(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 943 755 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.09.1999 Bulletin 1999/38

(51) Int. Cl.[6]: **E04H 12/18**

(21) Application number: **99104012.2**

(22) Date of filing: **12.03.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **17.03.1998 IT MO980060**

(71) Applicant: **Salardi, Massimo**
41100 Modena (IT)

(72) Inventor: **Salardi, Massimo**
41100 Modena (IT)

(74) Representative:
Modiano, Guido, Dr.-Ing. et al
Modiano & Associati SpA
Via Meravigli, 16
20123 Milano (IT)

(54) Extendable arm

(57) The extendable arm comprises two structures (2,3) whose mutual distance can vary, each structure (2,3) being constituted by at least three corner elements (4,5), each of which has two angled pivoting elements (6,7) for pivoting the corresponding ends (10) of at least three pairs of mutually articulated linkage members (11,12) which substantially constitute at least three pantograph-type couplings which are mutually connected in space, the approach or spacing of two of the corner elements (4,5) arranged on one of the diagonals of one of the structures (2,3) being adapted to determine the spacing or approach of the other structure and the simultaneous extension or retraction of the arm (1).

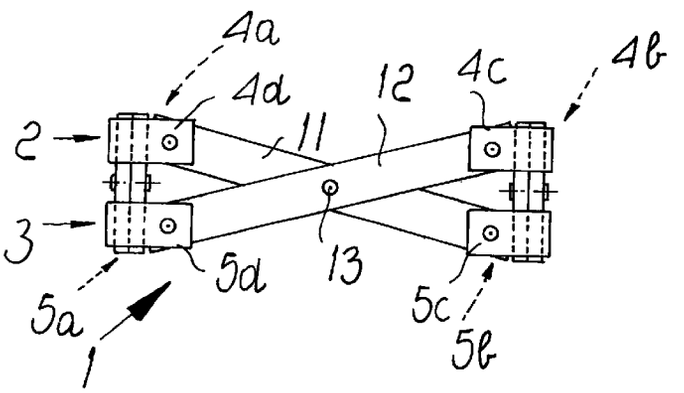

Fig. 1

EP 0 943 755 A2

Description

[0001] The present invention relates to an extendable arm.

[0002] It is already known to use telescopic arms which are employed in fields related to the handling and transfer of several products in which variable strokes in specific directions are required for loading/unloading the products.

[0003] Said telescopic arms are of different kinds and are generally constituted by a plurality of substantially longitudinal elements which are rigidly coupled to each other and are adapted to slide one inside the other along adapted guides, so as to provide the required stroke as a whole.

[0004] However, said telescopic arms suffer drawbacks, including the fact that they have considerable residual dimensions in the stroke direction owing to the presence of guides and similar members, which do not allow the various elements to fully fit inside each other, entail high manufacturing costs and require auxiliary supports in the stroke direction.

[0005] The aim of the present invention is to eliminate the above-mentioned drawbacks of known telescopic arms by providing an extendable arm which allows to eliminate the use of auxiliary members, to significantly reduce the residual dimensions in the stroke direction, to achieve significant size variations in said direction, and to limit manufacturing and maintenance costs.

[0006] Within the scope of this aim, an object of the present invention is to provide an extendable arm having a structure which is simple, relatively easy to manufacture, safe in use, effective in operation and relatively low in cost.

[0007] This aim, this object and others are achieved by the present extendable arm, characterized in that it comprises two structures whose mutual distance can vary, each structure being constituted by at least three corner elements, each of which has two angled pivoting elements for pivoting the corresponding ends of at least three pairs of mutually articulated linkage members which substantially constitute at least three pantograph-type couplings which are mutually connected in space, the approach or spacing of two of said corner elements arranged on one of the diagonals of one of said structures being adapted to determine the spacing or approach of the other structure and the simultaneous extension or retraction of the arm.

