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(54) Convertible ladder assembly.

(57) A collapsible ladder assembly comprises a plurality of sections (20), each providing two parallel stile parts (21) joined adjacent to one end by a transverse rung and the sections (20) being telescopically retractible each into the next wider section (20) with the rung end leading until the end transverse rungs of the two sections (20) lie one immediately above the other and the stile parts (21) of one section (20) lie between those of the next wider section (20).

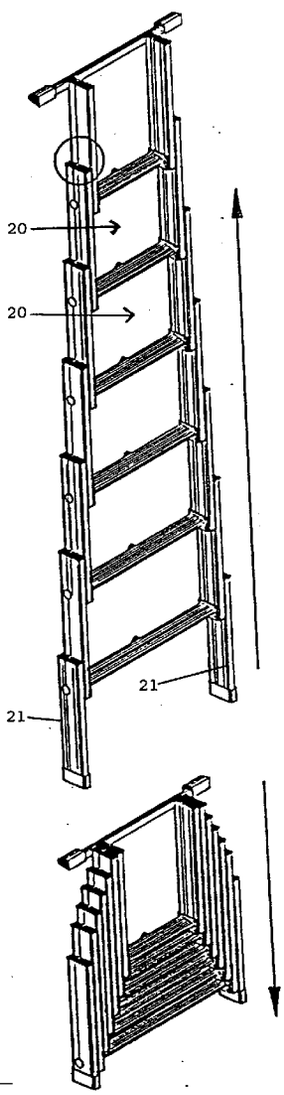

FIG.2A

FIG.2B

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The invention relates to a convertible ladder assembly comprising a plurality of sections each providing two parallel stile parts joined adjacent to one end by a transverse rung, the assembly being collapsible such that of any two adjacent sections, a narrower one of the sections can be nested between the stile parts of the wider one of the sections. The two sections may in some cases be pivotable relatively to one another about a transverse axis parallel to the rungs and arranged to be fixed in a selected one of at least two positions in one of which the stile parts are mutually parallel and in another of which the stile parts are inclined to one another. The assembly can thus be modified for a number of different uses, such as for a ladder when the sections are mutually fixed with their stile parts in parallel alignment, as a step ladder when in an A configuration or as a workbench if end sections of the assembly are fixed laterally as legs from one or more sections forming a supporting surface.

Such an assembly is disclosed, for example, in EP-A-0135666. However, in the construction disclosed in that specification any series of three adjacent sections are nested one within the next by pivoting the stile parts of one section so that the free ends of the stile parts lie adjacent to the rung of the next wider section. It necessarily follows that if the stile parts of the narrower inner section are to lie between the stile parts of the wider outer section, it cannot extend as far as the rung of the outer section. Consequently when the assembly is extended for use as a ladder, the inter-rung distance will successively decrease from the end of the assembly at which the widest section is positioned and this is an inconvenience. Because the sections have successively increasing lengths, the assembly cannot be folded to a symmetrical configuration, such as a level workbench. Furthermore, there are in practice difficulties in providing sufficiently precise pivotal connections such that there is an unacceptable slackness in the assembly, and in ensuring that the adjacent sections fold and unfold smoothly and without unnecessary friction.

In accordance with the first aspect of the present invention, a convertible ladder assembly comprises a plurality of sections each providing two parallel stile parts joined adjacent to one end by a transverse rung and the sections being telescopically retractible each into the next wider section with the rung end leading until the end transverse rungs of the two sections lie one immediately above the other in the direction of retraction and the stile parts of one section lie between those of the next wider section; the connection between the stile parts at each side of any two adjacent sections including complementary guide means which maintain parallelism between the stile parts whilst enabling the stile parts to slide relatively to one another upon extension and retraction of the adjacent sections, and means for fixing the stile parts of the extended sections at least in one position in which the stile parts are mutually parallel.

This provides a very neat construction which can readily be telescopically collapsed or extended simply by pushing the two end sections together or pulling them apart. Since each section telescopes into the "open" end of the next wider section, until the rungs are adjacent to one another, all the sections can have the same length so that, at least when there are three sections in the assembly, the inter-rung distances can all be made the same.

According to a second aspect of the invention, a convertible ladder assembly comprises a plurality of sections each providing two parallel stile parts joined adjacent to one end by a transverse rung and the sections being telescopically retractible each into the next wider section with the rung end leading and the stile parts of one section lie between those of the next wider section; the connection between the stile parts at each side of any two adjacent sections including complementary guide means which maintain parallelism between the stile parts whilst enabling the stile parts to slide relatively to one another upon extension and retraction of the adjacent sections, means enabling the stile parts of the extended sections to pivot relatively to one another about a transverse axis parallel to the rungs, and means for fixing the stile parts of the extended sections and hence the sections in a selected one of at least two positions in one of which the stile parts are mutually parallel and in the other of which the stile parts are inclined to one another.

This construction of assembly has the advantages of an assembly in accordance with the first aspect of the invention, but additionally enables the assembly to be converted from a ladder to other useful articles of which examples will be given later.

Most conveniently, the complementary guide means and the means enabling the stile parts of the extended sections to pivot relatively to one another comprise two guide elements sliding longitudinally of the stiles in a common or respective guideway, each guide element being attached to a different one of the stile parts than its guideway, whereby the guide elements and guideway(s) maintain parallelism between the stile parts when they are being extended and retracted, the arrangement being such that adjacent sections can be extended until one of the guide elements runs out of an end of its guideway, the other guide element then enabling the two stile parts to pivot relatively to one another about the transverse axis parallel to the rungs.

For maximum compactness when the sections are telescopically retracted, the front edges of all the stile parts preferably lie in a common plane, and the rear edges of the stile parts likewise in another common plane. The thickness of the collapsed structure will then be substantially no greater than the front to rear dimension of the thickest section.

Manufacture may be simplified if all the stile parts on one side of the assembly have the same section which will be a mirror image of, and may be the same as, that for the stile parts on the other side of the assembly. All the stile parts for at least one side can then be cut from a common extrusion of, for example, a plastic or aluminium based material.

Two of the assemblies according to either aspect of the invention may be hinged together at their narrower ends about an axis parallel to the rungs, whereby the two assemblies can be used with their stiles in parallel, either folded so that both assemblies extend in the same direction away from their hinged connection, or unfolded and extending in opposite directions away from their hinged connection, or at an acute angle to one another for use as a step ladder. In order to lock the two assemblies in the various different positions, each stile of each assembly is preferably provided with a plurality of apertures adjacent to, and disposed around the pivotal axis of the hinge, whereby at least one aperture of one assembly is aligned with at least one aperture of the other assembly when the assemblies are in various desired relative angular positions, and a locking member is provided which can be fitted through the aligned apertures. The locking member is preferably retractable along the pivotal axis of the hinge. This locking system may also be applicable to locking together two conventional ladder parts in various angular configurations.

Some examples of assemblies constructed in accordance with the present invention are illustrated in the accompanying drawings, in which:-

Figures 1A - 1D show the use of a first assembly in different positions;

Figures 2A - 2B show a second assembly in different positions;

Figures 3A - 3D show the use of a third assembly in different positions;

Figure 4 is a rung cross-section;

Figures 5A - 5C are sections through stile parts of adjacent sections of the first, second and third assemblies respectively;

Figures 6A - 6F are perspective details showing interconnections between adjacent stile parts of the second assembly;

Figures 7A - 7C are perspective details showing the interconnection between adjacent stile parts of the third assembly;

Figures 8A - 8B are exploded details of locking mechanisms;

Figures 9A - 9E show in perspective the operation of a sliding frame for locking two of the third assemblies in their extended position;

Figure 10 shows sixteen different possible uses of assemblies according to the invention;

Figure 11 is a section through stile parts of adjacent sections showing an alternative stile profile; and,

Figures 12A - 12C show an alternative mechanism for locking adjacent stiles when the stiles are relatively inclined.

Figures 13A - 13F show a locking mechanism for locking together two assemblies.

Three different models of assembly are illustrated in the drawings. The first, which may be termed a domestic model, is shown in Figures 1; the second, which may be termed a commercial model, is shown in Figures 2; and the third, which may be termed an industrial model, is shown in Figures 3.

The domestic model consists of two assemblies, each of two sections 11,12 and 13,14. Each section consists of a rung 15 at its nominal bottom end interconnecting two stile parts 16. The stile parts 16 of the sections 12 and 13 are also interconnected by transverse rungs 17. The stile parts of the sections 12 and 13 are respectively slidable inside the stile parts 16 of the sections 11 and 14 respectively. The interconnection between the adjacent stile parts will be explained subsequently with particular respect to Figures 5 and 6. Locking pins, also to be described later with respect particularly to Figures 8, fix the sections in their telescopically extended positions. The nominal upper ends of the stile parts 16 of the sections 12 and 13 are interconnected by hinge brackets 18 at each side, and locking pins in the upper rung of the section 12 cooperate with apertures in a plate 18A of the hinge brackets, to hold the sections in extended alignment as shown in Figure 1A, for use as a ladder. However, when the pins are released, the two assemblies, each of two sections, can fold to the "A" position shown in Figure 1B, for use as a stool or step ladder. Straps may be provided between the legs of the A to limit the angle of opening. For storage or transport, the assemblies can be folded against one another from the Figure 1B position, locking pins released, and the sections of each assembly telescoped into one another to produce the compact construction in Figure 1C.

The couplings between the stile parts of the sections 11 and 12, and between the stile parts of the sections 13 and 14, are to be described in respect of Figures 5 and 6, but the effect is that the section 11 can be pivotable about an axis parallel to the rung 15, relatively to the section 12 and refixed by means of locking pins, projecting transversely as shown in Figure 1D. Wheels 19 mounted on the nominal upper ends of the stile parts 16 of the section 11, and projecting rearwardly, then engage the ground to that the article can be used as a sack barrow.

The commercial model shown in Figure 2 is essentially an extension of the one of the two section assemblies of Figure 1, but with six sections 20 successively telescopically retractible into one another from the configuration of use shown in Figure 2A, to the contracted configuration shown in Figure 2B for storage or transport. The stile parts of adjacent sections

may, as will be described in more detail, be fixed in the parallel aligned position shown in Figure 2A, or inclined relatively to one another, so that the assembly can be used in one or more of the configurations shown in Figure 10. In order to allow the assembly to be used upright on uneven ground, legs 21, similar in section to the stile parts are longitudinally slidable on the stile parts of the lowermost section 20, in the same way that all the other adjacent stile parts are slidable relatively to one another, and are fixable, by means of the common type of locking pins, in a variety of extended positions.

Two of the assemblies shown in Figures 2 may be hinged together at their narrower upper ends for use as a step ladder, similarly to the domestic model, or fully unfolded in alignment for use as a double length ladder, or folded together to form a standard length ladder of double thickness and strength.

The industrial model shown in Figures 3 has six sections 22 which are telescopically collapsible from the Figure 3A to the Figure 3B configuration similarly to the other models. A difference is that in the case of the industrial model, the sections have, in addition to the nominal bottom rungs 15, intermediate rungs 23 which are mounted part-way along the stile parts of each section but attached to the front and rear edges of the stile parts. Consequently, upon telescopic retraction, the rung 15 of the narrower of two sections can pass between the intermediate rungs 23 of the next wider section before being obstructed by the rung 15 of the next wider section upon full retraction. Similarly the intermediate rungs 23 of the narrower of the two sections will then be obstructed by the rungs 23 of the next wider section.

The narrower ends of two of the assemblies shown in Figure 3A may be hinged together for use as a step ladder as shown in Figure 3C, or for use as a double length ladder as shown in Figure 3D. In the latter case a sliding frame 24, to be described with respect to Figures 9, is used for strengthening and securely fixing the two assemblies end to end.

Of course the adjacent sections of the industrial model also have provision for being fixed with their stile parts parallel, or in a position in which they are inclined to one another, for use in one or more of the Figure 10 configurations.

When two of the assemblies are hinged together at their narrower ends, for use alternately as a double length ladder or as a step ladder in an A configuration, the rungs will sometimes be used one way up and sometimes the other. For this reason the rungs are preferably symmetrical about a plane perpendicular to the stiles, so that the rungs 15, for example, may have a section as shown in Figure 4.

Figures 5 are horizontal sections through two overlapping stile parts of adjacent sections respectively of the domestic, commercial and industrial models. In each case it will be seen that both stile parts have the same section and the front edges of both stile parts are in a common plane, as are the rear edges of the two stile parts. It follows that when the assembly is collapsed as shown in Figures 1C, 2B, or 3B, except for trivial projections such as the wheel 19, the overall thickness of the collapsed assembly is no greater than the front to rear dimension of the stile part, or of two stile parts if two assemblies are hinged together and collapsed face to face as in Figure 1C.

The sections of the stile parts increase in robustness from the domestic to the industrial model but it will be seen that all include multiple box sections and at least one dovetail groove 25 or 25 and 25'. Of each pair of stile parts, the inner stile part 16' carries, on its inner face, a mounting 26 for the adjacent end of a rung 15. It also carries two nylon strips of dovetail cross-section, forming guide elements 27' which slide in the dovetail groove or grooves 25, 25', forming guideways in the outer stile part 16". As shown in Figures 5 one of the guide elements 27' is connected to its stile part 16' by rivets while the other guide element 27 is connected to its stile part 16' by a tubular rivet 28, which allows relative pivotal movement of the element relatively to the stile part about the axis of the rivet.

