

Oct. 22, 1963

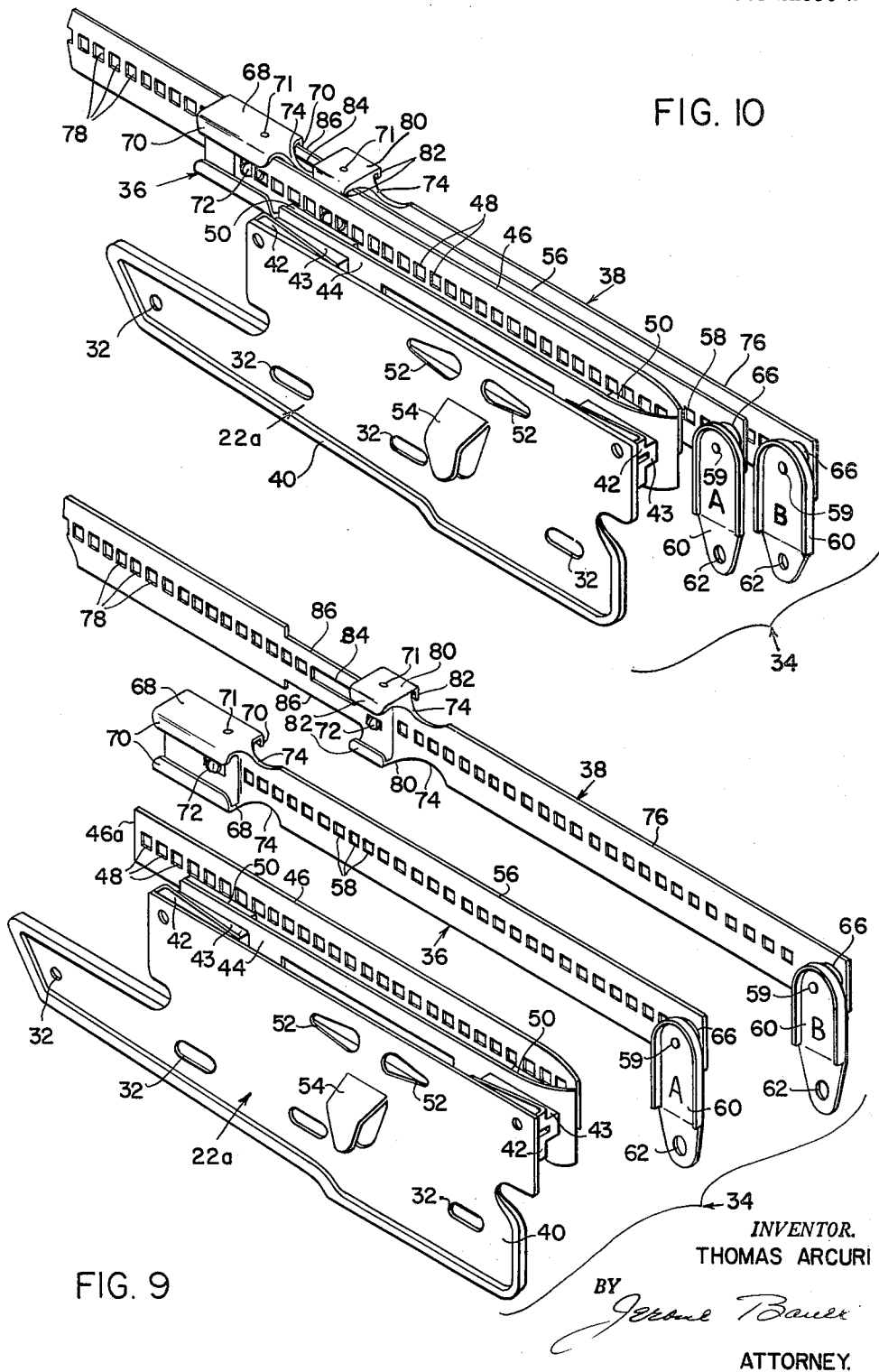
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3,107,723

MATERIAL HANDLING APPARATUS

Filed Oct. 27, 1960

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MATERIAL HANDLING APPARATUS

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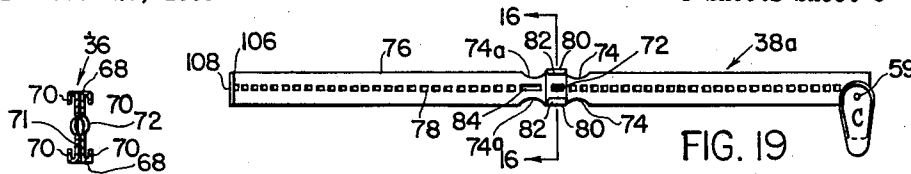


