Feb. 26, 1963 A. A. SILEN 3,078,953

COLLAPSIBLE PORTABLE LADDER

Filed March 7, 1960

FIG. 1

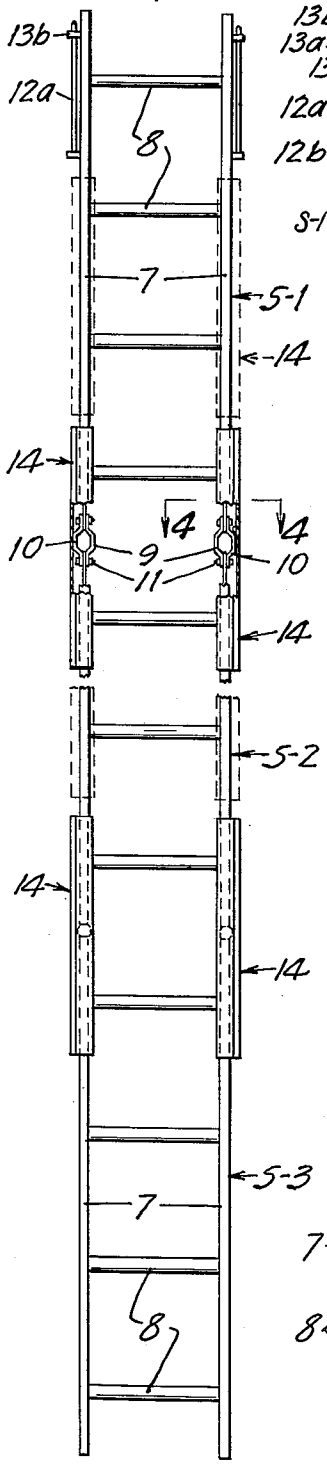


FIG. 2

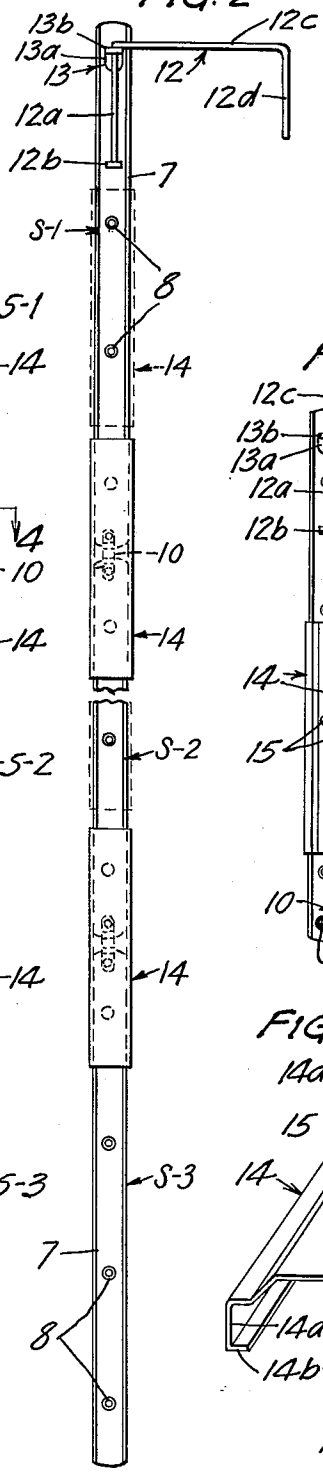


FIG. 4

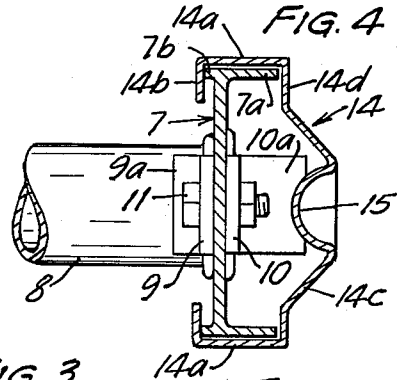


FIG. 3

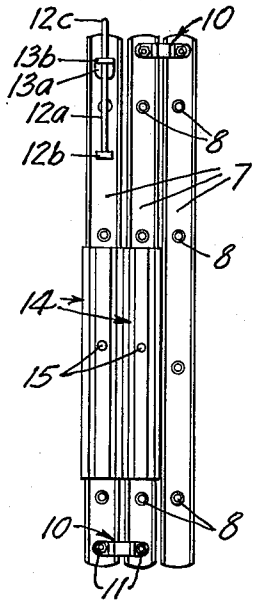


FIG. 5

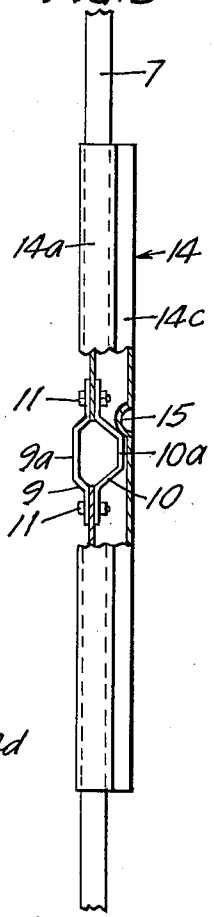
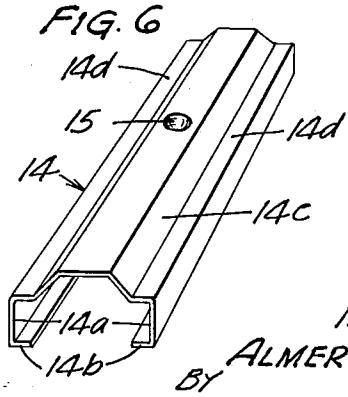


FIG. 6



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COLLAPSIBLE PORTABLE LADDER

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This invention relates to portable devices consisting of hingedly interconnected conventional ladder sections which may be employed either as fire escape devices for use in buildings such as dwellings, schools, offices, and the like or for use as a conventional ladder, and is conceived and constructed for compact collapsing and storage in a small space such as a closet and readily extendable and attachable to a window sill or the like for use outside of the building when utilized as a first escape.

More particularly, this invention relates to an interlocking device for use with collapsible portable devices comprising hingedly interconnected econventional ladder sections, and also particularly constitutes an improvement on my copending application, Serial No. 784,545, filed January 2, 1959, relating to portable collapsible fire escape devices.

The aforementioned application relates to a portable fire escape device consisting of hingedly interconnected rigid ladder sections which are readily collapsible to compact side-by-side relationship for ease in transportation and storage and which is adapted to be readily and quickly secured to a window sill with the ladder sections in unfolded condition extended downwarly from the window on the outside of the building to permit escape from the window to the ground when the normal exits from the building have been blockaded by flame and smoke.

An important object of my invention is a novel interlocking device which is simple in design and inexpensive in construction and which is capable of maintaining the ladder sections of devices of the class above described in rigid non-collapsible alignment.

Still another object is an interlocking device of the class described which works automatically without any help or assistance from the operator to lock the ladder sections together as they move into alignment with one another.

