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

(11) Publication number: 0 490 033 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 12.07.95 (51) Int. Cl.6: A63H 33/08

(21) Application number: 91116255.0

(22) Date of filing: 24.09.91

(54) Construction toy

(30) Priority: 11.12.90 US 625809
18.04.91 US 687386
19.06.91 US 717639

(43) Date of publication of application:
17.06.92 Bulletin 92/25

(45) Publication of the grant of the patent:
12.07.95 Bulletin 95/28

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(56) References cited:
EP-A- 0 284 311
DE-A- 3 524 467
FR-A- 1 475 308
GB-A- 866 557
US-A- 2 633 662

(73) Proprietor: Connector Set Limited Partnership
2800 Sterling Drive
Hatfield, Pennsylvania 19440 (US)

(72) Inventor: Glickman, Joel I.
1777 Oak Hill Drive
Huntingdon Valley,
Pennsylvania (US)

(74) Representative: Türk, Gille, Hrabal, Leifert
Brucknerstrasse 20
D-40593 Düsseldorf (DE)

EP 0 490 033 B1

Description

The invention is directed to constructions toys, and more particularly to novel and improved forms of construction toy, comprising hub-like conector elements and strut-like structural elements adapted to be removably engaged with the connector elements to form a composite structure, as defined in the preambles of claims 1 and 18. The invention is also directed to an adaptor element for such construciton toys.

A variety of construction toys is known, which are comprised of combinations of conector elements and structural elements which can be combined in various forms to form composite structures. One example is disclosed in DE-A-35 24 467.

The object of the invention is to provide construction toys incorporating a variety of unique and advantageous features enhancing their performances, which toys can be mass-produced on a low cost basis.

In order to comply with this object, a constructional toy system is proposed which comprises the features of claims 1 and 18, respectively. Furthermore, an adaptor element is which comprises the features of claim 35 is proposed.

Preferred embodiments and improvements of the invention are subject of the subclaims appended to the respective independent claims.

The device of the present invention, while being of a kown general type, incorporates a variety of unique and advantageous features which greatly enhance its perfomance. At the same time, the device is designed to be mass produced by injection molding techniques, so as to be capable of manufacture on a low cost basis.

A hub-like connector element is provided with a plurality of generally radially oriented sockets for receivng and lockingly engaging end portions of typical structural elements of strut-like configuration. The connecting sockets are designed to accomodate lateral snap-in insertion of the structural elements. The end extremities of the structural elements are formed with an annular groove, defining a flanged end. The sockets on the connector elements are defined by spaced pairs of gripping arms, and each arm includes an inwardly protruding locking projection arranged to be received in the annular groove of the structural element. Accordingly, upon lateral snap-in installation of a structural element, it is locked against axial withdrawal from the connector element.

The strut-like structural elements, molded to be of circular cross section at the ends, are configured, in regions intermediate the ends in a generally X-shaped cross section. The X-shaped cross section is arranged for cooperation with the opposed locking projections of the gripping arms such that, when the structural element is oriented at 90° to its "normal" radial orientation in the connector element, it may be pressed laterally between a pair of gripping arms and snapped into locked position, with the locking projections engaging the X-shaped cross section to immobilize the structural element.

Among the structural possibilities enabled by the last mentioned feature of crosswise gripping of structural elements is the assembly of articulated belt-like structures, which can be incorporated into dynamically operated toy structures, such as bulldozers, tanks, conveyor belts and the like, and also static structures such as catenary suspension elements.

One form of connector element enables one connector to be joined with another, in planes which are disposed at right angles to each other. A pair of thus-joined connector elements provides for an assembly with structural elements in two principal planes. In addition, each of the available sockets still retains the ability to lockingly receive structural elements oriented at right angles to the principal plane of the hub-like connector element. In one modification, an assembly of connector elements can be provided which accommodates the mounting of strut elements extending in four planar directions from a central axis. Modified forms of such connector element assemblies are provided in which strut elements extend in three planar directions (forming a Tee-shaped joint) or in two planar directions (forming a right angular corner joint).

The design and construction of the socket-forming recesses, on the one hand, and the ends of the strut elements, on the other hand, advantageously is such that the cooperative action of the rib and groove means serves to yieldably urge the strut elements axially into tight end face contact with the end wall of the recess. This provides for a significant degree of additional stability in the connection between the strut and connector.

To particular advantage, the construction toy system includes a series of struts of graduated lengths, graduated in accordance with a predetermined formula such that when two struts of a given length in a series are joined with connector elements to form a right angularly related structure, the strut of the next larger length in the series is of an appropriate length to be joined in the assembly along the hypotenuse of the triangular structure. In this manner, a large structural assembly may be formed utilizing rigid triangular structural subassemblies of various different sizes for maximum strength and rigidity.

In the new system, in which a series of strut elements of graduated lengths is provided according to the before- mentioned principle, a structure

consisting of a pair of like strut elements of a given length in the series, mounted on opposite sides of a connector element so as to be coaxial, are equal in length to the length of a strut element two sizes larger in the series. This arrangement provides for an extraordinary degree of flexibility in the arrangement of structural parts in any assembly.

A significant aspect of the foregoing geometric relationship is the fact that the strut elements can be assembled with the connector elements by lateral snap-in assembly, so that the center to center distance of a pair of connector elements does not have to be enlarged in order to receive a strut element. This enables a structure to be easily added to and/or modified even after it has reached a stage of substantial rigidity.

For many dynamic structures, a driving relationship between a strut element, functioning as an axle, and an associated connector element may be desired. To this end, the construction toy system incorporates a drive element comprising a socket-forming recess of the type described, which is intended for the crosswise reception of a strut element functioning as an axle for an adjacent connector element. The drive element is formed with a laterally extending drive pin arranged to be received between adjacent spoke-like webs of a connector element, in order to lock the connector element in driving relation to the strut on which it is supported.

For a more complete understanding of the above and other features and advantages of the invention, reference should be made to the following detailed description of preferred embodiments and to the accompanying drawing.

Preferred embodiments are described in connection with the drawings, in which

Fig. 1 is an elevational view, partly in section, of a hub-like connector element constructed according to the invention, with selected structural elements joined therewith.

Fig. 2 is a greatly enlarged, fragmentary, perspective view of a portion of the connector element of Fig. 1.

Fig. 3 is an enlarged, fragmentary view of the end portion of a strut-like structural element constructed in accordance with the invention.

Fig. 4 is a cross sectional view as taken on line 4-4 of Fig. 3.

Figs. 5, 6 and 7 are sequential views, as taken generally on line 7-7 of Fig. 1, showing progressive stages of lateral, snap-in insertion of a structural element into a socket of the connector element of Fig. 1.

Figs. 8 and 9 are enlarged, cross sectional views as taken generally on lines 8-8, 9-9 respectively of Fig. 1.

Fig. 10 is an elevational view of a strut-like structural element constructed according to the invention.

Fig. 11 is a highly enlarged, fragmentary perspective view showing the structural element of Fig. 10 installed in a socket of a connector element at right angles to the normal radial orientation.

Fig. 12 is a transverse cross sectional view as taken generally on line 12-12 of Fig. 11.

Fig. 13 is a bottom perspective view of an adapter block element, for integrating the construction toy with certain popular, block-type construction toys.

Fig. 14 is an elevational view, partly in section, of the adapter block of Fig. 13.

Fig. 15 is a top plan view of the assembly of Fig. 14.

Fig. 16 is a perspective view of an assembly of a pair of modified connector elements each with the other.

Fig. 17 is an exploded view showing the component elements of the assembly of Fig. 16.

Fig. 18 is a greatly enlarged, fragmentary perspective view of a connector element of Fig. 16.

Fig. 19 is an elevational view of the assembly of Fig. 16.

Fig. 20 is an enlarged, fragmentary sectional view, illustrating the manner in which a structural element of Fig. 19 is inserted in certain of the sockets of the connector element.

Fig. 21 is a side elevational view of a single socket connector element constructed to receive one strut element oriented axially in a socket-forming recess and a second strut element in a hub bearing, disposed at right angles thereto.

Fig. 22 is a side elevational view of a two element connector.

Figs. 23-29 illustrate other modifications of connector elements.

Fig. 30 is a group view illustrating a series of strut elements of graduated length and also the relationship of the length of a given strut of a series to smaller struts joined together coaxially by a connecting element.

Fig. 31 is a greatly enlarged view illustrating the socket portion of a connecting element in cross section as joined with a strut element.

Fig. 32 is an elevational view of an assembly of strut and connector elements arranged in triangular sub-units of increasing size.

Fig. 33 is a top plan view of an articulated belt or tread structure constructed of a plurality of single unit connectors and a plurality of strut elements mounted in crosswise relation therein.

Fig. 34 is a cross sectional view as taken along line 34-34 of Fig. 33.

Figs. 35-39 are various views illustrating a modified form of connector element which is capable of assembly with a like connector element.

Figs. 40, 41 illustrate a connector element of the type shown in Figs. 35-39, as assembled with a connector element of the type shown in Figs. 16-20.

Fig. 42 is a perspective view of a drive element constructed for crosswise reception of a strut element serving as an axle, and provided with a driving lug.

Fig. 43 is an elevational view of the driving element of Fig. 42, showing a strut element gripped in crosswise relation therein.

Fig. 44 is a view, similar to Fig. 43, showing in addition a connector element received on the strut element and drivingly engaged for rotation therewith.

Fig. 45 is an elevational view of a combined pulley and wheel-forming element.

Fig. 46 is a side elevational view of a tire-like element adapted for assembly with the element of Fig. 45.

Figs. 47, 48 are cross sectional views as taken generally on lines 47-47, 48-48 respectively of Figs. 45, 46.

A hub-like connector element 10 is shown particularly in Fig. 1. The connector element includes a central hub cylinder 11 and radiating spokes 12. The illustrated form provides for the connection of eight, radially disposed structural elements 13.

The radial spokes 12 support an array of eight sockets 14, each comprising an end wall 15 and spaced-apart, opposed gripping elements 16. The sockets 14 are radially disposed with respect to the central axis 17 of the connector, and the respective pairs of gripping elements 16 are desirably arranged on opposite sides of the radial axis of the socket, in generally parallel relation to such radial axis.

The gripping elements 16 are provided in their outer portions with concave grooves 18, which are concentric about the radial axis 19 of the socket and extend from the outer end extremities 20 of the gripping elements a suitable distance toward the base wall 15 of the socket, typically about halfway.

The strut-like structural elements 13 are of generally cylindrical construction at the their end extremities. The structural elements may have a nominal diameter of, for example, approximately 6,35 mm (0.250 inch),for cooperation with concave grooves 18 in the gripping elements formed on a diameter of the same dimension.

As is apparent in Fig. 5, the arc of the grooves 18 serves to narrow the entrance area to a dimension significantly less than the 6,35 mm (0.250 inch) diameter of the structural element. The dimension at the throat or opening 21 may be on the order 5,334 mm (0.210 inch). Accordingly, it is desirable to form the lateral edges 22 of the gripping arms to diverge from the throat 21 to the outer lateral surface 23 of the gripping arm. An angle of divergence of about 15° is appropriate. This facilitates the lateral insertion of the structural element 13 into the grooves 18 by causing the gripping arms 16 to be laterally displaced and separated. Once the structural element is seated in the grooves 18, the gripping arms 16 close snugly about the structural element to retain it in position.

Each of the gripping arms 16 is provided with a locking projection 24, desirably of semicylindrical configuration, extending at right angles to the radial axis of the socket defined by the gripping elements. In the illustrated construction, the projections 24 are of generally uniform cross section and extend from one side edge of the gripping arms 16 to the other, as shown best in the enlarged perspective view of Fig. 2.

The locking projections 24 are spaced radially outward a short distance from the base wall 15 of the socket and define therewith a flange-receiving recess 25 at the inner or base end of the socket.

As shown in Fig. 3, the end extremity of each of the structural elements 13 is configured such that a longitudinal cross section of the end portion is approximately the same as the longitudinal cross section of a socket 14, taken along its radial axis in a plane parallel to the flat sides of the connector element. The structural elements 13 include cylindrical end flanges 26 of a size and shape to be received in the flange-receiving recess 25 of the socket. Immediately adjacent the cylindrical end flange 26 is an annular groove 27 of a semicircular cross sectional configuration adapted to be received within the narrowed space between opposed locking projections 24. Immediately adjacent the annular groove 27 is a cylindrical gripping portion 28, which is adapted to be received in the concave grooves 18 and gripped snugly by the outer portions of the gripping arms 16. The axial length of the gripping portion 28 desirably corresponds to the effective length of the grooves 18. The cylindrical flange 26 may have an axial length of, for example, 1,575 mm (0.062 inch). The annular groove 27 and the locking projections 24 may have a typical radius of approximately, 1,575 mm (0.062 inch). For structural elements of 6,35 mm (1/4 inch) nominal diameter a suitable length overall for the gripping sockets 14 is about 8,89 mm (0.35 inch).

A typical form of strut-like structural element 13 is shown in Fig. 10. The element may of course be of any length, and a typical construction toy set incorporating principles of the invention would utilize large numbers of such elements, of various appropriate lengths. To particular advantage, por-

tions of the structural element between its respective end portions 30 are of an X-shaped cross sectional configuration, comprised of ribs 31, extending radially, typically at 90° angular intervals and preferably with the external surfaces 32 of the ribs lying on the cylindrical envelope of the element as defined by its cylindrical end portions.

By properly dimensioning the thickness 33 of the ribs 31, and slightly beveling the outer sidewall portions thereof, as indicated at 34, the structural element is able to be pushed laterally into the open end of a radial socket 14 and forced between a pair of opposed locking projections 24, as reflected in Figs. 11 and 12, seating the projections in recesses 39 between adjacent ribs.

The X-shaped cross section of the structural element may be periodically interrupted by one or more pairs of cylindrical portions 35 spaced apart a distance approximately equal to the width dimension 36 of the gripping arms 16. When the structural element is snapped into locked position on the projections 24, as shown in Figs. 11 and 12, the structural element is locked in position axially, laterally and rotationally. Alternatively, if the structural element is applied laterally into the radial socket 14 in one of its areas 37 in which adjacent cylindrical sections 35 are widely spaced, it is possible to adjust the position of the structural element along its axis, within limits.

In a specifically advantageous embodiment of the invention, the width of the ribs 31 may be on the order of 0,236 mm (0.093 inch), tapered convergently in the outer portions, as is reflected particularly in Fig. 4. It will be understood that "X-shaped" configuration of the structural elements 13 is not limited in principle to the use of two pairs of ribs. For example, three pairs of ribs may be arranged at 60° angular spacing. Accordingly, the term "X-shaped", as used herein, is to be interpreted as encompassing such alternatives.

As reflected in Figs. 13 to 15, the present invention provides an adapter element 40 of block-like configuration, which is adapted to interface between conventional block-type construction elements and the construction toy elements of the present invention.

In Figs. 14 and 15, for example, elements 41, 42 are block-like construction elements of a known type, constructed in the form of an open-sided block provided with a "top" wall 44 and sidewalls 45 to 48 forming an open cavity 49. The top wall 44 is provided with a plurality (eight in the illustration) of short circular projections 50. Also extending from the top wall 44 through the cavity 49 are three elongated tubular friction posts 51. In accordance with known design of the block-type construction elements 41, 42, the internal dimensions of the cavity 49 are such as to fit snugly about the external projections 50. In addition, the friction posts 51 are dimensioned to have tangential contact with the sides of the projections 50 when construction blocks are placed one atop the other. This enables, in a known manner, the plurality of construction blocks to be frictionally assembled to form a composite structure.

The adapter block 40 includes a "top" wall 52 and sidewalls 53. In the illustrated arrangement, the adapter block is of square configuration, but other configurations are possible within the contemplation of the invention. Projecting from the top wall 52 are four elongated cylindrical projections 54 of a diameter and spacing corresponding to the short circular projections 50 of the construction blocks 41, 42. These cylindrical projections 54 may be inserted into the open cavity 49 of a construction block and desirably are of a length corresponding generally to the depth of the cavity 49.

A tubular adapter sleeve 55 extends from the underside of the "top" wall 52, through the open cavity 56 in the adapter block 40. The internal diameter of the tubular sleeve is such as to snugly receive an end portion 30 of a structural element 13, as shown in Fig. 14. The tubular sleeve 55 is recessed below the open edge 57 of the adapter block side walls 53 so that the adapter block 40 may be assembled with a conventional construction block 41, 42 in an otherwise known manner.

A connector element 70, shown in Figs. 16, 17, has the general "snowflake" configuration of the device described above, and has many of the structural features of the before mentioned device, but is specially modified to accommodate assembly with a second, similarly configured connector element oriented at right angles thereto. The connector element 70 is generally of a flat, open configuration, typically about 6,35 mm (1/4 inch) in thickness. At its center, the connecting element 70 has a solid, semi-cylindrical core 71. Guide walls 72, 73 extend from opposite sides of the core 71, in spaced-apart, parallel relation. The spacing between the guide walls 72, 73 is substantially equal to the thickness of the connector element, allowing for a second such element 70a to be received within the recess 74 defined by the spaced-apart guide walls 72, 73 and a flat transverse wall 75 which forms one side of the core 71 and is positioned on an axial plane passing through the connector element.

Extending radially outward from the core are a plurality of spoke-like elements 76 to 78 which, at their outer ends, join with peripheral walls 79, 80. In the illustrated arrangement, the walls 79, 80 define seven sides of a generally octagonal structure, with the eighth side being open to accommodate the recess 74. As is evident in Fig. 17, the several walls 79 extend continuously from one spoke to the

other (or from a spoke to the guide walls 72, 73). The wall 80, which lies directly opposite the recess 74 is, however, formed with a discontinuity in form of a gap 81 the function of which will be explained hereinafter.

Each of the walls 79, 80 forms the end wall of a strut-receiving socket 82 (in the case of the walls 79) or 83 (in the case of the interrupted wall 80). Each of the sockets is defined by pairs of opposed gripping elements 84 provided internally with semi-cylindrical locking projections 85, which extend at right angles to the generally radial axis of the socket. The locking projections, in conjunction with the base walls 79, 80, define flange-receiving recesses 86. The outer portions of the gripping elements 84 are formed with concave grooves 87 concentric with respect to the generally radial axis 88 of the socket.

As shown in Fig. 19, strut-like structural elements 90 are provided with cylindrical end flanges 91, adjacent annular grooves 92, and cylindrical portions 93 arranged to be received snugly in the concave grooves 87 of the gripping elements. The structural member 90 (sometimes referred to as a strut) normally is assembled with the connector element 70 by being pressed laterally into one of the sockets 82. The lateral entrance to the socket 82 is partially closed by a narrow throat section, defined by upper and lower edges 94 of the cylindrical grooves 87. Divergent guide surfaces 95 are provided to facilitate lateral insertion of the structural elements.

To particular advantage, the configuration of the sockets and struts is such that, when a strut end is received in a socket, the flat flange end wall 91a of the strut is resiliently urged into firm face to face contact with the flat base wall 79 (or 80) of the socket. This arrangement adds significant stability and rigidity to an assembly of parts. The desired relationship is achieved by displacing the locking projections 85 slightly in the direction of the socket end wall 79, with respect to the "normal" position of the strut groove 92. Thus, when the strut is snapped into assembled position it is automatically pressed toward the bottom of the socket to urge the flat walls 91a and 79 into tight face to face contact.

With reference now to the exploded view of Fig. 17, a second connector element 70a identical to the connector element 70 is oriented so that its principal plane lies at right angles to that of the element 70 and also so that its recess side (not shown in Fig. 17) faces the recess 74 of the element 70. When these two elements 70, 70a are moved together, in the direction of the arrow 96, the portion of the connector 70 to the left of the end wall 75 is received by the recess of the connector element 70a. Likewise, the recess 74 of the element 70 receives the right-hand portion of the element 70a. The completed assembly of the two connecting elements 70, 70a is evident in the perspective view of Fig. 16. The assembled connectors provide radially oriented strut-receiving recesses in two planes, so that the structural possibilities of the system are greatly enhanced.

To secure the two connector elements 70, 70a in assembled relation, cooperating ribs and grooves are formed on the respective parts. The guide walls 72, 73 are provided with transverse detent grooves 97. These are arranged to receive appropriately located detent ribs 98 on the opposite connector element. The ribs 98, as indicated in Fig. 17, are formed on the radial spoke-like elements 77. During assembly of a pair of connector elements 70, 70a, as the projecting ribs 98 reach the outer end of the guide walls 72, 73, the guide walls are elastically displaced outwardly a distance sufficient to accommodate the presence of the ribs. This elastic displacement is facilitated by providing a small gap 81 in the recess wall 80. Thus, during the assembly process, the opposite halves of the divided wall 80 are displaced toward each other, facilitating the outward displacement of the guide walls 72, 73. This process is happening simultaneously on both of the connector elements 70, 70a, as will be understood.

The single plane connector element described in Figs. 1 to 5 is formed with a symmetrical array of eight strut-receiving sockets. The individual connector elements 70, 70a, on the other hand, are formed with one less strut-receiving socket, by reason of the open-sided recess 74 at one side of the connector. Nevertheless, when the two elements are assembled, as reflected in Fig. 16, for example, each connector element contributes, in effect, a strut-receiving socket to the other connector element, so that there are four pairs of opposed sockets in each plane.

When two of the connecting elements are assembled in the manner of Fig. 16, three opposed pairs of sockets on each connecting element are open and accessible for lateral insertion of a strut 90. However, in the case of one of the opposed pairs of sockets 83, 83a, normal lateral insertion of a strut is precluded by the immediate adjacency of outwardly extending gripping elements 84 carried by the opposite connecting element of the assembly.

Insertion of a strut element 90 into the partially inaccessible sockets 83, 83a is facilitated by reason of the slotted recess wall 80. The slot or gap 81 therein enables limited outward displacement of the adjacent gripping arms 84 to enable a strut element to be "cammed" into position through a levering motion, illustrated schematically in Figs. 19 and 20.

