United States Patent

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[45] Patented **Aug. 10, 1971**

[54] **LATERALLY MOVABLE SHUTTLE ASSEMBLY WITH AN ARTICLE PROBE DEVICE**
13 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** ..... **214/730,** 214/16.4 A
[51] **Int. Cl.** **B66f 9/14**
[50] **Field of Search** 214/16.4, 16.42, 730

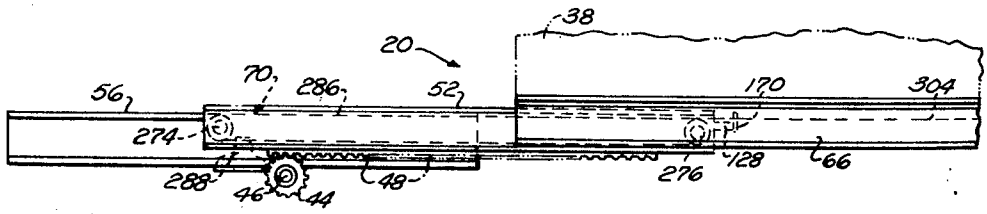
[56] **References Cited**

UNITED STATES PATENTS

3,132,753	5/1964	Choser et al.	214/16.4 A
3,232,455	2/1966	Fountain et al.	214/16.4 A

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ABSTRACT: Am improved shuttle assembly is operable from a retracted condition to an extended condition by moving a load-supporting section outwardly relative to an intermediate section while the intermediate section moves outwardly relative to a base section. A probe assembly for detecting the presence of a container or other obstruction in a storage area is mounted on the intermediate section. The probe assembly includes a base which is movable relative to the intermediate section by an operator assembly to extend a probe member on the base outwardly of the load-supporting section in response to relative movement between the intermediate and load-supporting sections. Upon engaging an obstruction in a storage area, the probe member cams or forces an actuator member sidewardly to operate a switch mounted on the intermediate section and thereby interrupts operation of the shuttle assembly toward the extended condition.



