United States Patent

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[54] STORAGE SYSTEM
8 Claims, 3 Drawing Figs.

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[50] Field of Search 312/201, 107, 199

[56] References Cited

UNITED STATES PATENTS

2,654,489	10/1953	Ingold	312/199
3,168,361	2/1965	Naito	312/199
3,198,592	8/1965	Zippel	312/198

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ABSTRACT: A storage system comprises a series of storage modules movable relative to one another to provide selectively an aisle space therebetween. The modules are selectively power driven through a drive bar that underlies the modules and is movable in opposite directions from a neutral position through a stroke sufficient to form the desired aisle after which a control circuit for the system automatically restores the drive bar to its neutral position.

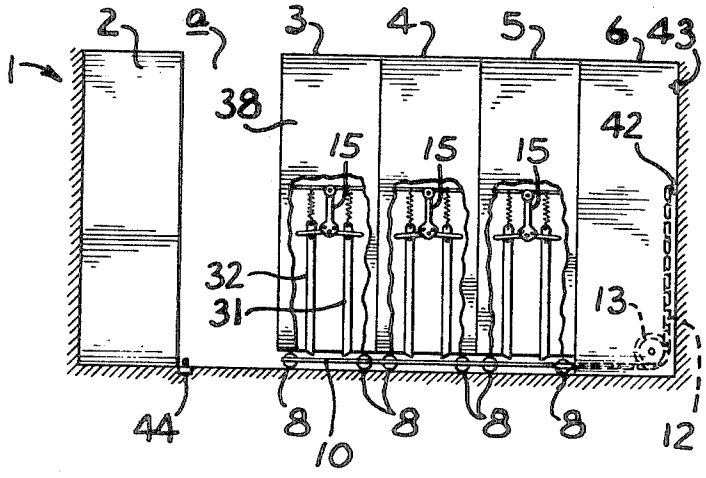


FIG. 1

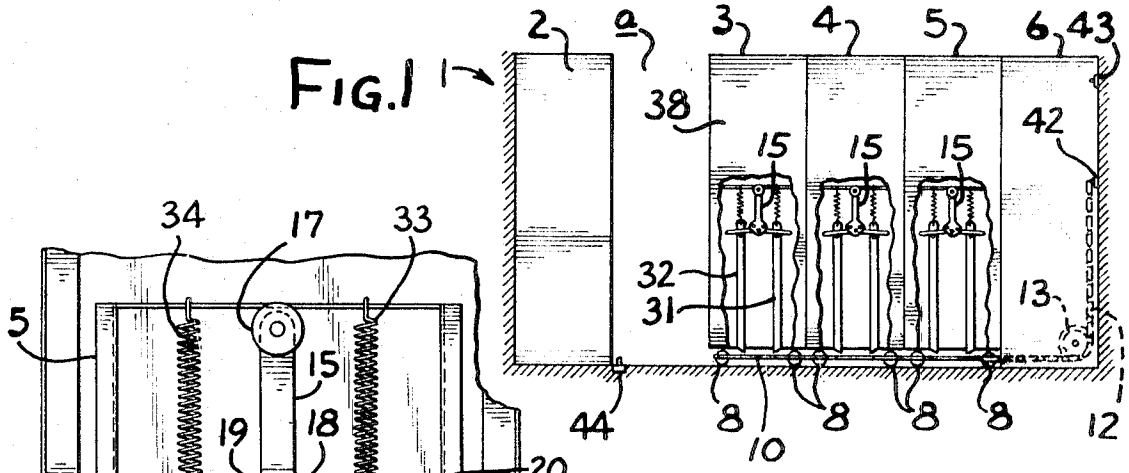
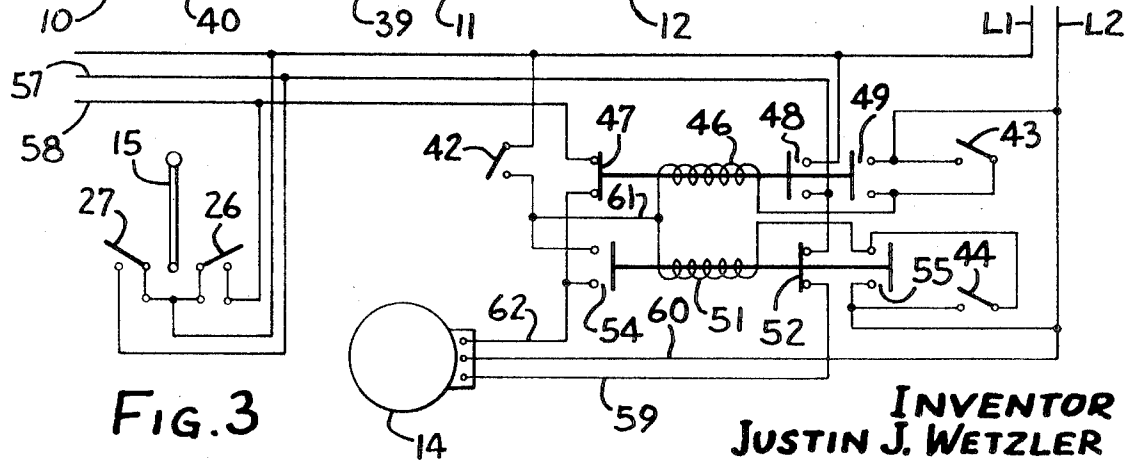