With reference to Fig. 19, the position of the strut element 90 shown in broken lines represents a typical starting position for inserting a strut into a socket 83a of a connecting element 70a. The end surface 100 of the strut is placed against an outer surface 101 of the adjacent gripping arm, and this serves somewhat as a guide as the strut is pushed laterally into the socket, while generally holding the angular orientation shown in Fig. 19. During this operation, there is an initial outward displacement of the opposed gripping arms, accommodated by the slot or gap 81 which tends to open up wider than normal. In addition, the recess guide wall 72 is deflected outward slightly and this is encouraged by a levering action of the strut element 90 in the direction of the arrow 102 of Fig. 19. This has the effect of prying upwardly against the guide surface 101, so that the adjacent gripping arm element 84 is displaced in the direction of the arrow 103 in Fig. 20. Levering of the strut continues until the flanged end of the strut snaps into place in the recess, as shown in full lines in Fig. 19. Removal of a strut from one of the partially blocked sockets 83 or 83a is accomplished by a generally reverse procedure.

As shown in Fig. 31, the configuration of socket-forming recesses 150 and struts 140 advantageously are such that the center of curvature of the ribs 130, 131 is located on an axis 151 which is offset from the surface 152 of end wall 125 a distance slightly less than the offset between the axis 153, containing the center of curvature of the annular groove 147, and the end surface 154 of the strut element. As a result when the strut element is forced laterally betwenn gripping arms 126, 127 into gripped position in the recess 150, the ribs 130, 131 are in pressure contact with side portions of the annular groove, in a manner to force the strut end surface 154 into tight face-to face contact with the surface 152 of the recess end wall. By tightly holding these two surfaces in face-to-face contact, a desirable degree of additional rigidity is imparted to the assembly of the strut and connecting element.

Connector elements may be formed in a wide variety of types and styles, having from one to a plurality of socket-forming recesses 150. Connector elements having more than one recess advantageously are configured so that recesses are separated angularly by 45°, or a multiple thereof, although other configurations are useable within the teachings of the invention.

In Fig. 21, a single recess connector 160 is illustrated. It includes a hub section 161 defined by a cylindrical wall 162. The inside diameter of the hub cylinder is approximately the diameter of a cylindrical envelope formed by the struts 140. The diameter of that cylindrical envelope corresponds to the diameter of the cylindrical end portions 146, 148 of the struts 140, and also to the diametric dimensions of the ribs 145. A strut element thus may be freely received in the cylindrical opening 163 of the hub section 161 with a slight clearance to accommodate free rotation and free longitudinal movement of the struts within the hub cylinder. The axis 164 of the hub cylinder is disposed at right angle to the longitudinal axis 165 of the recess 150. The wall 167, which forms the end wall of the recess 150, is spaced from the hub axis 164 by a pair of space web sections 166, which are integral with the wall 167 and the hub cylinder 162.

Typically, the connector elements are constructed of a predetermined, uniform thickness in the direction of the hub axis 164. Preferably, the width is approximately equal to the diameter of the cylindrical envelope of the strut elements. A thickness of approximately 6,2 mm (0.244 inch) has been found to be particularly desirable, in that it permits, in most cases, connector elements to be assembled side-by-side, cross-ways with respect to a strut, over the full length of the central body of the strut, with virtually no space left at either end. This allows structures to be formed with, in effect, a solid wall of elements joined to a transversely disposed strut across the full width of the body portion of the strut.

The connector device 170 illustrated in Fig. 22 is similar to that shown in Fig. 21, but includes a pair of socket-forming recesses 150 angularly separated by 180°, with the longitudinal axis 171 of the respective socket-forming recesses 150 being coaxially aligned and intersecting with the hub axis 172. The connector element of Fig. 22 is particularly useful for joining a pair of strut elements end to end, in coaxially aligned relation, as reflected in Fig. 30. For this and other reasons, the distance d from the hub axis 172 to the outer face of the recess end wall (corresponding to the surface 152 in Fig. 31) is the same for both recesses of the connector device 170 of Fig. 22 as for the single connector 160 of Fig. 21. This geometric relationship is also applied to the several varieties of connector elements illustrated herein such that, in all cases, a strut element secured in a socket-forming recess of a connector element is positioned a fixed, predetermined distance from the central hub axis of the connector element.

In the illustration of Fig. 23, a connector element 180 is shown, which also is provided with two socket-forming recesses 150. These are aligned along axes 181 intersecting with a hub axis 182 disposed at right angles thereto. The construction of the hub cylinder 185, recesses 150, etc. is generally the same as described with respect to the connector elements 160 and 170. However, in the modification of Fig. 23, the strut-receiving recesses 150 are spaced apart by an angle of 45°.

In the connector elements 190 and 200 of Figs. 24 and 25, respectively, the connector elements are provided with three and four strut-receiving recesses 150, respectively, in each case arrayed along axes 191, 201 intersecting with a hub axis 192, 202 and angularly spaced 45° apart. As reflected in the views of Figs. 23 to 25, the connector elements therein shown include intermediate, radially disposed spoke-like walls 183, 193, 203 which extend radially with respect to the hub axes 182, 192, 202 and are joined integrally with end walls of adjacent recesses 150. The outermost walls 184, 194, 204, on the other hand, extend into tangency with the respective hub cylinders 185, 195, 205.

In the illustrations of Figs. 26 to 28, connector elements 210, 220, 230 are formed to have, respectively, five, six and seven socket-forming recesses 150, each arrayed along an axis intersecting and extending radially from the hub axis 212, 222, or 232. The several recess axes 211, 221 and 231 are spaced apart at an angular distance of 45°, as in the case of the connectors of Figs. 23 to 25. Preferably, in each of the connector elements of Fig. 26 to 28, the exterior wall sections 214, 224, 234 are arranged to be tangent to the hub cylinders 215, 225, 235, for both esthetic and functional purposes. The wall sections 214 of the connector element 210, for example, in conjunction with the continuing wall of the associated socket-forming recess, provide a broad, flat surface on which to support the connector element and/or a flat surface to define an outer edge of a structure.

The connector element 240 of Fig. 29 is substantially of the configuration shown in Fig. 1, in this instance being formed as part of a series of connector elements of common dimensions. In this respect, the distance "d" from the hub axis 242 to the face of any recess wall is the same uniform distance as in the other illustrated forms of connector elements.

With reference to Figs. 30 and 32, the system of the invention advantageously incorporates strut elements in various graduated lengths, according to a predetermined size progression, such that strut elements of various sizes in a set may be assembled together with the before described connector elements to form a series of right triangular structural units of an assembly. In the composite illustration of Fig. 30, there are shown a series of strut elements 140a to 140f, inclusive, of progressively increasing lengths. The progression of lengths is such that when any two strut elements of a given size are joined with a connector element to form two sides of a right triangle, the strut of the next greater length is of the appropriate size to form the hypotenuse of that triangle. For example, in Fig. 32, a three-position, right angle connector element 190 is joined with two strut elements 140a of the smallest size, forming the sides of a right triangle. In the illustration, the vertically oriented strut element 140a is joined with a four-position connector element 200 and the horizontally oriented strut element 140a is joined with a five-position connector element 210. A strut element 140b, constituting the next size longer than the strut elements 140a, is joined with the connector elements 200, 210, forming the hypotenuse of a small right triangle.

In the illustration of Fig. 32, the strut element 140b, which forms the hypotenuse of the first described right angular structural element 250, itself forms one side of a right triangular structural element 260 of a larger size. In this respect, the connector element 200 is joined with a second strut element 416 of the same length as the strut element 140b to form two sides of the triangle structural element 260. A second four-position connector element 200 is joined to the upper end of the upper strut element 416, and a strut element 140c, being the third element in the length progression, is joined with the upper connector element 200 and the before mentioned connector element 210 and constitutes the hypotenuse of the triangular structural element 260. As is evident in Fig. 32, a pair of the strut elements 140c may in turn constitute the sides of a still larger right triangular structural unit 270, the hypotenuse of which is constituted by the next larger size strut element 140d. Progressively larger right triangular structural units may be assembled, within the limits of the maximum length strut element provided by the set.

In the system of the invention, the length progression of the strut elements is in accordance with a predetermined formula. Thus, in a system of "n" different lengths, each strut length is determined according to the formula:

$$L_x = (1.414)^{(x-1)} * D_{min} - (2 * d), \text{ where}$$

- L_x = Length of the x^{th} strut of a series of 1 to "n",
- D_{min} = the spacing between hub axes of two connector elements joined by the shortest strut element of the series,
- d = the distance from the hub axis to the end wall of the socket-forming section.

It is known to assemble structures of right triangular units, including structures in which the hypotenuse of one triangular unit constitutes a side of a second and larger right triangular unit. In the toy system of the present invention, however, unique advantages are derived from the design of the connector elements and strut elements to accommodate lateral, snap-in assembly of the strut elements into the connectors. This enables parts to be assembled and disassembled from the structure, without involving change of the center-to-cen-

ter distances between connector elements and connection points. Thus, complex, rigid, multi-dimensional structures can be designed and assembled for great facility.

As shown in Fig. 30, there is also an advantageous geometric relationship between the graduated length strut elements 140a to 140f and connector elements in which there are socket-forming recesses oriented 180° apart. This includes in particular the connector element 170 (Fig. 22), which is a two-position connector element having its recesses 150 coaxially aligned and oppositely facing. This connector element serves usefully as a splicing connector, to join two shorter strut elements to form a longer strut assembly. When one of the connector elements 170 (which may conveniently be referred to as a splice connector) is joined with two struts of a given size a strut assembly is formed which is equal in length to a strut two sizes larger than the strut elements joined by the splice connector. Thus, as shown in Fig. 30, two of the shortest strut elements 140a are spliced to form a strut assembly equal in length to the strut element 140c. Two of the next size strut elements 140b are spliced to form a strut assembly equal in length to the strut element 140d. Additional corresponding assemblies are shown in the composite view of Fig. 30. It is possible, of course, to join in a splice connector element 170 strut elements of different lengths, in order to develop strut assemblies of a length different from the standard, progressive strut length illustrated in Fig. 30.

Since all of the connector elements, regardless of configuration, employ a common spacing "d" from hub axis to the end surface of the socket-forming recess, the relationships illustrated in Fig. 30 will be true in any situation in which strut elements are assembled to a connector with a coaxial orientation.

The assembly shown in Figs. 33 and 34 is comprised of a plurality of single recess connector elements 160 (Fig. 21) joined with a plurality of strut elements of a predetermined uniform size, such as elements 140c as reflected in Fig. 30. A first plurality (three in the illustration) of single unit connector elements 160 are arranged in side-by-side relation, spaced apart by the width of a connector element, and are rotatably connected to a strut element 280 in Fig. 34. The strut element 280 is passed through the hub opening 281, in which it is freely received. For purposes of identification, the reference numeral 282 is applied to connector elements of the first group. Alternating with the connector elements 282 are similar connector elements 283. The connector elements 283 are snap fitted onto the strut element 280, with the rib portions 130, 131 of the connector element tightly received in the grooves 144 of the strut element, so as to tightly grip the strut element. Thus, while the individual connector elements 282 are freely movable with respect to the strut element 200, the alternating connector elements 283 are rigidly secured thereto, both against rotation and sliding movement. A successor of such assemblies provides an articulated belt-like structure, which can be endless in form or of finite length, as desired, and can be of any suitable width for the purpose intended. As shown in Fig. 33, the end extremities of the strut elements project a short distance from each edge of the belt-like assembly.

Structures of the type shown in Figs. 33, 34 have a wide variety of advantageous uses. Among these is the formation of tracks, for track-laying vehicles such as bulldozers, cranes, tanks and the like. Panel-like structures can also be assembled to function, in a toy structure, as wall or roof panels, for example, floor surfacing and the like. A narrow assembly can be utilized as a flexible cable-like element, for example.

With reference now to Figs. 35 to 41, there is shown a particularly advantageous form of connector element arranged for assembly with another connector element having similar features, to provide a connector assembly providing means for joining strut elements extending in a plurality of planar directions.

The connector elements 310 illustrated in Fig. 35 are formed with four recess positions 150, angularly spaced at 45°. Directly opposite one of the recess positions 150a of each element is positioned a special recess 311. The recess 311 is defined by spaced-apart side walls 312, 313 and a bottom wall 314. The side walls 312, 313 are spaced apart a distance equal to the standard thickness of a connector element and are arranged symmetrically to an imaginary plane extending through the geometric center of the connector element 310 and containing the longitudinal axis of the oppositely oriented strut-receiving recess 150a. The exposed surface of the end wall 314 lies on a plane at right angles to the previously mentioned plane, also passing through the principal axis 315 of the connector element 310.

The connector elements 310 are arranged to be assembled together in the manner reflected in Figs. 35 to 37, with the respective special recess portions 311 facing each other and the principal planes of the respective connector elements being oriented at right angles. The respective connector elements 310 are pressed together until the end walls 314 of the recesses 311 are in firm face-to-face contact, so that the respective central axes 315 of each element lie substantially in a common plane.

Desirably, each of the recess walls 312, 313 is formed with a transverse groove 316 arranged to

receive, in detent locking relation, ribs 317 projecting from opposite sides of spoke walls 319. Accordingly, when the two elements are assembled together, they are relatively rigidly locked together against any but intentional separation.

As reflected in Fig. 36, when the walls 312, 313 first engage the projecting ribs 317, the walls are displaced outwardly. The presence of a small gap 318 enables the gripping arms of the opposed strut-receiving recess 150a to be easily displaced toward each other while the walls 312, 313 are being outwardly displaced by the ribs 317. When the parts are pressed together to their final positions, with the end walls 314 seated against each other, each of the sets of ribs 317 will be seated in each of the sets of grooves 316, substantially as shown in Fig. 37.

The assembled connector elements of Figs. 35 to 39 provide for the support of strut elements in each of two planar directions disposed at right angles. The connector arrangement thus is perfectly suited for assembling external corners of structures, as can be appreciated by observations of Figs. 38 and 39.

In the composite view of Fig. 40, a connector element 310 of the type shown in Figs. 35 to 39 is arranged to be joined with a second, seven-position connector element 410. The connector element 410 includes a special recess 411 disposed coaxially opposite to a strut-receiving recess 150a.

Assembly of the connector elements 310, 410, to form a multi-planar assembly is accomplished in the same manner described with respect to Figs. 35 to 39. The resulting assembly is of T-shaped configuration when viewed from above, as reflected in Fig. 41, and provides for the mounting of strut elements in each of three planar directions. In the T-shaped assembly of Figs. 40, 41, the upper socket recess 150a is not accessible for normal, lateral snap-in assembly of a strut element, because of the presence of the associated connector element. However, by providing the gap 318 in the recess end wall, it becomes possible to insert the strut initially at an angle and to install it by a twisting motion, all as hereinbefore described. The gap 318 allows the gripping arms 126, 127 to more easily separate, in order to accommodate a twist-in assembly of the strut.

For certain applications, however, it may be desired to lock a connector element together with a strut passing through its central hub opening, for rotation in unison and/or for fixing the position of the connector element axially along the strut element. To this end, the system includes a drive element, such as illustrated in Figs. 42 to 44 of the drawing, for frictionally and non-rotatably gripping a strut element. In the illustrated form, the drive element comprises a drive block 510, injection molded of suitable plastic material and advantageously incorporating a socket-forming recess 150 of the form previously described. This includes particularly the opposed projecting ribs 130, 131 defining a narrow throat area between the gripping arms 126, 127, Adjacent the closed end of the recess 150, the block 510 advantageously mounts a driving lug 511 projecting laterally from one end face 512, generally parallel to the alignment of the ribs 130, 131.

In a typical utilization of the drive block 510, a connecting element 240, typically of a full "snowflake" configuration, having eight strut-receiving positions, is mounted on a strut 513. The drive block 510 is applied to the body portion of the strut 513, so that the respective ribs 130, 131 are received in and lockingly engaged with opposed longitudinal grooves 144 of the strut. The block 510 is thus rigidly fixed to the strut against rotation and also is frictionally restrained against longitudinal movement along the strut (being slidable thereallong, however, under appropriate force).

The location of the drive lug 511 is such that, when the connector element 240 and drive block 510 are directly adjacent each other, the drive lug 511 is positioned in and substantially occupies the trapezoidal space between a pair of adjacent, radially disposed spoke-like walls 123. The strut 513 and connector element 240 are thus locked against relative rotation, so that rotational drive applied to one of the elements is correspondingly imparted to the other. By positioning drive blocks 510 on opposite sides of a connector element, the connector element can be locked in position, axially on a strut.

For many dynamic toy assemblies, drive pulleys and/or wheels are useful and desirable elements. To advantage, a combined pulley/wheel element 610 is shown in Fig. 45. This is an injection molded part formed with an outer rim 611 and a central hub opening 612 adapted to be closely received over a strut element. Radially outward from the central opening 612 are one or more drive recesses 613. These are arranged to receive the drive lug 511 of a drive block (Fig. 42). As shown in Fig. 47, the element 610 is provided with an external annular recess 614, which enables the element to function as a pulley, when associated with an appropriate drive belt (not shown). When the element 610 functions as a pulley, it is drivingly connected to a strut element, using a drive block 510, functioning either as a drive pulley or a driven pulley, as the case may be.

The element 610 can be covered to form a wheel by applying the tire element of Fig. 46. The tire element 620 is formed of a resilient elastomer, such as neoprene. The inner portion 621 of the tire is of a width to be closely received in the annular

recess 614. The outer portion 622 of the tire is wider than the inner portion 621, advantageously equal in width to the thickness of the outer rim portion 611 of the wheel element 610. Shoulders 623 are formed at each side of the tire. These engage outer flanges 624 of the wheel element 610, to position the tire concentrically on the supporting rim.

When used as a wheel, the element 610 may be driven or not, as desired. If it is to be driven, then a drive block 510 is employed, as previously described.

The construction toy system of the invention provides a uniquely simplified, yet exceptionally versatile construction medium, for assembling a limitless variety of structures, both static and dynamic in character. The system easily lends itself to the production, by economical, mass production injection molding techniques of standardized building elements of a wide variety, permitting the relatively quick and simplified assembly of structures.

Within the basic concepts of the invention, it is possible to construct simplified and effective forms of dynamic structures, such as endless tracks or belts, driven rotating systems and the like. These are achieved with the consistent use of standardized strut elements and standardized connecting elements. That is, the connecting elements utilize standardized socket-forming recesses, although various in number, and such recesses are located at standardized distances from the principal axis of the connecting element. Likewise, the strut elements incorporate standard end configurations, in conjunction with body portions of various length. Further, by providing for a splice connector, capable of joining two strut elements end to end, the structural combinations available from a relatively limited number of standardized strut lengths is multiplied.

The elements of the construction toy of the invention are adapted readily for high production injection molding of the component parts of a suitable plastic material. A variety of such plastic materials are suitable for the purpose, it being necessary, of course, to select a material having a reasonable degree of strength and elasticity to enable proper functioning of the gripping arms, for example, over numerous assembly and disassembly operations. A material known to be suitable for the purpose is "Celcon M270", an acetal copolymer made available by Hoechst Celanese, Chatham, New Jersey, USA.

By enabling the hub-like connector elements to be joined with structural elements by a lateral snap-together action, it becomes more practical to assemble large and complex structures, because the center-to-center distance between component elements does not have to be altered during joining of the components. By contrast, where assembly of the components requires axial insertion of one part into another, center-to-center distances are temporarily enlarged, which at best requires great care and at worst may make it impossible to assemble certain types of structures.

The arrangement of the invention provides a unique two-way gripping action between the hub-like connector elements and the structural elements, wherein the outer, deflectable portions of the gripping arms provide lateral containment, while the innermost portions of the gripping arms form a relatively non-deflectable flange-receiving cavity which freely admits the end flange 86 of the structural element during lateral assembly, but provides positive restraint against axial movement of the structural element.

Claims

1. Construction toy system, comprising connector elements (10) and strut-like structural elements (13) adapted to be removably engaged with its ends in lateral and laterally open sockets (14) of such connector elements (10) to form a composite structure, said sockets (14) each having an inner end wall (15) and a pair of spaced-apart gripping arms (16) defining an axis (19) of said socket extending between said gripping arms, integral locking projections (24) extending inward from at least one of said gripping arms (16), said locking projections (24) being spaced from said inner end wall (15) and defining with said innner end wall (15) a first locking chamber, said gripping arms (16) being formed with concave grooves (18) therein, an opposed pair of said grooves (18) defining a second locking chamber, at least one end portion of said structural elements (13) being shaped to be confined within a generally cylindrical envelope, said end portion defining an axis of said structural element (13) and having a locking flange (26) receivable laterally within said first locking chamber and being locked therewith against movement in the direction of the axis of the structural element (13),
characterized in that,
each connector element (10) has more than one of said sockets (14), that the concave grooves (18) of the gripping arms (16) of each socket extend from said locking projection (24) toward the ends of each gripping arm of said socket (14), that said locking flange (26) is arranged at the end extremity of said structural element (13), that each end portion of the structural element (13) has a circumferential groove (27) immediately adjacent and partly

defining said locking flange (26), that said annual groove (27) is adapted to receive said locking projections (24) when said structural element (13) is inserted laterally into said open ended socket (14), that said concave groove (27) is shaped in a position to cloesely receive portions of the cylindrical envelope of the structural element (13), and that said gripping arms (16) are elastically deflectable to accomodate lateral insertion of said structural element (13) into said socket (14).

2. Toy systems according to claim 1, characterized in that the structural elements (13) have a generally circular cross section in the region of the end extremities thereof, that the spacing between pairs of gripping arms is less than the diameter of said circular cross section, and that the contours of the concave recesses (18) of said gripping arms correspond generally to the circular contours (28) of said structural elements.

3. Toy systems according to claim 1 or 2, characterized in that the inner end wall (15) of each socket-forming section (14) extends between the gripping arms (16) of each pair at their inner ends and define with said gripping arms a generally U-shaped socket for the lateral reception of an end portion of a structural element (13), the cross section configuration of said socket, taken along its longitudinal axis (19), and in a plane bisecting said gripping arms (16), being generally in close confirmity to the longitudinal cross sectional configuration of an end portion of one of said structural elements (13).

4. Toy system according to one of claims 1 to 3, characterized in that said locking projection means (24) is of arcuate convex configuration and extends generally from one edge of a gripping arm (16) to the other, the annular groove (27) in said structural element having a cross sectional configuration to closely receive said locking projections (24), whereby said structural element (13) is locked against separation from said connector element in the direction of the axis of said structural element.

