The invention readily provides adoption of rollers to carry various predetermined loads by selection of rollers in respect to the radial thickness of the rollers, that is, from a solid to a thin, spring-like radial thickness of the annulus.

The invention also provides a laterally, extremely thin over-all assembly of the three slide units to permit using a drawer in a cabinet of a maximum possible width.

Another advantage of the invention is found in the reduction of cost of manufacturing in those parts of the assembly which may be made of metallic extrusions and plastic moldings or extrusions, whereby machine work is reduced to a minimum. Also, as above indicated, the rollers may be cut or sliced diametrically across lengths of tubing, requiring no grinding or machining.

Other objects and advantages will become apparent to those versed in the art in the following description of the invention in reference to the accompanying drawings, in which

FIG. 1 is a view in side elevation of a structure embodying the invention and in slightly extended condition, one unit from another, and with fragments of walls broken away to disclose inner structure:

FIG. 2 is a view in top plan of the structure shown in FIG. 1:

FIG. 3 is a view in vertical section on the line 3--3 in FIG. 1, and in exaggerated width to avoid confusion of detail in the drawing:

FIG. 4 is a left hand view in end elevation, likewise exaggerated in width;

FIG. 5 is a right hand view in vertical elevation, also exaggerated in width;

FIG. 6 is a view in horizontal section on the line 6--6 in FIG. 1:

FIG. 7 is a view in partial section and in side elevation of a fragmentary portion of the right end of the structure as shown in FIG. 1, with modified end rollers;

FIG. 8 is a view of a detail in side elevation and section showing a further modification as to roller shapes;

FIG. 9 is a view in side elevation of a roller carrying a filler plug;

FIG. 10 is a view in section on the line 10--10 in FIG. 9;

and FIG. 11 is a view in vertical section illustrating a modified structure for an ultra-thin track.

Referring first to the structure of the invention as illustrated in FIGS. 1--6, a fixed unit 12 is formed in the nature of a plate to have upper and lower overturned flanges 13 and 14 forming roller runways within the flanges substantially perpendicular to both the plate 12 and flange legs 19 and 20, each runway being in the nature of a groove, one opening toward the other.

An intermediate unit 15 has a central body 16 which may be made of a plastic material. Along the top and bottom edges of the body 16 are longitudinal grooves 17 and 18 respectively and into which grooves the flange legs 19 and 20 extend in a freely sliding manner, FIGS. 3, 4 and 5.

Bars of metal 21 and 22 are fixed respectively to opposite sides of the body 16, each such as by screws 23, preferably fitting into recesses 24 and 25 in and along the body 16. A roller stop bar 26 extends vertically across the body 16 on its side directed toward the plate 12, approximately from bottom to top edges of the body 16 and across the left hand end (as viewed in the drawings) to extend from the body a distance approaching the thickness of rollers to be employed as will later be described. Also, there are roller stops 45 and 46 extending vertically across the right hand end of the plate 12 above and below the bar 21 to be in the paths of said rollers.
A plate 27 is formed to be the third unit of the structure, and in the present showing, has the same size, shape, and approximate length as of the plate 12. The plate 27 has overturned top and bottom flanges 28 and 29 at substantially right angles to the plate and has opposing legs 30 and 31 entering respectively into the body grooves 17 and 18. At the left hand end of the plate 27, there are two roller stops 32 and 33 each fixed to the plate 27, extending respectively from inside the flanges 28 and 29 toward top and bottom edges of the bar 22.

FIG. 1.

The member 16 carries a stop member 34, such as a screw, extending into the path of the plate 27 at the left hand end of the bar 22. The plate 27 has a cut-out 35 which will straddle and abut the stop 34 when the plate 27 is sufficiently moved to the left. The intermediate member 15 has a vertical, roller stop bar 36 fixed across its right hand end to extend laterally beyond the bar 22 toward the plate 27 but not into contact therewith, to serve as a stop limiting travel of rollers between the member 15 and the plate 27 as will be later described.

