TELESCOPING LADDER WITH A RETAINING MECHANISM

Embodiments include a telescoping ladder with a plurality of retaining mechanism. The telescoping ladder has a plurality of columns in a nested telescopic arrangement. The retaining mechanism positioned on an outer surface of a column prevents extending columns other than an immediately inner column from their nested arrangement until the immediately inner column is fully extended from its nested arrangement with an outer column.

Figure 4
This disclosure relates to telescoping ladders with a retaining mechanism.

BACKGROUND

Ladders typically include rungs supported between stiles formed from a plurality of columns. In some cases, the ladder can be a telescoping ladder and can be expanded to separate the columns from one another for extension of the ladder, or collapsed together for retraction of the ladder.

SUMMARY

It is an object of the present invention to provide an improved telescoping ladder. Accordingly, one aspect of the invention provides a telescoping ladder, comprising: a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, wherein, each column having a hollow body, such that when the ladder is collapsed from the fully-extended position, each column substantially nests within another column; a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile; and a plurality of column retaining mechanisms, each column retaining mechanism being provided on an outer surface of one of the columns, each column retaining mechanism adapted to retain a further column which is nested immediately within the one of the columns in the collapsed position, each column retaining mechanism preventing the column immediately within the one of the columns from being extended from its nested position until the one of the columns is fully extended from its nested position with respect to the column which is immediately outside the one of the columns. Advantageously, each retaining mechanism comprises a retaining hammer positioned an outer surface of each column near a bottom edge of the column, the retaining hammer being flexible between a hold position and a release position, wherein, in the release position, the retaining hammer flexes radially outwardly from a longitudinal axis of the column, thereby permitting the immediately inner column positioned within the one of the columns to be released therefrom, and in the hold position, the retaining hammer flexes radially inwardly toward the longitudinal axis of the column, thereby permitting the immediately inner column positioned within the one of the columns to be locked in its nested arrangement within the one of the columns.

Preferably, each retaining mechanism comprises a retaining strip positioned on the outer surface of each column such that when collapsed in a nested arrangement, the retaining hammer of the column immediately outside the one of the columns presses against the retaining strip of the one of the columns in the hold position to lock the one of the columns, with its immediately inner column, nested within the column immediately outside the one of the columns.

Conveniently, the retaining mechanism prevents relative sliding movement between the one of the columns and the immediately inner column in the hold position.

Advantageously, each column comprises a retaining slot for the retaining hammer to extend through in the hold position, the retaining slot being defined along the outer surface of each column.

Preferably, the retaining slot of each column is positioned at a longitudinal distance from an upper edge of the column, the longitudinal distance of the retaining slot of the outer column corresponding to an axial position of the retaining strip of the immediately inner column when in the nested arrangement, such that the retaining hammer extends through the retaining slot to press against the retaining strip of the immediately inner column.

Conveniently, the longitudinal distance from the upper edge of each respective column is between about two-thirds of the length of the column and about the length of the column.

Advantageously, each retaining hammer comprises one or more locating tabs configured for axially aligning the retaining hammer on each respective column, each locating tab being receivable by a corresponding aperture positioned on the respective column.

Preferably, each retaining hammer has a tapered leading surface to permit locating the retaining hammer on the retaining slot of a column, each retaining hammer having an upright trailing surface to prevent the retaining hammer from being removable from the retaining slot.

Another aspect of the present invention provides a telescoping ladder, comprising: a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, the plurality of columns comprising a first column, a second column and a third column, wherein, the first column substantially nests within the second and third columns, and the second column substantially nests within the third column in the collapsed position; a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile; a plurality of connector assemblies, each connector assembly having a latch assembly including a release button slideable along a front surface of the rung to unlock or selectively lock the relative axial movement between two adjacent columns; and a plurality of retaining ham-
Conveniently, each retaining hammer contacts a portion of a perimeter surface of a column, the retaining hammer being contoured to conform to the shape of each column.

Advantageously, each connector assembly comprises a collar and a rung portion, the collar substantially surrounding a column, and the rung portion being receivable by a rung, an inner surface of the collar of each connector assembly comprising a recessed portion for receiving a retaining hammer.

Preferably, when the second column is fully-extended from its nested arrangement with the third column, the retaining hammer of the second column abuts against the recessed portion of the collar of the connector assembly coupling the second column to a rung.

Conveniently, the first column is released from slidably relative to the second column when the retaining hammer of the second column abuts against the recessed portion of the collar.

Advantageously, each latch assembly comprises a locking pin configured for extending through an aperture on the collar of the connecting assembly, the locking pin being receivable by corresponding apertures on an upper edge of the third column and a lower edge of the second column to lock relative sliding movement between the second and third columns in the fully-extended position. Preferably, each retaining hammer is positioned circumferentially opposite to a portion of the perimeter surface of the column adjacent to the aperture on the collar through which the locking pin extends.