The coupling between the stile parts of adjacent sections of the commercial model is shown in more detail in Figures 6 but in as much as the stile sections have a single groove, the same principle is applicable to the coupling between the stile parts of the domestic model.

When the stile parts are telescopically retracted, or extended to the parallel position for use as a ladder, both the guide elements 27, 27' slide in the common guideway 25. This constrains the stile parts in the parallel configuration. In the extended position for use as a ladder, locking pins 29, to be described subsequently with respect to Figure 8, can be extended laterally from each end of the rung 15 through a hole 35 in the guide element 27, and through both opposed walls of one of the box sections 30 of the outer stile part 16". The tip of the locking pin 29 is exposed at the outer surface of the outer stile part 16" as a safety precaution.

When it is desired to pivot the narrower section relatively to the wider section, the pins 29 are retracted against spring action and the inner stile parts 16' are extended further relatively to the outer parts 16", until each upper guide elements 27' rides out of the upper end of the guideway 25. The inner stile parts 16' are then able to pivot about an axis parallel to the rung 15, because they remain connected to the outer stile part 16" only by the lower guide element 27, relatively to which each inner stile part 16' is pivotally connected. This additional extension of the stile parts is shown in Figure 6B and the subsequent pivoting action in 6C. Depending upon the configuration to be adopted, one or more additional holes 31 are

provided through the outer stile parts 16", for receiving the guide pins 29 when the appropriate angular orientation has been achieved.

A protective plastic cap 32 is provided on the bottom of each stile part 16' and a plastic end cap 33 is provided on the upper end of each stile part 16". A generally dovetail opening is provided in the end cap 33 in alignment with the dovetail channel 25. However, although not shown, the wings of the dovetail channel are truncated as are the wings of the guide element 27'. Consequently, the guide element 27' can ride through the opening in the end cap 33 to the position shown in Figure 6B, but the stile parts cannot become wholly disengaged because the wings of the dovetail section of the lower guide element 27 are not similarly truncated and cannot pass through the opening in the end cap 33.

Figures 6D-6F show a modification of Figure 6A-6C and from the front, rather than the back, of the assembly. In this case, as distinct from Figures 6A-6C, the stile parts have a symmetrical section, with a single dovetail channel guideway 25. In the back of the channel there is a rectangular sectioned recess 25" in the top of which is fixed a disk-shaped abutment 33', which has a similar function to the end cap 33. Instead of only the two rotatable and fixed guide elements 27 and 27' there is an additional button-like guide element 27" which is fixed to the stile part 16' and has a head of dovetail shape in axial section. This slides in the guideway 25 and can pass the abutment 33', as can the guide element 27'. However, in this case, the element 27 is of rectangular cross section, as shown in Figure 6F, and occupies the recess 25", so as to engage the abutment 33' and prevent complete disengagement of the stile parts 16', 16". The stile part 16' is of course pivotally attached to the guide element 27, so as to be pivotable relatively to the stile part 16", when the guide elements 27' and 27" have been lifted up out of the guideway 25. The purpose of the additional guide element 27" is to provide an additional stability between the stile parts 16', 16", when they are telescopically retracted.

In order to avoid unnecessary engagement between the guide element 27 and the outer side of the end cap 33, an additional hole 34 is provided through the outer stile part 16" into which the pin 29 will tend to ride under its spring urging to limit the extension of the stile part 16,16', before the end cap 33 is engaged.

The stile part coupling mechanism for the industrial model, shown in Figures 7 is directly analogous to that of Figures 6. The only difference is that there are two guide channels 25,25', one of which receives an upper fixed guide element 27' and a lower pivoted guide element 27, whereas the other guideway receives only a fixed guide element 27'. Upon additional extension prior to pivoting the stile parts relatively to one another, both the fixed guide elements 27' are caused to ride out of the guideways. Also, in Figure 7C, the two stile parts are shown rotating through an angle of the order of 135° from their aligned position, whereas in Figure 6C the inclination is of the order of 90°.

The mechanism for controlling the locking pins 29 both for securing adjacent stile parts in the respective mutual positions, and also for engaging the locking plates 18A to hold the two assemblies in their extended aligned position for use as a ladder, and for fixing the legs 21, is shown in Figure 8. Near each end of the rung, there is mounted within the rung a U-shaped bracket 36 through the side walls of which slides the locking pin 29. A helically coiled compression ring 37 surrounds the pin and acts between an inner arm of the bracket 36 and an abutment on the pin 29 to urge the pin outwardly for engagement with an appropriate hole. The pins associated with each rung may be simultaneously be withdrawn inwardly against the action of their return springs by rotation of a boss 38 by means of an externally exposed knob 39, which is keyed to the boss, the pins being connected to diametrically opposite portions of the boss by respective wires 40. Rotation of the knob 39 then pulls the pins inwardly against their return springs, and release of the knob allows the pins to move outwardly under the spring action.

In a modified arrangement shown in Figure 8B, the wires 40 and knob 39 are replaced by a pair of handles 39A, which are rigidly fixed to the inner ends of the respective bolts 29, and project out through respective slots 39B in the rear face of the rung 15. Two hands are therefore required to retract the bolts together for reconfiguring the assembly.

Figure 9 shows in more detail the operation of the sliding frame 24 previously referred to in connection with the industrial model, and in particular Figure 3D. Thus the two narrowest end stile parts 16"' of the two assemblies are interconnected by a hinge bracket 18'. This enables the two assemblies to adopt the A configuration shown in Figure 9C for use as a step ladder. The stile parts 16"" of the next wider sections are slidably and pivotably coupled to the stile parts 16"' as previously described and locked in the aligned position by means of the bolts 29 extending through the holes 35. Mounted between the end rungs 15 of the two assemblies is a sliding frame, which is shown in the enlarged circled portion of Figure 9C. This consists of two side pieces 41 interconnected by rungs 15'. Mounted on the outsides of the side pieces 41 are a pair of full length guide elements 27"' which are slidable in the dovetail guideways 25,25' of the stile parts 16"'. In order to lock the two assemblies in the extended aligned position for use as a ladder, the frame 24 is slid to a symmetrical position shown in Figure 9A, in which it partially overlaps the stile parts 16"' of both assemblies. It is locked in this position by means of locking pins 29, operated as described with refer-

ence to Figures 8, the locking pins entering holes 42 in the stile parts 16"'. When it is desired to release the aligned position, so that the two assemblies may be folded to a new angular orientation, the pins 29 are retracted and the frame is slid either upwards or downwards so that it is wholly within the stile parts 16"' of one or other of the assemblies, the pins 29 then being released to extend into respective holes 42 and 43 in the respective sections.

Figures 9D and 9E show a further modification of the sliding frame of Figures 9A-9C. Mounted between the side pieces 41 is a sub-frame consisting of inner parts 44 and 45, which are attached to the inner faces of respective ones of the side pieces 41, and are rigidly interconnected by the rungs 15'. The parts 44, with the upper two rungs 15' and are pivotally connected to their respective side pieces 41 by means of tubular rivets 46, whereas the parts 45, which are interconnected by only the lowermost rung 15', are rigidly screwed to their respective side pieces 41. The effect of this is that when the assemblies are pivoted to the step ladder position shown in Figure 9B with the side pieces 41 slid down one side of the A, the inner parts 44 and upper two rungs 15' can be pivoted over to a horizontal orientation to act as a platform adjacent to the top of the step ladder, as shown in Figure 19D.

Figure 11 shows an alternative stile profile in which the guideway 25A and guide element 27A, which may be the rotatable or fixed guide element, have different profiles to those shown in Figures 5A and 5C. In particular, the sides of guideway 25A are provided by opposing convex ribs 47, while the sides of the guide element 27A are formed as corresponding concave channels 48. The arrangement is designed to resist forces tending to pull the guide elements 27A out of the guide way 25A in a direction perpendicular to the axis of the stiles.

Figures 12A to 12C illustrate an alternative mechanism for locking a pair of stiles in a relatively inclined position. The locking mechanism comprising the locking pin 29 and hole 35 is still necessary to lock the stiles in their aligned position. However, the locking mechanism shown in Figures 12A to 12C provides an improved lock with the stiles inclined. The locking mechanism of Figures 12A to 12C comprises a latch which is built into a guide element 27 which is hollow and is slidable in the axial direction of the stile. The latch comprises a bolt 49 with a handle 50 at one end, and which is urged into the locked position by a helically wound compression spring 51 working against an inner end surface of the guide element 27. The adjacent stile is provided with a hole 52 which, when the stiles are pivoted to the desired position, is aligned with the bolt 49. Although only one hole is shown in Figure 12A, several could be provided corresponding to a variety of angular positions. The bolt 49 is pulled back against the action of the compression spring 51 and is released when the hole 52 is aligned with the bolt, so that the bolt is urged into the hole to lock the stiles in their inclined position.

Figures 13A to 13F show a mechanism for locking together two hinged adjacent ladder parts 53, 54 which may be two assemblies according to the present invention, or may be conventional ladder parts. The ladder parts 53, 54 are hinged about an axis 55 such that they can assume the various configurations shown in Figures 13A to 13D. Each ladder part 53, 54 is provided at opposite sides with a disk portion 56, 57, the disk portions being centered on the hinge axis 55, and the disk portion 56 of one ladder part 53 being interleaved with the disk portion 57 of the second ladder part 54, as best shown in Figures 13E and 13F. Each of the disk portions 56, 57 are provided with a plurality of apertures 58 disposed about the hinge axis 55. As can be seen in Figures 13A to 13D, when the two ladder parts 53, 54 are in various desired relative angular positions, apertures 58 on the two disk portions 56, 57 are aligned, and are shown shaded dark in Figures 13A to 13D.

The ladder parts 53, 54 are locked in the various angular configurations shown in Figures 13A to 13D by means of a locking knob 59 which is mounted to slide along and rotate about the hinge axis 55. The locking knob 59 is provided with a pair of projections 60 for engaging with the apertures 58. The locking knob 59 is urged towards the disk portions 56, 57 by virtue of a helical compression spring 61 which bears against the end of a stud 62 extending along the hinge axis 55.

In use, when the locking knob 59 is withdrawn against the action of the spring 61 as shown in Figure 13E, the two ladder parts 53, 54 are free to rotate relatively to one another to the desired angular configuration. Once they are in the desired position, certain apertures 58 in the disk portions 56, 57 are aligned, and the locking knob 59 is rotated so that the projections 60 are aligned with the aligned apertures 58 and released so that the projections are urged into the aligned apertures 58 under the action of the compression spring 61, thereby locking the two ladder parts 53, 54 in the desired configuration.

Claims

1. A collapsible ladder assembly comprising a plurality of sections each providing two parallel stile parts joined adjacent to one end by a transverse rung and the sections being telescopically retractible each into the next wider section with the rung end leading until the end transverse rungs of the two sections lie one immediately above the other in the direction of retraction and the stile parts of one section lie between those of the next wider section; the connection between the stile

parts at each side of any two adjacent sections including complementary guide means which maintain parallelism between the stile parts whilst enabling the stile parts to slide relatively to one another upon extension and retraction of the adjacent sections, and means for fixing the stile parts of the extended sections at least in one position in which the stile parts are mutually parallel.

2. A convertible ladder assembly comprising a plurality of sections each providing two parallel stile parts joined adjacent to one end by a transverse rung and the sections being telescopically retractible each into the next wider section with the rung end leading and the stile parts of one section lie between those of the next wider section; the connection between the stile parts at each side of any two adjacent sections including complementary guide means which maintain parallelism between the stile parts whilst enabling the stile parts to slide relatively to one another upon extension and retraction of the adjacent sections, means enabling the stile parts of the extended sections to pivot relatively to one another about a transverse axis parallel to the rungs, and means for fixing the stile parts of the extended sections and hence the sections in a selected one of at least two positions in one of which the stile parts are mutually parallel and in the other of which the stile parts are inclined to one another.

3. An assembly according to claim 2, wherein the complementary guide means and the means enabling the stile parts of the extended sections to pivot relatively to one another comprise two guide elements sliding longitudinally of the stiles in a common or respective guideway, each guide element being attached to a different one of the stile parts than its guideway, whereby the guide elements and guideway(s) maintain parallelism between the stile parts when they are being extended and retracted, the arrangement being such that adjacent sections can be extended until one of the guide elements runs out of an end of its guideway, the other guide element then enabling the two stile parts to pivot relatively to one another about the transverse axis parallel to the rungs.

4. An assembly according to claim 3, in which the guide elements have parallel sides which prevent them from rotating in the guideway(s), and the other guide element is pivotally connected to the stile part to which it is attached.

5. An assembly according to claim 4, in which the or each guideway is of dovetail cross-section.

6. An assembly according to claim 4, in which the or each guideway has facing convex sides, and the guide elements are provided with corresponding concave channels.

7. An assembly according to any one of claims 3 to 6, in which there are two of the guide elements in a single guideway having at its end an abutment partially obstructing the guideway, and the one guide element has a cross-section different from that of the other guide element whereby it can pass the abutment whilst the other guide element cannot do so.

