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(54) IMPROVEMENTS IN OR RELATING TO SLIDE AND PLUG DOOR MECHANISMS

(71) We, WESTINGHOUSE BRAKE AND SIGNAL COMPANY LIMITED, a Company incorporated under the Laws of Great Britain, of 3 John Street, London WC1N 2ES, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to slide and plug door mechanisms.

Slide and plug doors are known forms of door, particularly in the railway rapid-transit field, where, when the doors are closed, the surface of each door is substantially flush with the outer surface of the vehicle of which they form a part, and the doors are opened by an initial outward movement ("unplugging") followed by sliding movement along the vehicle, away from the doorway in more or less close proximity to the outer surface of the vehicle. Closing is undertaken by sliding each door along the exterior of the vehicle till it is substantially aligned with the respective doorway (or part of a doorway when two doors are used to close the doorway, i.e. double doors), followed by inward movement of each door ("plugging") until the exterior of the door is substantially flush with the exterior of the vehicle. Slide and plug doors may also be used in static buildings.

Mechanisms for imparting slide and plug motion to doors can take varied forms, of which several have been previously proposed, but all are characterised by a certain degree of complexity and/or a weakness in the support of the door in its opened position, and accordingly it is an object of the invention to provide an improved slide and plug door mechanism.

In this Specification, the following terms have the following meanings:—"leading edge" means the edge of the door which leads while the door is undergoing the sliding part of its closing motion (the "leading edge" trailing when the door is sliding open); "trailing edge" means the edge of the

door which trails when the door is undergoing the sliding part of its closing motion (the "trailing edge" leading when the door is sliding open); "top" and "bottom" have their plain meanings as applied to doors and doorways which lie generally in a vertical or near-vertical plane; "doorway" means the opening in a vehicle exterior surface or a wall or partition which is partly or wholly closed by a door when the door is in its closed position, and when the door is open, the "doorway" provides a passage communicating between the interior and exterior of a vehicle or through the wall or partition in situations when the door is not an exterior door of a vehicle.

According to the present invention, there is provided a slide and plug door supporting mechanism including traversing support means movable in operation between a first plugged position and a second unplugged position of a door in a door opening, a telescopic track arrangement carried by said traversing support means permitting sliding motion of the door between closed and open positions of the door in relation to the door opening, the traversing support means comprising respective pivoted crank members positioned generally at opposite sides of the door opening and coupled together for synchronous movement by a link, the track arrangement comprising a first sliding part slidable between the crank members on a second part and the door being carried at one side thereof on an outrigger rigidly fixed to the sliding part.

In the context of the slide and plug mechanism being installed in a vehicle to operate a door leading between the interior and exterior of the vehicle, a handle may be located in the interior of the vehicle for operation of the traversing support means by a passenger or an operator (e.g. a driver) of the vehicle; and there may be a further handle, which may be at a lower level than the first said handle, located outside the vehicle to enable the door to be plugged and unplugged by a person outside the vehicle. Latch

operating means may also be provided such that a latch may be operated from either side of the door when closed, and the latch means being operable to inhibit operation of the handle.

In order that the invention may be more clearly understood and readily put into effect, a preferred embodiment of the same will now be described by way of example with reference to the accompanying drawings wherein:—

Fig. 1 is an elevation of a door and doorway, viewed from outside together with parts of the slide and plug door mechanisms, viewed in a horizontal direction at right angles to the general plane of the door and the doorway;

Fig. 2 is a plan view of the part of the mechanism of Fig. 1 which is located in use at the top of the doorway;

Fig. 3 is a side elevation viewed from inside the doorway of the part of the mechanism shown in Fig. 2;

Fig. 4 is a section on the line IV—IV in Fig. 3;

Fig. 5 is a side elevation of a part of the mechanism;

Fig. 6 is an elevation of a further part of the mechanism, including an operating handle and a latch means;

Fig. 7 is a side elevation of the further part of the mechanism shown in Fig. 6;

Fig. 8 is a horizontal cross-section on the line VIII—VIII in Fig. 6;

Fig. 9 is an elevation of a still further part of the mechanism;

Fig. 10 is a side elevation of the part of the mechanism shown in Fig. 9;

Fig. 11 is a horizontal cross-section on the line XI—XI in Fig. 10; and

Fig. 12 is a horizontal cross-section on the line XII—XII in Fig. 1.