Conveniently, each column comprises a first retaining hammer and a second retaining hammer, each of the first and second retaining hammers contacting a portion of the perimeter surface of a column.

Advantageously, the first and second retaining hammers are each positioned circumferentially at an angle of about 90 degrees relative to a portion of the perimeter surface of the column adjacent to the aperture on the collar through which the locking pin extends.

A further aspect of the present invention provides a telescoping ladder comprising: a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns, the air dampers adapted to decrease a speed of the relative axial movement of the plurality of columns when the columns are collapsed into a collapsed position, each air damper having a cut-out portion for permitting the columns to collapse without the air damper of a column abutting against the retaining hammer of the immediately outer column.

Preferably, each air damper is positioned at or near a bottom edge of a column.

Another aspect of the invention provides a telescoping ladder comprising: a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, wherein, each column having a hollow body, such that when the ladder is collapsed from the fully-extended position, each column substantially nests within another column; a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile; and a plurality of column retaining mechanisms, each column retaining mechanism being provided on an outer surface of a column, each column retaining mechanism adapted to retain an immediately inner column nested within an outer column in the collapsed position, the column retaining mechanism adapted to retain an immediately inner column preventing columns other than the immediately inner column nested within the outer column from being extended from their nested arrangement until the immediately inner column nested within and positioned above the outer column is fully extended from its nested position.

A further aspect of the present invention provides a telescoping ladder comprising: a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns between a fully-extended position and a collapsed position, the plurality of columns comprising an outer column and an immediately inner column nested therewithin in the collapsed position; a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile; and a plurality of air dampers positioned within the plurality of columns, the air dampers adapted to decrease a speed of the relative axial movement of the plurality of columns when the columns are collapsed into the collapsed position, each air damper having a cut-out portion for permitting the columns to collapse without the air damper of a column abutting against the retaining hammer of the immediately outer column.
umn, and the retaining hammer of the outer column retaining the immediately inner column in the collapsed position, the retaining hammer of the outer column preventing columns other than the immediately inner column from being extended from their nested arrangement until the immediately inner column nested within the outer column is fully extended from its nested position; and a plurality of air dampers positioned within the plurality of columns, the air dampers adapted to decrease a speed of the relative axial movement of the plurality of columns when the columns are collapsed into the collapsed position, each air damper having a cut-out portion for permitting the columns to collapse without the air damper of the immediately inner column from abutting against the retaining hammer of the outer column.

[0023] The details of one or more examples are set forth in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

[0024] Figure 1A is a perspective view of a telescoping ladder according to an embodiment with the rungs shown in a collapsed position;

Figure 1B is a perspective view of the telescoping ladder of Figure 1A with the rungs in a lower portion of the ladder shown in an extended position;

Figure 1C is a perspective view of the telescoping ladder of Figure 1A, with the rungs of a lower portion of the ladder shown in an extended position;

Figure 2A is a cross-sectional view of the rungs of the telescoping ladder of Figure 1A;

Figure 2B is a cross-sectional view of the rungs of a telescoping ladder according to another embodiment;

Figure 3 is an exploded perspective view of the telescoping ladder of Figure 1A;

Figure 4 is a front perspective view of a portion of the columns of the ladder of Figure 1;

Figure 5 is a cross-sectional view of the telescoping ladder shown in the collapsed position with the retaining hammer in the hold position;

Figure 6 is a cross-sectional view of the telescoping ladder shown in the extended position, with the retaining hammer in the release position;

Figure 7 is a close-up perspective view of the telescoping ladder of Figure 1A with the columns being shown in transparent view to illustrate internal detail therein;

Figure 8 is a front perspective view of a single column of the telescoping ladder of Figure 1A;

Figure 9 is a perspective view of a portion of the connector assembly of the telescoping ladder of Figure 1A; and

Figure 10 is perspective view of a portion of the telescoping ladder with an air damper according to an embodiment.

DETAILED DESCRIPTION

[0025] FIG. 1A is a perspective view of a telescoping ladder 10 according to an embodiment.

[0026] Referring to Figure 1A, the telescoping ladder 10 comprises a first stile 14 and a second stile 16 (e.g., left hand and right hand stiles illustrated in Figure 1A). The first and second stiles each have a plurality of columns 18 disposed in a nested arrangement for relative axial movement in a telescopic fashion along a longitudinal axis 20 of the plurality of columns 18 between an extended position and a collapsed position. For instance, in Figure 1B, an upper portion 22 of the ladder 10 is shown in a collapsed position where the columns 18 are nested within each other along the longitudinal axis 20 of the columns 18 in a telescoping fashion while the lower portion 23 is shown in an extended position. In Figure 1C, the upper portion 22 of the ladder 10 is shown in an extended position.