8. An assembly according to any one of claims 2 to 7, in which the fixing means comprises at least two holes in the stile part of the wider section, and a laterally extensible locking bolt located adjacent to the rung of the narrower section, and arranged to enter a selective one of the holes to fix the stile parts in the selected position.

9. An assembly according to claim 8, wherein each stile part is an extrusion with at least one box section, and the holes extend through two opposite walls of a box section, the tips of the bolts being exposed at the outer edges of the stile parts when fully home.

10. An assembly according to claim 8 or claim 9, in which the bolts are spring loaded outwardly and the two bolts of a section are retractible by a common or respective handpiece.

11. An assembly according to any one of claims 3 to 10, in which the fixing means further comprises a bolt located in one of the guide elements of the narrower stile section, and being slidable in the axial direction of the stile; and a complementary hole in the stile part of the wider section, wherein the hole is aligned with the bolt when the sections are in a desired relatively inclined position.

12. An assembly according to any one of the preceding claims, in which all the stile parts on the same side of the assembly have the same section and have their front edges in a common plane.

13. An assembly according to any one of the preceding claims, in which each rung is symmetrical about a plane perpendicular to the stile parts.

14. An article consisting of two assemblies according to any one of the preceding claims, hinged together at their narrower ends about an axis parallel to the rungs, whereby the two assemblies can be used with their stiles in parallel alignment, as a ladder, or at an acute angle to one another

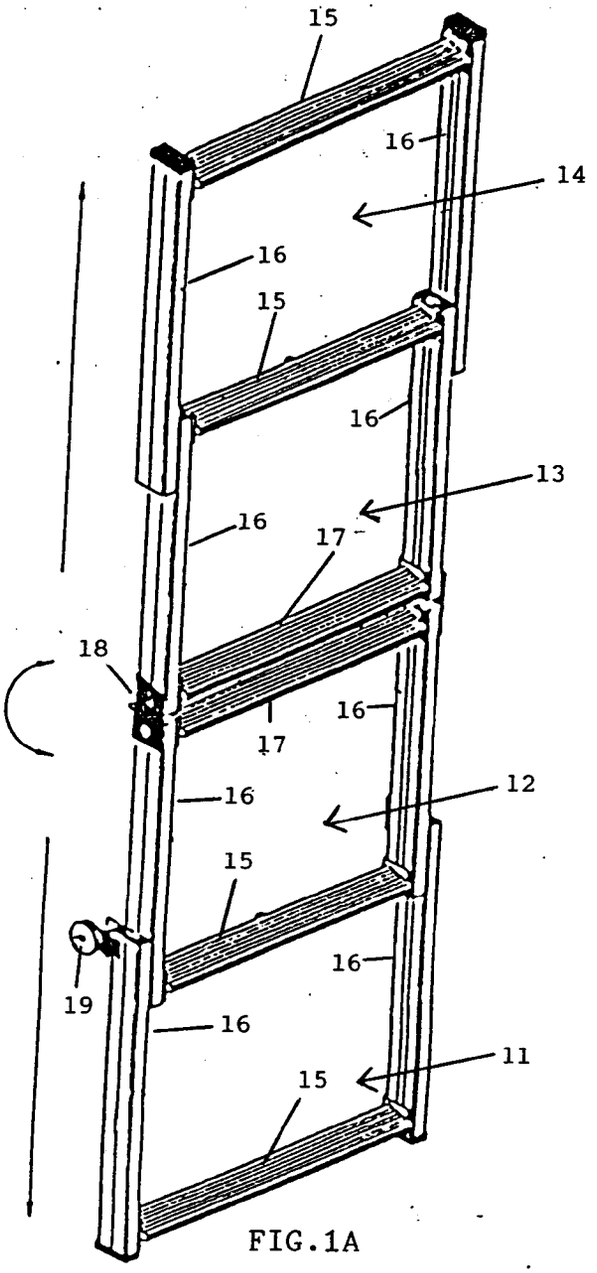
for use as a step ladder.

15. An article according to claim 14, wherein the two assemblies can be locked in position with the two assemblies extending in opposite directions away from their hinged connection for use as a ladder, by a frame having two side pieces which are slidable longitudinally along the inner surfaces of the stile parts of the narrower end sections of the two assemblies between an unlocked position in which the frame side pieces are located between the stile parts of only one of the end sections and a locked position in which they are located partly between the stile parts of each of the end sections.

16. An article according to claim 15, wherein each sidepiece has an inner part connected to the other inner part by at least two rungs to form a sub frame, the inner parts being pivotally connected to their respective side pieces about an axis parallel to the rungs, whereby, when the article is folded for use as a step ladder, the sub frame can be pivoted to provide a substantially horizontal support between the two assemblies adjacent to the top of the step ladder.

17. An article according to claim 14, wherein each stile of each assembly is provided with a plurality of apertures adjacent to, and disposed around the pivotal axis of the hinge, whereby at least one aperture of one assembly is aligned with at least one aperture of the other assembly when the assemblies are in various desired relative angular positions, and a locking member is provided which can be fitted through the aligned apertures.

18. An article according to claim 17, wherein the locking member is retractable along the pivotal axis of the hinge.


15
16
14
16
15
16
13
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17
18
16
12
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19
16
11
15

