

Sept. 9, 1952

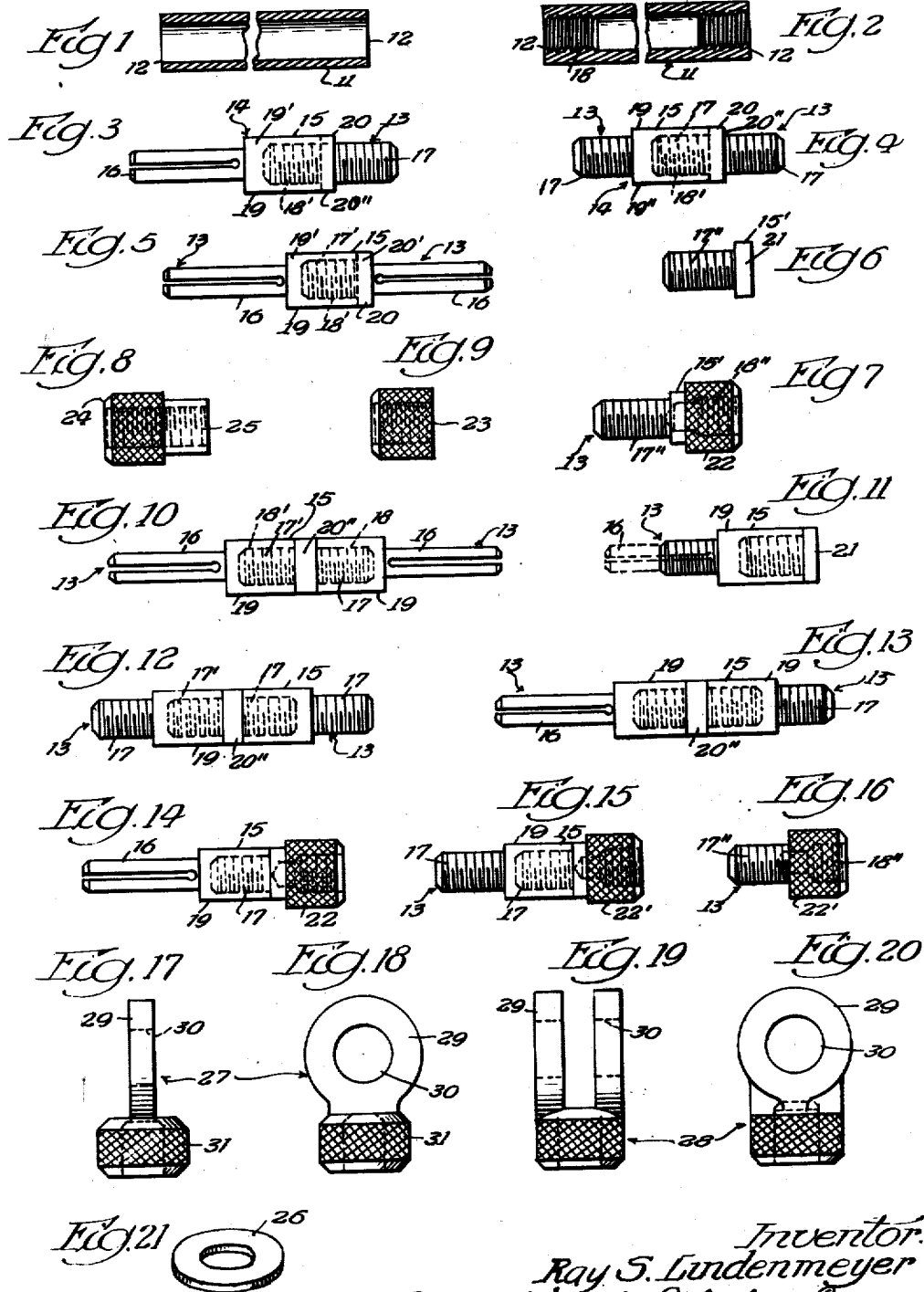
R. S. LINDENMEYER

2,609,638

CONSTRUCTION TOY CONNECTOR

Filed May 22, 1946

7 Sheets-Sheet 1



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Sept. 9, 1952

R. S. LINDENMEYER
CONSTRUCTION TOY CONNECTOR

2,609,638

Filed May 22, 1946

7 Sheets-Sheet 2

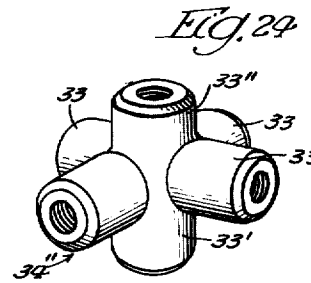
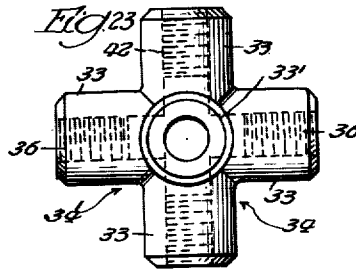
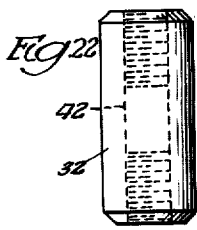


Fig. 25

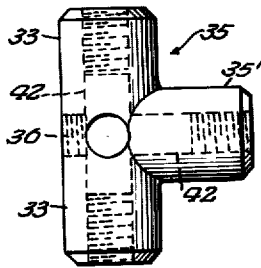


Fig. 26

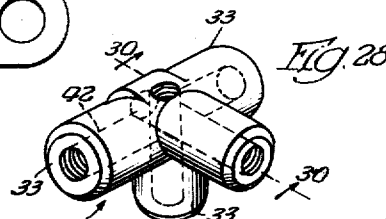
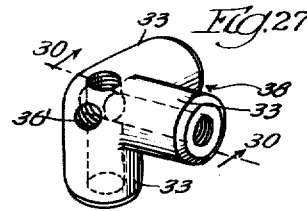
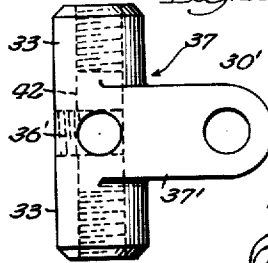


Fig. 31

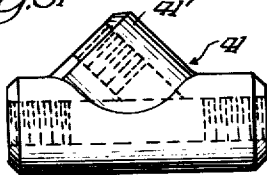


Fig. 29

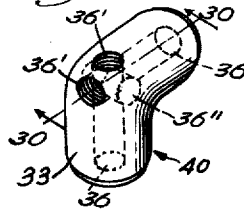


Fig. 30

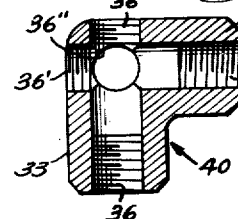


Fig. 34

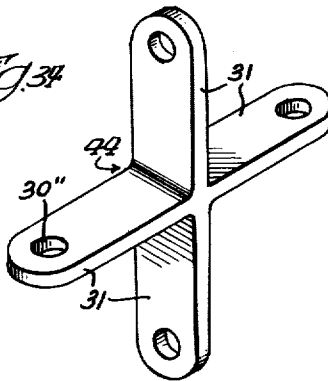


Fig. 32

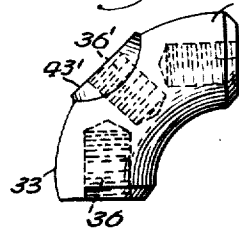
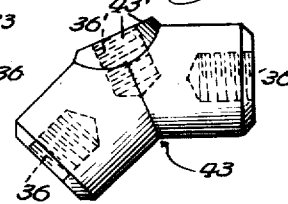