[0008] Further characteristics and advantages of the present invention will become apparent from the detailed description of a preferred but not exclusive embodiment of an extendable arm according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic front view of an extendable arm according to the invention in the retracted configuration;

Figure 2 is a schematic front view of the arm according to the invention in the extended configuration;

Figure 3 is a top view of the arm of Figure 1;

Figure 4 is a top view of the arm of Figure 2;

Figure 5 is a schematic front view of the arm according to the invention in the retracted configuration and with one of the two structures coupled to a footing;

Figure 6 is a schematic front view of the arm according to the invention in the extended configuration and with one of the two structures coupled to a footing;

Figure 7 is a top view of the arm of Figure 5;

Figure 8 is a top view of the arm of Figure 6;

Figure 9 is a schematic front view of the arm according to the invention in the retracted configuration and with the two structures coupled to respective footings;

Figure 10 is a schematic front view of the arm according to the invention in the extended configuration and with the two structures coupled to respective footings;

Figure 11 is a schematic front view of two arms according to the invention coupled to each other and in the retracted configuration;

Figure 12 is a schematic front view of two arms according to the invention coupled to each other and in the extended configuration;

Figure 13 is a top view of the arms of Figure 11;

Figure 14 is a top view of the arms of Figure 12.

[0009] With reference to the above figures, 1 generally designates an extendable arm according to the invention.

[0010] The arm 1 comprises two structures 2 and 3 whose mutual distance is variable; each structure is constituted by four corner elements, designated by the reference numerals 4a, 4b, 4c, 4d and 5a, 5b, 5c, 5d respectively.

[0011] Each one of the eight corner elements 4 and 5, which have been shown schematically as blocks shaped like a parallelepiped, has two perpendicular pivoting elements 6 and 7 which can be simply constituted by perpendicular millings which form two forks for the insertion and pivoting, by means of pivots having axes 8 and 9, of the corresponding ends of four pairs 10I, 10II, 10III, 10IV of flat linkage members 11 and 12 which are articulated to each other by means of pivots 13 having axes a, b, c, d.

[0012] The pairs of linkage members 10 substantially constitute four pantograph-like couplings which are mutually connected in space so that their ends are rigidly coupled to the corner elements 4 and 5; the approach, shown schematically by the white arrows in Figure 3, or the spacing of two corner elements arranged on one of the diagonals of one of the structures, for example the elements 4b-4d of the structure 2,

causes the spacing or respectively the approach of the other structure 3 and the simultaneous extension or retraction of the arm 1.

[0013] It should be observed that during these movements the corners of each one of the structures 2 and 3 remain mutually co-planar and the planes of the structures 2 and 3 move mutually closer or further apart while remaining mutually parallel.

[0014] In order to allow to use the invention for the most disparate applications, provisions are made for at least one of the structures 2 and 3 to be coupled to a footing 14 which is preferably square and has two rails 15, 16 rigidly coupled thereto in a cross-shaped arrangement at its diagonals.

[0015] Four sliding blocks 17a, 17b, 17c, 17d are slidingly mounted on the two rails, and each sliding block is rigidly coupled to the corresponding corner element 5a, 5b, 5c, 5d; in the example shown in the figures, the rails schematically have a rectangular cross-section and the sliding blocks have rail slots which have a U-shaped cross-section: in practice, the rails will have to have at least a T-shaped cross-section or another cross-section having the same function, and the sliding blocks will have to have a cross-section which is complementary to the cross-section of the rails in order to ensure an appropriate sliding coupling.

[0016] In Figures 9 and 10, the arm 1 has two structures 2 and 3 which are both coupled to corresponding footings 14.

[0017] As an alternative to the rails and the sliding blocks, other possible applications may be considered which use articulations provided by way of connecting rods pivoted in the directions in which the corner elements move; said articulations are connected to the footing and to each facing corner element.

[0018] Conveniently, in order to have a longer stroke, the corner elements of one or both of the two structures 2 and 3 are provided with additional pivoting elements 18 for the pivoting of the ends of the four pairs of linkage members 19 of a contiguous extendable arm 20 and even directly constitute one of the two structures 21 and 22 of said contiguous arm 20.

[0019] The additional pivoting elements 18 can be arranged on the corner elements 4 and 5 above or below the existing pivoting elements 6 and 7, with the possible consequent variable increase in residual dimensions.

[0020] In the example shown schematically for explanatory reasons in Figures 11 and 12, the additional pivoting elements 18 can be arranged so as to be co-planar, but can optionally be arranged below the existing pivoting elements 6 and 7, thus obtaining reduced residual dimensions.