FIG.1A

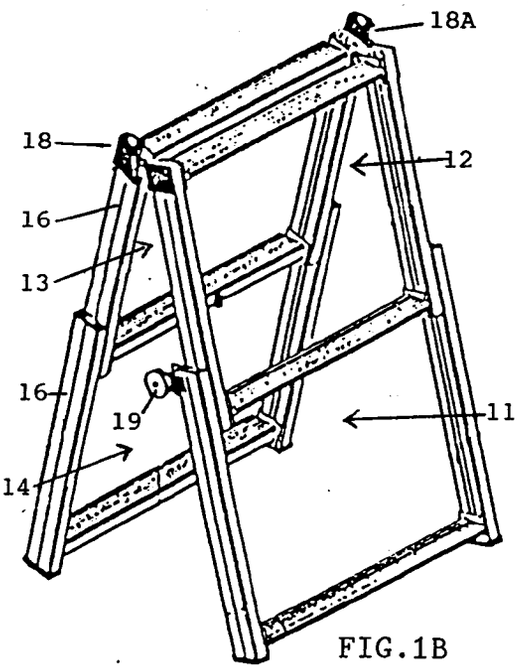

18A
18
12
16
13
16
19
11
14

FIG.1B

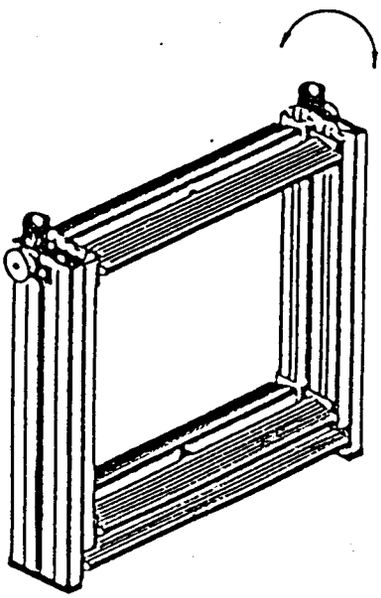


FIG.1C

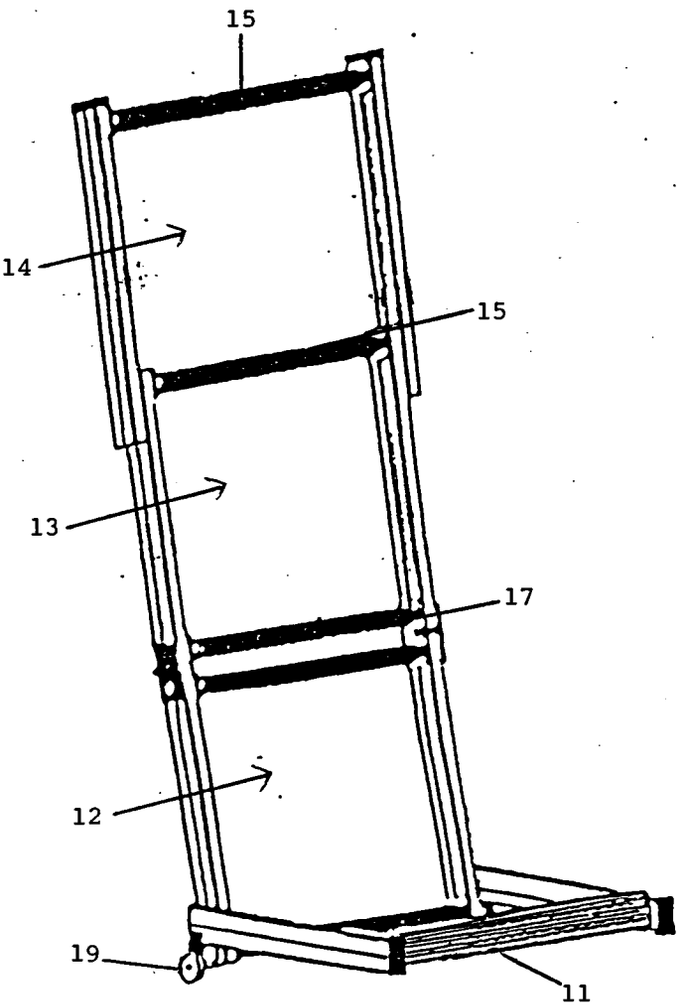


FIG.1D

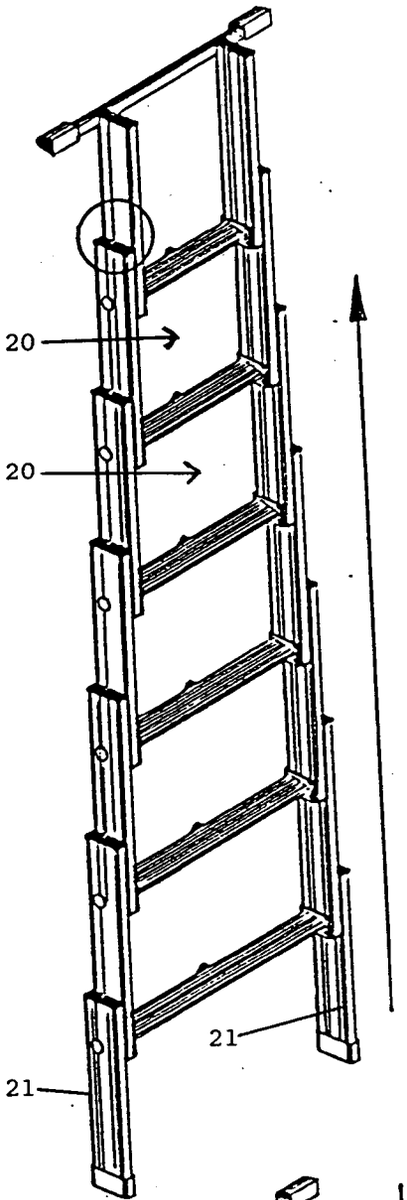


FIG.2A

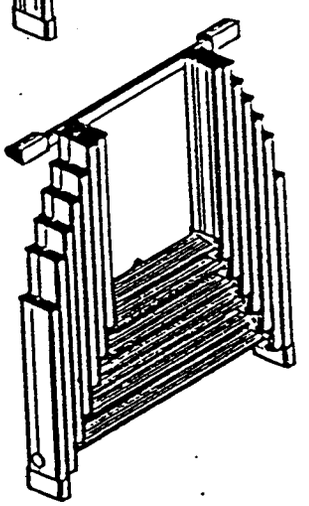


FIG.2B

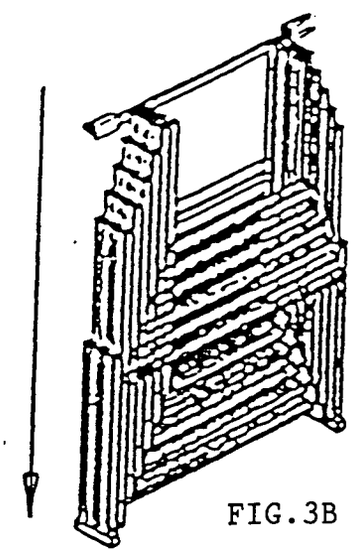


FIG.3B

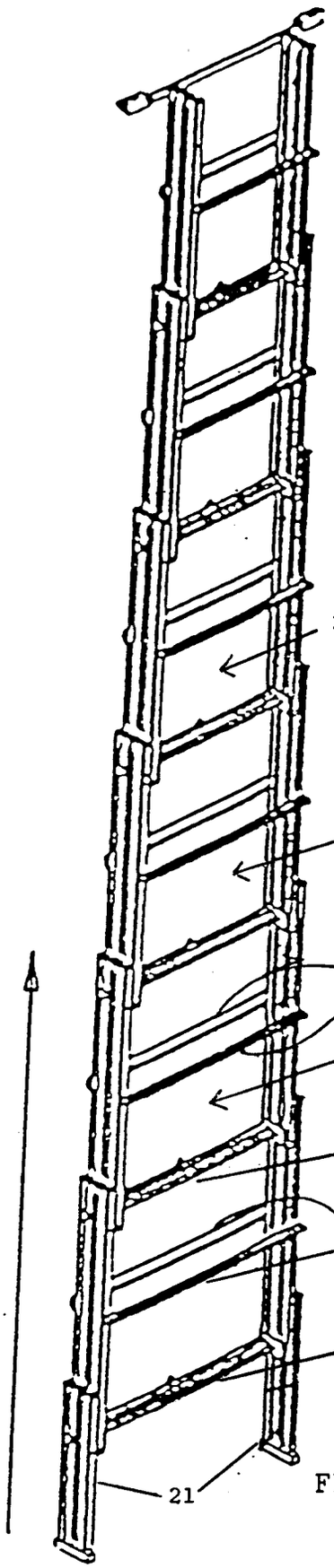


FIG.3A

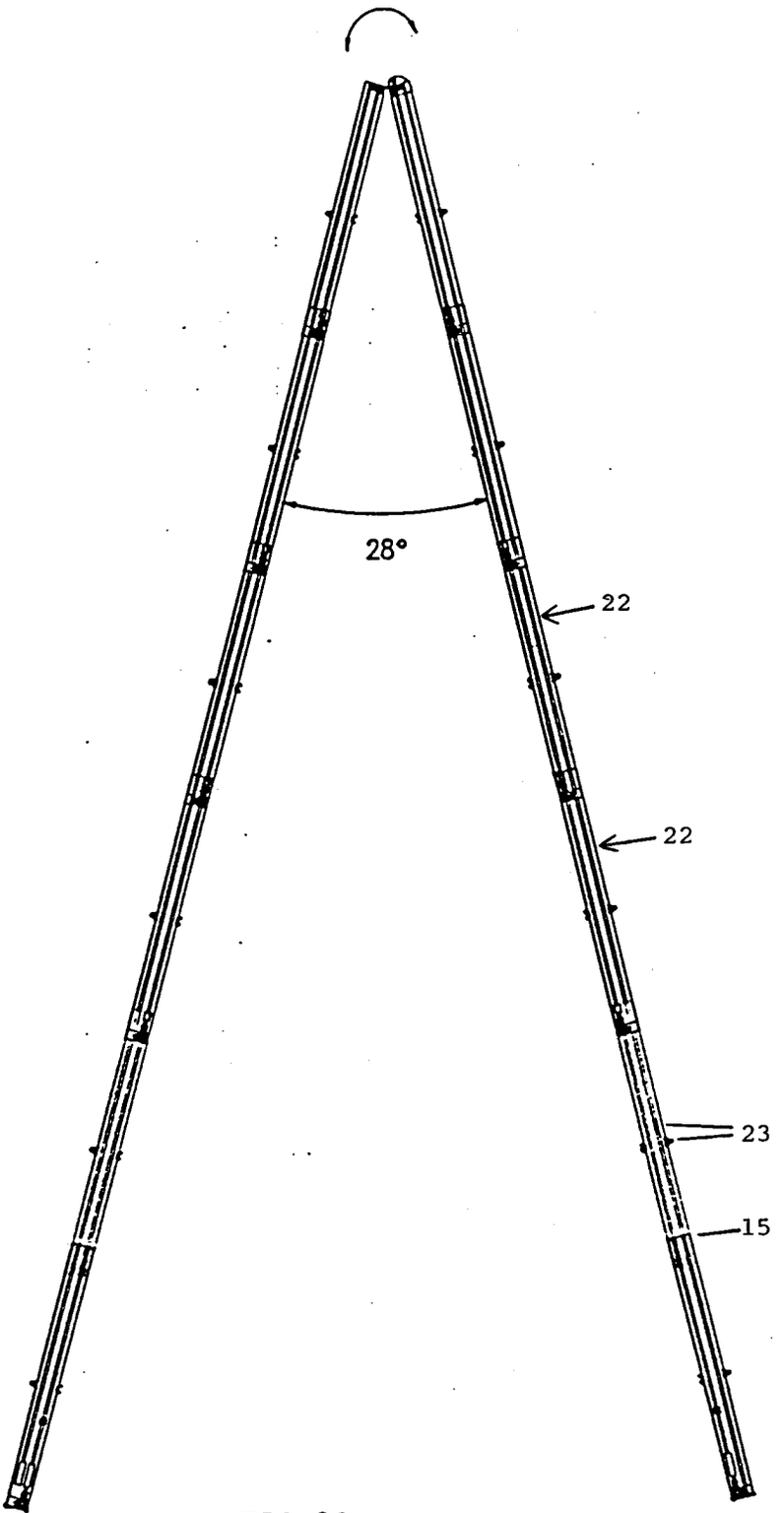


FIG.3C

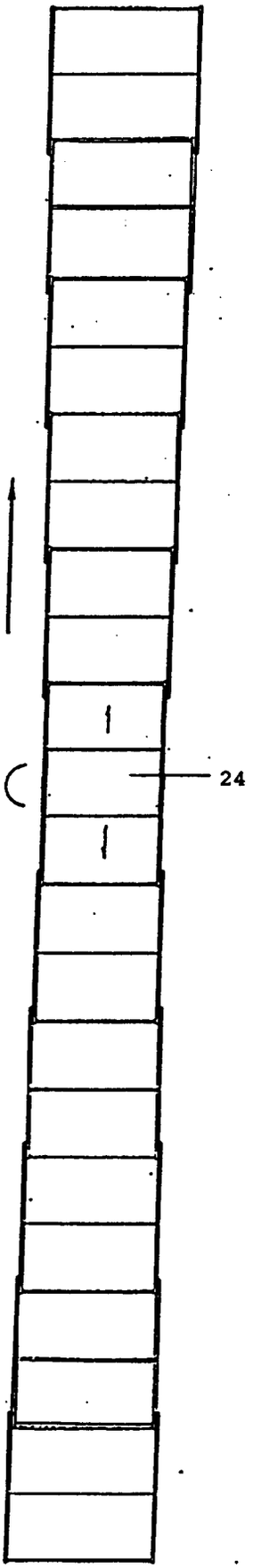


FIG.3D

FIG.4

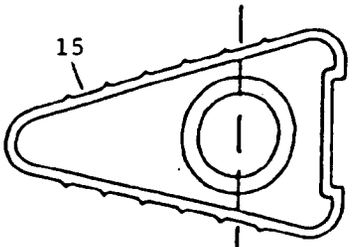


FIG.5A

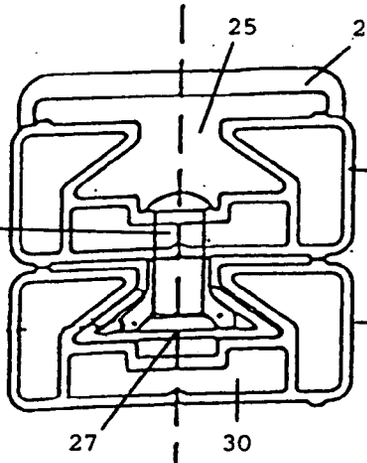


FIG.5B

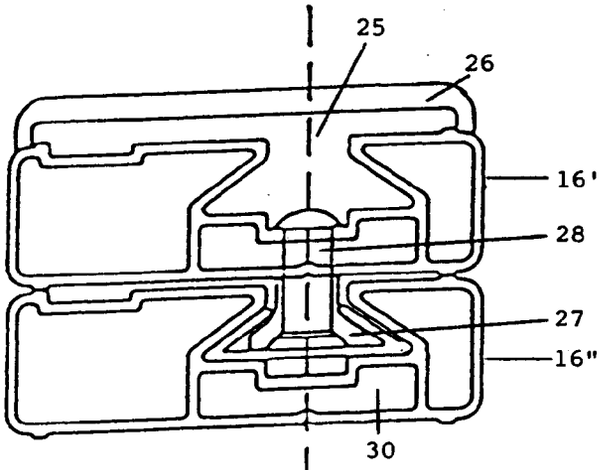
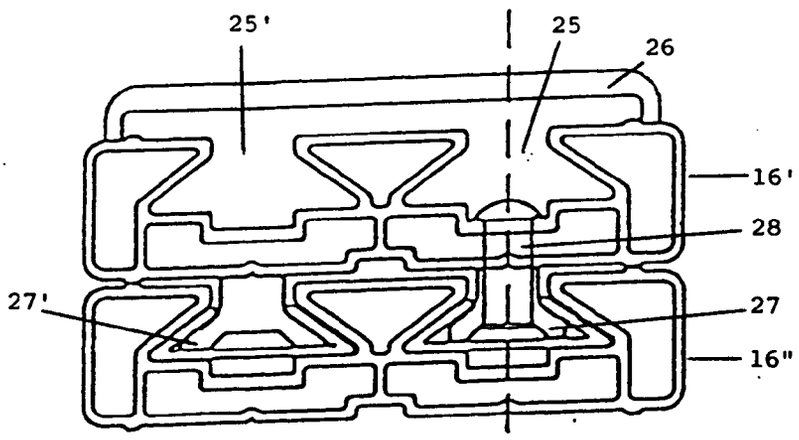