Fig. 33



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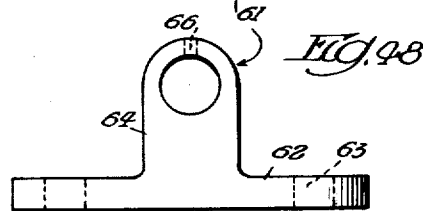
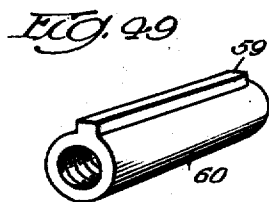
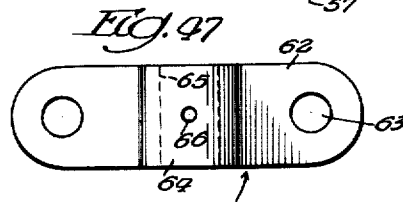
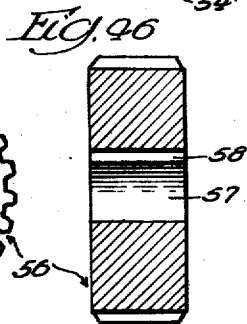
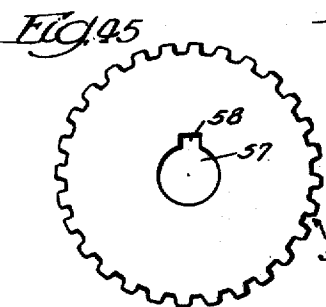
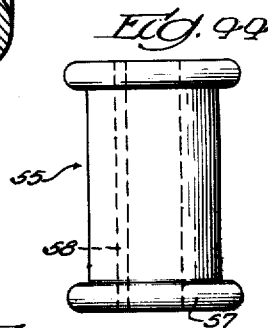
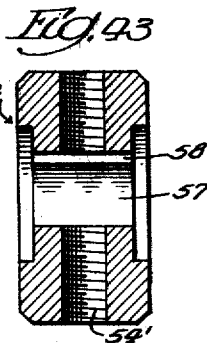
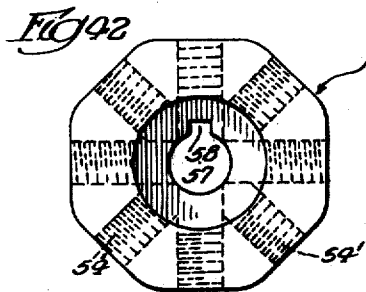
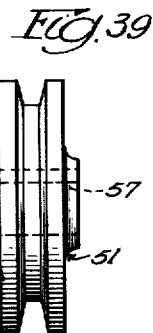
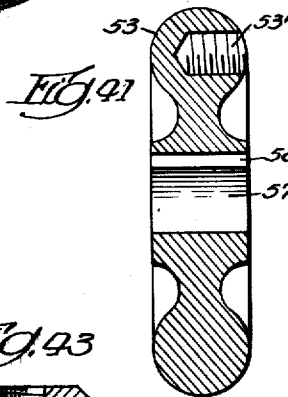
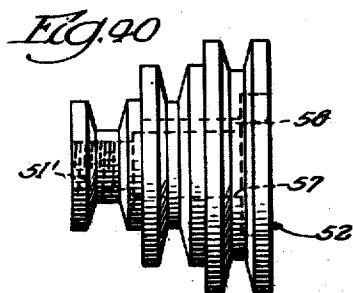
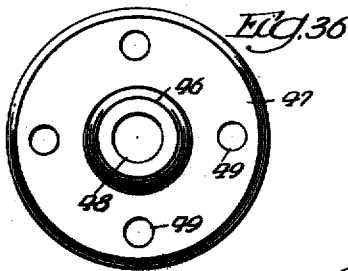
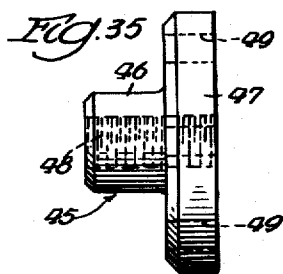
Sept. 9, 1952

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2,609,638

Filed May 22, 1946

7 Sheets-Sheet 3



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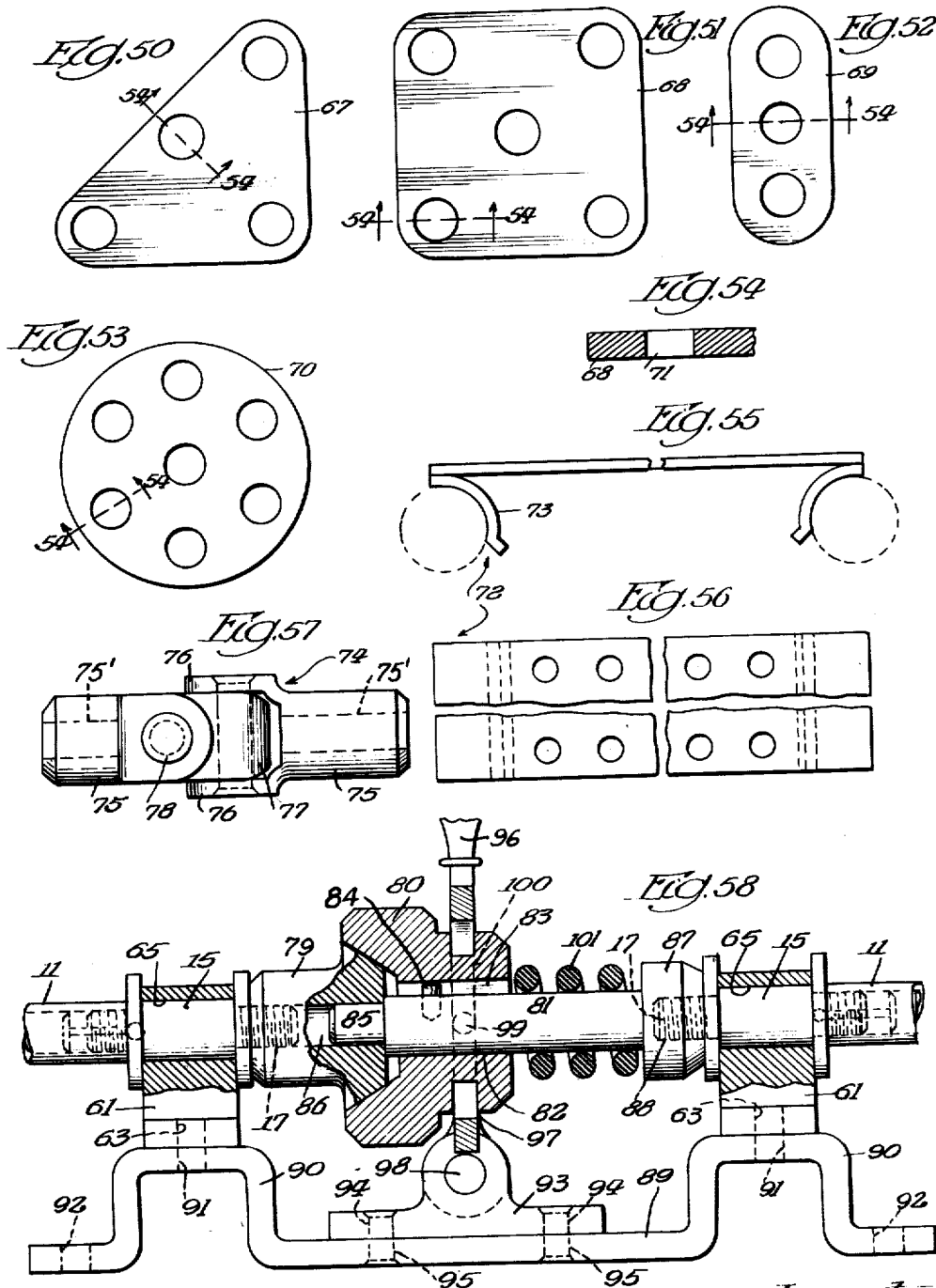
Sept. 9, 1952