[0027] As seen in Figure 1A-1C, the ladder 10 comprises a plurality of rungs 24 extending between the first stile 14 and the second stile 16. Each rung 24 can be connected to a column 18 of the first stile 14 and a column 18 of the second stile 16. As shown in Figure 1A, each rung 24 can be connected to the columns 18 by a connector assembly 26 as will be described later. With continued reference to Figure 1A, in some cases, each rung 24 comprises a planar first surface 28 and a planar second surface 30 opposite to the planar first surface 28. The first surface 28 of each rung 24 defines a planar standing surface 32. Referring to Figure 1C, when the ladder 10 is extended for use and leaned against a wall, a user may step on the planar first surface 28. The planar standing surface 32 may comprise treads 34 (best seen in Figure 2A) defined thereon to provide friction between the planar standing surface 32 and the contact surface of a user (e.g., soles of the user’s shoes).

[0028] As will be described further, the rungs 24 can be substantially hollow so as to allow a connector assembly 26 to fasten the rung 24 to a column 18 on each of the right-hand stile and left-hand side stile. Additionally, the hollow body of the rungs 24 allow a pair of latch assemblies (not shown) to be housed in the rung 24 to connect the rung 24 to a column 18. The rungs 24 can be extruded from aluminum, although other materials and means of manufacturing can also be used.

[0029] Rungs 24 can have a substantially rectangular cross-section or a parallelogram cross-section such as those illustrated in U.S. Publication No. 2012/0267197 A1, assigned to the assignee of the instant application, the disclosure of which is hereby incorporated by reference in its entirety. While the illustrated Figure 2A shows a substantially rectangular rung 24 wherein the planar first surface 28 of the rung 24 forms an angle of about...
90 degrees with the longitudinal axis 20 of the stile, Figure 2B illustrates a rung 24 having a parallelogram cross-section having at least a portion 38 of the first surface 28 (and optionally the second surface 30) that forms an angle θ with respect to the longitudinal axis 20 of the stile, and the front surface 48 (as well back surface) is parallel to the longitudinal axis 20 of the stile. The angled portion 38 can form an angle between about 95 degrees and 145 degrees (e.g., between 95 degrees and 110 degrees) with respect to the longitudinal axis 20 of the stile. Instead of a parallelogram shaped rung 24 shown in Figure 2B, the rungs 24 of Figures 1A-1C can have an angled portion attached to or integrally formed with the planar first surface 28 of the rung 24. Such embodiments allow at least the angled portion of the first surface 28 of the rung 24 to be horizontal when the ladder 10 is rotated toward a vertical wall (e.g., propped against a wall at an angle) so that during normal use, at least a portion 38 of the rung 24 can be nearly horizontal. However, depending on the angle at which the ladder 10 is propped against a vertical wall, the angled portion 38 may be past or short of being horizontal.

[0030] In some embodiments, the columns 18 are made of aluminum. Other materials are contemplated and are within the scope of the invention. The columns 18 are illustrated as having a circular cross-section (when viewed along the longitudinal axis 20 of the columns 18). However, the columns 18 can have a rectangular cross-section such as those illustrated in U.S. Publication No. 2012/0267197 A1 assigned to the assignee of the instant application, the disclosure of which is hereby incorporated by reference in its entirety. Other cross-sections (e.g., square, oval or polygonal shapes) are also contemplated. The columns 18 can be substantially hollow to receive another column 18 from above.

[0031] As described above and referring to Figure 3, the rungs 24 are connected to the columns 18 by a plurality of connector assemblies 26. The connector assemblies 26 can have latch assemblies housed in the hollow portion 45 of each rung 24 to unlock or selectively lock relative axial movement between adjacent columns 18. Such connector assemblies 26 are described in U.S. Patent No. 8,387,753 B2 and U.S. Patent No. 6,883,645 both assigned to the assignee of the instant application, the disclosure of which is hereby incorporated by reference in its entirety. Other cross-sections (e.g., square, oval or polygonal shapes) are also contemplated. The columns 18 can be substantially hollow to receive another column 18 from above.

[0032] As is apparent to one skilled in the art, telescoping ladders such as the ones described herein may have to be collapsed and extended without posing any safety hazards during their normal use. For example, several countries have safety regulations that prevent a user from extending columns 18 of the upper portion 22 of the ladder 10 until columns 18 of the lower portion 23 are fully extended. Such regulations may improve stability and prevent a user from suffering injuries by stepping on to a partially extended ladder 10 that can be unstable and tip over when a user steps on it. Accordingly, some embodiments disclosed herein include retaining mechanisms that permit telescoping ladders to comply with such safety regulations.