Another object is an interlocking device of the class described which enables collapsible portable type fire escape devices of the type above described and set forth in the aforementioned application to be made rigid automatically as the ladder sections of the device unfold from top to bottom and is particularly useful in fire escape devices of this type where there is no vertical supporting wall structure immediately adjacent the device to permit the device to rest thereagainst and aids in preventing undesirable flexing and movement of the ladder section as the person progressively lowers himself to the ground and also aids in preventing undue swaying thereof.

Still another object is a locking device which permits collapsible fire escape devices consisting of hingedly interconnected ladder type sections to be rigidly locked together for use as a conventional ladder when so desired.

Still another object is an interlocking device of the class described which permits two or more hingedly interconnected conventional ladder sections to be locked in aligned position to form a rigid ladder of variable length depending on the number of sections which are aligned and interlocked together.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a front elevation of my device in extended condition with the ladder sections in interlocked aligned relationship;

FIG. 2 is a side elevation of the same;

FIG. 3 is a side elevation of the same embodiment of the invention with the ladder sections of the entire device compactly collapsed for storage in an upright position;

FIG. 4 is a transverse cross sectional view taken on the line 4—4 of FIG. 1 and on an enlarged scale;

FIG. 5 is a front elevational view with portions broken away showing the ladder sections interlockingly interconnected by the device of my invention on an enlarged scale; and

FIG. 6 is a perspective view of one of the preferred forms of the locking device of my invention.

Reference is now made to the drawings for a more detailed description of a preferred form of my invention. In the embodiment of the invention illustrated, I provide a plurality of ladder sections identified as entireties by the letters S–1, S–2, and S–3, each as shown being identical in construction and comprising in each instance a pair of parallel opposed spaced rigid rails 7 preferably but not necessarily being constructed of very light channel members having the out-turned flanges 7*a* thereof disposed outwardly of the ladder section. Such materials as the number of different aluminum alloys are well suited for my construction.