R. S. LINDENMEYER
CONSTRUCTION TOY CONNECTOR

2,609,638

Filed May 22, 1946

7 Sheets-Sheet 4



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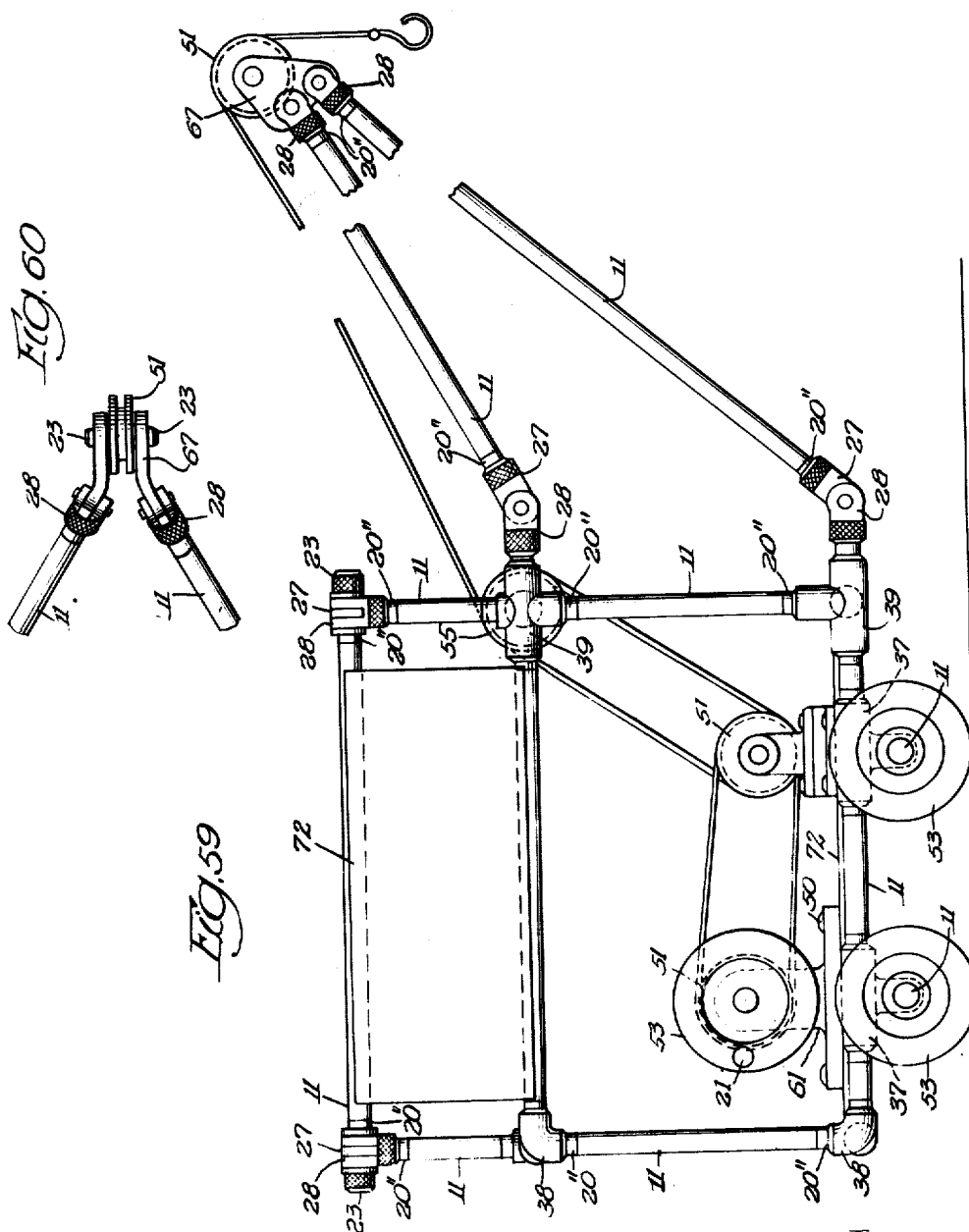
Sept. 9, 1952

R. S. LINDENMEYER
CONSTRUCTION TOY CONNECTOR

2,609,638

Filed May 22, 1946

7 Sheets-Sheet 5



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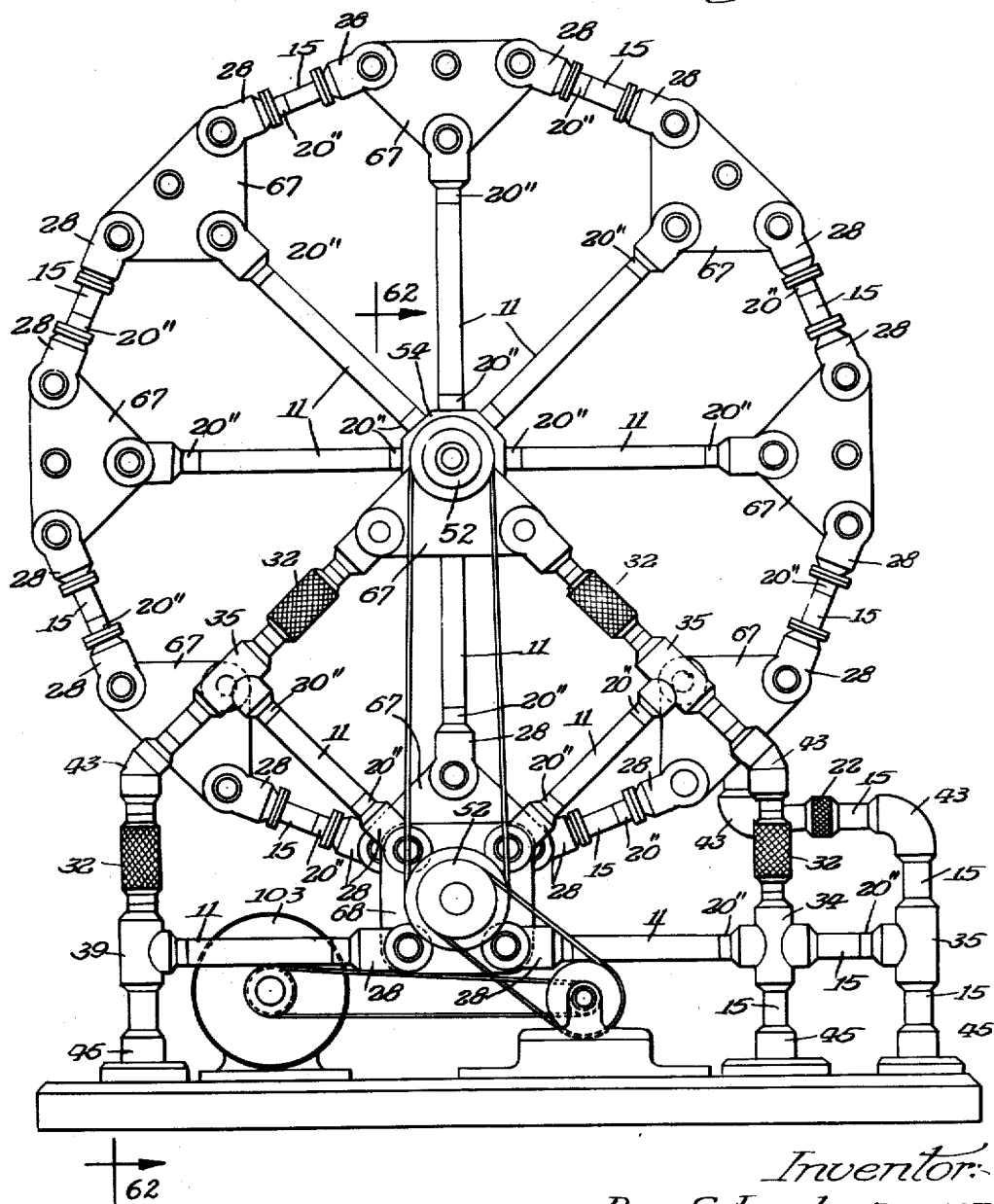
R. S. LINDENMEYER
CONSTRUCTION TOY CONNECTOR