FIG.5C



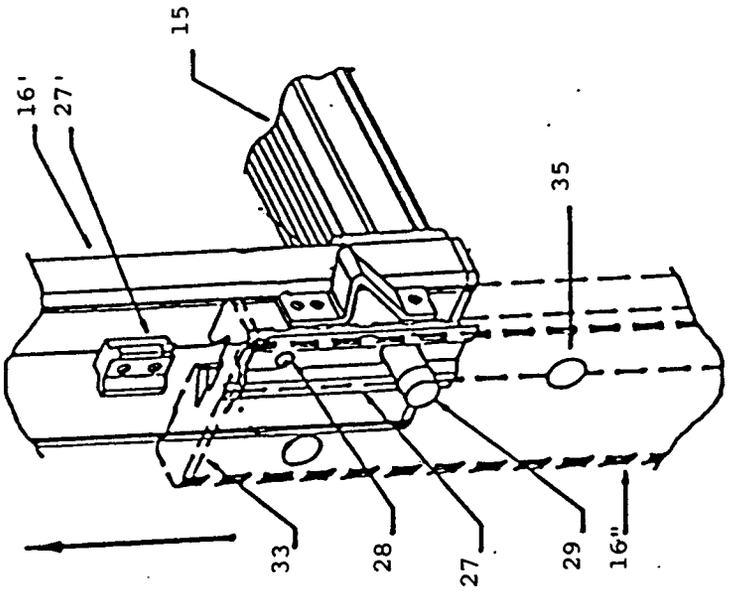


FIG.6B

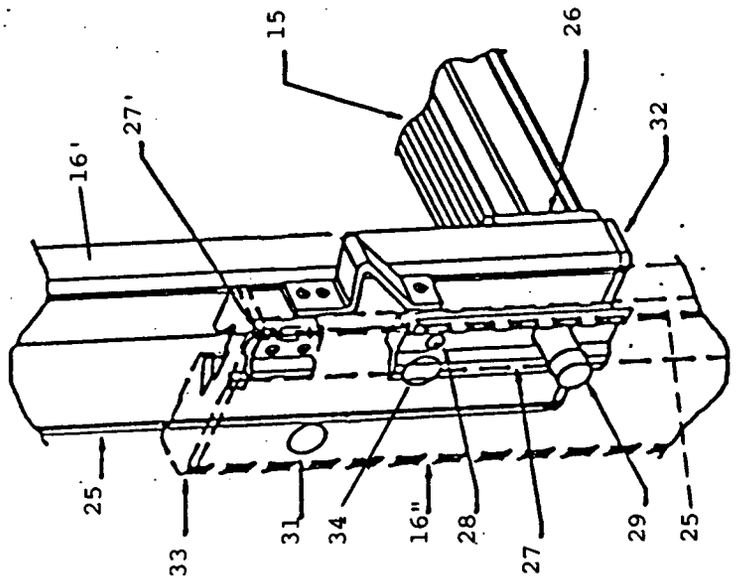


FIG.6A

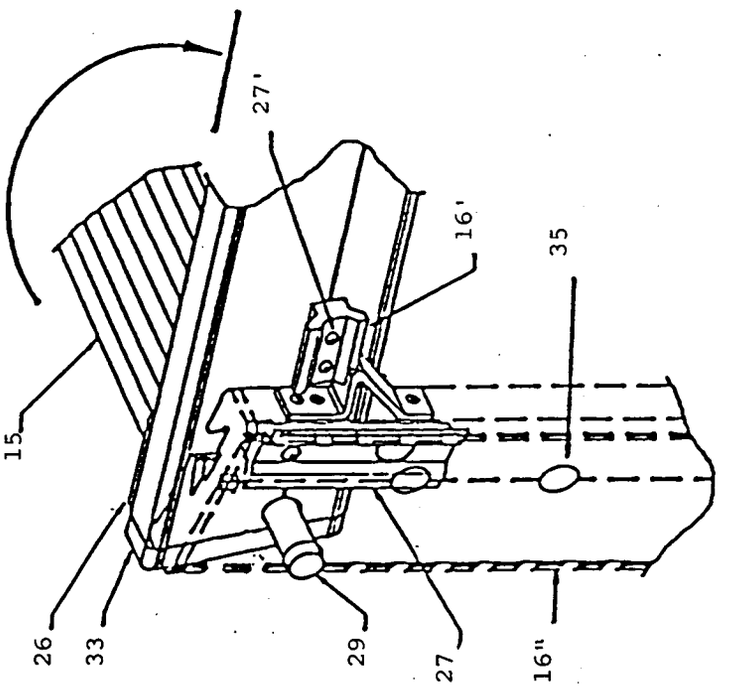
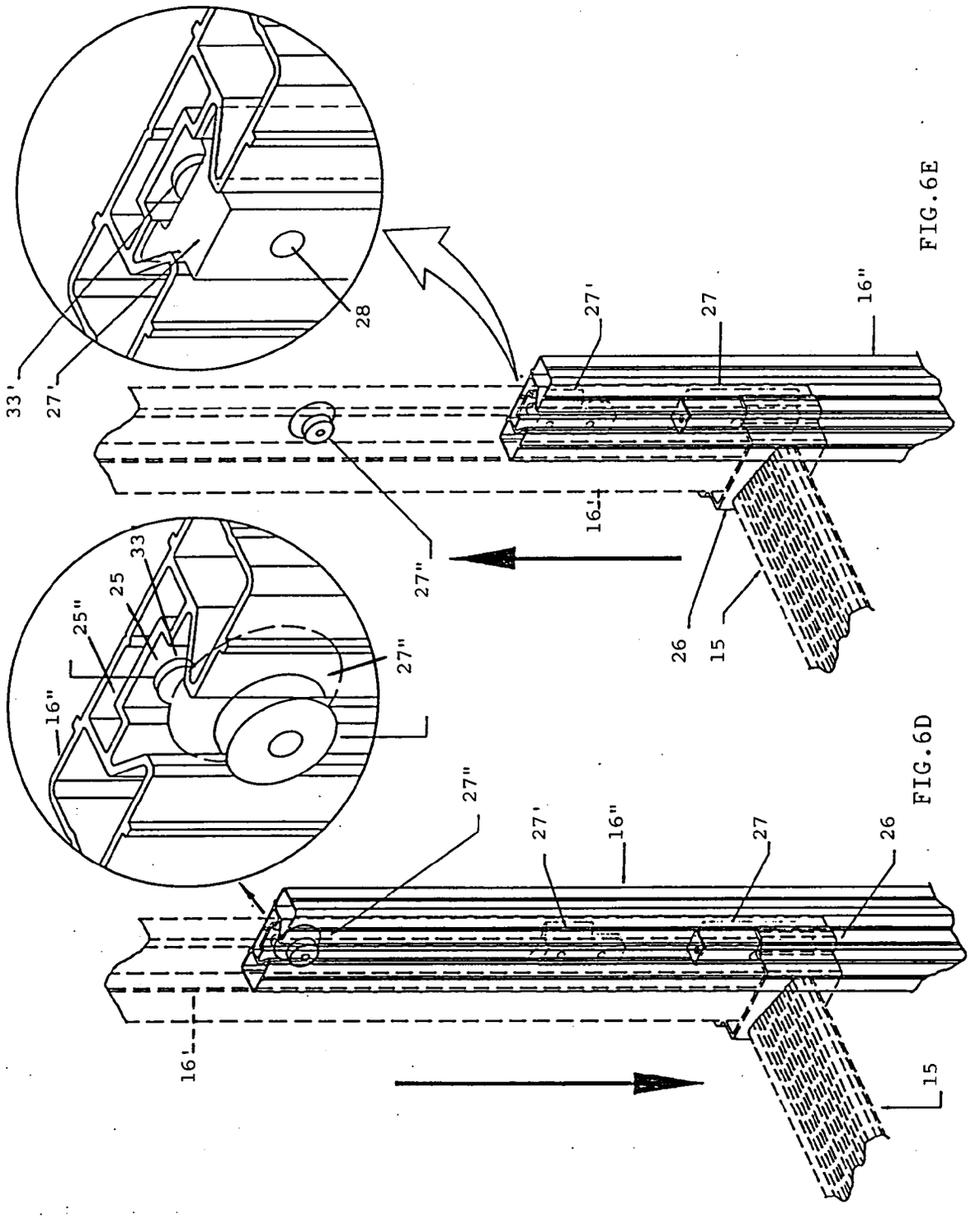


