Nov. 7, 1933. H. D. JAMES ET AL 1,934,503

FIRE PROTECTION FOR AUTOMOBILE STORAGE BUILDINGS

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Fig. 1.

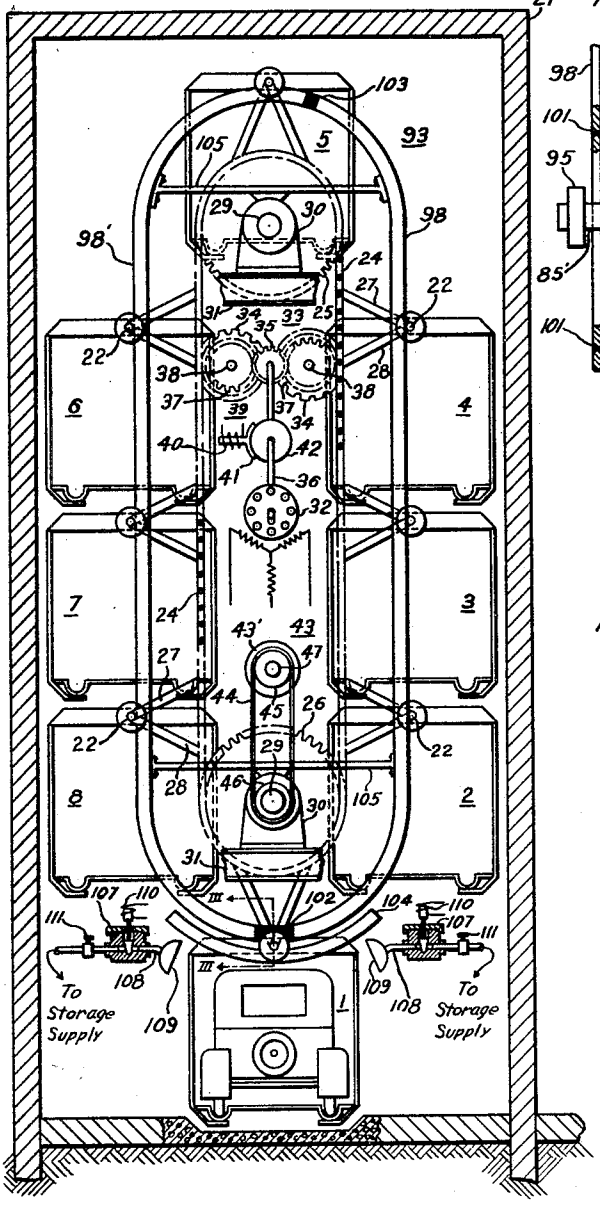


Fig. 2.

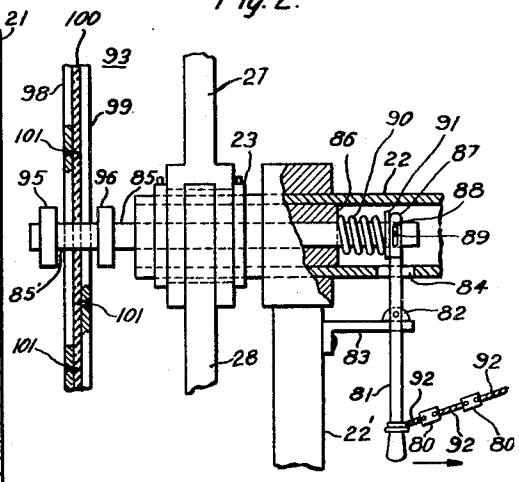
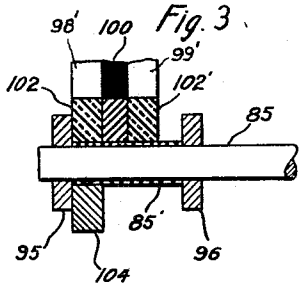


Fig. 3.



