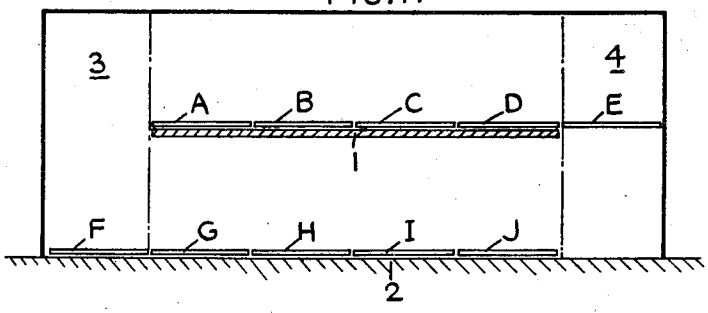
Jan. 9, 1940. H. AUGER ET AL 2,186,854

STORAGE EQUIPMENT

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FIG. 1.



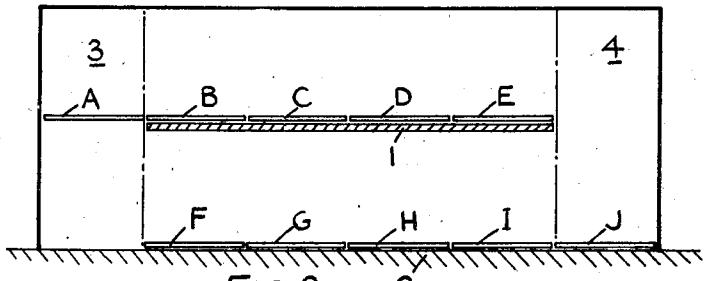


FIG. 2.

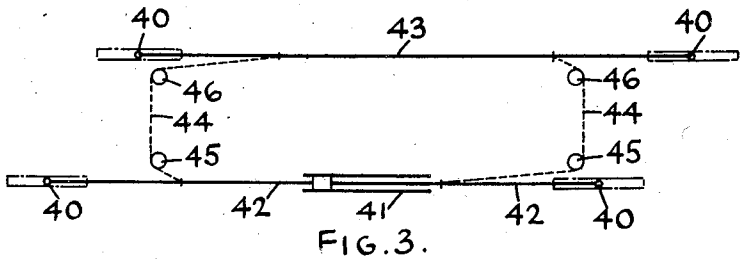


FIG. 3.

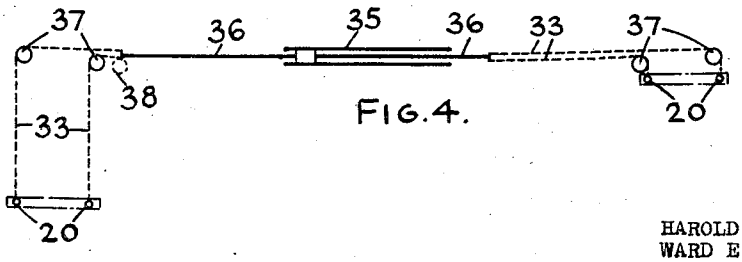


FIG. 4.

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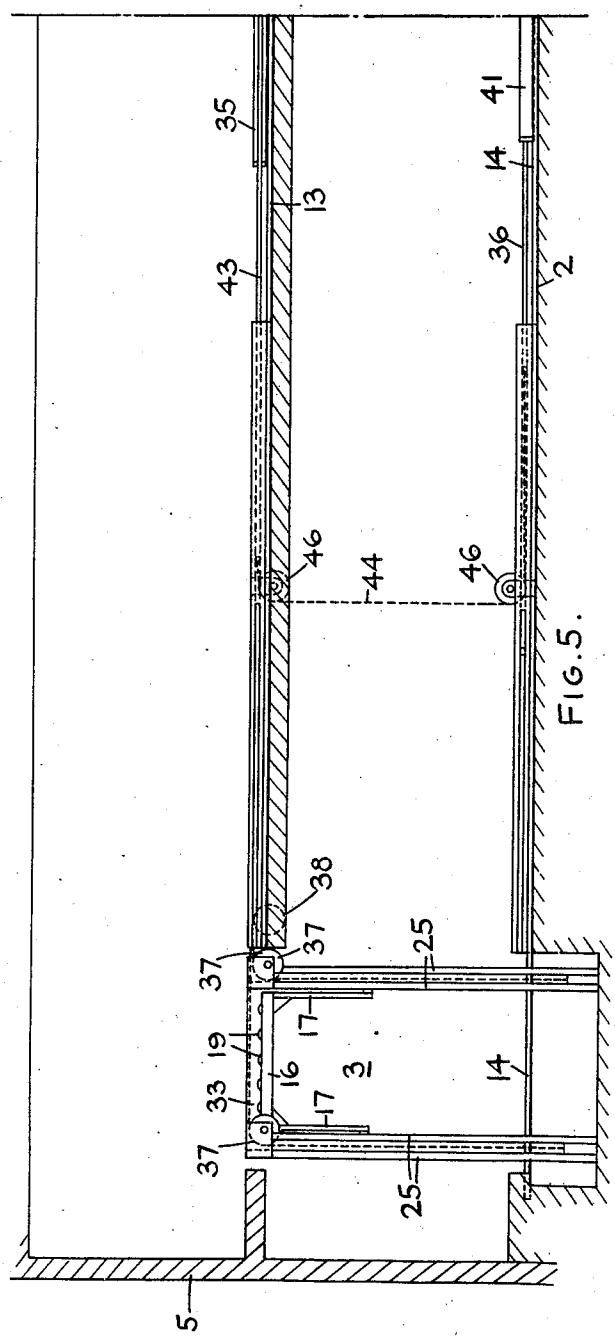


FIG. 5.

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STORAGE EQUIPMENT

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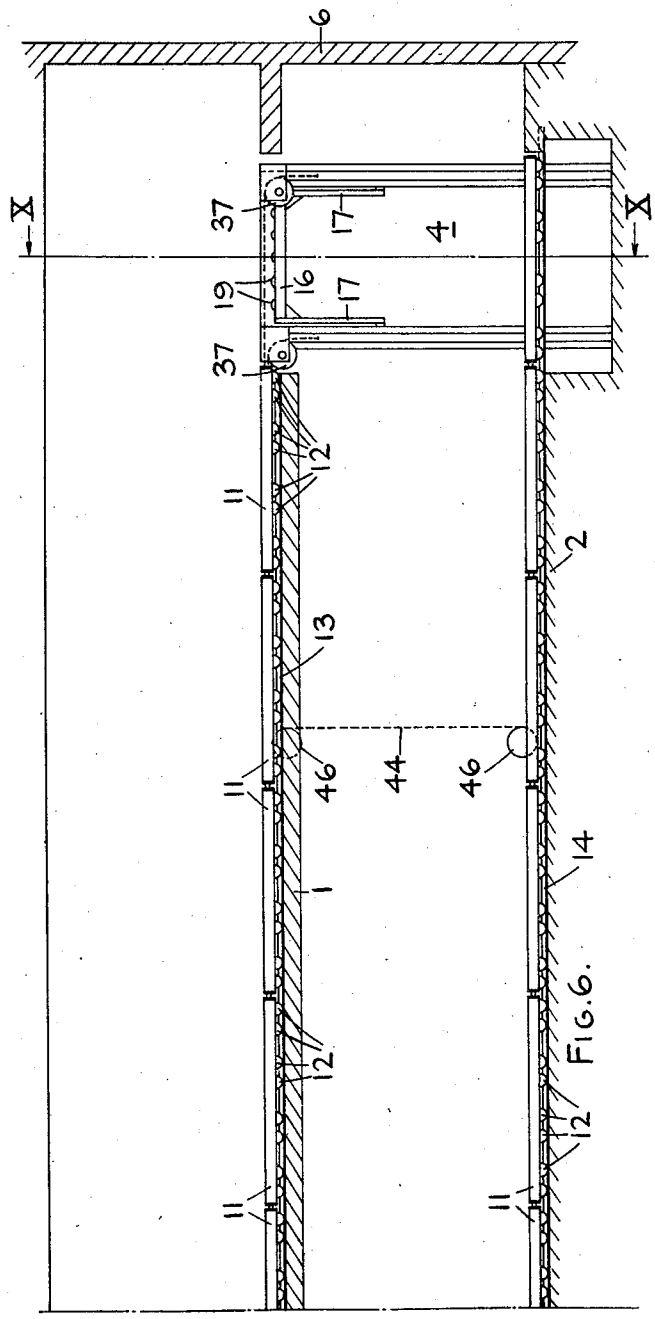