2,609,638

Filed May 22, 1946

7 Sheets-Sheet 6

FIG. 61



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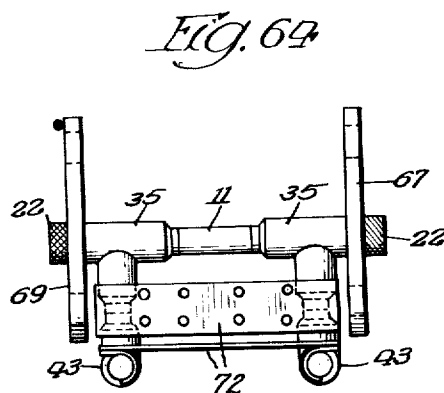
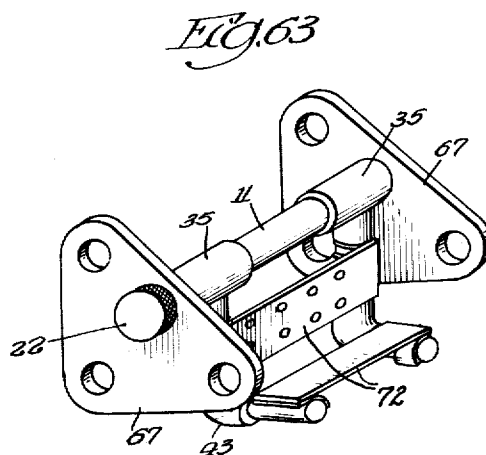
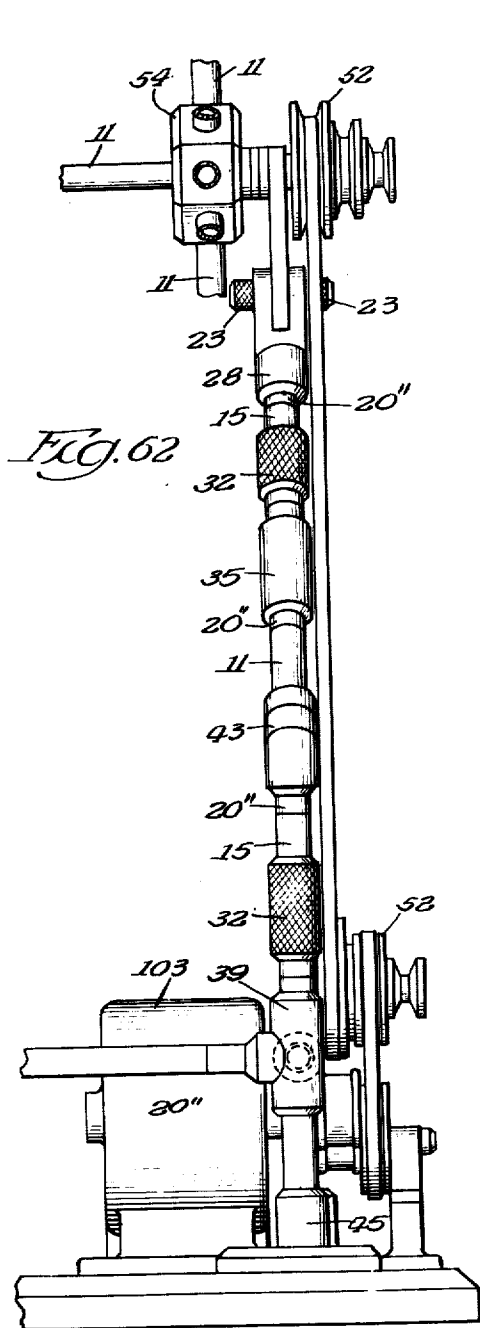
Sept. 9, 1952

R. S. LINDENMEYER
CONSTRUCTION TOY CONNECTOR

2,609,638

Filed May 22, 1946

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,609,638

CONSTRUCTION TOY CONNECTOR

Ray S. Lindenmeyer, Evanston, Ill.

Application May 22, 1946, Serial No. 671,532

5 Claims. (Cl. 46—29)

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The present invention relates in general to structural devices and has more particular reference to structural elements adapted for assembly in an infinite variety of combinations in the building of mechanical structures, the several elements being particularly well adapted for use in toy building sets for the amusement and education of youthful engineers, and others.

An important object of the present invention is to provide structural means of the character mentioned embodying elements of simplified form that are adapted for easy assembly in any selected combination, whereby a large number of different structures can be erected employing, as component elements, parts of relatively simple and inexpensive character.

Another important object is to provide a minimum number of relatively simple elements by means of which realistic engineering structures may be built up, in miniature, without requiring any appreciable skill on the part of the builder, whereby the various parts embodying the present invention may be used to advantage by children, or other untutored persons, as an educational toy, the parts, however, simulating standard engineering elements with sufficient accuracy to impart an appearance of technical correctness in miniature structures built therefrom.

Another important object is to provide structural elements of unusual simplicity that can be produced at low cost without, however, sacrificing the desirable appearance of technical correctness in mechanical structures assembled from the parts; a further object being to provide structural elements that can be assembled readily without the aid of tools, thereby providing for utmost facility in the assembly of the parts.

Another object is to provide parts having integral cooperating stops wherever necessary in order to maintain exact over-all dimensions of assembled parts.

Another object is to provide screw threaded parts including connectors so arranged that left-hand screw threads are entirely avoided.

Another important object is to provide construction means embodying, as its important feature, spacing rods of various lengths and having tubular ends providing sockets for the reception of connectors for the conjunction of such rods with other parts in a desired assembly; a further object being to provide connectors of simple form and allowing for either frictional interconnection or screw threaded connection; a still further object being to provide connectors comprising detachable parts whereby the connector may be assembled at will for frictional engagement within a mounting socket of a connected part or for screw threaded engagement in a threaded socket.

Another important object is to provide angular coupling members for use in combination with the above-mentioned connectors; a further object being to provide plate members and plank mem-

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bers of novel construction and properly sized for attachment upon the rod elements in various assemblies thereof to serve as floors, walls and roof members in structures assembled from the parts.

