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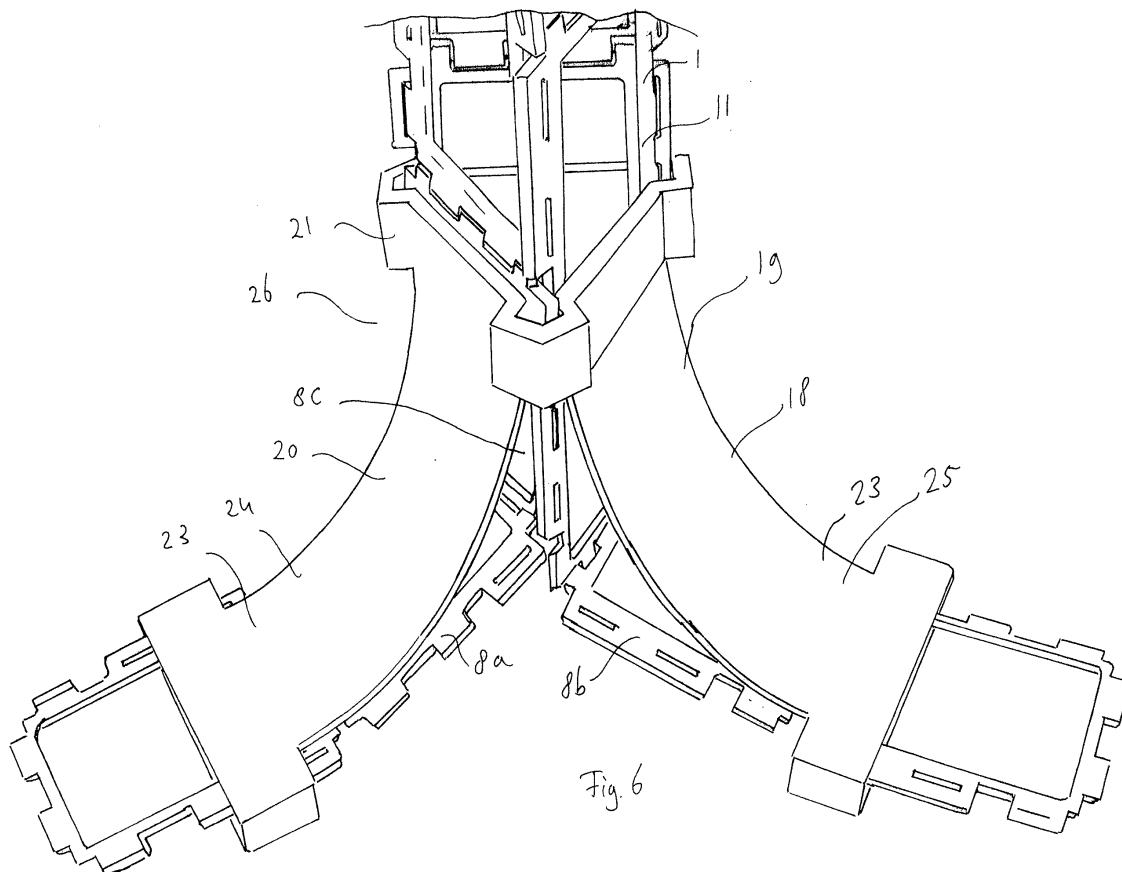
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(54) **APPARATUS EXTENSIBLE AND SHORTENABLE TO A MAST OR SUPPORT**

(57) Apparatus extensible and shortenable to a mast or support with frame- or plate-shaped segments (1) having at a bottom edge and upper edge connecting means for the linking of the segments to a chain (8a, 8b, 8c) with

at the side edges connecting means for a releasable horizontal link of the segments into a tube having in cross-section a triangular, respectively quadrangular, pentagonal or polygonal form.



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Description

[0001] The present invention relates to an apparatus extensible and shortenable to a mast or support.

[0002] Such an apparatus is known and is used as lifting device.

[0003] The U.S. Patent number 4,875,660 describes an apparatus in the form of a telescopic tube that is used as lifting device and which is constructed from two continuous strips of spring steel that are wrapped into an helix. In a withdrawn position the strips lie flat against each other. In a pulled out position the one strip fills up the space in the other strip. A mechanism takes care of the drawing in and pulling out of the apparatus. This apparatus is used for the supporting and lifting of a floor during a theatre presentation.

[0004] It is an object of the invention to provide an improved apparatus.

[0005] The apparatus according to the invention to that end is characterized, in that this comprises a number of frame- or plate-shaped segments, each having a left side edge, a right side edge, a bottom edge and an upper edge, whereby the bottom and upper edge are provided with connecting means for the formation of a releasable or fixed vertical link of the upper edge of the one segment to the bottom edge of the other segment, such that a number of at least two segments is or can be formed into a chain, whereby the side edges of the segments are provided with connecting means for the formation of a releasable horizontal link of the left side edge of the one segment to the right side edge of an adjacent other segment, such, that a number of at least three, respectively four, five or more segments can be joined into a tube having an in cross-section substantially triangular, respectively quadrangular, pentagonal or polygonal form, whereby means are provided by which the horizontal link between the segments can be brought about and can be undone.

[0006] According to a characteristic of the apparatus according to the invention the connecting means for the formation of the fixed vertical link are formed by one or more hinges, such that the segments can be linked into a chain that is foldable or rollable along the hinges.

[0007] According to a further characteristic of the apparatus according to the invention the connecting means for the formation of the releasable vertical link are formed by one or more dovetail connections.

[0008] According to another characteristic of the apparatus according to the invention the connecting means for the formation of the releasable horizontal link are formed by one or more slots and one or more lips, such that a slot being provided in to the one segment can take in a lip being provided to an adjacent segment.

[0009] According to another further characteristic of the apparatus according to the invention the means, by which the horizontal link between the segments can be brought about and can be undone, are formed by a drive station, provided with a vertically mounted hollow lead-

through for the segments, which hollow lead-through comprises:

a middle part in a form running narrower from below to above,

an upper part for the upwards feeding out and downwards feeding in of segments that have been linked into a tube, and

a lower part that runs out downwards radially in at least three or more guides, whereby each guide is intended to take up and guide one chain of segments, whereby drive means are provided for the moving from out of the guides upwards towards the middle and upper part, or for moving from the upper and middle part downwards back towards the guides, of the chains of segments, whereby the internal form of the middle part is adapted to the shape of the segments, such that the chains of segments in the course of their movement upwards are moved or forced with their side edges towards each other and the lips of the one segment insert into the slots of the other segment.