FIG.6C


33'
27'
28
27'
27
16"
16'
27"
26
15
FIG.6E
25"
25
33
16"
27"
27"
27'
16"
27
26
16'
15
FIG.6D

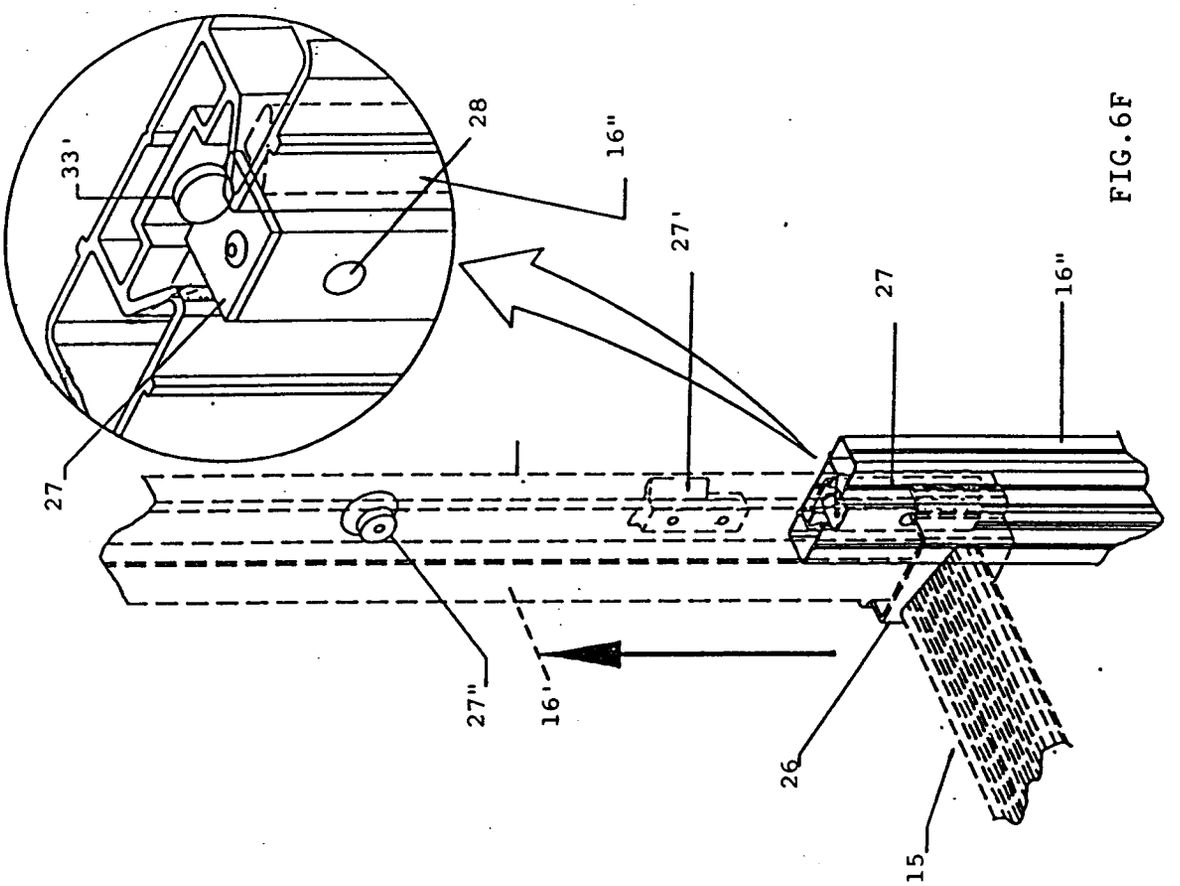


FIG.6F

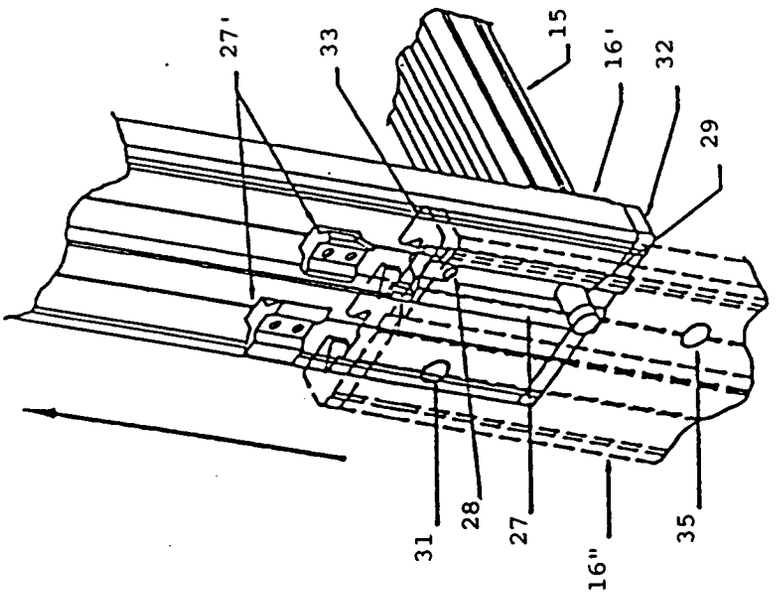


FIG.7B

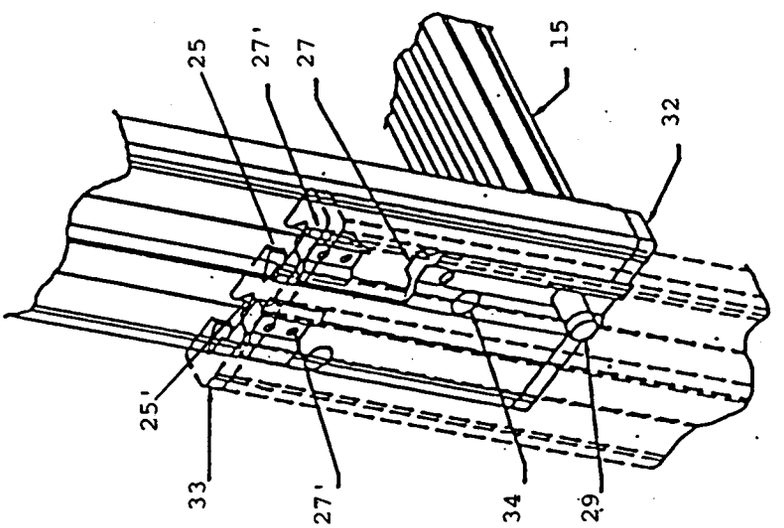


FIG.7A

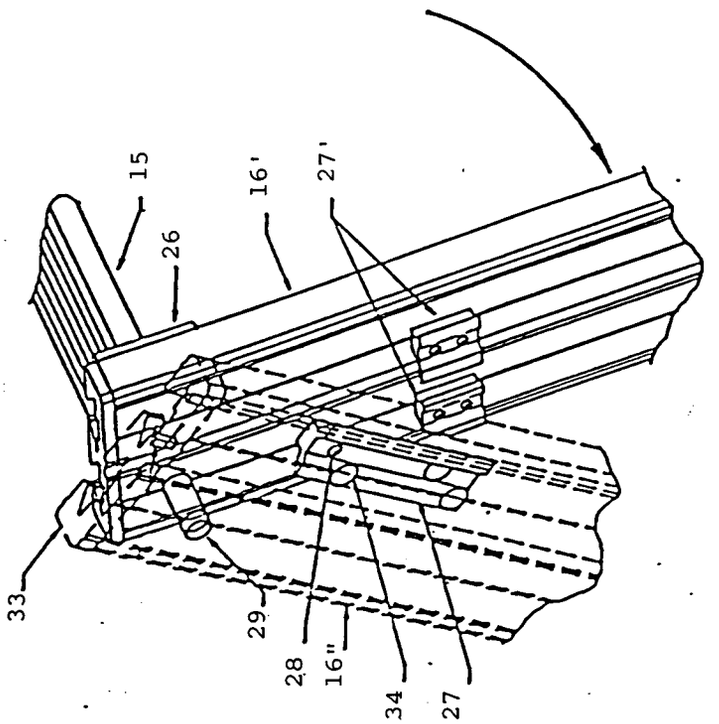


FIG.7C

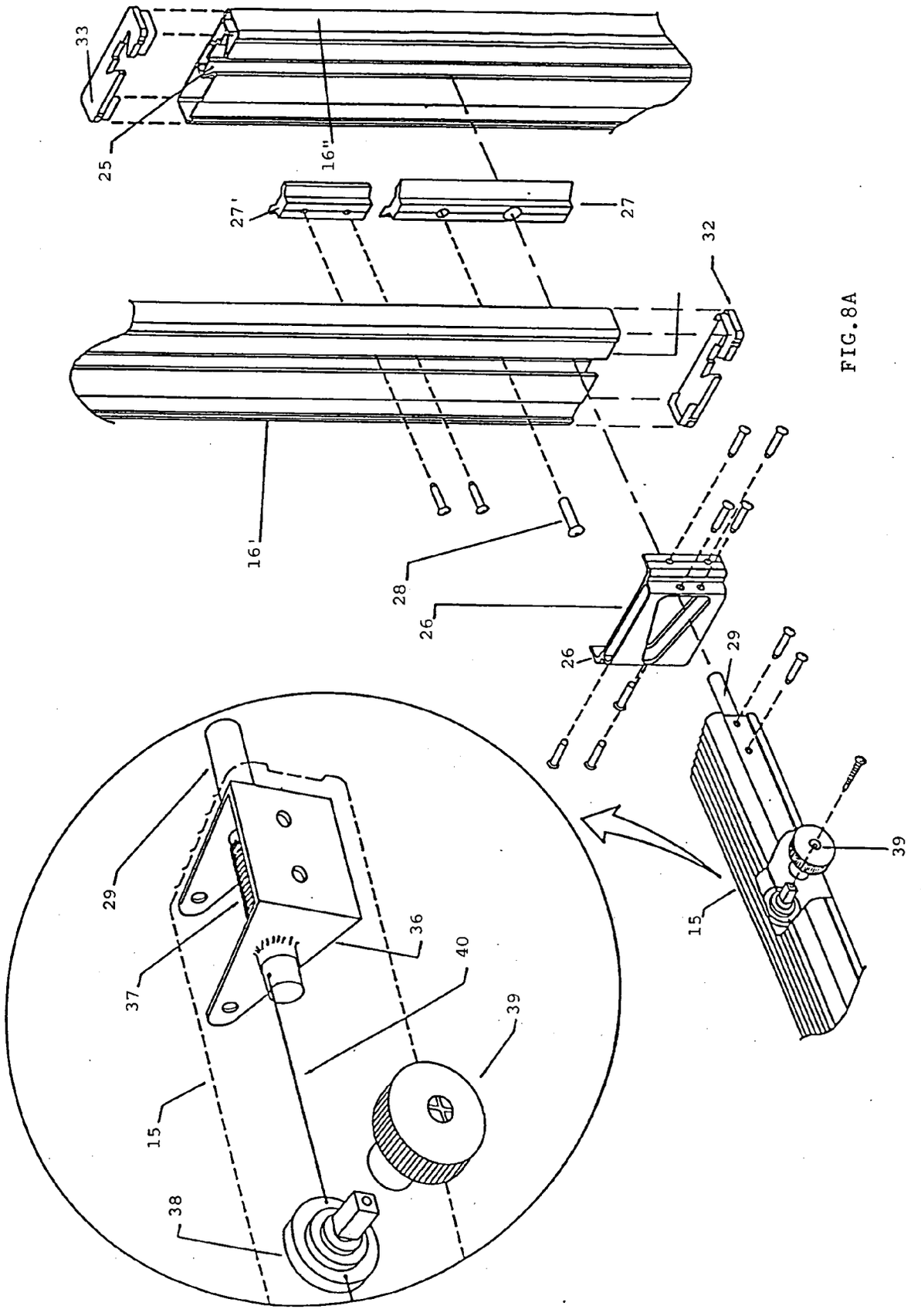


FIG.8A

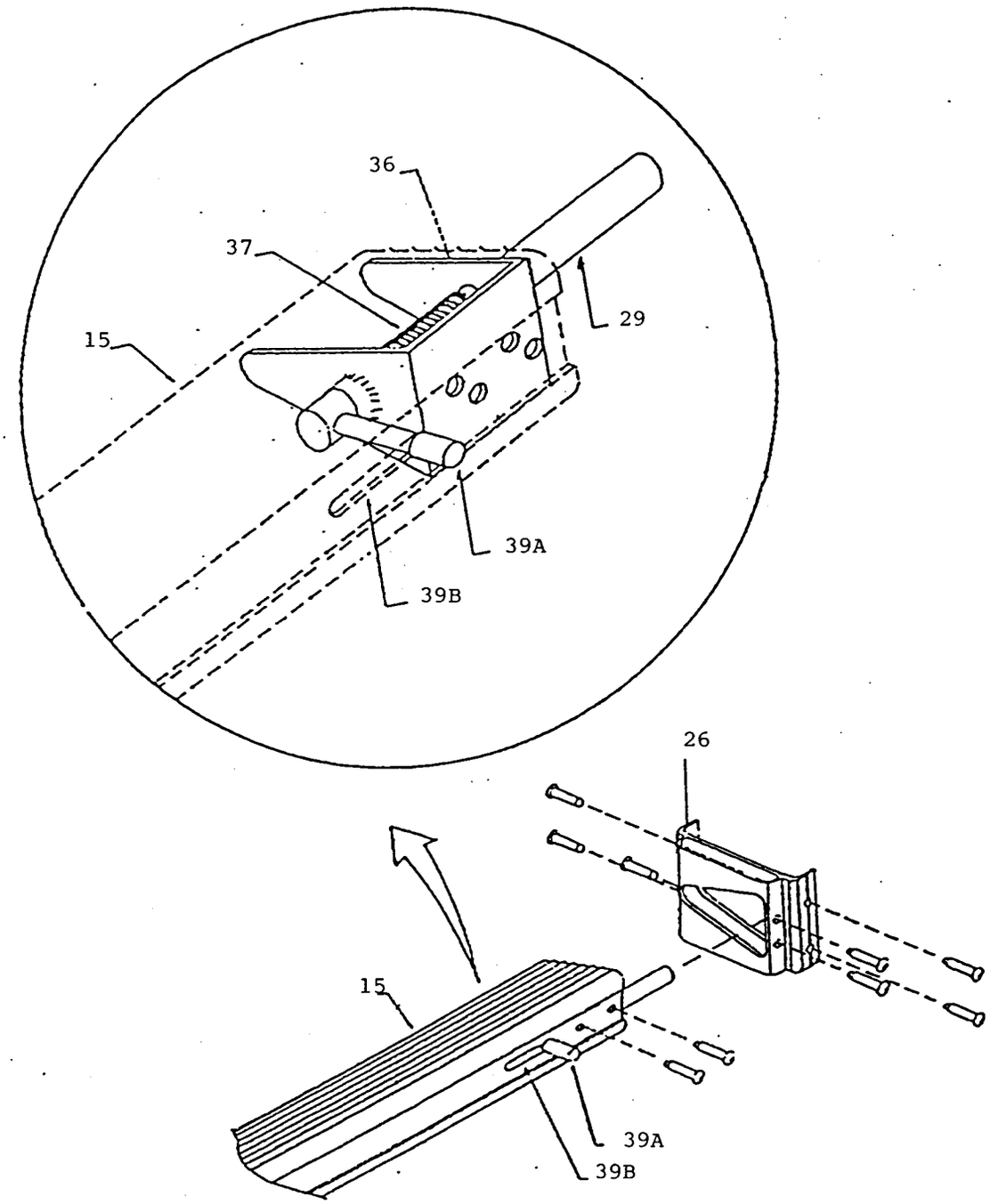


FIG.8B

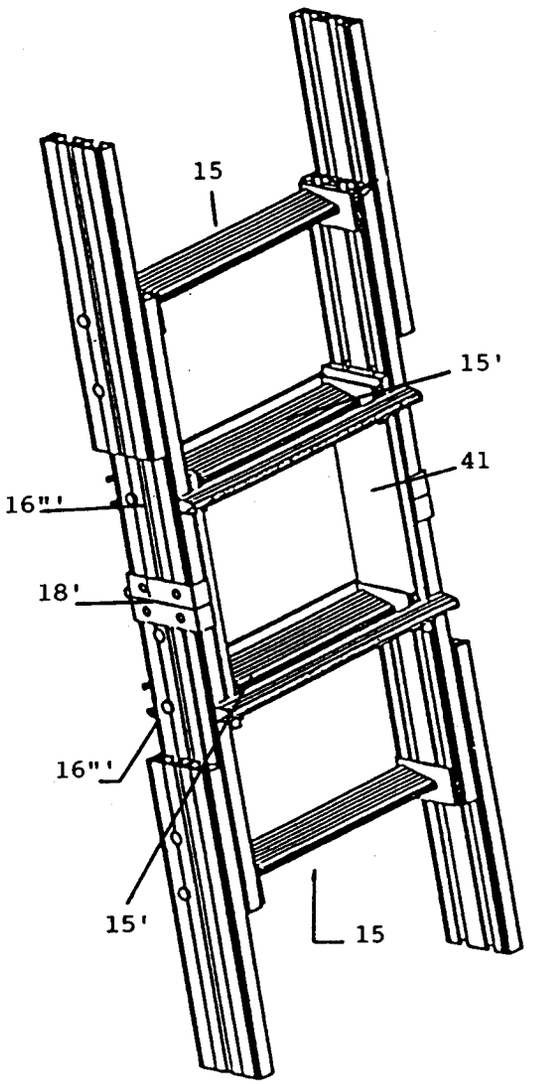

15
15'
41
16"'
18'
16"'
15'
15

FIG.9A

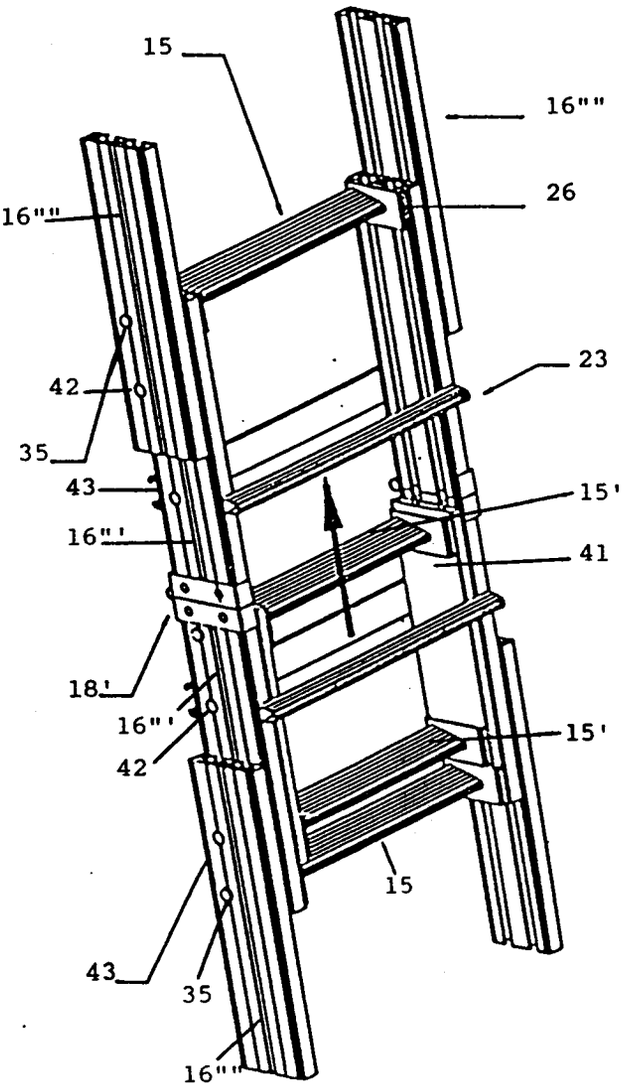

15
16""
26
16""
23
42
35
43
15'
16"'
41
18'
16"'
15'
42
15
43
35
16""