FIG. 2

FIG. 3



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STORAGE SYSTEM

This invention relates to improvements in storage systems of the type containing mobile cabinet or shelving units that are relatively displaceable to provide access aisles between the units.

It is an object of this invention to provide a storage system of the type stated in which the units are power driven by a mechanism that is efficient in operation and is economical in terms of the space required for its installation.

It is a further object of this invention to provide a system of the type stated that eliminates the need for an endless driving chain or the like to underlie the series of storage units in order to be able to drive groups of the units in either of two opposite directions.

In accordance with the objects of the invention, the system comprises a series of storage units or modules juxtaposed so that there is an aisle space between two of the modules. The two endmost modules are fixed while the intermediate modules are rollably mounted on a track. A drive system for the movable modules embodies a drive bar below the modules. There is a lever on each movable module to couple that module with the drive bar and at the same time initiate the movement of the drive bar and move it from its neutral and stationary position through a stroke sufficient to open the desired aisle space and close the previously opened aisle space. Upon completion of the movement of the module or modules, the drive bar is automatically returned to its neutral position and stopped. The drive bar may be actuated for movement in either direction so that the same drive bar may be used to move modules in either direction.

The attainment of the above and further objects of this invention will be apparent from the following description taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

FIG. 1 is a side-elevational view, partly broken away and somewhat diagrammatic in form, of a storage system constructed in accordance with and embodying the present invention;

FIG. 2 is a fragmentary front-elevational view, partly broken away and in section, and on an enlarged scale, of a portion of the structure of the system; and

FIG. 3 is a schematic of the control circuit that forms part of the present invention.

Referring now in more detail to the drawing, 1 designates a storage system comprising a series of storage modules 2, 3, 4, 5, 6, the endmost ones 2, 6 of which are fixed and the intermediate ones 3, 4, 5 of which are mobile. In a typical installation, the mobile modules 3, 4, 5 are each supported on rollers 8 which ride on floor-supported tracks such that each module 3, 4, 5 is capable of movement along a straight path to provide an access space or aisle between any two adjacent modules. The modules may each be units of shelving such that access to the shelves of each unit is provided when an aisle space is formed between two units. For instance, in the position shown in FIG. 1, there is an aisle *a* between modules 2, 3 while the other modules are flush against one another, closing off access between them. Thus, a person can pass between modules 2, 3 for access to the shelves on those modules, which open toward the aisle *a*. While three individually movable, similarly constructed modules 3, 4, 5 are herein shown, this is by way of example only since a greater or lesser number of movable modules may be embodied into the system.