[0010] According to yet another characteristic of the apparatus according to the invention the drive means are formed by gear drives provided in the drive station which co-operate with rack-and-pinion profiles provided in the segments.

[0011] According to another characteristic of the apparatus according to the invention the chains are positioned relative to each other in the guides in such a way, that at the coming about of the horizontal link the segments are linked to each other a portion of the height shifted. The manner in which these are shifted in height is dependant on the number of segments out of which the tube is put together. Like this, with a tube formed out of three segments, with an in cross section triangular shape, the segments every time will be linked to each other a third of the height shifted. With a shaft formed out of four segments, with an in cross section quadrangular shape, the segments accordingly every time will be linked to each other a fourth of the height shifted.

Figure 1a shows a top view of an example of an embodiment of a segment for application in the apparatus according to the invention.

Figure 1b shows a section of the segment according to figure 1a according to the line I-I.

Figure 2a shows a bottom view of the segment shown in figure 1a.

Figure 2b shows a section of the segment according to figure 2a according to the line II-II.

Figure 3 shows a top view of segments that have been hingedly connected to each other and make up a chain.

Figure 4 shows a top view of three, not yet horizontally linked, chains of segments, placed next to each other.

Figure 5 shows a perspective view of a part of a tube consisting of horizontally and vertically linked segments.

Figure 6 shows a perspective view of a drive station with three guides with in each a chain of segments. Figure 7a shows a top view of a further example of an embodiment of a segment for application in the apparatus according to the invention.

Figure 7b shows a side view of the segment according to figure 7a.

Figure 7c shows a bottom view of the segment according to figure 7a.

The figures 7d and 7e show sections of the segment according to the lines B-B respectively A-A in figure 7a.

Figure 8 shows a perspective view of the segment according to figure 7a.

Figure 9 shows a perspective view of a further example of an embodiment of a drive station according to the invention.

The figures 10a, 10b, 10c, 10d, 10e and 10f show the several steps of the upwards movement of the segments in the drive station.

The figures 11a, 11b, 11c, 11d, 11e and 11f show the several steps of the downwards movement of the segments in the drive station.

[0012] In the figure 1a is shown a top view of a segment 1 for application in the apparatus according to the invention. The segment is made up of a frame 1, with a left side edge 2, a right side edge 3, a bottom edge 4 and an upper edge 5. The bottom edge 4 and upper edge 5 are provided with connecting means 6 for the formation of a fixed vertical link of the upper edge 5 of the one segment 1 to the bottom edge 4 of the other segment 1, and by means of which the segments 1 can be put together into a loose chain 8 that is hingeable around the axles 7, as can be seen in figure 3. The segments 1 further at the side edges 2, 3 are provided with connecting means 9 for the formation of a releasable horizontal link of the left side edge 2 of the one segment to the right side edge 3 of an adjacent segment. In the example of an embodiment shown, and with reference to figure 1a, the connecting means are formed by two lips 14, 15 and a slot 17 that are provided at the left side edge 2, and a lip 16 and two slots 12, 13 that are provided at the right side edge 3. A lip 14, 15, 16 provided on the one segment can insert in a slot 12, 13, 17 provided on to an adjacent segment 1.

In figure 5 is shown how a number of three segments 1a, 1b and 1c in this manner is horizontally linked to each other and form a tube 11 having in cross section a triangular shape. It is possible to put four, five or more segments together in a corresponding manner in to a tube having in that case an in cross section substantially quadrangular, respectively pentagonal or more polygonal form. However, with the, in cross section, triangular shape the angular points can be linked moment free,

while by the putting together a tube comes into being that can offer resistance against bending and torsion.

[0013] In figure 4 three chains 8a, 8b and 8c of vertically linked segments are shown. The chains are, not yet horizontally linked, shown at different heights relative to one another, chain 8a a third of the height shifted with respect to chain 8b, and chain 8b a third of the height shifted with respect to chain 8c. For the bringing about of the horizontal link of the three chains 8a, 8b, 8c in to an, in cross section, triangular tube, as shown in figures 5 and 6, the slots 12 and 13 that are provided at the right side edge 3 of the segment 1a in chain 8a are intended to take in lips 14 and 15 that are provided on to the left side edge of the segment 1b in chain 8b, while the slots 12 and 13 that are provided onto the right side edge 3 of the segment 1b in chain 8b are intended to take in lips 14 and 15 that are provided on to the left side edge of the segment 1c in chain 8c. The lip 16 that is provided in top on to the right side edge 3 of the segment 1a in chain 8a is intended to insert in the slot 17 that is provided at the bottom on to the left side edge of the segment 1b that is linked above the segment 1b in chain 8b.

In the, in cross section, triangular shape, the angular points of the tube can be linked moment free, while by the putting together a tube comes into being that can offer resistance against bending and torsion.

[0014] In figure 6 a drive station 18 is shown by means of which the horizontal link between the segments 1 can be brought about and can be undone. The drive station 18 comprises a vertically mounted hollow lead-through 19 for the segments 1. This comprises a middle part 20 in a form running narrower from below to above, an upper part 21 for upwards feeding out and downwards feeding in of the segments 1 that have been linked in the middle part 21 into a tube 11, and a lower part 23 that runs out downwards radially in three guides 24, 25 and 26. Each guide 24, 25, 26 is intended to take up and guide one chain 8a, 8b or 8c of segments 1. There are provided drive means (not shown in the drawing) for the moving of the chains from the three sides from out of the guides 23, 24 and 25 towards the middle part 20. The internal shape of the middle part 20 is adapted to the shape of the segments 1, such that the three chains 8a, 8b, 8c of segments in the course of their movement upwards are moved or forced with their side edges towards each other, and the lips 14, 15 respectively 16 of a segment in the one chain insert into the slots 12 and 13 respectively 17 of segments in the both chains located on either side. To that end the lips are provided on their outer end with a lip part 14a, 15a, 16a sloping along an angle of 30 degrees (figures 1, 2 and 3), while the inner side of the slots is provided with a corresponding slot part 12a, 13a, 17a sloping along an angle of 30 degrees. With this is attained a good fit and confinement of the lip in the accessory slot.

[0015] Each segment in a chain is connected at each of its side edges to two other segments, by means of which these are secured against outwards movement. The vertical force in the tube and the sides of the tube is

transmitted, not only by the hinge connection, but also because the lips fall into the slots. The segments of the tube each engage into each other one third of the height shifted.

[0016] The positioning of the lips and slots to the side edges of a segment is chosen such, that during the the horizontal link to each other the segments take in the desired shift in height relative to each other.