5. Toy system according to one of claims 1 to 4, characterized in that said structural elements (13) are of generally circular cross section over at least a portion of their length, that said structural elements are of generally "X" cross section, within the envelope of said generally circular cross section, over at least a portion of their length, said portions of generally "X" cross section being receivable in the space between a pair of said gripping arms (16) while said structural elements (13) are disposed at right angels to the axis (19) defined by said gripping arms, and that said structural element (13) is adapted to be forced laterally between a pair of opposed locking projections (24) on said gripping arms (16) and being thereby lockingly gripped by said projections.

6. Toy system according to one of claims 1 to 5, characterized in that opposed locking projections (130, 131) on said gripping arms (126, 127) extend transversely thereto and extend into the space between said gripping arms, that said strut-like structural element (13) has an end flange defined in part by said annular groove (147) and a flat end face (154) spaced from said groove, and that said annular groove (147) and said locking projections (130, 131), and said end wall (152) and said flat end face (154), are so geometrically related that, when said structural element is assembled in said recess, the flat end face of said structural element is urged firmly and resiliently in an axial direction into face to face contact with said end wall (152).

7. Toy system according to one of claims 1 to 6, characterized in that said connector element comprises a first connector element (70) and has a central core (71) defining a central axis of said connector element, a plurality of sockets (82) arranged generally radially about said core for receiving structural elements, said core and sockets forming said first connector element to be of generally flat configuration and of predetermined thickness, and an open-sided recess (74) in one side of said first connector element, extending to said central axis and having a width to the thickness of the connector element, said open-sided recess (74) being adapted to receive a second connector element (70a) to form a composite connector element having sockets radiating in two planes.

8. Toy system according to claim 7, characterized in that the first connector (70) has a socket (83) for receiving a strut-like structural element (90) directly opposite said open sided recess, whereby, in an assembly of first and second joined connector elements (70, 70a), the second connector element (70a) has a socket for receiving a strut-like structural element at the location of the open-sided recess in the first connector element (70).

9. Toy system according to claim 7 or 8, characterized in that the open-sided recess (74) is defined by a pair of spaced-apart, parallel guide walls (72, 73) for receiving the second connector element (70a), said guide walls having detent means (97) therein cooperating with detent means (98) on the second connector element (70a) to retain an assembled pair of first and second connector elements in joined relation.

10. Toy system according to one of claims 7 to 9, characterized in that said first connector element (70) has a plurality of sockets (82, 83), each comprised of a pair of gripping arms and an end wall, the end walls (79, 80) of adjacent sockets being adjacent and integrally joined, and that at least one of said end walls (80) is slotted to form a gap (81), to accomodate outward deflection of said guide walls (72, 73).

11. Toy system according to one of claims 7 to 10, characterized in that said first connector element has a socket (83) for receiving a structural element located directily opposite said open-sided recess, and that said this socket (83) has the slotted end wall (80).

12. Toy system according to one of claims 5 to 11, characterized in that said sockets (82, 83) are configured for lateral, snap-in reception of end portions of said structural elements (90), and that the gripping arms of said last mentioned socket (83) is separable upon displacement of the parts of said slotted end wall (80), to accommodate assembly of a structural element (90) by other than lateral, snap-in reception.

13. Toy system according to one of claims 7 to 12, characterized in that said open sided recess (74) has detent means (97) of a first type therein, and that portions of said first connector element (70) located diametrically opposite said open sided recess are formed with detent means (98) of a second type engageable with detent means (97) of said first type for lockingly engaging a pair of connector elements (70, 70a) in assembled relation.

14. Toy system according to one of claims 7 to 13, characterized in that said first connector element (310) has a plurality of sockets (150, 150a), each comprised of a pair of gripping arms and an end wall, that the end walls of adjacent sockets are adjacent and integrally joined, that at least one of said sockets (150a) is arranged directly opposite to said open-sided recess (311), and that the balance of said sockets (150) being arrayed on the same side of plane containing said open-sided recess (311) and said one socket (150a), whereby, when said first connector element is joined with a second connector element (310), said second connector element has a plane containing the axes of its sockets, the sockets of the first connector element project in the plane of and/or one side of the plane of the second connector element.

15. Toy system according to claim 14, characterized in that the first connector element is configured with one socket (150a) directly opposite to said open-sided recess (312) and all other sockets (150) are on one side of a plane containing said one socket (150a) and said recess (311) and are disposed at right angles to said plane containing the open-sided recess (311) and at least one socket (150a) of said first connector element.

16. Toy system according to claim 15, characterized in that said second connector element is configured the same as the first connector element, whereby a connected pair of said connector elements define a right angle corner structure.

17. Toy system according to claim 15, characterized in that said second connector element (410) is configured with sockets (150, 150a) extending in an array of greater than 180, whereby a connected pair of said first and second connector elements (310, 410) define a Tee-shaped joint structure.

18. Construction toy system, comprising connector elements (10) and strut-like structure elements (13) removably joinable with other elements to form a coherent structure, wherein at least certain of the connector elements (10) comprise a common portion and a plurality of socket-forming sections (14) extending generally radially outward from said common portion, each said socket-forming section being disposed on a predetermined socket axis (19) extending generally radially from said common portion, each said socket-forming section comprising a pair of spaced-apart, generally parallel cantilever mounted gripping arms (16) symmetrically arranged with respect to its said socket axis, each pair of gripping arms (16) defining between them an open-sided, axially disposed socket (14), said strut-like structural elements (13) being formed with opposite end portions and intermediate portions integrally

joining said end portions,
characterized in that,
the gripping arms (16) are formed with first interlock means (18) to interlock with a strut-like structural element (13) for releasably but firmly holding a strut element aligned with said socket axis, second interlock means (24) are formed in said socket-forming section to interlock with a strut-like structural element (13) simultaneously engaged by the first interlock means (18) for releasably but firmly holding the strut-like structural element (13) in a predetermined axial position along said socket axis, the opposite end portions being provided with first and second interlocking means (28, 27) for simultaneous cooperative engagement with the first and second interlocking means (18, 24) of a socket-forming section of a connector element, whereby the respective first interlocking means (18, 28) hold a structural element in coaxial alignment with a selected socket axis while the respective second interlocking means (24, 27) hold said structural element in predetermined axial position on said selected socket axis, said arms (16) being resiliently separable to accommodate lateral snap-in reception of an end portion of a strut-like element (13) in a direction transverse to the socket axis (19), whereby the
structural element is firmly spaced and positioned in fixed relation to the socket-forming section.

19. Toy system according to claim 18, characterized in that the second interlocking means comprise opposed rib-like elements (24) on the spaced-apart gripping arms (16) and conforming groove means (27) on the opposite end portions of the strut-like structural elements (13), the rib-like elements (24) being oriented transversely to the socket axis (19) to receive the conforming groove means (27) during lateral reception of an end portion between a pair of gripping arms (16).

20. Toy system according to claim 18 or 19, characterized in that the socket-forming section includes an end wall (154) integral with the gripping arms and spaced from the rib-like elements (130), the strut-like structural elements (140) having end surfaces spaced from said conforming groove means (147), the spacing between the rib-like elements (330) and the end wall (154) being such, in relation to the spacing between the conforming groove means (147) and the end surface (152), that the end wall (154) and the end surface (152) are urged into snug contact when a strut-like structural element (13) is received in the socket-forming section.

21. Toy system according to claim 18, characterized in that the second interlocking means comprise a rib-like interlocking means (24) on one of the socket-forming section (14) or the strut-like structural element (13), and conforming groove means (27) on the other of said section or element.

22. Toy system according to claim 21, characterized in that the socket-forming section has a closed end formed by an end wall (152) and that the structural element has an end surface (154), the second interlock means yieldably urging the end surface into snug contact with the end wall.

23. Toy system according to claim 18, characterized in that the commong portion of the connector element (160) includes a hub-forming section (161) having a transverse opening (163) therein of a size and shape for the axial reception of a strut-like structural element and defining a hub axis (164), the hub axis being disposed at rigth angles to and substantially intersecting with said socket axis (164), and the connector element (160) comprises a single socket-forming section (150) integrally associated with a single hub-forming section (161).

24. Toy system according to claim 18, characterized in that the connector element (170) comprises a pair of socket-forming sections (150) integrally associated with a single hub-forming section, the socket-forming sections being oppositely disposed and being aligned along a common socket axis (171).

25. Toy system according to claim 18, characterized in that the connector element comprises a plurality of "n" socket-forming sections, each of said socket-forming sections being aligned along respective socket axes disposed approximately 45° with respect to a neighboring socket axis and all of said axes intersecting each other substantially at said hub axis, wherein "n" is an integer between 2 and 8.

26. Toy system according to one of claims 23, 24 or 25, characterized in that each of said socket-forming sections being disposed at a fixed predetermined distance (d) from the hub axis, whereby, when a strut-like structural element (13) is retained in any socket-forming section, the end extremity of the structural element is

spaced a fixed, uniform distance from the hub axis.

27. Toy system according to one of claims 18 to 26, characterized in that it includes a series of strut-like structural elements of graduated lengths, wherein in a system of "n" different lengths of said structural elements, each length is determined according to the formula $L_x = (1.414)^{(x-1)} * D_{min} - (2 * d)$, where L_x = Length of the x^{th} structural element of a series 1 to "n", D_{min} = the spacing between hub axes of two connector elements joined by the shortest structural element of the series, and d = the distance from the hub axis to the end wall of the socket-forming section,
a plurality of connector elements and strut-like structural elements of said system being adapted to be assembled into one or more right triangles (250, 260, 270).

28. Toy system according to claim 27, characterized in that an assembly comprising a connector element (170) of claim 7, joined with two structural elements (140b) of length l_x in a series, is equal in length to a structural element (140d) of length $L_{(x+2)}$ in said series.

29. Toy system according to claim 18, characterized in that the gripping arms (16) are formed with rib-like projections (24) extending transverse with respect to the socket axis (19) and project inward toward the socket axis, the strut-like structural element (13) being formed, in a predetermined area between its ends, with opposed longitudinally extending grooves (39), the strut-like structural element (13) being yieldably received in the socket (14) in an orientation disposed at 90° to the socket axis (19), with said rib-like projections (24) being received in an opposed pair of said grooves (39), whereby the strut-like structural element (13) is non-rotatably gripped by the connector element with the structural element disposed perpendicular to the socket axis (19).

30. Toy system according to claim 29, characterized in that the common portion of the connector element includes a hub-forming section (161) having a transverse opening (163) therein of a size and shape for the axial reception of a strut-like structural element and defining a hub axis (164), the hub axis being disposed at right angles to and substantially intersecting with the socket axis (165), wherein a plurality of such connector elements are joined to form a belt-like structure, a first group (282) of such connector elements being arranged in side-by-side relation, spaced apart by a distance at least equal to the width of a connector element, the hub axes of each of the elements of said first group being coaxially aligned, a first strut-like structural element (280) extending through the hubs of each of the connector elements of said first group, a second group (283) of such connector elements (160) being arranged in side-by side relation, and interspersed in the spaces between connector elements of the first group (282), the connector elements of the second group (283) gripping said first strut-like structural element (280) by engagement of the rib-like projections (130, 131) of the connector elements with an opposed pair of longitudinal grooves (144) of said first structural element, and additional groups (282, 283) of such connector elements and strut-like structural elements are connected in an extended series to form an articulated belt-like structure.

31. Toy system according to claim 30, characterized in that the strut-like structural elements (280) are of such length, in relation to the combined width of the first and the second groups (282, 283) of connector elements, that end portions of the structural elements project laterally from each side of the assembly.

32. Toy system according to claim 29, characterized in that the connector element (510) comprises an integral formed, laterally extending drive lug (511), the connector element being mounted on a strut-like structural element (513) with the rib-like projections (130, 131) of the connector element being received in opposed longitudinal grooves (144) of the structural element, whereby the connector element is locked in fixed relation to the structural element with the structural element at right angles to the socket axis, and that an additional element (240) is mounted on the structural element, the additional element being positioned adjacent to the connector element, the drive lug (511) being in driving engagement with an adjacent portion of the additional element.

33. Toy system according to claim 32, characterized in that the additional element comprises a circular wheel-like element (610) having a rim portion (611) and a hub portion, the hub portion having a hub opening (612) for receiving the strut element, that the wheel-like element has a drive opening (613) located a predetermined distance radially outward from the center of the hub portion, for the reception of the drive lug (511) of the connector element, and that the wheel-like element has an outwardly

facing circumferential groove (614) in its rim portion.

34. Toy system according to claim 33, characterized in that an annular tire-like element (620) formed of elatomeric material is removably received in the annular groove (614).

35. Adaptor element for use in interfacing the construction toy of one of claims 1 to 34 with a building block set of the type comprising a hollow molded building block element (41, 42) of rectangular configuration, provided with a top wall (44) and four side walls (45 to 48) defining an open cavity (49), a plurality of regularly spaced circular projections (50) extending upward from the top wall, and a plurality of internal projections (51) extending from said top wall into said cavity and toward the open side therof, which adaptor element comprises a hollow molded adaptor block (40) of rectangular configuration having one open side, said hollow molded adaptor block having a top wall (52) and four side walls (53), the internal surfaces of said side walls closely circumscribing an area occupied by a predetermined plurality of circular projections (50) of said building block element (41, 42), whereby said side walls (53) can be snugly engaged internally by said circular projections (50), said hollow molded adaptor block (40) further having a plurality of elongated, cylindrical projections (54) extending from its closed side, said cylindrical projections (54) having a length substantially greater than their diameter, spaced-apart pairs of said elongated projections (54) being separated from each other by a distance approximately equal to twice the thickness of the side walls (45 to 48) of said building block elements (40, 41), whereby a pair of said elongated projections, when inserted into the open sides of two adjacent building block elements (40, 41), secure said elements together and to the adaptor element, and said adaptor element has a hollow tubular internal projection (55) extending from its top wall substantially to its open side and being of an internal diameter to closely receive an end extremity of one of said structural elements.

36. Adaptor element according to claim 35, characterized in that said adaptor block (40) is of a width corresponding to the width of at least certain ones of said building block elements (41, 42), and that said elongated projections (54) being receivable internally of said certain building block elements and gripped therein.

Patentansprüche

1. Spielbaukasten enthaltend Verbindungselemente (10) und strebenförmige Strukturbauteile (13), welche so ausgelegt sind, daß sie mit ihren Endabschnitten löslich in seitlicher Richtung in seitlich offene Buchsen (14) dieser Verbindungselemente (10) eingreifen können, um auf diese Weise eine Verbundstruktur zu bilden, wobei diese Buchsen (14) jeweils eine innere Abschlußwand (15) und ein Paar im Abstand angeordnete Spannarme (16) aufweisen, welche die Achse (19) der sich zwischen den Spannarmen erstreckenden Buchse bilden, und in dem sich integrale Verriegelungsansätze (24) von mindestens einem der Spannarme (16) nach der Innenseite erstrecken, wobei die Verriegelungsansätze (24) im Abstand von der inneren Abschlußwand (15) verlaufen und mit dieser inneren Abschlußwand (15) eine erste Verriegelungskammer bilden, und in dem die Spannarme (16) konkave Einkerbungen (18) aufweisen und in dem ein gegenüberliegendes Paar dieser Einkerbungen (18) eine zweite Verriegelungskammer bildet, und in dem mindestens ein Endabschnitt des Strukturbauteils (13) so geformt ist, daß es in einer weitgehend zylindrischen Umhüllenden enthalten ist und dieser Endabschnitt eine Achse des Strukturbauteils (13) bildet und einen Verriegelungsflansch (26) aufweist, der seitlich innerhalb der ersten Verriegelungskammer aufgenommen ist und damit gegen eine Verschiebung in Richtung der Achse des Strukturbauteils (13) blockiert ist,
dadurch gekennzeichnet, daß
jedes der Verbindungselemente (10) mehr als eine der Buchsen (14) aufweist, so daß sich die konkaven Einkerbungen (18) der Spannarme (16) jeder der Buchsen von dem Verriegelungsansatz (24) zu den Endabschnitten der Spannarme der Buchse (14) erstrecken, und dadurch, daß der Verriegelungsflansch (26) am Endabschnitt des Strukturbauteils (13) angeordnet ist, und daß jeder Endabschnitt des Strukturbauteils (13) eine ringförmige Nut (27) in unmittelbarer Nähe des Verriegelungsflansches (26) aufweist und diesen teilweise bildet, und daß die ringförmige Nut (27) so ausgebildet ist, daß sie den Verriegelungsansatz (24) aufnehmen kann, wenn das Strukturbauteil (13) seitlich in die offene Buchse (14) eingeschoben wird, und daß die konkave Nut (27) an einer Stelle ausgebildet ist, um Teile der zylindrischen Umhüllenden des Strukturbauteils (13) dicht aufzunehmen, und dadurch, daß die Spannarme (16) elastisch biegbar sind, um ein seitliches Einschieben des Strukturbauteils (13)

in die Buchse (14) zu ermöglichen.

2. Spielbaukasten nach Anspruch 1,
dadurch gekennzeichnet, daß
die Strukturbauteile (13) im Bereich ihrer Endabschnitte einen weitgehend kreisförmigen Querschnitt aufweisen, und dadurch, daß der Abstand zwischen einzelnen Paaren von Spannarmen kleiner ist, als der Durchmesser des kreisförmigen Querschnittes, und daß das Profil der konkaven Einkerbungen (18) der Spannarme weitgehend dem kreisförmigen Profil (28) der Strukturbauteile entspricht.

3. Spielbaukasten nach einem der Ansprüche 1 oder 2,
dadurch gekennzeichnet, daß
sich die innere Abschlußwand (15) jeder der die Buchsen bildenden Abschnitte (14) zwischen den paarweise angeordneten Spannarmen (16) an ihren inneren Endabschnitten erstrecken, um mit diesen Spannarmen eine weitgehende U-förmige Buchse für die Aufnahme eines Endabschnittes eines Strukturbauteils (13) zu bilden, wobei der Querschnitt der Buchse entlang ihrer Längsachse (19) und in einer die Spannarme (16) schneidenden Ebene weitgehend mit dem Querschnitt in Längsrichtung eines Endabschnittes eines der Strukturbauteile (13) übereinstimmt.

4. Spielbaukasten nach einem der Ansprüche 1 bis 3,
dadurch gekennzeichnet, daß
der Verriegelungsansatz (24) eine gekrümmte konvexe Konfiguration aufweist und sich weitgehend von einer Kante eines Spannarmes (16) zu dessen anderer Kante erstreckt, und dadurch, daß die ringförmige Nut (27) in dem Strukturbauteil (13) einen Querschnitt besitzt, welcher es erlaubt, die Verriegelungsansätze (24) in einer Rastverbindung aufzunehmen, wodurch das Strukturbauteil (13) gegen eine Abtrennung von dem Verbindungselement in Richtung der Achse des Strukturlementes blokkiert ist.

5. Spielbaukasten nach einem der Ansprüche 1 bis 4,
dadurch gekennzeichnet, daß
die Strukturbauteile (13) mindestens über einen Teil ihrer Länge einen weitgehend kreisförmigen Querschnitt aufweisen, und daß diese Strukturbauteile innerhalb der Umhüllenden dieses weitgehend kreisförmigen Querschnittes mindesten über einen Teil ihrer Länge einen weitgehend "X"-förmigen Querschnitt haben und die Teile mit dem weitgehend "X"-förmigen Querschnitt in dem Freiraum zwischen einem Paar von Spannarmen (16) aufgenommen werden können, während die Strukturbauteile (13) im rechten Winkel zu der durch die Spannarme gebildeten Achse (19) angeordnet sind, und daß die Strukturbauteile (13) so ausgelegt sind, daß sie zwangsweise in ein Paar von gegenüberliegenden Verriegelungsansätzen (24) auf den Spannarmen (16) eingeschoben werden können, um auf diese Weise durch diese Verriegelungsansätze blockiert zu werden.

6. Spielbaukasten nach einem der Ansprüche 1 bis 5,
dadurch gekennzeichnet, daß
gegenüberliegende Verriegelungsansätze (130, 131), die auf den Spannarmen (126, 127) angeordnet sind und quer dazu verlaufen und sich in den Freiraum zwischen den Spannarmen erstrecken, und daß das strebenförmige Strukturbauteil (13) einen Abschlußflansch, welcher teilweise durch die ringförmige Einkerbung (147) gebildet wird, sowie einen flachen Endabschnitt (154) aufweist, welcher im Abstand von der Einkerbung angeordnet ist, und dadurch, daß die ringförmige Einkerbung (147), die Verriegelungsansätze (130, 131), die Abschlußwand (152) und der flache Endabschnitt (154) geometrisch so verbunden sind, da, wenn das Strukturbauteil in die Einkerbung eingesetzt wird, der flache Endabschnitt des Strukturbauteils fest und reibschlüssig in axialer Richtung in engen Flächenkontakt mit der Abschlußwand (152) gedrückt wird.

7. Spielbauskasten nach einem der Ansprüche 1 bis 6,
dadurch gekennzeichnet, daß
das Verbindungselement ein erstes Verbindungselement (70) aufweist und einen zentralen Kern (71) besitzt, welcher eine zentrale Achse des Verbindungselementes bildet, sowie eine Vielzahl von Buchsen (82), welche in weitgehend radialer Ausrichtung um den Kern angeordnet sind, um Strukturbauteile aufzunehmen, wobei dieser Kern und die Buchsen das erste Verbindungselement mit einer weitgehend flachen Konfiguration und vorbestimmter Dicke bilden, und dadurch, daß eine seitlich offene Einkerbung (74) in einem Seitenteil des ersten Verbindungselementes vorgesehen ist, welche sich gegen die zentrale Achse erstreckt und eine Weite entsprechend der Dicke des Verbindungselementes aufweist, wobei diese seitlich offene Einkerbung (74) so ausgelegt ist, daß sie ein zweites Verbindungselement (70a) aufnehmen kann, um einen Verbund zu

bilden, der Buchsen aufweist, welche sich in zwei Ebenen erstrecken.