[0033] Figure 4 shows a close-up perspective view of the telescoping ladder, with column 18i shown in ghost view to illustrate the internal details of the ladder. In Figure 4, portions of the connector assembly are removed to illustrate details of column retaining mechanism 60. As seen in Figure 4, the telescoping ladder 10 can have a plurality of column retaining mechanisms 60. Each column retaining mechanism can be provided on an outer surface 62 of a column 18 to retain an immediately inner column 18 therewithin in the collapsed position. When secured in this manner, the column 18 retaining mechanism of each column 18 prevents columns 18 other than an immediately inner column 18 therewithin from being extended from their nested arrangement until the immediately inner column 18 nested within and positioned above a column 18 is substantially extended from its nested position. For example, in the cross-sectional illustrated view of Figure 5, first column 18i surrounds second columns 18j and third column 18k. Column 18k nests completely within column 18j, and column 18j completely nests within column 18i. In this arrangement, the column retaining mechanism of column 18j locks column 18k from being extended until the column retaining mechanism of column 18i releases column 18j such that column 18j fully extends out of column 18i. Each column 18 is extended after the column 18 immediately therebelow is fully-extended, at which position the column 18 retaining mechanism releases the column 18 thereabove.

[0034] Continuing with Figure 5, each column 18 retaining mechanism comprises a retaining hammer 70 positioned on an outer surface 62 of each column 18 near a bottom edge of the column 18. The retaining hammer 70 can be flexible relative to the column 18, and can be movable between a hold position and a release position. Figure 5 shows the retaining hammer 70 in the hold position wherein the retaining hammer 70 prevents the col-
umn 18 from being extended from the column 18 below, whereas Figure 6 shows the hammer in the release position. As seen in Figure 6, in the release position, the retaining hammer 70 flexes radially outwardly from the longitudinal axis 20 of the stile and thereby permits an immediately inner column 18 (e.g., column 18k in Figure 5) positioned within each column 18 (e.g., column 18j in Figure 5) to be released therefrom. Referring back to Figure 5 in the hold position, the retaining hammer 70 flexes radially inwardly toward the longitudinal axis 20 of the stile and thereby permits each column 18 to be locked in its nested arrangement within an immediately inner column 18.

[0035] Referring back to Figures 3 and 4, each retaining mechanism comprises a retaining strip 80 positioned on the outer surface 62 of each column 18 such that when collapsed in a nested arrangement, the retaining hammer 70 of a column 18 presses against the retaining strip 80 of an immediately inner column 18 in the hold position to lock the column 18 with its immediately inner column 18 nested therewithin. As such, the retaining hammer 70 and the retaining strip 80 cooperate to prevent sliding motion of the inner column 18 from sliding past the axial location corresponding to the portion where the hammer 70 presses against the strip 80. When locked as such, the retaining mechanism prevents relative sliding movement between two adjacent columns 18 when the retaining hammer 70 locks the columns 18 in the hold position. The axial location of each retaining strip 80 relative to the retaining hammer 70 can be such that in the collapsed position, the retaining hammer 70 of an outer column 18 presses against the retaining strip 80 of the immediately inner column 18k nested therewithin.

[0036] The retaining hammer 70 can be positioned and oriented at a suitable location such that the retaining hammer 70 can press against the retaining strip 80. As seen in Figure 7, each column 18 comprises a retaining slot 82 defined along the outer surface 62 of the column 18 for the retaining hammer 70 to extend therethrough in the hold position. In this position, the retaining hammer 70 protrudes through the retaining slot 82 and abuts against an upper edge 83 of the retaining strip 80. If a force is applied on the upper (or inner) column 18a shown in Figure 7 the contact of the retaining hammer 70 against the edge 83 of the retaining slot 80 prevents the upper (or inner) column 18a shown in Figure 7 from being extended out of column 18b. Referring back to Figures 5 and 6, each retaining hammer 70 has a tapered leading surface 84 to permit locating the retaining hammer 70 on the retaining slot 82 of a column 18. Additionally, each retaining hammer 70 has an upright trailing surface 86 to prevent the retaining hammer 70 from being removable from the retaining slot 82. When positioned in this manner, the retaining hammer 70 can extend through the retaining slot 82 and press against the retaining strip 80 of the column 18 nested within.