[0017] The figures 7a to 7f show another embodiment of the segment. The figures show a plates shaped segment 27 having a left side edge 28, a right side edge 29, a bottom edge 30 and a top edge 31. The bottom edge 30 and top edge 31 also are provided with hinge connecting means 6, so that the segments can be combined into a chain 8, and ultimately one of the three planes 22a, 22b, 22c of a tube 11, as can be seen in figure 9. The segments 1 are provided at their side edge 28 with a slot 32 and a lip 33, and at their other side edge 29 also are provided with a slot 34 and a lip 35. As can be seen in figure 8 at the top side of the segment two rack-and-pinion profiles 37 are provided.

[0018] Figure 9 shows an embodiment of a drive station 18 for a chain built up by these segments, with also a vertically mounted hollow lead-through 19 for the segments 1, with a middle part 20 having a form running narrower from below to above, an upper part 21 for the upwards feeding out of the segments 1 linked to a tube 11, and a lower part 23 that runs out downwards radially in three guides 24, 25 and 26. Each guide 24, 25, 26 is intended to take up and guide one chain 8a, 8b or 8c of segments 1.

Also here the internal shape of the middle part 20 is adapted to the shape of the segments 1, such that the three chains 8a, 8b, 8c of segments in the course of their movement upwards are moved or forced with their side edges 28, 29 towards each other, and the lip 35 inserts into the slot 32 of an adjacent segment and the lip 33 inserts into the slot 34 of a segment adjacent on the other side in the both chains located on either side. In this manner a segment at its one side 28 is connected to two other segments located adjacent that side, and also at the other side 29 is connected to two other segments located adjacent that side. Taking an, in cross section, triangular or threeplanar tube form a segment therein is linked to four other segments.

[0019] In the lead-through drives are provided that cooperate with rack-and-pinion profiles 37 provided in the segments. To that end in the guide 24, 25, 26 above the paths of movement of the chains 8a, 8b, 8c, there are provided axles 38 that run perpendicular to the direction of movement thereof, with gear wheels 36 that engage into the rack- and-pinion profiles 37 provided onto the segments. During the movement upwards of the segments 1 in the direction of the middle part 20 the segments are moved or lifted from a substantially lying position into a more or less inclined position by their connection to a segment present above it. By the axle 38 a second axle 43 is driven with a push-out arm 39 by means

of which the segments 1 from out of this sloping position are moved to a standing upwards position in the middle part 20, as is shown in the figures 10a-10f. In this position the horizontal link can take place by means of the inserting of the lips of the one segment into the slots of other segments located on either side thereof.

[0020] The other way around, during the movement downwards from out of the middle part 20 of the segments or chains it is of importance that the segments return from a standing upwards position to a lying or rest position. As can be seen in the figures 11a-11f to that end onto the axle 38 a pulling arm 40 with a take along part 44 is provided that is controlled by a notch 41, that is provided onto the second axle 43, that is driven by the first axle 38. Hereby the upwards standing segment is pulled over to a lying position in the course of the downwards moving of the chain.

[0021] The figures 10a, 10b, 10c, 10d, 10e and 10f show the various steps of the movement upwards of the segments in the drive station.

[0022] The figures 11a, 11b, 11c, 11d, 11e and 11f show the various steps of the movement downwards of the segments in the drive station.

[0023] With the invention an apparatus extensible and shortenable to a mast or support, more in particular an apparatus extensible and shortenable to a tube-shaped profile, is provided, which comes about by means of segments that interlock. After the segments have been interlocked, these constitute the planes of the tube profile. By moving this tube upwards and outwards, respectively downwards and inwards, relative to the drive station, at the same time in turns hinging or folding of the segments in to each other, respectively out of each other, there comes into being a tube becoming longer respectively shorter. This can be applied as hoisting jack, lifting device, and such. This can take place vertically, horizontally or in any desired angle. In this way a long column can be formed from out of a drive station and guides in which the chains of segments lie rolled up. When using separate segments these are stacked.

[0024] By subsequently in turns adding the segments from the three sides or guides to the tube that has been put together, this tube becomes longer and longer. Because of the form-locked manner in which the segments interlock, the chain of segments has to be held together only at the upper part by means of an end coupling piece 42, as can be seen in figure 9. At the bottom side only the outward movement of the lowermost segments has to be countered, by their locking up in the middle part 20 of the drive station 18. The segments in between cannot move away from each other due to the manner in which they engage form-locked in to each other.

[0025] It is possible to use loose segments instead of a chain. These segments are provided with a dovetail by means of which a detachable connection can be formed. The loose segments are then stacked in the guides, and can be linked into each other translating-sliding.