[0021] In order to cause the extension or retraction of the extendable arm according to the invention, one acts on two corner elements arranged on one of the diagonals of one of the structures, applying thereto two opposite self-centering forces in the direction which is normal to the retraction or extension of the arm.

[0022] The variation in the two Cartesian dimensions that relate to the plane of the corner elements on which the forces act is symmetrical and is equidistant with respect to the normal that passes through the centerline of the distance between the two above said corner elements.

[0023] As an alternative, it is possible to act on just one of the two corner elements, keeping the other one fixed as a restraint: in this case, the Cartesian dimensions vary with respect to the element taken, as static point.

[0024] It has thus been shown that the invention achieves the intended aim and object, i.e. achieves size variations with minimum residual dimensions for that direction and provides a device which is highly versatile and relatively inexpensive.

[0025] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0026] All the details may furthermore be replaced with other technically equivalent ones.

[0027] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the protective scope of the appended claims.

[0028] The disclosures in Italian Patent Application No. MO98A000060 from which this application claims priority are incorporated herein by reference.

[0029] Where technical features mentioned in any claim are followed by reference signs, those reference signs, have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An extendable arm, characterized in that it comprises two structures (2, 3) whose mutual distance can vary, each structure (2, 3) being constituted by at least three corner elements (4, 5), each of which has two angled pivoting elements (6, 7) for pivoting the corresponding ends (10I, 10II, 10III, 10IV) of at least three pairs of mutually articulated linkage members (11, 12) which substantially constitute at least three pantograph-type couplings which are mutually connected in space, the approach or spacing of two of said corner elements (4, 5) arranged on one of the diagonals of one of said structures (2) being adapted to determine the spacing or approach of the other structure (3) and the simultaneous extension or retraction of the arm (1).

2. The arm according to claim 1, characterized in that at least one of said structures (3) is coupled to a footing (14) to which at least two rails (15, 16) are

rigidly coupled, said rails (15, 16) being arranged in a cross-like configuration, at least three sliding blocks (17) being slidingly mounted along said rails (15, 16), each sliding block (17) being rigidly coupled to the corresponding corner element (4, 5).

3. The arm according to one or more of the preceding claims, characterized in that said corner elements (4, 5) have a substantially prism-like shape which can vary according to the number of corner elements provided in each structure, and in that said angled pivoting elements (6, 7) are adapted to form two elements such as cantilevered supports and/or forks for the insertion and pivoting of the corresponding ends of said at least three pairs of linkage members (11, 12).

4. The arm according to one or more of the preceding claims, characterized in that each one of the corner elements (4, 5) of at least one of said structures (2, 3) comprises, or supports, two additional pivoting elements (18) for pivoting the corresponding ends of at least three pairs of linkage members (11, 12) of a contiguous extendable arm (1) and are adapted to constitute one of the two structures of said contiguous arm (1).

5. The arm according to claim 4, characterized in that said additional pivoting elements (18) are arranged on said corner elements (4, 5) at a higher level than said pivoting elements (6, 7).

6. The arm according to claim 4, characterized in that said additional pivoting elements (18) are arranged on said corner elements (4, 5) at a lower level than said pivoting elements (6, 7).

7. The arm according to claim 4, characterized in that said additional pivoting elements (18) are arranged on said corner elements (4, 5) which are co-planar to said pivoting elements (6, 7).

8. The arm according to one or more of the preceding claims, characterized in that said additional pivoting elements (18) are formed, or accommodated, on said corner elements (4, 5) and are adapted to form elements, such as cantilevered supports and/or forks, for the insertion and pivoting of the corresponding ends of the pairs of linkage members (11, 12) of said contiguous arm (1).

9. The arm according to one or more of the preceding claims, characterized in that said corner elements (4, 5) and said pair of linkage members (11, 12) are four.