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FIRE PROTECTION FOR AUTOMOBILE STORAGE BUILDINGS

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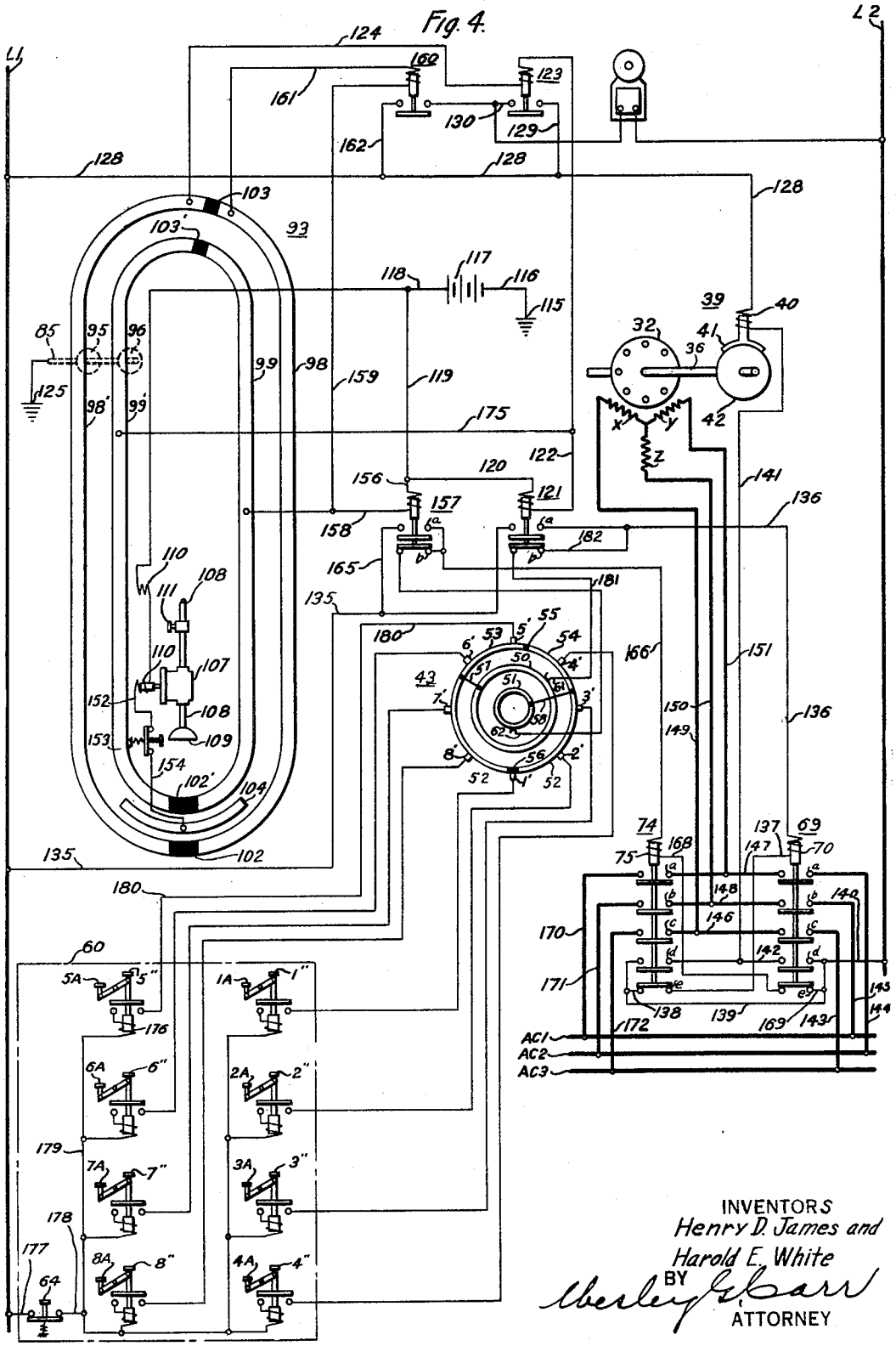
Fig. 4.



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UNITED STATES PATENT OFFICE

1,934,503

FIRE PROTECTION FOR AUTOMOBILE STORAGE BUILDINGS

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Application October 6, 1930. Serial No. 486,690

12 Claims. (Cl. 187—16)

Our invention relates to fire protection for automobile storage buildings and it has particular relation to a control system for an automobile parking device of the circuitous-elevator type which automatically effects the movement of a receptacle to a station by the shortest route when a fire occurs thereon, and to a control system for effecting movement of a circuitous elevator by control means on each receptacle thereof.

As a solution to the automobile parking problem incident to congested metropolitan areas, automobile storage buildings having elevators of the circuitous type have long been contemplated and various modifications of circuitous elevators, as to mechanical structure, have been suggested, each comprising essentially a plurality of automobile movers, cages, or receptacles simultaneously movable successively through two adjacent vertical straight paths interconnected at top and bottom to constitute an endless circuitous path. A preferred construction comprises a plurality of receptacles for supporting automobiles pivotally suspended in succession between a pair of endless flexible members, such as chains, disposed one on each side of the receptacles and suitably supported at the top and bottom by rotatable sheaves or sprocket wheels.

Our invention, as herein described, is applied to an automobile-storage device of the latter type, although it should be understood that it is applicable to circuitous elevators of any type.

The danger of fire hazard incident to the commercial operation of an automobile-storage device of this type, by reason of the presence of explosive and inflammable gasolines and oils, is obvious. In ordinary constructions, the circuitous elevator is completely enclosed in a towerlike structure which prevents access to automobile receptacles located, or stopped, at levels other than that of the loading station at the ground floor.

Therefore, in order to move a receptacle in which a fire has occurred, to a point in its travel, such as at the loading station at the ground level, where ready access thereto may be had for the application of fire-extinguishing fluids or vapors, we have provided a control system for the motive means of the circuitous elevator. Upon the occurrence of a fire in any one of the receptacles, our control system automatically effects the actuation of the circuitous-elevator motive means to move the receptacle, upon which a fire has occurred, to the lowest position in the supporting structure, by the shortest route, stops the burning receptacle thereat and automatically effects the operation of fire-extinguishing sprays upon the arrival of the burning receptacle at the proper position.

We have further provided, as a part of our control system, control means on each receptacle by which a person on a receptacle at some position, other than the loading and unloading station may control the operation of the circuitous elevator. Such a control is decidedly advantageous for purposes of maintenance and repair, or when a person is, for any other reason, carried upon a receptacle away from the loading and unloading station, designedly or accidently, in that the person may return the receptacle to the loading and unloading station, or otherwise control the operation of the circuitous elevator.

Therefore, it is an object of our invention to provide a means, including a means responsive to heat or fire upon any of the receptacles of a circuitous elevator, for automatically effecting the movement of the receptacles, whereby the receptacle upon which a fire occurs is moved, by the shortest route, to a predetermined position and stopped thereat.

Another object of our invention is to provide an auxiliary means for controlling the movement of the circuitous elevator by control means on each receptacle.

Another object of our invention is to provide an alarm means for indicating the occurrence of a fire on any of the receptacles of a circuitous elevator.

A further object of our invention is to provide means for automatically effecting the operation of sprays for projecting fire-extinguishing fluids or vapors into a burning receptacle upon its arrival at a predetermined position.