Each of said ladder sections includes a plurality of spaced, rigid rung members 8 which preferably are tubular and welded or otherwise rigidly secured at their ends to the respective rails 7. It will be noted that the rungs 8 in each section are so arranged with reference to the elongated rails 7 that the ends of the rails extend for a considerable distance in each instance above or below the end rungs so that the spacing between the opposing end rungs of adjacent sections corresponds to the spacing between the rungs of each section to provide uniformly spaced steps when the device is in unfolded extended condition.

The ends of the successive ladder sections S–1, S–2, and S–3 are hingedly coupled together by a very strong and efficient hinge structure to provide for rapid and sure extension of the structure from the collapsed and stored position shown in FIG. 3 to the unfolded positions of the ladder sections shown in FIGS. 1 and 2. As shown, the lower ends of the rails 7 of section S–1 are hingedly connected to the appropriate upper ends of the rails 7 of section S–2 and the lower ends of section S–2 are similarly connected to the upper ends of the rails 7 of section S–3. The preferred embodiment of the efficient hinge coupling construction illustrated for each hinge connection comprises a pair of opposed heavy hinge plates 9 and 10 respectively. The inner plate 9 of each pair of hinge plates has an offset medial portion 9*a* to clear the flanged edges 7*b* of the channel rails 7 while the outer hinge plate 10 is provided with an offset central portion 10*a* to adequately clear the out-turned flanges 7*a* of the rail channel members. The flat end attachment portions of each pair of the hinge plates 9 and 10 are pivotally secured to the appropriate medial portions of the appropriate rail 7 by common heavy nutted bolts 11 and the outer ends of the bolts are preferably slightly swedged to positively prevent disconnection of the bolts of the coupled parts.

If the hingedly interconnected ladder sections above described are to be employed for use as a fire escape, then the following mechanism is provided. At the upper end of the first ladder section S–1 and slidably secured for upward extension from each of the rails 7 of said section, I provide very strong attachment and support means for cooperating with window sills varying substantially in width and dimensions. As shown, the upper

portions of each of the rails 7 of the first ladder section S–1 are provided with rigid inverted U-shaped sill engaging rods 12 which have inward vertical shanks 12*a* slidably mounted for longitudinal extension in heavy angle brackets 13 which, as shown, are pivotally bolted by heavy bolts to the respective upper ends of the rail 7 of the ladder section S–1. The flat pivotally attached portions 13*a* of the angle brackets are confined for restricted swinging movement between the outstanding flanges 7*a* of the respective rails. The outwardly disposed flanges 13*b* of the angle brackets are centrally apertured to accommodate the heavy shanks 12*a* of the sill engaging rods 12, and shanks 12*a* at their lower ends are provided with permanently and rigidly attached enlarged abutments 12*b*. Thus, the shanks 12*a* are freely vertically extensible and retractible with respect to the rails upon which they are mounted. This enables the U-shaped members 12 to be swung inwardly towards one another to overlie and rest upon the upper ends of the rails upon which they are mounted for compactness during storage. The pivotal mounting of the brackets 13 enables the shanks 12*a* to be slightly tilted out of vertical alignment with one another to enable the U-shaped portions of the hooks to lie in parallel side-by-side relationship when swung inwardly towards one another.

The U-shaped supporting and securing members 12 include medial horizontal rod portions 12*c* and depending hook arms 12*b* which terminate in free ends. The members 12 may be swung outwardly to the position shown in FIGS. 1 and 2 to lie in planes substantially perpendicular to the wide elongated faces of the channel rails 7 or they may be swung when slightly extended by raising of the shanks 12*a* above the positions shown in FIGS. 1 and 2 to cause the medial portions or arms 12*c* to overlie the top ends of the ladder section above the top rungs of that section as shown in FIG. 3. In said last mentioned position of the two supporting and securing means 12, the members are very closely collapsed as with the general structure.