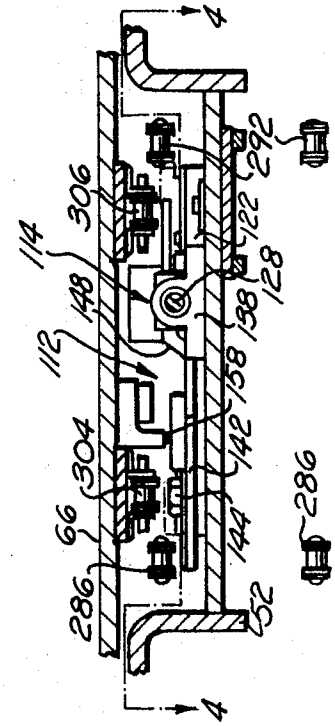


FIG. 3

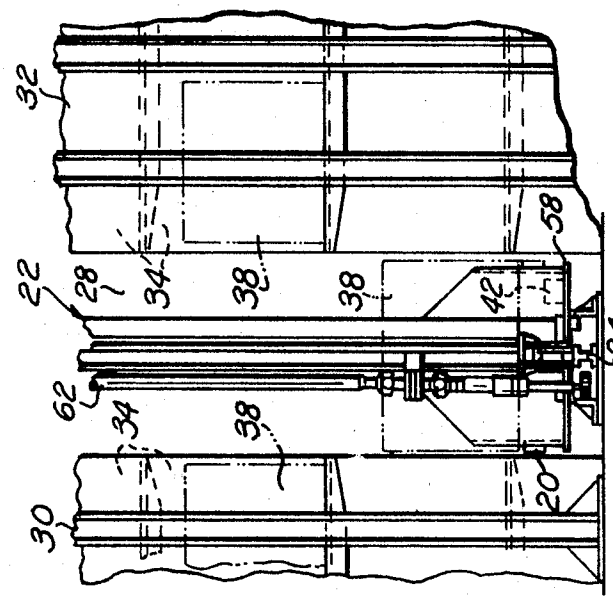


FIG. 1

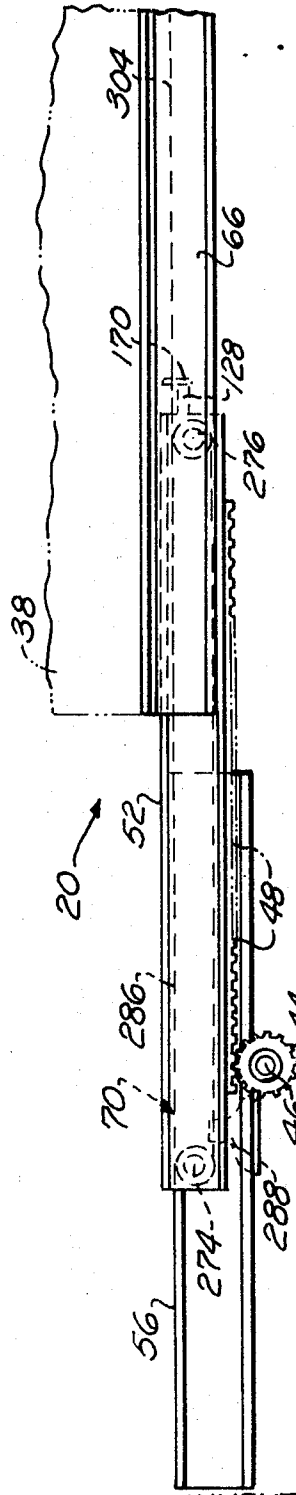


FIG. 2

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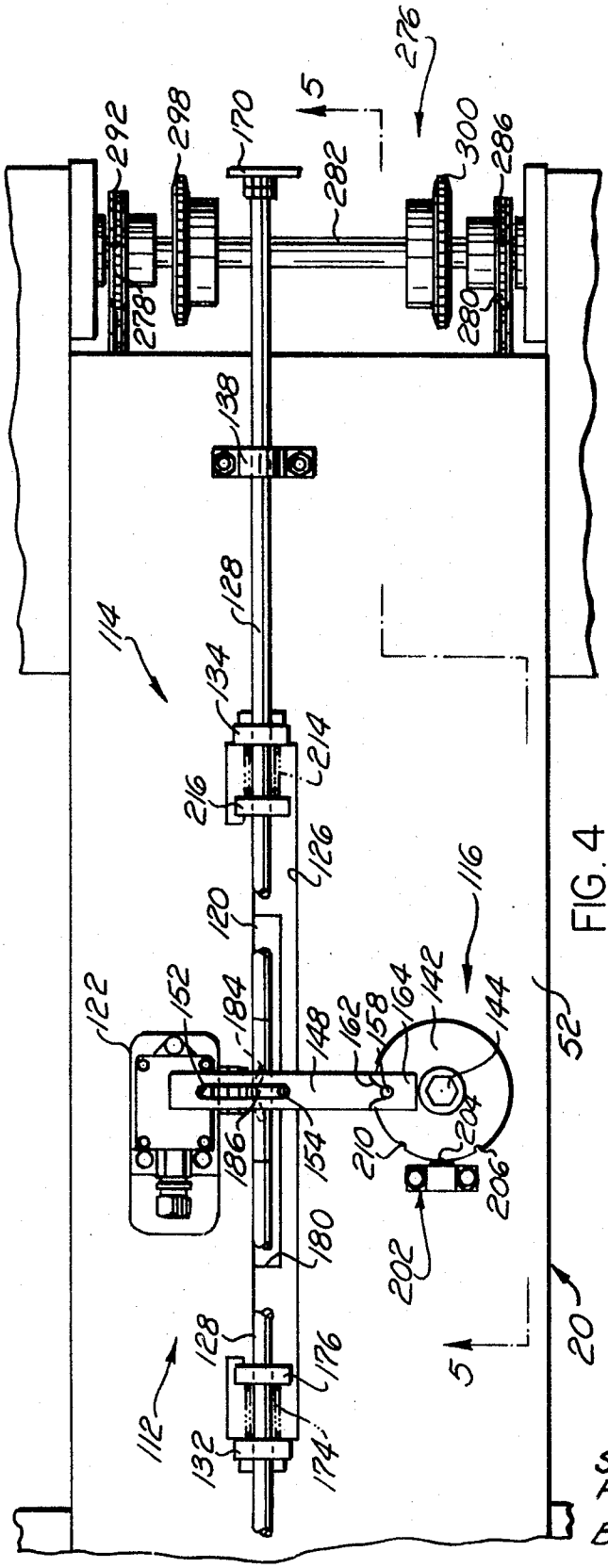