A still further object of our invention is to provide means for interlocking our auxiliary control system with the main control system for the normal operation of the circuitous elevator, whereby the latter is rendered ineffective whenever the former is operated.

Other objects of our invention will be readily appreciated from the subsequent description of our invention in connection with the accompanying drawings, wherein:

Figure 1 is a diagrammatic view partly in front elevation and partly in section, of a circuitous elevator showing the application of our invention thereto;

Fig. 2 is an enlarged fragmentary view of the means for supporting a receptacle from a trunnion shaft or rod, and the means associated therewith for establishing an electrical connection to a receptacle through the end thereof;

Fig. 3 is an enlarged fragmentary view, taken on line III—III of Fig. 1, showing the relation of the brush members and the associated track, comprising contact strips, when a receptacle is in the lower-most position in the building structure, and

Fig. 4 is a diagram of the control system for our invention for effecting the results herein described.

Our invention is illustrated as applied to a circuitous elevator (see Fig. 1) in which a plurality of automobile receptacles or cages, 1 to 8 inclusive, are suitably supported for simultaneous movement within a supporting or housing structure 21 in a circuitous path comprising two adjacent straight vertical portions which are interconnected at the top and at the bottom.

Each receptacle is suspended from a trunnion rod or shaft 22, each end of which is pivotally attached to, and supported at a lateral distance from, one of a pair of endless chains 24 having the shape of a loop and disposed on opposite sides of the receptacle. The chains 24 are suitably supported and movable around upper sheaves or sprocket wheels 25 and lower sheaves or sprocket wheels 26.

Bracket arms 27 and 28 are provided for supporting the receptacles at a lateral distance from the endless chains 24. One end of the arm 27 is pivotally attached to the endless chain 24 at one portion thereof, and one end of the arm 28 is pivotally attached to the same endless chain at a distance therefrom, approximately equal to the length of the arms 27 and 28. The other corresponding ends of the arms 27 and 28 converge and are suitably fastened to a bearing member 23 for rotatably supporting one end of the trunnion shaft 22. Similar bracket-arm supports are attached to the parallel endless chains at corresponding levels and at regular intervals for supporting opposite ends of the trunnion shaft 22 of each receptacle.

The bracket arms 27 and 28, supporting the receptacles at a lateral distance from the endless chains, effect a close spacing of successive receptacles during movement thereof through the vertical portions of their path of travel and also effect an increased speed of movement of the cages, as they transfer from one vertical path to the other around the upper sprocket wheels 25 or the lower sprocket wheels 26, whereby the necessary clearance is obtained between successive receptacles.

Each of the sprocket wheels 25 and 26 is keyed to a stub shaft 29 which is suitably retained in bearing members 30 attached to structural members 31 constituting parts of the building structure 21.

The receptacles are moved simultaneously through a circuitous path which is similar to, and greater in length than, that of the endless chains 24, by a motor 32 of any suitable type. The motor 32 drives a gear mechanism 33 comprising a pair of sprocket wheels 34, each engaging one of the adjacent straight vertical portions of the endless chain 24 at corresponding levels and having a pinion gear 35 keyed to the shaft 36 of the motor 32 and meshing with the gear wheels 37 which are also keyed to the same shafts 38, respectively, as the sprocket wheels 34.

Each of the receptacles or cages is of a box-shape and is suitably constructed of structural material constituting a suitable framework. Each of the cages is provided with fire protective and insulating material disposed at the top and at the bottom thereof. The ends of each cage are preferably open, and automobiles are driven directly upon and off the cages when they are in their lowermost position at a loading and unloading station at the bottom of the building structure 21. Suitable gates or closures may be provided which may or may not be of fire-protective material. The sides of the cages or receptacles are open, since the receptacles are of such a width as to necessitate such construction to allow the doors of the automobiles disposed thereon to be opened.

A brake 39, of a suitable and well known type, comprising a magnet coil 40 energizable to release the brake shoe 41 from engagement with the brake drum 42, keyed to the shaft 36 of the motor, is provided.

A selector switch 43, comprising a part of the control system for normal operation of the circuitous elevator and for effecting the movement of a selected receptacle to a loading station by the shortest route, is provided.

The principle of construction and operation of the selector switch 43 is described in the copending application of F. E. Lewis, Serial No. 398,898, now Patent 1,856,876, assigned to Westinghouse Electric & Manufacturing Company, and an almost identical system of control, associated with a selector switch of this type, is described in the copending application of H. D. James and H. E. White, Serial No. 458,110, assigned to the Westinghouse Electric & Manufacturing Company. It should be understood that this selector switch and its associated control system do not constitute parts of our invention.

Briefly, the selector 43 comprises a cylindrical drum 43′ (see Fig. 1) which has three rings 50, 51 and 52, (see Fig. 4) disposed around the outside periphery thereof, and which is driven in accordance with the movement of the receptacles by any suitable means, such as an endless chain 44 which connects the sheaves or sprocket wheels 45 and 46 attached, respectively, to the shaft 47 of the drum 43′ and to one of the shafts 29.

The selector switch may be mounted in any suitable position, such as on the wall of the supporting structure 21.

The rings 50 and 51 are of any suitable conducting material and present an unbroken outer periphery. The ring 52 comprises two semi-circular segments 53 and 54 of conducting material, the segment 53 being slightly longer than segment 54, and the two segments being separated by insulating segments 55 and 56. The segment 53 is connected to the ring 50 by a conductor 57, and segment 54 is connected to the ring 51 by a conductor 58.

A push-button panel board 60 is provided which has push button switches 1′′ to 8′′ disposed thereon in a suitable manner for the purpose of calling receptacles 1 to 8 respectively, to the bottom-most position at the ground level by the shortest route.