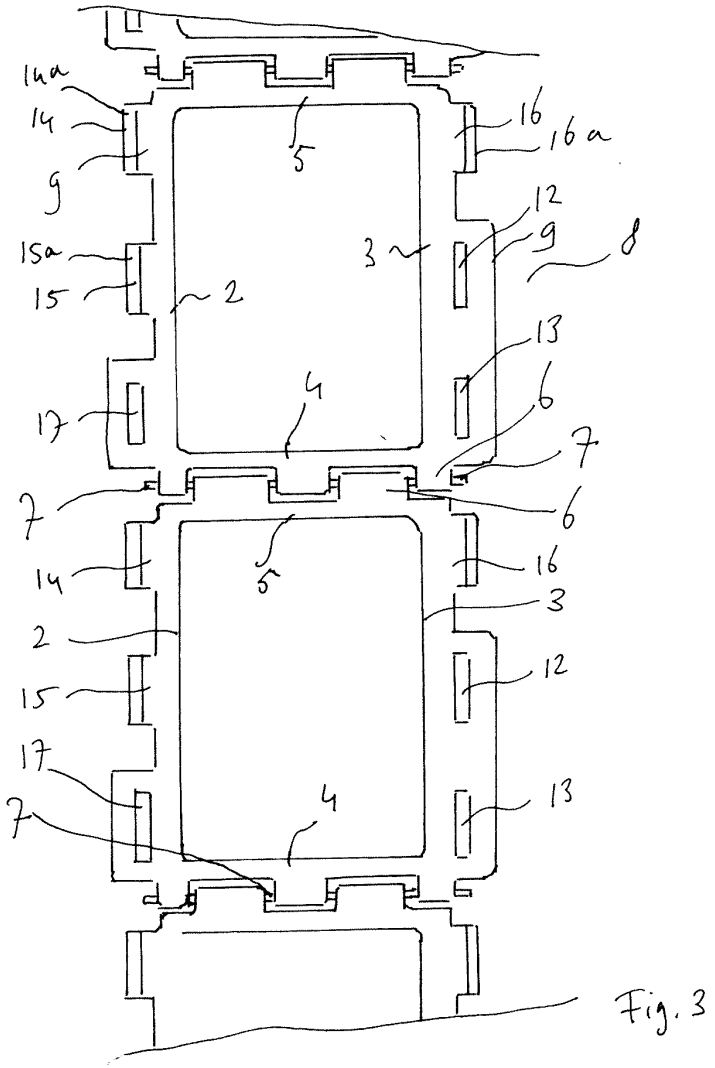
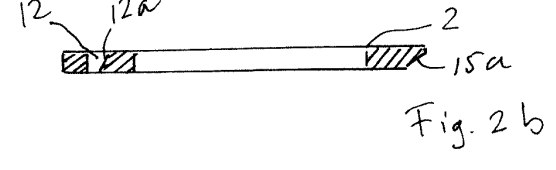
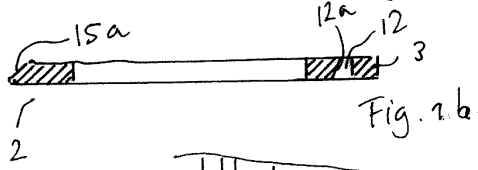
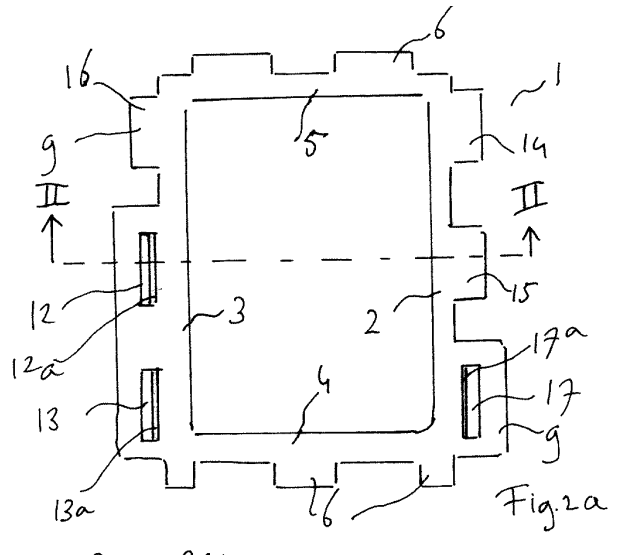
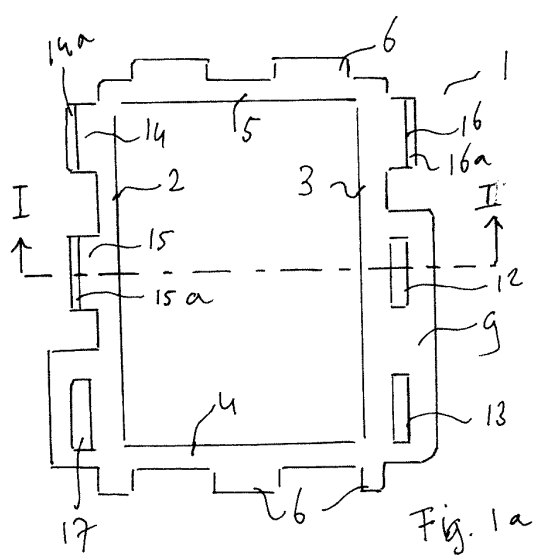
[0026] The embodiment in which the segments are