[0037] Continuing with the foregoing description, and as best seen in Figure 8, the retaining slot 82 of each column 18 is positioned at a longitudinal distance 88 from an upper edge 90 of the column 18. The longitudinal distance 88 of the retaining slot 82 corresponds to an axial position of the retaining strip 80 of an immediately inner column 18 when in the nested arrangement, such that the retaining hammer 70 extends through the retaining slot 82 to press against the retaining strip 80 of the immediately inner column (not shown in Figure 18). It should be noted that in Figure 8, the retaining strip 80 of the column 18 is at a longitudinal distance 92 from the upper edge 90 of the column 18, which corresponds to the axial location of a retaining hammer of an outer surrounding column (not shown in Figure 8). As illustrated, the longitudinal distance 88 from the upper edge 90 of the column 18 is between about two-thirds of the length of the column 18 and about the length of the column 18. In the illustrated embodiment, for instance, the longitudinal distance 88 from the upper edge 90 of the column 18 is about % of the length of the column 18.

[0038] As seen in Figure 7, to facilitate locating the retaining hammer 70 at an appropriate longitudinal distance 88, each retaining hammer 70 comprises one or more locating tabs 94 for axially aligning the retaining hammer 70 on a column 18. Likewise, each column 18 can be fabricated with corresponding apertures 96 (best seen in Figure 4) at a desired longitudinal distance 88 where the retaining hammer 70 is to be positioned. Each locating tab is receivable by a corresponding aperture 120 positioned on the column 18. While the illustrated embodiments show tabs, other locating means such as dimples, pins, studs, buttons and the like can be used.

[0039] With continued reference to Figure 7, the retaining hammer 70 can be fabricated to generally conform to shape of the column 18 to facilitate assembly of the retaining hammer 70 on to a column 18. For instance, if the columns 18 have a generally circular shape when viewed along the longitudinal axis 20 of the stile, the retaining hammer 70 can be fabricated to have a generally curved shape such that when the retaining tabs (or pins, tabs, buttons and the like) are received by corresponding apertures 96 (best seen in Figure 4), the retaining hammer 70 generally contacts and surrounds (e.g., flush against) a portion of the perimeter surface 118 of the column 18. Accordingly, in the illustrated embodiments, the retaining hammers have a shape that corresponds to a portion 116 of a circle when viewed along the longitudinal axis 20 of the stile. In such embodiments, when the locating tabs 94 are pressed on to corresponding apertures 96 (best seen in Figure 4) of the column 18, the retaining hammer 70 is positioned flush against the outer surface 62 of the column 18. The upright trailing surface 86 rests against an edge of the retaining slot 82, and tapered leading surface 84 protrudes through the retaining slot 82 and presses against the retaining strip 80. Alternatively, if the columns 18 have a generally square, rectangular or other planar (non-arcuate) shapes when viewed along the longitudinal axis 20 of the stile, the retaining hammer 70 can be fabricated to have a gen-
eraly planar shape, such that when positioned on the column 18, the retaining hammer 70 generally contacts and surrounds (e.g., flush against) a portion 116 of the perimeter of the column 18. The retaining hammer 70 can be contoured (e.g., by molding) during the fabrication process to conform to the shape of each column 18. Such embodiments allow the retaining hammer 70 to rest securely on the column 18 and press against the retaining strip 80 to prevent the columns 18 other than the immediately inner column 18 from being extended, until the immediately inner column 18 is fully extended from its nested arrangement within an immediately outer (surrounding) column 18.

[0040] In operation, and referring back to Figures 1A-1C, the ladder 10 can be extended from its collapsed state by extending the outermost column 18 nested within the column 18z proximal to the surface on which the ladder 10 is positioned first, and progressively extending each immediately inner column 18 thereafter. In such embodiments, the bottom-most column 18z may not have a retaining strip 80, but has a retaining hammer 70 extending through a retaining slot 82 to press against the retaining strip 80 of column 18y which immediately nests within column 18z. The steps can be repeated until each successive column 18 is fully extended from its nested arrangement, until the top-most column 18a is fully extended. As is apparent to one of ordinary skill in the art, the top-most column 18a may not have a retaining hammer 70 or a retaining slot 82, but has a retaining strip 80 which is pressed against by the retaining hammer 70 of the immediately outer column 18b.