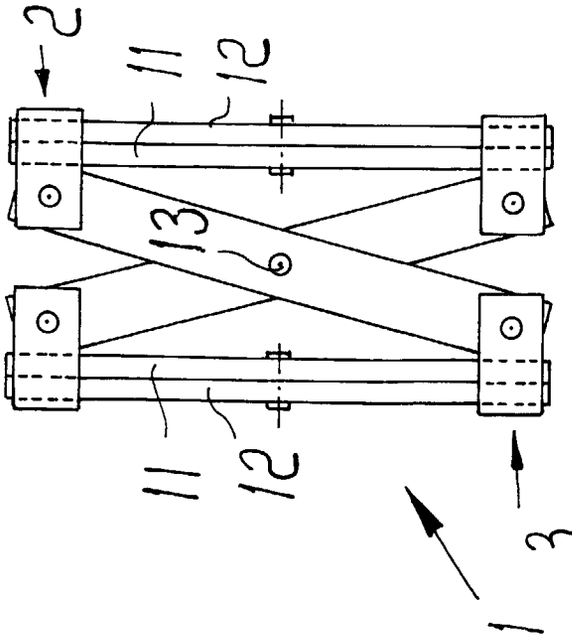

Fig. 2

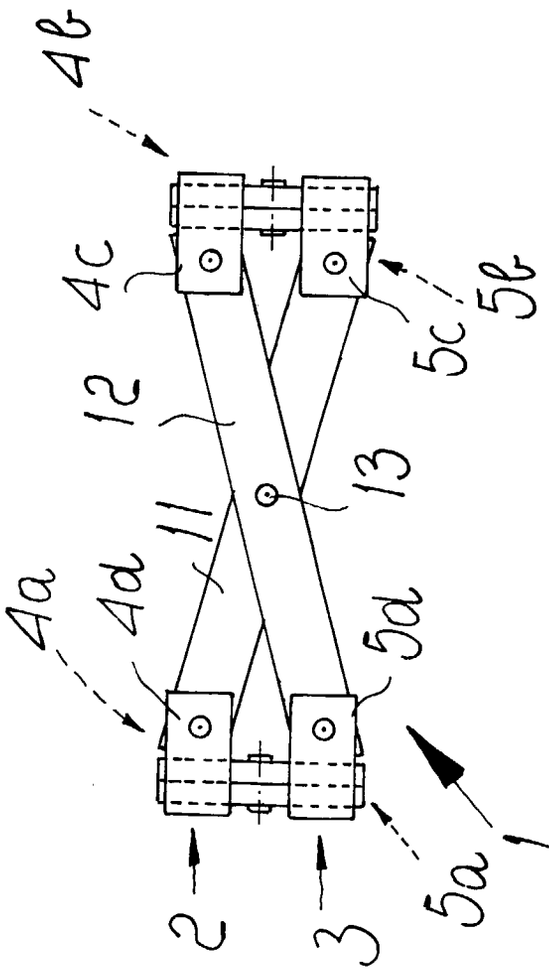

Fig. 1

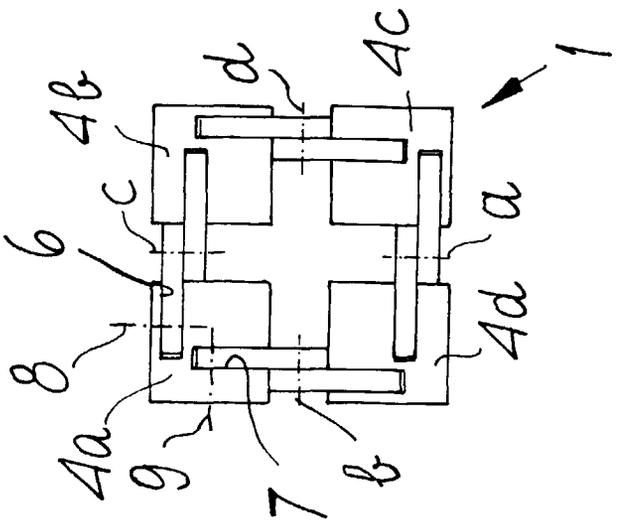
1
4c
d
4b