8. Spielbaukasten nach Anspruch 7, **dadurch gekennzeichnet, daß** das erste Verbindungselement (70) eine Buchse (83) für die Aufnahme eines strebenförmigen Strukturbauteils (90) direkt gegenüber der seitlich offenen Einkerbung aufweist, wodurch in einem Zusammenbau aus ersten und zweiten Verbindungselementen (70, 70a) das zweite Verbindungselement (70a) eine Buchse aufweist, um ein strebenförmiges Strukturbauteil an der Stelle der seitlich offenen Einkerbung in dem ersten Verbindungselement (70) aufzunehmen.

9. Spielbaukasten nach einem der Ansprüche 7 oder 8, **dadurch gekennzeichnet, daß** die seitlich offene Einkerbung (74) durch ein Paar im Abstand angeordnete parallele Führungswände (72, 73) gebildet wird, um so das zweite Verbindungselement (70a) aufzunehmen, und diese Führungswände Spannmittel (97) aufweisen, welche mit Spannmitteln (98) auf dem zweiten Verbindungselement (70a) zusammenwirken, um ein zusammengebautes Paar aus ersten und zweiten Verbindungselementen in Verbindung zu halten.

10. Spielbaukasten nach einem der Ansprüche 7 bis 9, **dadurch gekennzeichnet, daß** das erste Verbindungselement (70) eine Vielzahl von Buchsen (82, 83) aufweist, welche aus einem Paar Spannarmen und einer Abschlußwand bestehen, und die mit Abschlußwänden (79, 80) von benachbarten Buchsen integral verbunden sind, und dadurch, daß mindestens eine der Abschlußwände (0) geschlitzt ist, um einen Spalt (81) zu bilden, um dadurch eine Durchbiegung der Führungswände (72, 73) nach der Außenseite zu ermöglichen.

11. Spielbaukasten nach einem der Ansprüche 7 bis 10, **dadurch gekennzeichnet, daß** das erste Verbindungselement eine Buchse (83) für die Aufnahme eines Strukturbauteils aufweist, welches direkt gegenüber der seitlich offenen Einkerbung angeordnet ist, und dadurch, daß diese Buchse (83) die geschlitzte Abschlußwand (80) enthält.

12. Spielbaukasten nach einem der Ansprüche 5 bis 11, **dadurch gekennzeichnet, daß** die Buchsen (82, 83) für ein seitliches Einrasten von Endabschnitten der Strukturbauteile (90) konfiguriert sind, und daß die Spannarme der letztgenannten Buchse (83) durch Verschiebung der Einzelteile der geschlitzten Abschlußwand (80) gelöst werden können, um einen Zusammenbau eines Strukturbauteils (90) auf eine andere Weise, als durch seitliches Einrasten zu ermöglichen.

13. Spielbaukasten nach einem der Ansprüche 7 bis 12, **dadurch gekennzeichnet, daß** die seitlich offene Einkerbung (74) Arretiermittel (97) einer ersten Art aufweist, und daß Teile des ersten Verbindungselementes (70), welche diametral gegenüber der seitlich offenen Einkerbung angeordnet sind, mit Srretiermitteln (98) einer zweiten Art ausgerüstent sind, welche mit den Arretiermitteln (97) der ersten Art in Eingriff treten, um ein Paar Verbindungselemente (70, 70a) im zusammengebauten Zustand zu blockieren.

14. Spielbaukasten nach einem der Ansprüche 7 bis 13, **dadurch gekennzeichnet, daß** das erste Verbindungselement (310) eine Vielzahl von Buchsen (150, 150a) aufweist, die jeweils aus einem Paar Spannarme und einer Abschlußwand bestehen,, und daß die Abschlußwände von benachbarten Buchsen aneinanderliegen und integral verbunden sind, und daß wenigstens eine der Buchsen (150a) direkt gegenüber der seitlich offenen Einkerbung (311) angeordnet ist, und dadurch, daß die übrigen Buchsen (150) auf der gleichen Seite einer Ebene angeordnet sind, welche die seitlich offene Einkerbung (311) und eine der Buchsen (150a) umfaßt, wodurch bei der Verbindung des ersten Verbindungselementes mit einem zweiten Verbindungselement (310) dieses zweite Verbindungselement eine Ebene umfaßt, welche die Achsen der Buchsen einschließt und daß sich die Buchsen des ersten Verbindungselementes in die Ebene des und/oder einer Seite der Ebene des zweiten Verbindungselementes erstreckt.

15. Spielbaukasten nach Anspruch 14, **dadurch gekennzeichnet, daß** das erste Verbindungselement eine Buchse (150a) direkt gegenüber der seitlich offenen Einkerbung (312) aufweist und daß sich alle anderen Buchsen (150) auf einer Seite einer Ebene befinden, welche diese Buchse (150a) und die Einkerbung (311) einschließt, und daß sie im rechten Winkel zu der Ebene angeord-

net sind, welche die seitlich offene Einkerbung (311) und wenigstens eine Buchse (150a) des ersten Verbindungselementes enthält.

16. Spielbaukasten nach Anspruch 15, **dadurch gekennzeichnet, daß** das zweite Verbindungselement genauso konfiguriert ist, wie das erste Verbindungselement, so daß das Paar Verbindungselemente eine rechtwinklige eckige Struktur bildet.

17. Spielbaukasten nach Anspruch 15, **dadurch gekennzeichnet, daß** das zweite Verbindungselement (410) mit Buchsen (150, 150a) ausgestattet ist, welche sich in einer regelmäßigen Anordnung von über 180° erstrecken, wodurch ein verbundenes Paar aus ersten und zweiten Verbindungselementen (310, 410) eine T-förmige Anschlußstruktur bilden.

18. Spielbaukasten mit Verbindungselementen (10) und strebenförmigen Strukturbauteilen (13), welche löslich mit anderen Elementen verbunden werden können, um eine zusammenhängende Struktur zu bilden, in dem wenigstens einige der Verbindungselemente (10) einen gemeinsamen Teil und eine Vielzahl von Buchsen bildenden Abschnitten (14) enthalten, welche sich weitgehend radial nach außen von diesem gemeinsamen Teil erstrecken, und jeder der eine Buchse bildenden Abschnitte auf einer vorbestimmten Achse der Buchse (19) angeordnet ist, welche sich weitgehend radial von diesem gemeinsamen Teil erstreckt, und jeder der eine Buchse bildenden Abschnitte ein Paar im Abstand angeordnete weitgehend parallel und freitragend montierte Spannarme (16) aufweist, welche symmetrisch um die Achse der Buchse angeordnet sind, und jedes einzelne Paar Spannarme (16) in ihrem Zwischenbereich eine seitlich offene axial angeordnete Buchse (14) bildet, und die strebenförmigen Strukturbauteile (13) gegenüberliegende Endabschnitte und Zwischenbereiche enthalten, welche diese Endabschnitte integral miteinander verbinden,
dadurch gekennzeichnet, daß
die Spannarme (16) erste Verriegelungsmittel (18) aufweisen, welche in ein strebenförmiges Strukturbauteil (13) eingreifen, um ein mit der Achse der Buchse gefluchtetes Strebelement löslich aber in fester Stellung zu halten, und daß in dem die Buchse bildenden Abschnitt zweite Verriegelungsmittel (24) vorgesehen sind, um in ein strebenförmiges Strukturbauteil einzugreifen, welches gleichzeitig mit dem ersten Blockiermittel (18) in Eingriff steht, um das strebenförmige Strukturbauteil (13) in einer vorbestimmten axialen Position an der Achse der Buchse löslich aber in fester Stellung zu halten, und daß die entgegengesetzten Endabschnitte mit ersten und zweiten Verriegelungsmitteln (28, 27) für einen gleichzeitigen zusammenwirkenden Eingriff mit den ersten und zweiten Verriegelungsmitteln (18, 24) eines eine Buchse bildenden Abschnittes eines Verbindungselementes ausgestattet sind, so daß die jeweils ersten Verriegelungsmittel (18, 28) ein Strukturbauteil in koaxialer Fluchtung mit einer ausgewählten Achse der Buchse halten können, während die jeweils zweiten Blockiermittel (24, 27) dieses Strukturbauteil in einer vorbestimmten axialen Position auf der ausgewählten Achse der Buchse halten, und dadurch, daß die Spannarme (16) elastisch spreizbar sind, um ein seitliches Einrasten eines Endabschnittes eines strebenförmigen Elementes (13) in einer Richtung zu ermöglichen, welche quer zu der Achse der Buchse (19) verläuft, wodurch das Strukturbauteil sicher im Abstand gehalten und in einem festen Verhältnis zu dem die Buchse bildenden Abschnitt positioniert werden kann.

19. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** die zweiten Verriegelungsmittel gegenüberliegende rippenartige Elemente (24) auf den im Abstand angeordneten Spannarmen (16) aufweisen, und daß entsprechende Einkerbungen (27) an den entgegengesetzten Endabschnitten der strebenförmigen Strukturbauteile vorgesehen sind, wobei die rippenartigen Elemente (24) quer zur Achse der Buchse (19) ausgerichtet sind, um die entsprechenden Einkerbungen (27) während dem seitlichen Einschieben eines Endabschnittes zwischen einem Paar Spannarmen (16) aufzunehmen.

20. Spielbaukasten nach einem der Ansprüche 18 oder 19, **dadurch gekennzeichnet, daß** der die Buchse bildende Abschnitt eine Abschlußwand (154) aufweist, welche integral mit den Spannarmen ausgebildet und von den rippenartigen Elementen (130) im Abstand angeordnet ist, und daß die strebenförmigen Strukturbauteile (140) Endflächen aufweisen, welche im Abstand von den entsprechenden Einkerbungen (147) angeordnet sind, und daß der Abstand zwischen den rippenartigen Elementen (330) und der Abschlußwand (154) so ausgelegt ist, daß er im Verhältnis mit dem Abstand zwischen den entsprechenden Einkerbungen (147) und der Abschlußwand (152)

steht, so daß diese Abschlußwand (154) und die Endfläche (152) in einen weichen Kontakt gedrückt werden, wenn ein strebenförmiges Strukturbauteil (13) in dem die Buchse bildenden Abschnitt aufgenommen wird.

21. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** die zweiten Verriegelungsmittel rippenartige Verriegelungsmittel (24) auf einem der die Buchse bildenden Abschnitte (14) oder dem strebenförmigen Strukturbauteil (13) aufweisen, sowie entsprechende Einkerbungen (27) an dem anderen Abschnitt oder Element.

22. Spielbaukasten nach Anspruch 21, **dadurch gekennzeichnet, daß** der die Buchse bildende Abschnitt ein durch eine Abschlußwand (152) gebildetes geschlossenes Ende aufweist und daß das Strukturbauteil eine Endfläche (154) aufweist und daß das zweite Verriegelungsmittel die Endfläche elastisch in einen weichen Kontakt mit der Abschlußwand drückt.

23. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** der gemeinsame Teil des Verbindungselementes (160) einen eine Nabe bildenden Abschnitt (161) aufweist, welcher eine schräge Öffnung (163) in einer Größe und Form aufweist, welche für die axiale Aufnahme eines strebenförmigen Strukturbauteils geeignet ist und eine Nabenachse (164) bildet, und daß die Nabenachse im rechten Winkel zu der Achse der Buchse (164) angeordnet ist und diese weitgehend schneidet, und daß das Verbindungselement (160) einen einzigen eine Buchse bildenden Abschnitt (150) aufweist, welcher integral mit einem einzigen eine Nabe bildenden Abschnitt (161) ausgebildet ist.

24. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** das Verbindungselement (170) ein Paar Buchsen bildende Abschnitte (150) aufweist, welche integral mit einem einzigen eine Nabe bildenden Abschnitt ausgebildet sind, und daß die die Buchsen bildenden Abschnitte entgegengesetzt angeordnet und entlang einer gemeinsamen Achse der Buchse (171) gefluchtet sind.

25. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** das Verbindungselement eine Vielzahl von "n" Buchsen bildenden Abschnitten aufweist, wobei jeder dieser die Buchsen bildenden Abschnitte entlang entsprechenden Buchsenachsen gefluchtet und in einem Winkel von etwa 45° gegenüber einer benachbarten Achse der Buchse angeordnet sind, und daß sich alle diese Achsen weitgehend an dieser Nabenachse schneiden, und daß "n" ein ganze Zahl zwischen 2 und 8 darstellt.

26. Spielbaukasten nach einem der Ansprüche 23, 24 oder 25, **dadurch gekennzeichnet, daß** jeder der die Buchsen bildenden Abschnitte in einem festen vorbestimmten Abstand (d) von der Nabenachse angeordnet ist, wodurch, wenn ein strebenförmiges Element (13) in einem der eine Buchse bildenden Abschnitte gehalten ist, der Endabschnitt des Strukturbauteils in einem festen gleichmäßigen Abstand von der Nabenachse gehalten wird.

27. Spielbaukasten nach einem der Ansprüche 18 bis 26, **dadurch gekennzeichnet, daß** er eine Reihe von strebenförmigen Strukturbauteilen unterschiedlicher Länge aufweist, wobei in einem System von "n" unterschiedlichen Längen dieser Strukturbauteile jede einzelne Länge nach der Formel $L_x = (1{,}414)^{(x-1)} * D_{min} - (2 * d)$ berechnet wird, und darin ist L_x gleich die Länge des x^{ten} Strukturbauteils einer Reihe von 1 bis "n", und D_{min} ist der Abstand zwischen den Nabenachsen von zwei Verbindungselementen, welche durch das kürzeste Strukturbauteil der Reihe verbunden sind, und d ist der Abstand zwischen der Nabenachse und der Abschlußwand des die Nabe bildenden Abschnittes, und daß eine Vielzahl von Verbindungselementen und strebenförmigen Strukturbauteilen dieses Systems so ausgelegt ist, daß sie in einem oder mehreren rechteckigen Dreiecken (250, 260, 270) zusammengefaßt werden können.

28. Spielbaukasten nach Anspruch 27, **dadurch gekennzeichnet, daß** ein ein Strukturbauteil (170) aus Anspruch 7 enthaltender Zusammenbau, welcher mit zwei Strukturbauteilen (140b) mit einer Länge 1_x reihenweise verbunden ist, die gleiche Länge hat, wie ein Strukturbauteil (140d) mit einer Länge $L_{(x+2)}$ in dieser Reihe.

29. Spielbaukasten nach Anspruch 18, **dadurch gekennzeichnet, daß** die Spannarme (16) mit rippenartigen Vorsprüngen (24) ausgestattet sind, welche sich quer zur Achse der Buchse erstrecken, und daß das strebenförmige Strukturbauteil (13) in

einem vorbestimmten Bereich zwischen seinen Endabschnitten mit gegenüberliegenden sich in Längsrichtung erstreckenden Einkerbungen (39) ausgestattet ist, und daß das strebenförmige Strukturbauteil (13) elastisch in der Buchse (14) in einem Winkel von 90° zur Achse der Buchse (19) angeordnet ist, und daß die rippenartigen Vorsprünge (24) in einem entgegengesetzten Paar von Einkerbungen (39) aufgenommen sind, wodurch das strebenförmige Strukturbauteil (13) drehfest von dem Verbindungselement erfaßt wird, wobei das Strukturbauteil vertikal zur Achse der Buchse (19) angeordnet ist.

30. Spielbaukasten nach Anspruch 29, **dadurch gekennzeichnet, daß** der gemeinsame Teil des Verbindungselementes einen eine Nabe bildenden Abschnitt (161) mit einer schrägen Öffnung (163) aufweist, welche eine Größe und Form aufweist, welche für die axiale Aufnahme eines strebenförmigen Strukturbauteils geeignet ist und eine Nabenachse (164) bildet, und daß die Nabenachse im rechten Winkel zur Achse der Buchse (165) und diese weitgehend schneidend angeordnet ist, und daß eine Vielzahl solcher Verbindungselemente miteinander verbunden ist, um eine bandartige Struktur zu bilden, und daß eine erste Gruppe (282) solcher Verbingungselemente im Seitenverhältnis zueinander in einem Abstand angeordnet ist, welche mindestens gleich der Dicke des Verbindungselementes ist, und daß die Nabenachsen jedes dieser Elemente dieser ersten Gruppe koaxial gefluchtet sind, und daß sich ein erstes strebenförmiges Strukturbauteil (280) die Haben der einzelnen Verbindungselemente der ersten Gruppe durchquert, und daß eine zweite Gruppe (283) solcher Verbindungselemente (160) im Seitenverhältnis zueinander im Abstand in den Freiräumen zwischen den Verbindungselementen der ersten Gruppe (282) angeordnet ist, und daß die Verbindungselemente der zweiten Gruppe (283) das erste Strukturbauteil (280) durch den Eingriff der rippenartigen Vorsprünge (130, 131) der Verbindungselemente in ein gegenüberliegendes Paar von längsförmigen Einkerbungen (144) des ersten Strukturbauteils erfassen, und daß zusätzliche Gruppen (282, 283) solcher Verbindungselemente und strebenartiger Strukturbauteile in einer erweiterten Reihe miteinander verbunden sind, um eine angelenkte bandartige Struktur zu bilden.

31. Spielbaukasten nach Anspruch 30, **dadurch gekennzeichnet, daß** die strebenförmigen Strukturbauteile (280) eine Länge haben, welche im Verhältnis zu der kombinierten Dicke der ersten und zweiten Gruppen (282, 283) von Verbindungselementen steht, und dadurch, daß sich die Endabschnitte der Strukturbauteile seitlich von jeder der Seiten des Zusammenbaus erstrecken.

32. Spielbaukasten nach Anspruch 29, **dadurch gekennzeichnet, daß** das Verbindungselement (510) eine integral geformte sich seitlich erstreckende Antriebsnase (511) aufweist, und daß das Verbindungselement auf einem strebenförmigen Strukturbauteil (513) montiert ist, und daß die rippenartigen Vorsprünge (130, 131) des Verbindungselementes in gegenüberliegenden längsförmigen Einkerbungen (144) des Strukturbauteils aufgeommen sind, wodurch das Verbindungselement in einem festem Verhältnis mit dem Strukturbauteil verriegelt ist, wobei sich das Strukturbauteil im rechten Winkel zu der Achse der Buchse befindet, und dadurch, daß ein zusätzliches Element (240) auf dem Strukturbauteil montiert ist und dieses zusätzliche Element in der Nachbarschaft des Verbindungselementes positioniert ist und daß sich die Antriebsnase (511) in antriebsmäßigen Eingriff mit einem benachbarten Teil dieses zusätzlichen Elementes befindet.

33. Spielbaukasten nach Anspruch 32, **dadurch gekennzeichnet, daß** das zusätzliche Element ein kreisförmiges radartiges Element (610) mit einem Felgenteil (611) und einem Nabenteil aufweist, und daß der Nabenteil eine Nabenbohrung (612) für die Aufnahme des Strebenelementes aufweist, und daß das radförmige Element eine Antriebbohrung (613) aufweist, welche in einem vorbestimmten Abstand in radialer äußerer Richtung von dem Mittelpunkt des Nabenteils angeordnet ist, um die Antriebsnase (511) des Verbindungselementes aufzunehmen, und dadurch, daß das radförmige Element in seinem Felgenteil eine nach außen zeigende Umfangsnut (614) aufweist.

34. Spielbaukasten nach Anspruch 33, **dadurch gekennzeichnet, daß** ein aus einem Elastomerwerkstoff hergestelltes ringförmiges reifenartiges Element (620) löslich in der ringförmigen Einkerbung (614) aufgenommen ist.

35. Adapterelement für die Verwendung in einem Spielbaukasten nach einem der Ansprüche 1 bis 34, enthaltend einen Baublocksatz von ei-

ner Art, welche ein hohles gegossenes Baublockelement (41, 42) in einer rechteckigen Konfiguration aufweist, das eine obere Wand (44) sowie vier Seitenwände (45 bis 48) umfaßt, welche einen offenen Hohlraum(49) bilden, und enthaltend eine Vielzahl von in regelmäßigen Abständen angeordneten kreisförmigen Vorsprüngen (50), welche sich von der oberen Wand in oberer Richtung erstrecken, und enthaltend eine Vielzahl von inneren Vorsprüngen (51), welche sich von dieser oberen Wand in den Hohlraum zu dessen offener Seite erstrecken, wobei dieses Adapterelement einen hohlförmigen gegossenen Adapterblock (40) rechteckiger Konfiguration mit einer offenen Seite aufweist, und dieser hohlförmige gegossene Adapterblock eine obere Wand (52) sowie vier Seitenwände (53) aufweist, und die Innenflächen dieser Seitenwände in enger Weise einen Bereich eingrenzen, welcher eine vorbestimmte Anzahl von kreisförmigen Vorsprüngen (50) des Baublockelementes (41, 42) enthält, wodurch diese Seitenwände (53) an der Innenseite dieser kreisförmigen Vorsprüngen (50) in weichem Kontakt gehalten werden können, und daß der hohle gegossene Adapterblock (40) weiterhin eine Vielzahl von längsförmigen zylindrischen Vorsprüngen (54) aufweist, welche sich von seinem geschlossenen Ende erstrecken, und diese zylindrischen Vorsprünge (54) eine Länge haben, welche deutlich größer ist, als ihr Durchmesser, und daß im Abstand angeordnete Paare dieser längsförmigen Vorsprünge (54) untereinander einen Abstand aufweisen, welcher etwa gleich 2 mal der Dicke der Seitenwände (45 bis 48) der Baublockelemente (40, 41) ist, so daß ein Paar dieser längsförmigen Vorsprünge, wenn sie in die offenen Seiten von zwei benachbarten Baublockelementen (40, 41) eingeschoben werden, diese Elemente untereinander und mit dem Adapterelement verbinden, und daß dieses Adapterelement einen hohlen rohrförmigen inneren Vorsprung (55) aufweist, welcher sich von seiner oberen Wand weitgehend zu seinem offenen Ende erstreckt, und der einen Innendurchmesser aufweist, der so beschaffen ist, daß er den Endabschnitt eines der Strukturbauteile im Paßsitz aufnehmen kann.

36. Adapterelement nach Anspruch 35,
dadurch gekennzeichnet, daß
der Adapterblock (40) eine Dicke hat, welche der Dicke von mindestens einigen der Baublockelemente (41, 42) entspricht, und dadurch, daß die längsförmigen Vorsprünge (54) innerhalb von bestimmten Baublockelementen aufgenommen und darin verankert werden können.