FIG. 4

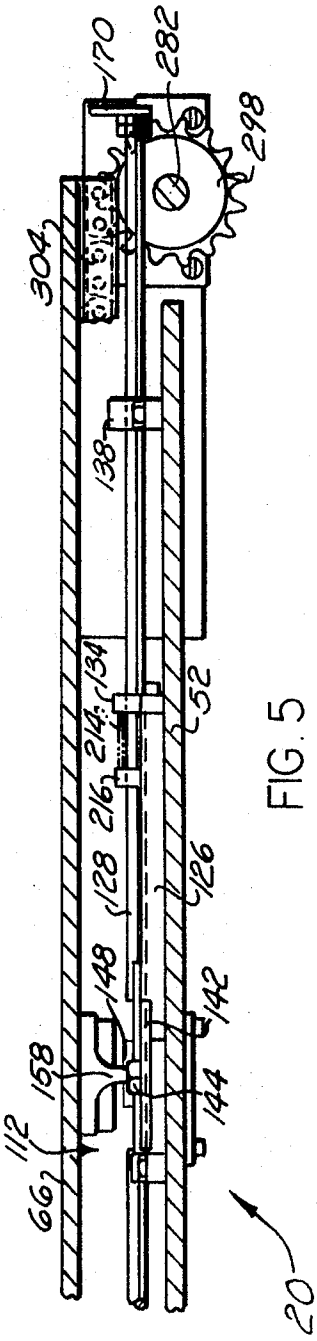


FIG. 5

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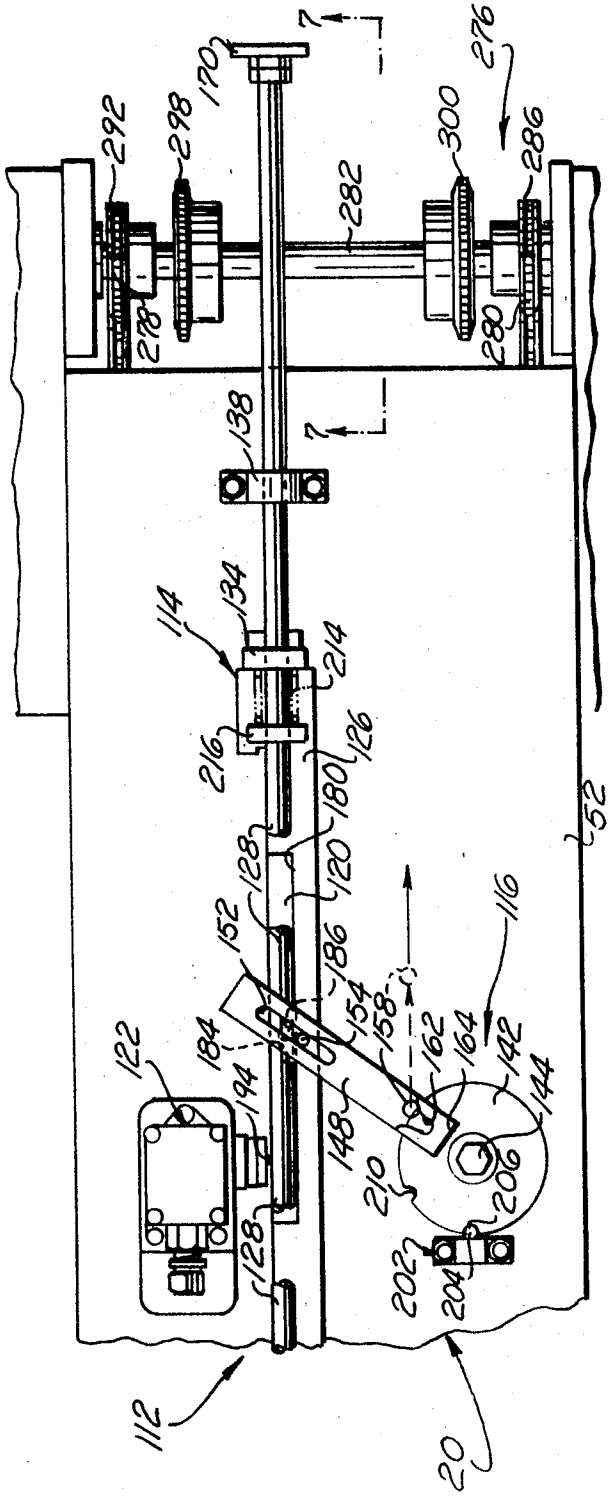


FIG. 6

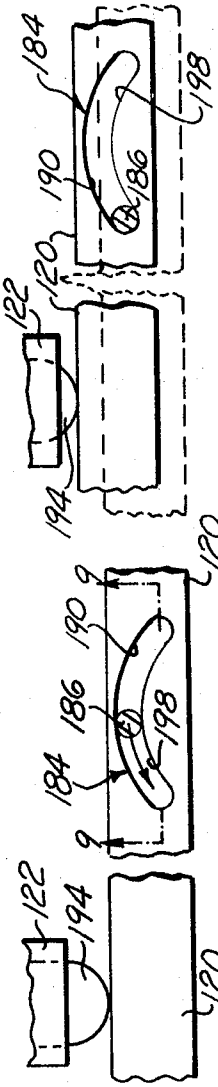


FIG. 8

FIG. 10

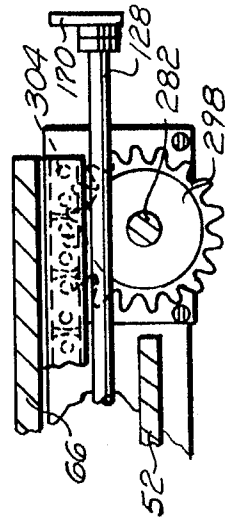


FIG. 7

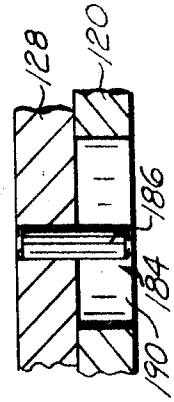


FIG. 9

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LATERALLY MOVABLE SHUTTLE ASSEMBLY WITH AN ARTICLE PROBE DEVICE

This invention relates to an improved probe assembly for use with a shuttle assembly to detect the presence of an obstruction in a storage area.

Stacker cranes and other material-handling machines often include shuttle assemblies which are extendible in either of two directions to deposit loads in storage areas on either side of an aisle. If the shuttle assembly is extended toward a storage area in which there is a load or other obstruction, the stored load will be damaged and the normal operation of the stacker crane will be interrupted. Therefore, it is desirable to detect the presence of an obstruction in a storage area and to prevent the shuttle assembly from being extended into the obstructed storage area.

Accordingly it is an object of this invention to provide a new and improved shuttle assembly which is operable between a retracted condition and either one of two extended conditions to deposit a load in a selected one of a plurality of storage racks disposed on opposite sides on an aisle, wherein the shuttle assembly includes a probe which is extendible in a selected one of two directions in response to an initial extending of the shuttle assembly in the selected direction to enable the probe to detect the presence of a container or obstruction in a selected storage area in either of the storage racks.

Another object of this invention is to provide a new and improved shuttle assembly in accordance with the next preceding object and wherein the shuttle assembly further includes an actuator assembly operable to interrupt extension of the shuttle assembly in response to the probe encountering an obstruction in a selected storage area.