Below the mobile modules is a horizontal drive bar 10 for moving the mobile modules in a manner hereinafter described. The drive bar 10 is secured at one end 11 to the end of a flexible chain 12 which is driven by a sprocket 13 located at the bottom corner of the fixed module 6. The chain extends upwardly along the side of the module 6 that is remote from the module 5, as shown in FIGS. 1 and 2. The chain 12 is of a known type that is capable of transmitting a pushing force to move the drive bar 10 to the left without causing the chain to buckle. The drive bar 10 and chain 12 may be suitably guided by appropriate bearings or guide elements in a manner known in the art. An electric motor-gear reduction unit 14 drives the sprocket 13 under a control of the circuit shown in FIG. 3.

Each mobile module has an operating lever 15 pivoted on the module by a pivot pin 16 manipulated by a handle 17. The lever 15 carries camming pins 18, 19 that are adapted to engage selectively actuator members 20, 21 depending upon the direction of rotation of the lever 15. The members 20, 21 are pivoted for up and down movement on the module by pins 23, 24 and respectively operate normally open switches 26, 27. The members 20, 21 are also adapted to engage follower pins 29, 30 on vertical parallel latch bars 31, 32 to depress the latch bars in opposition to return the springs 33, 34. The vertical positions of the latch bars 31, 32 are maintained by roller-carrying guides 35, 36, 37 on the module.

The latch bars 31, 32 are respectively in the line with slots 39, 40 in the drive bar 10. Thus, when the lever 15 on any one of the mobile modules is rotated from the neutral position shown in the drawing counterclockwise, the member 21 is depressed to close switch 27 and at the same time cause the latch bar 32 to engage in the slot 40. When the lever 15 is released, it returns to the neutral position under the action of the return spring 34. Likewise, when the lever 15 is rotated clockwise, the member 20 closes the switch 26 and latch bars 31, 32 and associated parts may be enclosed by a front panel through which the handle 17 projects.

The control circuit of the system includes a neutral position switch 42 that is of the normally closed type but is maintained open by a suitable projection (not shown) on the chain 12 when the chain 12 and drive bar are at their at rest or neutral positions, as shown in the drawing. There is also provided for the system a right hand return limit switch 43 and a left hand return limit switch 44. The precise physical locations of the limit switches 43, 44 may vary depending upon the location of the actuating elements for the same on the chain-drive bar unit, but suffice it to say that the switches 43, 44 are closed by engagement with the chain-drive bar unit or actuators thereon when the drive bar 10 has moved either to the right or to the left, as the case may be, from its neutral position through its operating stroke. The circuit also includes a relay that has a coil 46 for operating closed contacts 47 and normally open contacts 48, 49. A second relay has a coil 51 for operating normally closed contacts 52 and normally open contacts 54, 55. Power to the circuit is supplied through lines L1, L2. The switches 26, 27 associated with each mobile module are connected in like manner across conductors 57, 58 and line L1. Only one such pair of switches 26, 27 is shown, however, in FIG. 3 for simplicity of illustration.

In use, assume that it is desired to close the aisle space *a* and open an aisle space between modules 5 and 6. The lever 15 on the module 5 is rotated counterclockwise to close switch 27 and engage the latch bar 32 in the drive bar slot 40. Current will then be supplied to the motor 14 from lines L1, L2 through switch 27, conductor 57, normally closed contacts 52 and conductors 59, 60. The motor drives the sprocket 13 clockwise moving the drive bar 10 to the left. With the lever 15 being held in its rotated position, the drive bar 10 moves to the left carrying with it the unit 5, and the units 3, 4 which are pushed by the unit 5.

When the drive bar 10 reaches the end of its stroke, the space *a* will be fully closed and an aisle space of the same width will be provided between the units 5, 6. The stroke of the drive bar 10 is substantially the same as the width of the aisle. At the end of its stroke, the drive bar 10 will close the limit switch 44. Lever 15 may then be released to open switch 27 and allow the lever 15 to return to its normal vertical position. Closing of the limit switch 44 energizes coil 51 by a circuit from L1 through now closed switch 42, conductor 61, and now closed switch 44 to L2. Energizing coil 51 closes contacts 54, 55 and opens contacts 52. This establishes a holding circuit for coil 51 from line L1 through contacts 55 to line L2.