FIG. 6.

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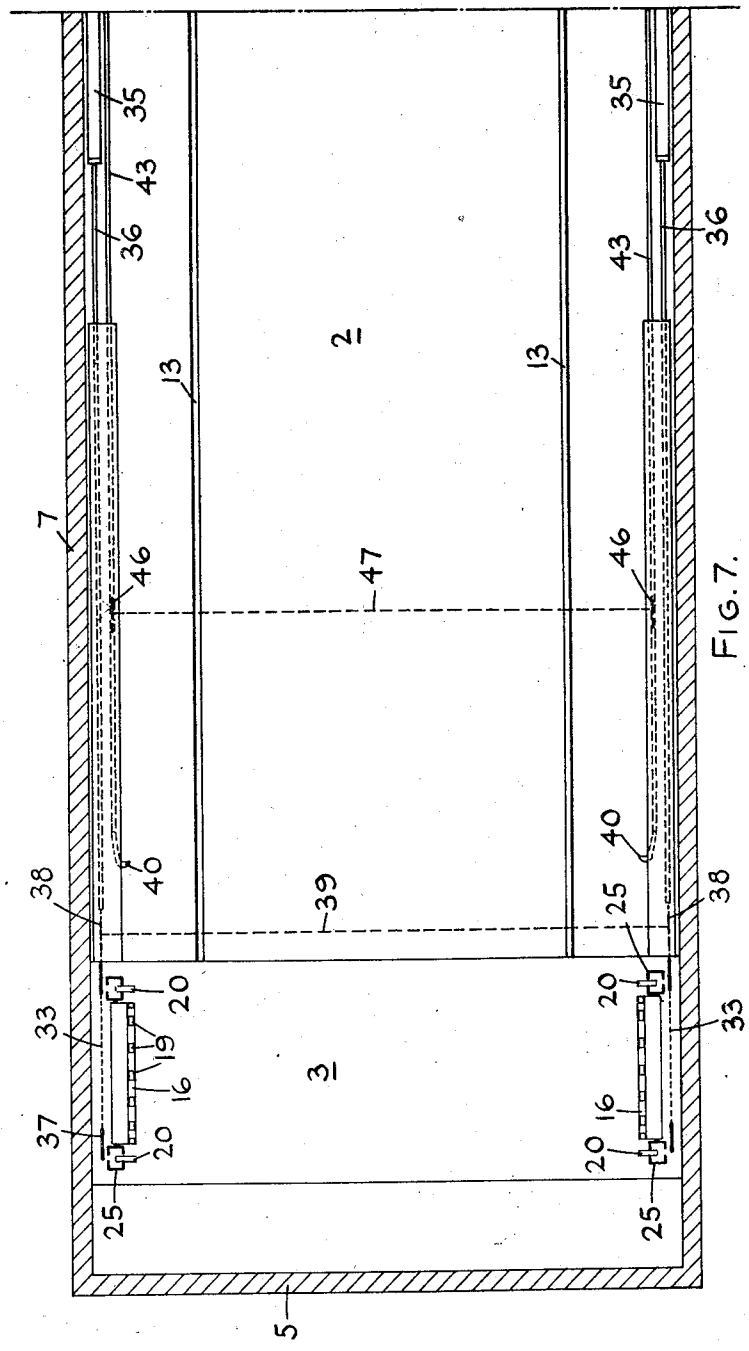


FIG. 7.

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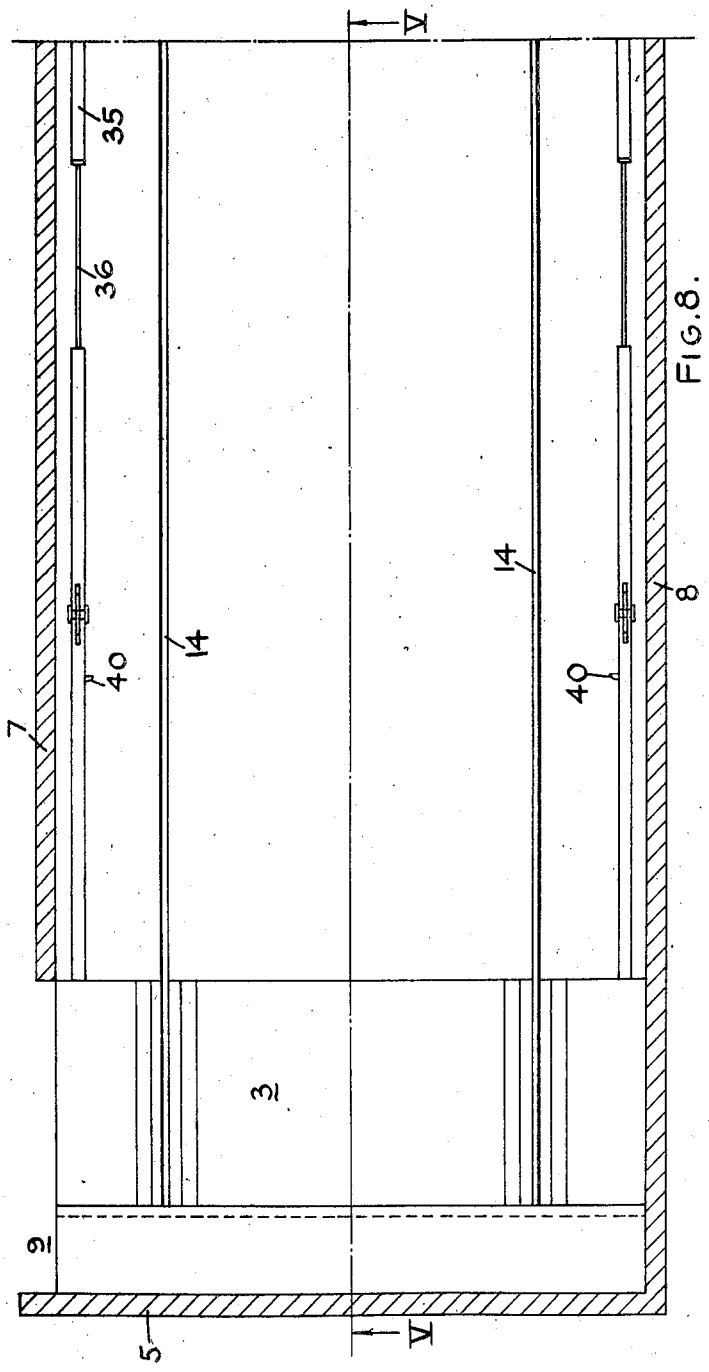


FIG. 8.