It is another object of this invention to provide an improved shuttle assembly having a probe for detecting the presence of an obstruction in a storage area wherein the probe is relatively compact and reliable in operation and is adapted to be mounted between relatively movable intermediate and load-supporting sections of the shuttle assembly.

Another object of this invention is to provide a new and improved shuttle assembly having a probe mounted on an intermediate section of the shuttle assembly and an operator assembly for automatically extending the probe outwardly of a load-supporting section of the shuttle assembly in response to initiation of operation of the shuttle assembly to an extended condition and for automatically retracting the probe during operation of the shuttle assembly from the extended condition to the retracted condition.

Another object of this invention is to provide a new and improved probe assembly adapted to be mounted on a shuttle assembly to detect the presence of an obstruction in a storage area upon the extension of the shuttle assembly toward the storage area wherein the probe assembly includes an operator means for moving a probe member to an outwardly extending condition in which the probe member projects outwardly of a load-supporting section of the shuttle assembly upon movement of the load-supporting section toward a storage area, the probe member being moved inwardly upon engaging an obstruction in the storage area to operate an actuator means which interrupts movement of the load-supporting section toward the storage area.

These and other objects and features of the invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a schematic illustration depicting the relationship of a stacker crane relative to a plurality of storage racks disposed on opposite sides of an aisle;

FIG. 2 is an enlarged schematic illustration of a shuttle assembly constructed in accordance with the present invention and utilized to move loads relative to the storage racks;

FIG. 3 is a sectional view illustrating the relationship between intermediate and load-supporting sections of the shuttle assembly and a probe assembly for detecting the presence of an obstruction in a selected storage area;

FIG. 4 is a plan view, taken generally along the line 4–4 of FIG. 3, illustrating the probe assembly in a retracted or initial position relative to the intermediate section of the shuttle assembly;

FIG. 5 is a sectional view, taken generally along the line 5–5 of FIG. 4, further illustrating the relationship between the probe assembly and the intermediate and load-supporting sections of the shuttle assembly of FIg. 2;

FIG. 6 is a plan view, generally similar to FIG. 4, illustrating the probe assembly in an extended or detecting condition;

FIG. 7 is a fragmentary sectional view, taken generally along the line 7–7 of FIG. 6, further illustrating the probe assembly in the extended condition;

FIG. 8 is an enlarged fragmentary illustration of an actuator member for operating a switch to interrupt extending movement of the shuttle assembly in response to the probe assembly encountering an obstruction;

FIG. 9 is a fragmentary sectional view, taken generally along the line 9–9 of FIG. 8, illustrating the relationship between the actuator member and a probe member; and

FIG. 10 is a schematic illustration, generally similar to FIG. 8, illustrating the actuator member in an operated condition.

Although a shuttle assembly constructed in accordance with the present invention can be utilized with many different types of article-handling machines, a shuttle assembly 20 forming a specific preferred embodiment of the present invention is illustrated in FIG. 1 in association with a stacker crane 22. The stacker crane 22 is movable along a track 24 in an aisle 28 between storage racks 30 and 32. The storage racks 30 and 32 provide storage areas 34 for holding containers of materials, indicated at 38 in FIG. 1. The materials 38 are deposited in and removed from the storage areas 34 by operating the shuttle assembly 20 between the retracted condition illustrated in FIG. 1 and the extended condition illustrated in FIG. 2. The shuttle assembly 20 can be extended to either the right of the left, as viewed in FIG. 1, to move materials relative to either of storage racks 30 and 32.

The shuttle assembly 20 is operated between the retracted and extended conditions by moving sections of the shuttle assembly relative to each other with a reversible motor, indicated schematically at 42 in FIG. 1. The motor 42 is connected with a drive gear 44 (FIG. 2) by a shaft 46. The drive gear 44 meshes with a rack gear 48 on an intermediate section 52 of the shuttle assembly 20. The intermediate section 52 of the shuttle assembly 20 is mounted for movement relative to a base section 56 by suitable rollers (not shown). The base section 56 is fixedly secured to a carriage 58 (FIG. 1) mounted for vertical movement along an upstanding mast 62 of the stacker crane 22. A load-supporting section or platform 66 is movable on suitable rollers (not shown) relative to the intermediate section 52 (FIG. 2). A load platform drive assembly 70 is operated in response to movement of the intermediate section 52 relative to the base section 56, to extend the load platform 66 outwardly relative to the intermediate section 52 as the intermediate section 52 is being moved outwardly relative to the base section 56.

If the shuttle assembly 20 is extended toward a storage area 34 in which materials 38 have already been stored, an impact between the shuttle assembly and the stored materials will tend to jam operation of the stacker crane 22 and damage the stored materials. To prevent this from happening, a detector assembly 112 is provided to detect the presence of an obstruction, such as the stored materials 38, in the storage area toward which the shuttle assembly is being extended. The detector assembly is mounted between the load-supporting platform or section 66 and the intermediate section 52 (see FIGS. 3 through 5) and includes a probe assembly 114.