[0041] As used herein, the terms “substantially nested” or “fully-nested” refer to the collapsed position wherein at least about 3/4 of the length of the column 18 is nested within the immediately adjacent column 18. The connector assembly 26 of each column 18 can be manipulated (e.g., sliding the release button 46 along a front surface 48 of the rung 24) to unlock the relative axial movement between two adjacent columns 18. For instance, as shown in Figure 6, the connector assembly 26j-k connecting the second column 18j and third column 18k is released to extend the third column 18k out of the second column 18j. As described previously, the retaining hammer 70 of the second column 18j is not releasable until the retaining hammer 70 of the first column 18i releases the second column 18j, and the second column 18j is substantially extended from its nested arrangement within the first column 18i. Once the second column 18j is fully extended, its hammer 70 is proximal to the connector assembly 26j-k. Accordingly, when the connector assembly 26j-k connecting the second and third columns 18j and 18k is released, the retaining hammer 70 of the second column 18j moves to its release position, and the third column 18k is now slideable relative to the second column 18j. As illustrated herein, “substantially extended” or “fully-extended” refers to the extended position wherein at least about 3/4 of the length of the column 18 extends out of an immediately adjacent column 18 within which it was nested in the collapsed position.

[0042] As best seen in Figure 3, the connector assembly 26 comprises a collar 100 and a rung portion 102. The collar 100 substantially surrounds a column 18. Referring again to Figures 3, 6 and 9, an inner surface 104 of the collar 100 of each connector assembly 26 comprises a recessed portion 106 for receiving a retaining hammer 70. For instance, as referred to above, when the second column 18j is fully-extended from its nested arrangement from within the third column 18k, the retaining hammer 70 of the second column 18j abuts against a ledge 107 of the recessed portion 106 of the collar 100 of the connector assembly 26j-k coupling the second column 18j to a rung 24. The abutment of the retaining hammer 70 against the recessed portion 106 j-k of the collar 100 j-k of the connector assembly 26 j-k results in the flexing the retaining hammer 70 radially outwardly, thereby releasing the next immediately inner (e.g., first column 18i). The first column 18i is thereby released from and slideable relative to the second column 18j when the retaining hammer 70 of the second column 18j abuts against the recessed portion 106 of the collar 100. These steps can be successively repeated until the ladder 10 is fully-extended.

[0043] As referred to above, and referring back to Figure 3, each latch assembly comprises a locking pin 108 configured for extending through an aperture 120 on the collar 100 of the connecting assembly. The locking pin 108 is receivable by corresponding apertures 122 near the upper edge 90 of a column 18 and a lower edge 114 of the outer column 18b surrounding it to lock relative sliding movement between the two columns 18. For instance, the locking pin 108j-k of the connector assembly 26j-k is receivable by an upper edge 90j of the second column 18j and a lower edge 114k of the third column 18k to lock relative sliding movement between the second and third columns 18j and 18k in the fully-extended position. In such embodiments and referring back to Figure 4, each retaining hammer 70 is positioned circumferentially at a suitable location so as to not interfere with the operation of the locking pin 108 and to take advantage of room available for packaging the retaining hammer 70 at other locations of the collar 100. For instance, in the view shown in Figures 5 and 6, the locking pin protrudes in a direction perpendicular to the plane of the drawings. In the view shown in Figure 3, the retaining hammer 70 can be positioned on the front of the column 18 (e.g., the side that faces toward the user when the user actuates the locking pin 108), and/or the rear side of the column 18 (e.g., the side that faces away from the user when the user actuates the locking pin 108).

[0044] While embodiments described herein illustrate a single retaining hammer per column 18, each column 18 can optionally comprise a first retaining hammer and a second retaining hammer. In such embodiments, and referring to Figure 7, each of the first and second retaining hammers is positioned flush against and contacts a portion 116 of the perimeter surface 118 of a column 18,
The portion 116 is at 90 degrees relative to the portion of the column that receives the locking pin 108, as discussed previously. The first and second retaining hammers can each be positioned circumferentially at an angle of about 90 degrees relative to a portion 116 of the perimeter surface 118 of the column 18 adjacent to the aperture 120 on the collar 100 through which the locking pin 108 extends. Such embodiments offer advantages such as compactly packaging the retaining hammer 70 at positions where space is available on the collar 100, and preventing the operation of the retaining hammer 70 from interfering with the locking pin 108 extension and retraction. Of course, as described previously, the topmost column 18a does not have a retaining hammer 70, and the bottom-most column 18z does not have a retaining strip 80.

[0045] As is apparent to one of ordinary skill in the art, when the locking pin 108 is retracted to collapse the columns 18, the retaining hammer 70 moves from the release position shown in Figure 6 to the hold position shown in Figure 5. The retaining hammer 70 moves radially inwardly once the locking pin 108 is retracted and the columns 18 can be collapsed into the nested arrangement. Some such embodiments can have dampers to reduce the speed with which columns 18 collapse into the nested arrangement.