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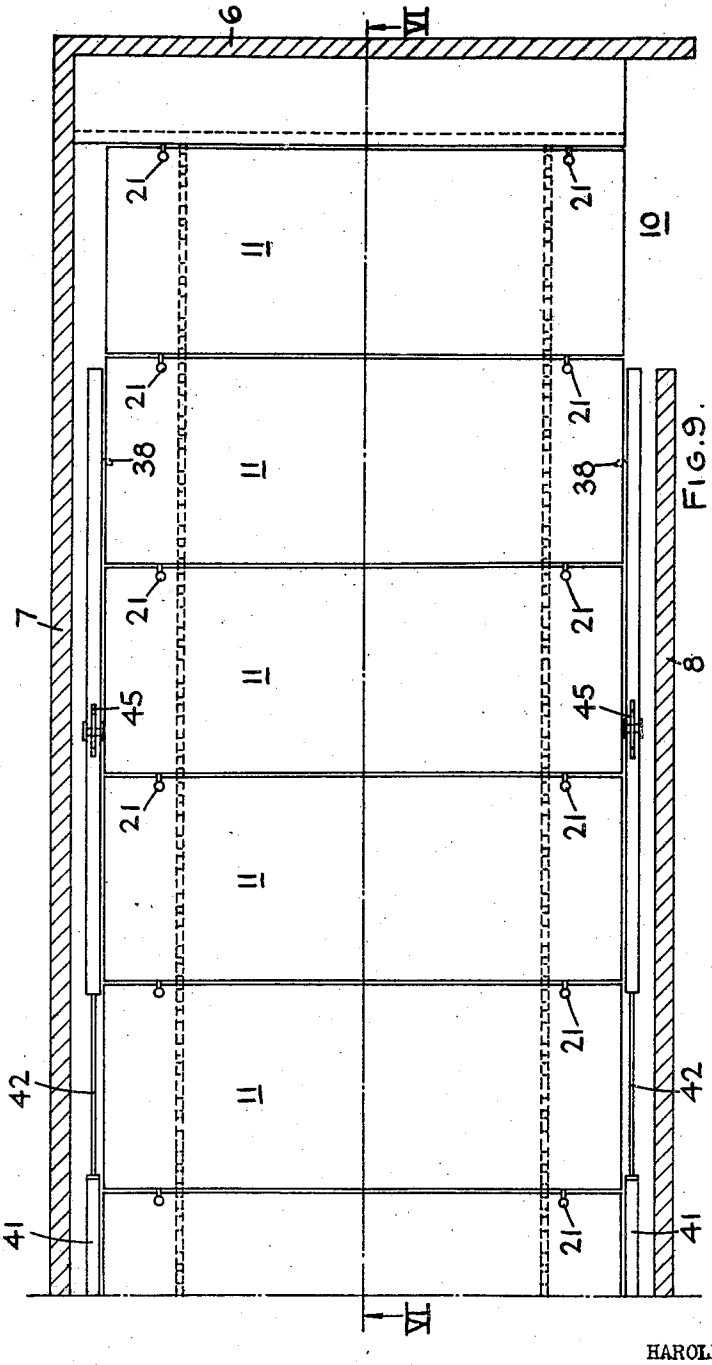


FIG. 9.

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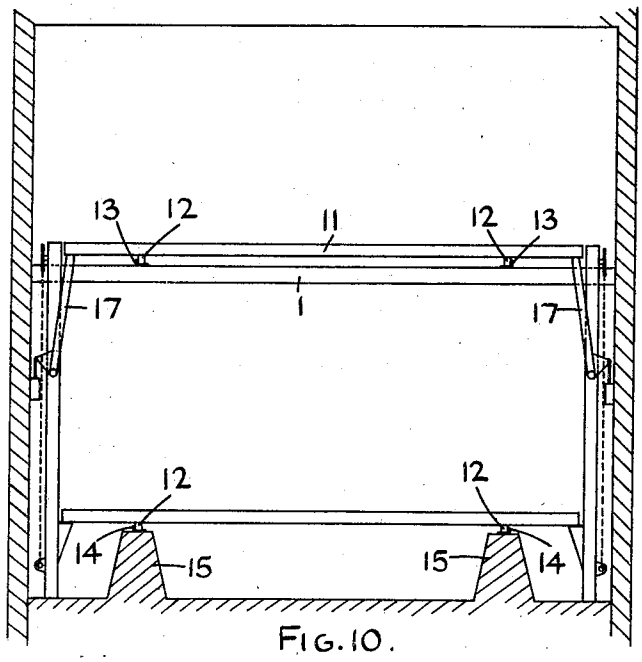


FIG. 10.

FIG. 17.

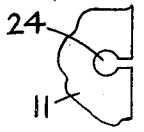


FIG. 15.

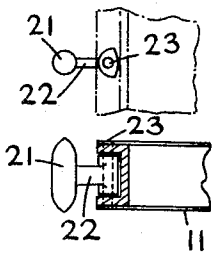


FIG. 18.

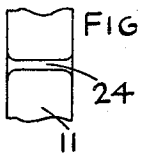


FIG. 16.

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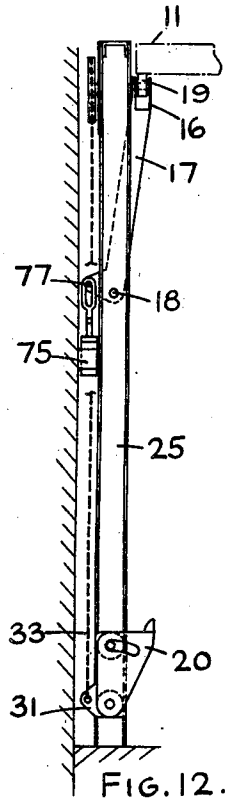


FIG. 12.

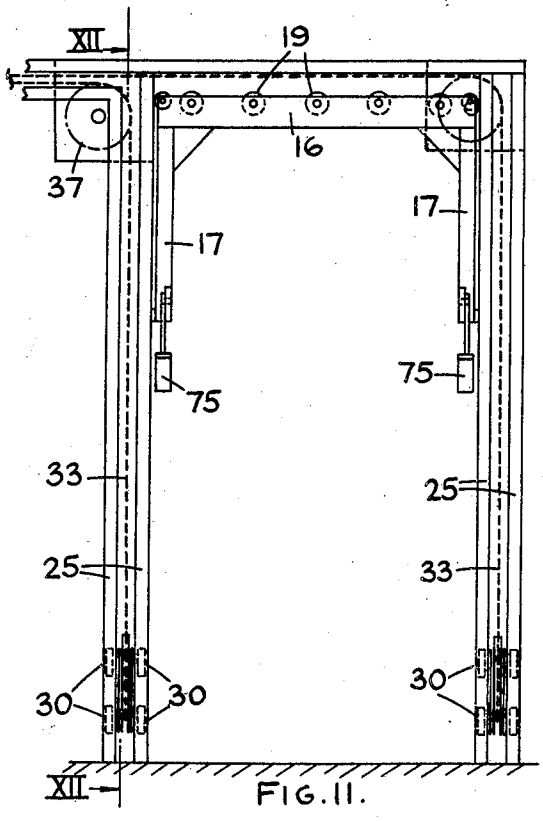


FIG. 11.