FIG.9B

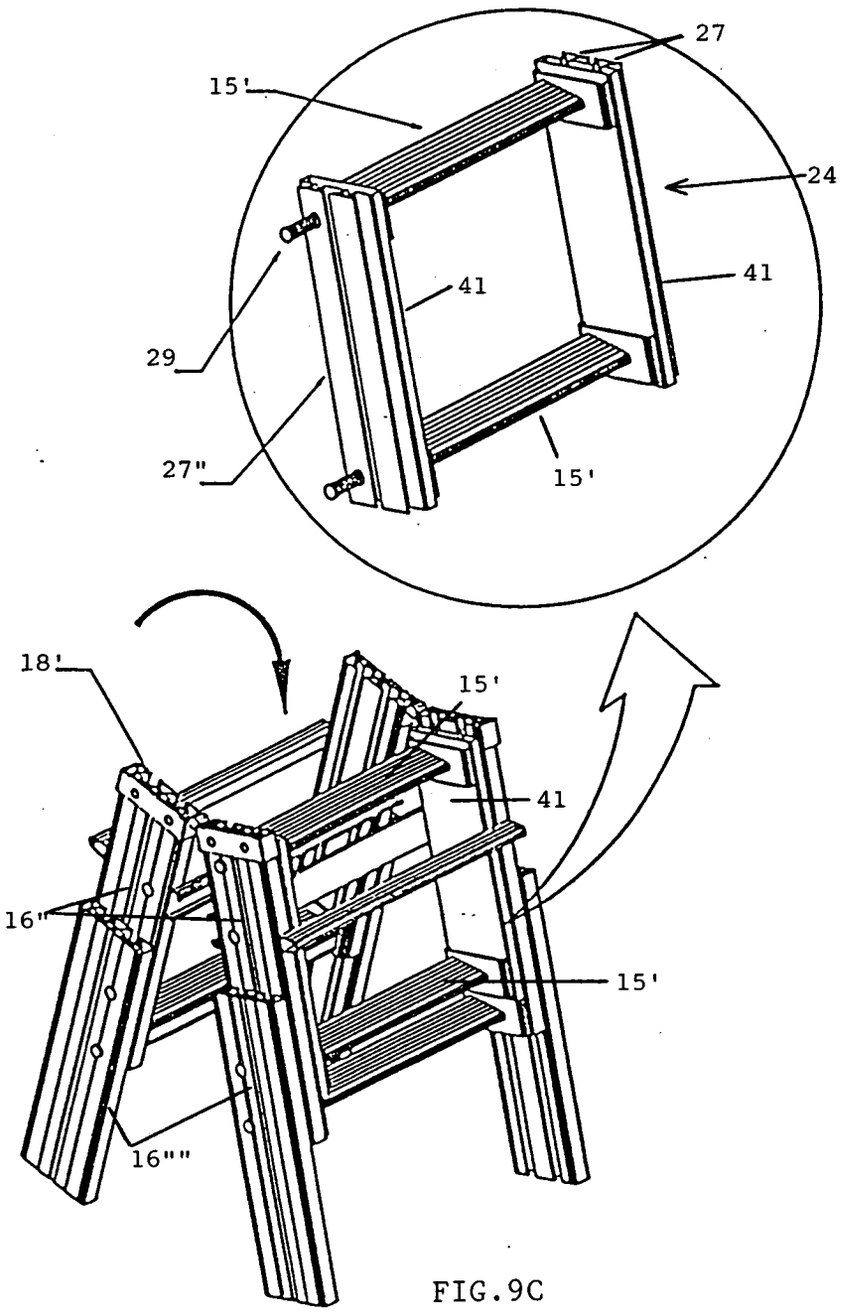


FIG.9C

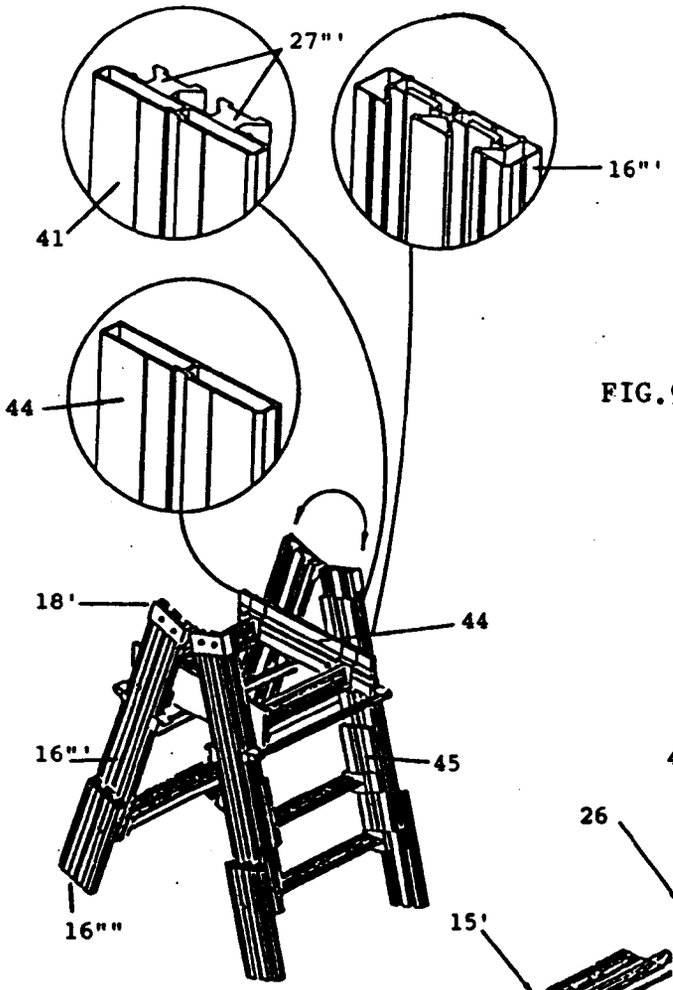


FIG.9D

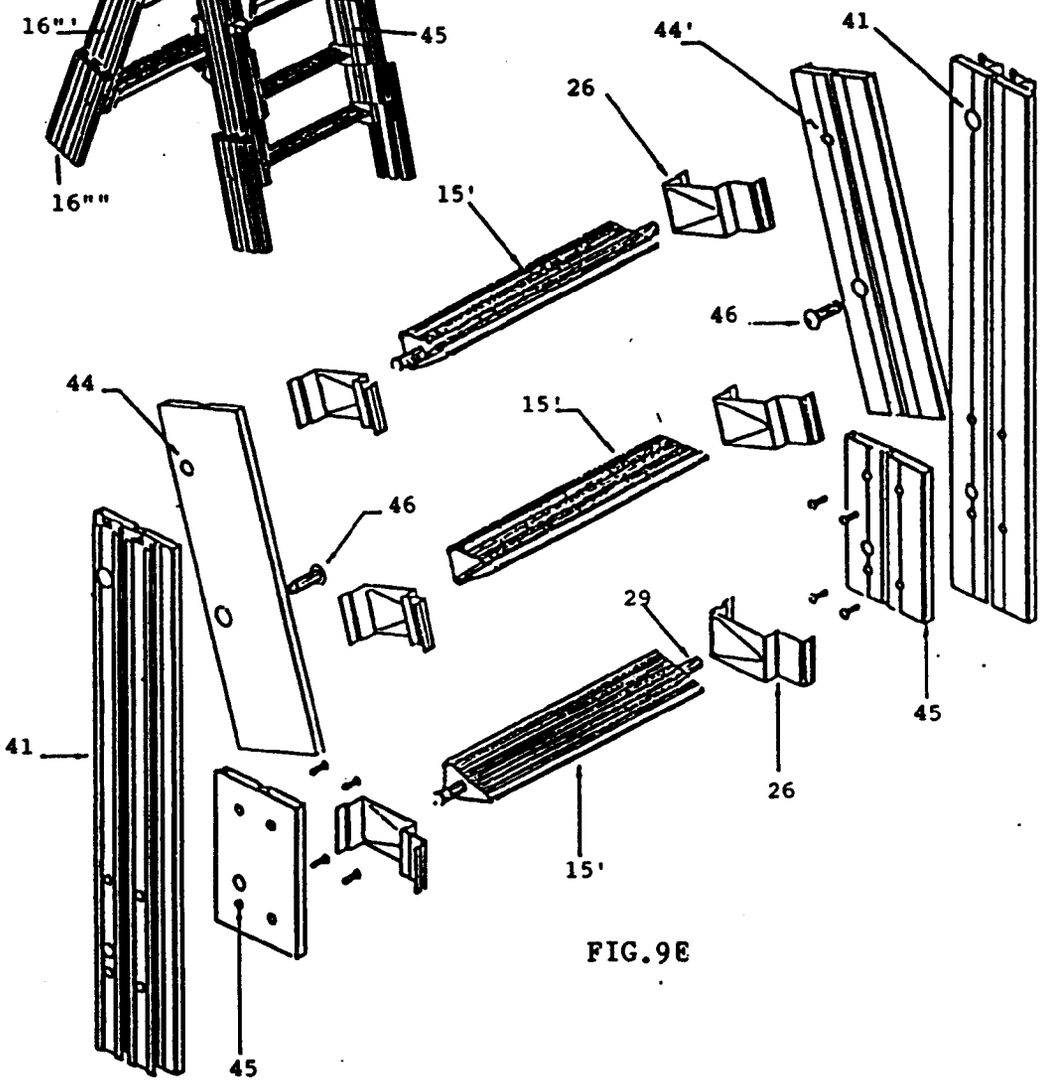


FIG.9E

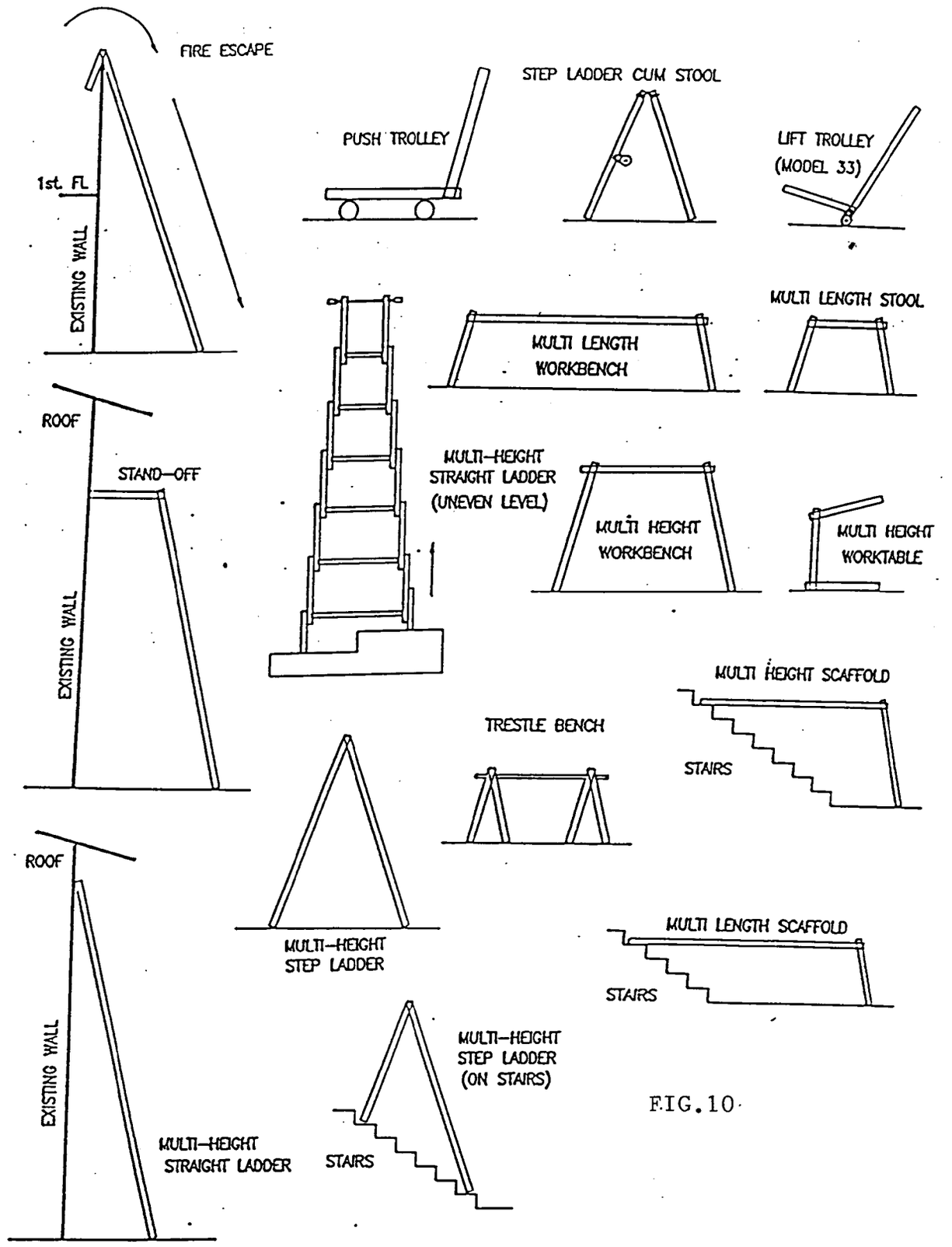

FIRE ESCAPE
1st. FL
EXISTING WALL
PUSH TROLLEY
STEP LADDER CUM STOOL
LIFT TROLLEY
(MODEL 33)
MULTI LENGTH STOOL
MULTI LENGTH
WORKBENCH
ROOF
STAND-OFF
EXISTING WALL
MULTI-HEIGHT
STRAIGHT LADDER
(UNEVEN LEVEL)
MULTI HEIGHT
WORKBENCH
MULTI HEIGHT
WORKTABLE
MULTI HEIGHT SCAFFOLD
STAIRS
TRESTLE BENCH
ROOF
MULTI-HEIGHT
STEP LADDER
MULTI LENGTH SCAFFOLD
STAIRS
EXISTING WALL
MULTI-HEIGHT
STEP LADDER
(ON STAIRS)
MULTI-HEIGHT
STRAIGHT LADDER
STAIRS