Revendications

1. Système de jeu de construction comprenant des éléments de liaison (10) ainsi que des éléments structuraux (13) dont les parties finales sont adaptées à être engagées de façon amovible dans des manchons (14) latéraux à ouverture latérale desdits éléments de liaison, chacun des manchons (14) étant pourvu d'une paroi interne (15) ainsi que d'une paire espacée de bras de serrage (16) définissant un axe (19) dudit manchon s'étendant entre lesdits bras de serrage, ainsi que des bosses intégrales de blocage (24) s'étendant vers l'intérieur à partir d'au moins l'un des bras de serrage (16), lesdites bosses (24) étant espacées de ladite paroi interne (15) et définissant avec ladite paroi interne (15) une première chambre de blocage, lesdits bras de serrage (15) étant pourvus d' encoches concaves (18), une paire opposée desdites encoches (18) définissant une deuxième chambre de blocage, et dans lequel au moins une section finale des éléments structuraux (13) est configurée telle qu'elle est comprise dans une enveloppe cylindrique, ladite section finale formant un axe dudit élément structural (13) et est pourvue d'une bride de blocage (26) latéralement recevable dans ladite première chambre de blocage et étant bloquée avec cette chambre contre tout mouvement en direction de l'axe de l'élément structural (13),
caractérisé en ce que
chacun des éléments de liaison (10) comprend plus d'un des manchons (14), et que les encoches concaves (18) des bras de serrage (16) de chacun des manchons s'étendent à partir de ladite bosse de blocage (24) vers les parties finales des bras de serrage du manchon (14), et en ce que la bride de blocage (26) est disposée à la section finale dudit élément structural (13), et en ce que chacune des parties finales dudit élément structural (13) est pourvue d'une gorge circonférentielle (27) située à proximité immédiate de ladite bride de blocage (26) et définissant partiellement celle-ci, et en ce que ladite gorge circonférentielle (27) est agencée pour recevoir les bosses de blocage (24) lorsque l'élément structural (13) est latéralement inséré dans le manchon (14) à section finale ouverte, et en ce que la gorge circonférentielle (27) est formée à une position permettant de recevoir étroitement des parties de l'enveloppe cylindrique de l'élément structural (13), et en ce que les bras de serrage (16) sont élastiquement déplaçables pour per-

mettre l'insertion de l'élément structural (13) dans le manchon (14).

2. Jeu de construction suivant la revendication 1, **caractérisé en ce que** les éléments structuraux (13) présentent dans la zone de leurs parties finales une section généralement circulaire dans le domaine de leurs parties finales, et en ce que l'espacement entre différentes paires de bras de serrage est plus petit que le diamètre de ladite section circulaire, et en ce que le profil des encoches concaves (18) des bras de serrage correspond généralement au profil circulaire (28) des éléments structuraux.

3. Jeu de construction suivant l'une des revendications 1 ou 2, **caractérisé en ce que** la paroi finale (15) de chaque section (14) formant manchon s'étend entre les parties finales de chacune des paires de bras de serrage (16) et définit avec lesdits bras de serrage un manchon en forme d'un U permettant de recevoir latéralement une section finale d'un élément structural (13), et en ce que la configuration de la section du manchon en direction de son axe longitudinal (19) et dans un plan bissectant les bras de serrage (16) se trouve en général en conformité étroite avec la configuration de la section longitudinale d'une partie finale de l'un des éléments structuraux (13).

4. Jeu de construction suivant l'une des revendications 1 à 3, **caractérisé en ce que** les bosses de blocage (24) ont une configuration convexe courbe et s'étendent généralement entre un bord d'un bras de serrage (16) et l'autre bord de celui-ci, et en ce que la gorge circonférentielle (27) prévue dans l'élément structural a une configuration de section telle à pourvoir recevoir étroitement les bosses de blocage (24) permettant ainsi de bloquer l'élément structural (13) contre toute séparation de l'élément de liaison en direction de l'axe dudit élément structural.

5. Jeu de construction suivant l'une des revendications 1 à 4, **caractérisé en ce que** les éléments structuraux (13) sont pourvus d'une section essentiellement circulaire sur au moins une partie de leur longueur, et en ce que sur au moins une partie de leur longueur lesdits éléments structuraux présentent à l'intérieur de cette enveloppe une section essentiellement en forme d'un "X", et en ce que les parties en forme d'un "X" peuvent être reçues dans un espace ménagé entre l'une des paires des bras de serrage (16), lesdits éléments structuraux (13) étant disposés à angle droit par rapport à l'axe (19) défini par les bras de serrage, et en ce que ledit élément structural (13) est latéralement inséré de force entre une paire opposée de bosses de blocage (24) disposée sur lesdits bras de serrage (16) pour être ainsi bloqués au moyen de ces bosses.

6. Jeu de construction suivant l'une des revendications 1 à 5, **caractérisé en ce que** des bosses opposées de blocage (130, 131) disposées sur lesdits bras de serrage (126, 127) se projettent transversalement par rapport à ces derniers et s'étendent dans l'espace prévu entre les bras de serrage, et en ce que l'élément structural (13) est pourvu d'une bride finale définie en partie par ladite gorge circonférentielle (147) ainsi que d'une section finale plane (154) espacée de ladite gorge (147), et en ce que lesdites bosses de blocage (130, 131) et ladite paroi finale (152) ainsi que la partie finale plane (154) ont un rapport géométrique tel que lorsque ledit élément structural est placé dans ladite encoche, la surface finale plane de cet élément structural est axialement emmanchée fermément et élastiquement en contact de surface avec ladite paroi finale (152).

7. Jeu de construction suivant l'une des revendications 1 à 6, **caractérisé en ce que** ledit élément de liaison comprend un premier élément de liaison (70) et est pourvu d'un noyau central (71) définissant un axe central dudit élément de liaison, et en ce que une multitude de manchons (82) disposés essentiellement en direction radiale autour de ce noyau pour recevoir des éléments structuraux, et en ce que ledit noyau et ces manchons forment ledit premier élément de liaison présentant une configuration essentiellement plane et une épaisseur déterminée, ainsi qu'une encoche (74) à ouverture latérale agencée dans un côté du premier élément de liaison s'étendant vers cet axe central et ayant une largeur correspondant à l'épaisseur de l'élément de liaison, ladite encoche (74) à ouverture latérale étant agencée pour recevoir un deuxième élément de liaison (70a) pour former un élément de liaison composite pourvu de manchons s'étendant en direction radiale dans deux plans.

8. Jeu de construction suivant la revendication 7, **caractérisé en ce que** le premier élément de liaison (70) est pourvu d'un manchon (83) pour recevoir un élément structural (90) directement à l'opposé de ladite encoche latéralement ouverte assurant ainsi que dans un assemblage composé de premier et deuxième éléments de liaison (70, 70a) interconnectés, le deuxième élément de liaison (70a) comporte un manchon pour recevoir un élément structural à l'endroit de l'encoche à ouverture latérale prévue dans le premier élément de liaison.

9. Jeu de construction suivant l'une des revendications 7 ou 8, **caractérisé en ce que** l'encoche (74) à ouverture latérale est définie par une paire espacée de parois parallèles de guidage (72, 73) pour la réception du deuxième élément de liaison (70a), lesdites parois de guidage étant pourvues de dispositifs d'arrêt (97) coopérant avec des dispositifs d'arrêt (98) prévus sur le deuxième de ces éléments de liaison (70a) afin de retenir une paire assemblée de premier et deuxième éléments de liaison dans une relation assemblée.

10. Jeu de construction suivant l'une des revendications 7 à 9, **caractérisé en ce que** le premier élément de liaison (70) comporte une multitude de manchons (82, 83) comprenant chacun une paire de bras de serrage ainsi qu'une paroi finale, et en ce que les parois finales (79, 80) de manchons voisins sont disposées de façon adjacente et intégralement assemblées, et en ce que'au moins l'une des ces parois finales (80) est fendue pour former une fente (81) pour permettre de la sorte la déflection des parois de guidage (72, 73)vers l'extérieur.

11. Jeu de construction suivant l'une des revendications 7 à 10, **caractérisé en ce que** le premier élément de liaison est pourvu d'un manchon (83) pour recevoir un élément structural disposé directement à l'opposé de l'encoche à ouverture latérale, et en ce que ce manchon (83) comporte la paroi finale fendue.

12. Jeu de construction suivant l'une des revendications 5 à 11, **caractérisé en ce que** les manchons (82, 83) sont configurés tels pour permettre la réception latérale emboitable des parties finales des éléments structuraux (90), et en ce que les bras de serrage de ce dernier manchon (83) est amovible par déplacement des parties de ladite paroi finale fendue (80) pour permettre l'assemblage d'un élément structural par une insertion autre qu'emboitable.

13. Jeu de construction suivant l'une des revendications 7 à 12, **caractérisé en ce que** l'encoche (74) à ouverture latérale est pourvue d'un dispositif d'arrêt (97) d'un premier type, et en ce que des parties dudit premier élément de liaison disposées diamétralement à l'opposé de ladite encoche à ouverture latérale sont pourvues d'un dispositif d'arrêt (98) d'un deuxième type coopérant avec le dispositif d'arrêt (97) d'un premier type pour bloquer ainsi une paire d'éléments de liaison (70, 70a) en condition assemblée.

14. Jeu de construction suivant l'une des revendications 7 à 13, **caractérisé en ce que** ledit premier élément de liaison (310) est pourvu d'une multitude de manchons (150, 150a), chacun composé d'une paire de bras de serrage et d'une paroi finale, et en ce que les parois finales de manchons voisins sont adjacentes et intégralement interconnectées, et en ce que'au moins l'un des manchons (150a) est disposé directement à l'opposé de ladite encoche (311) à ouverture latérale, et en ce que l'ensemble de ces manchons (150) est disposé du même côté d'un plan comprenant ladite encoche (311) à ouverture latérale et l'un des manchons (150a), assurant ainsi que lorsque ledit premier élément de liaison est joint à un deuxième élément de liaison (310), ledit deuxième élément de liaison forme un plan contenant les axes de ces manchons, et en ce que les manchons du premier élément de liaison s'étendent dans le plan de et/ou d'un côté du plan du deuxième élément de liaison.

15. Jeu de construction suivant la revendication 14, **caractérisé en ce que** le premier élément de liaison est pourvu d'un manchon (150a) disposé directement à l'opposé de ladite encoche (312) à ouverture latérale, et en ce que tous les autres manchons (150) sont situés sur le côté d'un plan comprenant ledit manchon (150a) et ladite encoche (311) et disposés à angle droit par rapport au plan comprenant l'encoche (311) et au moins un manchon (150a) du premier élément de liaison.

16. Jeu de construction suivant la revendication 15,
caractérisé en ce que
ledit deuxième élément de liaison présente la même configuration que le premier élément de liaison assurant ainsi qu'une paire assemblée desdits éléments de liaison définissent une structure à bords droits.

17. Jeu de construction suivant la revendication 15,
caractérisé en ce que
le deuxième élément de liaison (410) comporte des manchons (150, 150a) disposés à un angle de plus de 180° assurant ainsi qu'une paire assemblée composée des premier et deuxième éléments de liaison (310, 410) définit un assemblage sous forme d'un "T".

18. Jeu de construction comprenant des éléments de liaison (10) ainsi que des éléments structuraux (13) pouvant être joints de façon amovible à d'autres éléments dans le but de former une structure cohérente, et dans lequel au moins certains de ces éléments de liaison (10) comportent une partie commune et une multitude de sections formant manchon (14) s'étendant généralement en direction radiale vers l'extérieur de ladite partie commune, et dans lequel chaque section formant manchon est disposée sur un axe de manchon prédéterminé (19) s'étendant généralement en direction radiale par rapport à ladite partie commune, et dans lequel chaque section formant manchon comprend une paire espacée de bras de serrage (16) montés sur des articulations généralement parallèles et disposées symmetriquement par rapport à l'axe des manchons, chacune des paires de bras de serrage (16) définissant individuellement un manchon (14) latéralement ouvert et disposé axialement, les éléments structuraux (13) étant formés avec des parties finales opposées et des sections intermédiaires joignant intégralement lesdites parties finales,
caractérisé en ce que
les bras de serrage (16) comportent de premiers moyens de liaison (18) s'emboitant dans un élément structural (13) afin de maintenir de façon amovible mais fermement un élément structural aligné sur l'axe du manchon, et en ce que de deuxièmes moyens de liaison (24) sont prévus dans la section formant manchon pour s'emboiter dans un élément structural (13) simultanément lié avec ledit premier moyen de blocage (18) pour maintenir ainsi de façon amovible mais fermement l'élément strucutural (13) dans une position axiale prédéterminée en direction longitudinale de l'axe du manchon, et en ce que les parties finales opposées sont pourvues de premier et second moyens de liaison (28, 27) pour un engagement simultané positif avec les premier et second moyens de liaison (18, 24) d'une section formant le manchon d'un élément de liaison, assurant ainsi que les premiers moyens de liaison (18, 28) maintiennent un élément structural en alignement axial avec l'axe d'un manchon déterminé, tandisque les seconds moyens de liaison (24, 27) maintiennent ledit élément structural dans une position axiale prédéterminée sur l'axe du manchon choisi, et en ce que les bras de serrage (16) sont élastiquement écartables afin de permettre un emboitement latéral d'une partie finale d'un élément structural (13) dans une direction transverse par rapport à l'axe du manchon (19,) assurant ainsi que l'élément structural soit fermement espacé et positionné vis-à-vis de la section formant manchon.

19. Jeu de construction suivant la revendication 18,
caractérisé en ce que
les deuxièmes moyens de liaison comportent des nervures opposées (24) disposées sur les bras espacés de serrage (16) ainsi que des encoches (27) complémentaires prévues sur les parties finales opposées des éléments structuraux, et en ce que les nervures (24) sont orientées transversalement par rapport à l'axe du manchon (19) pour recevoir les encoches complémentaires (27) pendant l'introduction latérale d'une partie finale entre une paire de bras de serrage (16).

20. Jeu de construction suivant l'une des revendications 18 ou 19,
caractérisé en ce que
la section formant manchon comporte une paroi finale (154) formée intégralement avec les bras de serrage et espacée des nervures (130), et en ce que les éléments structuraux (140) sont pourvus d'une surface finale espacée desdites encoches complémentaires (147), et en ce que l'espacement entre les nervures (330) et la paroi finale (154) par rapport à l'espacement entre les encoches (147) complémentaires et la surface finale (152) est tel que la paroi finale (154) et la surface finale (152) entrent dans un contact étroit lorsqu'un élément structural (13) est reçu dans la section formant manchon.

21. Jeu de construction suivant la revendication 18,
caractérisé en ce que

les deuxièmes moyens de liaison comportent un moyen de liaison sous forme de nervure (24) disposé sur l'une des sections formant manchon (14) ou sur l'élément structural (13) ainsi que des encoches (27) complémentaires disposées sur l'autre de ces sections ou éléments.

22. Jeu de construction suivant la revendication 21,
caractérisé en ce que
la section formant manchon comporte une section finale formée par une paroi finale (152), et en ce que l'élément structural comporte une surface finale (154), et en ce que le deuxième moyen de liaison pousse la surface finale élastiquement en contact étroit avec la paroi finale.

23. Jeu de construction suivant la revendication 18,
caractérisé en ce que
la partie commune de l'élément de liaison (160) comporte une section formant moyeu (161) pourvu d'une ouverture transversale (163) d'une dimension et d'une configuration permettant l'insertion en direction axiale d'un élément structural et définissant un axe de moyeu (164), et en ce que l'axe du moyeu est disposé à angle droit par rapport à l'axe de manchon (164) et bissectant essentiellement ce dernier, et en ce que l'élément de liaison (160) comporte une seule section formant manchon (150) intégralement associée à une seule section formant moyeu (161).

24. Jeu de construction suivant la revendication 18,
caractérisé en ce que
l'élément de liaison (170) comporte une paire de sections formant manchon (150) intégralement associées à une seule section formant moyeu, et en ce que les sections formant manchon sont disposées en vis-à-vis et alignées sur un axe de manchon (171) commun.

25. Jeu de construction suivant la revendication 18,
caractérisé en ce que
l'élément de liaison comporte une multitude de "n" sections formant manchon, et en ce que chacune des sections formant manchon est alignée sur les axes correspondants des manchons disposés à un angle d'environ 45° par rapport à une axe de manchon adjacent, et en ce que l'ensemble de ces axes s'entrecoupe essentiellement à l'endroit de l'axe de moyeu, et en ce que "n" est un nombre entier variant entre 2 et 8.

26. Jeu de construction suivant l'une des revendications 23, 24 ou 25,
caractérisé en ce que
chacune des sections formant manchon est disposée à une distance prédéterminée fixe (d) par rapport à l'axe de moyeu, assurant ainsi que lorsqu'un élément structural (13) est retenu dans l'une des sections formant manchon la partie finale de l'élément structural est espacée d'une distance uniforme fixe de l'axe du moyeu.

27. Jeu de construction suivant l'une des revendications 18 à 26,
caractérisé en ce que
il comprend une série d'éléments structuraux ayant des longueurs graduées, et en ce que dans un système incluant "n" longueurs différentes de ces éléments structuraux, chacune de ces longueurs est déterminée suivant la formule $L_x = (1.414)^{(x-1)} * D_{min} - (2 * d)$, dans laquelle L_x = la longueur du $n^{ième}$ élément structural d'une série variant de 1 à "n", D_{min} = la distance entre les axes de moyeu de deux éléments de liaison liés par l'élément structural le plus court dans la série, et d = la distance entre l'axe de moyeu et la paroi finale de la section formant manchon, et en ce qu'une multitude d'éléments de liaison et d'éléments structuraux du système sont configurés tels qu'ils peuvent être assemblés sous forme d'un ou de plusieurs triangles rectangles (250, 260, 270).

28. Jeu de construction suivant la revendication 27,
caractérisé en ce que
un assemblage comprenant un élément de liaison (170) suivant la revendication 7 combiné avec deux éléments structuraux (140b) d'une longueur l_x dans une série a la même longueur qu'un élément structural (140d) d'une longueur $L_{(x+2)}$ dans cette série.

29. Jeu de construction suivant la revendication 18,
caractérisé en ce que
les bras de serrage (16) sont formés avec des bosses (24) ayant la forme de nervures s'étendant transversalement par rapport à l'axe du manchon (19) et se projetant vers l'intérieur par rapport à l'axe de manchon, et en ce que les éléments structuraux (13) comportent, dans une zone prédéterminée entre leurs parties finales, des encoches longitudinales opposées (39), et en ce que l'élément structural (13) est élastiquement reçu dans le manchon (14) dans une orientation de 90° par rapport à l'axe du

manchon (19), et en ce que les bosses sous forme de nervures (24) sont reçues dans une paire opposées des encoches (39) assurant ainsi que l'élément structural (13) est saisi avec résistance à la torsion par l'élément de liaison tandisque l'élément structural est disposé verticalement par rapport à l'axe du manchon (19).

30. Jeu de construction suivant la revendication 29,
caractérisé en ce que
la partie commune de l'élément de liaison comporte une section formant moyeu (161) pourvu d'une ouverture transversale (163) d'une dimension et d'une configuration permettant l'insertion en direction axiale d'un élément structural et définissant un axe de moyeu (164), cet axe de moyeu étant disposé à angle droit par rapport à l'axe de manchon (165) et intersectant essentiellement ce dernier, dans lequel une multitude de tels éléments de liaison est assemblée pour former une structure du type bande, et en ce que un premier groupe (282) de tels éléments de liaison est disposé dans un rapport de côtés et espacé d'une distance au moins égale à la largeur d'un élément de liaison, et en ce que les axes de moyeu de chacun des éléments du premier groupe sont coaxialement alignés, et en ce qu'un premier élément structural (280) traverse les moyeux de chacun des éléments de liaison du premier groupe, et en ce qu'un deuxième groupe (283) de tels éléments de liaison (160) est disposé dans un rapport de côtés et inséré dans les espaces libres prévus entre les éléments de liaison du premier groupe (282), et en ce que les éléments de liaison du deuxième groupe (283) fixent ledit premier élément structural (280) par engagement entre les nervures (130, 131) des éléments de liaison et une paire opposée des encoches longitudinales (144) dudit premier élément structural, et en ce que des groupes supplémentaires (282, 283) composés de tels éléments de liaison et de tels éléments structuraux sont assemblés en série pour former une structure articulée sous forme d'une bande.

31. Jeu de construction suivant la revendication 30,
caractérisé en ce que
par rapport à la largeur combinée des premier et deuxième groupes (282, 283) des éléments de liaison, les éléments structuraux (280) ont une longueur telle que des parties finales des éléments structuraux débordent en direction latérale des côtés de l'ensemble.

32. Jeu de construction suivant la revendication 29,
caractérisé en ce que
l'élément de liaison (510) comprend une patte d'entrainement (511) intégrale s'étendant en direction latérale, et en ce que l'élément de liaison est monté sur un élément structural (513), et en ce que les nervures (130, 131) de l'élément de liaison sont reçues dans des encoches longitudinales (144) opposées de l'élément structural, assurant ainsi que l'élément de liaison est bloqué dans un rapport fixe vis-à-vis de l'élément structural, l'élément structural étant disposé à angle droit par rapport à l'axe du manchon, et en ce qu'un élément supplementaire (240) est monté sur l'élément structural, cet élément supplémentaire étant positionné au voisinage de l'élément de liaison, tandisque la patte d'entrainement se trouve en liaison entrainée avec une partie adjacente de l'élément supplémentaire.

33. Jeu de construction suivant la revendication 32,
caractérisé en ce que
l'élément supplémentaire comprend un élément circulaire sous forme d'une roue (610) comportant une partie de jante (611) ainsi qu'une partie de moyeu, ledit moyeu étant pourvu d'une ouverture de moyeu (612) destinée à la réception de l'élément structural, et en ce que cet élément sous forme d'une roue est pourvu d'une ouverture d'entrainement (613) disposée à une distance radiale prédéterminée se prolongeant vers l'extérieur du centre du moyeu en vue de la réception de la patte d'entrainement (511) de l'élément de liaison, et en ce que l'élément sous forme d'une roue comporte dans sa partie de jante une gorge circonférentielle (614) se prolongeant vers l'extérieur.