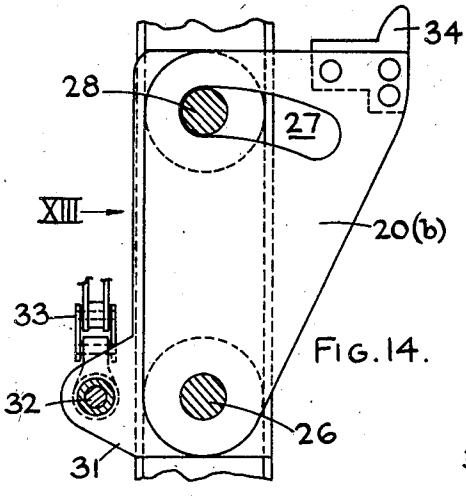


FIG. 14.

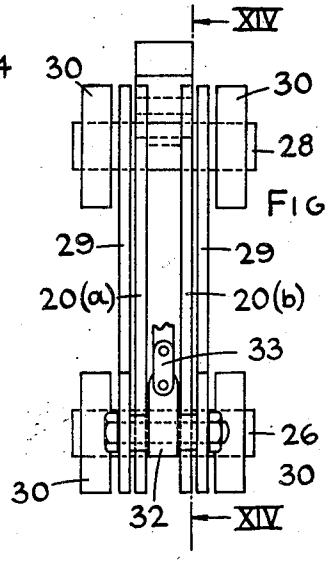


FIG. 13.

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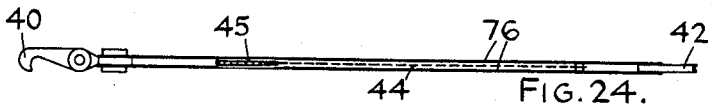


FIG. 24.

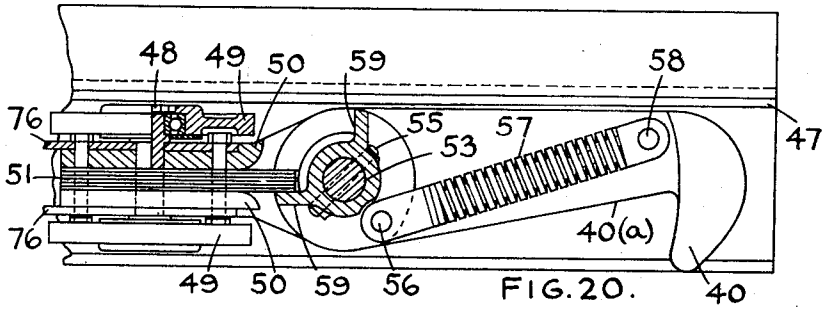


FIG. 20.

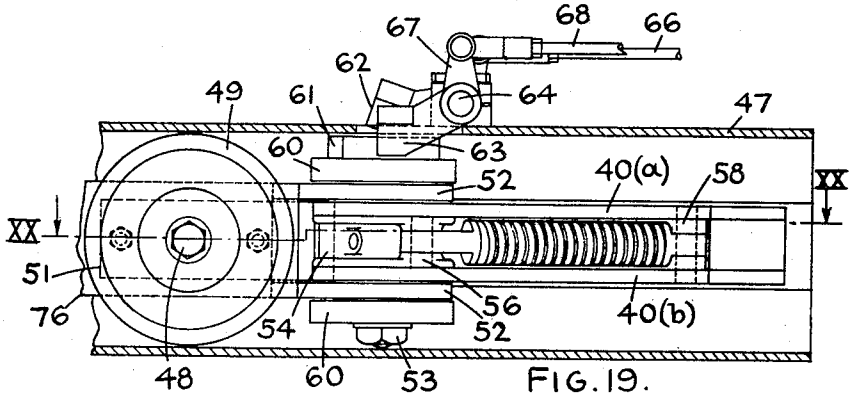


FIG. 19.

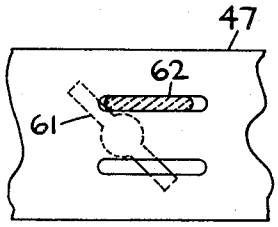


FIG. 22.

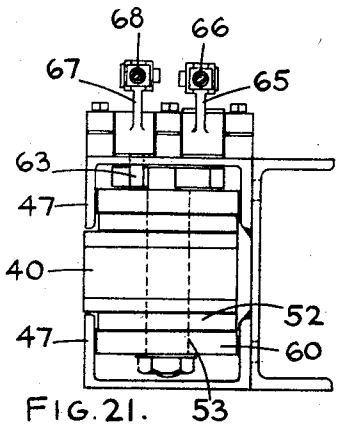


FIG. 21.

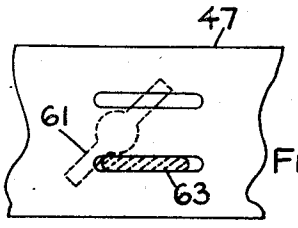


FIG. 23.

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FIG. 26.

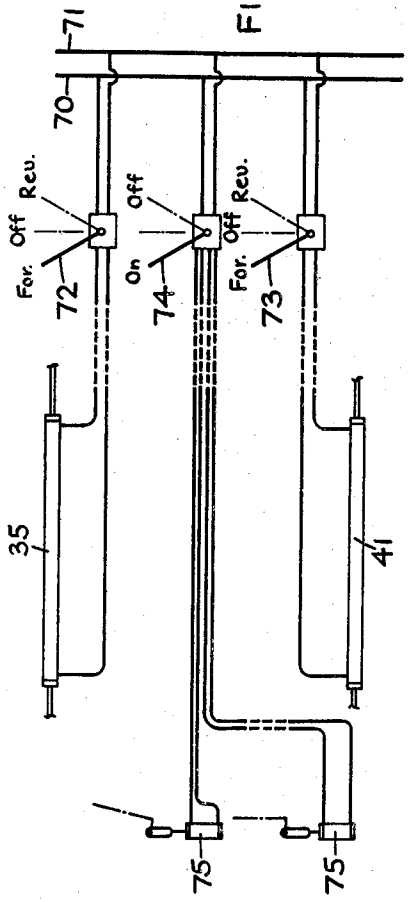
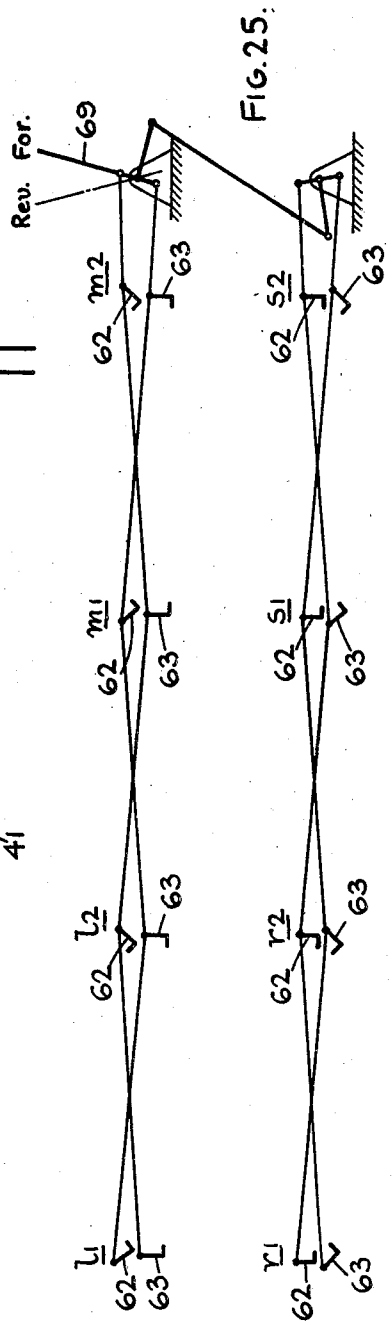


FIG. 25.