FIG.10

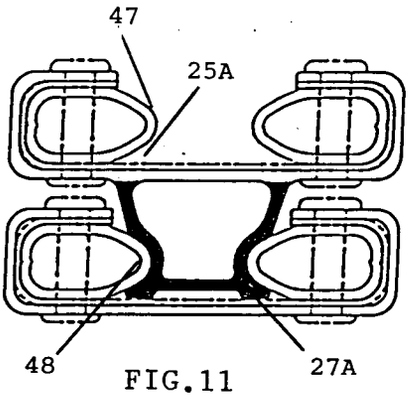


FIG.11

FIG.12A

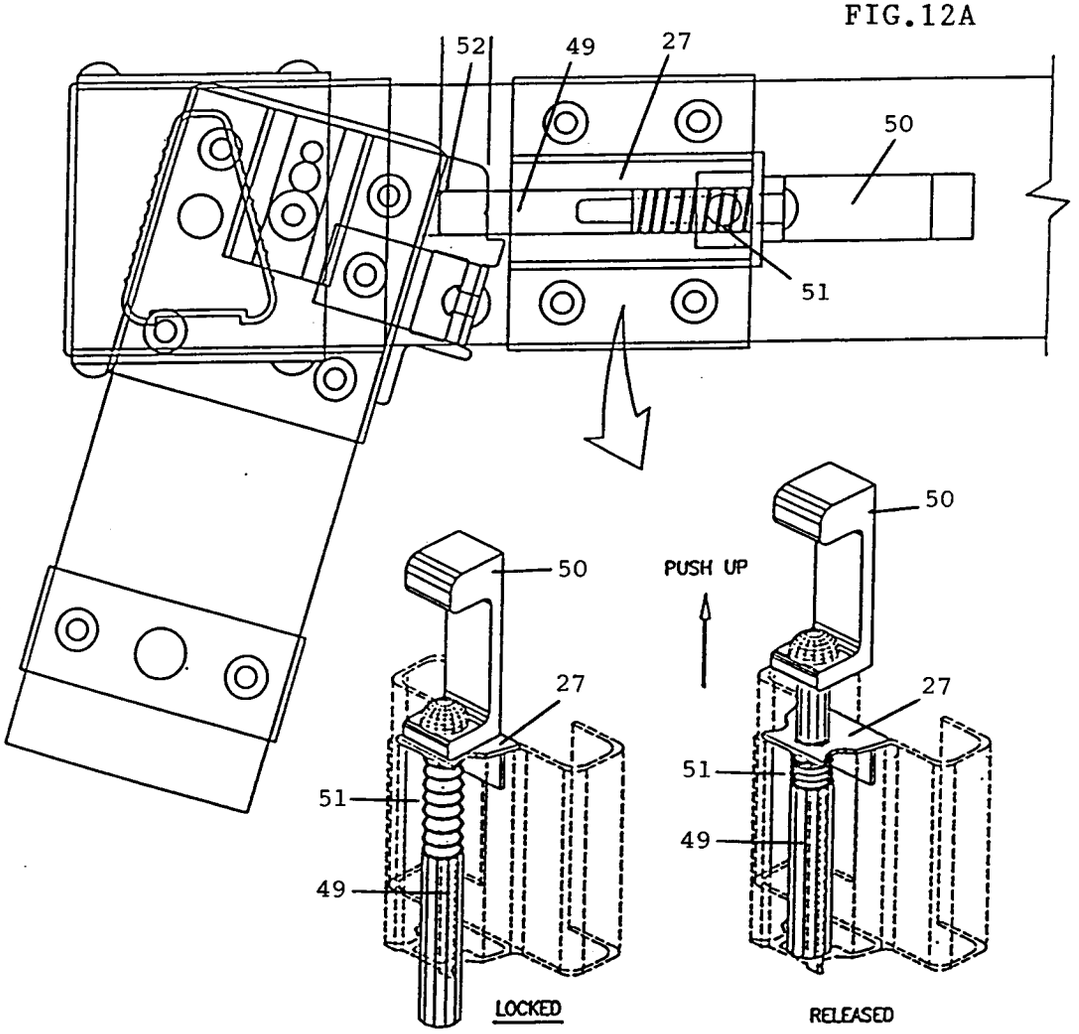
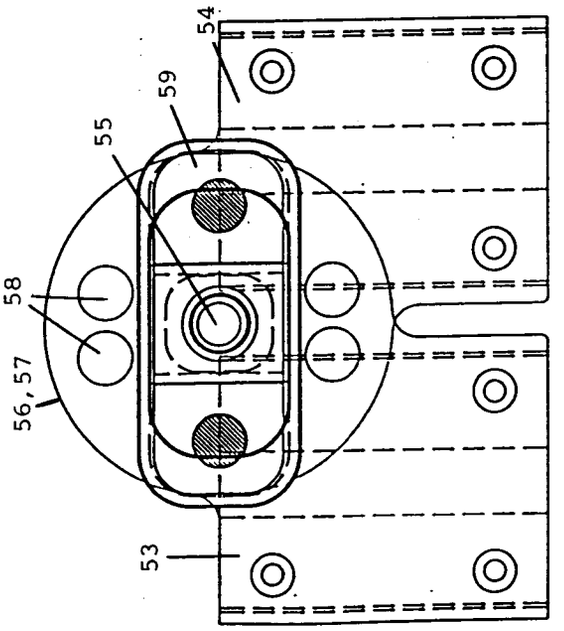


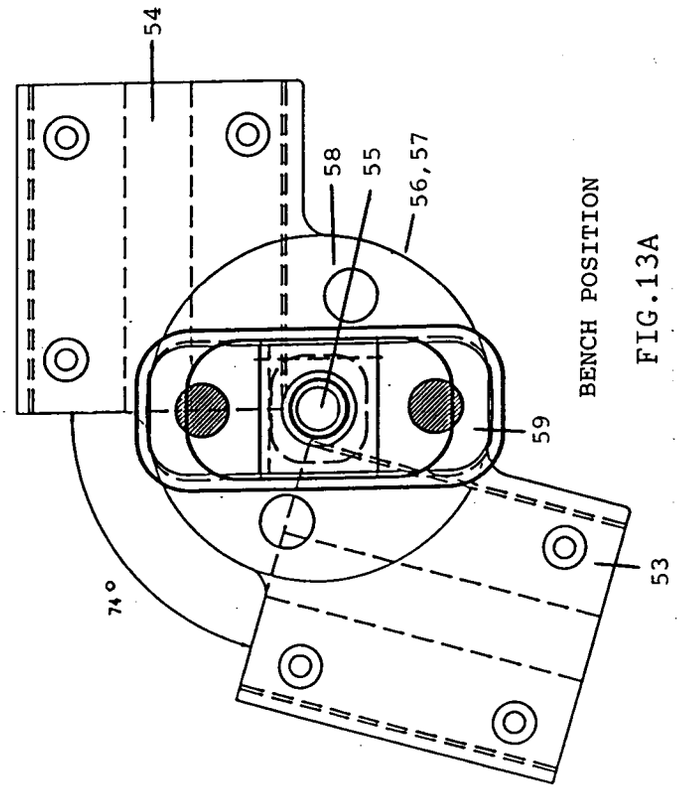
FIG.12B

FIG.12C



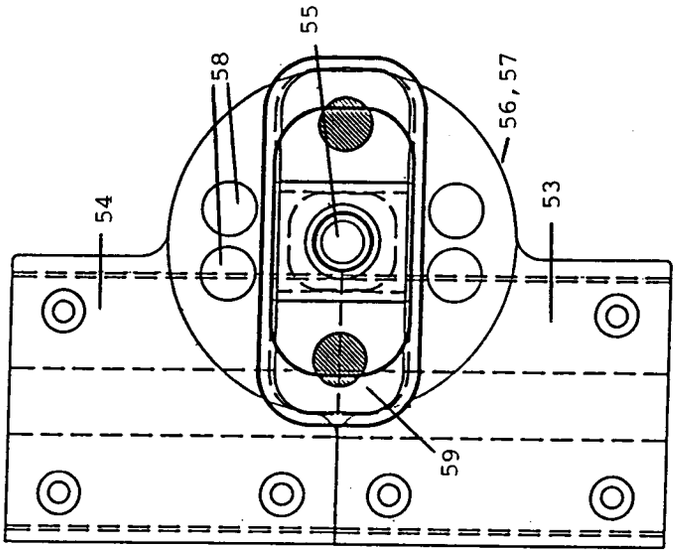
FOLDING POSITION FOR CARRYING

FIG.13B



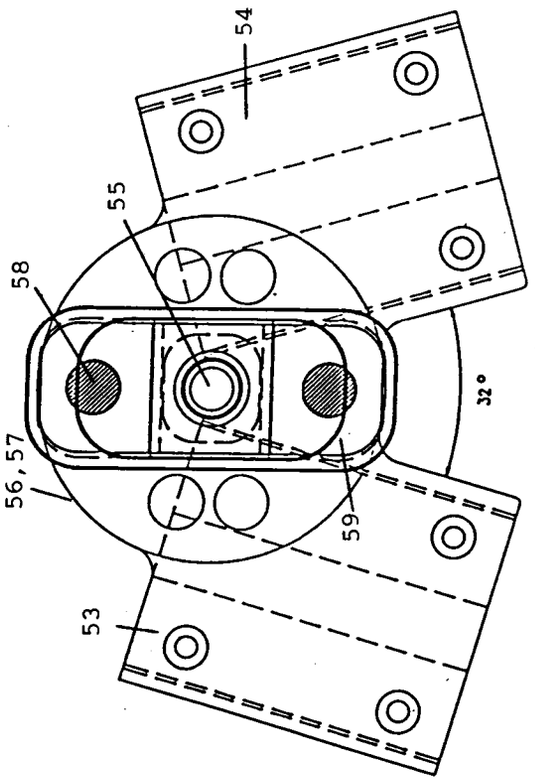
BENCH POSITION

FIG.13A



LEAN-ON LADDER POSITION

FIG.13D



STEP-LADDER POSITION

FIG.13C

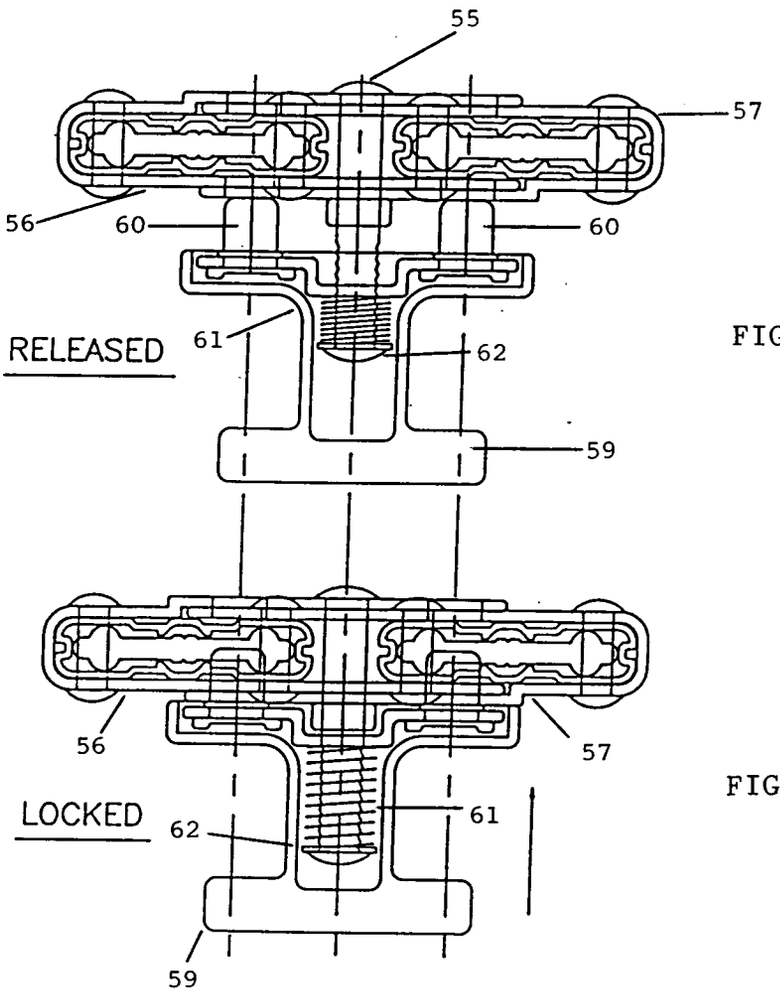


FIG.13E

FIG.13F

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 9062

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US-A-5 062 499 (TU) * the whole document * ---	1 2,8,10, 13,14	E06C1/12 E06C1/22 E06C1/32 E06C1/39
X Y	US-A-1 337 666 (REMALIA) * page 1, line 64 - page 2, line 10 * * page 2, line 23 - page 2, line 54 * * figures 1-6 * ---	1,12 2-6,8,13	
Y A	US-A-2 836 337 (THOMAS) * column 2, line 25 - column 3, line 5 * * column 3, line 32 - column 47 * * figures 1,2,4 * ---	2-6,8,10 7	
Y	FR-A-1 445 477 (CAPGRAS) * page 2, column 2, line 1 - page 2, column 2, line 16 * * figures 1,2,7 * ---	13	
Y	GB-A-2 110 286 (ORBAN) * page 1, line 56 - page 1, line 89 * * figures 1-4 * ---	14	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E06C
A	US-A-3 061 042 (GILES) * column 5, line 19 - column 7, line 7 * * column 21, line 25 - column 21, line 60 * * figures 1-4,22-25 * ---	1,2	
A	US-A-2 827 216 (NAPOLITANO) * figures 1-4,7-11 * ---	1,9,10, 13	
A	DE-A-35 08 042 (YEH) * claim 1; figures 1-6 * ---	11	
	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 March 1995	Hendrickx, X

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 9062

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 000 848 (MANUFACTURE D'ARMES ET CYCLES DE CHATELLERAULT) * abstract; figures 1-8 * -----	17,18	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 March 1995	Hendrickx, X

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)