail. The end of the vertical track T^1 terminates a short distance above the horizontal track H^1, there being gaps in both tracks adjacent the point at which they would otherwise intersect. Designed to occupy the gaps are the shiftable track sectors 15 and 16, one being curved in a 90° arc and adapted to extend from the lower end of the vertical track T^1 downwardly and toward the right (Figure 10) to the end of the portion of the horizontal track H^1 beyond the gap, while a straight sector 16 serves to bridge the gap in the horizontal track H^1. These sectors are pivotally mounted at one end to abut the main tracks of which they form sections, being provided with stout pivot pins 16^a, 16^a, respectively, which extend laterally from the inner faces and fit into sockets 17 on the base flange 1^a of the track 5. Considering each sector independently of the other, if the curved sector is in the position shown in Figure 10 the right-hand hanger 3 of the cab will follow around the curved sector 15 onto the horizontal track in the manner shown in Figure 14. The straight sector 16 in the meantime is dropped down at an angle, thereby permitting the hanger to pass through the gap thus provided. After the leading hanger has passed onto the horizontal track, the following hanger on reaching the same now travels to the right, and in order to pass the junction of the right-hand vertical track with the horizontal track, the curved sector 15 is elevated and the straight sector 15 brought up into the line of the horizontal track as shown in Figure 13, the shifting of the two sectors being accomplished simultaneously by the following mechanism:

In the first place, the two sectors 15 and 16 are connected together adjacent their free ends by a link 18, the connection between the link and the curved sector being through the medium of a pin and slot connection at 19 in order to obtain the desired freedom of movement. Secondly, a plate 20 is mounted immediately behind the track members at their point of junction with a small space between, and on this plate is mounted a solenoid 21 positioned above the curved sector so that its plunger 21^a can be connected therewith by means of a short link 22. Each solenoid would necessarily include an operating circuit which, in its simplest form would have a controlling switch, so that the sectors would be shifted to permit the hangers to pass over a junction point without changing directions or to pass around the junction point with a change of direction.

Manifestly, the solenoid is quite inadequate to hold the sectors in place, and especially to support any appreciable weight, so auxiliary locking devices are applied, which function just before and after a shift of one of the sectors has taken place.

Thus as shown in Figures 11 and 12, another solenoid 23 is mounted on the plate 20 immediately behind the point of interlocking of the free ends of the shiftable sectors with the horizontal track H^1. This solenoid is so mounted that its plunger 23^a shifts endwise toward and from the track rather than in the plane of the track as in the case of the sector shifting solenoid 21. On the end of its plunger is a plate 24 carrying a locking pin 25 projecting into the path of the track sectors and adapted to engage registering sockets or holes 15^b and 16^b, respectively, in their inner faces and adjacent their ends. Thus each auxiliary solenoid 23 would be controlled to act just before the switching operation takes place, first, to release the active sector 30, allowing it to shift and the other to take its place, and then lock the latter in place.

As shown in Figures 11 and 12, the track sectors 15 and 16 are somewhat reduced in width to accommodate the operating linkage and other parts. Moreover, the free ends of the sectors and the adjacent end of the horizontal track are slotted so that a sort of dovetail connection is made when the ends are brought together, thus affording greater stability in transverse direction while relying on the locking bolts for taking the vertical load of the car.

Aside from the operation of the switches to shift the sectors, the functioning of the system is comparatively simple. As indicated in Figure 1, a number of cars C at definite intervals would follow each other about the closed circuit, the number of cars in operation being determined by the traffic conditions.

The previous reference to a vertical cog railway indicates the manner in which the cars are propelled along the tracks, the traction being provided by the pinions meshing with the racks backed by the rollers bearing against the opposite side of the track flange. While moving vertically, it follows that the hangers assume a normal position with the pinions and rollers horizontally opposing each other. However, on reaching a curved sector, it is necessary for the bearing blocks 5 to revolve in the bearing standard 4 of each hanger so that the curve can be negotiated, and finally when the car is traversing the horizontal tracks at the top or bottom, the pinions or rollers, as the case may be, are arranged vertically, one above the other, as the car is propelled as though suspended from an overhead track, as in fact it is.