34. Jeu de construction suivant la revendication 33,
caractérisé en ce que
un élément annulaire sous forme d'un pneu (620) réalisé dans un matériau élastomère est reçu de façon amovible dans la gorge circonférentielle (614).

35. Elément d'adaptateur utilisé pour l'interconnexion du jeu de construction suivant les revendications 1 à 34 avec un jeu de blocs de construction du type comprenant un élément moulé creux d'un bloc de construction (41, 42) d'une configuration rectangulaire pourvu d'une paroi supérieure (44) et de quatre parois latérales (45 à 48) définissant un espace ouvert

(49), et comportant une multitude de bosses circulaires (50) espacées à distance régulière s'étendant vers le haut de la paroi supérieure, ainsi qu'une multitude de bosses internes (51) s'étendant à partir de la paroi supérieure vers l'intérieur de cet espace en direction de son côté ouvert, ledit adaptateur comprenant un bloc d'adaptateur moulé creux (40) d'une configuration rectangulaire avec un côté ouvert, ledit bloc d'adaptateur moulé creux étant composé d'une paroi supérieure (52) ainsi que de quatre parois latérales (53), dans lequel les surfaces internes des parois latérales enveloppent étroitement un espace occupé par une multitude prédéterminée de bosses circulaires (50) dudit bloc de construction (41, 42), assurant ainsi que, à l'intérieur, les parois latérales (53) sont étroitement engagées par lesdites bosses cylindriques (50), et en ce que ledit bloc moulé creux de l'adaptateur (40) comprend par ailleurs une multitude de bosses cylindriques longitudinales (54) s'étendant à partir de son côté fermé, et en ce que ces bosses cylindriques (54) ont une longueur essentiellement plus grande que leur diamètre, et en ce que des paires espacées desdites bosses longitudinales (54) se trouvent à une distance l'une par rapport à l'autre qui est approximativement égale à deux fois l'épaisseur des parois latérales (45 à 48) des éléments (40, 41) du bloc de construction, assurant ainsi qu'une paire de ces bosses longitudinales, lorsqu'elles sont insérées dans les côtés ouverts de deux éléments (40, 41) adjacents du bloc de construction, fixent ces éléments l'un par rapport à l'autre et à l'adaptateur, et en ce que l'adaptateur comprend une bosse tubulaire creuse (55) s'étendant essentiellement à partir de sa paroi supérieure vers son côté ouvert et ayant un diamètre intérieur permettant de recevoir en contact étroit une partie finale de l'un des éléments structuraux.

36. Elément adaptateur suivant la revendication 35, **caractérisé en ce que**
ledit bloc adaptateur (40) a une largeur correspondant à la largeur d'au moins quelques-uns des éléments (41, 42) dudit bloc de construction, et en ce que lesdites bosses longitudinales (54) peuvent être reçues et serrées à l'intérieur de certains de ces éléments du bloc de construction.

FIG. 1.

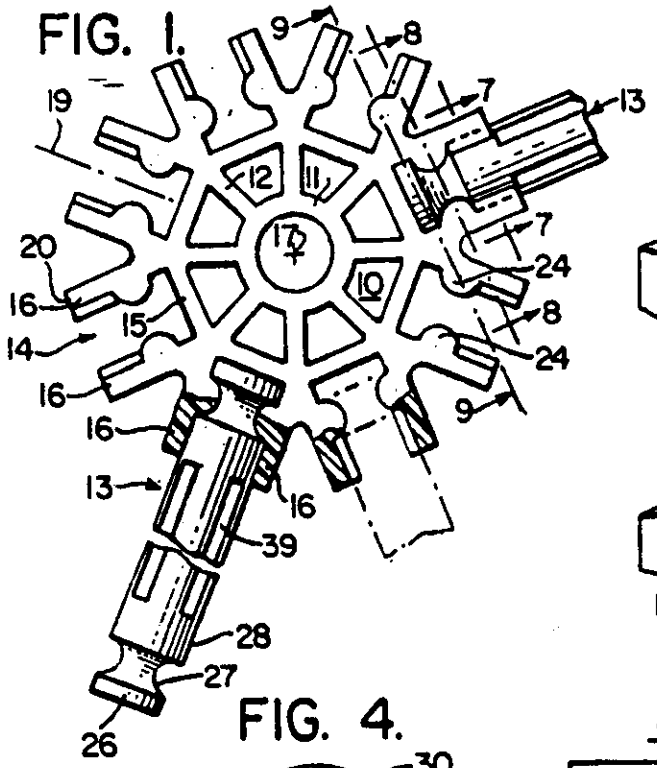


FIG. 2.

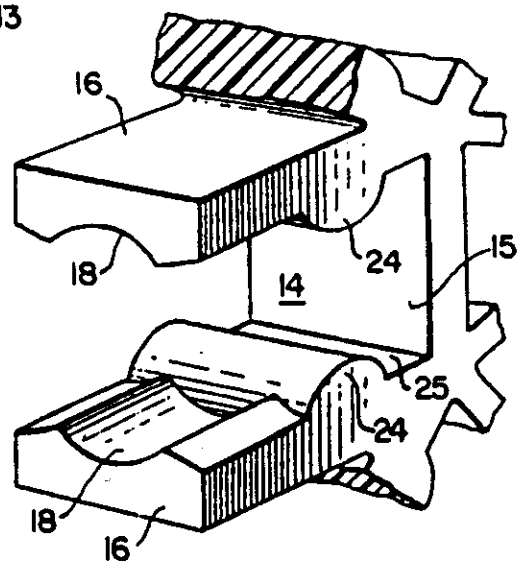


FIG. 4.

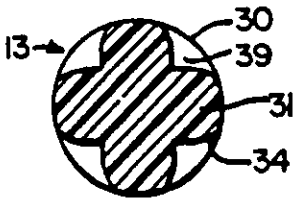


FIG. 3.

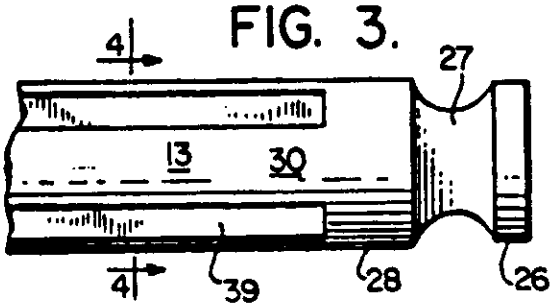


FIG. 5.

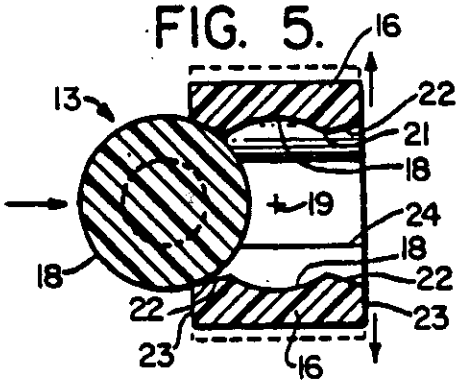


FIG. 6.

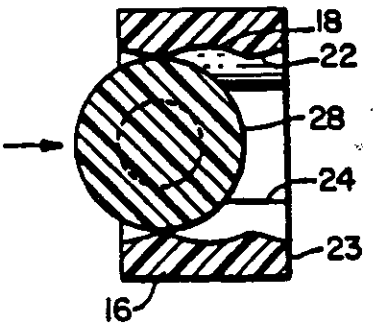


FIG. 7.

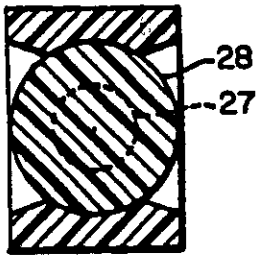


FIG. 8.

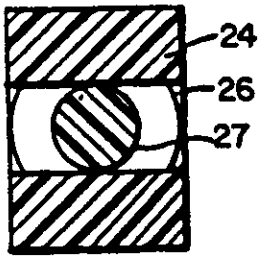


FIG. 9.

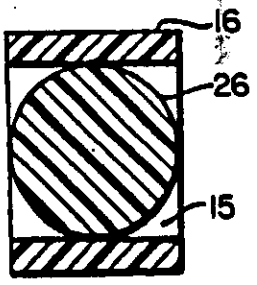


FIG. 10.

FIG. 11.

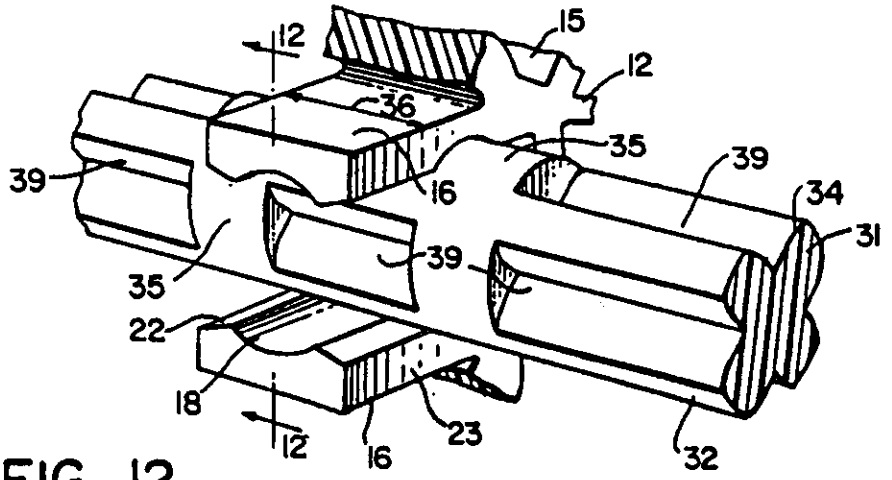


FIG. 12.

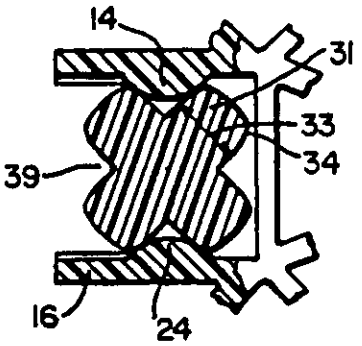


FIG. 13.

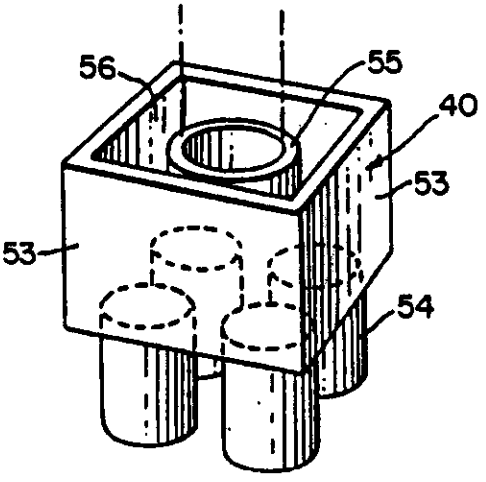


FIG. 14.

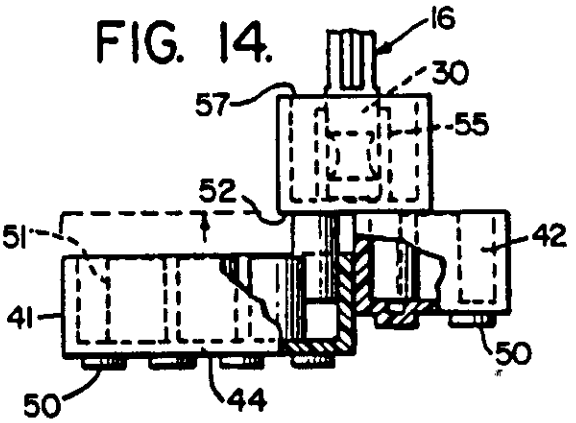


FIG. 15.

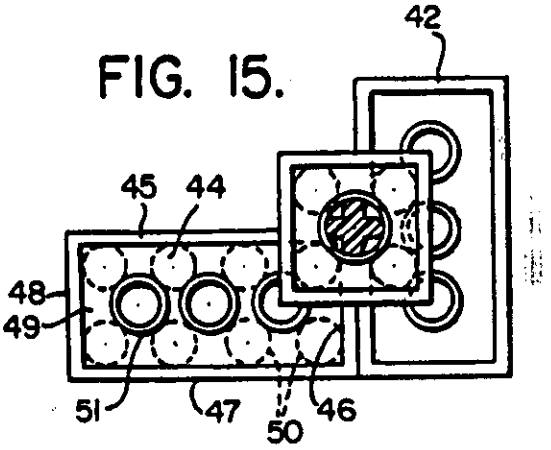


FIG. 16

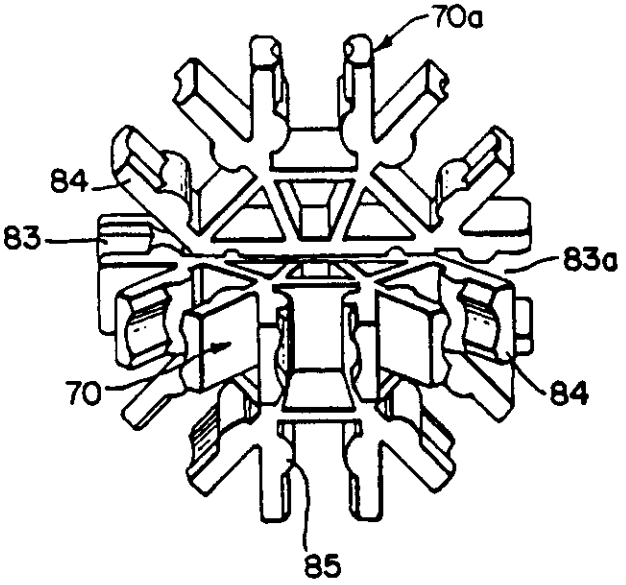

70a
84
83
83a
70
84
85

FIG. 17

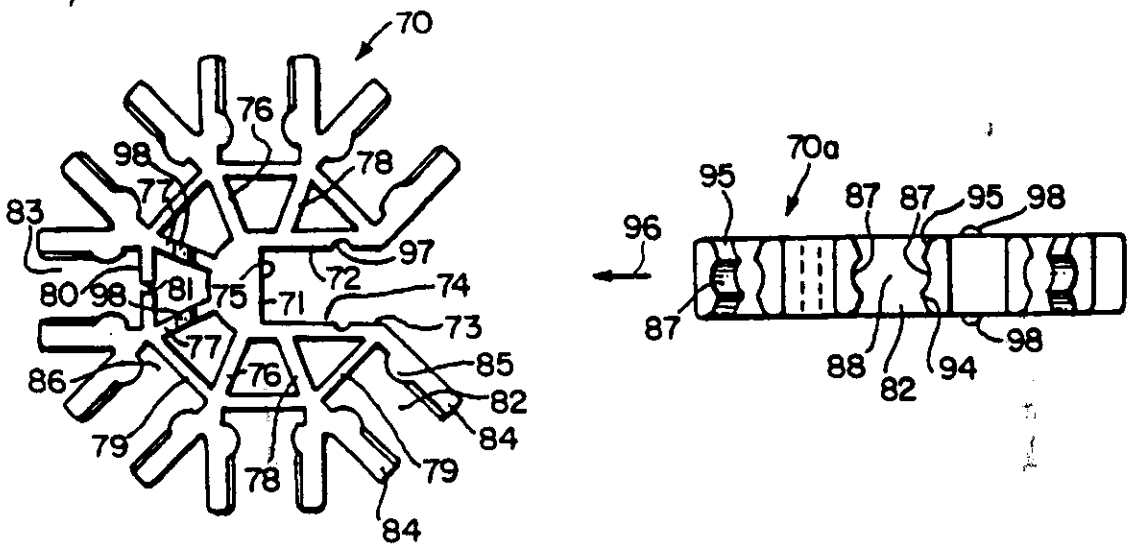

70
76
98
78
77
83
97
72
74
80
98
81
75
71
73
77
85
86
76
82
84
79
78
79
84
70a
95
87
87
95
98
96
87
98
88
82
94