One contact member of each of the push-button switches 1′′ to 8′′ is connected, by electrical conductors, to the brushes 1′ to 8′, respectively, which are disposed at regular angular intervals, around the periphery of the ring 52 in engagement with the segments thereof.

A brush member 61, engaging the ring 50, and a brush member 62, engaging the ring 51, are connected, respectively, to the energizing coil 70 of a direction relay 69 and the coil 75 of a direction relay 74.

The energization of the relay 69, by the opera-

tion of any of the call switches 1'' to 8'', effects the actuation of the motor 32 for moving the receptacles through the building structure 21 in a counter-clockwise direction. The relay 74, when energized by the operation of any of the call switches 1'' to 8'', effects the actuation of the motor 32 to move the receptacles through the building structure 21 in a clockwise direction.

The direction of movement of a receptacle which is called to the loading station by the operation of one of the push-button switches 1'' to 8'' is automatically determined by the physical relation of the segments 53 and 54 on ring 52 and the brush members 1' to 8', which establishes the proper control circuit to so energize either relay 69 or relay 74 that the receptacle called moves to the lowermost position in the building structure 21 by the shortest route.

An emergency-stop push-button 64 is provided on the panel 60 for the purpose of stopping the movement of receptacles at any time during their movement.

The call switches 1'' to 8'' may be of any suitable type which remain closed after a momentary closing thereof by hand, until the receptacle, which is called thereby, reaches the lowermost position in its path of travel.

Auxiliary push-button members 1A to 8A are provided for the push-button switches 1'' to 8'', respectively, for manually opening each of the switches once they are closed, whether the receptacle which the operation thereof has called to the loading station has reached that position or not. That is, these auxiliary push-buttons 1A to 8A are provided for the purpose of cancelling a call prior to the complete response to the call set up by the operation of the call switches 1'' to 8'', respectively.

We have provided a means for detecting extraordinary heat or fire on any of the receptacles 1 to 8, which comprises a plurality of fusible links 80 on each receptacle (see Fig. 2). Each of the fusible links comprises a strip of metal which fuses, at a predetermined degree of heat or temperature caused by fire.

Referring to Fig. 2, it will be seen that we have provided a switch lever 81, pivotally attached at the joint 82 to a bracket arm 83, and in turn, attached to the top cross member 22' of a receptacle. The lever 81 is for the purpose of controlling the actuation of motor 32 for moving the receptacles.

The upper end of the lever 81 extends into the hollow end of the trunnion rod 22, the elongated slot 84 in the wall of the trunnion rod permitting a pivotal movement of the lever 81 about the joint 82. The upper end of the lever 81 is bifurcated, the prongs 87 of which having elongated slots 88 therein, extend parallel to the longitudinal axis of the lever.

A rod or shaft 85 is slidably mounted in a bearing member 86 which is retained within the hollow end of the trunnion shaft 22 and has a pair of lugs 89 projecting radially outward, at the opposite ends of a horizontal diameter of the rod 85, to engage the slots 88 in the prongs 87 of the lever 81.

A cylindrical spring 90 is disposed concentrically around the rod 85 between the inside end of the bearing member 86 and a collar 91 on the rod 85 which engages the prongs 87 of the lever 81. One end of a cable 92, comprising the fusible links 80, previously mentioned, is attached to the lower end of the lever 81, and the other end is attached to a portion of the receptacle, such as the opposite end of the trunnion shaft 22, whereby the fusible links 80 are suitably positioned to be acted upon by extraordinary heat or fire occurring in the receptacle.

The length of the cable 92 and its point of attachment to the receptacle are such that the lever 81 is normally maintained in a vertical position against the force of the spring 90. The lever 81, although normally maintained in a vertical position, is manually movable to the right, in the direction indicated by the arrow in Fig. 2, against the force of the spring 90. The lower end of the lever 81 is also movable to the left, in Fig. 2, by the force of the spring 90 when any of the fusible links 80 break. When the lower end of the lever 81 is moved to the left a requisite distance, the rod 85 is moved slidably in the bearing 86 to the right and a brush member 95 on the rod 85 is caused to engage a contact segment 98. When the lower end of the lever 81 is moved to the right, the rod 85 is slidably moved to the left, and a brush member 96 thereon engages a contact segment 99.

The contact segments 98 and 99 constitute parts of a switching means for automatically determining the direction of rotation of the motor 32 to move the receptacle on which a fire has occurred to the lowermost position in the structure 21 by the shortest route.

The contact segments 98 and 99 are parts of an endless track 93 that is similar, in contour, to the path of travel of the endless chains 24 and supported in parallel and concentric relation thereto. (See Fig. 1.) The track is of laminated structure, having conducting strips on the outside that are separated by, and attached to, a common insulating strip 100 by means of screws 101. One of the conducting strips comprises two segments 98 and 98', respectively, the two segments being separated by short insulating segments 102 and 103. The segment 102 is disposed at the lowermost point of the track at the bottom of the structure 21, and the segment 103 is disposed in the portion of the track near the top of the structure 21.

The conducting strip on the other side of the insulating strip 100 comprises the two segments 99 and 99', separated by two short insulating segments 102' and 103', in the manner described for segments 102 and 103, respectively, and alined therewith.

The track is suitably supported in such manner as to allow a continuous movement of the brush members 95 and 96, on the receptacles, therearound but free from engagement therewith until moved by the lever 81 into engagement therewith. The preferred method of supporting the track is by horizontally disposed struts 105, suitably attached to the bearing members 30 on the outside of the sprocket wheels 25 and 26 and connected to portions of the track on opposite sides of the sprocket wheels.