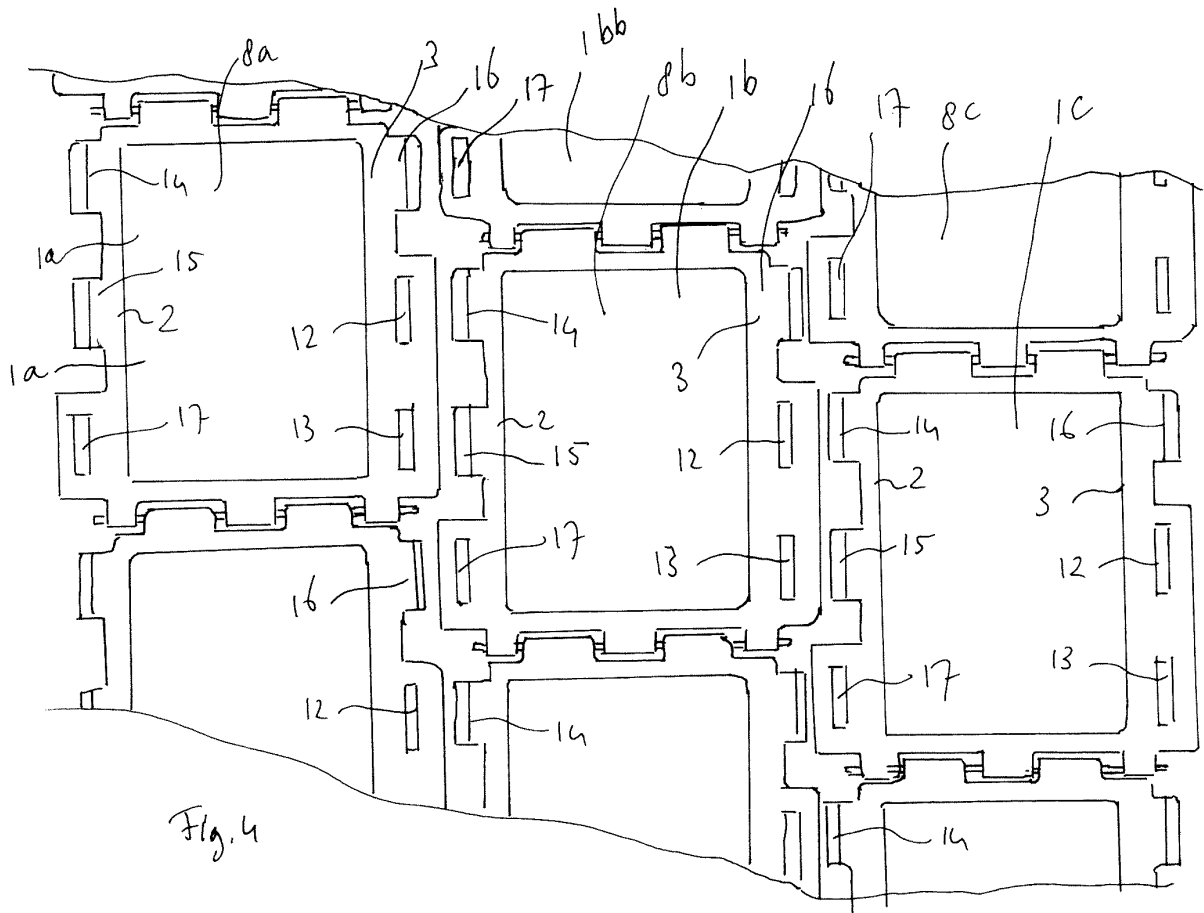
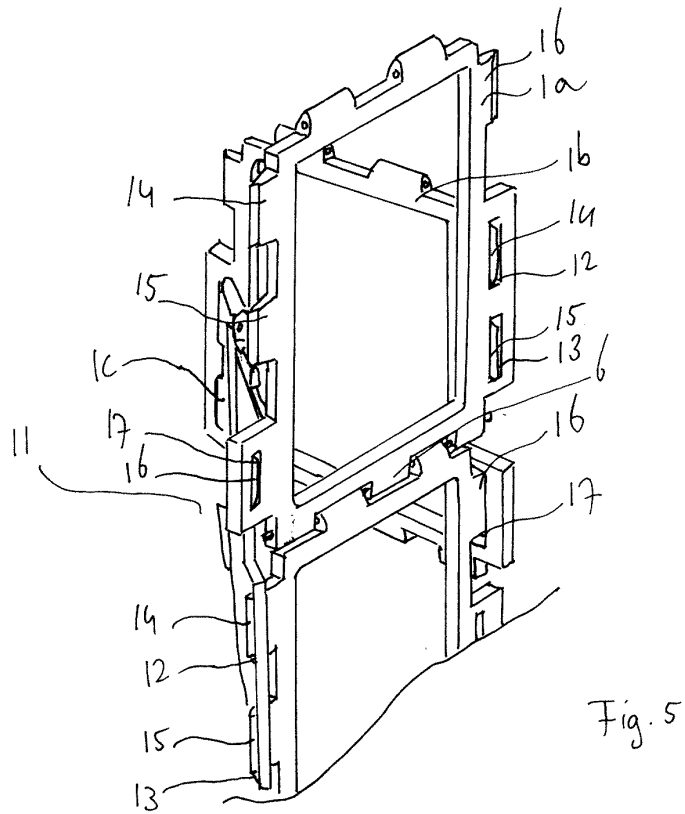
hingedly connected however is preferred because the hinged connection of the segments forms an extra provision against the movement of the segments outwards out of the tube.