The probe assembly 114 is moved between a retracted or initial condition, illustrated in FIGS. 4 and 5; and a detecting or extended condition, illustrated in FIGS. 6 and 7, by an operator assembly 116 upon initial operation of the shuttle assembly

20 from the retracted condition toward one of the extended conditions. Upon being extended, the probe assembly 114 projects outwardly of the load platform or section 66 and will encounter an obstruction such as stored materials 38 before they are engaged by the load platform. Upon engagement of the probe assembly 114 with an obstruction, an actuator member 120 (FIG. 4) is moved sidewardly to operate a switch 122 mounted on the intermediate section 52. Operation of the switch 122 interrupts outwardly extending movement of the shuttle assembly 20 before the load platform 66 is impacted against the stored materials or other obstruction. The switch 122 is advantageously connected in suitable control circuitry and, upon being actuated, initiates reverse or return movement of the shuttle assembly from a partially extended condition in which an obstruction was engaged by the probe assembly 114 to the retracted condition of FIG. 1. Once the shuttle assembly 20 has been operated to the retracted condition, the stacker crane 22 can be moved to a position adjacent to an empty storage area 34.

The probe assembly 114 includes a base or main section 126 for supporting a probe member or shaft 128. The base 126 is movable relative to the intermediate section 52 of the shuttle assembly 20 by the operator assembly 116 to move the probe member 128 between the retracted position of FIGS. 4 and 5 and the extended position of FIGS. 6 and 7. The probe member 128 is mounted on the base 126 by collars or guides 132 and 134 so that upon movement of the base 126 from the retracted position of FIG. 4 to the extended position of FIG. 6 the probe member 128 is moved outwardly as the base is moved along the intermediate section 52 of the shuttle assembly. This movement of the base 126 is guided or directed by a pair of collars or guides, only the guide 138 being shown, which are fixedly secured to the intermediate section 52 and are slidably engaged by the probe member 128.

Upon operation of the shuttle assembly 20 toward a rightward extended condition as viewed in FIG. 1, the operator assembly 116 is actuated to move the probe member 128 from the retracted position of FIGS. 4 and 5 to the extended position of FIGS. 6 and 7. The operator assembly 116 includes a wheel or disk 142 which is rotatably or pivotally mounted on the intermediate section 52 by a suitable pin or fastener 144. An operator lever or member 148 is fixedly connected with the disk 142 and has a longitudinally extending slot 152 for receiving a pin 154 which is fixedly connected to the base 126. An actuator pin or finger 158 is fixedly mounted on the load-supporting section 66 of the shuttle assembly 20 (see FIG. 5) and extends into a recess 162 (see FIG. 4) formed by a plate 164 which is secured to the disk or wheel 142 and the operator lever 148.

Upon initiation of operation of the shuttle assembly 20 from the retracted condition of FIGS. 4 and 5 toward the rightward extended condition of FIG. 2, the intermediate section 52 of the shuttle assembly is moved outwardly relative to the base section 56 by the gears 44 and 48 (FIG. 2). Simultaneously therewith, the load-supporting section 66 is moved outwardly relative to the intermediate section 52 by the drive assembly 70. Outward movement of the load-supporting section 66 relative to the intermediate section 52 moves the actuator pin 158 relative to the intermediate section 52 to pivot the disk or wheel 142 from the position shown in FIG. 4 to the operated position shown in FIG. 6. During this pivotal movement of the disk 142, the operator lever or arm 148 moves the probe assembly base 126 outwardly, or toward the right as viewed in FIG. 4. The guides or collars 138 interact with the probe member 128 to direct this movement of the base 126 in a straight outward or rightward direction as viewed in FIGS. 4 and 6. During this movement, the pin 154 which is fixedly mounted on the base 126 slides along the slot 152 in the operator lever 148.

The probe member 128 and base 126 are automatically moved together toward the extended condition upon an initial outward movement of the load supporting section 66 relative to the intermediate section 52. Thus, a pad or plate 170 on the probe member 128 is moved outwardly or ahead of both the load-supporting section 66 and intermediate section 52 (see FIGS. 6 and 7). Therefore, the pad or plate 170 will engage materials or other obstructions in a storage space toward which a shuttle assembly 20 is being extended before the materials are engaged by the load-supporting section 66.

Assuming that the storage area toward which the shuttle assembly 20 is being extended is vacant or free of obstructions, the load-supporting section 66 continues to be moved outwardly relative to the intermediate section 52 to position a load 38 (see FIG. 2) relative to the storage area. This continued outward movement of the load-supporting section 66 moves the pin 158, which is fixedly connected to the load-supporting section, out of the recess 162 formed in the plate 164. This movement is indicated by dashed lines and an arrow in FIG. 6. As the load-supporting section 66 will pass by or be extended outwardly of the plate or pad 170 on the probe member 128 (see FIG. 2). The load 38 can then be placed adjacent to a rear wall of a storage rack without engaging the rear wall with the pad or plate 170.

Once the load 38 has been positioned in the desired storage area, the direction of operation in the motor 42 is reversed and the shuttle assembly 20 is operated to the retracted condition of FIG. 1. Reversing the direction of operation of the motor 42 rotates the gear 44 in a counterclockwise direction as viewed in FIG. 2 to move the intermediate section 52 toward the left. This movement of the intermediate section 52 causes the drive assembly 70 to move the load-supporting section toward the left relative to the intermediate section 52. As the load supporting section 66 is retracted relative to the intermediate section 52, the actuator pin 158 moves through the dashed line position of FIG. 6 to the position indicated in solid lines in FIG. 6. Continued movement of the load-supporting section 66 relative to the intermediate section 52 then results in the actuator pin 158 again engaging the recess 162 in the plate 164 to pivot the disk or wheel 142 in a counterclockwise direction as viewed in FIG. 6 to the initial or normal position of FIG. 4. This counterclockwise pivoting movement of the disk 142 causes the arm 148 to move the base 126 to the initial position of FIG. 4.