An insulating cylinder 85' surrounds the portion of the rod 85 between the two brush members 95 and 96 to prevent short-circuiting the segments 98 and 99 or the segments 98' and 99' by the rod 85.

The engagement of the brush member 95 on a receptacle with the segment 98, when caused by movement of the associated operating rod 85, establishes an electrical circuit including the clockwise direction relay 74, which effects the energization of the motor 32 to move that receptacle, in a clockwise direction, to the lowermost position in the structure, which is the shortest route to that position. When the brush member

95 runs off the strip 98 and upon the insulating segment 102, the circuit is interrupted, and the motor stops, with the receptacle in the loading and unloading position, whereby an automobile may be driven directly on or off the receptacle.

When the brush member 95 engages the segment 98' an electrical circuit is set up which causes the motor 32 to move the receptacles in a counter-clockwise direction and, when the brush 95 runs off the segment 98' and upon the insulating segment 102, this circuit is interrupted, and the motor is stopped, with the corresponding receptacle in the lowermost position.

An alarm device, such as an ordinary electrically-operated bell 106, is provided, which rings whenever any of the brush members 95 engage either of the segments 98 and 98'. The alarm bell serves to attract attention to the fact that a fire has occurred in one of the receptacles.

An arcuate conducting strip 104, extending parallel to the lowermost portion of the track 93 is suitably supported from the structure 21. The arcuate strip 104 is disposed in the plane of the segments 98 and 98', and the brush member 95 simultaneously engages the lowermost portions of either of the segments 98 and 98' and the strip 104, as illustrated in Fig. 3.

A plurality of fire-extinguishing sprays 109 for projecting suitable fluids or vapors into a receptacle in the lowermost position of the path of travel thereof are provided in a suitable position and are automatically actuated when the brush member 95 of any receptacle engages the arcuate strip 104.

The sprays 109 have pipe lines or hose lines 108 leading thereto from a source of supply (not shown) to be controlled by electro-magnetically operated valves 107, which are normally closed, and manually operated valves 111, which are normally open.

The engagement of any of the brush members 95 with the arcuate strip 104 completes an energizing circuit for the magnet coils 110 of the valves 107, whereby the valves are opened. The valves 107 are reclosed by opening the normally closed switch 153, preferably of the push-button type, which deenergizes the magnet coils 110.

The valves 111 are for the purpose of stopping the operation of the sprays at any time.

The main control system, comprising call switches 1'' to 8'' inclusive is interlocked with the auxiliary control system, comprising the lever 81 on each receptacle, by means of contact members *b* on relays 121 and 157, whereby the former is rendered ineffective whenever the latter is operated. The relay 121 is actuated to open its normally closed contact members *b* whenever any of the brush members 95 and 96 engage, respectively, the segments 98' and 99', whereby the effective operation of the call switches 1'' to 8'' inclusive having the contact members *b* or relay 121 in circuit therewith, is prevented. The relay 157 is actuated to open its normally closed contact members *b* whenever any of the brush members 95 and 96 engage, respectively, the segments 98 and 99, whereby the effective operation of the call switches 1'' to 8'' inclusive is prevented.

The operation of the system, as a whole, is best understood by an assumed operation. Let it be assumed that a fire occurs on receptacle 6 when positioned as illustrated in Fig. 1. One or several of the fusible links 80, melting under the application of heat or fire thereto, sever and thus release the lever 81. The spring 90 forces the upper end of the lever 81 and, therefore, the rod 85 to the right (Fig. 2), causing the brush 95 to engage the segment 98' which completes an electrical circuit for actuating the alarm bell 106 and effects the rotation of the motor 32 in such direction as to cause the receptacles to be moved in a counter-clockwise direction. The circuit extends from the ground connection 115, through conductor 116, a source of supply, such as a battery 117, conductors 118, 119 and 120, relay 121, conductor 122, relay 123, conductor 124, segment 98', brush 95, and rod 85, back to the ground connection 125. It will be understood that the rod 85 is electrically connected to the ground through the bracket arms 27 and 28, the chains 24, the sprocket wheels 25 and 26, the bearings 30 and the structural members 31.

The energization of the relay 123 effects the closing of the normally open contact members thereof which completes an energizing circuit through the alarm bell 106, causing it to ring. This circuit extends from supply conductor L1, through conductors 128 and 129, contact members of relay 123, conductors 130 and 131, bell 106, and conductor 134, to supply conductor L2. Thus the alarm bell 106 rings whenever a fire occurs, or whenever a predetermined degree of heat, sufficient to fuse the links 80, exists on any of the receptacles so positioned that its brush member 95 will engage the segment 98'.

The energization of the relay 121 effects the closing of the normally open contact members *a* and the opening of the normally closed contact members *b* thereof.

The opening of the contact members *b* of the relay 121 opens the control circuit through the call switches 1'' to 8'' and prevents the operation of the circuitous elevator thereby. Therefore, it will be seen that the contact members *b* constitute an interlock between the main control system for the motor 32 comprising the call switches 1'' to 8'' and the auxiliary control for the motor 32, comprising the lever 81 on each of the receptacles, and prevents operation of the former control whenever the latter is in use.

The closing of the contact members *a* of the relay 121 closes a circuit for energizing the coil 70 of the counter-clockwise direction relay 69, which circuit extends from supply conductor L1, through conductor 135, contact members *a* of the relay 121, conductor 136, coil 70, conductor 137, normally closed contact members *e* of the clockwise direction relay 74 and conductors 138, 139 and 140, to supply conductor L2.