Referring first to Fig. 1, this represents a horizontal view from the outside of a doorway 20 in the side of the driver's compartment of a rapid-transit rail vehicle (only parts of which are shown in outline in the drawings). The doorway 20 is to be closed by a single door 22 (having a window 208 with a lower vertically slidable portion 206) moving with a generally known form of slide and plug movement, the door 22 being shown in Fig. 1 in its fully open position allowing free movement of the driver and/or other persons (inspectors, maintenance staff, cleaners etc.) into and out of the driver's compartment. (The invention could equally well be applied to a guard's compartment, or to passenger doors). The slide and plug door mechanism generally comprises a header assembly 24, a door bottom guide means 26, a latch means 28, an external door operating mechanism 30, and a catch means 31. It will be clearly seen from Fig. 1 how the header assembly 24 is located at

the top of the doorway 20, the door bottom guide means 26 is located at a position which is adjacent the bottom of the trailing edge of the door 22 when the door 22 is closed, the latch means 28 is about two-thirds of the way up the side of the doorway 20 which is contiguous with the leading edge of the door 22 when the door 22 is closed, the external mechanism 30 is about a quarter of the way up the same side of the doorway 20 as the latch means 28, and the catch means 31 is located at the bottom edge of the doorway 22 on the same side as the mechanism 30. A full description of the mechanism parts 24—31 now follows. The header assembly 24 is particularly described with reference to Figs. 2, 3 and 4; the door bottom guide means 26 is particularly described with reference to Figs. 1 and 5; the latch means 28 is particularly described with reference to Figs. 6 and 7; the external operating mechanism 30 is particularly described with reference to Figs. 9, 10 and 11; and the catch means 31 is particularly described with reference to Fig. 12.

Referring now to Figs. 2, 3, and 4, the header assembly 24 is shown as viewed in Fig. 3 from inside the vehicle looking outwards, and comprises a traversing support means including a rod 32 of a length such that it extends across the width of the doorway 20, a door support means 34 which is slidable on the rod 32, and a mounting means in the form of a pivotal trunnion 36 and a pivotal bellcrank 38 which support either end of the rod 32 as will be subsequently described. The trunnion 36 is pivotal about an axis 40 and is formed in two halves 42 and 44, the lower half 42 being rotatable by torque applied to a square-ended spigot 46. The upper half 44 is coupled to the lower half 42 for conjoint rotation therewith through the intermediary of a pivot block 48 rigidly attached to the end of the rod 32 by a nut 50 forcing the block 48 against a shoulder 52 on the rod 32. The upper trunnion half 44 is formed as a bellcrank for a purpose to be explained below. The trunnion halves 42 and 44 are pivotally mounted on a fixed bracket 54 bolted to the doorway framework.

The bellcrank 38 is pivotable about an axis 56 and is mounted for pivoting by a fixed bracket 58 bolted to the doorway framework. The trunnion upper half 44 is directly linked to the bellcrank 38, so that both are positively conjointly rotated, by thrust and tension transmitting means in the form of a rod or strut 60 screw-threaded at one end into a spherical joint 62 pivotally secured to the bellcrank portion 44 of the trunnion 36 for pivoting about an axis 64, and the rod or strut 60 is also screw-threaded at its other end into a further spherical joint 66 pivotally secured to the bellcrank 38 for

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pivoting about an axis 68. Because of the screw threading of the rod or strut 60 into the joints 62 and 66, the effective distance between the axes 64 and 68 may be selectively adjusted during installation of the mechanism and/or if required for maintenance, thereby to vary the lateral position of the rod 32 and hence of the door support means 34 when the trunnion 36 and the bellcrank 38 coupled thereto are rotated to swing the door support means 34 outwards of the vehicle.

Rotation of the bellcrank 38 is converted to conjoint rotation of a vertical shaft 70 rotatably mounted on the bracket 58 by means of a further rod or strut 72 pivotally mounted at one end on the bellcrank 38 by means of a spherical joint 74, for pivoting about an axis 76, and pivotally mounted at the other end on a lever 78 rigidly secured to the top of the shaft 70, by means of a clevis 80 pivotable about an axis 82. The shaft 70 is rotationally coupled to the door bottom guide means 26, as will subsequently be described with reference to Figs. 1 and 5.

As already described, the end of the rod 32 supported by the trunnion 36 is simply supported by a pivot block 48, but the support of the other end of the rod 32 is more complex. Encompassing the rod 32 and slideable thereon is a hollow tube 84 forming a major component of the door support means 34. The rod 32 terminates within the tube 84 at a point 86, and the tube 84 extends further to the left as viewed in Figs. 2 and 3 to be supported on the bellcrank 38 by a trolley 88 pivotal thereon about an axis coincident with the section line IV—IV, and extending through a slot 90 in the bottom of the tube 84 to support the tube 84 by means of two cylindrical slide blocks, of which one (92) is visible in Fig. 4. The trolley 88 is provided with two vertically pivoted rollers 94 engaging the sides of the slot 90 for guidance. The left end (as viewed in Figs. 2 and 3) of the slot 90 is curved outwards through a right angle to engage a further roller 96 vertically pivoted on the bellcrank 38. With the door header assembly 24 in the position shown in Figs. 2 and 3, the presence of the roller 96 in the right-angled extension of the slot 90 prevents leftward movement of the tube 84 and hence of the door support means 34.

To facilitate installation of the header assembly 24 at the top of the doorway 20, the bracket 54, the door support means 34, and the bracket 58 are initially rigidly connected together by a length of rigid angle iron 98 and screws 100 upon completion of factory assembly to ensure correct relative positioning of the screwed-together parts during installation. Upon installation, the effective length of the rod or strut 60 is adjusted by its being screwed into or out

of the joints 62 and 66 until it is at a suitable value appropriate to the factory-set positions of the brackets 54 and 58, and the door support means 34. Thereupon the screws 100 are removed and the angle iron 98 discarded, thereafter to allow movement of the movable parts of the header assembly 24, as will now be described.