c
6
a
8
4d
4a
9
7
b

Fig. 4

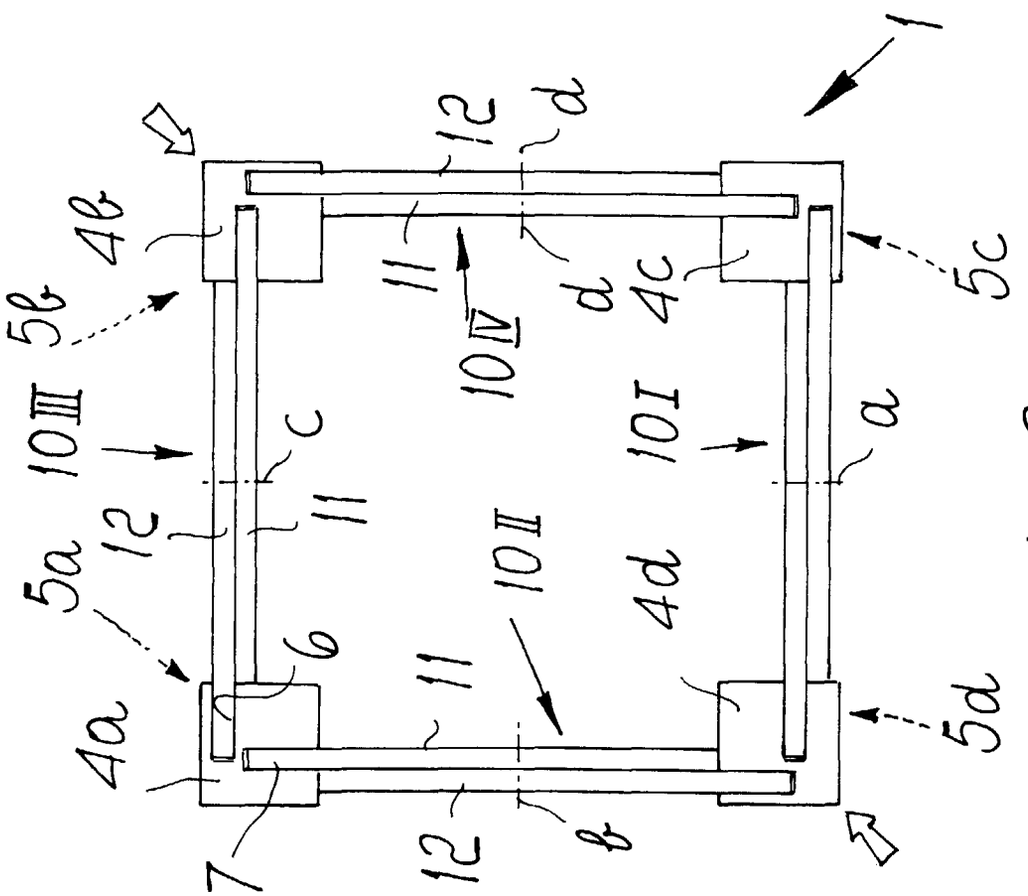
1
12
d
4b
5b
11
10 IV
d
4c
5c
10 III
c
10 I
a
5a
12
11
10 II
4d
6
11
4a
5d
7
12
b