[0046] Referring now to Figure 10, the telescoping ladder 10 comprises a plurality of air dampers positioned within the plurality of columns 18 to decrease a speed of the relative axial movement of the plurality of columns 18 when the columns 18 are collapsed into the collapsed position. Such air dampers are described in U.S. Publication No. 2012/0267197 A1 assigned to the assignee of the instant application, the disclosure of which is hereby incorporated by reference in its entirety. In the illustrated embodiment, air damper 224 caps the lower edge 114 of column 18 to restrict air flow through the column 18. Air damper 224 and column 18 is representative of the other air dampers and columns 18, although the columns 18 on the right stile may be a mirror image of column 18. Air damper 224 has two pins 226 on its inner surface 104 that are received in corresponding openings 228 on the lower edge 114 of column 18 to retain the air damper 224 on the column 18. In Figure 10, a single opening 228 is illustrated, but a second opening is substantially similar to the illustrated opening 228, and is positioned on the circumference of the column 18 correspondingly to receive one of the pins 226 on the air damper 224. In addition the thickness of air damper 224 is such that its outer surface 227 contacts the internal surface 229 of the adjacent, larger column 18. Accordingly, air damper 224 provides stability to the lower edge 114 of the inner column 18. The inner surface 229 of outer column 18 supports the lower edge 114 of the inner column 18 via mutual contact with air damper 224. Air damper 224 may also have an aperture (not shown) at the bottom through which limited air may flow into the bottom of the column 18 to which air damper 224 is attached. Such apertures may be used to control the rate of descent of one column 18 into its lower columns 18.

[0047] In some cases, the air damper 224 may be chafed by the retaining hammer 70 as it moves from its release position to hold position (e.g., radially inward). In some such cases, as shown in Figure 10, each air damper 224 has a cut-out portion 225 for permitting the columns 18 to collapse without the air damper 224 contacting the retaining hammer 70 of an immediately inner column 18. Such embodiments prevent damage to the air damper 224 and allow the ladder 10 to be collapsed easily.

[0048] Embodiments disclosed herein teach one or more advantages. Ladders such as those disclosed herein can permit a user to extend each subsequent nested column 18 in a sequential manner such that columns 18 in the lower portion 23 are extended first prior to columns 18 in the upper portion 22 of the ladder 10. Such embodiments offer improved stability and comply with various regulations to provide safe and efficient use of the ladder 10.

[0049] In this document, reference is made to retaining hammers. Each retaining hammer comprises a resilient catch member, which may flex between a hold position and a release position. The cross-sectional shape of each catch member resembles a hammer, in that the cross-sectional shape includes an elongate stem, with a head positioned at the end of the stem. The head has, as described herein, a tapered leading surface to permit locating the head on the retaining slot of a column, and an upright trailing surface to prevent the head from being removable from the retaining slot.

[0050] Various examples have been described. These and other examples are within the scope of the following claims.

[0051] When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components.

[0052] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A telescoping ladder, comprising:

- a first stile,
- a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in
a telescoping fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, wherein, each column having a hollow body, such that when the ladder is collapsed from the fully-extended position, each column substantially nests within another column;

a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile; and

a plurality of column retaining mechanisms, each column retaining mechanism being provided on an outer surface of one of the columns, each column retaining mechanism adapted to retain a further column which is nested immediately within the one of the columns in the collapsed position, each column retaining mechanism preventing the column immediately within the one of the columns from being extended from its nested position until the one of the columns is fully extended from its nested position with respect to the column which is immediately outside the one of the columns.

2. The telescoping ladder of claim 1, wherein each retaining mechanism comprises a retaining hammer positioned on an outer surface of each column near a bottom edge of the column, the retaining hammer being flexible between a hold position and a release position, wherein, in the release position, the retaining hammer flexes radially outwardly from a longitudinal axis of the column, thereby permitting the immediately inner column positioned within the one of the columns to be released therefrom, and in the hold position, the retaining hammer flexes radially inwardly toward the longitudinal axis of the column, thereby permitting the immediately inner column positioned within the one of the columns to be locked in its nested arrangement within the one of the columns.

3. The telescoping ladder of claim 2, wherein each retaining mechanism comprises a retaining strip positioned on the outer surface of each column such that when collapsed in a nested arrangement, the retaining hammer of the column immediately outside the one of the columns presses against the retaining strip of the one of the columns in the hold position to lock the one of the columns, with its immediately inner column, nested within the column immediately outside the one of the columns.

4. The telescoping ladder of claim 3, wherein the retaining mechanism prevents relative sliding movement between the one of the columns and the immediately inner column in the hold position.

5. The telescoping ladder of claim 3 or 4, wherein each column comprises a retaining slot for the retaining hammer to extend through in the hold position, the retaining slot being defined along the outer surface of each column.