Assuming the header assembly 24 to have been correctly installed and the angle iron 98 to have been removed, consider an operating rotation of the spigot 46 in a clockwise direction (as viewed in Fig. 2) to be effected. This rotates the trunnion 36 and moves the pivot block 48 about the axis 40, the complete angular movement being about 45°, until the right end of the rod 32 is moved fully outwards relative to the doorway 20. At the same time, due to the linking of the trunnion 36 to the bellcrank 38 by the rod or strut 60, the bellcrank 38 rotates about 45° in an anti-clockwise direction (as viewed in Fig. 2) which moves the trolley 88 rightwards along the extended straight part of the slot 90 and swings the roller 96 round the bend in the slot 90 until the roller 96 lies in the extended straight part of the slot 90 thereby removing the previous impediment to movement of the tube 84 along the rod 32. This rotation of the bellcrank 38 swings the left end of the tube 84, and with it the left end 86 of the rod 32, outwards relative to the doorway 20.

Rigidly secured to the tube 84 is a further tube 102 having internally secured thereto a bearing tube 104 slideable on cylindrical bushes 106 on the rod 32 (which is preferably made of hardened chrome steel), the bushes 106 being protected from external contamination and having their lubricant (oil or grease) retained by known forms of garter seals 108. A tubular outrigger support member 110 is welded to the further tube 102, and the member 110 has rigidly secured to its outer end a door support bracket 112. The bracket 112 has two key-hole-shaped slots 114 by which the door 22 is hung on slot-penetrating fasteners 116 (Fig. 1). The door 22 is shown in chain-dashed outline in Fig. 2. The fasteners 116 are preferably eccentric rods whereby rotation thereof by suitable amounts can lift, lower, and tilt the door 22 so that it can be correctly mounted, the length of the slots 114 permitting lateral correction in addition. Inward and outward adjustment of the door 22 is effected by a suitable choice of number and thickness of shims 55 between the bracket 54 and the doorway frame, and similarly by shims 59 between the bracket 58 and the doorway frame.

With the door support means 34 swung outwards as above described, the door support bracket 112 lies outside the external surface of the vehicle, and since the door 22

is mounted on the outside of the bracket 112, the door 22 also lies outside the surface of the vehicle. (The surface of the vehicle is shown in chain-dashed outline at 118 in Fig. 2, and the door 22 is shown in the plugged position in Fig. 2, with edge seals 120 rendering the door substantially air-tight or at least draught-proof.) With the door 22 unplugged by the above described rotation of the trunnion 36 and the bellcrank 38, the door 22 may be slid (to the left as viewed in Fig. 2) to open the doorway 20, the bracket 112 passing along the outside of the vehicle surface 118, and the tube 84 passing along the inside of the surface of the vehicle, the edge of the doorway 20 being accommodated by the lateral separation of the bracket 112 and the tube 84, and the extreme rightwards positioning of the support member 110, there being no more leftward connection of the bracket 112 and the tube 84 which would otherwise impede the opening of the door 22.

Referring now to Figs. 1 and 5, the door bottom guide means 26 is rotationally coupled to the shaft 70 by means of a vertical torque and rotation transmitting shaft 122 incorporating two flexible joints 124 of known form to allow misalignment of the ends of the shaft 122. As may be more clearly seen from Fig. 5, the door bottom guide means 26 comprises an arm 126 swung outwardly relative to the doorway 20 by anti-clockwise rotation of the shaft 70 (caused in turn by the door-unplugging rotation of the trunnion 36 and the bellcrank 38, which are coupled to the shaft 70 by the rod 72 and the lever 78), the arm 126 carrying at its outer end an upstanding vertically-pivoted roller 128 engaged in an inverted "U" shaped channel 130 running along the bottom edge of the door 22. Thus the door bottom guide means 26, by way of the arms 126 from the roller 128, provide guidance of the bottom of the door 22 to prevent the door 22 swinging around the rod 32, i.e. the door 22 is prevented from flapping. Moreover, the door bottom guide means 26 provides positive unplugging force at the bottom of the trailing edge of the door 22 when the top of the door 22 is unplugged by operation of the header assembly 24, and conversely the bottom of the door's trailing edge is positively plugged by operation of the header mechanism 24 from the unplugged condition described above to the plugged position shown in Fig. 2. (The door bottom guide means 26 preferably takes the form of the mechanism described in United Kingdom Patent Specification No. 52280/75, 1548928A).

Referring now to Figs. 6, 7 and 8, these illustrate the latch means 28 and also one handle by which the header assembly 24 (together with the door bottom guide means

26) may be operated for unplugging and plugging action on the door 22. The relationship of the latch means 28 to the header mechanism 24 may best be seen, in general, from Fig. 1, and in greater detail from Fig. 6, from which it will be seen that the spigot 46 is coupled to the latch means 28 by a cardan shaft 132 incorporating two universal or Hooke joints 134 to allow the axis 40 of rotation of the spigot 46 to be misaligned relative to an input shaft 136 of the latch means 28 (see Fig. 1). The input shaft 136 may be selectively latched or unlatched by changing the rotational position of a latch handle 138, the latching mechanism (not shown) being of any suitable form to perform this function, and by reason of the rotation coupling through the shaft 132, the header assembly 24 and in turn the door bottom guide means 26 may be selectively latched to be immovable, or be unlatched for movement as described. In practice, the handle 138 is operated to latch the mechanisms 24 and 26 when the door 22 is plugged in the doorway 20, and when it is desired to unplug the door 22 the latch handle 138 is rotated to unlatch the shaft 136 and the other shafts and mechanisms rotationally coupled thereto. Rotationally coupled to the shaft 136 is a further input shaft 140, coupling of the shafts 136 and 140 being accomplished in any suitable manner, for example by the meshing of a pair of pinions (not shown) within the casing of the latch means 28, one pinion being secured on each shaft 136 and 140. (The purpose of the shaft 140 is for coupling to the external door operating mechanism 30, as will subsequently be described).

In order to impart rotation to the shaft 132 and hence to operate the header mechanism 24 and the door bottom guide means 26 such as selectively to plug or unplug the door 22 from the doorway 20, a lateral handle 142 is pinned to the shaft 132 near the latter's mid-point. A combination of cranking of the handle 142 inwardly of the vehicle's interior surface as indicated by the chain-dashed line 144, and a recess 146 formed on the interior surface 144, allow a vehicle driver's hand (not shown) to be placed round the handle 142 when the handle is in the position shown in solid outline in Fig. 8, whereupon manual pulling on the handle 142 rotates it inwardly of the vehicle surface 144 to the position shown in chain-dashed outline in Fig. 8 thereby actuating the header assembly 24 and the door bottom guide means 26 to unplug the door 22 from the doorway 20. Thereafter the door 22 can be slid open to clear the doorway 20. With the door 22 slid shut, the door 22 can be plugged into the doorway 20 by manually pushing the handle 142 to return it to the position shown in solid outline in

Fig. 8, and thereafter be latched by pushing down the latch handle 138. (The unplugging forces exerted by the seals 120 (Fig. 2) in their deformed position when the door 22 is plugged may be sufficient that when the shaft 132 is unlatched by operation of the latch handle 138, the door 22 is self-unplugging, but the handle 142 may be actuated if desired or necessary to ensure full unplugging, and conversely to ensure full plugging before latching in the door-closing operation).

So far has been described the mechanism for unplugging and sliding open (and the converse sequence of sliding closed and plugging) of the door 22 relative to the doorway 20 by means of an internal handle 142. It is highly desirable, and may be essential, that in practice such operations can be performed by a person external to the vehicle, and accordingly the external door operating mechanism 30 is provided and will now be described in detail with reference to Figs. 9, 10 and 11.

The external door operating mechanism 30 is rotationally linked to the latch means' second input shaft 140 by further cardan shaft 148 incorporating universal or Hooke joints 150 so that the shaft 140 may be misaligned relative to a shaft 152 rotationally mounted on a base plate 154 of the mechanism 30 by means of two spaced-apart plummer blocks 156 and 157. Pinned to the shaft 152 is a handle 158 extending through a slot 160 in the plummer block 157 (Fig. 11) and through a slot 162 in the base plate 154 to lie in a recess 164 in the external surface 118 of the vehicle, the recess 164 being formed by removing a rectangular piece of the exterior surface 118 and filling the so-formed gap by the suitably dished base plate 154 (see Fig. 10). Also extending through the base plate 154 is a shaft 166 mounted on a block 167 secured to the base plate 154 and having an external handle 168 secured thereto, and internally of the vehicle, a lock plate 170 also secured to the shaft 166. Mounted on the base plate 154 is a cylinder tumbler lock mechanism 172 controlling the insertion and withdrawal of a detent 174 into and out of a hole 176 in a lock plate 170 selectively to lock and unlock the shaft 166 respectively to be unrotatable and to be rotatable. The lock plate 170 is linked by a link 178 (for example, a Bowden wire) to a lever 179 secured to the shaft of the latch handle 138 such that rotation of the shaft 166 by turning the handle 168 to the position shown in chain-dashed outline in Fig. 9 causes the latch means 28 to unlatch the shaft 136. A spring means (not shown) causes the latch means 28 to re-latch upon release of the handle 168 to relieve tension in the link 178. Thus the handle 168 is a handle by which a person

external to the vehicle may, after unlocking the lock 172, unlatch the header assembly 24 and the door bottom guide means 26, whereupon manual pressure on the handle 158 to pull the handle 158 outwardly of the vehicle to the position shown in chain-dashed outline in Fig. 11 operates the header assembly 24 and the door bottom guide means 26 through the linkage formed by the shaft 148, the shaft 136, the shaft 132, the rod or strut 60, and the shaft 122 (all mutually linked for conjoint rotational movement), to unplug the door 22 from the doorway 20. Thereupon, by manual engagement of the lower handle recess 180 (Fig. 1) by a person standing on the vehicle's trackbed, or by manual engagement with an upper handle recess 182 (Fig. 1) by a person standing on a platform alongside which the vehicle is standing, the door 22 may be slid open. The reverse sequence of the above operation effects sliding shut the door 22, plugging the door 22 in the doorway 20, latching the slide and plug mechanism, and locking the mechanism.

Referring now to Fig. 12, this illustrates a cross-section of the catch means 31 taken on the line XII—XII in Fig. 1. The edge of the doorway 20 is provided with a recess 184 within which is slideable a catch 186 spring-loaded outwardly of the doorway edge by a compression spring 188. Secured to the leading edge of the door 22 at the bottom thereof is a detent 190 provided with a bevelled leading edge 192. The door 22 is shown in Fig. 12 in its plugged position relative to the doorway 20. The edge seals 120 have been omitted from Fig. 12 for the sake of clarity.

The paths followed by the edge 192 of the detent 190 during plugging and unplugging are shown in the line diagram 194 in the upper part of Fig. 12. Sliding movement of the edge 192 takes place along a line parallel to the line 196, and the point 198 represents the relative location of the edge 192 when the door 22 is in its fully slid shut but unplugged position. During plugging of the door 22, the edge 192 moves along the path 200, the edge 192 at some point engaging the catch 186 and pushing the catch 186 back into its recess 184 until the edge 192 finishes up in the relative position 202 at which point the catch 186 will spring back outwards to the position shown in Fig. 12. During unplugging of the door 22, the catch 186 remains in its illustrated position since there is no force to push it into the recess 186. Thus the detent 190 is constrained to slide along the inside edge of the catch 186 until the edge 192 clears the tip of the catch 186 whereupon the bottom of the leading edge of the door springs outward to the unplugged position 198, as illustrated by the path 204. This initial preven-

tion of unplugging of the bottom of the leading edge of the door 22 leads to slight bending of the door 22, but this is relatively slight and is readily allowed for by the considerable separation of the catch means 31 from both the door header assembly 24 and the door bottom guide means 26 which apply positive unplugging guidance to the upper edge and bottom of the trailing edge of the door 22. The provision of the catch means 31 will be seen to provide a positive plugging force on the bottom of the leading edge of the door 22 when the door 22 is plugged in the doorway 20.

Although only manual operation of the movements of the door 22 have been described, powered movements may be performed by the provision of suitable electrical, mechanical, pneumatic, or hydraulic actuators (not shown) of known form.

The invention may be applied to the opening and closing of a double-width doorway closable by a pair of the doors and associated mechanisms above described.

Other modifications and variations may be made within the scope of the invention.

WHAT WE CLAIM IS:—

1. A slide and plug door supporting mechanism including traversing support means movable in operation between a first plugged position and a second unplugged position of a door in a door opening, a telescopic track arrangement carried by said traversing support means permitting sliding motion of the door between closed and open positions of the door in relation to the door opening, the traversing support means comprising respective pivoted crank members positioned generally at opposite sides of the door opening and coupled together for synchronous movement by a link, the track arrangement comprising a first sliding part slidable between the crank members on a second part and the door being carried at one side thereof on an outrigger rigidly fixed to the sliding part.

2. A mechanism as claimed in Claim 1 the telescopic track arrangement comprising a first member located by one said pivoted crank member and a second member which

is slidable in telescopic fashion in relation to the first member and supported by the other said pivoted crank member and constrained by guide means carried thereby.

3. A slide and plug door mechanism as claimed in Claim 2, the first member being a rod member and the second member being tubular.

4. A slide and plug door mechanism as claimed in Claim 3, the second tubular member having a longitudinal slot provided therein and the guide means comprising means which engages said slot.

5. A slide and plug door mechanism as claimed in Claim 4, the slot being curved outwards and the guide means comprising two locating members engaging within the slot.

6. A slide and plug door mechanism as claimed in Claim 5 the two cranks being coupled together via a tie rod.

7. A slide and plug door mechanism as claimed in any preceding Claim including means for providing rotational coupling between the traversing support means and further traversing means for locating a further part (for example the lower edge) of the door.

8. A slide and plug door mechanism as claimed in any preceding Claim and including locking means operable in said plugged position, to inhibit unplugging of the door.

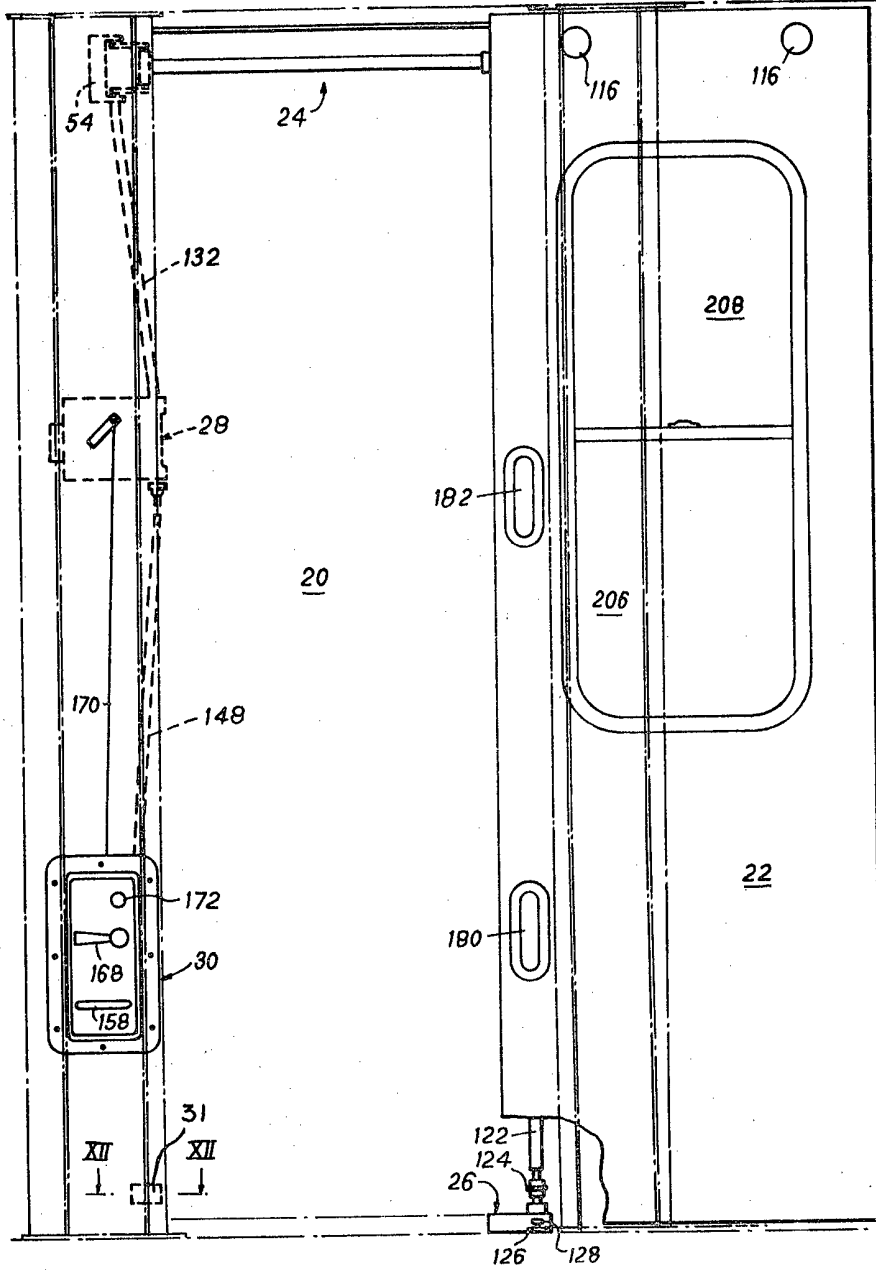
9. A slide and plug door mechanism as claimed in Claim 7 or 8, provided with a shaft which is provided with a handle accessible from one side of the doorway for manual movement of the traversing support means between the first and second positions.

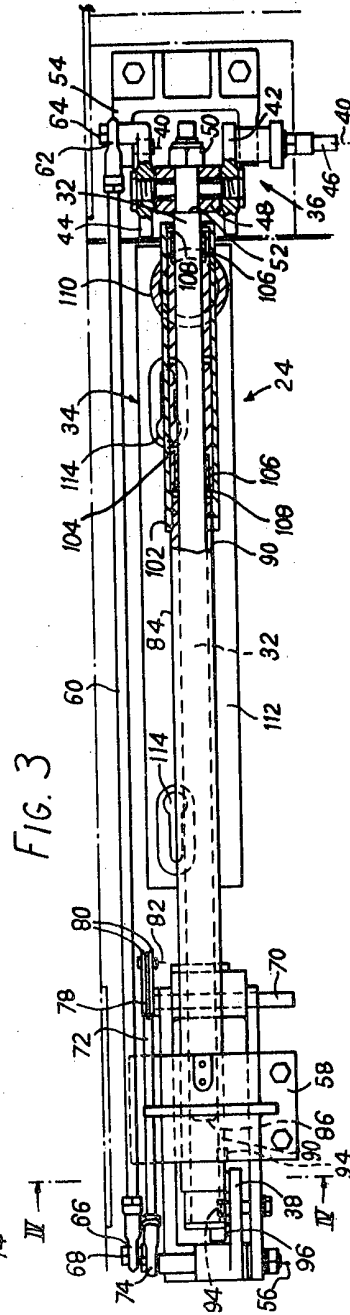
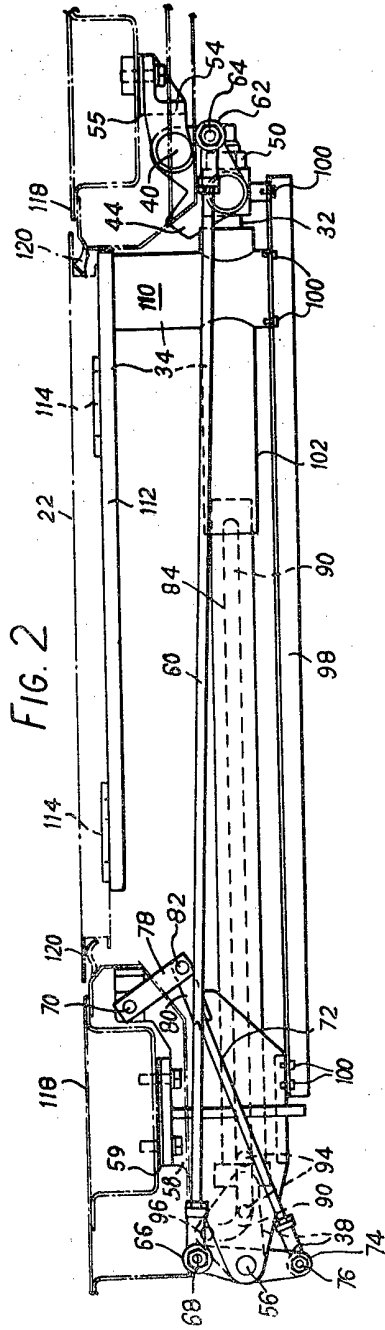
10. A slide and plug door mechanisms as claimed in Claim 9, a further handle being provided coupled to the shaft and manually operable from the other side of the doorway.

11. A slide and plug door mechanism substantially as described herein with reference to Figs. 1, 2 and 3 of the accompanying drawings or Figs. 1 to 12 of the accompanying drawings.

A. R. TURNER,
Agent for the Applicants.

FIG. 1



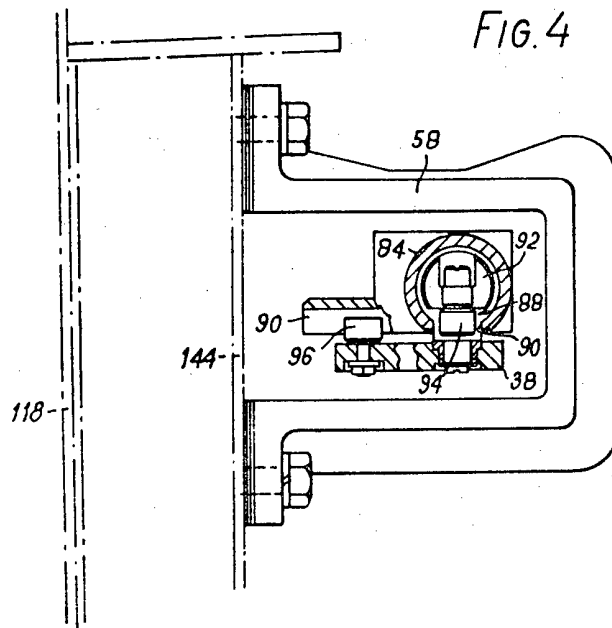


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COMPLETE SPECIFICATION

7 SHEETS

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the Original on a reduced scale
Sheet 3



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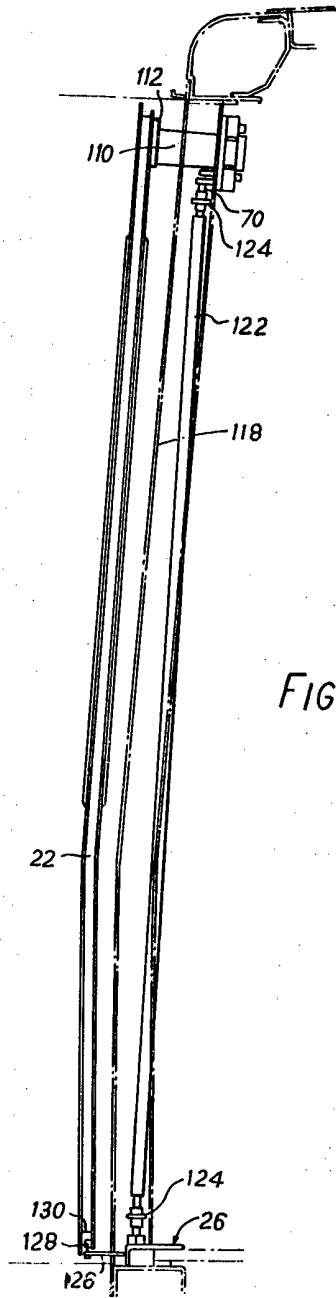


FIG. 5

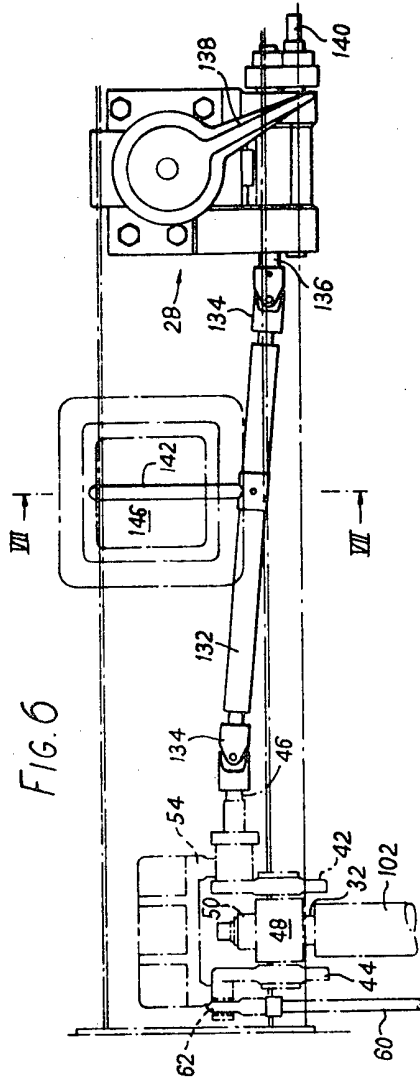
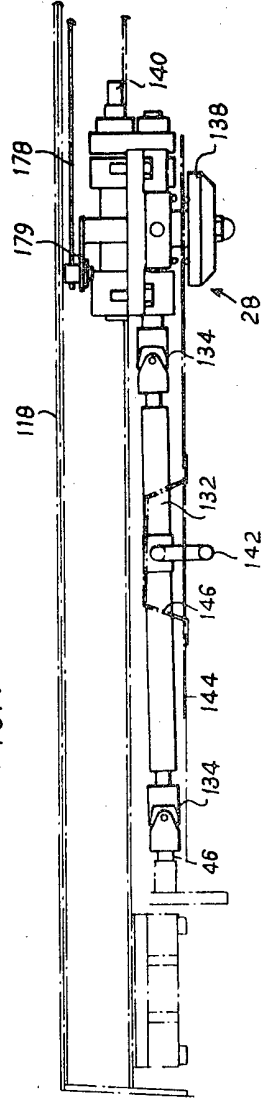


FIG. 7



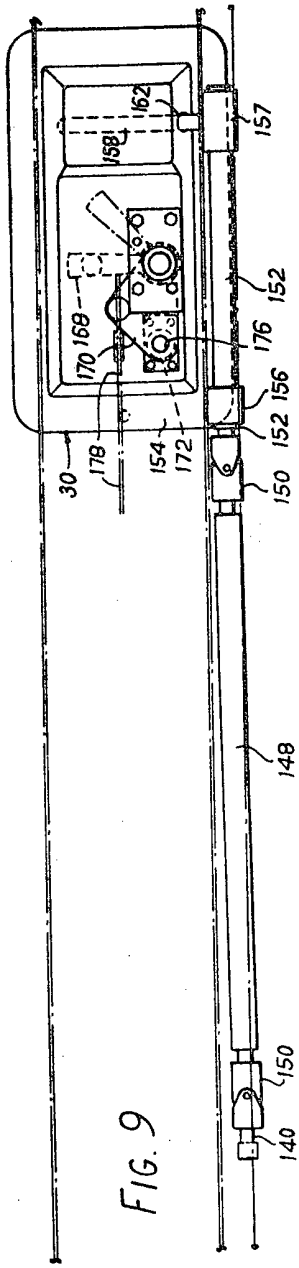


FIG. 9

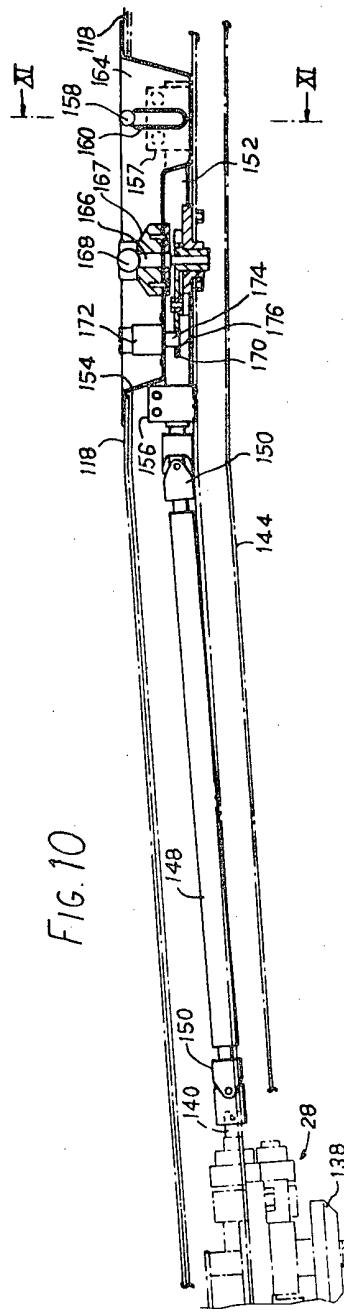


FIG. 10