Another important object of the invention is to provide structural parts well adapted for quantity production, as by die casting, molding, forging, stamping, and by turning on automatic or semi-automatic machines.

Another important object resides in providing construction elements including rods, nipples, angle connectors, flanges, clevis connectors, wheels, pulleys, universal joints, drums, bearing blocks, bolts, planks, gears, clutch mechanism, multi-way connectors, and a novel bolt and nut structure adapted for universal application in joining other parts.

A further object is to provide, for incorporation in structures, sub-assemblies including a clutch structure, and a universal joint provided for assembly with the various coupling elements of a construction set.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the invention is more fully understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

Figs. 1 and 2 are sectional views of connecting rods;

Figs. 3 through 16 are views of connector elements adapted for interconnection in various combinations with each other and with the connecting rods;

Figs. 17 and 18 are views of an eye connector, while Figs. 19 and 20 show a clevis connector, both connectors being sized for interfitting assembly with the elements shown in the preceding figures of the drawing;

Fig. 21 is a perspective view of a washer sized for use with the connectors shown in Figs. 3 through 16;

Fig. 22 is a view of a sleeve connector, while Figs. 23 through 33 are views of angle coupling elements adapted for interfitting engagement with certain of the connectors shown in Figs. 3 through 16;

Fig. 34 is a perspective view of a four-way connector adapted for interfitting assembly with certain of the elements shown in Figs. 1 through 16;

Figs. 35 and 36, respectively, are side and face views of a coupling flange sized for assembly with certain of the elements shown in Figs. 3 through 16;

Figs. 37 and 38 show, respectively, a bolt and nut sized for use with the coupling flange, and for other purposes;

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Fig. 39 is a perspective view showing a plain pulley;

Fig. 40 is a view of a multi-step pulley;

Fig. 41 is a sectional view of a wheel;

Figs. 42 and 43 are, respectively, side and sectional views of a hub element;

Fig. 44 is a view of a winding drum;

Figs. 45 and 46 are, respectively, side and sectional views of a spur gear;

Figs. 47 and 48 are, respectively, top and end views of a pedestal bearing;

Fig. 49 is a perspective view of a spline element sized for use with the elements shown in Figs. 39 through 46 and for interfitting engagement with the coupling devices shown in Figs. 3 through 16.

Figs. 50 through 53 are face views of connector plate elements;

Fig. 54 is a sectional view taken substantially along the line 54—54 in Figs. 50, 51, 52 and 53;

Figs. 55 and 56, respectively, are end and bottom plan views of a plank element;

Fig. 57 is a side view of a universal joint unit;

Fig. 58 is a side elevation of a clutch assembly;

Fig. 59 is a side elevation view of a crane assembly constructed of parts embodying the present invention;

Fig. 60 is a top plan view of a portion of the crane shown in Fig. 59;

Fig. 61 is a side elevation view of a wheel structure made from parts embodying the present invention;

Fig. 62 is a sectional view taken substantially along the line 62—62 in Fig. 61;

Fig. 63 is a perspective view of a subassembly portion of the structure shown in Fig. 61; and

Fig. 64 is a front view of the subassembly portion shown in Fig. 63.

To illustrate the invention, the drawings show structural devices comprising elements adapted for assembly in any selected combination for building desired structures, on a miniature scale, in close simulation of the mechanical structure and appearance of corresponding full size devices. Construction sets embodying the present invention include elongated spacing members or rods 11, in various selected lengths, the members being formed at their opposite ends with sockets 12 sized to receive therein the mounting portions 13 of coupling members 14, which are preferably provided in several forms, as shown in Figs. 3, 4 and 5.

Although the members 11 may have any desired sectional configuration and may comprise either solid or hollow rods, it is preferable that the members 11, in the interests of maximum strength, minimum weight, and low cost, comprise tubular members of preferably cylindrical configuration, wherein the bore of the tubular members forms the sockets 12 at the opposite end of the members 11. The members 11 thus may be fabricated, at minimum expense, by cutting off suitable lengths from standard low-cost tube stock having desired diametral dimensions, such tube stock being of any preferred material, such as metal, including steel, or aluminum, where minimum weight is desired; or plastic material may be employed if desired.

The coupling members 14, as shown in Figs. 3, 4 and 5, may comprise solid rod material of preferably cylindrical shape having a central portion 15, the diametral dimension of which preferably corresponds with the outer diameter of the members 11. The mounting portions 16 of the coupling members extend outwardly of

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and in axial alignment with the central portions 15 at the opposite ends thereof. The mounting portions 16 may comprise diametrically split rod-like extensions 16 adapted to frictionally fit within the sockets 12, said extensions being of substantial length to firmly mount the coupling members at the end of the members 11.

The mounting portions 13 may also comprise screw threaded extensions 17 adapted for threading engagement in the outer portions of the sockets 12, which may be internally threaded, as indicated at 18, to a depth sufficient to receive the threaded mounting portions of the coupling members. It will be noted, however, that the diametrically slotted mounting portions 16 are substantially longer than the threaded mounting portions 17 to frictionally engage the inner portions of the sockets 12 inwardly of the threaded portions 18, where such sockets are provided with threads for the reception of the threaded mounting portions 17. It will be noted also that the diameter of the portions 16 is substantially equal to the diameter of the threaded portions 17 measured at the base of the threads.

As a consequence, all of the mounting portions of the coupling members, whether threaded or not, may interfit in the threaded sockets 12 of all of the members 11. Thus, when any coupling member is mounted at the end of a member 11, the enlarged portion 15 of the coupling member may form a continuation of the external surfaces of the member 11 on which it is mounted. The coupling members 14 may each be formed as an integral part comprising the enlarged portion 15 and a mounting portion 13 of either sort, at either or both ends of said enlarged portion. As indicated in dotted lines in Figs. 3, 4 and 5, however, each coupling member may be formed as a pair of cooperating parts 19 and 20 for threaded interconnection, the coupling member, in such case, being divided at the enlarged portion 15 to provide a threaded connecting projection 17', on one part 20, and an internally threaded socket 18', on the other part 19, whereby the parts may be threadedly interconnected or may be used separately, or in combination with still other parts. The threaded connecting projections on the parts 20 preferably correspond in size and shape with the threaded mounting portions 17.

Ordinarily, an entirely adequate construction set for use as a toy for children may be provided by supplying only integral coupling members of the sort shown in Fig. 5 having split friction mounting portions 16 formed at the opposite ends of the coupling members. In such case the sockets 12 need not be threaded. By threading the sockets 12, however, and by supplying integral coupling members of the sort shown in Figs. 3 and 4 as well as couplings of the sort shown in Fig. 5, the flexibility of the construction set may be greatly increased. Maximum structural flexibility, however, is afforded where split coupling members, comprising the separable parts 19 and 20, are provided. Such arrangement requires the provision of only four different parts, namely, a part 19' as shown in Figs. 3 and 5, with friction connector portion 16; a part 19'' as shown in Fig. 4, with threaded connector portion 17; a part 20' as shown in Fig. 5, with friction connector portion 16; and a part 20'' as shown in Figs. 3 and 4 with threaded connector portions 17. These four parts not only allow coupling members of the three kinds shown in Figs. 3, 4 and 5 to be assembled, but permits the

assembly of other connector forms, hereinafter described.

Assembly of a part 20'' with a part 19' provides the coupling member shown in Fig. 3, while use of the part 20'' in combination with a part 19'' produces the coupling member shown in Fig. 4. Conjoint use of parts 19' and 20' provides the coupling member shown in Fig. 5.