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Patented Jan. 9, 1940 2,186,854

UNITED STATES PATENT OFFICE

2,186,854

STORAGE EQUIPMENT

Harold Auger, Burnham, and Ward Edgerly Pearson, London, England; Natalie Pearson Nicholson executrix or administratrix of Ward Edgerly Pearson, deceased

Application September 22, 1938, Serial No. 231,244
In Great Britain September 25, 1937

7 Claims. (Cl. 214—16.1)

This invention relates to storage equipment for goods. The invention is especially applicable for storing heavy articles and has an important application in parking arrangements for automobiles. The term goods as employed herein is to be interpreted as including automobiles.

The invention, however, has other applications such for example as for storing large packing cases and the like in warehouses and other storage places.

An important object of the present invention is to store goods in such a manner that goods in any part of the storage space may readily be extracted.

Another object is to store heavy goods with a maximum economy of space.

Another object is to provide an improved parking arrangement for automobiles which combines economy of space with ability to remove an automobile readily from any locality in the parking space.

A further object is to provide an automobile parking arrangement suitable for locations in which the ground space available is restricted.

According to the present invention the storage equipment comprises a plurality of supporting devices for goods to be stored arranged in two substantially parallel ranks displaced vertically, power actuated means for shifting said supporting devices along the upper rank in at least one direction, power actuated means for shifting said supporting devices along the lower rank in at least the opposite direction, means for transferring supporting devices from an end of the upper rank towards which the shifting means act to the adjacent end of the lower rank and means for transferring said supporting devices from the opposite end of the lower rank to the adjacent end of the upper rank.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawings which show an example of an automobile parking equipment embodying the invention.

In the equipment illustrated the automobiles are supported on trucks which are arranged in two ranks one over the other with an elevator at each end for transferring trucks from one rank to the other. The elevators are of a particular construction to be described subsequently and means are provided for supporting a truck at the top or bottom of an elevator independently of the elevator.

In the drawings Fig. 1 is a diagrammatic side elevation of an automobile parking equipment showing the general arrangement.

Fig. 2 is a similar view but showing another position of the trucks for supporting the automobiles.

Fig. 3 is a diagrammatic view illustrating the operation of the mechanism for moving the automobile supporting trucks along the ranks.

Fig. 4 is a similar diagrammatic view explaining the mode of working of the mechanism for operating the elevators.

Figs. 5 and 6, which are intended to be placed end to end, show in greater detail a side elevation of the parking equipment, Fig. 5 showing the left-hand half and without the trucks, whilst Fig. 6 shows the right-hand half and with the trucks.

Fig. 7 is a plan view of the upper rank as shown in Fig. 5, i. e. without the trucks.

Fig. 8 is a similar plan view of the left-hand half of the lower rank as shown in Fig. 5.

Fig. 9 again shows a plan view of the right-hand half of the lower rank as shown in elevation in Fig. 6, i. e. with the trucks in position.

Fig. 10 is a vertical cross-section on the line X—X in Fig. 6.

Fig. 11 is a side elevation to an enlarged scale of the elevator mechanism at the right-hand end of the equipment.

Fig. 12 is a vertical sectional view on the line XII—XII of Fig. 11.

Fig. 13 is a detailed view to an enlarged scale of a bracket member constituting part of an elevator.

Fig. 14 is a sectional view on the line XIV—XIV of Fig. 13.

Figs. 15–18 illustrate a coupling formed between adjacent trucks. Figs. 15 and 16 respectively showing plan and side views of a slot formed in the right-hand sides of the trucks as viewed in Fig. 9. Fig. 16 being turned through 90°, and Figs. 17 and 18 respectively showing plan and side elevations in part section of a coupling member on the left-hand side of the trucks which engages the slot shown in Figs. 15 and 16.

Fig. 19 is a detailed side view to an enlarged scale of a part of the mechanism for moving the trucks along the ranks.

Fig. 20 is a horizontal section on the line XX—XX of Fig. 19.

Fig. 21 is an end view of the mechanism shown in Fig. 19 looking at the left end.

Figs. 22 and 23 are diagrammatic views illustrating the arrangement of the mechanism for

reversing the direction of movement of the trucks.

Fig. 24 is a detail view showing somewhat diagrammatically a portion of the mechanism for shifting the trucks along the ranks.

Fig. 25 is a diagrammatic view illustrating the controls to the direction reversing mechanism shown in Figs. 20–23.

Fig. 26 shows diagrammatically the controls for the various hydraulic apparatus employed.

Referring first of all to Figs. 1 and 2, the equipment comprises essentially an upper rank of trucks A, B, C and D movable from left to right or from right to left along an upper floor 1, and a lower rank of trucks G, H, I and J which rest upon the ground floor 2. At the left-hand end of the equipment is an elevator the space or shaft of which is indicated generally by the reference 3, whilst at the right-hand end is an elevator 4.

In Fig. 1 the elevator 3 contains a truck F at its lower level or landing, i. e., in line with the lower rank of trucks, whilst at the upper level or landing the elevator 3 is vacant. The elevator 4 on the other hand contains a truck E at its upper landing, i. e. in line with the upper rank of trucks, whilst at the lower landing it is vacant.

Fig. 2 shows the positions of the trucks after the upper rank, including the truck E, has been moved together bodily to the left so the truck E is moved out of the top of the elevator space on to the right-hand end of the floor 1, whilst at the same time the truck A has been moved into the top of the elevator 3. Similarly, in the case of the lower rank the truck F has been moved out of the bottom of the elevator 3, whilst the truck J has been moved into the bottom of the elevator 4.

In the particular embodiment of the invention being described, power operated means are provided for shifting the trucks along the ranks and the shifting means for the two ranks are coupled together so that they work synchronously and move the trucks in the two ranks simultaneously in opposite directions. Similarly, the power operated means for operating the elevator 3 is coupled with that for operating elevator 4 so that the two elevators work in opposite directions. If, therefore, when the trucks have reached the positions shown in Fig. 2 the elevators are operated so that the truck A is lowered to the bottom of the elevator 3 whilst the truck J is raised to the top of the elevator 4 and then the trucks are again shifted along the ranks in the same respective directions as previously. The truck B will now occupy the top of the elevator 3 and the truck I will occupy the bottom of the elevator 4. Thus, by repeating the two operations, namely of shifting the trucks along the ranks and operating the elevators the trucks may be caused to circulate progressively from right to left along the upper rank, and then from left to right along the lower rank. Supposing that the entrance is located opposite the bottom of the elevator 3 whilst the exit is located opposite the top of the elevator 4, when it is desired to park a car the trucks may be successively moved until a vacant truck is brought opposite the entrance; the car may then be placed on the truck. Similarly, when it is desired to remove a car the trucks are successively moved until the desired car reaches the bottom of the elevator 4 opposite the exit.