To rigidly interconnect and lock the ladder sections S–1, S–2, and S–3 in fixed alignment with one another, whether the hingedly interconnected sections be employed solely as a ladder or as a fire escape or as both, I provide the channel type interlocking attachment indicated generally by the numeral 14. A pair of these channels are provided on each of the ladder sections above the bottom section, which in the form shown, are on sections S–1 and S–2, one of the interlocking channel members 14 being freely slidably mounted on each of the rail sections 7. The locking channels 14 enclose the rail members 7 with the sides 14 thereof overlying the outer faces of the rail flanges formed by the flange portions 7*a* and 7*b* thereof and lie in contiguous sliding relation therewith for guided longitudinal movement of the locking channels 14 on the rails 7. The channel sides 14*a* are provided with inturned flange or feet portions 14*b* which overlie the ends of the flanges 7*b* of the rails 7 in contiguous sliding relation therewith and prevent lateral removal of the channel 14 from the rail 7. The medial portion 14*c* lying between the sides 14*a* is outwardly offset a sufficient distance to form a longitudinally and outwardly extending groove or relief portion of sufficient depth to freely clear the medial portions 10*a* of the hinge plates 10 which extend outwardly beyond the edges of the rail 7. The medial portion 14*c* is connected with the sides 14*a* at each end thereof by portions 14*d* which lie in spaced apart generally parallel opposition to the inturned flange portions 14*b* and contiguously overlie the ends of the flanges 7*a* of the rail 7, the portions 14*a*, 14*b*, and 14*c* cooperating to permit free sliding guided movement of the interlocking channel 14 on the rail 7 while preventing any appreciable lateral or transverse movement with respect thereto.

The medial portion 14*c* is provided with a depressed portion 15 intermediate the ends of the channel 14 and approximately midway of such ends to provide an inwardly extending abutment surface. The depressed abutment 15 extends inwardly a sufficient distance to enable it to readily abut with and engage the upper surface of the medial portion 10*a* of the hinge plate 10 to limit downward movement of the channel 14 and interlock the adjacent hingedly connected ladder sections by overlapping the adjacent end portions of the opposing rails and thereby prevent relative movement therebetween.

As best seen in FIGS. 1, 2 and 5, when the channel 14 is in locking position, the depressed abutment member 15 engages the out-turned medial portion 10*a* of the hinge plate 10, with the upper portion of the channel 14 overlying the lower portion of the upper ladder section and the lower portion of the channel 14 overlying the upper portion of the lower ladder section. Thus, the channel 14 provides a rigid interconnection between the adjacent ladder sections and prevents any collapsing movement therebetween.

When not in use, the channel sections 14 are disposed completely on one ladder section intermediate the ends thereof as shown by the broken line positions of FIGS. 1 and 2 and also shown in FIG. 3. When it is desired to rigidly interconnect two or more of the adjacent ladder sections, the ladder sections are simply brought into alignment with one another, which causes the locking channel section 14 to move by force of gravity from their broken line positions of FIGS. 1 and 2 to the interlocking solid line positions shown in FIGS. 1 and 2, the downward movement of the member 14 being automatically arrested by engagement of the depressed abutment member 15 with the medial portion 10*a* of the hinge plate 10.

Thus, the locking device of my invention operates automatically to interconnect rigidly the adjacent hingedly interconnected ladder section without any operation on the part of the operator except that necessary to bring the ladder sections into alignment. To unlock the adjacent ladder sections, the channels 14 are simply raised above the hinge mechanisms to enable the ladder sections to be collapsed into side-by-side relationship as shown in FIG. 3. Because the channel sides 14*a* are thin and flat, they do not intefere with the collapsed nature of the sections as shown in FIG. 3.

From the foregoing, the advantages of my invention are readily apparent. The interlocking device is substantially fully automatic and extremely easy to operate. The manner in which it freely moves to interlock the adjacent ladder sections in rigid relationship is particularly important when the device is used as a fire escape mechanism. It enables the collapsed folded sections to be simply hung out of the window and attached to the window sill and simply allowed to naturally unfold to extended position and as the sections unfold and come into alignment with one another the locking channels automatically slide into interlocking relationship to provide an integral unit structure, thus avoiding the undesirable feature of having a flexible fire escape which will sway and bend as the person lowers himself to the ground thereon and eliminates the necessity for rigidly interconnecting the sections prior to extending the fire escape from the window, which not only is awkward and inconvenient but which is dangerous and time consuming where a matter of seconds can be the difference between life and death to a person attempting to escape when a fire is raging in a building. This interlocking arrangement also permits elimination of the wall spacing members which were previously employed and disclosed in my aforementioned application. The interlocking device of my invention also permits hingedly interconnected ladder sections to be rigidly aligned to easily convert the collapsed structure into a rigid elongate structure and also permits a selective number of these hingedly joined ladder sections to be rigidly united in as many sections as desired to form a ladder of the length desired. Thus, two, three, four or more sections may be rigidly interconnected to form as long a ladder as desired with the