The intermediate member 15 carries a stop member 37 protruding therefrom at the right hand end of the bar 22. A strike and stop against the right hand end of the plate 12, serving as a limit of travel of the member 15 to the left.

A plurality of groups of rollers, each generally designated by the numeral 38 is introduced into each of four raceways formed between each side of the intermediate unit 15, two above and two below the bars 21 and 22, and between the plates 12 and 27. These raceways are designated by the numerals 39, 40 and 41, 42. The rollers 38 in any one group do not fill the longitudinal length of its raceway in any instance, the number of rollers 38, for example in raceway 44 total to six. This number may vary depending upon the length of a raceway between the end stops 33 and 36 as shown in Fig. 1, in turn varying with the full longitudinal travel desired in each of the units 15 and 27 in relation to the length of the fixed unit 12. The limiting factor as to the number of rollers in each raceway is the use of only that number of rollers which may be free to roll as a group between those stops at the ends of the raceways.

As one example, assuming that the third unit 27 which carries the load is moving to the right in relation to the intermediate or second unit 15, the rollers 38 will roll in the raceway of the top plate 27 at approximately half the speed of the travel of the plate 27. The plate 27 may continue in its outward travel until the stops 32 and 33 come into abutment with the rearmost rollers 38b in the respective raceways 40 and 42. At the same time, or shortly thereafter, each of the forward rollers 38a will come against the bar 36, depending upon the length of the raceways and the number of rollers in the raceways. The lengths of the raceways are preferably made to be such that the travel of each group of a common number of rollers therein will, at respective ends of plate 27 travel either be against the plate stops 32, 33 or the body 16 stop 36 so as to avoid non-rolling sliding of the rollers in approaching the respective stops.

At the outward end of plate 27 travel, the rollers abutting the body 16 bar 36 will then push the body 16 outwardly. In so doing, the body 16 will be moved between the stops 32 and 41. These rollers will be stopped in their outward travel by coming against the upper and lower stops 45 and 46, particularly so, when the body 16 carried stop bar 26, FIG. 6 comes up against the rear rollers 38b.

In reverse, inward travel of the plate 27, the rollers 38 in the top and bottom raceways 40 and 42 will move away from the stop bar 36 until the plate 27 strikes the stop 34 on the body 16. Then the unit 15 is pushed inwardly with the rollers 38 moving away from the stops 45 and 46, continuing to do so until the body 16 carried stop abuts the end of the plate 27.

In each raceway, considering raceways 40 and 42 for example, the rollers 38 in the upper raceway 40 will have a load impressed upon their upper sides by the flange 28, the load being that which is carried by the plate 27. In turn, these upper rollers will ride on the bar 22. Side motion of these rollers is limited by reason of the contacting plate 27 on the one side and the body 16 on the other side. The spacing apart of these members 27 and 16 is controlled by reason of the plate flange legs 30 and 31 fitting into the body grooves 17 and 18. This spacing is held against decreasing by the thickness of the rollers therein.

The under edge of the bar 22 transmits the load impressed upon the upper edge of the bar to the rollers 38 thereunder, and in turn, to the flange 29 of the plate 27. The rollers in the top and bottom raceways 40 and 42, each being an elastic annulus, readily deformable under the superimposed load to cause each roller in each group to carry its share of the over-all load. In some instances, particularly where vertical dimensions of the three units are required to be limited, so that the rollers in turn are limited in diameters, and where a particularly high load must be carried, the smaller diameter rollers may still be employed by springs 37b within the hole 51 of the roller 38, thus in effect, for that particular situation, the rollers become solid members.