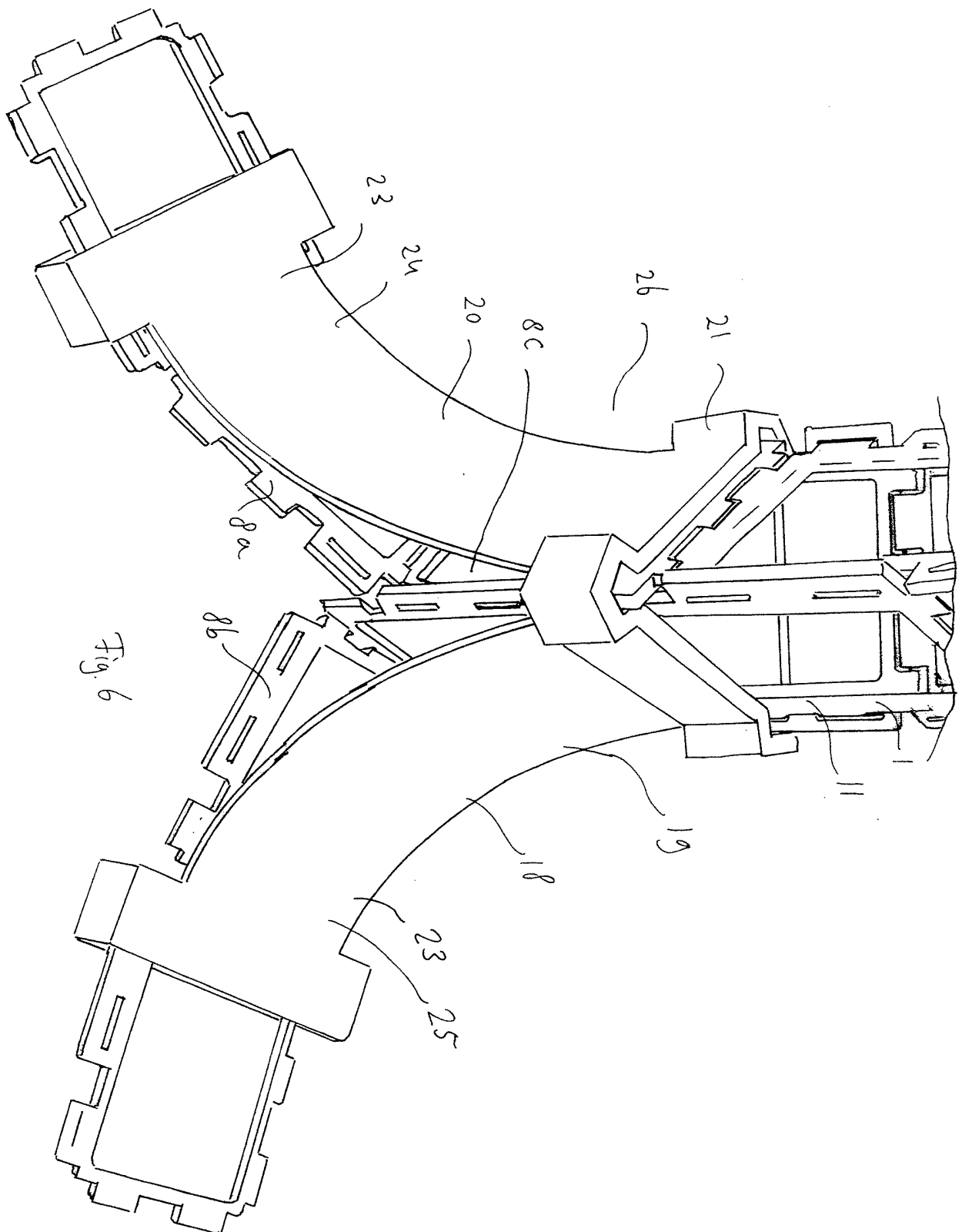
Claims

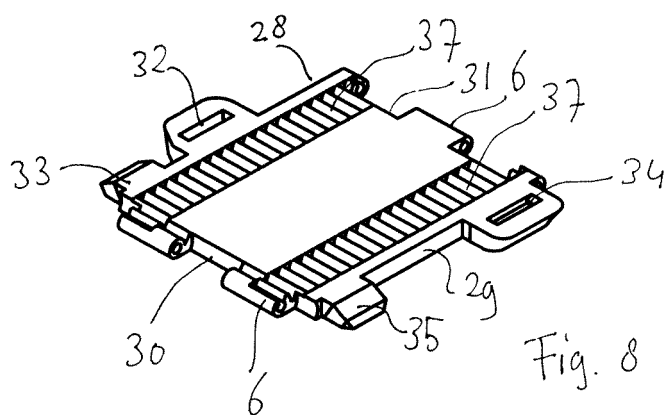
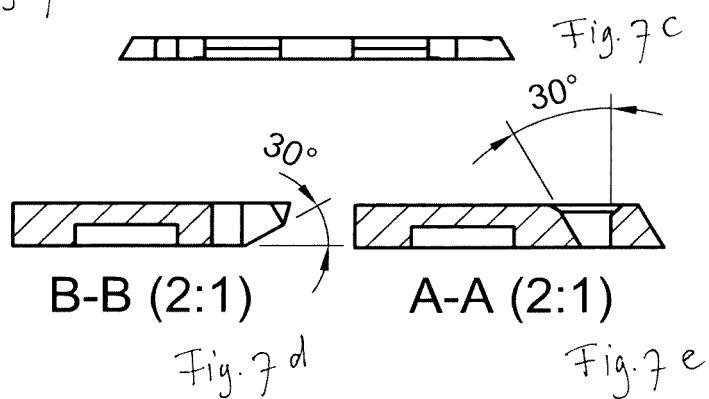
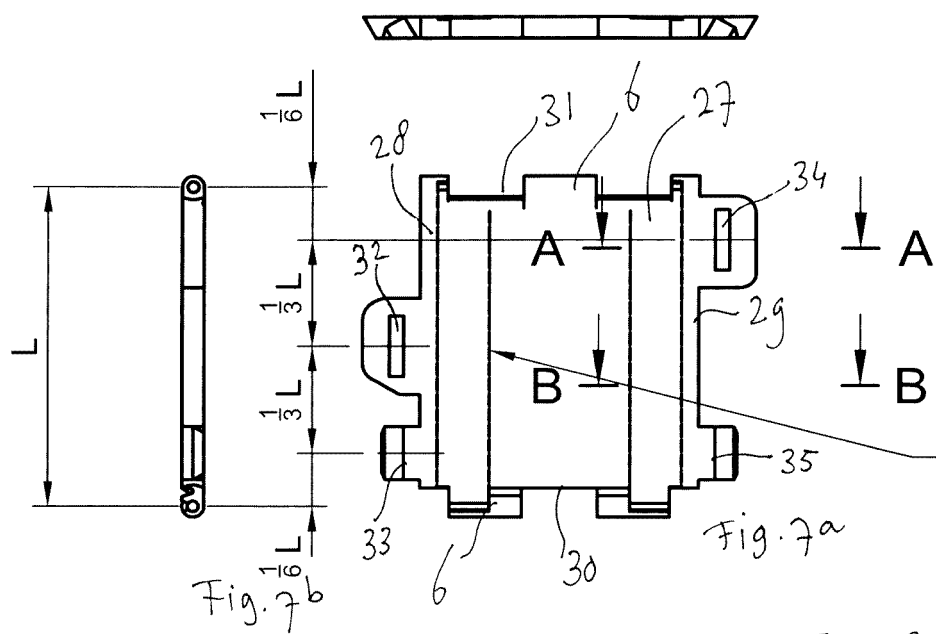
1. Apparatus extensible and shortenable to a mast or support, **characterized in that** this comprises a number of frame- or plate-shaped segments, each having a left side edge, a right side edge, a bottom edge and an upper edge, whereby the bottom and upper edge are provided with connecting means for the formation of a releasable or fixed vertical link of the upper edge of the one segment to the bottom edge of the other segment, such that a number of at least two, three, respectively four, five or more segments is or can be formed into a chain, whereby the side edges of the segments are provided with connecting means for the formation of a releasable horizontal link of the left side edge of the one segment to the right side edge of the other segment, such that a number of at least three, respectively four, five or more segments can be put together into a tube having in cross-section a triangular, respectively quadrangular, pentagonal or polygonal form, whereby means are provided by which the horizontal link between the segments can be brought about and can be undone.
2. Apparatus according to claim 1, **characterized in that** the connecting means for the formation of the fixed vertical link are formed by one or more hinges, such that the segments can be linked into a chain that is foldable or rollable along the hinges.
3. Apparatus according to claim 1, **characterized in that** the connecting means for the formation of the releasable vertical link are formed by one or more dovetail connections.
4. Apparatus according to claim 1, 2 or 3, **characterized in that** the connecting means for the formation of the releasable horizontal link are formed by one or more slots and one or more lips, such that a slot being provided to the one segment can take in a lip being provided to an adjacent other segment.
5. Apparatus according to one of the preceding claims, **characterized in that** the means by which the horizontal link between the segments can be brought about and can be undone are formed by a drive station, provided with a vertically mounted hollow lead-through for the segments, which hollow lead-through comprises:
 - a middle part in a form becoming narrower from below to above,
 - an upper part for the upwards feeding out and downwards feeding in of segments that have been linked into a tube, and
 - a lower part that runs out downwards radially in at least three or more guides, whereby each guide is intended to take up and guide one chain of segments, whereby drive means are provided for the moving from the guides upwards towards the middle and upper part, or for the moving from the upper and middle part downwards back towards the guides, of the chains of segments, whereby the internal form of the middle part is adapted to the shape of the segments, such that the chains of segments in the course of their movement upwards are moved or forced with their side edges towards each other and the lips of the one segment insert into the slots of the other segment.
6. Apparatus according to claim 5, **characterized in that** the drive means are formed by gear drives provided in the drive station which co-operate with rack-and-pinion profiles provided in the segments.
7. Apparatus according to claim 5 or 6, **characterized in that** the chains are positioned relative to each other in the guides in such a way, that on the coming about of the horizontal link the segments are linked to each other a portion of the height shifted.
8. Apparatus according to claim 7, **characterized in that** on the application of three chains of segments these in the horizontal link are linked to each one third of the height shifted.
9. Apparatus according to claim 7 or 8, **characterized in that** the apparatus comprises a drive station with three guides for the formation of a tube having in cross section a substantially triangular shape.
10. Apparatus according to one of the preceding claims, **characterized in that** a segment along one side edge is provided with two lips and below that a slot, while at the other side edge two slots are provided and below that a lip.
11. Apparatus according to one of the claims 1 up to and including 8, **characterized in that** each segment along each side edge is provided with a lip and a slot.