When the shuttle assembly 20 is extended toward a storage area in which materials 38 have previously been stored, engagement of the pad or plate 170 with the stored materials results in the outward operation of the shuttle assembly being reversed. Thus, initial operation of the shuttle assembly 20 from the retracted condition toward the extended condition causes the probe assembly 114 to be extended in the manner previously explained. Continued outward movement of the shuttle assembly 20 toward the extended condition results in the pad or plate 170 on the outer end of the probe member 128 engaging the stored materials 38 before the load-supporting section 66 is moved to the extended condition of FIG. 2. After initial engagement of the pad or plate 170 with the stored materials 38, continued operation of the shuttle assembly 20 toward the obstructed storage area results in the probe member 128 being moved inwardly relative to the intermediate section 52. This inward movement of the probe member 128 is against the influence of a biasing spring 174 which is mounted between the guide 132 and a collar 176 which is fixedly secured to the probe member 128.

Inward movement of the probe member 128 upon engagement of the pad or plate 170 with an obstruction, moves the actuator member 120 sidewardly from a generally rectangular recess 180 (FIG. 6) in the base 126 to operate the switch 122 in the manner illustrated schematically in FIGS. 8 and 10. The actuator member 120 is moved sidewardly in response to inward movement of the probe member 128 by interaction between an arcuate cam slot 184 in the actuator member and a pin 186 fixedly connected to the probe member 128 (see FIGS. 8 and 9). Upon inward movement of the probe member 128 toward the left, as viewed in FIGS. 6 and 8, the pin 186 engages an upper cam surface 190 of the cam slot 184 and forces or cams the actuator member 120 out of the generally

rectangular recess **180** (FIG. 6) in the base **126**. Outward movement of the actuator member presses a plunger **194** of the switch **122** from the normal or unoperated position of FIG. **8** to the operated position of FIG. **10**. This movement of the plunger **194** actuates the switch **122** to effect a reversal of the operation of the motor **42** to thereby retract the partially extended shuttle assembly **20**.

As the shuttle assembly **20** is retracted after operation of the switch **122**, the biasing spring **174** causes the probe **128** to move outwardly relative to the base **126** so that the probe member **128** returns to its initial position relative to the base **126**. As the probe member **128** moves outwardly or rightwardly relative to the base **126** as viewed in FIGS. **6** and **10**, the actuator pin **186** engages a lower cam surface **198** of the cam slot **184** to force or cam the actuator member **120** back to its normal position in the recess **180** in the base **126**.

Of course, continued retraction of the load section **66** results in the operator assembly **116** (FIGS. **4** and **6**) being operated in the manner previously explained to retract the probe assembly **114**. It should be noted that during the retracting and extending movement of the probe assembly **114** the actuator member **120** is moved with the base **126** in the recess **180**.

A detent assembly **202** (FIG. **4**) cooperates with the disk or wheel **142** to retain the base **126** against sliding movement upon engagement of the pad or plate **170** with an obstruction in the storage area. Thus, the detent assembly **202** includes a spring-loaded plunger or detent member **204** which engages a recess **206** in the disk **142** upon operation of the probe assembly **114** to the extended position of FIG. **6** in the manner previously explained. When the probe member **128** engages an obstruction, the probe member is moved relative to the base **126** which is restrained against movement by the inneraction between the detent assembly **202**, disk **142** and operator arm **148**. However, when the shuttle assembly **20** is being operated from the extended condition to the retracted condition, the actuator member or finger **158** on the load-supporting section **66** applies sufficient force against the plate **164** to pivot the disk **142** back to the initial or normal position of FIG. **4** against the initial influence of the detent assembly **202**.

Since the shuttle assembly **20** can be extended to either the right or to the left as viewed in FIGS. **1** and **2** to place materials **38** in storage areas **34** on opposite sides of the aisle **28**, the probe assembly **114** is extendible to either the right or the left as viewed in FIG. **4**. Therefore, a pad or plate, not shown, similar to the pad or plate **170** is mounted on the left end (as viewed in FIG. **4**) of the probe member **128**. When the probe member is in the initial or retracted condition of FIG. **4**, both of the pads or plates at the outer ends of the probe member **128** are slightly inwardly of the outer ends of the probe member **128** are slightly inwardly of the outer ends of the intermediate section **52** (FIG. **5**) so that the shuttle assembly **20** can be readily moved along the aisle **28** by the stacker crane **22**. Of course, upon operation of the shuttle assembly to a leftward extended condition, the actuator member **158** on the load-supporting section **66** pivots the disk **142** in a counterclockwise direction to extend the probe assembly **114** toward the left as viewed in FIG. **4**. The detent assembly **202** then cooperates with a recess **210** in the disk **142** to retain the base **126** against inward movement relative to the intermediate section **52** until the shuttle assembly **20** is retracted. A biasing spring **214** is located between the guide **134** and a collar **216** and cooperates with the probe member **128** in much the same manner as explained in connection with the biasing spring **174**.