Also, current is then supplied from line L1 through closed switch 42, closed contacts 54 and conductor 62 through the motor 14, conductor 60 and line L2 to rotate the motor 14 and sprocket 13 in the opposite direction. The motor 14 will continue to operate to retract the drive bar 10 to its neutral position which, when reached, results in the switch 42 being biased opened to interrupt the current to the motor 14 and break the holding circuit to the coil 51.

If now an aisle space between modules 3 and 4 is desired, the lever 15 on the module 4 is rotated clockwise to close switch 26 and engage the latch bar 31 in the drive bar hole 39. With the lever 15 so held, current will now be supplied to the motor 14 from lines L1, L2 through switch 26, conductor 58, normally closed contacts 47 and conductors 62, 60. Neutral position switch 42 will become closed. The motor 14 operates to drive the sprocket 13 counterclockwise moving the modules 4 and 5 to the right until the chain 12 closes the limit switch 43, which, as before, occurs at the end of the stroke of the drive bar 10. Closing limit switch 43 energizes coil 46, which closes contacts 48, 49 and opens contacts 47. A holding circuit for coil 46 is established through closed contacts 49, conductor 61 and closed switch 42. Upon release of the lever bar 15, current will be supplied to the motor 14 through conductors 60, 59, normally closed contacts 52 and now closed contacts 48, thereby reversing the direction of the motor 14 and sprocket 13 to retract the drive bar 10 to its neutral position, at which time switch 42 opens to break the holding circuit for the coil 46 and open contacts 48 to interrupt the current to the motor 14.

The motor 14 has a conventional thermostatic overload switch which prevents damage thereto should a person using the system shift one of the levers 15 in a direction in which there is no space for movement. For instance, if the system is in the condition shown, an operator moves the lever 15 on any of the modules 3, 4 or 5 clockwise, no movement of the module will take place but the system will not be damaged.

The precise constructions herein shown are illustrative of the principles of the invention.

What I consider new and seek to be secured by Letters Patent is:

1. A storage system comprising a series of storage modules, said modules being juxtaposed with access space between two adjacent modules with access space between other adjacent modules being closed, means mounting at least one of said modules for movement to open an access space between it and an adjacent module and close said first-mentioned access space, driving means engageable with said movable module, said driving means being movable from a neutral position in a direction toward the first-mentioned space and through a stroke sufficient to open said last-mentioned access space, and

means operable in response to disengagement of said driving means with said movable module for returning said driving means to its neutral position.

2. A storage system according to claim 1 in which said driving means is operable to shift in opposite directions from its neutral position, and the stroke of said driving means from its neutral position is substantially the extent of said second-mentioned access space.

3. A storage system according to claim 1 in which the driving means comprises a member movable through a predetermined path, means for actuating the member including an electrical control circuit, means on each movable module for coupling that module to said member and for initiating the operation of said actuating means to move the driving means and coupled module through the stroke of said driving means and means in said control circuit operable upon disengagement of the coupling means with the member for automatically effecting the operation of said actuating means to return said member through said path to its neutral position.

4. A storage system comprising a series of storage modules, means mounting said storage modules for movement along a common path, driving means for moving selected ones of the storage modules, and means for operating the driving means to move the same from a normally stationary neutral position through a predetermined stroke, said operating means including means for moving the driving means in the direction opposite to its stroke and relative to said selected ones of the storage modules for returning the driving means to its neutral position in response to completion of said stroke.

5. A storage system according to claim 4 including means for releasably coupling one of said selected ones of the modules to said driving means and at substantially the same time activating said operating means, and means operable on release of said coupling for automatically activating said means for moving the driving means in said opposite direction.

6. A storage system according to claim 5 in which said driving means is operable to form an access space between two modules, and said driving means comprises a bar that reciprocates along a straight path from the neutral position through a stroke that is substantially equal to the width of said access space.

7. A storage system according to claim 6 in which said means for operating the driving means includes a chain attached to one region only of said bar, and said bar is pushed and pulled by said chain at said region to move said bar in opposite directions.

8. A storage system according to claim 4 in which said means for operating the driving means includes a chain that pushes the driving means in one direction and pulls the driving means in the opposite direction.