FIG. 16

FIG. 19

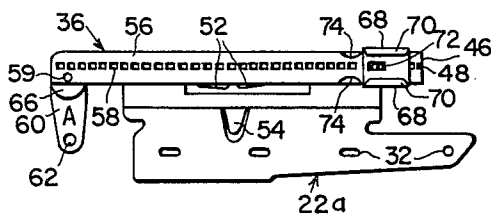


FIG. 17

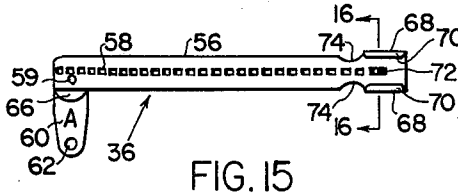


FIG. 15

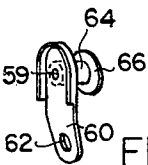


FIG. 22

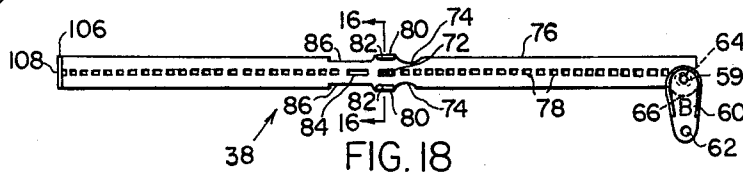


FIG. 18

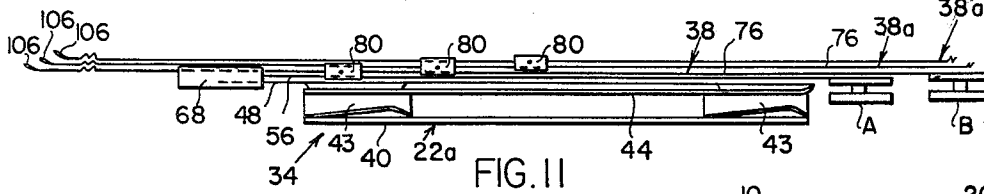


FIG. 11

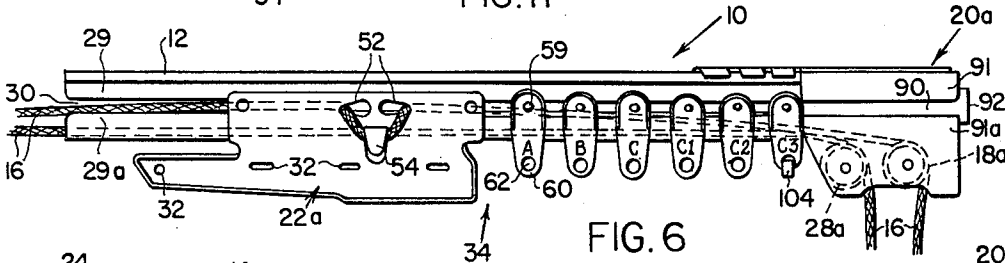


FIG. 6

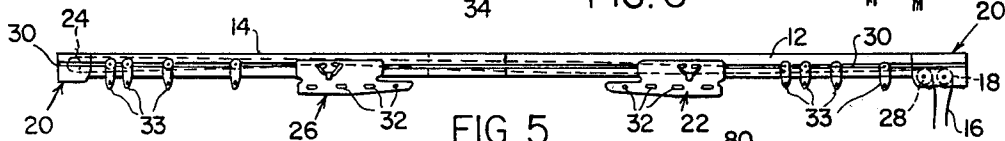


FIG. 5

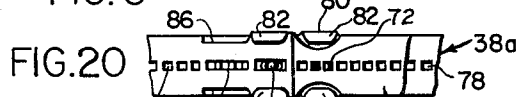


FIG. 20

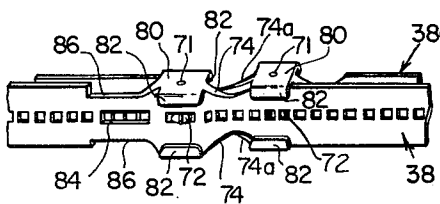


FIG. 21

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3,107,723

MATERIAL HANDLING APPARATUS

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Filed Oct. 27, 1960, Ser. No. 65,393

29 Claims. (Cl. 160-346)

This invention relates to material handling apparatuses and more particularly to adjustable traverse rods for the support of curtains, draperies or like material.

Heretofore, it has been customary that material handling apparatuses as traverse rods for supporting curtains, draperies and the like utilize a pair of master glide units. The master glide units were generally joined together by a manually operated cord that physically moved the same toward and away from each other along the length of the traverse rod guided by a slot or opening defined therein. The curtains, draperies or other material supported on the two relatively movable master glide units were, in turn, moved toward each other into closing relationship and away from each other into opening relationship in accordance with the movement of the glide units. Because each master glide unit was of relatively short length, it could support only a correspondingly short length of the material. Hence, the remaining length of the material was suitably supported from the traverse rod by securing the same at predetermined portions of its length to additional glide elements that were idly mounted within the guide slot of the traverse rod.

Inasmuch as the master glide members were the sole means by which the curtain material was caused to move between open and closed positions, the relative spacing of the supporting portions thereof connected to the idle glide elements was non-uniform as the curtain was moved to any position intermediate its closed and opened positions. For example, when the master glide units were moved toward each other, as illustrated diagrammatically in FIG. 1, from a fully separated relationship wherein the curtain was fully open, each of the supported portions of the curtain material M would move therewith and gradually separate and become spaced from each other, first immediately adjacent to the moving master glide unit and then in succession each next adjacent supported portion was pulled opened until the whole length of curtain material was moved into extended position. In like manner, when the master glides were actuated from their fully closed relationship, each supported portion of the curtain material was caused to gather and bunch together gradually and successively, first immediately adjacent to the master glide member as the same were moved along the traverse rod in the direction of the arrows and as diagrammatically illustrated in FIG. 2 until all the supported portions were gathered in the open position of the curtain material M.

The gradual non-uniform separation and bunching together of the curtain material at its supported portions is best understood by the fact that because the intermediate supported portions of the material M were supported from glide members that were permitted only idle movement along the glide slot in the traverse rod, such portions of the material connected to the idler glide members had to await their turn to be moved by the master glide unit. This meant that a period of lag or lost-motion was required between the time that the master glide unit could reach a point in its movement either to stretch or bunch together the material M since the idler glide members were linked to the master glide member solely by the curtain material itself. The movements of such idler glide members were controlled by the stretching or bunching together of the material folds in response to the movement of the master glide units only.

Being mechanically unconnected directly with the

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master glide units, the idler glide members were incapable of maintaining any uniform or proportionate spacing between the portions of the material M supported thereon. This resulted in an unsymmetrical gradual gathering or bunching together of the material when the curtain was opened partially and an unsymmetrical successive separation of the supported portions of the same material when the curtain was closed partially. In consequence, the inability to move all the supported portions of the material M equally and simultaneously along a portion of the length of the traverse rod, detracted from its decorative appearance.

Accordingly, the purposes and desideratum of this invention is to provide a material handling apparatus that has general utility, but is peculiarly adapted for use as a traverse rod for curtains, draperies and the like.

It is an object of this invention to provide a material handling apparatus that will support material at predetermined portions of its length and physically move such supported portions relative to each other, that during such movement the spacing of such supported portions will be varied uniformly so that the distance between each supported portion of the material will have a predetermined proportionate relationship with every other supported portion of such material, and that such relationship will be maintained throughout the movement of the material whether the same is moved to reduce or increase the relative spacing between said supported portions thereof.

It is another object of the invention to provide a material handling apparatus in which there are a plurality of material support units, each of which is connected with the other to enable their simultaneous relative movement whereby the portions of material supported thereon are maintained in a predetermined spaced relationship during the operation and relative movement of the material support units.

Still another object of the invention is to provide a material handling apparatus that is simple in construction, easily assembled, one that may be modified quickly and easily to increase or decrease the number of material supports thereof without affecting its operation, an apparatus that requires a minimum of basic operating parts, one in which the parts thereof are connected with each other in such manner as to insure their mutual cooperation for uniform relative movement of the material supported thereon, and an apparatus which, when utilized as a traverse rod, will support selected portions of curtain or drapery material in uniform equidistant relationship during the movement of the material along the apparatus.