FIG. 18

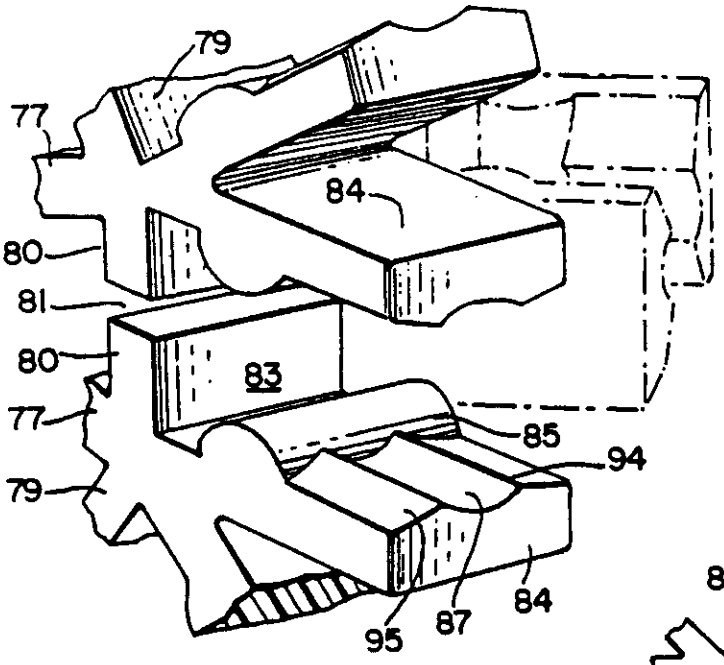


FIG. 20

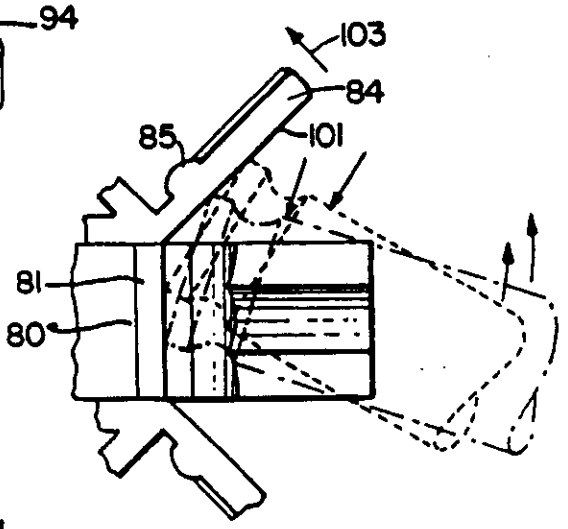


FIG. 19

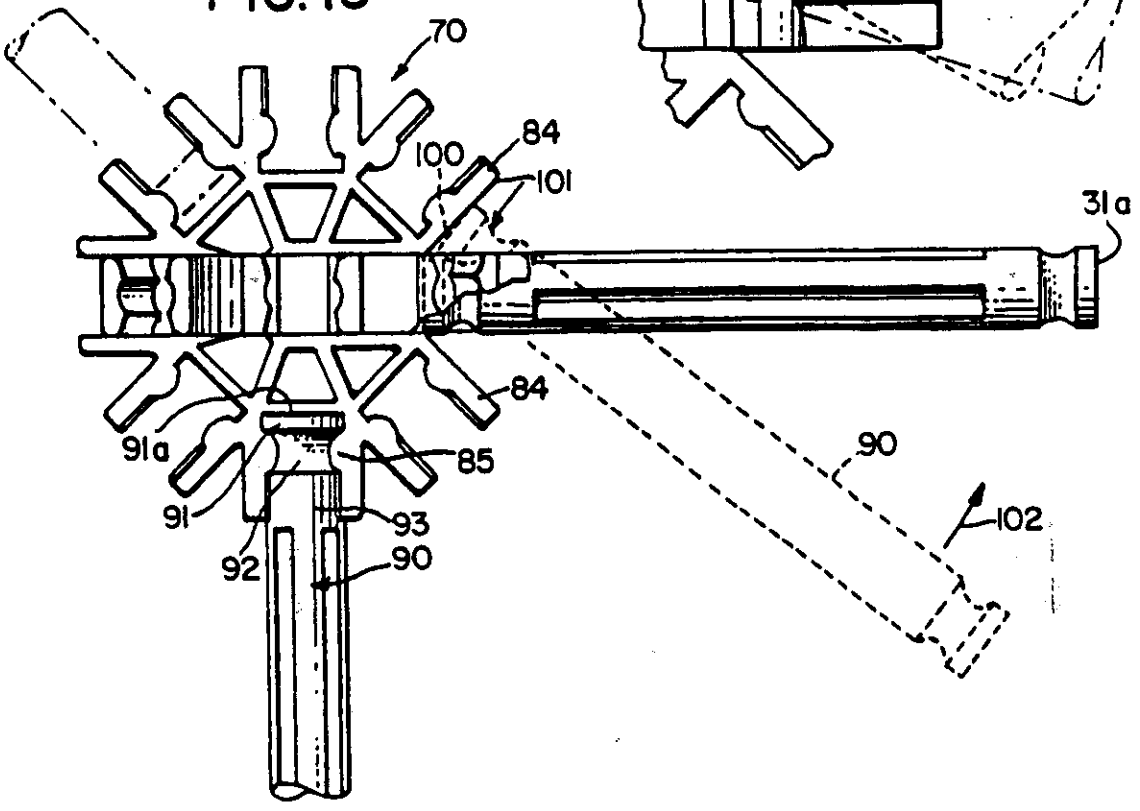


FIG. 21

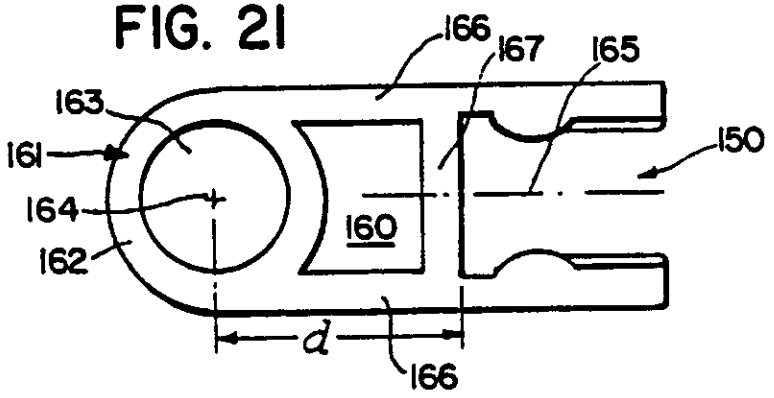

166
167
165
163
161
164
162
160
150
d
166

FIG. 22

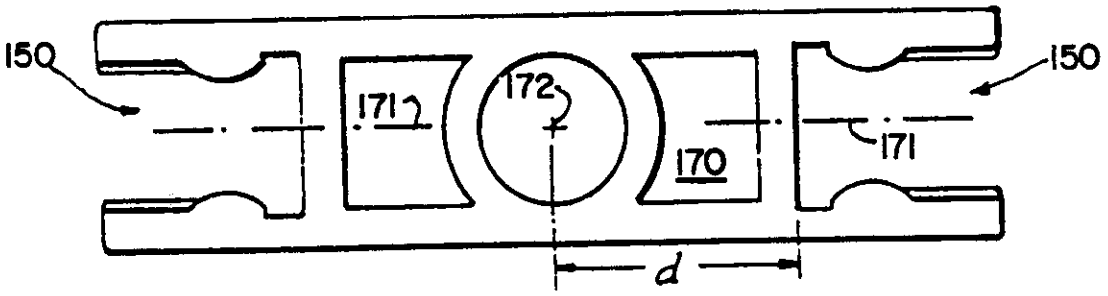

150
171
172
170
171
150
d

FIG. 23

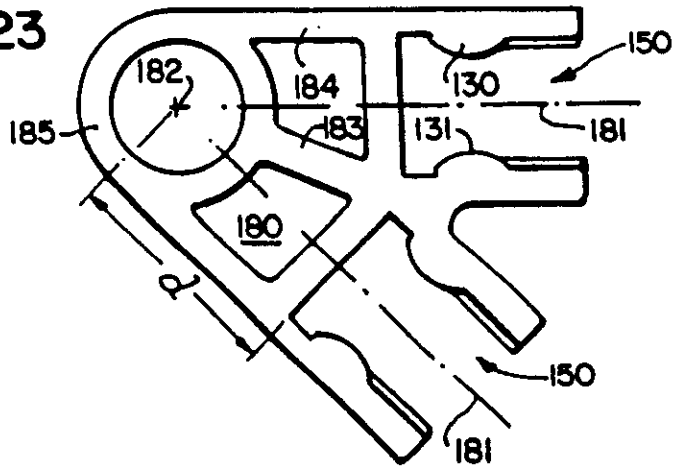


FIG. 24

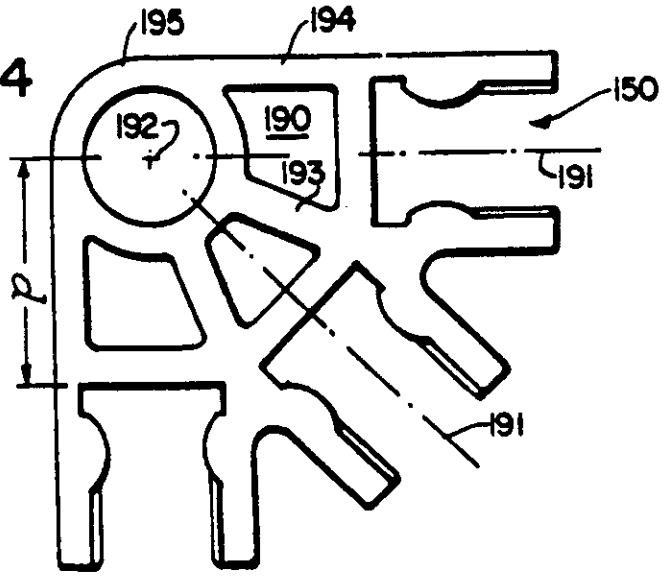


FIG. 25

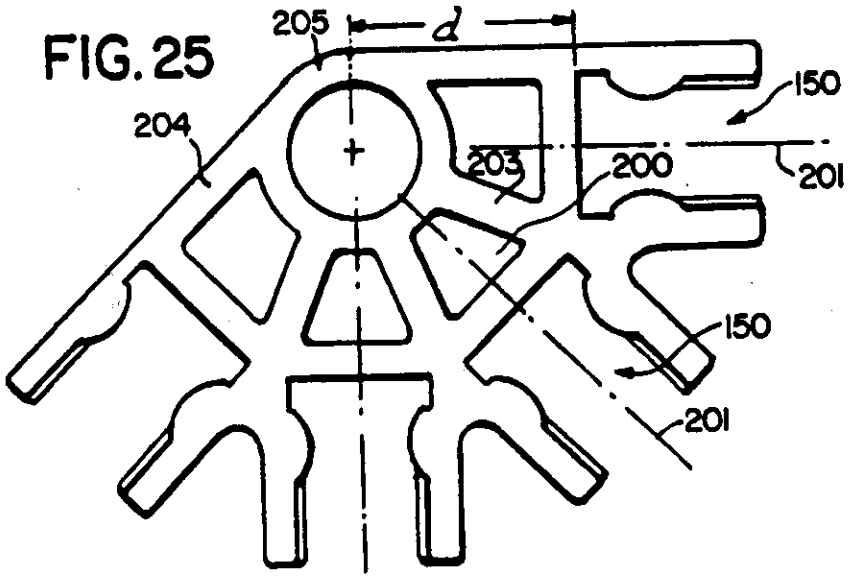


FIG. 26

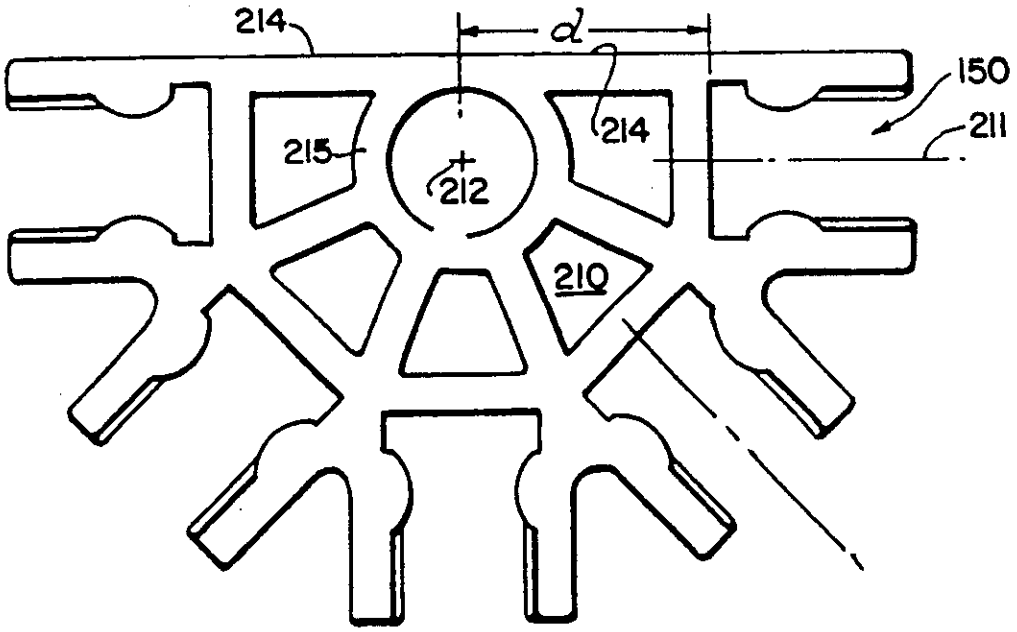


FIG. 27

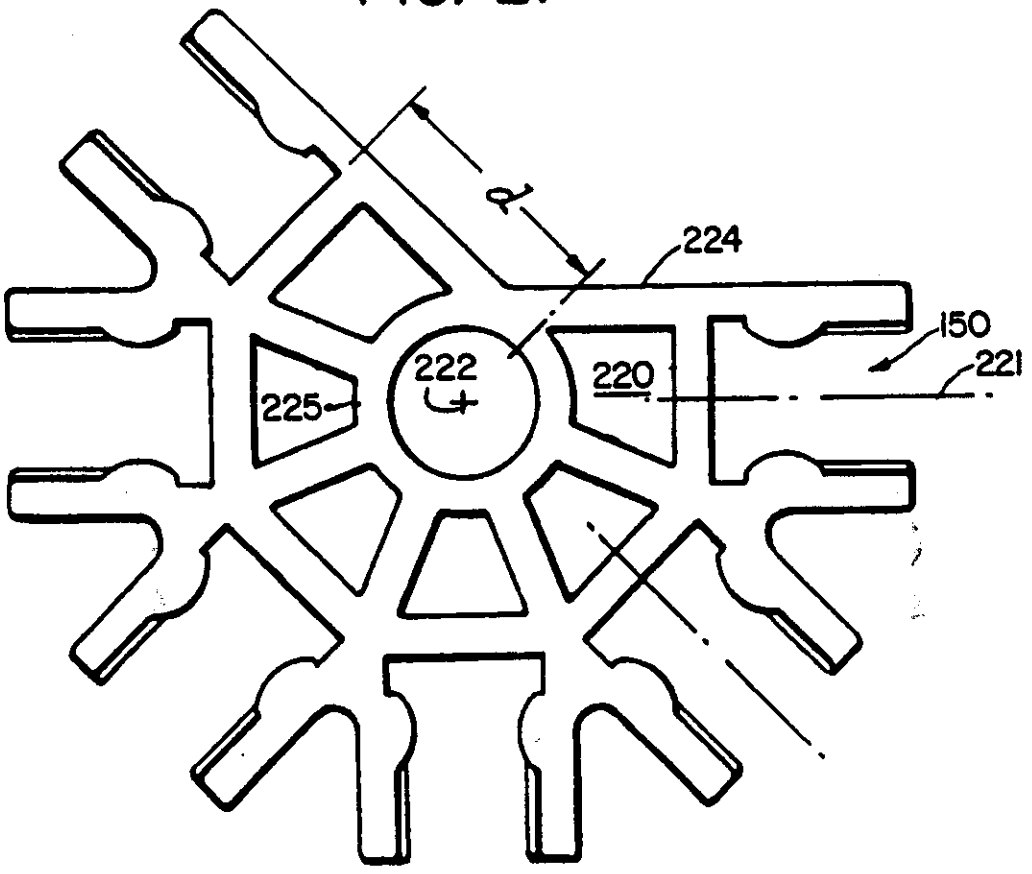


FIG. 28

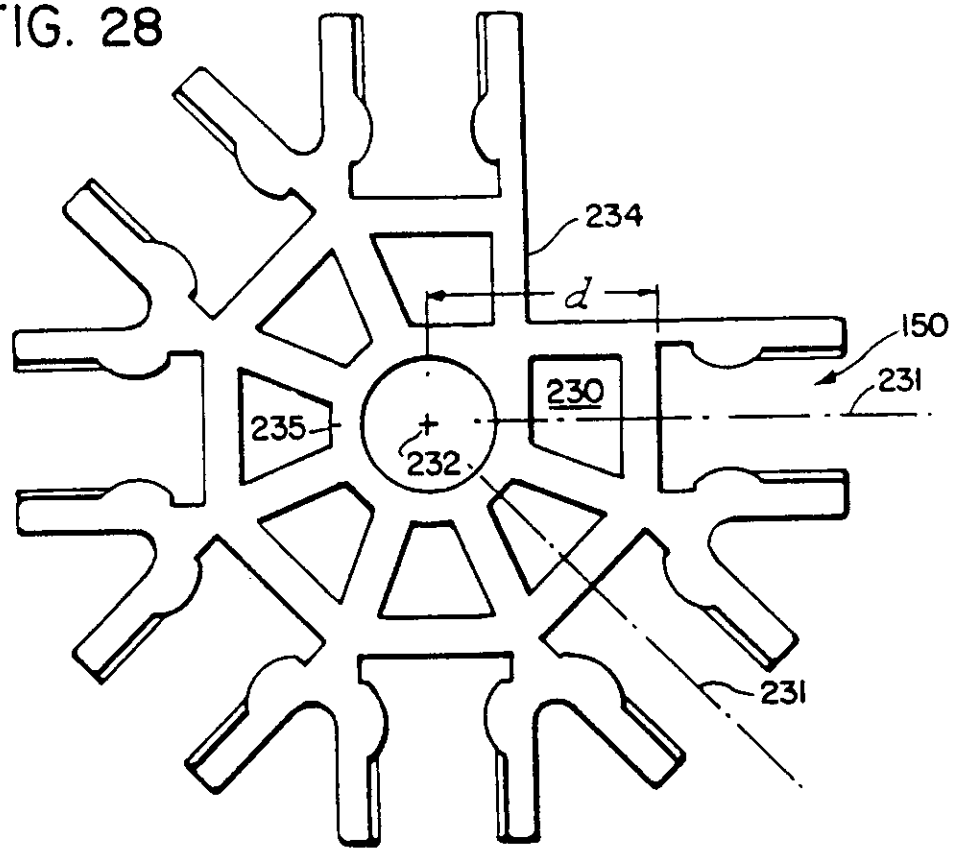
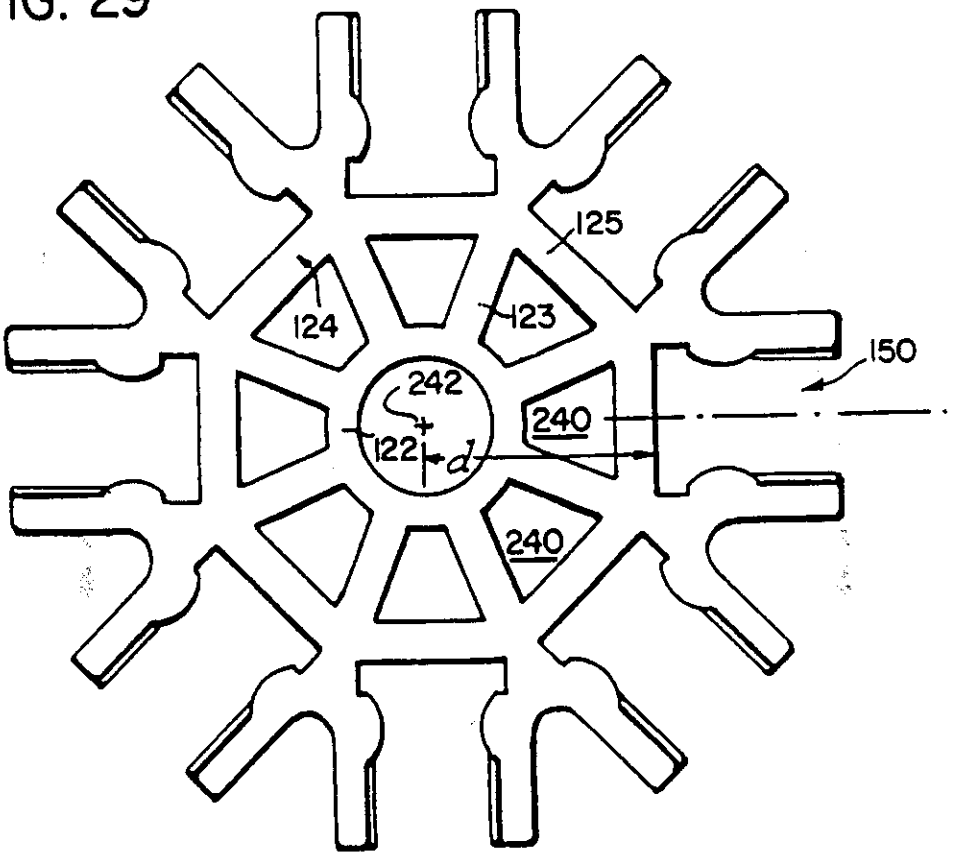


FIG. 29



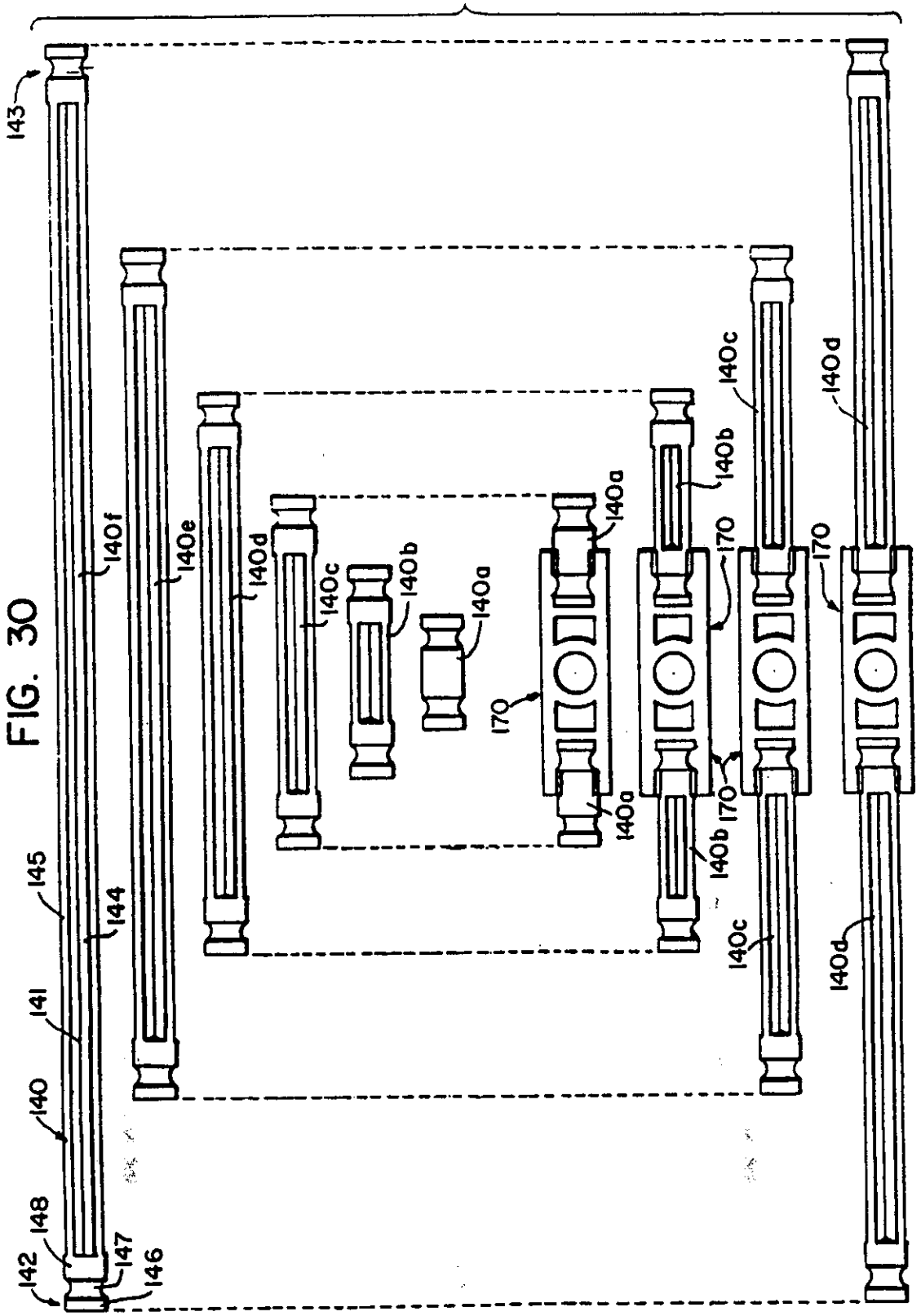

143
140f
140e
140d
140c
140b
140a
170
145
144
141
140
148
147
146
142

FIG. 30

FIG. 31

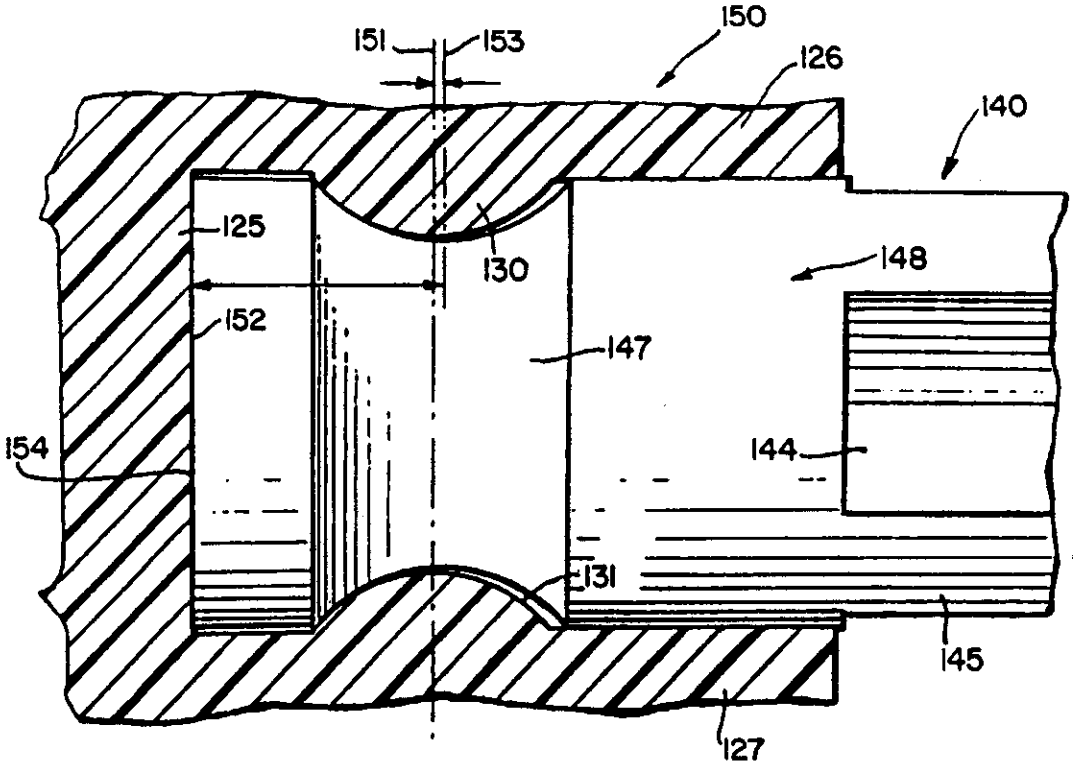

151
153
150
126
140
125
130
148
152
147
154
144
131
145
127

FIG. 32

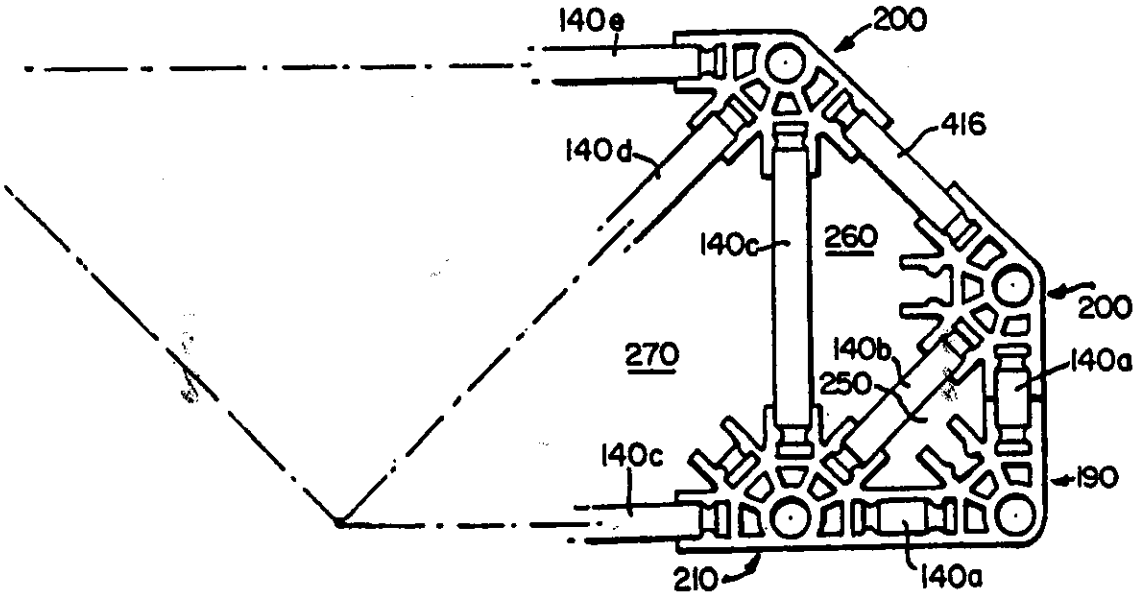

140e
200
416
140d
140c
260
200
270
140b
140a
250
140c
190
210
140a

FIG. 33

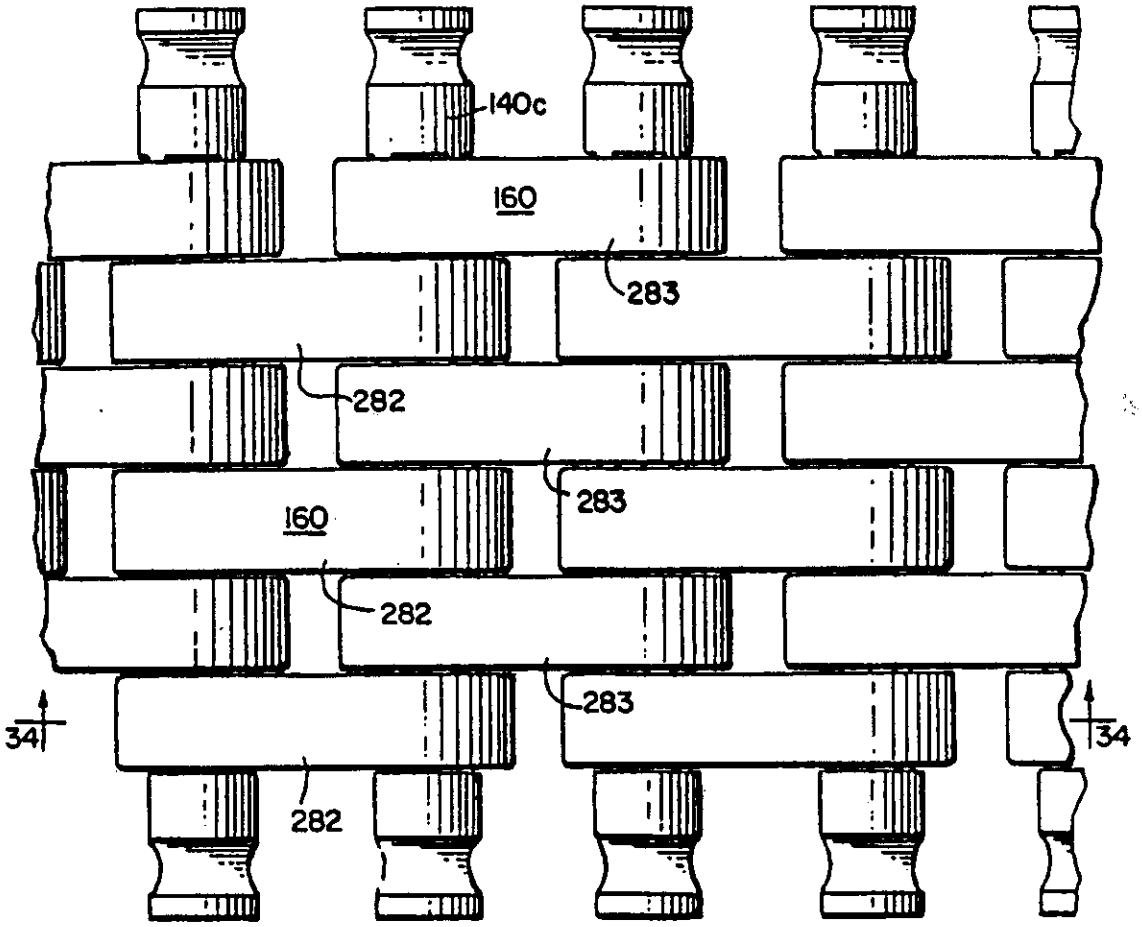
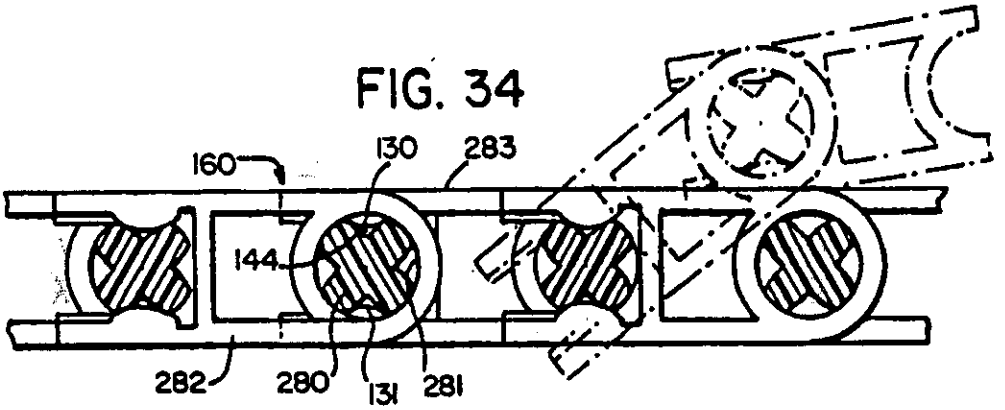

140c
160
283
282
160
283
282
283
34
34
282

FIG. 34


160
130
283
144
282
280
131
281

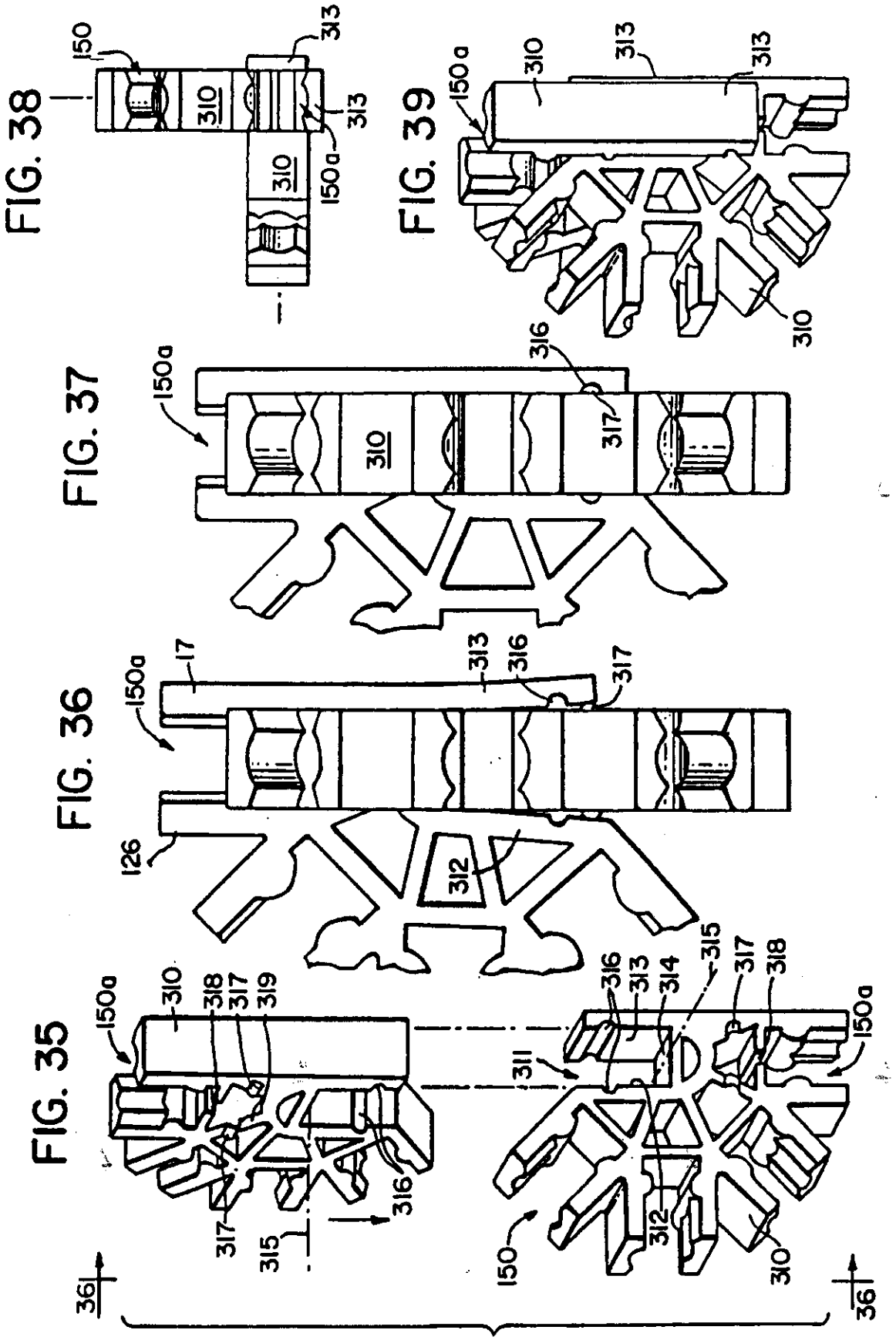


FIG. 38
150
313
310
313
310
150a
FIG. 39
150a
310
313
313
310
FIG. 37
150a
316
310
317
FIG. 36
150a
17
313
316
317
126
312
FIG. 35
150a
310
318
317
319
316
317
315
311
316
313
314
315
317
318
150a
312
150
310
361
361

FIG. 43

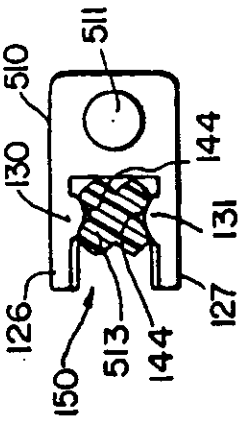


FIG. 44

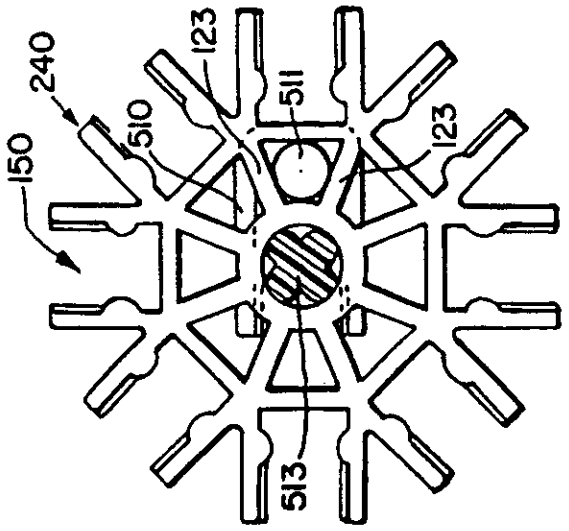


FIG. 41

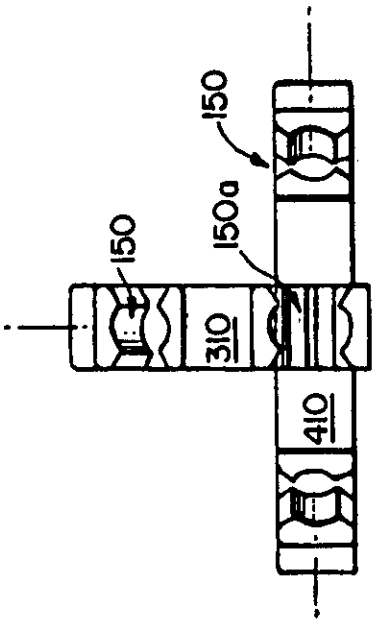


FIG. 42

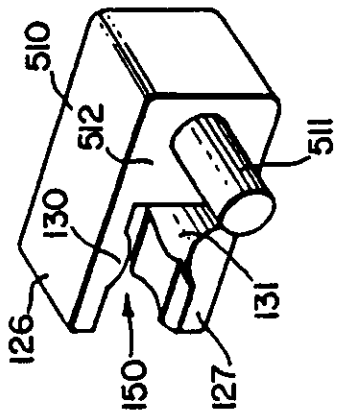


FIG. 40

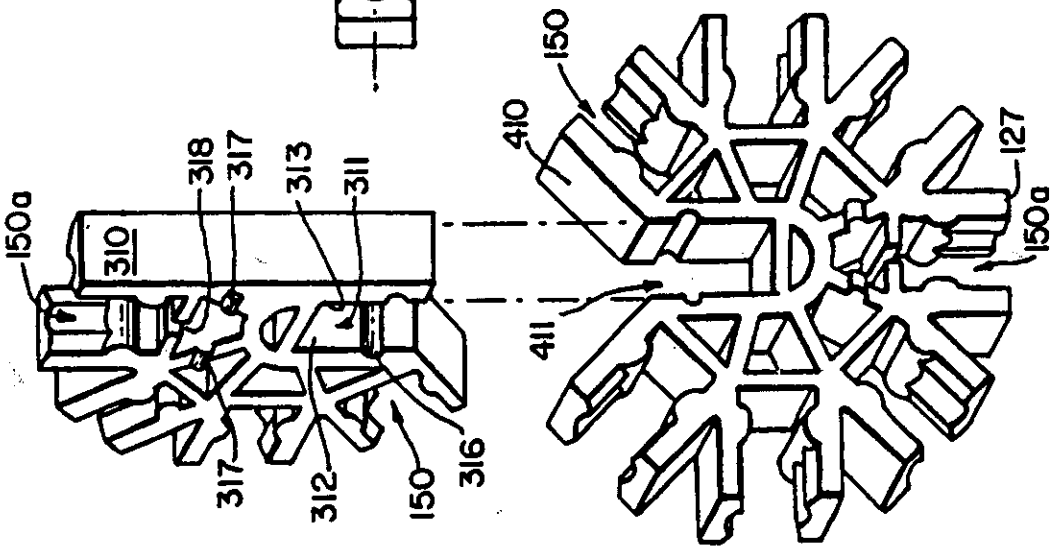


FIG. 47

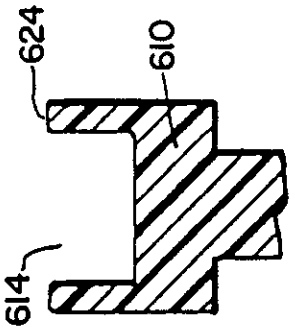


FIG. 48

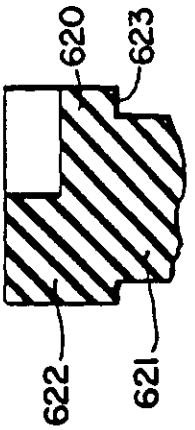


FIG. 45

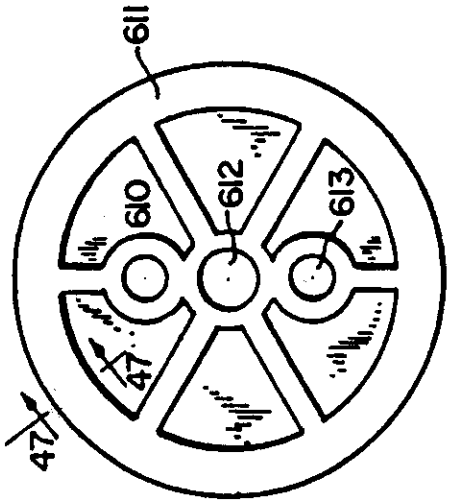
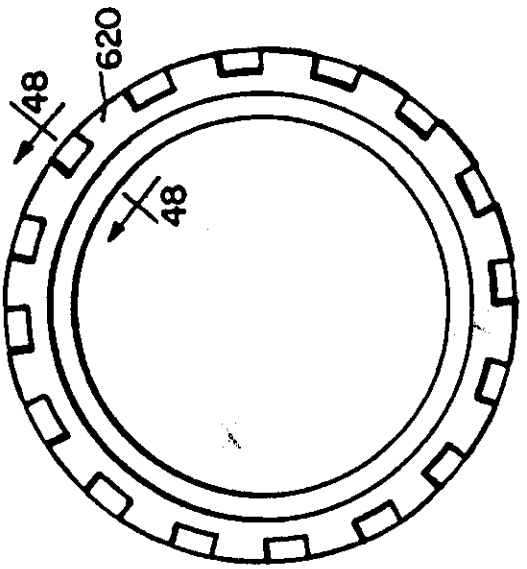


FIG. 46



REGISTER ENTRY FOR EP0490033

European Application No EP91116255.0 filing date 24.09.1991

Priorities claimed:
11.12.1990 in United States of America - doc: 625809
18.04.1991 in United States of America - doc: 687386
19.06.1991 in United States of America - doc: 717639

Designated States BE CH DE DK ES FR GB GR IT LI LU NL SE AT

Title CONSTRUCTION TOY.

Applicant/Proprietor
CONNECTOR SET TOY COMPANY, 2800 Sterling Road, Hatfield, Pennsylvania 19440, United States of America [ADP No. 59829143001]

Inventor
JOEL I. GLICKMAN, 1777 Oak Hill Drive, Huntingdon Valley, Pennsylvania, United States of America [ADP No. 59829150001]

Classified to
A63H

Address for Service
BARKER, BRETTELL & DUNCAN, 138 Hagley Road, Edgbaston, BIRMINGHAM, B16 9PW, United Kingdom [ADP No. 00000232001]

EPO Representative
HRABAL GILLE TÜRK, Brucknerstrasse 20, W-4000 Düsseldorf 13, Federal Republic of Germany [ADP No. 50304021001]

Publication No EP0490033 dated 17.06.1992
Publication in English

Examination requested 17.09.1992

Patent Granted with effect from 12.07.1995 (Section 25(1)) with title
CONSTRUCTION TOY.

18.12.1992 Notification from EPO of change of Applicant/Proprietor details
from
CONNECTOR SET TOY COMPANY, 2800 Sterling Road, Hatfield, Pennsylvania 19440, United States of America [ADP No. 59829143001]
to
CONNECTOR SET LIMITED PARTNERSHIP, 2800 Sterling Road, Hatfield, Pennsylvania 19440, United States of America [ADP No. 60509692001]
Entry Type 25.14 Staff ID. RD06 Auth ID. EPT

29.03.1995 BARKER, BRETTELL & DUNCAN, 138 Hagley Road, Edgbaston, BIRMINGHAM, B16 9PW, United Kingdom [ADP No. 00000232001]
registered as address for service
Entry Type 8.11 Staff ID. TP1 Auth ID. AA

09.06.1995 Notification from EPO of change of Applicant/Proprietor details
from
CONNECTOR SET LIMITED PARTNERSHIP, 2800 Sterling Road, Hatfield,
Pennsylvania 19440, United States of America [ADP No. 60509692001]
to
CONNECTOR SET LIMITED PARTNERSHIP, 2800 Sterling Drive, Hatfield,
Pennsylvania 19440, United States of America [ADP No. 60509692001]
Entry Type 25.14 Staff ID. RD06 Auth ID. EPT

09.06.1995 Notification from EPO of change of EPO Representative details from
HRABAL GILLE TÜRK, Brucknerstrasse 20, W-4000 Düsseldorf 13,
Federal Republic of Germany [ADP No. 50304021001]
to
HRABAL GILLE TÜRK LEIFERT, Brucknerstrasse 20, D-40593 Düsseldorf,
Federal Republic of Germany [ADP No. 50304021001]
Entry Type 25.14 Staff ID. RD06 Auth ID. EPT

**** END OF REGISTER ENTRY ****

RENEWAL DETAILS

PUBLICATION NUMBER EP0490033

PROPRIETOR(S)

Connector Set Limited Partnership, 2800 Sterling Drive, Hatfield, Pennsylvania 19440, United States of America

DATE FILED 24.09.1991

DATE GRANTED 12.07.1995

DATE NEXT RENEWAL DUE 12.10.1995

DATE NOT IN FORCE

DATE OF LAST RENEWAL

YEAR OF LAST RENEWAL 00

STATUS PATENT IN FORCE

**** END OF REPORT ****