Fig. 3

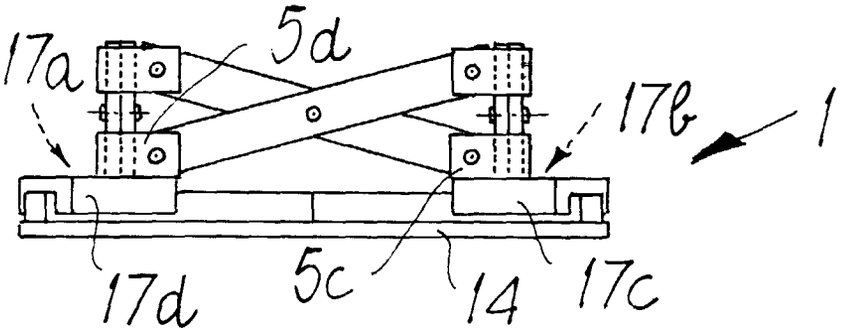

Fig. 5

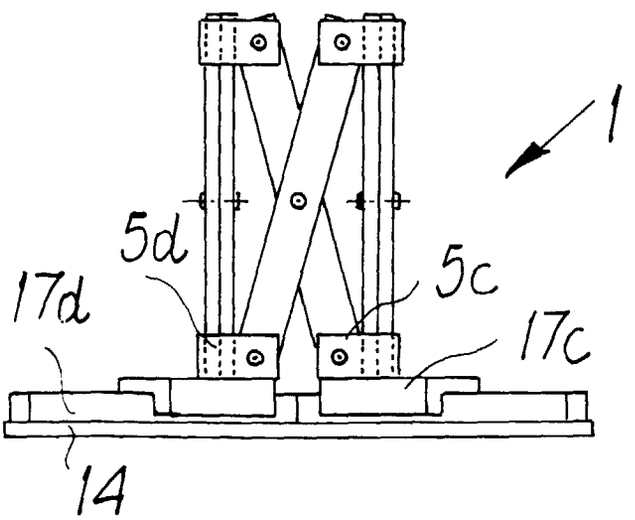

Fig. 6

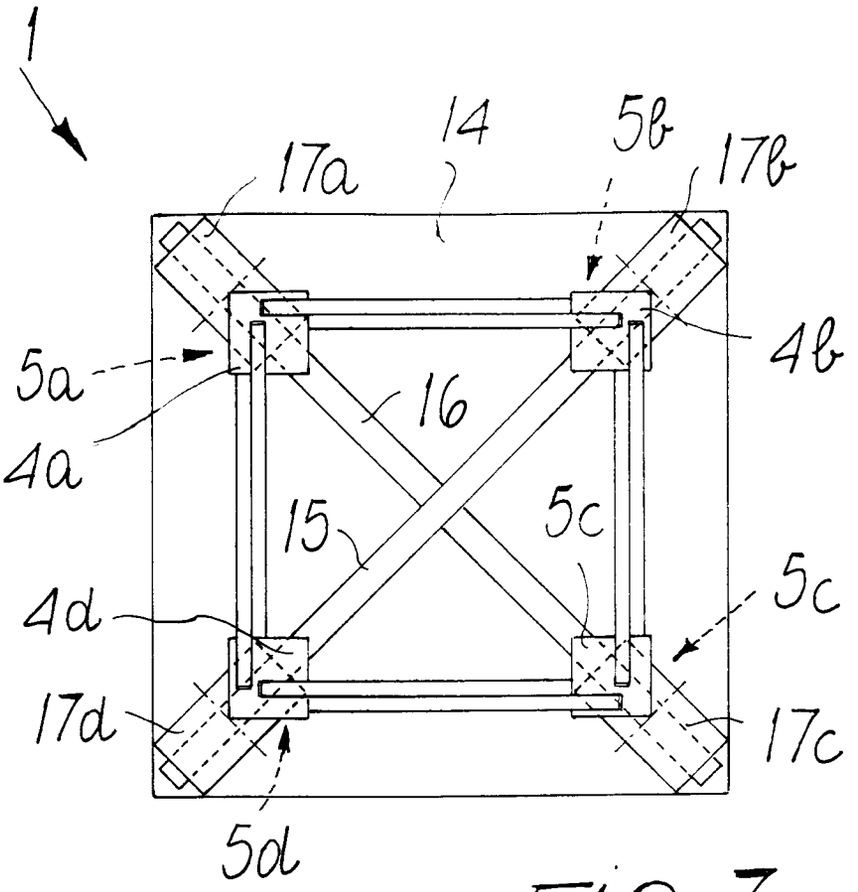
1
14
5b
17a
17b
4b
5a
4a
16
15
5c
4d
5c
17d
17c
5d