By joining a pair of members 19' by use of a member 20'' as shown in Fig. 10, an elongated version of the coupling shown in Fig. 5 may be produced. In like fashion, extended forms of the couplings shown in Figs. 3 and 4 may be produced, as shown in Figs. 12 and 13. Coupling members of any desired length may thus be built up from the four basic parts heretofore mentioned.

Additional coupling flexibility may be accomplished by providing the auxiliary parts shown in Figs. 6 through 9 and Fig. 16. In Fig. 6 is shown a stud 21 formed with a head 15' sized to conform with the diameter of the portion 15 and a threaded portion 17'' adapted to fit the sockets 18 and 18'. The stud 21 consequently may be used to close the end of any rod 11 or the socketed end of any of the members 19, as shown in Fig. 11. In Fig. 7 is shown a stud 22, like the stud 21 but having, in addition to the portion 15', an integral enlarged and preferably knurled head, which is formed with an axial internally threaded cavity 18'' corresponding in size with the cavities 18 and 18'. In Fig. 16 a modified form 22' of the stud 22 is shown, in which the portion 15' is omitted. Either form may be mounted on any of the sockets 18, 18' or 18'', as shown in Figs. 14 and 15.

Fig. 8 shows a sleeve member 24 formed with an enlarged, preferably knurled head, and a sleeve portion 25 having an outer diameter matching the diameter of the rods 11 and the portions 15 of the connectors, the sleeve member having an axial bore equal in diameter to the bore of the tubes 11. The sleeve member may also be internally threaded. It consequently may frictionally fit on the connector portions 16 and also may threadingly engage the threaded connector portions 17, 17' and 17''.

Fig. 9 shows a nut 23 sized to fit the threaded connector portions 17, 17' and 17'' being also frictionally fittable on the connector portions 16.

Fig. 21 shows a washer 26 sized to fit on any of the mounting portions 13. If desired, this washer may be internally threaded to fit the portions 17, 17' and 17'', the threaded washer also slidably fitting the portions 16.

It will be seen from the foregoing that a large variety of coupling devices may be built up by the screw threaded interconnection of a relatively few interfittable elements in order to allow for the interconnection of the various parts of the construction set, including the mounting of coupling members at the ends of the rod members 11 in order to provide either frictional mounting portions 16 or threaded mounting portions 17, projecting at the ends of the members 11, for attachment with other members 11, either directly or by way of additional coupling devices hereinafter more fully described. The coupling members also provide means for mounting the enlarged portions 15 at the ends of the members 11 to serve as axles, pivot pins, mounting pins, and other types of connectors, for wheels, pulleys, rollers, and other elements of the set, as hereinafter revealed.

An eye fitting 27 is shown in Figs. 17 and 18,

and a clevis element 28 is shown in Figs. 19 and 20. These elements comprise ears 29 of washer-like configuration having central openings 30 therethrough. The ears are supported on nut portions 31. The eye fitting comprises a single ear 29 formed on and lying in a plane extending axially of its supporting nut 31. The clevis element comprises spaced ears on the supporting nut, the openings in the ears being in axial alignment. The spacing of the ears 29 of the clevis element is preferably equal to the thickness of the ears, whereby the ear of the eye element may be assembled between the ears of the clevis and pivoted thereto, as by pin elements of the sort shown in Figs. 3 through 15, the openings 30 being sized to fit the portions 15 of said elements, as well as the rods 11. The nut portion 31 of each element is preferably configured in conformity with the shape of the nut 23 and the heads 22 and 22' of the studs heretofore described. The nut portion 31 preferably has outer knurled surfaces and an axial threaded cavity adapted to threadingly connect with any of the threaded mounting portions 17, 17' and 17'' of the coupling members, said threaded cavity preferably having its axis extending at right angles with respect to the axis of the openings 30.

In Fig. 22 is shown a connector 32 comprising a cylindrical block of metal having an axial threaded bore sized to fit the mounting portions 16 and for threading engagement with any of the threaded mounting portions 17, 17' and 17'', heretofore described. The connector 32 has outer surfaces, preferably knurled so that, if desired, the connector 32 may be applied as an extension between a pair of rod members 11, fitted with coupling members mounted in the ends thereof to provide projections 16 or 17 for engaging in the bore of the member 32. The member 32 also may be used as a handle.

Angle connectors are shown in Figs. 23 through 33, the same preferably comprising metal castings providing preferably cylindrical portions forming ends or bosses 33 extending outwardly in various directions from the medial portions of the couplings, said outwardly extending bosses 33 being provided with internally threaded sockets 36 sized like the sockets 18 to threadingly receive the threaded portions 17, 17' and 17'' of the coupling members shown in Figs. 3 through 16.

The coupling 34 shown in Fig. 23 provides four bosses 33 arranged in pairs, the threaded sockets of each pair being in axial alignment and facing outwardly in opposite directions, and the axes of said socket pairs lying in a common plane and intersecting at right angles at the center of the coupling. If desired, a fifth embossment 33' may be provided on one side of the coupling and formed with a threaded socket, to form a five-way coupling 34', the axis of said socket extending in a direction normal to the plane of the axes of the sockets of the bosses 33 and intersecting said plane at the intersection of the axes of the aligned pairs of sockets of the bosses 33. If desired, as shown in Fig. 24, a sixth embossment 33'' may be formed on the side of the coupling opposite from the embossment 33', in order to form a six-way coupling 34'', said sixth embossment having a threaded socket in axial alignment with the socket of the embossment 33'.

As shown in Fig. 25, a three-way coupling 35 may comprise a pair of embossments 33 having sockets 36 in oppositely facing axial alignment, and a third embossment 35' disposed medially of

the other two embossments and having a socket, the axis of which extends at right angles and in a common plane with the axis of the aligned sockets of the coupling embossments 33.

The three-way coupling 37 shown in Fig. 26 may comprise a pair of embossments 33 having threaded sockets in oppositely facing alignment, and a third embossment or lug 37' disposed medially of the other two embossments and having an opening 30' formed through the embossment, the axis of the opening 30' being spaced from the axes of the aligned cavities of the embossments 33, the opening 30' being similar in diameter to the holes 30 of the fittings shown in Figs. 17 through 20, and hence adapted to receive the rods 11 or the portions 15 of the connectors shown in Figs. 3 through 15.

In Figs. 27 through 30, modified forms of the couplings shown in Figs. 23 and 25 are illustrated. The coupling 38 shown in Fig. 27 comprises three embossments 33 having outwardly opening, internally threaded sockets, the axes of which extend mutually at right angles, said axes intersecting at a common point in the coupling. The coupling 39 shown in Fig. 28 embodies four embossments 33 having internally threaded sockets, the axes of three of which extend mutually at right angles and meet at a common point, the axis of the fourth being in alignment with the axis of one of the other three. The elbow coupling 40 shown in Figs. 29 and 30 comprises two embossments 33 formed with threaded sockets having axes meeting at right angles. The coupling 41 shown in Fig. 31 is also a modification of the form illustrated in Fig. 25, the coupling comprising a pair of embossments 33 having threaded sockets in oppositely facing alignment, and a third embossment 41' disposed medially of the other two embossments and having a socket, the axis of which extends in a common plane with the axes of the aligned sockets by making an angle other than a right angle, preferably a 45° angle with the axes of said aligned sockets.