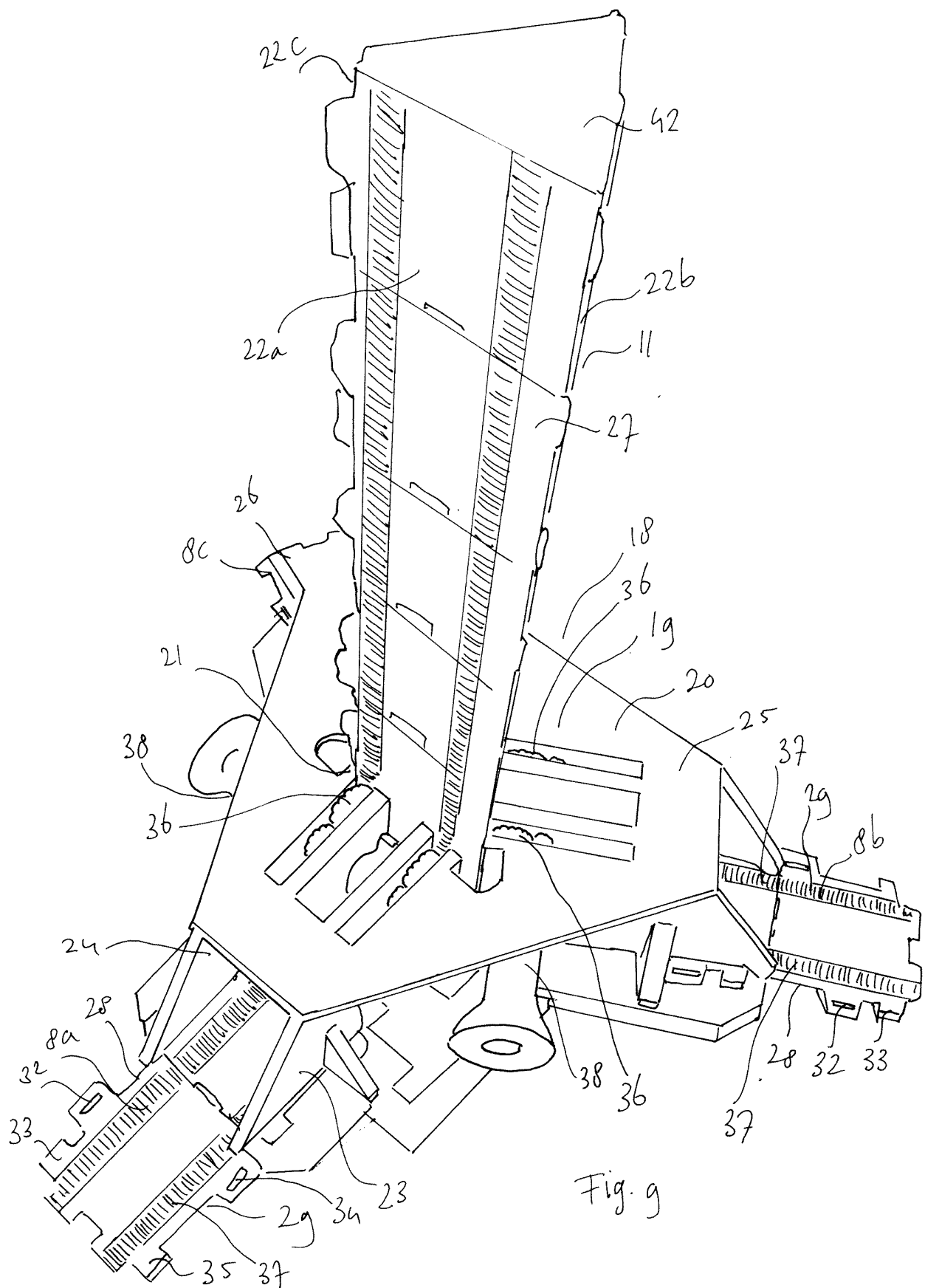
a middle part in a form becoming narrower from

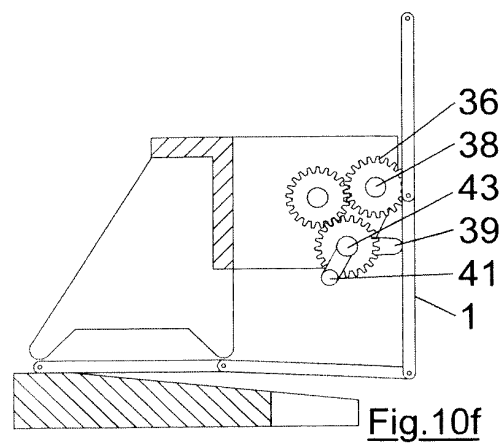
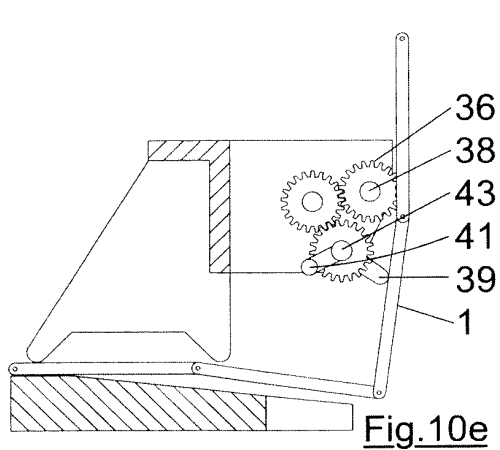
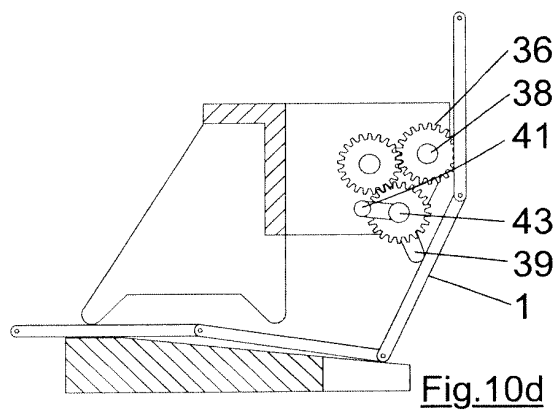
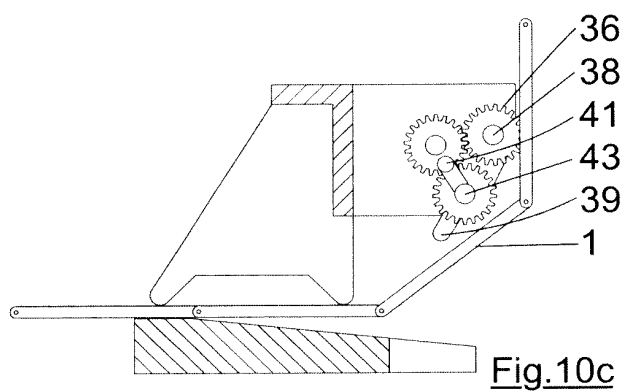
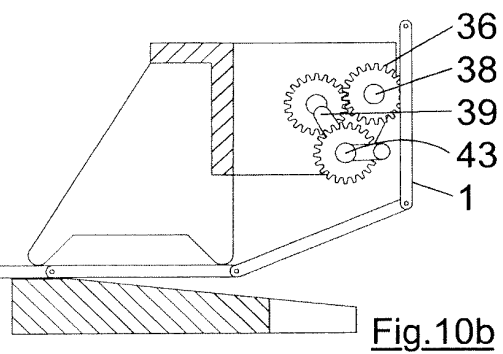
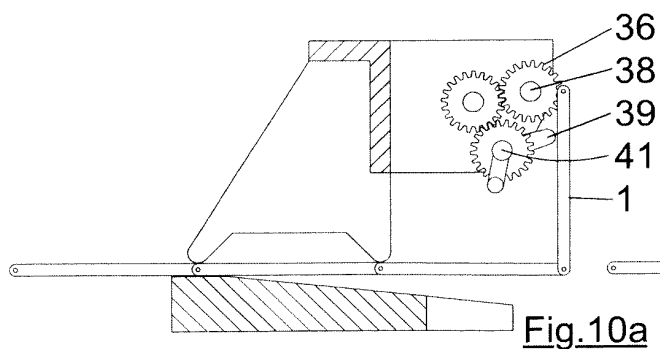