As before stated, the operation of the elevators and the throwing of the switches would all be accomplished by suitably designed electrical means, controlling the operation manually or automatically as the conditions demand, all of which could be readily worked out by one skilled in the art. Similarly the results herein disclosed may be attained in other ways, and hence the present invention is not limited to any particular mechanism for accomplishing the results, but generally to a system of elevator control which permits the accomplishment of the advantages herein indicated as especially noteworthy.

I claim as my invention:

1. In an elevator system, the combination of vertical shafts connected by transverse passages, parallel tracks making a complete circuit of said shafts and passages, cars adapted to be propelled along said tracks, interchangeable straight and curved track sectors located at the junction points of the vertical and horizontal portions of said tracks and adapted to be shifted before and after the passage of a car over said junction point and means for locking the active sector in its track.

2. In an elevator system, the combination of vertical shafts connected by transverse passages, a continuous trackway making a complete circuit of said shafts and passages, cars adapted to be propelled along said trackway, said trackway comprising a group of tracks paralleling each other throughout the circuit, pairs of interchangeable straight and curved track sectors located at the junction points of said tracks,

means for shifting said track sectors before and after the passage of a car over each junction point, and coacting locking means operative to lock the active sector in its track.

3. In an elevator system, the combination of vertical shafts connected by transverse passages, a continuous trackway making a complete circuit of said shafts and passages, cars adapted to be propelled along said trackway, said trackway comprising a group of tracks paralleling each other throughout the circuit, pairs of interchangeable straight and curved track sectors located at the junction points of the vertical and horizontal sections of said tracks and adapted to be shifted immediately before and after the passage of a car over each junction point, and coacting locking means operative before and after each shifting movement to lock and release the active sector in its track.

4. In an elevator system, the combination of vertical shafts connected by transverse passages, a continuous trackway making a complete circuit of said shafts and passages, cars adapted to be propelled along said trackway, said trackway comprising a group of tracks parallaling each other throughout the circuit, certain of the tracks intersecting each other at the junction of the vertical and horizontal trackways and merging into single horizontal tracks, and sets of curved and straight track sectors adapted to be interchangeably shifted into the single track at said points of intersection to permit said cars to pass the junction points.

5. In an elevator system, the combination of vertical shafts connected by transverse passages, a series of connected tracks making a complete circuit of said shafts and passages provided with hangers and driving gear members, engaging teeth on said tracks whereby said cars are propelled along the same, said tracks meeting in curved sectors and certain of said vertical tracks intersecting and merging with certain of the horizontal tracks, and straight track sectors adapted to replace said curved sectors at predetermined junction points to permit the cars to pass the same.

6. In an elevator system, the combination of a vertical shaft, connected up and down tracks in said shaft, cars adapted to be propelled vertically and horizontally along said tracks and having hangers supporting driven pinions meshing with rack teeth on said tracks, certain of the same having curved sectors at the junction of their vertical and horizontal sections, with certain of the same merging into single horizontal tracks, and sets of straight track sectors adapted to be shifted to replace said curved sectors at said points of intersection to permit said hangers to pass over or around said points of intersection.

7. In an elevator system, the combination of a vertical shaft, connected up and down toothed tracks in said shaft making a complete circuit, cars adapted to be propelled along said tracks, and comprising hangers pivotally mounted on said cars and having driven pinions and idler rollers engaging said tracks, the vertical sections of each track meeting its horizontal section in a curved track sector, certain of said vertical tracks merging into single horizontal tracks, and sets of interconnected track sectors adapted to be interchangeably thrown at said points of intersection to permit the hangers to pass over or change directions at said points of intersection.

8. In an elevator system, the combination of a continuous trackway making a complete circuit of the vertical space to be served by said system and comprising connected vertical and horizontal tracks paralleling each other throughout the circuit, cars adapted to be propelled along said trackway, interchangeable track sectors located at the junctions of the vertical and horizontal tracks, and means for shifting said track sectors to permit the passage of said cars over the junction points.

9. In an elevator system, the combination of a vertical shaft, a continuous trackway making a complete circuit of said shaft and comprising a group of tracks paralleling each other throughout the circuit, cars adapted to be propelled along said tracks, sets of interchangeable straight and curved track sectors located at the junction points in said trackway, and means for shifting said track sections to effect the passage of a car over the junction points and means for locking the active sectors in the track.

JARVIS HUNT.