In the particular apparatus to be described subsequently, means are provided for operating the ranks and the lifts in either direction. Thus the trucks in the upper rank may be moved progressively to the left and those in the lower rank progressively to the right or alternatively the trucks in the upper rank may be moved progressively to the right and the trucks in the lower rank moved progressively to the left. In the latter case, of course, the elevator 3 would serve to raise trucks from the lower rank to the upper rank, whilst the elevator 4 would serve to lower trucks from the upper rank to the lower rank. Thus the entire space may be occupied by cars with the exception of the spaces corresponding to that occupied by two of the trucks, whilst at the same time a car located on any of the trucks may be readily removed from the equipment.

Figs. 5–9 show the arrangement of a car park of the kind illustrated diagrammatically in Figs. 1 and 2 in somewhat greater detail. The arrangement shown comprises a left-hand end wall 5 (Figs. 5, 7 and 8), and a right-hand end wall 6 (Figs. 6 and 9), and side walls 7 and 8. An entrance 9 (Fig. 8) is located opposite the bottom of the elevator 3 and an exit 10 (Fig. 9) is located opposite the bottom of the elevator 4.

In the particular arrangement shown the trucks 11 (Figs. 6 and 9) are of a rectangular shape and are arranged with their greatest dimensions laterally of the ranks, i. e., so that cars driven in through the entrance 9 will be located across the rank. It will, of course, be appreciated that they might be arranged the other way so that the cars would be located longitudinally of the ranks. In such a case of course the entrance and exit openings 9 and 10 would be preferably located in the end walls 5 and 6. The trucks 11 are each supported on a series of wheels 12, which in the case of the upper rank run on rails 13 resting on the floor 1, whilst in the case of the lower rank the wheels run on rails 14 resting on the floor 2. In the particular arrangement shown each truck is provided with sixteen wheels. The positions of the rollers and rails are preferably such that they come approximately underneath the wheels of a car resting on a truck. The rails 13 extend the length of the floor 1 and terminate at each end adjacent the elevator spaces, whilst the rails 14 of the lower rank extend across the elevator spaces, the rail extensions being supported by raised portions 15 of the floor as shown in Fig. 10.

In order to support the trucks in the elevator spaces at the upper level or landings, there are provided at the top of each elevator a pair of beams 16 mounted on the upper ends of arms 17 pivoted to the framework 18 (Fig. 12). The arrangement is such that the beams normally extend into the elevator space as shown most clearly in Fig. 7 and assume such a position that they will support a truck which is moved along the upper rank into the elevator space. The beams 16 are so located that the edges of the trucks will rest on them and in order to permit movement of the truck along the beams the latter are provided with a series of rollers 19. Whilst as previously stated the beams 16 normally assume the positions shown in Figs. 7, 11 and 12, it will be appreciated a truck which is being raised by the elevator in question will abut against the arms 17 and rotate them about their pivots so that the beams 16 are moved out of the elevator space, thus the beams 16 do not obstruct the raising of a truck.

The elevators are each constituted by four pivotal bracket members 20 which support the four corners of a truck and either raise the truck from a position on the extended portions of the

rails 14 to a position in which it rests upon the beams 16 or vice versa, lower it from the beams 16 to the rails 14. The construction of the elevators will be described subsequently in greater detail.

In order that the trucks in each ranks shall be moved together simultaneously, they are coupled together by means of coupling members 21, (Figs. 15–18) which are mounted on arms 22 pivoted at 23 to the left-hand sides of each truck. These arms engage apertures 24 in the right-hand side of each adjacent truck and constitute couplings between the trucks. At the same time when a truck is raised or lowered by an elevator the coupling can readily disengage since the members 21 can move in a vertical direction out of the slots 24. At the same time when a truck is moved by an elevator to a fresh rank it will engage the truck at the adjacent end of the fresh rank, and to facilitate this the slots 24 are chamfered at each end, whilst the coupling members 21 are tapered at each end and are also pivoted at 23 in a manner permitting a limited movement sufficient to compensate for any slight misalignment of the coupling members 21 and the slots 24.

The elevator mechanism will now be described in greater detail.

Referring to Fig. 7, it will be observed that at each corner of the elevator space 3 there is a pair of vertical channel members 25. These are arranged with their channels facing each other and with a slight gap between the side flanges. The bracket member 26 protrudes through this gap into the elevator space. The construction of the bracket member is shown best in Figs. 13 and 14 and it will be observed that it comprises a pair of substantially triangular plates 26a and 26b pivoted at their lower ends upon a short stub axle 26, whilst a slot 27 is formed in the upper parts of the plates 26a and 26b, which slot engages another stub axle 28. The stub axles 26 and 28 each pass through a pair of links 29 and at their outer ends the axles each carry guide rollers 30. On one side the links 29 are formed with lugs 31 which are joined by a bolt 32 to which is attached a chain 33. The chain 33 serves the purpose of lifting the entire bracket assembly. The guide rollers 30 run within the channel members 25 as may be seen best from Fig. 11 and serve to locate the bracket assembly when it is being raised or lowered. The actual portion of the bracket member upon which the trucks rest is constituted by a bearing piece 34.

The two elevators are arranged in counterpoise and are operated by hydraulic cylinders 35 (Figs. 4–8) located on each side of the upper rank. Operating rods 36 extend in each direction from each of these hydraulic cylinders along the side of the rank to a point at which they are coupled to a pair of elevator chains or cables 33, these cables passing over guide pulleys 37.

In the arrangement employed each of the hydraulic cylinders 35 operates two of the chains of each lift; thus the cylinder 35 on the front side of the upper rank, that is the uper side as viewed on in Figs. 7, 8, and 9, operates the two chains at the two front corners of the elevator 3, and also in the other direction operates the two chains at the two front corners of the elevator 4. Similarly, the hydraulic cylinder 35 on the rear side of the upper rank, that is the upper side as viewed in Figs. 7 to 9, operates the chains at the two rear corners of the elevator 3 and those at the two rear corners of the elevator 4. The arrangement of the elevator operating mechanism may be most clearly seen from the diagram in Fig. 4, which shows one of the hydraulic cylinders 35 and the operating rods and chains 33 connected to it.

In order to synchronise the mechanisms on the two sides of the equipment one of the chains 33 on each side engages a sprocket wheel 38, Figs. 5 and 7, rigidly mounted on a shaft 39, the shaft 39 being recessed on the floor 1 if necessary.

The mechanism for shifting the trucks along the ranks will now be described in detail. The mechanism consists essentially of a pair of hooks 40 on each side of both of the ranks, these are moved horizontally backwards and forwards through a distance equivalent to a truck space and they are so arranged that they are operative to engage the trucks during their forward movement and are inoperative during their return movement. Thus considering the upper rank only for the moment, and supposing that the trucks are being moved to the left, the hooks will be operative whilst they are being moved to the left but will be inoperative when being moved backwards to the right.

Fig. 3 is a diagrammatic view illustrating the arrangement of the mechanism for effecting movement of the hooks 40 for shifting the trucks along the rank. This figure shows the mechanism on one side of the equipment only as in the manner adopted in the case of Figure 4. The mechanism is actuated by a hydraulic cylinder 41 which is connected in either direction by rods 42 with the hooks 40 at the opposite ends of the lower rank. The hooks 40 on each side of the upper rank are coupled together by rods 43 and these are actuated from the hydraulic cylinder on the same side of the equipment by means of sprocket chains 44 each passing over sprocket wheels 45 and 46, the arrangement being such that the hooks in the upper rank move in the opposite direction to those in the lower rank.

In order to synchronise the two mechanisms the pair of sprocket wheels 46 at each end of the upper rank are each interconnected by a synchronising shaft 47, the position of that at the left end being indicated in Fig. 7, and the shafts may if necessary be recessed in the floor 2 of the upper rank.