remaining sections if any being permitted to remain in collapsed nested condition against the lowermost of the rigidly interconnected ladder sections. The automatic operation of my interlocking device is also important when employed with collapsible fire escape devices since it requires no manually operated parts which might be difficult or impossible for certain persons such as children or those which are old, feeble or sick to successfully manipulate, and enables the device to be carried to the window and mounted thereon while in collapsed condition, with the interlocking of the sections taking place automatically as the sections unfold into alignment with one another.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. In a device having a plurality of ladder sections hingedly connected at their adjacent ends for compact folding of the sections into side by side relationship in which the ladder sections include a pair of spaced rails interconnected by a plurality of transversely disposed rungs, means for detachably locking the sections in rigid alignment with one another comprising an elongate channel member telescopically mounted on the rail of one of said sections and adapted for free longitudinal movement thereon back and forth past said rungs, said member freely sliding downwardly into overlapping simultaneous engagement with adjoining rails when they are in generally vertical alignment with one another thereby overlaying the hinge connection between said rails and preventing hinged movement therebetween, outwardly protruding first abutment means provided by said hinge connection, and inwardly extending second abutment means carried by said channel intermediate the ends thereof cooperatively engaging said first abutment means when in overlapping locking position and preventing further downward movement of said channel member, said member when in locking position being capable of free upward unlocking movement to release the hinge connection for folding of said sections.

2. A device having in combination a plurality of rigid ladder sections, each comprising a pair of spaced rails interconnected by a plurality of vertically spaced rungs, said sections being successively hinged together at substantially abutting end portions thereof for compact storing relation when in collapsed parallel side by side position, and characterized by hinge connections between the lower ends of the rails of one section and the upper ends of the rails of an adjacent section, each hinge connection comprising a pair of spaced parallel plates pivoted at their upper ends to and on opposite sides of the lower end of the upper ladder section and pivoted at their lower ends to and at opposite sides of the upper ends of the rails of said lower section, said plates being adapted to receive the edge portions of the rails therebetween when folded, one of said plates having an outwardly offset portion providing a first abutment element, and means for rigidly interlocking adjacent sections in aligned relationship, said means comprising an elongate interlocking member mounted for free sliding longitudinal movement on a rail of the upper section of adjoining ladder sections, and second abutment means carried by said interlocking member approximately midway between the ends thereof and extending inwardly towards said offset portion, said member being adapted to fall freely into overlapping relationship with the end portions of the opposing rails of adjoining sections when in substantially vertical alignment with one another, said first and second abutment means cooperatively engaging one another to prevent downward movement of said locking member past overlapping interlocking position and maintaining said member in said position.

3. In a device having at least two conventional ladder sections each consisting of side rails and a series of transverse rungs interconnecting said rails and in which the sections are hingedly joined together in end to end aligned relationship by hinge means interconnecting opposing end portions of corresponding aligned rail members on adjacent sections, and wherein said hinge means extend laterally outwardly beyond the side faces of said rails and provide an abutment, a channel member telescopically mounted on one of said side rails of the upper of two adjoining sections and overlying the outer face and edges thereof for free sliding movement thereon throughout substantially the entire length thereof without interference from the rungs, the portion of the base of said member overlying the outer face of the rail in alignment with said abutment being outwardly concaved along the entire length thereof, the concavity being of sufficient depth to enable said member to pass freely over said abutment, said member having an inwardly depressed portion in the wall of said concavity located approximately midway between the ends of said member and providing a stop member adapted to cooperatively engage said hinge abutment, and limit downward movement of said member and maintain it in overlying relationship with said hinge when said sections are in vertical operative position and in simultaneous locking engagement with the exposing end portions of said rail members to thereby prevent hinging movement between said later sections, said member when in locking position being capable of free upward movement on the upper rail section on which it is mounted to free the hinge for folding of said sections.

4. A collapsible folding ladder device comprising a plurality of rigid ladder sections, each having a pair of space rails consisting of parallel flat strip portions integrally united by a thin web portion, the rails of each section being interconnected by a plurality of vertically spaced rungs extending between and connected to the web portions of said rails, said sections being successively hinged together at abutting end portions thereof for folding of said sections into compact parallel side-by-side relationship by hinge connections between the lower ends of the rails of one section and the upper ends of the rails of an adjacent section, each hinge connection comprising a pair of spaced elongate hinge plates whose end portions are pivotally connected to opposite sides of the web portions of the rails coupled thereby, said hinge plates having medial portions for enclosing therebetween the opposed flat strip portions of the coupled rail sections when in folded condition, said hinge plates preventing relative lateral movement between adjacent ladder sections, and an elongate interlocking member mounted for free sliding longitudinal movement on a rail of one of said sections and adapted to fall freely into overlapping relationship with the adjacent opposed end portions of adjoining sections when in substantial vertical alignment with one another, and stop means for arresting the free falling movement of said member when it has reached overlapping interlocking position and holding said member in said position.

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