The energization of the coil 70 closes the normally open contact members *a*, *b*, *c*, and *d* and opens the normally closed contact members *e* of the relay 69.

The contact members *e* of the relay 69 are in the energizing circuit of the coil 75 of the clockwise-direction relay 74, and, therefore, when open, prevent the energization thereof. It will thus be seen that the contact members *e* constitute an interlock between the direction relays 69 and 74, whereby only one can be actuated at a time.

The closing of the contact members *d* of relay 69 closes the energizing circuit through the magnet coil 40 for the brake 39, associated with the motor 32, which circuit extends from supply conductor L1, through conductor 128, coil 40, conductors 141 and 142, contact members *d* of relay 69 and conductor 140, to supply conductor L2. The energization of the coil 40 moves the brake shoe 41 away from the brake drum 42, against the force of a spring (not shown) and permits the rotation of the motor 32, which is effected by the

electrical connections established to the three phases X, Y and Z, of the motor 32, by the closing of the normally open contact members *a*, *b* and *c*, of relay 69.

The electrical connections to the three phases X, Y and Z of the motor 32, for this direction of rotation, extend from the three-phase supply conductors AC3, AC2 and AC1, respectively, through the conductors 143, 144 and 145, contact members *c*, *a*, and *b*, conductors 146, 147 and 148 and conductors 149, 150 and 151.

The motor 32 thus rotates and causes the receptacles to be moved in a counter-clockwise direction. The receptacles continue to move until the brush-member 95 of receptacle 6 engages the arcuate strip 104, which establishes an energizing circuit through the magnet coils 110 for controlling the electromagnetically operated valves 107. This circuit extends from the ground connection 115, through conductor 116, source of supply 117, conductor 118, the coils 110, conductor 152, normally closed switch 153, conductor 154, arcuate strip 104, brush member 95 and the shaft 85, to the ground connection 125, as previously described.

The energization of the coils 110 opens the pipe line 108 leading to each of the sprays 109 and causes them to project a fire-extinguishing fluid or vapor upon and into the receptacle 6, which is, at this time, in the line of projection thereof.

A short further movement of the receptacle 6 causes the brush member 95 thereon to run off the segment 98' and upon the insulating segment 102, which effects the interruption of the motor and bell circuits previously traced, and stops the motor 32, with the receptacle 6 in the lowermost position, where the sprays 109 continue to project the fire-extinguishing fluid or vapor into the receptacle. When the fire is extinguished, the manually operated valves 111 are closed or the switch 153 is opened. In either case, the pipe lines 108 are closed, and the operation of the sprays 109 is stopped. We have illustrated only two sprays 109, but it should be understood that a plurality of similar sprays may be suitably disposed for more efficient fire-extinguishing operation.

It should be noted that the moving of the receptacle, upon which a fire has occurred, to the lowermost position, permits the application by the garage attendants of fire-extinguishing fluids or vapors by means, other than the sprays 109, which may be conveniently brought or moved to a burning receptacle in the lowermost position in its path of travel.

For a further understanding of our control system, let it be assumed that a fire has occurred on the receptacle 4. In this case, the fusible links 80 thereon are severed, the rod 85 is so moved that the brush 95 on receptacle 4 engages the segment 98 which establishes a circuit for causing the alarm bell 106 to ring and the motor 32 to rotate in such direction as to move the receptacles in a clockwise direction. This circuit extends from the ground connection 115, through conductor 116, source of supply 117, conductors 118, 119 and 156, relay 157, conductors 158 and 159, relay 160, conductors 161, segment 98 and brush 95, to the ground connection 125 in a manner similar to that previously traced.

The energization of the relay 160 closes the normally open contact members thereof, which establishes a circuit through alarm bell 106, which circuit extends from supply conductor L1, through conductors 128 and 162, contact members of the relay 160, conductors 130 and 131, bell 106, and conductor 134, to supply conductor L2. It will thus be seen that the engagement of the brushes 95 with either of the segments 98 and 98' effects the ringing of the alarm bell 106.

The energization of the relay 157 closes its normally open contact members *a* and opens its normally closed contact members *b*. The opening of contact members *b* prevents the effective operation of call switches 1'' to 8'' inclusive since it opens the control circuits controlled thereby. The closing of contact members *a* closes the energizing circuit through the coil 75 of the clockwise-direction relay 74. This circuit extends from supply conductor L1, through conductors 135 and 165, contact members *a* of the relay 157, conductor 166, coil 75, conductor 168, normally closed contact members *e* of the relay 69 and conductors 169 and 140, to supply conductor L2.

The energization of the coil 74 causes the normally open contact members *a*, *b*, *c*, and *d* of the relay 74 to close and the normally closed contact members *e* to open.

As previously mentioned, the opening of contact members *e* prevents energization of relay 69 so long as relay 74 is actuated to a closed position.

The closing of the contact members *d* of the relay 74 effects the energization of the coil 40 of the brake 39 in the same manner and through substantially the same circuit as was traced for contact members *d* of the relay 69, the contact members *d* of the relay 74 being shunted across the contact members *d* of the relay 69.

The contact members *a*, *b* and *c* of the relay 74, when closed, connect the three-phase alternating-current supply conductors AC1, AC2 and AC3 to the terminals of phases Y, Z and X, respectively, of the motor 32. The connection to the terminal of the phase Y extends from the supply conductor AC1, through conductor 170, contact members *a* of relay 74 and conductors 147 and 151. The connection to phase Z extends from supply conductor AC2, through conductor 171, contact members *b* of the relay 74 and conductors 148 and 150. The connection to phase X extends from supply conductor AC3, through conductor 172, contact members *c* of the relay 74 and conductors 146 and 149.