The arrangement by which the chain 44 is connected to the rod 42 in the case of the lower rank mechanism is shown somewhat diagrammatically in the plan view of Fig. 24, and it will be observed that the rod 42 is connected to a pair of spaced links 76 which at their further end are connected to the hook member 40. The synchronising chain 44 is suitably connected to the links 76 near the end connected to the rod 42 and passes around the sprocket wheel 45 and upwards to the upper rank. It will be appreciated that the hook 40, the links 76 and the rod 42 all travel horizontally to and fro through a distance equal to that between two adjacent truck positions, the sprocket wheel 46 on the other hand is stationary and accordingly it follows that the length of the links 76 must be slightly greater than their travel to ensure that the sprocket wheel 46 is not fouled by the moving parts of the mechanism. Similar arrangements are employed for connecting the rods 43 with the respective hooks 40. The actual construction of one of the hooks is shown somewhat in greater detail in Figs. 20 to 23, in which 47 is a fixed channel member or casing along which the hook 40 travels and which is open on the inner side, i. e. on the side facing the trucks, so that the hook 40 may protrude and engage a

truck. The two links 76 which have been previously referred to in the description of Fig. 24 carry a shaft 48 on which are mounted guide rollers 49 which guide the assembly in the channel member 47. Between the links 76 is located the two sides of a packing piece 50, and in between the packing piece is a laminated spring 51. The packing piece 50 is formed with lugs 52 which carry a shaft 53 on which is pivotally mounted the hook member 40; this latter member comprises a pair of spaced plates 40a and 40b. These plates are freely rotatable on the shaft 53 and located between them and also mounted on the shaft 53 is a hub 54. This hub however is rigidly mounted on the shaft 53 by means of a pin 55. The hub is formed with a pair of flanges which are connected by a pin 56. A spring 57 is connected at one end to the pin 56 on the hub member and at the other to a pin 58 on the end of the hook member, and it will be observed that in the position shown in Fig. 20 the hook member is biased by the spring 57 inwardly so that it is inoperative. If on the other hand the hub member were rotated so that the pin 56 came on the other side of the dead centre then the hook member would be biased out of the channel 47 so as to be operative.

The rotational movement of the hub member 54 is limited by the fingers 59 which abut against the end of the laminated spring 51 and this serves as a reaction member for the biasing spring 57. 60 are rollers for locating the hook assembly in a direction at right angles to that in which it is located by the rollers 49. As previously mentioned the hook 40 reciprocates along the channel member 47 and it will be appreciated that when it reaches the end of each stroke it will be necessary to reverse the action of the biasing spring 57 so that after the hook has made an operative stroke during which it will of course be protruding sideways out of the channel member 47 it is withdrawn into the channel member for the return stroke and similarly at the end of the returned stroke it will be necessary to project the hook member again out of the channel so that it is operative. These changeover positions are effected by rotating the hub member 53 so that the pin 56 is on one or the other side of the dead centre and its rotation is effected by means of a two armed lever 61 which is integral with the shaft 53 and which extends diametrically across its axis. The shape of the lever 61 is shown dotted in Figs. 22 and 23. This lever co-operates with a pair of fingers 62 and 63 which are mounted independently on a pivot 64. The finger 62 is rigid with an arm 65, Fig. 21, connected to an operating rod 66 whilst the finger 63 is rigid with an arm 67 connected to an operating rod 68. By means of the operating rods 66 and 68 one or the other of the fingers may be caused to project through the aperture in the channel member 47 so that when the hook reaches the end of its travel the lever 61 will abut against the finger in question. The effect of this may be seen from Figs. 22 and 23.

In Fig. 22 the finger 62 is depressed through the aperture in the channel member 47 so that when the hook in moving from left to right reaches this position the upper end of the arm 61 will abut against the finger 62 and the arm will be rotated in a counter-clockwise direction. This will rotate the hub member 54 and changeover the pin 56 to the other side of the dead centre, the final position it reaches being that shown dotted in Fig. 22.

Fig. 23 similarly shows the conditions to be obtained when the finger 62 is raised but the finger 63 is depressed. In this case the finger 63 will abut against the lower end of the arm 61 and will rotate it in a clockwise direction, it being assumed, of course, that it was previously in the position shown dotted in Fig. 22. This, it will be appreciated will again rotate the hub member 54 but in the opposite direction to that which occurred when the finger 62 was depressed. Thus supposing that the ranks lie in a north and south direction and that there are a pair of fingers 62 and 63 at each end of the travel of the hook, if the fingers 62 at the north and south ends are both depressed it follows that the north end of the hook will be changed over from the inoperative to the operative position and that the south end will be changed over from the operative to the inoperative position and thus it will always move the trucks when it is moving from north to south. It being remembered that the same corresponding fingers have the opposite effect at opposite ends of the travel due to the fact that the hook assembly is moving in opposite directions when it reaches this position. If on the other hand the fingers 63 at both ends are depressed it follows that the changes will occur in the opposite direction, that is to say when the hook is at the north end of its travel it will be changed over from the operative to the inoperative position and when it is at the south end of its travel it will be changed over from the inoperative to the operative position. Thus the trucks will be moved in the opposite direction i. e. from south to north.

Fig. 25 shows a control layout in which a control lever 69 operates fingers 62 and 63 associated with all the hooks actually in Fig. 25. The fingers associated with one side only of the equipment are shown, it being understood that the whole mechanism shown in Fig. 25 is repeated for the other side of the equipment and the two mechanisms are coupled together. The fingers at the positions L1 and L2 are associated with one of the hooks in the upper rank, that is to say, the finger at the position L1 operates when the hook in question is at one end of its travel and that at the position L2 operates when the hook is at the other end of its travel. Similarly the fingers at the positions M1 and M2 operate on the other hook in the top rank and in the same way the positions R1 and R2 correspond to the ends of the travel of one of the hooks in the lower rank and the positions S1 and S2 correspond to the ends of the travel of the other hook. It will be appreciated that all the hooks 40 in the top rank are moved in or out simultaneously and similarly all the hooks in the lower rank are moved in or out together. At the same time, however, only the hooks which are at the rear end considering the direction in which the trucks are moved are really effective, the hooks at the front end serving mainly to arrest the movement of the trucks when the end of the travel is reached.

Thus in Fig. 25 all the fingers 63 in the top rank are lowered and all the fingers 62 are raised. In the lower rank on the other hand in which it is desired that the movement of the trucks shall occur in opposite directions all the fingers 62 are lowered, whilst all the fingers 63 are raised. By changing over the lever 69 from the forward to the reverse positions the fingers are all changed over and thus the trucks will be moved along the ranks in the reverse direction to that in which

they move when the lever and fingers are in the positions shown.