Other and further objects of my invention reside in the structures and arrangements hereinafter more fully described with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic illustration of material as a curtain, drapery or the like being moved to its closed position in the direction of the arrows by a prior art material handling apparatus,

FIG. 2 diagrammatically illustrates the manner of drawing open material supported on the prior art apparatus of FIG. 1 in the direction of the arrows,

FIG. 3 is a view similar to FIG. 1 diagrammatically illustrating the movement of the supported material in the direction of the arrows on a material handling apparatus constructed in accordance with the teaching of the invention,

FIG. 4 diagrammatically illustrates the manner of moving material supported on the present invention to its open position in the direction of the arrows,

FIG. 5 is a diagrammatic rear view of any well-known prior-art traverse rod,

FIG. 6 is a rear view of one of the traverse rod housing members constructed in accordance with the teaching of the invention,

FIG. 7 is a perspective view of the traverse rod housing member shown in FIG. 6,

FIG. 8 is a perspective view of the pulley housing per se shown in FIG. 7,

FIG. 9 is an exploded perspective view of the glide units of the glide structure of the present invention,

FIG. 10 illustrates the manner of assembling the glide units of the glide structure shown in FIG. 9,

FIG. 11 is a diagrammatic top view of FIG. 10,

FIG. 12 is a front view of the master glide unit,

FIG. 13 is a top view of FIG. 12,

FIG. 14 is an end view of FIG. 12,

FIG. 15 is a front view of the intermediate glide unit,

FIG. 16 is a section taken along lines 16—16 of FIG. 15,

FIG. 17 is a front view illustrating the cooperation between the master and intermediate glide units,

FIG. 18 is a rear view of a primary basic glide unit,

FIG. 19 is a rear view of a secondary basic glide unit,

FIG. 20 is a side view of the primary and secondary basic glide units arranged for initial engagement while

FIG. 21 is a perspective view of FIG. 20 with the units thereof in engaged relationship, and

FIG. 22 is a perspective view of a material support element.

To provide a clear understanding of the invention, reference is initially made to the diagrammatic illustration of FIG. 5 showing a prior art material handling apparatus arranged for use as a traverse rod for curtains, draperies and like material. Shown in FIG. 5 are a plurality of elongated traverse rod housings of symmetrical construction, each having hollow interiors and being telescopically engageable one within the other, it being immaterial which housing telescopes within the other since the purpose for the telescopic connection is to permit the lengthwise adjustment of the traverse rod to any desired length.

The traverse rod of FIG. 5 diagrammatically illustrates the use of a manually operated continuous cord 16 that passes about a pulley 18 rotatably mounted at one end of the traverse rod in a pulley housing generally identified by the numeral 20. The cord 16 is suitably secured in any well known manner to a first master glide unit generally identified by the numeral 22. It continues along and within the confines of the telescoped housings 12 and 14 to the opposite end of the apparatus and bearingly engages about a set of pulleys 24 contained within a similar housing 20 at the other end of the housing 14. The cord 16 is doubled back about pulleys 24 and secured in any well known manner to a second master glide unit generally identified by the numeral 26. The remainder of the cord length passes beyond the back of the first master glide member 22 and bears against the periphery of a pulley 28 rotatably mounted in the first pulley housing 20.

The traverse rod material handling apparatus diagrammatically illustrated in FIG. 5 serves to illustrate the manner of movement of the first and second master glide units 22 and 26 toward and away from each other. Thus, if one end of the cord 16 is manually pulled downward, the glide units 22 and 26 are caused to separate and in like manner if the other end of the cord is pulled downward the two glide units are caused to move toward each other. Hence, if material such as curtains, draperies or the like are supported on the master glide units, the same will be caused to move therewith. Each master glide unit 22 and 26 is guided in its movement along the length of the apparatus of FIG. 5 by longitudinally extending slots 30 defined by a vertical separation of upper and lower walls 29 and 29a forming the rear face of each housing member 12 and 14 (see FIGS. 6 and 7). The guiding slots 30 of each of the housings 12 and 14 are in constant

linear alignment regardless of the relative telescoping relationship of the housings thereby providing a constant and continuous guideway for the movement of the master glide units 22 and 26 along the length of the apparatus.

Thus, FIG. 5 illustrates the basis of operation of a prior art traverse rod. In such prior art devices, it was common to hang the material on the master glide units by the use of hooks that were adapted to pass through suitable openings 32 provided in the bodies of each such unit. Additional selected portions of the length of the material were then supported in hanging suspension from the traverse rod by the use of additional hanger members 33 that simply rode idly within the guide slot 30. Such hanger members 33 were unconnected, in any mechanical manner, with the master glide units 22 and 26 and, therefore, during the movement of the glide units toward and away from each other, as a result of the manual operation of the cord 16 joining the same together, there was no way of maintaining a predetermined uniform or proportionate spacing between the supported portions of the material.

The illustration of FIG. 5 may now be employed to serve as a basis for explanation of the structural details of the present invention. Referring to the remaining figures of the drawings, the material handling apparatus of the present invention is generally identified by the numeral 10. It too includes housing devices such as the housings 12 and 14 previously described. For this reason FIGS. 6 and 7, illustrating the apparatus 10, include only the one half housing 12 of the traverse rod 12—14 of FIG. 5, it being understood that the other half housing 14, omitted from the illustration of the apparatus 10, is symmetrical for telescopic movement therein as previously described and, therefore, need not be illustrated.

Referring now to FIGS. 6, 9, 10 and 11, when the material handling apparatus 10 of the present invention is utilized as a traverse rod for closing and opening curtains, drapes, etc., it will include a plurality of glide structures generally identified by the numeral 34. Each glide structure 34 may be visualized as being a substitute for the operation of either one of the master glide units 22 and 26 and their respective sets of idler members 33. To more clearly illustrate this, each glide structure 34 comprises a master glide unit that has been correspondingly numbered generally with the numeral 22a. Also included in each glide structure 34 is an intermediate glide unit 36 (FIGS. 9, 10, 11, 15, 16 and 17), a primary basic glide unit generally identified by the numeral 38 (see FIGS. 6, 9, 10, 11 and 18 to 21), and a secondary basic glide unit generally identified 38a (FIG. 19), if the same is required.

The master glide unit 22a, forming a part of each master glide structure 34, comprises a body member 40 extending in a direction lengthwise of the housing devices 12 and 14 for guided movement therealong. It includes a plurality of material supporting openings 32 defined in the surface thereof and through which suitable hooks or other securing means may pass to support material thereon. The height of the body member 40 is such as to enable the same to depend from below the housing devices 12 and 14 as the same is mounted thereon and moved relative therealong.

It includes a pair of longitudinally spaced bearing members 42 that are conveniently mounted on the front thereof. The members 42 are narrowed in width at 43 for surface bearing engagement with the upper and lower spaced walls 29 and 29a of the linearly aligned guide slots 30 provided on the elongated housing devices 12 and 14. Mounted on the bearing members 42 is a back guide plate 44 that is adapted to fit within the hollow telescoping elongated housing devices 12 and 14 and ride against the interior surfaces of the walls 29 and 29a to prevent the accidental displacement of the master glide unit 22a from the slot 30. Hence, the height of the back guide plate 44 is greater than the width of the slot 30 and thereby assures that the master glide member 22a will be retained in position on the housing devices 12 and 14 and that the

upper and lower bearing surfaces 43 of the longitudinally spaced bearing members 42 thereof will remain in constant guiding cooperation with the vertically spaced defining walls 29 and 29a.

Back guide plate 44 further serves to mount a surface member 46 on the master glide unit 22a. The surface member 46 is mounted on the plate 44 in a position that is slightly above the uppermost dimension of the body member 40 to enable the same to cooperate with the intermediate glide unit 36 in a manner to be described. It includes engaging means 48 in the form of a plurality of rack-shaped openings that are equally spaced along its face.

In practice it has been found that because the surface member 46 can be made of very thin but sturdy metallic material, as spring steel, the engaging mover means 48 are easily and conveniently provided in the form of openings that extend completely through such member. However, it will be recognized as the description proceeds that such engaging means can be in the form of a rack or other convenient frictional engagement configuration which may be provided on or defined along the surface member 46. Thus, the illustration of the through openings 48 is not to be deemed to constitute a limitation upon the scope of this invention. As is more clearly shown in FIGS. 13 and 14, the surface member 46 when mounted on the back guide plate 44, is slightly spaced laterally therefrom by the use of suitable shims 50.

The body member 40 is provided with a pair of longitudinally spaced tear-shaped openings 52 and a locking finger 54 that is pressed outward from the back surface thereof as is more clearly illustrated in FIGS. 9 and 10. The tear-shaped openings 52 are adapted to accommodate the passage of the cord 16 therethrough while the locking finger 54 enables the cord to be passed thereunder as is shown more clearly in FIG. 6 thereby enabling the cord to be securely affixed to the master glide unit 22a and its movement to be transmitted directly thereto.

The intermediate glide unit 36 illustrated in FIGS. 9, 10, 15, 16 and 17 comprises a surface member 56 constructed of substantially the same sturdy material as the surface member 46 of the master glide unit 22a. It is sufficiently flexible to be bent along portions of its length, yet sturdy in construction to support the weight of whatever material is mounted thereon. The surface member 56 is also provided with surface engaging mover means in the form of a plurality of equally spaced rack-shaped openings 58 that extend for substantially the full length thereof.

The openings 58 extend completely through both side faces of the member 56. However, once again, it will be recognized that the same may be provided in any other suitable form along the opposite surfaces of the member 56 to function in the manner to be described. Pivotally mounted at 59 proximate one end of the surface member 56 is a material support element 60 (FIG. 22). The element 60 is provided with an aperture 62 through which a suitable hook or other support means may extend and be fastened to support material from and for movement with the intermediate glide unit 36.

The material support element 60 has a narrowed circular bearing surface 64 of such diameter as to enable the same to be bearingly guided between the vertically spaced walls 29 and 29a of the slot 30 defined in the telescoping housing devices 12 and 14. A rear backing formation 66 of larger diameter than the vertical spacing of the defining walls 29 and 29a of the slot 30 is formed integral with the bearing surface 64 for surface engagement with the interior of such walls to prevent the accidental lateral displacement of the bearing surface 64 from the slot. The back of the formation 66 is in close-fitting but rotatable engagement with the corresponding surface member 56.

One of the ends of the surface member 56 is provided along its top and bottom edges with connecting means in

the form of arms 68 that project laterally from the opposite sides thereof and are turned inward into parallel relationship with the surface thereof at the legs 70. Each leg 70 is spaced from its adjacent face of the member 56 a distance sufficient to accommodate therebetween the thickness of a surface member 46 of the master glide unit 22a previously described. The thickness of each leg 70 is slightly less than the thickness of the shims 50 separating the member 46 from the plate 44 of the glide unit 22a to enable the same to be accommodated therebetween and to ride along the edges of the surface member 46.

Rotatably mounted on the surface member 56 at 71 is a mover or engaging means in the form of a rotatable pinion 72 that is positioned intermediate the edges of the surface member 56 and the guiding legs 70 of the arms 68. The mover or pinion 72 projects laterally through the opposite sides of the surface member 56. The surface member 56 is provided with reception openings in the form of arcuate cutouts 74 along both of its opposite edges immediately adjacent to the termination of the connecting means 68 and their respective guide legs 70.

Also included in the glide structure 34 is at least one basic glide unit. One of the basic glide units shown in FIG. 18 is referred to as the first or primary basic glide unit and is generally identified by the numeral 38 while the other basic glide unit, referred to as the secondary, is generally identified as 38a and is shown in FIG. 19. At this time, for ease of explanation, it may be said that both the primary and secondary basic glide units 38 and 38a are identical. The distinction and structural differences between them will be described presently.

It will be understood that the first and second basic glide units 38 and 38a each comprises a surface member 76 made of substantially the same material as are the surface members 44 of the master glide unit 22a and 56 of the intermediate glide unit 36. That is to say, the material is substantially rigid and quite strong in construction yet easily flexed or bent to permit the same to bow about contours or irregular configurations which the housing devices 12 and 14 the apparatus 10 may contain. The surface member 76, like the previously described corresponding surface members 44 and 56, is provided with a surface engaging mover means in the form of a plurality or a continuous series of equally spaced rack-shaped openings 78.

Engaging means 78 are through openings facing onto opposite sides of the surface member 76 and, therefore, are accessible for engagement by suitable pinion or mover means 72 rotatably mounted on the intermediate glide member 36. The engaging means 78 may, however, take any other convenient form to enable its cooperation with the mover or pinion means 72 of the intermediate glide unit 36. The engaging mover means 78 extend for substantially the full length of the surface member 76.

The basic glide unit 38, like the intermediate glide unit 36, pivotally mounts at 59, a material support element 60 having a material support aperture 62 through which a hook or other suitable material supporting device may be inserted and engaged. The details of construction of the material support element 60 pivotally mounted at the one end of the primary and secondary basic glide units 38 and 38a are exactly the same as that shown in FIG. 22 previously described with respect to the intermediate glide unit 36. Thus, the element 60 is provided with a narrowed bearing surface 64 having an enlarged backing formation 66 to insure the proper guided movement of the element 60 within the slot 30 of the housing devices 12 and 14.

Each basic glide unit 38 and 38a is provided, intermediate its ends and formed along opposite edges of the surface member 76, with a pair of connecting means in the form of laterally projecting arms 80 each of which terminate in inward guide legs 82. The connecting arms

80 and their attendant guide legs 82 have exactly the same cross-sectional appearance as the connecting arms 68 and attendant guide legs 70 previously described with respect to the intermediate glide unit and as shown in FIG. 16. It will be noted, however, that the longitudinal extent of the connecting arms 80 and the legs 82 is substantially shorter than those provided on the intermediate glide unit 36.

In like manner each basic glide unit 38 and 38a includes a mover or engaging means in the form of a pinion 72 that is rotatably mounted at 71 on the surface member 76, positioned intermediate the edges of the surface member, yet within the longitudinal confines of the legs 82 formed on the connecting means 80. The engaging means 72 thus interrupts the continuation of the rack-shaped engaging means 78 which are further interrupted intermediate their longitudinal extent by a pinion reception slot 84, the length and height of which is sufficient to accommodate the mover or pinion 72 of the intermediate glide unit 36.

Defined along the opposite edges of the surface member 76 on one side and immediately adjacent to the connecting means 80 are arcuate cutouts or connection reception openings 74 having substantially the same shape as provided on the surface member 56 of the intermediate glide unit 36. At this time it is noteworthy that the shape of the openings 74 corresponds to the shape of the guide legs 82 on the secondary basic unit 38a and also of those immediately longitudinally adjacent thereto.

Referring now to FIG. 18 wherein the first or primary basic glide unit 38 is disclosed, it is to be noted that further straight sided elongated connection reception cutouts or openings 86 are defined along the opposite edges of the surface member 76 immediately longitudinally adjacent to the connecting means 80. Once again, it is noteworthy that the connection reception openings 86 defined along the opposite edges of the surface member 76 correspond in length and in shape to the guide legs 70 of the connecting means 68 formed on the intermediate glide unit 36 in order to accommodate and receive the same therein.

By comparison, the second glide unit 38a of FIG. 19 also includes one set of edgewise reception openings 74 on the one side of the connection means 80 and an additional similarly shaped set of reception cutouts or openings 74a on the other side of the connection means 80 defined along the opposite edges of the surface member 76 in vertically aligned relationship with the pinion reception slot 84. The size and shape of the additional set of reception openings 74a provided in the second basic glide unit 38a of FIG. 19 is of the same contour as the openings 74 previously described. For a better understanding of the pinion or mover means 72, reference again may be had to FIG. 16.

In order that a clearer understanding may be had of the manner of assembling the glide units 22a, 36, 38 and 38a of the whole glide structure 34, the material support elements 60 pivotally mounted on the respective glide units 36, 38 and 38a have been suitably lettered A, B, and C while additional secondary basic glide units 38a added to the glide structure 34 have been identified in FIG. 6 by the letters C1, C2 and C3. Perhaps the manner of assembling the glide structure 34 can be more clearly illustrated in FIGS. 9 and 10, wherein, the surface member 46 of the master glide unit 22a, being longer in length than the space between the connection means 68 and element A of unit 36 is placed in facing adjacent relationship with the surface member 56 of the intermediate glide unit 36. When so positioned the lefthand portion 46a of the surface member 46 extends beyond the length of the back guide plate 44 to which the same is affixed and is bent into alignment for reception between the inwardly directed legs 70 of the connecting means 68 formed on the lefthand end of the surface member 56.

It is to be understood that the material support element 60 (lettered A) and the connecting means 68 are longitudinally spaced on the surface member 56 of the intermediate glide unit 36 less than the length of the surface member 46. In consequence, when the adjacently disposed faces of the surface members 46 and 56 are placed next to each other as shown in FIG. 10, the end 46a must be bent or deflected between legs 70 and thereafter they are moved relative to each other causing the lefthand end 46a of the surface member 46 to enter into cooperative engagement with the upper and lower connecting means 68 on the surface member 56 and to be engaged and guidingly directed between the adjacent faces of the surface member 56 and the spaced legs 70.

This guided relative movement of the surface members 46 and 56 causes the rotatable pinion or mover means 72 to cooperate and engage with the rack-shaped openings 48 provided along the length of the surface member 46. The relative movement of adjacently arranged surface members 46 and 56 and subsequent engagement of the mover or pinion means 72 on the member 56 with the corresponding engaging means 48 on the member 46 serves to connect the two surface members for relative movement. They are further connected and guided during such relative movement by the vertically separated connection means 68 on the surface member 56 and their inward parallel legs 70 that engage along the upper and lower edges of the surface member 46.

Any relative movement that may thereafter occur between the two members 46 and 56 will be transmitted through the mover or pinion 72 cooperating with the engaging means 48 while the relative movement of such members will be guided by the edgewise connection means 68. The lengthwise extent of the connection means 68 and their inwardly disposed legs 70 assure sufficient surface contact with the corresponding edges of the surface member 46 so that relative cantering between the members 46 and 56 during relative longitudinal movement is substantially eliminated.

After the master glide unit 22a is connected with the basic glide unit 36 in the manner described, the first basic glide unit 38, containing the material supported element 60 (lettered B), may be connected thereto. To accomplish this, the first basic glide unit 38 is arranged in adjacent parallel relationship with the surface member 56 of the intermediate glide unit 36 in the manner shown in FIGS. 9 and 10. The edgewise connection reception openings 86 thereof are placed in adjacent lateral alignment with the guide legs 70 of each of the opposite edgewise connection means 68 provided on the surface member 56.

This alignment of the connection openings 86 with the legs 70 results in a corresponding alignment of the pinion reception slot 84 with the pinion or mover means 72 of the member 56. In like manner, the aligned relationship places the inturned legs 82 of the connecting means 80, provided along opposite edges of the surface member 76, into adjacent lateral alignment with the correspondingly shaped cutouts or connection reception openings 74 provided along the opposite edges of the surface member 56. The two surface members 76 and 56 are then placed in adjacent surface abutting relationship and each is moved relative to the other with the member 76 being moved to the right and the member 56 being moved to the left.

The relative movement causes the mover or pinion means 72 of the member 56 to become cooperatively engaged with the rack-shaped openings 78 to the left of the reception slot 84 while the connection means 68 now engage the respective encompassed edges of the member 76. The legs 70 of the connection means 68 guide the movement of the members 56 and 76 relative to each other so that neither can separate laterally from the other. The relative rightward and leftward movement of the members 76 and 56 respectively similarly brings the con-

necting arms 80 of the member 76 into encompassing engagement with the edges of the surface member 56 after moving beyond the accommodating reception openings 74. The inward arms 82 guide the relative movements of the members 56 and 76 so as to prevent their lateral separation while the mover or pinion means 72, pivoted on the member 76, now is in position to engage successive ones of the rack-shaped engaging means 58 of the surface member 56.

It will be clear that as the intermediate and first basic glide units 36 and 38 are movingly engaged with each other for relative movement by way of their respective mover or pinion means 72 cooperating with the corresponding engaging means 58 and 78 provided on adjacent sides of their respective surface members 56 and 76, such surface members are doubly prevented from lateral separation by the connection means 68 encompassingly engaging along the edgewise portions of the surface member 76 and the connection means 80 encompassingly engaging along the edges of the surface member 56. This double connection and double pinion and rack engagement between the members 56 and 76 assures that the movement of any one member will be immediately transmitted to the other.

Hence, with the master glide unit 22a connected to the intermediate glide unit 36 as previously described, so that the mover or pinion means 72 of the latter engages the rack means 48 of the former, the same pinion means 72 will also engage the rack means 78 of the surface member 76 provided on the first basic glide unit 38. One can readily recognize that when either one of the glide units 22a, 36 or 38 is moved, the double engaging pinion means 72 of the intermediate glide unit 36 will transmit the motion of such moving glide unit to the other next adjacent glide unit. Under all conditions, the intermediate glide unit 36 will be caused to move between the master glide unit 22a and the basic glide unit 38, a distance corresponding to that of the moving glide unit.

A basic glide structure 34 may consist, therefore, of the master glide unit 22a, the intermediate glide unit 36 and the basic glide unit 38. However, generally the mere inclusion of these three glide units as a composite single glide structure is not sufficient to accommodate the handling of material of any substantial quantity or length. In consequence, if it is desired or necessary, additional secondary basic glide units 38a may be added to support the full quantity or length of material for uniform and equidistant movement of such material. In this connection the secondary basic glide units 38a (FIG. 19) include the material support elements 60 and each of which is lettered with the prefix "C" (FIG. 6) and subsequently numbered "1," "2" and "3."

To add a secondary basic glide unit 38a to the glide structure 34, reference may now be made to FIGS. 20 and 21. In FIG. 20 there is shown a secondary basic glide unit 38a positioned behind the first or primary basic glide unit 38 in the same adjacent parallel surface relationship as was described with respect to FIGS. 9 and 10. The legs 82 of the secondary basic glide unit 38a are placed in adjacent lateral alignment with the arcuate cutouts or reception openings 74 of the primary unit 38 while the legs 82 formed on the connecting means 80 of the primary unit 38 are aligned in adjacent lateral relationship with the corresponding arcuate reception openings 74a of the surface member 76 of the secondary basic glide unit 38a. This aligned relationship is depicted more clearly in FIG. 21 and thus enables the mover or pinion means 72 on the glide unit 38 to be aligned and accommodated within the confines of the reception slot 84 of the unit 38a.

Thereafter, relative movement of the two units 38 and 38a to the left and right respectively will cause their respective connection means 80 to move into encompassing engagement with corresponding edges of the next adjacent surface members 76 of each unit 38 and 38a.

In like manner, the mover or pinion means 72 of each unit 38 and 38a and the correspondingly facing rack-shaped openings 78 provided in the adjacent surface of each next adjacent member 76 are moved into cooperative engagement. This relative movement and engagement is depicted more clearly in FIG. 21.

Quite obviously, the inward guide legs 82 of each member, being spaced sufficiently from the adjacent face of their respective surface member 76 by a distance at least sufficient to accommodate the thickness of the adjacent surface member 76 of either the unit 38 or 38a, as the case may be, thus serves to restrict and guide the relative movements of the units. Because there are two pairs of connection means 80, one on each of the surface members 76 of the units 38 and 38a, there is a double connection and guide relationship formed between each unit. Similarly, there is a double pinion and rack engagement since each unit 38 and 38a has its respective pinion 72 extending through the opposite faces of its respective surface member 76 into engagement with the engaging means on the surface member of the next adjacent glide unit.

For example, in the glide structure shown in FIGS. 10 and 11 the pinion means 72 of the intermediate unit is in cooperative engagement with the engaging means 48 and also 78 of each of the next adjacent units 22a and 38 respectively. So also, the mover or pinion means 72 of the primary unit 38 will engage the means 58 and 78 of the next adjacent units 36 and 38a respectively with which its unit 38 is connected. In this manner any number of secondary basic glide units 38a may be added to the glide structure 34 in order to accommodate as many pieces of material or portions of a length of material as is necessary.

Assuming the glide structure 34 is assembled in the manner previously described to contain, as shown in FIG. 6, the master glide unit 22a, the intermediate glide unit 36 with its support element A, the first or primary glide unit 38 with its support element B and any additional number of secondary basic glide units 38a with their attendant support elements C, C1, C2 and C3. A portion of this assembled glide structure 34 is depicted in the line drawing of FIG. 11 to serve as an indication that it may be handled as a complete structure for insertion into the elongated housing devices 12 and 14.

To facilitate the use of the glide structure 34 the same may be inserted into the housing 12, for example, at the pulley housing 20a shown separately in FIG. 8. Pulley housing 20a is much like the housing 20, but includes a flat spring 88 that is bowed upward at 90 to abut against the inner surface of the walls 91 and 91a defining a continuation in the housing 20a of the guide slot 30. Thereafter, the bowed portion 90 terminates in a downward smoothly curved finger 92 that is accessible for manual deflection through an opening 94 provided in the end of the pulley housing 20a.

The pulley housing 20a is assembled as a terminal cover to the housing 12 by a set of upper and lower bracket arms 96 and 98 contoured to tightly or snugly fit about correspondingly curved portions of the housing 12. Thus the bracket arms 96 and 98 cause the pulley housing 20a to be moved into engagement with and to be securely mounted on an end of the housing 12. Suitable holes 100 are provided in a bracket extension 102 that enable the material handling apparatus 10 to be secured to the ceiling or any other convenient surface.

With the pulley housing 20a securely mounted on the end of the traverse rod housing 12 in substitution for the pulley housing 20 as shown in FIG. 14, and with a similar housing 20a mounted in a similar manner on the opposite end of the traverse rod housing 14 for the housing 20 shown in FIG. 5, the assembled glide structure 34, containing the numerous glide units and material support elements A, B, C, C1, C2 and C3, may now be inserted into the confines of the housings 12 and 14 through the

openings 94 provided in their respective pulley housings 20a. With the structure 34 completely assembled the glide units are in adjacent connected relationship as depicted in partial form in FIG. 10.

The master glide unit 22a is the first to be inserted into the pulley housing 20a through the opening 94. This accomplished simply by depressing the spring 88 at the exposed finger 92 to open the righthand end 94 of the guideway 30 of FIG. 7. The surface member 46 and plate 44 of the master glide unit 22a are inserted behind the vertically spaced guideway defining walls 91 and 91a with the narrowed upper and lower bearing surfaces 43 of the attendant bearing member 42 positioned therebetween in the guideway 30. The back guide plate 44 is thus positioned in surface engagement with the interior surface of the walls 91 and 91a preventing the outward or lateral separation of the master glide unit 22a from the guideway.

After the master glide unit 22a is slid into the pulley housing 20a through the opening 94 thereof and is guided at its bearing surfaces 43 along the length of the guide slot 30 of the housing 12 or 14, the intermediate glide unit 36 connected therewith is caused to follow into the confines of the slot 30. The narrowed circular bearing surface 64 of its material support element 60 (A) is also brought into engagement between the upper and lower walls 91 and 91a and thus serves to guide the one end of its surface member 56 for movement along the slot 30. The other end of the surface member 56, being connected to the surface member 46 of the master glide unit 22a, is actually guided within the housing 12 or 14 by the bearing surfaces 43 of such master glide unit.

Thus, as each successive glide unit, while connected with the next adjacent glide unit, is caused to enter the pulley housing 20a through the opening 94 thereof, the narrowed circular bearing surface 64 of its respective material support element 60 becomes engaged with the upper and lower defining walls 91 and 91a of the slot 30 to cooperate therewith and guide the movement of its respective surface member along the length of the slot. Each basic glide unit 38 and 38a thus enters the pulley housing 20a in the manner previously described with the narrowed bearing surface 64 of its respective support element 60 becoming engaged seriatim with the upper and lower defining walls of the slot 30.

The glide structures 34 inserted into the housings 12 or 14 through the respective pulley housings 20a become integral operating parts of the material handling apparatus 10. Each glide unit of the glide structures 34 so mounted within the housings 12 and 14 are, therefore, guided along the guideway 30 thereof at least one portion by the bearing surface 43 or 64, as the case may be. Inasmuch as each glide structure 34 has its units connected for relative guided movement not only with respect to each other but also with respect to the guideway 30 within which the same is contained, its units to move in a train relationship; that is to say, each unit of the glide structure 34 is connected with the other to be drawn along equally and in a predetermined proportionate relationship in train.

The train movement is facilitated by securing the endmost glide unit of the glide structure 34 from relative movement to the guideway 30. To accomplish this, the pulley housing 20a is provided with a retaining means in the form of a sample hook 104 (see FIGS. 6, 7 and 8). Inasmuch as the secondary basic glide unit, having the material supporting element identified as C3, forms the last of the train of its glide structure 34 as shown in FIG. 6, the material supporting aperture 62 thereof is engaged by the restraining finger 104 against movement along and relative to the guideway 30.

With two glide structures 34 substituted for the units 22 and 26 of FIG. 5 and secured to the limiting hooks 104 as shown in FIG. 6, the cord 16 there shown is then threaded along the length of the telescoped housings 12

and 14. A portion of the length thereof is inserted through the teardrop shaped openings 52 provided on body member 40 of the master glide units 22a and then looped beneath the locking finger 54. Thereafter, when either end of the string 16 is pulled, the master glide unit 22a is caused to move along the length of the guideway 30 while its bearing surfaces 43 cooperate with the defining walls of the guideway to insure its proper guided movement therealong.

As the master glide unit 22a is moved by the cord 16, its movement is transmitted to the intermediate unit 36 through the cooperating engaging means 48 and the mover or pinion means 72. Because the intermediate glide unit 36 also has its mover or pinion means 72 in cooperating engagement with the engaging means 78 of the primary basic glide unit 38, the movement of the master glide unit 22a is simultaneously transmitted to the intermediate glide unit 36, to the primary basic glide unit 38, and from there to all the additional secondary glide units 38a containing the material supported elements C, C1 and C2.

Quite obviously, the movement transmitted from one glide unit to the other will be in proportion and in the same direction as that of the master glide unit 22a. Hence, each material supporting element A, B, C, C1 and C2 will simultaneously become spaced from the other. The material supported thereon will assume the uniform appearance illustrated in FIGS. 3 and 4, regardless of the direction of movement of the master glide unit 22a. Because the material support element C3 is secured at 104 from movement relative to the guideway 30 and the apparatus housings, the glide units of the structure 34 will each move in train relative to the other in the same direction and in response to the movement of any one unit of the structure relative to any other unit.

It will be apparent to those skilled in the art that the glide units of each structure 34 will easily follow along the guideway 30 even though the housings 12 and 14 may be curved along portions of their lengths. This is so because the lengthwise extent of the surface member 46 of the master glide unit 22a need not be too long while the additional surface members 56 of the unit 36 and 76 of the units 38 and 38a are sufficiently flexible to bend in their guided movements about such curvatures.

However, when the glide units of their respective glide structures 34 are stretched out in train it is important that the mover means 72 be prevented from moving beyond the end of the next adjacent surface member and out of engagement with the complementary engaging means (48, 58, 78) thereon. In practice it has been found that such disengagement can be prevented by terminating each surface member 76 in a thickened portion 106 (FIG. 11) over which the mover or pinion means 72 is incapable of riding. It has also been found that if the engaging means 78 are terminated short of the ends 108 of the basic glide unit surface members 76 the engaging pinion means affecting relative movement between adjacent surface members will be incapable of moving out of engagement therewith. In effect, each basic glide unit 38 and 38a has means to limit its movement relative to the next adjacent unit. Such means are found in the spacing between the stop portions 106 and the connecting means 80 thereon.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

I claim:

1. In a material handling apparatus having a guideway, a plurality of material support members movable

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relative to said guideway and in a line relative to each other, means cooperating with each of said members to connect the same together for relative movement, mover means, said mover means being operable between each of said members to move the same relative to the other in response to the movement of one of said connected members relative to the other, and guide means on said members cooperable with others of said members to guide the relative movements of said members.

2. In a material handling apparatus having a guideway, a plurality of adjacent members relatively movable in a line in said guideway and each having connecting means, said connecting means each connecting their respective members with others of said members on opposite adjacent sides thereof, and mover means engaging between a plurality of adjacent ones of said members and being operable to move said engaged members in response to the movement of one of said engaged members relative to the other.

3. In a material handling apparatus, guide means thereon, a plurality of adjacent members each having connecting means, said connecting means each connecting their respective members with others of said members on adjacent sides thereof, mover means engaging between a plurality of adjacent ones of said members and being operable to move said engaged members in response to the movement of one of said engaged members relative to the other, and means on said members cooperating with said guide means to guide said members in a line along said guide means during their relative movement.

4. In a material handling apparatus, a plurality of relatively movable material supporting members, a plurality of mover means, each of said members being operatively engaged with at least one of said plurality of mover means to be moved thereby, said mover being operatively engaged with a plurality of said members, means engaging between each of said members to connect the same in operative engagement with their respective mover means, a housing and means on said members and housing to guide the relative movements of said members.

5. In an apparatus having guide means defined thereon, a plurality of members each including means connecting their respective members to, and for relative movement with at least another one of said members, said connecting means each including means to guide the movement of its respective member relative to said other member with which the same is connected, mover means operable between each of said connected members to move the same relative to each other in response to the movement of any one of said connected members relative to the others, and means on said members cooperable with said guide means to guide the relative movements of each of said members and along said guide means.

6. In an apparatus for handling material in proportionate spaced relationship, support means, a plurality of material supporting members, means to connect and guide each of said members for relative movement in a train relationship, mover means on each of said members, said mover means on one of said members being in engagement with said mover means on at least another of said members in said train to move their respective members relative to each other a distance in proportion and in response to the relative movement of any one of said members to the other, and means on said support means and said members cooperable to guide the relative movements of said members in said train relationship.

7. In an apparatus for handling and guiding the movement of material relative to a guideway defined thereon, a plurality of material supporting members arranged in adjacent relationship for relative movement in the same linear direction and each having means operable in said guideway to guide the relative movements of

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said members, means on each member to connect the same with the next adjacent member and to guide the relative movements of said connected members, and movable means on each member engaging with the next adjacent member to move said members in response to the relative movement of any of said members.

8. In a material handling apparatus, support means, a plurality of material support members in adjacent relationship and relatively movable in a train, means on certain of said members engaged with members adjacent their respective members to cause each of said engaged members to move relative to the other a distance in proportion and in response to the movement of any of said members relative to the other, means connecting said material support members in said adjacent relationship and guiding the same for relative movement in a train, and means on said support means cooperable with said members to guide their relative movements in a train and with an end one of said train of material support members to restrain the movement thereof.

9. In a material moving apparatus, support means having guide means to guide the movement of material supported thereon, a glide structure including a plurality of material support members connected in adjacent relationship for relative movement in a linear train, means cooperable with said guide means to guide the relative train movement of said members thereof and means engaged with each one of a plurality of adjacent ones of said members to move the same relative to each other in response and in a predetermined proportion to the relative movement of any one of said engaged members relative to the other, and means on said support means restraining the movement of an end one of said members in said train.

10. In a material handling apparatus, support means, a plurality of material support members, means connecting said members for relative movement in adjacent side by side facing relationship, means on said members and said support means cooperating to guide said members during their relative movement, means on each member engaging the next adjacent member and rotatable in response to the relative movement of one of said engaged members to move its respective member and said engaged adjacent member relative to each other.

11. In a material handling apparatus, support means having guide means, a plurality of flexible movable material support members arranged in adjacent relationship and each including means cooperable with said guide means to guide the relative movements of said members, reception means defined in each member, connector means extending laterally from each member for removable accommodation by the reception means of the next adjacent members and for releasable connecting engagement with said next adjacent members, rotatable means and complementary engaging means on each of said members, said rotatable means cooperatively engageable with said complementary engaging means of said member next adjacent its respective member, reception means formed contiguous with said complementary engaging means to enable said rotatable means to engage therewith, and means on said support means cooperable with an end one of said adjacent arranged members to restrain the same from movement.

12. In a handling apparatus for proportionate traverse movement of material, support means having a guideway, a master glide unit, an intermediate glide unit and at least a basic glide unit, means on said intermediate and basic glide units to connect the same for guided movement relative to each other, means on said intermediate glide unit to connect the same with said master glide unit for guided relative movement, mover means on said intermediate and basic units, said mover means on said intermediate glide unit engaging said master glide unit and said mover means on said basic

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glide unit engaging said intermediate glide unit, said mover means being operative to move said units relative to each other in response to the movement of any one of said units, means on said support means restraining the movement of said basic intermediate glide unit, means on each of said glide units to support material thereon for movement therewith and means on said glide units to guide the same for movement relative to said guideway.

13. In an apparatus as in claim 12, said master glide unit comprising a body having said means to support material thereon, a surface member including spaced rack-shaped means in engagement with said mover means of said intermediate glide unit, and bearing means on said master glide unit in cooperation with said guideway to guide the movement of said master glide unit therealong.

14. In an apparatus as in claim 12, said intermediate glide unit including means to support material thereon for movement therewith, a surface member having rack-shaped engaging means spaced along the length thereof in engagement with said mover means of said basic glide unit, and bearing means on said intermediate glide unit in cooperation with said guideway to guide the movements of said intermediate glide unit therealong.

15. In an apparatus as in claim 12, said basic glide unit having a surface member, said surface member including means to support material thereon for movement therewith and engaging means spaced along the length thereof in engagement with said mover means of said intermediate glide unit, and bearing means on said basic glide unit in cooperation with said guideway to guide the movements of said basic glide unit along said guideway.

16. In a material handling apparatus, a glide unit comprising a flexible longitudinally extending surface member, means proximate one end of said surface member for supporting material therefrom, a plurality of equally spaced rack-shaped openings defined along the length and on opposite sides of said member, connecting means proximate the other end of said member projecting laterally from opposite sides thereof, rotatable pinion-shaped means mounted on said surface member and projecting through opposite sides and intermediate the edges thereof, and reception openings defined along opposite edges of said member adjacent said laterally projecting connecting means.

17. In a material handling apparatus, a glide unit comprising a flexible longitudinally extending surface member, means proximate one end of said surface member for supporting material therefrom, a plurality of equally spaced rack-shaped openings defined along the length of said member, connecting means on said mem-

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ber intermediate the ends thereof and projecting laterally from opposite sides thereof, rotatable pinion-shaped means mounted on said surface member and projecting laterally through opposite sides and intermediate the edges thereof, said rack-shaped openings being interrupted intermediate their length by a pinion reception slot defined in said member adjacent said pinion-shaped means, and reception openings defined along opposite edges of said member on adjacent sides of said transversely extending connecting means.

18. A material handling apparatus comprising an elongated device, a pair of glide structures on said device each being movable therealong toward and away from each other, each of said glide structures including a plurality of interconnected relatively movable glide units, means interconnecting said glide units of each of said respective glide structures in adjacent relation for relative movement, complementary engaging means on each of said glide units, said complementary engaging means on adjacent ones of said glide units of said respective glide structures being in engagement with each other to move their respective glide units relative to each other in the direction and in proportion to the movement of their respective glide structures, means on each glide unit to support material thereon for movement therewith, and means on said elongated device restraining a predetermined end one of said glide units of each of said glide structures for movement.

19. A material handling apparatus as in claim 18, each of said glide units moving with their respective glide structures having means engageable with said elongated device to guide the movement of said respective glide unit therealong.

20. A material handling apparatus comprising an elongated member, a plurality of glide structures each movable relative to the other along said elongated member, said glide structures each including a plurality of glide units, means connecting each of said plurality of glide units of each structure for proportionate movement relative each other in the direction of and in response to the movement of their respective glide structures, and means operatively connected with each of said glide structures to move the same relative to each other simultaneously.

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