It will thus be seen that the connections to the phases Y and Z are interchanged from that established by the closing of contact members *a*, *b* and *c* of the relay 69. Therefore, it will be apparent that the closing of the relay 74 effects the rotation of the motor 32 in a direction opposite to that effected by the closing of the relay 69, and that the direction is such that the receptacles are moved in a clockwise direction.

When receptacle 4 reaches substantially the lowermost position in its path of travel, its brush member 95 engages the arcuate strip 104, which establishes an energizing circuit for the coils 110, for opening the valves 107 in the pipe lines 108 leading to the fire-extinguishing sprays 109, in the same manner as, and through a circuit substantially identical with that described previously for receptacle 6.

When receptacle 4 reaches the lowermost position in its path of travel, its brush 95 runs off the segment 98 and upon the insulating segment 102, which effects the interruption of the energizing circuits previously traced for the alarm bell 106 and the motor 32. Thus, the bell stops ringing, and the motor 32 stops with receptacle 4 in the lowermost position in its path of travel.

We have further provided a means for controlling the movement of the receptacles by a person

operating a control means on any of the receptacles. In this system of control, the lever 81 of any of the receptacles is operated by a person on that receptacle, by his moving the lower end of the lever 81 to the right, in Fig. 2. The upper end of the lever is thus moved a sufficient amount to the left, against the force of the spring 90, until the brush 96 engages the contact segment 99, comprising a part of the track 93, previously described.

The engagement of the brush 96 with the segment 99, completes a control circuit for energizing the motor 32 to rotate in such direction as to move the receptacles in a clockwise direction. The automatic stopping of the motor 32 to stop the receptacle on which the lever 81 has been operated, in its lowermost position in its path of travel, is effected by the brush 96 running off segment 99 and upon the insulating segment 102'. The operation of this part of our control system is best understood by an assumed operation.

Let it be assumed that a person on receptacle 4, positioned as illustrated in Fig. 1, operates the lever 81 so that the brush 96, associated therewith, engages the contact segment 99. The engagement of brush 96 with the segment 99 completes a circuit for energizing relay 157, which circuit extends from ground connection 115, through conductor 116, source of supply 117, conductors 118, 119 and 156, relay 157, conductor 158, segment 99, brush 96 and shaft 85 to the ground connection 125.

The energization of the relay 157 closes its normally open contact members *a*, and opens its normally closed contact members *b*. The functions of these contact members have been previously explained. Contact members *a*, when closed, complete an energizing circuit through coil 75 of clockwise-direction relay 74, which circuit has been previously traced. Movement of the receptacles by the motor 32 is thus effected in a clockwise direction.

The arcuate strip 104, being in the plane of the contact strips 98 and 98' and not in the plane of the contact strips 99 and 99' (see Fig. 3), it will be obvious that, when receptacle 4 reaches substantially its lowermost position in its path of travel, the brush 96 thereon does not engage the arcuate strip 104 and, therefore, the fire-extinguishing sprays 109 are not operated.

When the receptacle 4 reaches the bottom-most position in its path of travel, the brush 96 thereon runs off the segment 99 and upon the insulating segment 102', which effects the interruption of the energizing circuit for relay 157, and, therefore, the immediate stopping of the receptacle 4 in that position, as a result of the immediate stopping of the motor 32.

Similarly, the operation of the lever 81 on receptacle 6, as positioned in Fig. 1, effects the engagement of the brush member 96 on that cage with contact strip 99'. This completes the energizing circuit through relay 121, which circuit extends from ground connection 115, through conductor 116, source of supply 117, conductors 118, 119 and 120, relay 121, conductors 122 and 175, contact strip 99', brush member 96 and the shaft 85, to the ground connection 125.

The actuation of the relay 121, opens its normally closed interlock contact members *b* and closes its normally open contact members *a*, which complete the energizing circuit for coil 70 of the counter-clockwise direction relay 69, as previously traced. This effects a rotation of the motor 32 in a direction to cause the receptacles to move in a counter-clockwise direction until the brush 96 on the receptacle 6 runs off the segment 99' and upon the insulating segment 102, which effects the stopping of the motor 32, in the manner previously described.

The normal operation of the circuitous elevator is effected by the main control system comprising the push-button switches 1'' to 8'' located on the panel 60. This part of the control system illustrated in Fig. 4 does not constitute a part of our invention. However, an assumed operation for this control system will serve to complete the understanding of our invention. Let it be assumed that it is desired to call receptacle 5 from its position, illustrated in Fig. 1, to the lowermost position in its path of travel, namely, the position occupied by receptacle 1 in Fig. 1. A person depresses the call switch 5'', thus immediately closing the contact members thereof. The closing of the contact members completes an energizing circuit through coil 176 of the switch 5'' which effects the maintenance of the closed position of the contact members of the switch 5''. The closing of the contact members of the switch 5'' also completes an energizing circuit through coil 70 of the counter-clockwise-direction relay 69, which is the same as the energizing circuit for the coil 176, and which extends from supply conductor L1, through conductor 177, emergency stop push-button switch 64, conductors 178 and 179, coil 176, contact members of the switch 5'', conductor 180 brush member 5', contact segment 53 of the selector switch 43, conductor 57, ring 50, brush member 61, conductor 181, interlock contact members *b* of the relay 121, conductors 182 and 136, coil 70, conductor 137, contact members *e* of the relay 74 and conductors 138, 139 and 140, to supply conductor L2.