Fig. 26 shows diagrammatically the hydraulic control apparatus for the several hydraulic cylinders and it will be observed that all the hydraulic cylinders are connected to a pressure main 70 and an exhaust main or drain 71. The cylinders 35, of which only one is shown in the drawings, are connected in parallel and are both operated by the lever 72, whilst cylinders 41, which are also connected in parallel, only one being shown in the drawings, which controls the movements of the trucks along the ranks, are both controlled by a lever 73. The lever 74 controls hydraulic cylinders 75 which are shown also in Figs. 11 and 12. These are connected through a slotted link with a pin 77 mounted on arms extending at right angles from the arms 17 and the purpose of these cylinders 75 is to withdraw the supporting beams 16 laterally out of the elevator space when it is desired to lower a platform. Thus, considering the control gear shown in Fig. 26 in connection with the diagrammatic views shown in Figs. 1–4, in order to move from the position shown in Fig. 1 to that shown in Fig. 2 the lever 72 would be moved from the off to the forward position. This would move the top ranks of trucks bodily to the left and similarly move the lower rank bodily to the right, so that the position of Fig. 2 is attained. When this is reached the lever 72 will be moved back to the off position. Lever 74 would then be moved to the on position so as to withdraw the beams 16 and whilst the lever 74 is in the on position the lever 73 would be moved from the off to the forward position. This would cause the elevator 3 to lower and simultaneously the elevator 4 to rise. The position of Fig. 1 would then be again attained excepting that the trucks would all have been moved round one space, that is to say, that the truck A would be in the position occupied by the truck F in Fig. 3 and so on. Further movement of the trucks can then be effected by repeating the sequence of operations of the levers 72, 74 and 73. Whilst in the arrangement shown it has been assumed that one of the landings at each elevator would always be vacant, it will be appreciated that the invention is also applicable to cases in which there is only one vacant space in the equipment, that is to say that one of the elevators will always have both its landings filled, but the other elevator will have only one landing filled. In such a case the synchronising sprocket chains 44 would be omitted and an additional hydraulic cylinder independently operated for the hooks 40 in the upper rank. Similarly, two sets of hydraulic cylinders 35 would be provided, one set operating each elevator. Thus supposing that in the arrangement of Fig. 1 the upper landing space of elevator 3 was occupied and the only vacant space was the lower landing space of the elevator 4 as shown in the drawings, in order to circulate the trucks about the elevator it will be necessary first to move the lower rank bodily to the right so as to move truck J into the lower landing space of elevator 4. This would leave a vacant space at lower landing of elevator 3. Elevator 3 would now be operated so as to lower the truck at its upper landing to the lower landing. The upper rank of trucks would now be moved bodily to the left. Elevator 4 would then operate so as to raise the truck J to its upper landing. Thus, however, each cycle of movement would consist of four operations instead of two.

It will be appreciated that the travels of the rank traversing mechanism, that is of the hooks 40 and also the travels of the elevators are limited by the permissible movement of the pistons in the several hydraulic cylinders. Additional limit switches or other protective means such as are well known may be in some cases employed if desired.

We claim:

1. Storage equipment comprising a plurality of supporting devices for goods to be stored located in two ranks one vertically over the other and movable longitudinally along said ranks, elevator means at each end of the pair of ranks for moving said goods supporting devices vertically from either rank to the other, means for supporting said goods supporting devices in the elevator space at each landing independently of the elevator, the supporting means at the upper landings being retractible to permit movement of a goods supporting device by the elevator, the number of supporting devices being such as to occupy fully each rank whilst at least one of the supporting means at the four elevator landings is unoccupied, and power actuated means associated with each rank for moving the goods supporting devices bodily along the rank in question through a distance such that a goods supporting device at an end adjacent an unoccupied supporting means at an elevator landing may be moved on to said supporting means.

2. Storage equipment comprising a plurality of supporting devices for goods located in two ranks one vertically over the other and movable longitudinally along said ranks, elevator means at each end of the pair of ranks for moving said goods supporting devices vertically from either rank to the other, means for supporting said goods supporting devices in the elevator space at each landing independently of the elevator, the supporting means at the upper landings being retractible to permit movement of an automobile supporting device by the elevator, the number of goods supporting devices in each rank being such as to occupy the rank fully and one of the elevator landings, power actuated means associated with each rank for moving the supporting devices bodily along the rank in question through a distance such that the supporting device at the one end is moved off a support in the elevator space whilst the supporting device at the other end of the rank is moved on to a support in the adjacent elevator space, synchronising connections between said respective power actuating means such that the automobile devices in the two ranks are moved together in opposite directions, and synchronising connections between the elevators such that they are moved together in opposite directions.

3. Storage equipment comprising a plurality of supporting devices for goods to be stored located in two ranks one vertically over the other and movable along the ranks, elevator means at each end of the pair of ranks for transferring a goods supporting device at the end of one rank to the adjacent end of the other rank, said elevators each comprising a plurality of bracket members arranged to support a goods supporting device and which may be raised or lowered simultaneously, power operated means associated with each rank for shifting all the supporting devices simultaneously along the rank in question so as to move the goods supporting device at one end out of the elevator space and move the goods supporting device at the other end into the ad-

jacent elevator space, means for supporting said supporting devices in the elevator spaces in alignment with the lower rank and independently of the elevator bracket members, and means for supporting said supporting devices in the elevator space in alignment with the upper rank and independently of the elevator bracket members, said latter supporting means being laterally retractible to permit movement past them of the supporting devices when being moved vertically by the elevator, and said bracket members being also hinged and retractible so that when descending they may move past a goods supporting device located in the lower part of the elevator space.

4. Storage equipment for automobiles comprising a plurality of trucks each adapted to support an automobile said trucks being arranged in two ranks vertically displaced one over the other, elevator means at each end of the pair of ranks for transferring a truck from one rank to the other said elevators each comprising a plurality of bracket members arranged to support a truck and which may be raised or lowered simultaneously so as to raise or lower a truck, rails along each rank space for supporting said trucks, the rails of the lower rank space extending across the elevator spaces so as to support a truck therein independently of said elevators, means for supporting a truck in said elevator spaces in alignment with the upper rank, said means comprising a pair of horizontal beams each carried on the upper ends of arms pivoted at their lower ends, said arms being biased so that the beams normally assume a position in the elevator space such as to permit support of a truck but may be retracted out of said elevator space by an ascending truck, power means for retracting said beams when it is desired to lower a truck, and rollers in the upper side of said beams to permit movement along them of a truck.

5. Storage equipment for automobiles comprising a plurality of trucks each adapted to support an automobile and arranged in two ranks vertically one over the other, elevator means at each end of the pair of ranks for transferring said trucks one at a time from one rank to the other, means for supporting said trucks in the elevator spaces in alignment with the ranks and independently of the elevators, the upper supporting means being retractible to permit movement past it of a truck when being conveyed by an elevator and power means associated with each rank for shifting the trucks longitudinally therealong.

6. Storage equipment for automobiles comprising a plurality of trucks each adapted to support an automobile and arranged in two ranks vertically one over the other, elevator means at each end of the pair of ranks for transferring said trucks one at a time from one rank to the other rank, said elevators being interconnected so that they operate simultaneously in opposite directions, means for supporting said trucks in the elevator spaces in alignment with the ranks and independently of the elevator, the upper supporting means being retractible to permit movement past it of a truck when being conveyed by an elevator, power operated means for shifting the trucks in each rank bodily along the rank so that trucks in the two ranks are moved simultaneously in opposite directions, the number of trucks in each rank being such that each rank is entirely filled and one only of the elevator spaces in alignment with each rank and the travel of said shifting apparatus being such that at one end of each rank a truck is moved out of the elevator space and at the other end of said rank a truck is moved into an elevator space.

7. In an automobile storage equipment a plurality of supporting devices for automobiles arranged in a plurality of vertically displaced ranks, elevator means for transferring supporting devices from one rank to another, said elevator means comprising a plurality of bracket members adapted to support an automobile supporting device and to be raised and lowered simultaneously so as to raise or lower a supporting device resting thereon and means for supporting a supporting device located in the elevator space in alignment with a rank independently of said bracket members.

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