FIG. 7

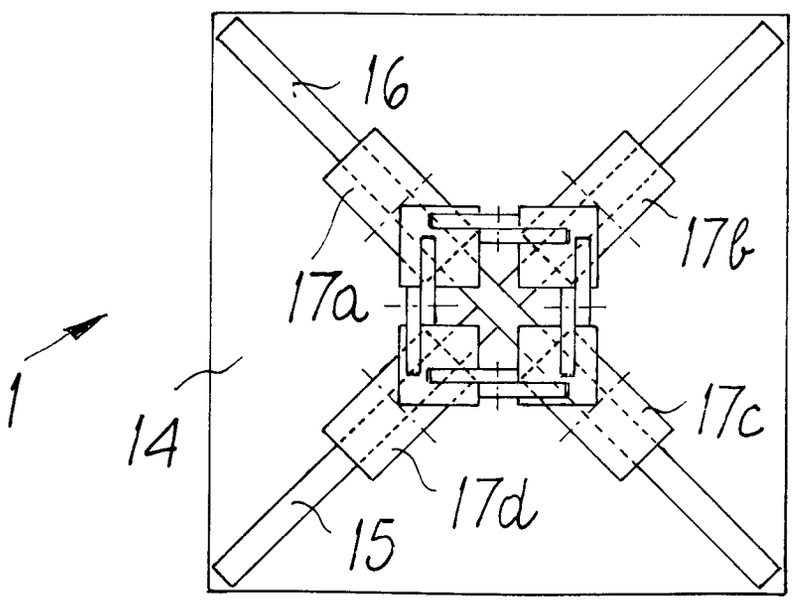
16
17b
17a
1
14
17c
17d
15

FIG. 8

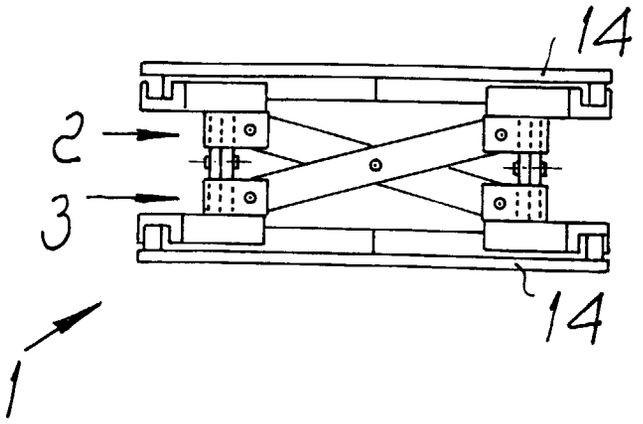

FIG. 9

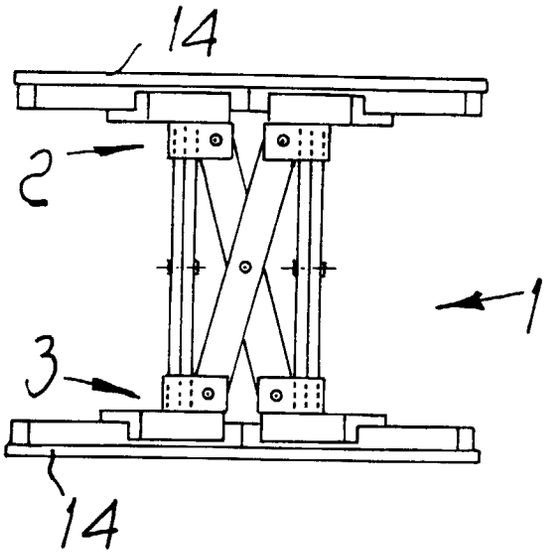

FIG. 10