To provide for movement of the load platform **66** relative to the intermediate section **52** upon operation of the shuttle assembly **20** between the retracted and extended conditions, the drive assembly **70** includes two sets of pinions or sprockets **274** and **276** (FIG. **2**) which are mounted at opposite ends of the intermediate section **52**. The sprocket set **276** includes a pair of relatively small sprockets or pinions **278** and **280** (see FIG. **4**) which are secured to an axle **282**. Similarly, the sprocket set **274** includes a pair of relatively small sprockets (not shown) which are also fixedly secured with an axle. A chain loop **286** (see FIGS. **2** and **3**) engages the sprocket **280** of the sprocket set **276** and a corresponding sprocket of the sprocket set **274**. The chain loop **286** is secured to the base section **56** at **288** (FIG. **2**). Since the chain loop **286** is secured to the base section **56** at **288**, movement of the intermediate section **52** under the influence of the gears **44** and **48** rotates the axle **282** (see FIGS. **2** and **4**). A chain loop **292** (FIG. **3**) is associated with the sprocket of the sprocket set **276** and with a corresponding sprocket of the sprocket set **274** in much the same manner as the chain loop **286**.

The sprocket set **276** also includes a pair of large pinions or sprockets **298** and **300** (FIG. **4**) which are mounted on the shaft **282** and mesh with chain racks **304** and **306** (FIG. **3**) which are connected to the load platform **66**. Therefore, upon rotation of the shaft **282** by the small sprockets **278** and **280**, the large sprockets **298** and **300** are rotated to move the load platform **66** relative to the intermediate section **52** by means of the chain racks **304** and **306**. The sprocket set **274** is of the same construction as the sprocket set **276** and includes a pair of small pinions or sprockets which cooperate with the chain loops **286** and **292** in the same manner as in which do the small sprockets **278** and **200** and a pair of large sprockets which cooperate with the chain racks **304** and **306** in the same manner as the large sprockets **298** and **300**.

The shuttle assembly **20** is operated from the retracted condition of FIG. **1** to the extended condition of FIG. **2** upon energization of the motor **42** to drive the pinion gear **44** and rack **48**. This moves the intermediate section **52** relative to the base section **56** of the shuttle assembly. The load platform **66** of the shuttle assembly **20** is simultaneously moved outwardly relative to the intermediate section **52** by the drive arrangement **70**. Of course, reversing the direction of rotation of the gear **44** reverses the direction in which the shuttle assembly **20** is extended. The drive arrangement for moving the shuttle assembly **20** between the retracted and extended conditions is more fully set forth in application Ser. No. 812,010 filed by Aaronson et al. on Apr. 1, 1969 and entitled Load-Handling Apparatus.

In view of the foregoing remarks, it can be seen that the probe assembly **114** is operable to detect the presence of an obstruction in a storage area upon operation of the shuttle assembly **20** to either a rightward or a leftward extended condition. The probe assembly **114** is relatively compact so that it can be mounted between the intermediate section **52** and load-supporting section **66** of the shuttle assembly **20**. This positioning of the probe assembly **114** enables it to be automatically operated to the extended condition upon initial movement of the shuttle assembly **20** toward one of the extended conditions by the operator finger or pin **158** which is fixedly secured to the load-supporting section **66** and is moved relative to the intermediate section **52** upon operation of the shuttle assembly to the extended or retracted condition.

Having described several embodiments of the invention, we claim:

1. A shuttle assembly operable between retracted and extended conditions to move a load relative to storage rocks, said shuttle assembly comprising a base section, an intermediate section operatively connected to said base section and movable relative thereto, a load-supporting section operatively connected with said intermediate section and movable relative to said base and intermediate sections, drive means operatively connected with said intermediate load-supporting sections for moving said intermediate section relative to said base section and for moving said load-supporting section relative to said intermediate section to thereby operate said base section and for moving said load-supporting section relative to said intermediate section to thereby operate said shuttle assembly between the retracted and extended conditions, probe means for detecting the presence of an obstruction in the storage racks, said probe means being mounted on said intermediate section for movement therewith upon operation of

said shuttle assembly between the retracted and extended conditions and being operable between a first condition in which an outermost end portion of said outermost end portion of said probe means is disposed adjacent to an outermost end portion of said intermediate section and a second condition in which said outermost end portion of said probe means is disposed a substantial distance outwardly of said outermost end portion of said intermediate section, operator means for operating said probe means from the first conditions to the second condition in response to initiation of operation of said shuttle assembly from the retracted condition toward the extended condition and for operating said probe means from the second condition to the first condition during operation of said shuttle assembly from the extended condition to the retracted condition, and means for interrupting operation said shuttle assembly toward the extended condition in response to said probe means encountering an obstruction in the storage racks to thereby prevent said shuttle assembly from being extended into a storage area containing the obstruction.

2. An assembly as set forth in claim 1 wherein said operator means includes a first assembly mounted on said intermediate section and movable relative thereto to operate said probe means between said first and second conditions, said operator means further including a second assembly mounted on said load-supporting section for effecting movement of said first assembly relative to said intermediate section in response to movement of said load-supporting section relative to said intermediate section to thereby operate said probe means from the first condition to the second condition.

3. An assembly as set forth in claim 2 wherein said second assembly mounted on said load-supporting section is movable from a position engaging said first assembly on said intermediate section to a position spaced apart from said first assembly in response to continued movement of said load-supporting section relative to said intermediate section after operation of said probe means to the second condition.