If desired, the aligned pairs of sockets in the couplings shown in Figs. 23 through 31 may be formed in the coupling as channels 42 extending completely through the coupling, the sockets comprising the internally threaded, outwardly opening ends of said channel. In the connectors shown in Figs. 25 through 30, also, sockets 36' may be formed in the walls of the connectors in line with sockets 36, and also transversely, as at 36'', in Fig. 29. The channels 42 thus will frictionally receive the mounting portions 16 as well as the threaded portions 17, 17' and 17'' of the connectors shown in Figs. 3 through 16.

The couplings 43 shown in Figs. 32 and 33 each comprise an arcuately curved body providing embossments 33 formed with sockets 36 having relatively inclined axes lying in a common plane and intersecting at a right angle, as shown in Fig. 32, or at other than a right angle, preferably an angle of 135° as shown in Fig. 33. If desired, the couplings may be provided with a third embossment 43' medially of the arcuate coupling body and formed with an internally threaded socket 36', as shown in dotted lines, said socket having its axis lying in a common plane with and bisecting the axes of the other two sockets 36. If desired, the couplings shown in Figs. 32 and 33 may be provided with a perforated embossment like the embossment 37' of the coupling shown in Fig. 26, in place of the embossment 43' heretofore described.

Fig. 34 shows a coupling 44 comprising flat

sheet metal strips forming arms 31 connected together at the medial portions of the coupling, the arms radiating thence outwardly of said medial coupling portions and having openings 30'' formed in the arms at the outer ends thereof, said openings 30'' being circular and of the same size and shape as the coupling 30' of the fittings shown in Figs. 17 through 20 and the opening 30' of the fitting shown in Fig. 26. The arms of the coupling 44 are preferably equal in thickness to the spacing of the ears 29 of the clevis 28 whereby clevis elements may be attached to any of the arms.

The openings 30, 30' and 30'' are preferably sized to receive the rods 11 or the portions 15 of the coupling members shown in Figs. 3 through 15, the tubes 11 and said portions 15, to this end, preferably having a diameter of the order of one quarter inch, and the openings 30, 30' and 30'' having like diametral dimensions.

In this connection, also, the threaded and frictional connecting portions 16 and 17, and the sockets and channels in which said portions are adapted to threadedly or frictionally interfit, may have diametral dimensions of the order of three-sixteenths of an inch. Further, in this connection, the rod member 11 preferably has an outer diameter matching the outer diameter of the portions 15 of the coupling members and an inner diameter matching the minimum diametral dimensions of the coupling portions 16 and 17.

A coupling flange 45 having a hub portion 46 and a flange portion 47 is shown in Figs. 35 and 36, said coupling having an internally threaded axial bore 48 having an inner diameter to fit the portions 16 and to threadingly engage any of the threaded portions 17, 17' and 17'' of the coupling members shown in Figs. 3 through 16. The flange portion 47, also is provided with a series of circularly arranged openings 49 there-through, the axes of said openings being parallel and extending parallel with the axis of the threaded channel 48. The openings 49 may be sized to fit the portion 15 of the coupling member or, as shown, may have a diameter of the order of one-eighth inch to receive one-eighth inch coupling bolts 50, as shown in Figs. 37 and 38, or similar fastening elements.

Figs. 39 through 46 show various turnable devices including a single pulley 51, a multiple step pulley 52, a wheel 53, a wheel hub 54, a winding drum 55, and a gear 56. These elements are each provided with a central axial bore 57 sized to turnably receive the rod members 11 or the mounting portions 15 of any of the connectors shown in Figs. 3 through 15, whereby the turnable elements may be mounted on the rods 11 or the coupling members operating as supporting axles.

The elements shown in Figs. 39 through 46 may also be formed each with a spline groove 58 sized to receive the spline rib 59 on an axle element 60, as shown in Fig. 49. The axle channels 57, except in the winding drum 55 and in the pulley 52 which may be longer, are all preferably of the same length, of the order of three-eighths inch, and the axle element 60 is preferably of like length to fit all of the elements. It may comprise a cylindrical rod formed with threaded sockets, like the sockets 36, in its opposed ends, whereby the turnable elements may be mounted on the connectors shown in Figs. 3 through 16.

The axial bore 57 of the multiple step pulley 52 may include a portion sized to receive the portion 15 of a coupling member, such as the coupling

member shown in Figs. 3 or 4, and a bore portion 57' of lesser diameter and internally threaded to threadingly engage any of the threaded extensions 17, whereby the step pulley 45 may be mounted on and threadedly engaged with any of the coupling members, as for example a member 20'' attached to the end of a member 60.

By combining coupling elements, especially of the sort shown in Fig. 4, with the element 60, any of the turnable elements of Figs. 39 through 46 may be mounted in splined relation with axle forming coupling members; or the elements may be mounted for rotation freely on axle forming elements, including the rods 11.

The wheel 53 shown in Fig. 41 may be formed with a threaded socket 53' formed in its rim and opening outwardly at a side, or on opposite sides of the rim, the socket being sized to receive the mounting portions 17 of connector elements, especially the element shown in Fig. 11 to form a crank handle on the wheel.

The wheel hub 54 may be formed with tangential surfaces, at its periphery, and radially extending, internally threaded channels 54' may be formed in the hub element from said tangential surfaces 54 to the axial bore 57, said channels 54' preferably having axes lying in a common plane at right angles with respect to and radiating from the axis of the bore 57. The channels 54' are internally threaded at least at the outer ends thereof and may receive the portions 16 of the coupling members; and the channels 54' also are sized to threadingly engage any of the threaded projections 17, 17' and 17'' of the coupling members, whereby said coupling members may be mounted on the periphery of the wheel hub in position to receive and carry rod members 11 as wheel spokes on said hub.

The winding drum 55 shown in Fig. 44 comprises a cylindrical body affording a winding surface and annular outstanding flange portions at opposite ends of the winding surface.

A pedestal bearing 61 is illustrated in Figs. 47 and 48, said pedestal comprising a base 62 having openings 63 at its opposite ends preferably corresponding in size with the openings 49 of the flange coupling shown in Figs. 35 and 36, whereby said openings 63 may receive the bolt 50. The bearing pedestal includes an upstanding pedestal portion 64 mounted on the base 62 medially of the opposite ends thereof, said portion 64 being formed with a bearing opening 65, including an oil hole 66 disposed medially of the opening 65. The opening 65 is sized to turnably receive the rod elements 11 or any of the mounting portions 15 of the coupling members, whereby the rods or the coupling members may be journaled in the pedestal bearing.

Several preferred forms of connector plate elements 67, 68, 69, and 70 are shown in Figs. 50 through 54. These plate elements preferably comprise sheet metal plates of triangular, rectangular, elongated, and circular configuration, as shown. The plates are formed with openings 71 preferably arranged symmetrically in the plates and sized to receive the members 11, or the portions 15 of the coupling members shown in Figs. 3-15.

In the triangular embodiment 67, shown in Fig. 50, the openings 71 include openings at each of the corners of the element and an opening centrally of its longest side. In the rectangular embodiment 68, shown in Fig. 51, the openings are preferably placed at the corners of the element and at its mid-point. In the elongated element

69, shown in Fig. 52, the openings are placed one at each of the opposite ends of the element and one medially of said ends. In the circular form 70, shown in Fig. 53, an opening may be placed at the center of the element and others formed in spaced arrangement along the periphery of the plate.