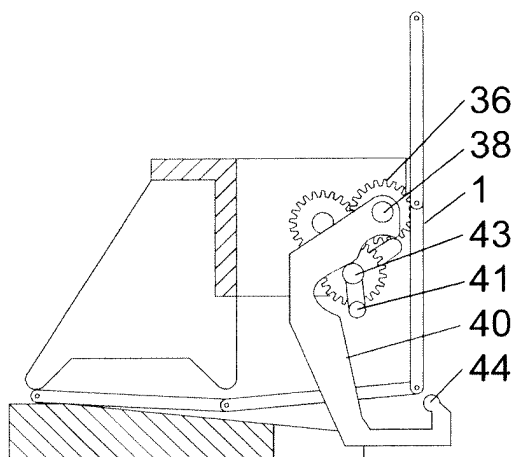


Fig. 11a

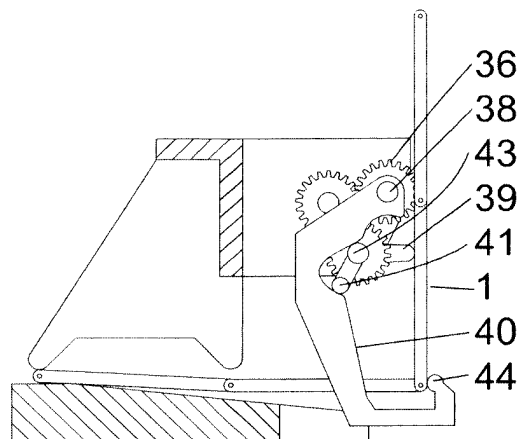


Fig. 11b

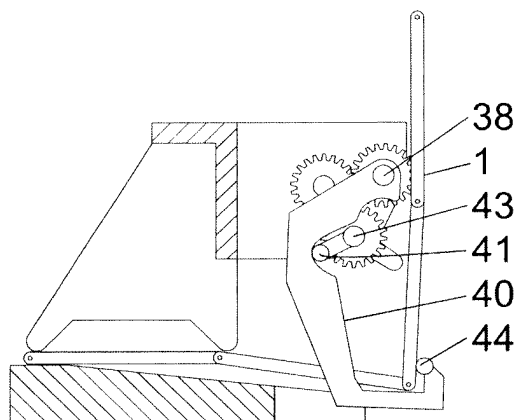


Fig. 11c

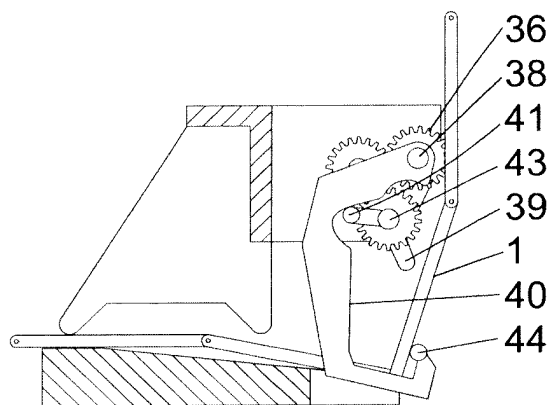


Fig. 11d

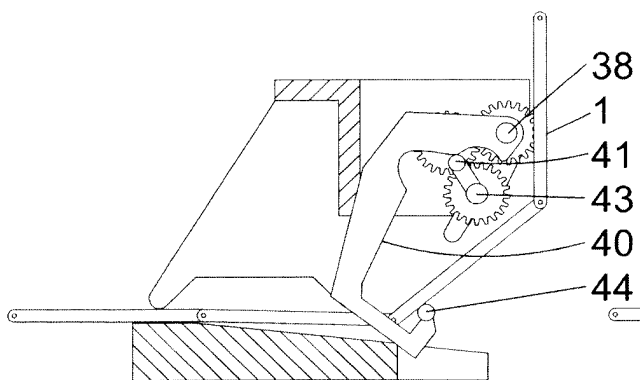


Fig. 11e

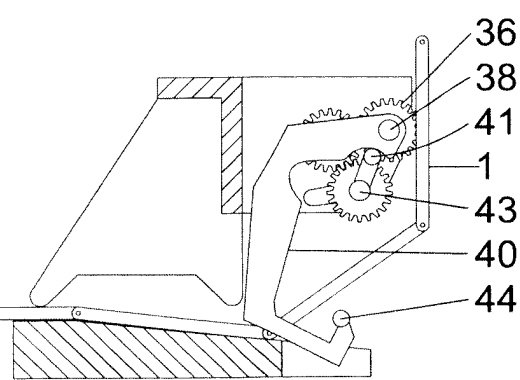


Fig. 11f



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 07 5012

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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Y	* paragraphs [0117], [0120], [0147], [0153]; figures 1, 12, 21,42,46, 48, 49-62 *	3,11	
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A	* abstract; figures *	1	
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A	----- US 2006/219144 A1 (PHELAN MICHAEL [US] ET AL) 5 October 2006 (2006-10-05)	1	
	* abstract; figures 7-18 * * paragraph [0041] - paragraph [0046] *		
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 February 2020	Examiner Verheul, Omiros
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	

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 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-02-2020

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