In the great majority of instances the annular rollers are used. A further advantage in using such rollers, is that there may be interspersed in each roller group a spring roller of relatively thin wall such as is suggested in FIGS. 7 and 8; in FIG. 7, a spring roller 52 is placed at the end of a group of rollers 38 to absorb the shock arising by a quick pull of the plate 27 when a roller 38 would otherwise strike the stop 36 with considerable force. The spring roller 52 has a much thinner ring section than do the rollers 38. The distortion of the roller 52 may be lessened as indicated in FIG. 8 where a smaller diameter spring roller 53 is inserted within the roller 52 to serve as a shock absorber under heavier load conditions. Spring rollers 52 may also be inserted within the group of rollers 38, as indicated in FIG. 8 for additional resilience in linear directions of roller travel.

The invention also lends itself to ultra-thin construction as indicated in FIG. 11. Here there is a back or fixed plate 55 having top and bottom over-turned flanges 56 and 57 terminating in down and upturned legs 58 and 59 respectively. A body 60, which is illustrated as plastic, but which may be extruded aluminum, is formed to have a central portion 61 extending with a clearance along the central part of the plate 55 and to be offset from the plate 55 and thence upwardly and downwardly to form roller raceways 62 and 63 respectively receiving rollers 38 therein with the flange 56 riding on the rollers 38 which in turn ride on a shoulder 64, and by an under shoulder 65 riding on rollers 38 in turn riding on the lower plate flange 57.

The central portion 61 has approximately the thickness of a roller 38. The offset top and bottom body portions 66 and 67 have shoulders 68 and 69, centrally between which extends a floating bar 70, either of plastic or metallic material, to define upper and lower raceways 71 and 72 between it and the shoulders 68 and 69.

Rollers 38 are placed in the upper raceway 71 to have the shoulder 68 bear on the rollers and the rollers 38 in turn bear upon the bar 70. Rails 73 are placed on the raceway 72 to have the bar 70 bear on them and in turn to bear on the shoulder 69.

The rollers 38 in both the top and bottom raceways 71 and 72 are retained therein by a spring steel plate 74 which carries the bar 70 and their top and bottom edges fitted to slide up and down within opposing grooves 75 and 76 opposing one another in the body portions 66 and 67. A plate 77 bears against the plate 74 and is fixed thereto in any suitable manner, such as by a screw 78, and 79 is shaftable up and down with the plate 74. The plate 74
maintains substantially constant widths of the raceways 71 and 72 to permit free rolling of the rollers therein.

The legs 58 and 59 are slidingly carried within top and bottom grooves 80 and 81 as means for maintaining the raceways 62 and 63 of substantially constant widths, sufficiently wide to permit free rolling of the rollers therein.

In this thin structure the plate 55 is fixed to the wall of a cabinet or the like, and the loaded member (not shown) is attached to the plate 77 which constitutes the third unit body, and which travels longitudinally of the plastic intermediate or second unit, in turn carried by the first or fixed plate 55.

The rollers 38 in the upper raceways 39, 40 of the form shown in FIGS. 1-8, do not normally carry a direct downward directed load thrust, but do bear upwardly against the flanges 13 and 28 to prevent tendency of the plate 27 to tilt downwardly under load when in its extended position. The same is true of the rollers 38 in the raceways 62 and 71 of the FIG. 11 form. However, these devices are made to be interchangeably used in either left or right hand positions, in which case the plate 12 or the plate 55 carrying the second and third units is simply turned over one assembled device in respect to the other without change in internal construction or assembly. That is, the top flange 13 would be the bottom flange and likewise the flange 56 would be the bottom flange.

The rollers 38 may be magnetized as a means for resisting the free travel of individual rollers from their groups. Obviously, if each roller 38 is magnetized to have an N pole and an S pole on its axis, and the N and S poles, respectively, of adjacent rollers in a group are oppositely disposed, adjacent rollers will always be magnetically attracted to each other to maintain the integrity of the group. The methods by which the rollers 38 can be so magnetized are well known and need not be discussed, in detail, herein.

Another feature of the invention resides in the fact that the flanges 13, 14 and 28, 29 are at right angles to the respective plates 12 and 27 which means that the rollers 38 being short cylinders ride on the flanges in side, sliding contact with those plates and thereby permit a thinner over-all construction than when there is an arc of curvature in a radius between those flanges and their plates. Not only is that true, but more importantly, there is less flange bending load by spacing the rolling members against the plates than if they were spaced outwardly therefrom. Furthermore this assures of full line contact of the rollers against the flange laterally across the periphery of the rollers.