4. An assembly as set forth in claim 3 wherein said first assembly includes a first member pivotally mounted on said intermediate section and operatively connected to said probe means, said second assembly including a second member fixedly mounted on said load-supporting section for pivoting said first member relative to said intermediate section in response to relative movement between said load-supporting and intermediate sections.

5. An assembly as set forth in claim 1 wherein said probe means includes a base and a probe member mounted on said base and providing the outermost end portion of said probe means, said base and probe member being movable together relative to said intermediate section by said operator means to thereby operate said probe means from said first condition to said second condition, said probe member being movable relative to said base under the influence of said outermost end portion of said probe means encountering an obstruction to thereby effect actuation of said means for interrupting operation of said shuttle assembly.

6. An assembly as set forth in claim 5 wherein said means for interrupting operation of said shuttle assembly includes switch means secured to said intermediate section and an actuator member mounted for movement with said base relative to said intermediate section, said actuator member being movable relative to said base to actuate said switch means in response to movement of said probe member relative to said base.

7. An assembly as set forth in claim 6 wherein said means for interrupting operation of said shuttle assembly further includes cam means associated with said actuator member and follower means operatively connected to said probe member for cooperating with said cam means to effect movement of said actuator member in a direction transverse to the direction of movement of said probe member relative to said base.

8. An assembly as set forth in claim 5 wherein said operator means includes an operator member pivotally mounted on said intermediate section and operatively connected to said base and means for effecting pivotal movement of said operator member relative to said intermediate section in response to relative movement between said load-supporting section and said intermediate section to thereby effect movement of said base relative to said intermediate section.

9. An assembly as set forth in claim 8 wherein said operator means further includes detent means for retaining said operator member and base against movement relative to said intermediate section upon movement of said probe member when said probe member encounters and obstruction.

10. An assembly as set forth in claim 8 wherein said operator means further includes an element mounted on said load-supporting section for pivoting said operator member relative to said intermediate section upon relative movement between said intermediate and load-supporting sections.

11. A shuttle assembly operable between a retracted condition and either of two extended conditions to move a load relative to storage racks, said shuttle assembly comprising a base section, an intermediate section operatively connected to said base section and movable relative thereto, a load-supporting section operatively connected with said intermediate section and movable relative to said base and intermediate sections, drive means operatively connected with said intermediate and load-supporting sections for moving said intermediate section relative to said base section in either of two directions from a retracted position and for moving said load-supporting section relative to said intermediate section in either of the two directions to thereby enable said drive means to operate said shuttle assembly to either of the two extended conditions, probe means mounted on said intermediate section for detecting the presence of an obstruction in a storage rack upon movement of said shuttle assembly toward either of the extended conditions, said probe means including a probe member mounted on said intermediate section for movement therewith and having an initial position in which a first end portion of said probe member is disposed adjacent to one side of said intermediate section and a second end portion is disposed adjacent to an opposite side of said intermediate section when said shuttle assembly is in the retracted condition, said probe member being movable from said initial position in a selected one of two opposite directions relative to said intermediate section to extend said probe member outwardly from said intermediate section in the selected one of the two directions, operator means for moving said probe member outwardly relative to said intermediate section from the initial position in the selected one of the two directions in response to initiation of operation of said shuttle from the retracted condition to an extended condition in the selected direction and for moving said probe member back to the initial position during operation of the shuttle assembly from the extended condition in the selected direction to the retracted condition, said operator means including an assembly mounted on said intermediate section for moving said probe member relative to said intermediate section in either of the two directions and an actuator means mounted on said load-supporting section for actuating said assembly to effect outward movement of the probe member in the selected one of the two directions in response to movement of said load-supporting section relative to said intermediate section in the selected direction, and means for interrupting operation of said shuttle assembly toward the extended condition in the selected direction in response to movement of said probe member relative to said intermediate section in a direction opposite to the selected direction upon said probe member engaging an obstruction in the storage racks.

12. An assembly as set forth in claim 11 wherein said probe means further includes a base operatively connected to said probe member and to said assembly for moving said probe member, said base being movable relative to said intermediate section in the selected one of the two directions by said operator means to extend said probe member in the selected direction, said probe member being movable relative to said base upon engaging an obstruction to thereby effect operation

of said means for interrupting operation of said shuttle assembly.

13. A shuttle assembly as set forth in claim 11 wherein said actuator means is movable from a position engaging said assembly mounted on said intermediate section to a position spaced from said assembly upon operation of said shuttle assembly to one of the extended conditions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,598,265 Dated August 10, 1971

Inventor(s) Stephen F. Aaronson; Harry Y. Jackson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 11:	After "area" insert---before the shuttle assembly is extended into the storage area---as it was omitted.
Col. 2, line 38:	"of" should read---or---.
Col. 4, line 16:	After "66" insert---is moved outwardly relative to the intermediate section 52, the leading end portion of the load supporting section 66--- as it wa omitted.
Col. 6, line 10:	After "sprocket" (first occurrence) insert---278---.
Col. 6, Claim 1, lines 69-71:	Delete---base section and for moving said load supporting section relative to said intermediate section to thereby operate said---as it is a repeat.
Col. 7, lines 3 & 4:	Delete---outermost end portion of said ---as it is a repeat.
Col. 7, line 9:	"conditions" should read---condition---

Signed and sealed this 14th day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents