United States Patent

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[54] **POWERIZED ANGLED PARTITION**
8 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **160/188,** 160/193
[51] **Int. Cl.** **E05f 15/14**
[50] **Field of Search** 160/188, 193, 196, 199, 206

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ABSTRACT: A powerized partition which may be shifted from a collapsed storage position to an extended, wall-defining position. The wall structure provided by the extended panel is nonlinear, being in the form of an L or similar configuration. The panel assembly is provided with powerized drive means for extending and collapsing the same.

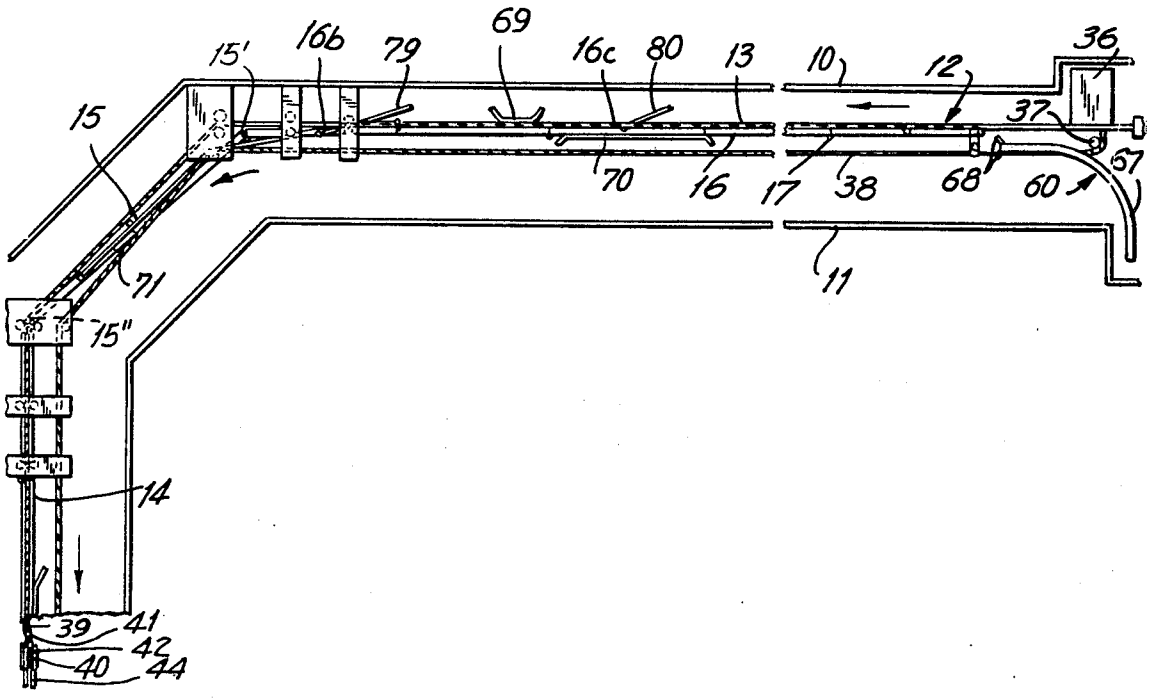
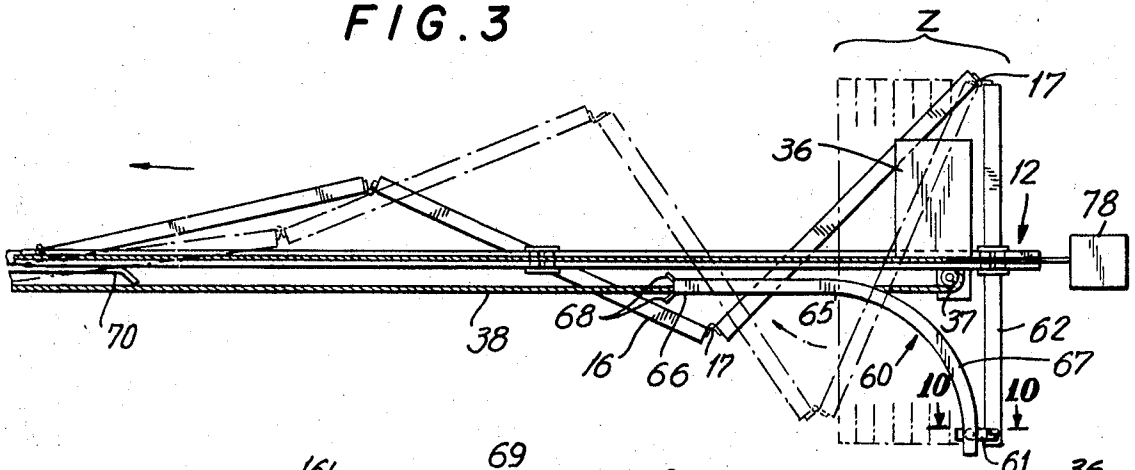


FIG. 3



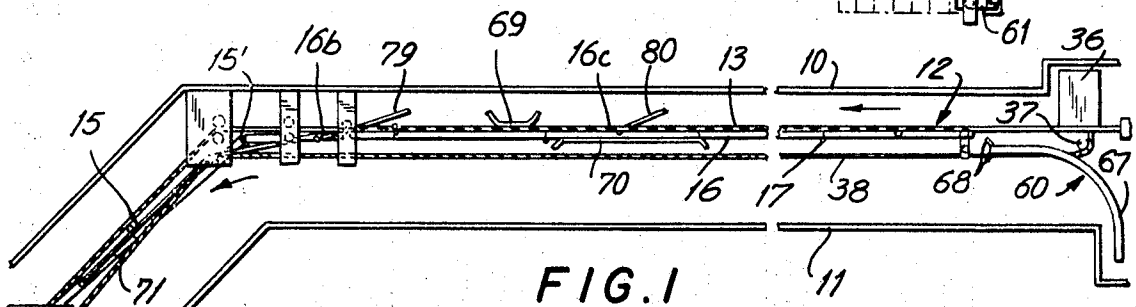


FIG. 1

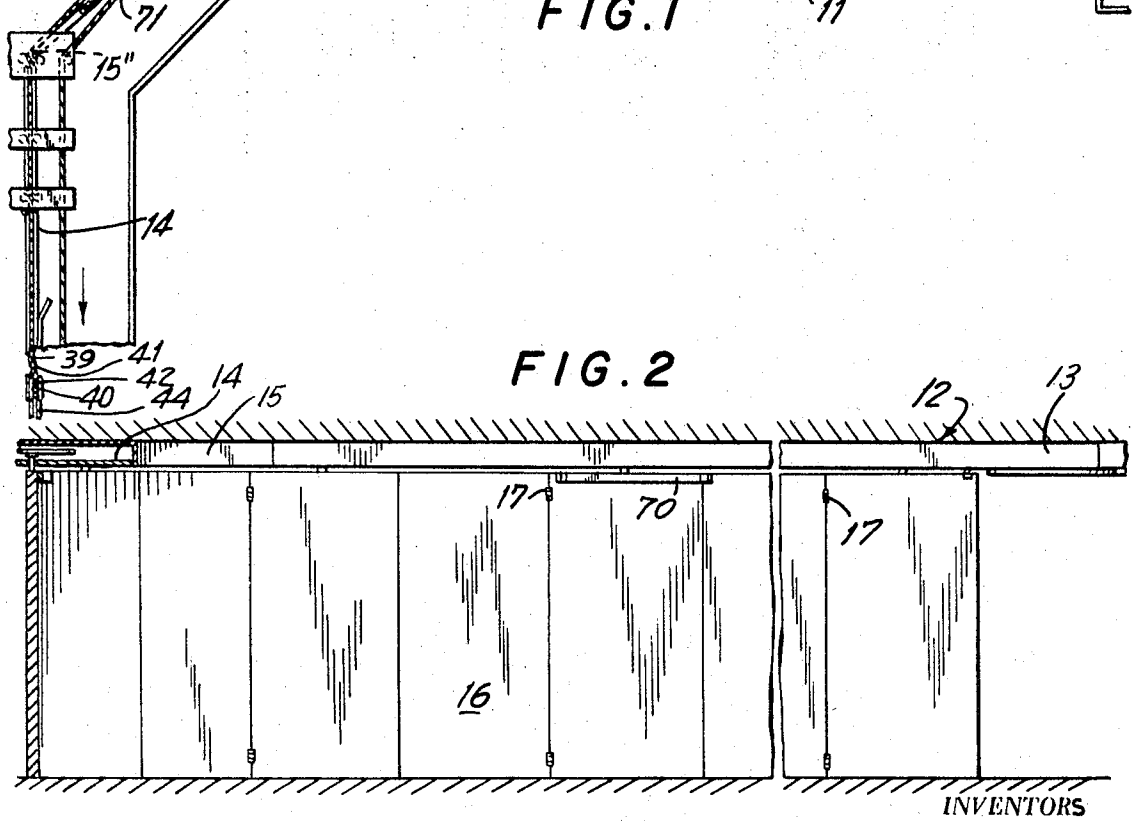


FIG. 2

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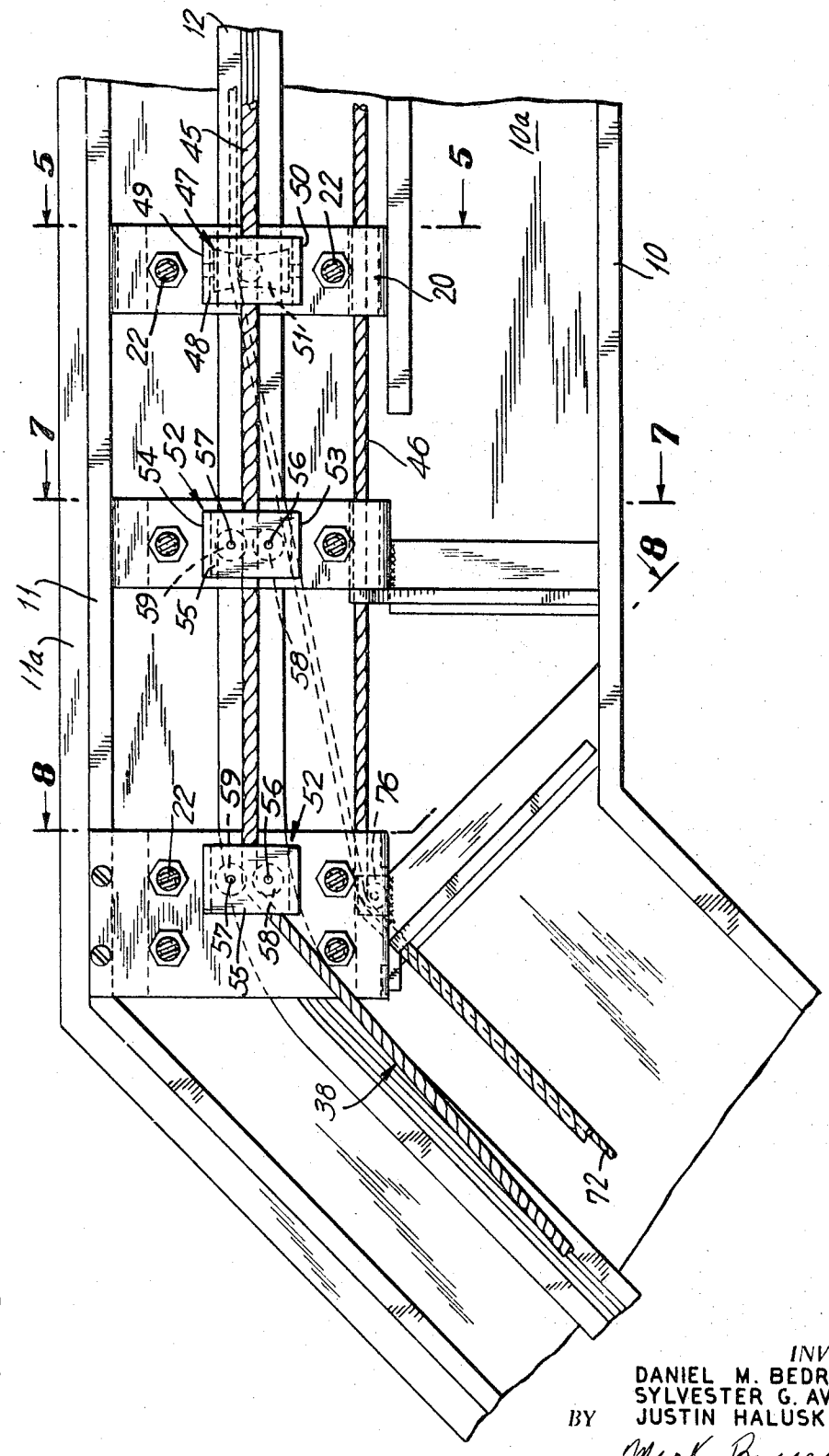
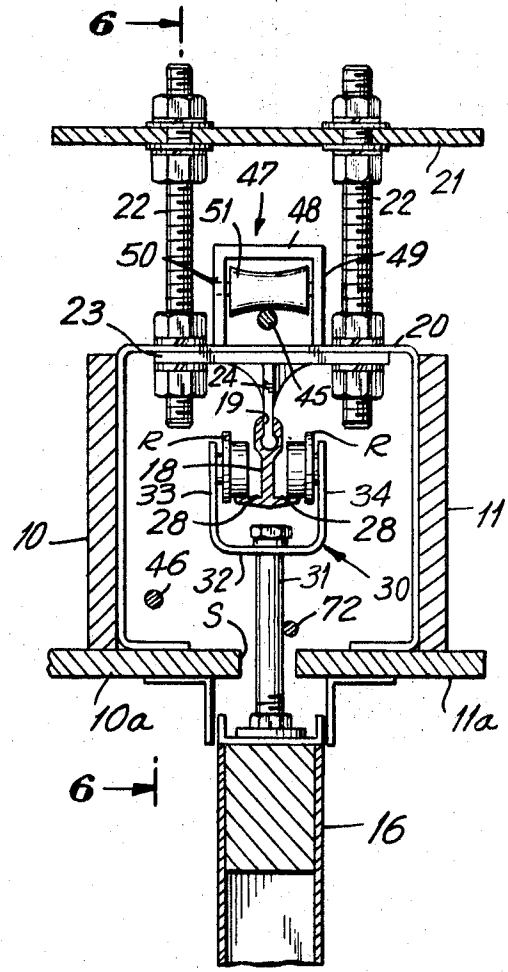


FIG. 4

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FIG. 5



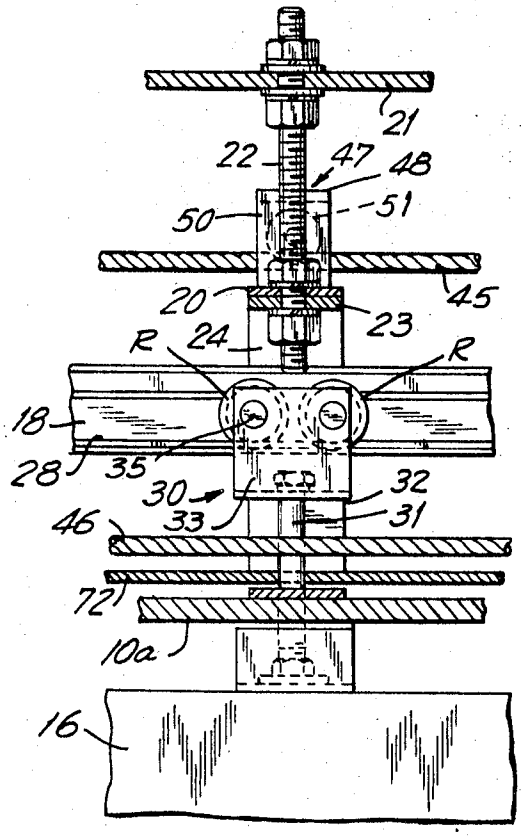
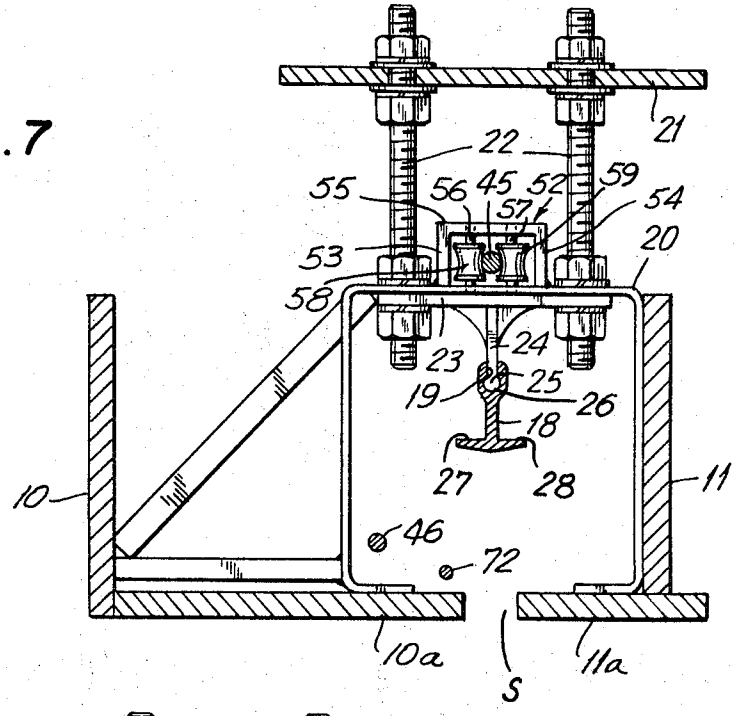


FIG. 6

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FIG. 7



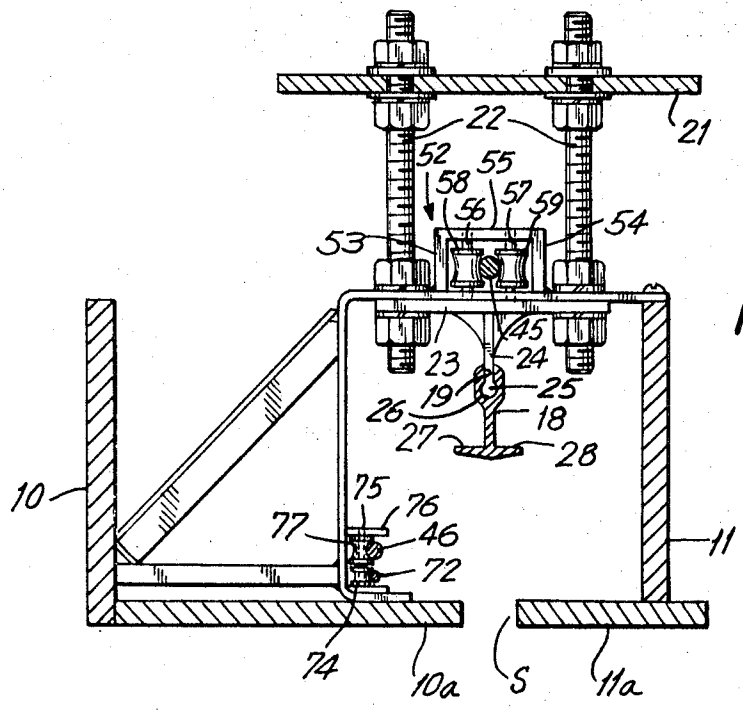


FIG. 8

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FIG. 9

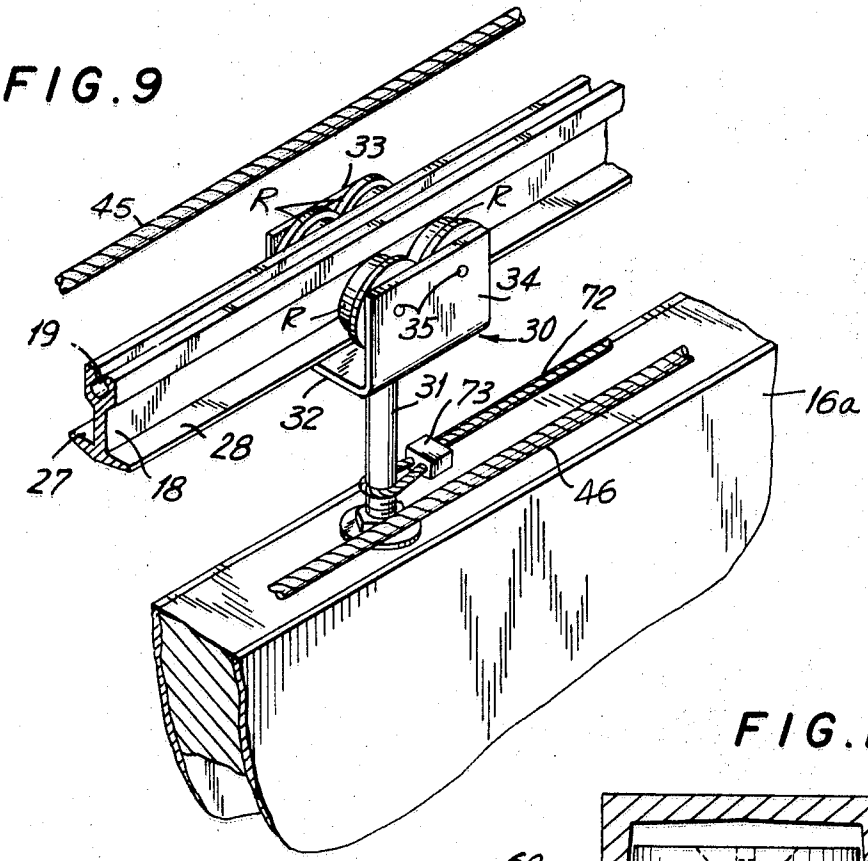


FIG. 10

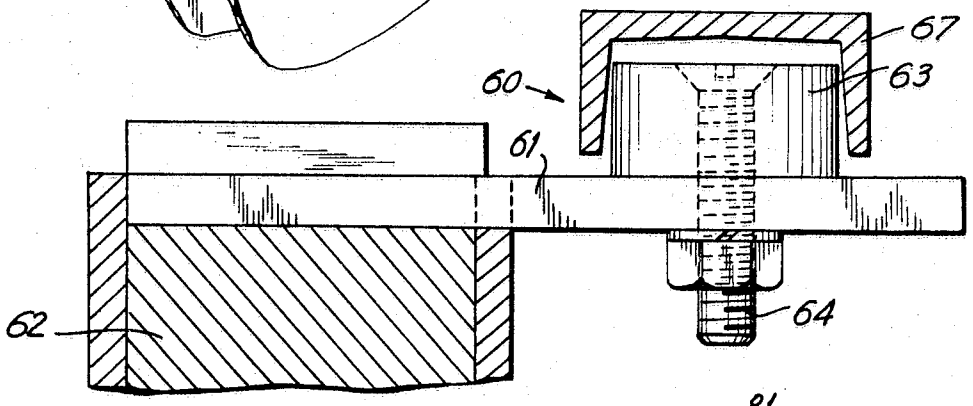
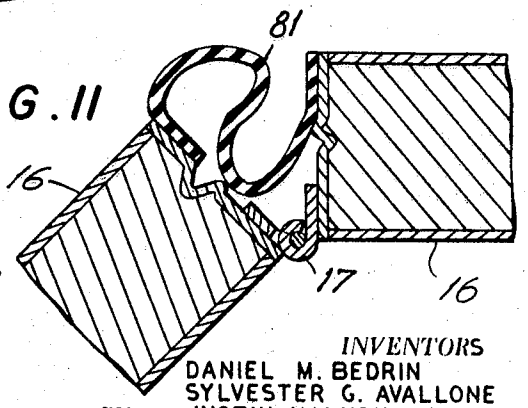


FIG. 11



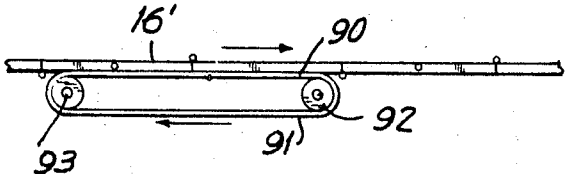


FIG. 12

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POWERIZED ANGLED PARTITION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is in the field of partition assemblies of the type frequently used to subdivide large interior spaces, relating particularly to at least one partition assembly shiftable from a stacked storage position along an angular path to an extended position, the panels, in the extended position, defining a partition essentially corresponding to the angular path.

2. The Prior Art.

It is known to provide partition assemblies of the motorized or manually shiftable type which may be used to subdivide large rooms, such as gymnasiums, auditoriums, classrooms and the like. Such known devices typically comprise a series of large rectangular panels, hingedly connected to each other and mounted in some manner for translatory movement along a trackway.

The typical installation comprises a linear trackway extending transversely across the space to be subdivided. In large installations, particularly those having high ceilings and requiring large partition spans, it is impractical to provide manually shifted panel assemblies in view of the weight of the partitions.

While numerous motorized partition assemblies suitable for satisfactorily shifting such partitions are known, such motorized assemblies have been restricted in their application to panels which are advanced along a linear or substantially linear path from the stacked to the partition defining position. More particularly, no known integral partition assembly which, in the extended position describes an angular path, such as a right angle, has been equipped with a powerized drive means capable of automatically advancing and stacking the panels defining the partition. Heretofore, where an angled corner of a room was to be subdivided, it was considered necessary to provide two separate partition assemblies, each of which formed a leg of the desired angled partition.

SUMMARY OF THE INVENTION

This invention relates to a motorized partition assembly which may be advanced along a nonlinear path, such as an angled path, to isolate, for instance, a corner of a larger area. The lead panel is provided with an essentially conventional powerized cable drive, the cable being specially rigged to follow the path of the track from which the panels are suspended. Where the panels are to define an angular wall section, for instance, the cable is guided to follow one leg of the angle and to bend around the angle in alignment with the second leg.

A primary area of novelty of the invention lies in the provision of secondary drive and tensioning means for the panel assembly which is in driving connection with at least one of the panels in the area between the storage zone and the junction of the legs, and which urges the panels between the storage zone and junction in a direction aligned with the trackway between these two points, and which provides a relative separating force to the panels in this area, where necessary.

There is thus defined a structure having a main drive, which shifts the lead panel in a direction coincident with the track supporting lead panel, a secondary or auxiliary drive operating only on the panels between the junction of the legs and the storage area, and urging the panels between these points in a direction coinciding with the direction of the first leg, and one or more tensioning auxiliary drive members applying a separating force to the panels.

It is therefore an object of the invention to provide a motorized partition assembly movable along an angled path.

It is a further object of the invention to provide a motorized assembly of the type described which is capable of shifting a partition along a path describing a desired included angle.

A further object of the invention is the provision of a partition assembly of the type described including a main drive means urging the lead panel of a hingedly connected series in a direction coinciding with the direction of the track traversed by the lead panel, the device including one or more auxiliary drive means which yieldably urge the panels toward the stacked position in the direction of the first leg or initial path of movement of the partitions as they emerge from storage. The auxiliary drive or drives serve multiple functions, namely, to provide a force component to the panels in the direction of the stacking area and to provide a straightening force to the panels disposed between the curve area and the stacking zone to obviate the tendency of the panels to jackknife, and jam under the influence of the forces applied by the main cable drive to the lead panel.

A further object of the invention is the provision of an assembly of the type described wherein the auxiliary drive and tensioning mechanism is effective on panels arrayed between the storage zone and the transition or angling zone leading to the second leg.

A still further object of the invention is the provision of a device of the class described wherein the secondary or auxiliary drive means is effective only so long as some of the panels are still disposed on the second leg, i.e. the leg lying between the terminal end of the trackway and the angle or transition area.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, reference is made to the accompanying drawings, forming a part hereof, in which:

FIG. 1 is a fragmentary top plan view of a partition installation in accordance with the invention;

FIG. 2 is a side elevational view of the partition assembly of FIG. 1;

FIG. 3 is a magnified fragmentary plan view of components of the partition adjacent the stacking zone;

FIG. 4 is a magnified plan view of the area of the assembly adjacent the curved track section, showing details of construction;

FIG. 5 is a vertical section taken on the line 5–5 of FIG. 4;

FIG. 6 is a section taken on the line 6–6 of FIG. 5;

FIG. 7 is a section taken on the line 7–7 of FIG. 4;

FIG. 8 is a section taken on the angular line 8–8 of FIG. 4;

FIG. 9 is a magnified perspective view of a panel and its support, showing the manner of attachment of the auxiliary of tensioning cable;

FIG. 10 is a magnified section taken on the line 10–10 of FIG. 3;

FIG. 11 is a magnified horizontal section through a pair of adjacent panel edges which, in the extended condition of the partition, will be disposed at the curved track section;

FIG. 12 is a fragmentary plan view of an embodiment of the invention.

Referring now to the drawings, in FIG. 1 there is depicted a top plan view of components of a partition assembly details of certain of the conventional components of which have been simplified in order to facilitate an understanding of the operation of the invention.

It will be understood that elements 10, 11 represent side skirts depending from supportive beams of the structure to be partitioned, and function to conceal the interior mechanism on which the partition is mounted as well as to contain the drive mechanism therefor. It well be understood that the lowermost edges of the skirts 10, 11 are optionally but preferably flush with the ceiling and that decorative horizontal trim strips 10*a*, 11*a* are affixed at the lowermost edges of the skirts, and extend toward the panel members forming the partition, the trim strips being spaced apart a distance sufficient to provide a clearance slot S for the panels.

Since, as will more fully be explained hereinafter, the panels are not at all times aligned with the panel support track assembly 12, the clearance slot S in areas where the panels are angled relative to the track must be of considerably greater width than the thickness of the panels—see FIGS. 7 and 8. Moreover, the width of the slot may vary throughout its length since unduly large clearances need not be provided in areas of the track where the panels and track are aligned.

The track assembly 12 comprises generally a first track section 13, a second section 14 and a curved or transition section

15 which connects the first and second sections 13, 14 to provide a continuous trackway.

Each of the individual panels 16 is hingedly connected as by hinges 17 to the adjacent panels in a well known manner, so that the panels affixed to either side of any given panel fold in opposite directions relative to the central panel.

As best shown in FIGS. 7 to 9, the track may comprise a generally inverted T conformation, the vertical branch 18 having an upwardly open slot 19. A boxlike encasement structure 20 parallels the track path and is supported from the overhead beam structure 21 by hanger bolts 22 at spaced intervals along its length. Depending hanger brackets 12 are supported by the hanger bolts 22, the brackets including a central web 24 having an enlarged bead 25 which is disposed within an enlarged bead receiver pocket 26 at the lower edge of the slot 19 of the track branch 18.

As will be readily perceived from the drawings, the interfit of the bead 25 in the enlarged pocket 26 acts to support the track at the lower ends of the webs 24 of the various brackets 23.

The track includes horizontally directed roller support shoulders 27, 28 extending to either side of the central branch or flange 18. The support shoulders 27, 28 are engaged by roller carriages 30 disposed at the upper end of pendents 31 affixed to each alternate panel 16.

The roller carriages, which are pivotable about a vertical axis relative to the pendents 31, include an upwardly open U bracket 32 including opposed vertical flanges 33, 34.

Each of the flanges 33, 34 carries a pair of rollers R mounted for rotation about horizontal axes 35. The rollers are seated on the support shoulders 27, 28 of the track and permit translatory movement of the pendents and panels along the trackway, while permitting pivotal movement of the panels relative to the track.

As will be appreciated from the preceding description, the panels may be shifted from a stacked or side-by-side folded position adjacent the stacking zone Z—see FIG. 3, dot and dash lines—to an extended position in which the panels are disposed along the length of and are substantially aligned with the track assembly, each panel conforming substantially to the direction of the track section with which it is aligned.

To supply the prime motive power for shifting the panels between the extended and stacked positions, a main drive motor 36, FIG. 3, which includes a speed-reducing gear mechanism is mounted adjacent the casing 20. A cable drive drum 37 is connected to the reduced speed output of the motor 36, the drive cable 38 being convoluted for a few turns about the drum to provide a driving connection. The drive cable 38 is arrayed in an essentially endless loop, with the free ends 39, 40 of the cable connected to drive posts 41, 42, respectively, disposed forwardly and rearwardly of pendent 31 of the lead panel 44, the lead panel being defined as the outermost panel when the partition is being shifted from the stacked to the wall or partition-defining position.

It will be understood that in the loop defined by the main drive cable 38, the upper segment 45 of the loop forms the return flight portion of the cable and the lower segment 46 forms the active or power-transmitting section.

The upper return segment 45 of the main drive cable is guided in the straight runs, i.e. in the runs of the cable disposed in alignment with the first and second track sections 13, 14, within spaced cable guide assemblies 47 see FIG. 4 and 5.

The guide assemblies for the straight sections comprise downwardly directed U-shaped brackets 48, the legs 49, 50 of which are fixed as by welding to the upper surface of the casing 20. The legs 49, 50 carry a concave roller 51, rotatable about a horizontal axis, the tensioned return run 45 of the cable engaging against the under surface of the concave roller to provide some centering influence. Where the return section 45 is required to follow the curve of the track section, the cable is passed through horizontal centering guides 52—see FIGS. 7 and 8—which comprise a downwardly directed U-shaped structure including depending legs 53, 54 welded to the upper surface of the casing 20. The branch 55 of the U brackets carries a pair of depending stub shafts 56, 57 on which are rotatably mounted a spaced pair of concave rollers 58, 59, respectively. The concave rollers surround the cable, and provide support and guiding functions in both horizontal and vertical planes.

As best seen from FIG. 4, the various cable guides 47 and 52 are arrayed in vertically spaced relation to the track in such manner as to maintain the cable in substantially vertical alignment with the track throughout its straight sections.

From the foregoing it will be appreciated that when the motor 36 is activated, the cable may be driven in such manner as to induce an outward movement of the pendents of the lead panel 44, causing the panel to shift progressively along the track sections, drawing with it the succeeding panels and ultimately extending and aligning the series of panels along the track.

In the retromovement of the panels, that is, in shifting the assembly from the partition defining to the stacked position, a breaker assembly 60, shown best in FIG. 3 and 10, is provided to effect the initial folding of the innermost panel. The breaker assembly generally comprises an offset arm 61 affixed to the upper edge of the innermost panel 62 and extending laterally from the panel. The arm, at its distal end, includes a roller member 63 rotatably mounted on a vertical stud 64 extending above the arm. The roller rides within an offset track section 65 having an outer end portion 66 which parallels the main track section, and a curved section 67 extending progressively away from the main track section. a pair of entry guide cams 68 may be formed at the outer terminal end of the track section 66 to facilitate entry of the roller 63 into the track section.

As will be appreciated and as is customary in devices of this sort, the conjoint action of the roller and curved portion 66 of the track, upon the initiation of stacking movement, effects a breaking or kick out of the inner panel to induce a swiveling action of the panel about its pendent 31. Once the initial panel 62 is swiveled in the manner set forth, the succeeding panels will automatically fold or break progressively as they approach the stacking area.

In order to assure that the panels do not break or fold prematurely, guide sections 69, 70 are disposed in the straight run between the curved track section 15 and the breaking zone, thus to assure that the folding action of the panels is restricted to a predetermined area adjacent the stacking zone.

As will be more fully explained hereinafter, it is imperative that the guides 69, 70 be displaced a predetermined distance from the curved track section 15 since some angularity of the panels as they traverse and pass this track section is inevitably experienced.

The apparatus heretofore described, with the exception of the curved intermediate section, is essentially conventional. It has been determined that the apparatus hereinabove described will be ineffective without the further modifications hereinafter set forth, to extend the panel sections and to return the same to their stacked condition. More particularly, if only a straight track run were involved, the above described units would be fully operative. However, with the addition of the intermediate curved section, problems have arisen which cannot be solved without the addition of the auxiliary drive and tensioning mechanism hereafter described and forming an important feature of the invention.

Specifically, attempts to induce the above described mechanism to shift from the extended partition defining position to the stacked storage position inevitably result in a jamming and stalling of the motor mechanism. Without limitation to any particular theory, it is believed that the inability to shift the panels to stacked position is the result of two separate phenomena—the ineffectiveness of a force applied in the direction of the track segment 14 to induce any significant movement of the panel members in the direction of the track section 13, and the further tendency of the panels, particularly

those in the curved transition section and those in the first section adjacent the curved section, to become disaligned upon application of compressive forces and consequently to exert a lateral pressure against the pendents and rollers, to jam the same against the track sections.

The problems may be best placed in perspective by an analogy to movement of articles through a pipe section. If a series of elongated objects, such as children's blocks, are placed in end to end position within a straight pipe length, a force applied to the lead block will obviously be effective to shift all of the blocks axially of the pipe section. If, however, a similar attempt is made with a pipe that has been bent to include an angle, and particularly an angle approaching or exceeding a right angle, the compressive force applied against the lead block is ineffective to induce movement of the blocks in the leg of the pipe section remote from the point of application of the force.

The difficulties noted have been cured in the instant device by the expedients of providing an auxiliary drive or drives acting on at least some of the panels in the section 13 of the track assembly, and particularly on the panels within and/or in trailing relation to the curved section 15. The auxiliary drive has two separate effects which permit the desired translatory movement of the panels to the stacked position. First, the auxiliary drive provides a component of force aligned with the track section 13. Secondly, a second auxiliary drive or tensioning drive acts to draw the panels closer to the stacking zone away from the panels disposed in and adjacent the curved section, which drawing force prevents the panels from a premature breaking action which would otherwise result from the application of a compressive force. It is this premature breaking action which develops the lateral jamming forces against the track sections previously alluded to.

It should be noted at this point that the use of guide means to prevent the breaking or deflection of the panels is not feasible in those areas where the panels traverse or are adjacent a curved track section since the geometry of the assembly requires the panels to lie in constantly changing angular relations to the track.

The auxiliary drive and tensioning effects are preferably effected by one or more secondary cables. Thus, in accordance with the illustrated embodiment, the panel 16*a*, being the lead panel within the curved or transition section 15, has a secondary or auxiliary cable 72 looped about its pendent 31—see FIG. 9—, the end of the cable being locked about the pendent by a suitable cable clamp 73. The cable 72 is guided about the corner over a concave pulley 74 supported for rotation about a vertically directed pintle 75 affixed to bracket 76. The pintle 75, in addition, supports a larger pulley 77 for guiding the lower segment of he main drive cable about a corner. The auxiliary drive cable 72 is maintained under a constant tension, as by a negator spring motor assembly 78.

In a similar manner, additional panels 16*b*, 16*c*, FIG. 1, which, in the extended or partition forming position of the assembly, lie in the track section 13 rearwardly of the curve, are provided with cables 79, 80 connected to tensioning negator spring motors.

It will be appreciated that instead of negator springs, a system of counterweights will be effective to provide the required yieldable driving force for the cables 72, 79 and 80, although, for space-saving purposes, negator spring motors are preferred.

It will be further appreciated that the auxiliary cables may be guided in vertically spaced-apart relation so as to avoid any possibility of entanglement.

The operation of the device will be apparent from the preceding description. Assuming the panels to be in the stacked condition in the stacking zone Z, and assuming the motor 36 to be energized in the panel-extending direction, the lower section 46 of the main drive cable will pull the lead panel 44 outwardly along the track. By reason of the hinged connection between adjacent panels, the succeeding panels follow the lead panel. As the panels emerge from the stacking zone and traverse the section 13 of the track, they are aligned with the track section by the pulling forces exerted from the lead panel as well as by the panel guides 69, 70. Some deflection or breaking of the panels occurs as the panels traverse the curved or transition section 15 to the track section 14. However, on the outward movement of the panels to the extended position, no difficulty is presented since a pulling as opposed to a compressive, force is exerted.

Typically, limit switch means (not shown) interrupts the circuit to the motor 36 when the panels have reached their extended position.

Since, in the extended or partition defining position, certain determined ones of the panels will be angularly related to other panels, it is preferred, as shown in FIG. 11, to affix a yieldable, elastomeric strip 81 in the space between the abutting edges of the panels, to inhibit the transmission of sound through the gap which would otherwise exist at the panel junctions. Normally these panel junctions will be calculated to coincide with the curved areas 15′, 15″ at the beginning and end of the transition section 15, the section between the curve areas being essentially straight.

In the course of the outward movement of the panels 16*a*, 16*b*, 16*c*, the cables 72, 79 and 80, respectively, will be tensioned and energy will be stored in the negator spring motors connected to these respective cables. When it is desired to stack the panels, the motor 36 is again energized to be driven in an opposite direction, the lower section 46 of the cable applying a pulling force to the lead panel 44. It will be observed that the constant forces applied by the cables 72, 79 and 80 implement the closing movement of the panels, the forces of such cables being exerted essentially in the direction of the track section 13. Preferably, the total of the forces of the cables 72, 79 and 80 is sufficient to induce a movement of the panels in the sections 15 and 13 toward the stacking zone.

The number of auxiliary or tensioning cables required in any given installation is best empirically determined based primarily on the number of panels disposed between the curve section and the stacking zone, and the ratio that such number bears to the number of panels on the second section 14. In some installations, satisfactory operation may be achieved by the use of only a single auxiliary cable which will normally be attached to the pendent of the panel which, in the extended position of the door, lies in or adjacent the curved panel section. Where there are fewer panels in the second section 14 than in the first section 13, only a single auxiliary drive cable need be employed. In partition assemblies wherein a greater number of panels, in the extended position, lie in the track section 14 than lie in the section 13, it is necessary to secure an auxiliary drive cable or cables to one or more of the panels in the track section 14, as well as a tensioning cable to one or more panels in section 13. Specifically, it is important to provide at least one auxiliary cable which is urging the panel sections toward the stacking zone at all times when the lead panel is on the section 14 of the track assembly.

In the course of the closing movements, the cables 79 and 80 set up a relative tension, tending to separate the panels to which the cables are attached from the preceding panels. This tension tends to maintain the panels in alignment and offsets the jamming tendencies above described, which would be experienced if movement of the partition to the stacked position were effected solely by a compressive force exerted by the main drive or, in the case of large assemblies, by a combination of the main drive forces and a single auxiliary drive cable.

It will be appreciated that this tensioning effect will greatly reduce wear by eliminating, to a considerable degree, the frictional losses resulting from pressing of the roller supports against the support track at angles offset from the track path.

The tension cables, as noted above, are particularly effective in preventing a premature buckling or breaking of the panels in the area between the curve and the panel guides 69, 70, while still permitting a relative angularity between the adjacent panels, as required by the geometry of the curve.

In FIG. 12 there is shown an embodiment of the invention in which a friction belt drive is substituted for the auxiliary cable

drives of the prior embodiment. In accordance with this embodiment, the panels 16' within the encasing structure are engaged by the inner flight 90 of a friction belt 91 stretched between drive pulley 92 and idler pulley 93. The pulleys are yieldably pressed toward the lateral surfaces of the panels 16' to drive the belt in the direction of the arrows shown in FIG. 12, when the main cable drive is activated in a direction to shift the panels to the stacked position. In the extending position of the doors, the pulleys 92, 93 are free wheeling so as not to oppose the forces applied by the main drive.

It will thus be appreciated that the net effect of the use of the friction belt drive assembly parallels that of the auxiliary drive cables of the preceding embodiment by providing vectors of force toward the stacking zone and, additionally, setting up a tension or separating pull between the panels to offset the adverse effects resulting from the application of compressive interpanel forces.

Preferably the belt is driven at a speed slightly in excess of the speed of motion of the panels and a slip clutch or equivalent assembly is interposed between the belt and its source of power to obviate or minimize any slippage of the belt relative to the panels themselves.

From the foregoing it will be apparent that there is provided a powerized, multiple panel partition defining assembly which may be advanced along a nonlinear path between a stacked storage position and an extended partition-defining position. The partition or wall defined by the extended structure conforms essentially to the nonlinear track path, making it possible to divide off a corner or portion of a large enclosed space without providing a plurality of separately actuated extensible partitions.

The device is enabled to traverse a curvilinear path by reason of the employment of novel auxiliary or secondary drive means, with or without additional tensioning means, the noted expedients avoiding any tendency of the panels to jam, particularly in the course of powerized movement toward the storage position.

I claim:

1. A powerized folding partition comprising a suspension track assembly including a first section, a second section and a curved transition section interposed between said first and second sections, a plurality of hingedly connected panel members mounted on said track assembly for translatory movement from a stacked position at a stacking zone adjacent the end of said first section to an extended, partition-defining position wherein said panels are arranged in edge-to-edge alignment along said track assembly, main drive means including a cable aligned with said track assembly and connected to the lead panel for shifting said lead panel along said assembly between said stacked and said extended positions, and independently powerized auxiliary drive means operatively associated with at least one selected panel between said curved section and stacking zone in the extended position of said panel members, urging said selected panel toward said zone.

2. A device in accordance with claim 1 wherein said auxiliary drive means comprises a cable connected to said selected panel and arrayed in substantial alignment with said first section.

3. A device in accordance with claim 2 wherein said cable is under constant tension.

4. A device in accordance with claim 3 wherein said auxiliary drive means includes a negator spring motor applying said constant tension.

5. A device in accordance with claim 1 and including guide means along said first section interposed between said curved section and said stacking zone for limiting folding movement of said panels in advance of said panels reaching said stacking zone.

6. A powerized folding partition comprising a suspension track assembly including a first section, a second section and a curved transition section interposed between said first and second sections, a plurality of hingedly connected panel members mounted on said track assembly for translatory movement from a stacked position at a stacking zone adjacent the end of said first section to an extended, partition-defining position wherein said panels are arranged in edge-to-edge alignment along said track assembly, main drive means operatively connected to the lead panel for alternatively pulling said lead panel from the stacked to the extended position and pushing said lead door from the extended to the stacked position, and auxiliary tension means engaging at least one panel which, in the extended condition of said partition, is disposed between said curve section and said stacking zone, for yieldingly urging said one panel toward said zone.

7. A device in accordance with claim 6 wherein a plurality of the panels which, in the extended condition, are disposed between said curved sections and stacking zone, are provided with individual tension means for yieldably urging the panels of said plurality toward said zone.

8. A device in accordance with claim 7 wherein the combined force of said tension means is sufficient to advance said panels on said first section toward said stack zone.