While we have herein shown and described our invention in more or less minute detail, it is obvious that materials may be selected to differ from those recited, and also, that structural changes may be made without departing from the spirit of the invention and the limitations which may be imposed by the following claims.

We claim:
1. An extensible and retractable track comprising a first unit; a second unit; means shiftably retaining the second unit along the first unit; means forming a pair of vertically spaced, rectilinear raceways having horizontal surfaces extending between vertical walls of said units; a horizontally free group of cylindrical rollers in tangency one with the other and carried in each of said raceways for movement as a group longitudinally back and forth therein, each roller of each group including means by the roller alone resisting separation of the roller from its group; and the length of each of said groups being less than the length of each of said raceways.

2. The structure of claim 1 in which said rollers are annuli, each having a radial thickness to support a predetermined load; and further comprising roller stops carried at one end of said second unit to extend respectively into said raceways; roller stops carried at the opposite end of said first unit to extend respectively into said raceways; and at least one of said rollers in each group having a lesser radial thickness than that of the others whereby said annular roller is rendered spring-like in nature to act as a shock absorber when the roller groups strike said roller stops.

3. The structure of claim 1, in which said rollers are cylindrical with axially extending holes therethrough defining resilient annuli, the radial thickness of the annuli being selected to carry predetermined loads; and a plug tightly fitted in the hole of some, but not all of said rollers in each of said groups to increase the load carrying capacity of each group.

4. The structure of claim 1, in which said second unit retaining means comprises upper and lower vertically disposed flange members, each flange member forming a side of a channel extending longitudinally along each of the upper and lower edges of said second unit; said first unit comprises vertically extending upper and lower flanges extending downwardly and upwardly respectively into said channel; and a third unit forming, in combination with said second unit, a pair of vertically spaced raceways having horizontal surfaces extending between vertical walls of said units on the side of the second unit opposite to that of the first pair of raceways; a second group of horizontally free cylindrical rollers in approximate tangency one with the other and carried in each of said second pair of raceways, the lengths of each of said second groups of rollers being less than each of the lengths of said second pairs of raceways; and said third unit also comprising vertically extending flanges engaging said second unit to prevent lateral separation of said second and third units.

5. The structure of claim 4, in which said second unit carries offset ledges defining said first and second pairs of raceways, said ledges extending approximately respectively to said first unit and said third unit wall.

6. The structure of claim 4, in which said second unit has a vertically extending control portion thickness approximately equal to that of one of said rollers, and a horizontally offset portion vertically extending around each of said groups of rollers in the first pair; said raceways being located respectively on the top and bottom portions of said central portion between the respective offset portions and said first unit; said first group of rollers riding on said central body raceways; a shoulder under the upper offset portion extending laterally from said central portion forming said second pair of raceways; a shoulder over the lower offset portion extending laterally from said central portion; said second pair of rollers riding on said second raceways; said second raceways being spaced vertically a distance exceeding two diameters of said rollers; a spacer element inserted between the second pair of rollers to maintain the two groups of rollers in approximate contact with the respective second raceways; a plate-like member carrying said spacer element shiftable vertically of the second unit; and means carried by said second unit shiftably carrying
said element and retaining said rollers of said second
pair against lateral shifting;
7. The structure of claim 1, in which said rollers are
magnetized and remain in contact one with the other,
free of spacing cages.
8. The structure of claim 1 wherein said rollers in
each group are magnetized to resist separation of in-
dividual rollers of a group.
9. The structure of claim 1 wherein said units each
comprise roller stops extending into each raceway, and
wherein at least one roller in each group is a resilient
annulus arranged to act as a shock absorber when said
group strikes said roller stops, there being at least one
substantially solid roller in each group.

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