6. The telescoping ladder of claim 5, wherein the retaining slot of each column is positioned at a longitudinal distance from an upper edge of the column, the longitudinal distance of the retaining slot of the outer column corresponding to an axial position of the retaining strip of the immediately inner column when in the nested arrangement, such that the retaining hammer extends through the retaining slot to press against the retaining strip of the immediately inner column, and preferably wherein the longitudinal distance from the upper edge of each respective column is between about two-thirds of the length of the column and about the length of the column.

7. The telescoping ladder of any one of claims 2 to 6, wherein each retaining hammer comprises one or more locating tabs configured for axially aligning the retaining hammer on each respective column, each locating tab being receivable by a corresponding aperture positioned on the respective column, and preferably wherein each retaining hammer has a tapered leading surface to permit locating the retaining hammer on the retaining slot of a column, each retaining hammer having an upright trailing surface to prevent the retaining hammer from being removable from the retaining slot.

8. A telescoping ladder, comprising:

   a first stile, a second stile, the first and second stiles each having a plurality of columns disposed in a nested arrangement for relative axial movement in a telescoping fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, the plurality of columns comprising a first column, a second column and a third column, wherein, the first column substantially nests within the second and third columns, and the second column substantially nests within the third column in the collapsed position;

   a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile;

   a plurality of connector assemblies, each connector assembly having a latch assembly including a release button slideable along a front surface of the rung to unlock or selectively lock the relative axial movement between two adjacent columns; and
a plurality of retaining hammers provided on an outer surface of a column, the retaining hammer of the second column retaining the first column in the collapsed position, and the retaining hammer of the third column retaining the second column in the collapsed position, the retaining hammer of the second column being releasable until the retaining hammer of the third column releases the second column, and the second column is fully-extended from its nested arrangement within the third column.

9. The telescoping ladder of claim 8, wherein each retaining hammer contacts a portion of a perimeter surface of a column, the retaining hammer being contoured to conform to the shape of each column.

10. The telescoping ladder of claim 8 or 9, wherein each connector assembly comprises a collar and a rung portion, the collar substantially surrounding a column, and the rung portion being receivable by a rung, an inner surface of the collar of each connector assembly comprising a recessed portion for receiving a retaining hammer.

11. The telescoping ladder of claim 10, wherein when the second column is fully-extended from its nested arrangement with the third column, the retaining hammer of the second column abuts against the recessed portion of the collar of the connector assembly coupling the second column to a rung, and preferably wherein the first column is released from and slidable relative to the second column when the retaining hammer of the second column abuts against the recessed portion of the collar.

12. The telescoping ladder of any one of claims 9 to 11, wherein each latch assembly comprises a locking pin configured for extending through an aperture on the collar of the connecting assembly, the locking pin being receivable by corresponding apertures on an upper edge of the third column and a lower edge of the second column to lock relative sliding movement between the second and third columns in the fully-extended position, and preferably wherein each retaining hammer is positioned circumferentially opposite to a portion of the perimeter surface of the column adjacent to the aperture on the collar through which the locking pin extends.

13. The telescoping ladder of any one of claims 8 to 12, wherein each column comprises a first retaining hammer and a second retaining hammer, each of the first and second retaining hammers contacting a portion of the perimeter surface of a column, and preferably wherein the first and second retaining hammers are each positioned circumferentially at an angle of about 90 degrees relative to a portion of the perimeter surface of the column adjacent to the aperture on the collar through which the locking pin extends.

14. A telescoping ladder, comprising:

- a first stile,
- a second stile, the first and second stiles each having
- a plurality of columns disposed in a nested arrangement for relative axial movement in a telescopic fashion along an axis of the plurality of columns between an fully-extended position and a collapsed position, the plurality of columns comprising an outer column and an immediately inner column nested therewithin in the collapsed position;
- a plurality of rungs extending between the first stile and the second stile, each rung connected to a column of the first stile and a column of the second stile;
- a plurality of retaining hammers provided on outer surfaces of respective columns, and the retaining hammer of the one of the columns retaining the column immediately inside the one of the columns in the collapsed position, the retaining hammer of the one of the columns preventing the column immediately inside the one of the columns from being extended from its nested arrangement until the one of the columns is fully extended from its nested position with respect to the column immediately outside the one of the columns; and
- a plurality of air dampers positioned within the plurality of columns, the air dampers adapted to decrease a speed of the relative axial movement of the plurality of columns when the columns are collapsed into the collapsed position, each air damper having a cut-out portion for permitting the columns to collapse without the air damper of a column abutting against the retaining hammer of the immediately outer column.

15. The telescoping ladder of claim 14, wherein each air damper is positioned at or near a bottom edge of a column.
Figure 2A

Figure 2B
Figure 3
Figure 4
## DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
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