The actuation of the relay 69 effects the actuation of the motor 32 to move the receptacles in a counter-clockwise direction. The stopping of the receptacles is effected when the brush member 5' runs off the contact segment 53 and upon the insulating segment 56, which occurs when receptacle 5 reaches the lowermost position in its path of travel. The engagement of the brush 5' with the insulating segment 56 interrupts the energizing circuit through the coil 176 of the switch 5'' and coil 70 of the relay 69 previously traced, so that the contact members of the switch 5'' open simultaneously with the stopping of receptacle 5 in its lowermost position in its path of travel.

The operation of the call switch 4'', when the receptacle 4 is in the position illustrated in Fig. 1, effects the movement of receptacle 4 to its lowermost position in its path of travel by the shortest route, which is a clockwise direction. The automatic stopping of receptacle 4, upon its arrival at its lowermost position in its path of travel, is effected by the interruption of the energizing circuit for relay 74 by the engagement of the brush 4' with insulating segment 56 of the selector switch 43.

It will thus be seen that we have provided a control system for automatically effecting the movement of a receptacle of a circuitous elevator, upon which a fire has occurred, to the lowermost position in its path of travel by the shortest route, immediately upon the occurrence of the fire, and for automatically stopping it upon its arrival thereat.

It will be seen also that we have provided a means for controlling the movement of receptacles by control means on each receptacle.

It will be seen also that we have provided a

means for automatically actuating fire-extinguishing sprays to project suitable fluids or vapors into a receptacle upon which a fire has occurred, when that receptacle reaches the lowermost position in its path of travel.

It will be seen further that we have provided a means for interlocking the control system comprising operating means on each receptance, when the control system for normal operation of the circuitous elevator whereby the latter is rendered ineffective when the former is operated or in operation.

We are aware that our invention is capable of various modifications without departure from the spirit of our invention. We intend that the figures and diagrams, which we have described, be illustrative only, and do not desire to be limited except by the scope of prior art and the appended claims.

We claim as our invention:

1. In a conveyor, a plurality of load movers movable in a circuitous path past a station, motive means for moving the load movers in said path, and means, including means responsive to the existence of a predetermined degree of heat or the existence of fire in any of said load movers, for effecting the actuation of said motive means to move a load mover so conditioned to the said station by the shortest route.

2. In a conveyor, a plurality of load movers movable in a circuitous path successively past a station, motive means for moving the load mover in said path, and means, including means responsive to the existence of a predetermined degree of heat or the existence of fire in any of said load movers, for effecting the actuation of said motive means to move said load movers and stop them when one on which a predetermined degree of heat or on which a fire exists reaches the said station.

3. In a conveyor, a plurality of load movers movable in a circuitous path successively past a station, motive means for moving the load movers in said path, and means, including means responsive to the existence of a predetermined degree of heat or the existence of fire in any of said load movers, for effecting the actuation of said motive means to move a load mover on which a fire or a predetermined degree of heat exists to the said station by the shortest route and stop it thereat.

4. In a control system for the motive means for moving the receptacles of a circuitous elevator, means including means responsive to a predetermined degree of heat on any of the receptacles, for effecting the actuation of the motive means to move a receptacle, on which a predetermined degree of heat exists, to a predetermined position.

5. In a control system for the motive means for moving the receptacles of a circuitous elevator, means including means responsive to a predetermined degree of heat on any receptacle, for effecting the actuation of the motive means to move a receptacle on which a predetermined degree of heat exists to a predetermined position and stop it thereat.

6. In a control system for the motive means for moving the receptacles of a circuitous elevator, means, including means responsive to a predetermined degree of heat on any receptacle, for effecting the actuation of the motive means to move a receptacle on which a predetermined degree of heat exists to a predetermined position by the shortest route.

7. In a control system for the motive means for moving the receptacles of a circuitous elevator, means, including means responsive to the existence of a predetermined degree of heat on any receptacle, for effecting the actuation of the motive means to move a receptacle on which a predetermined degree of heat exists to a predetermined position by the shortest route and stop it thereat.

8. In a control system for the motive means for moving the receptacles of a circuitous elevator, means, including means responsive to the existence of a fire on any of the receptacles, for effecting the actuation of the motive means to move the receptacles until the receptacle on which a fire exists reaches a predetermined position in its path of travel and then stopping the receptacles.

9. In a control system for the motive means for moving the receptacles of a circuitous elevator, means, including means responsive to the existence of a fire on any of the receptacles, for effecting the actuation of the motive means to move the receptacle on which a fire exists to a predetermined position by the shortest route and stop it thereat.

10. In a fire protective system for a conveyor comprising a plurality of load movers simultaneously movable in a circuitous path successively past a station, means responsive to the existence of a fire on any of the load movers, fire-extinguishing means at said station, and means, cooperable with said fire-responsive means, for actuating said fire-extinguishing means when a load mover on which a fire exists arrives substantially at the station.

11. In a conveyor comprising a plurality of load movers movable simultaneously in a circuitous path successively past a station, and motive means for moving the receptacles in said path, control means for said motive means for automatically moving a load mover, on which a fire exists, to said station by the shortest route and stopping it thereat, comprising a track having conducting segments and insulating segments therebetween, said track being similar in size and shape to the path of movement of said load movers, means on each load mover responsive to the existence of a fire thereon, means on each load mover actuable thereby to engage one of the segments of the said track, whereby said motive means is connected to a source of supply and caused to move the load movers until the track-engaging means engages one of the insulating segments.

12. In a control system for the motive means for moving the receptacles of a circuitous elevator, control means for said motive means for normal operation of said circuitous elevator, and control means for said motive means, on each of the receptacles, for operation in other cases, and means preventing the operation of the former control means upon operation of the latter.

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