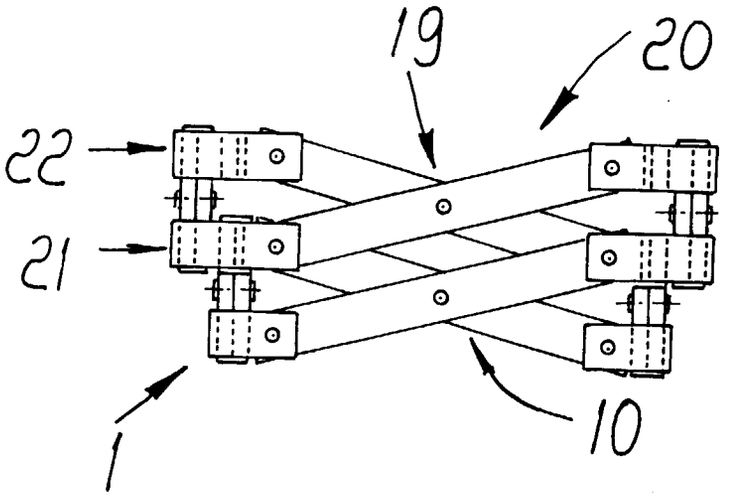

FIG. 11

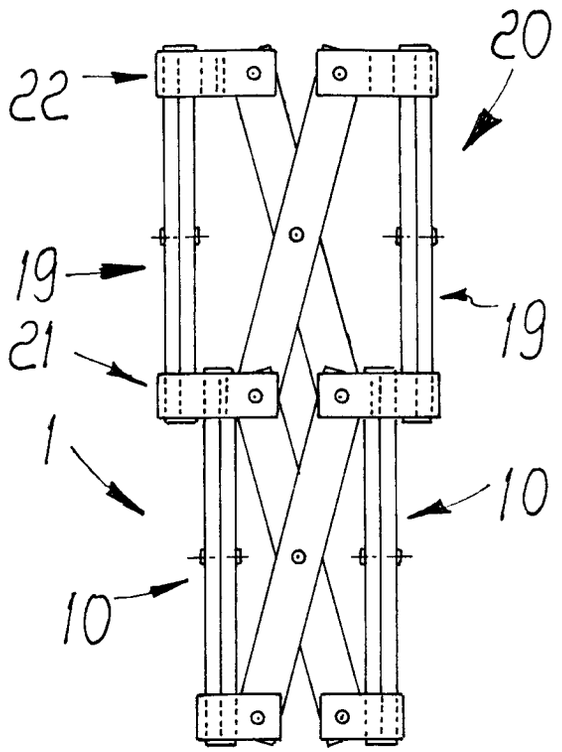

FIG. 12

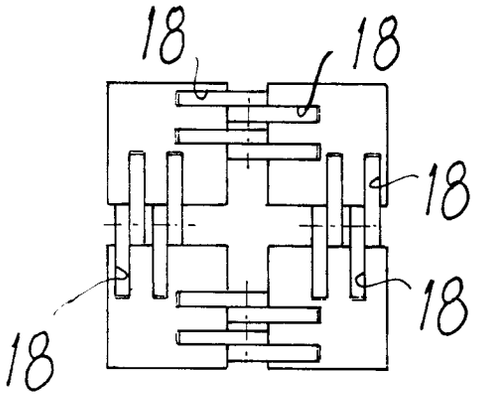

FIG. 14

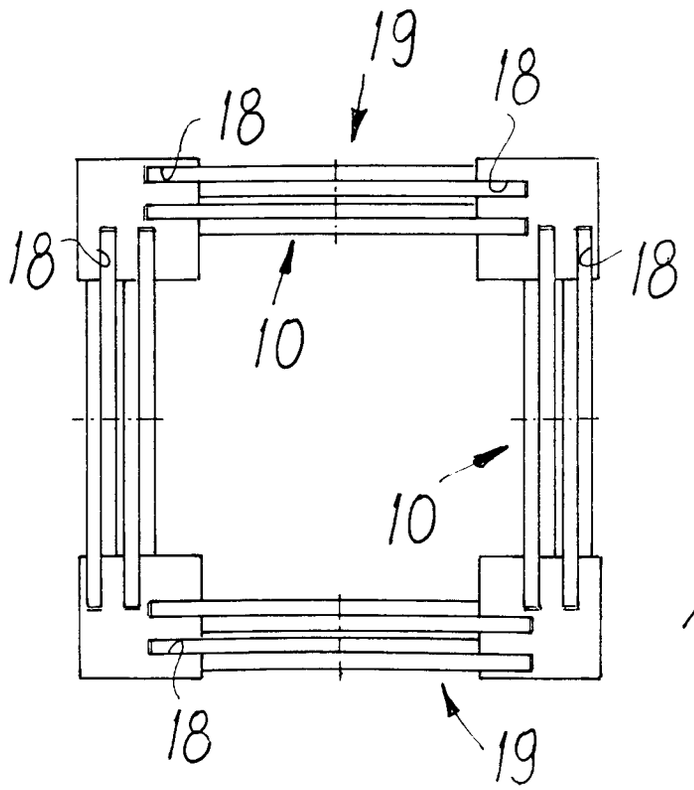

FIG. 13