A plank element 72 is shown in Figs. 55 and 56, said plank element comprising a preferably rectangular strip or plate of sheet material having inwardly extending mounting clips 73 at its opposite ends. These clips 73 are curved to interfittingly engage rods 11 in spaced relationship, whereby the plank elements may be snapped into position on such spaced rods and held in mounted position thereon by the resilience of the clips. Planks may be formed with openings therein sized and spaced in accordance with the size and spacing of the openings 63 of the pedestal bearing, whereby said bearing and comparable elements may be attached to the planks as by the bolts 50 or other fasteners. The planks may be supplied in several lengths with clips 73 spaced thereon to accommodate various spacing of mounting rods, the invention particularly contemplating planks to accommodate rod spacings of three, four and six inches. The planks 72, likewise, may be supplied in different widths, the invention contemplating planks in various widths from one-half inch to six inches.

A universal joint 74 is shown in Fig. 57, the same comprising a pair of end portions 75 of preferably identical shape and providing hub portions formed with axially extending, internally threaded sockets 75' corresponding in size with the sockets 33 of the coupling members shown in Figs. 22 through 30, and hence adapted to receive and interfit with the extensions 16, 17, 17', and 17'' of the coupling elements shown in Figs. 3-16, whereby the universal joint may be mounted on said coupling members between the abutting ends of rod members 11. The coupling elements 75 also include spaced ears 76 at the ends thereof remote from the sockets 75', the coupling comprising a coupling block 77 extending between the ears 76 of both coupling elements 75, the block being rockingly pinned to said ears, as by means of the rocking pins 78 extending mutually at right angles.

As shown in Fig. 58, the present invention contemplates a clutch assembly comprising clutch parts 79 and 80, the member 79 comprising a hub formed with a beveled flange at one end in position to engagingly enter a correspondingly beveled socket in an end of the member 80. The member 80 also includes a hub portion for mounting the same on a shaft 81, said hub portion of the member 80 being formed with an axial channel 82 to slidably receive the shaft 81, said channel 82, on one side, having a spline groove 83, and said shaft having a radially extending pin 84 mounted for splined engagement in the grooves 83. The member 80 thus is splined to the shaft to turn therewith while being slidable axially thereon toward and away from clutching engagement with the member 79.

The end of the shaft 81 is provided with an extension 85 sized to fit turnably within one end of a channel 86 formed axially in the member 79. The other end of said channel 86 is internally threaded to threadingly engage the threaded extension 17 of a coupling member of the sort shown in Fig. 3 or 4. The shaft 81 projects outwardly of the clutch member 80 and is formed with a shouldered head 87, said head be-

ing provided with an internally threaded socket 88 for threaded engagement with the threaded extension 17 of a coupling member of the sort shown in Fig. 3 or 4. The coupling members, thus mounted in the threaded sockets of the clutch member 79 and shaft head 87, have their mounting portions 15 disposed within the bearing channels 65 of pedestal bearings 61 of the sort shown in Fig. 47, washers of the sort shown in Fig. 21 being mounted on the coupling members at the opposite ends of the coupling portions 15 and the bearing channels 65. The projecting portions of the coupling members project in opposite directions from the bearings, on the sides thereof remote from the clutch members 79 and 80, and provide for drivingly engaging with rod members 11.

The pedestal bearings 61 may, of course, be mounted in any preferred fashion on a suitable base to maintain them in spaced relation supporting the clutch mechanism therebetween. A base plate 89, however, is preferably supplied for mounting the clutch assembly, said base plate comprising a formed plate of sheet metal having upstanding ribs 90 in spaced relation thereon and formed with bolt holes 91 in spaced relationship to register with the bolt holes 63 in the base portions 62 of the pedestal bearings. The holes 63 and 91 are of like size and adapted to receive coupling elements of the sort shown in Fig. 37, used as anchor bolts.

The opposite ends of the base plate 89 also may be formed with spaced bolt holes 92 preferably of the same size as the holes 91 and, consequently, adapted to receive bolts 50 or other fastening elements to anchor the plate on a support base. Medially of the plate 89 is fastened a bearing block 93 having a base formed with holes 94 sized and spaced to register with corresponding holes 95 formed in the base plate 89, whereby said bearing block 93 may be mounted on the base plate in any suitable fashion. To this end, the bearing block 93 may be permanently riveted on the base plate, or, the openings 94 and 95 may be internally threaded to receive the threaded stem of a fastening stud of the sort shown in Fig. 16.

The bearing block 93 is adapted to turnably receive a clutch operating lever mechanism comprising a collar formed with an operating handle 96 on one side of the collar, a portion 97 on the other side of the collar and adapted to be tiltably mounted in the bearing block, as on a pivot pin 98; the medial portions of the lever member being annular and encircling the hub of the member 80. Said annular portions may have inwardly extending pins 99 on opposite sides of said hub in position to extend into and ride in an annular groove 100 formed in the said hub. By moving the handle 96 in one direction or the other, the member 80 may be moved on its supporting shaft 81 to engage and disengage the clutch members. Biasing spring means 101, preferably a helical spring, may be mounted on the shaft 81 in position to engage between the shouldered shaft head 87 and the facing end of the hub of the clutch member 80 in order to normally urge the clutch member 80 in a direction on the shaft 81 toward clutch engaging position with the clutch member 79.

A derrick structure of the sort adapted to be assembled from parts heretofore described is illustrated in Figs. 59 and 60. Said derrick structure comprises a framework built up by assembling rod members 11 using coupling members

of the sort shown in Fig. 3, in combination with the rod members 11, coupling members 20', 28, 35, 37, 38, 39; and fasteners of the sort shown in Figs. 7, 9 and 15. A portion of the frame may be boxed in by plank members 11 applied between the spaced rod members 11. Other plank members may be utilized between spaced rod members 11 to form a floor on which a bearing 61 may be mounted as by fastening means 50 applied through openings in the planks. The bearing may carry axle means supporting a pulley 51, driven by a wheel 53, with crank handle mounted on the rim thereof. A clutch assembly, of the sort shown in Fig. 58, fitted with pulley means, of the sort shown in Fig. 39, may also be mounted on the floor of the structure and belted to the crank connected pulley. The pulleys and crank wheel may be drivingly connected with their shafts 14 by coupling means 20'.

The coupling members 37 forming a portion of the frame may carry rod members 11 in the openings 30' thereof to form wheel axles on which support wheels 53 may be mounted, as by coupling members of the sort shown in Figs. 3 or 4 and 9, the wheels being mounted on the bearing portions 15 of the coupling members, and held in place thereon by and between a pair of washers of the sort shown in Fig. 21. A derrick boom comprising a pair of rod members 11 may be mounted on the frame, as at a pair of constituent coupling members 37 thereof, by eye members 27, clevis members 28, and coupling members of the sort shown in Figs. 3 or 4, 9 and 15. The outer ends of the boom member may be fitted with clevis elements 28 by means of coupling members 20' or members of the sort shown in Figs. 3 or 4; and the clevis elements may be fastened to the openings of a triangular plate element 67 of the sort shown in Fig. 50 by means of coupling elements of the sort shown in Figs. 9 and 15 extending through the ears of the clevis and the openings 71 of the plate element, as shown more particularly in Fig. 60.

The derrick may thus be provided with a pair of boom arms comprising a pair of spaced plates 67 between which may be mounted a pulley 51, as by means of coupling members of the sort shown in Figs. 4 and 9. A cable drum 55 and a driving pulley may be journaled on a member 11 of the frame between the boom arms and drivingly interconnected, as by means of coupling members 20' therebetween, said winding drum carrying a derrick cable wound thereon and extending over the pulley at the remote end of the boom, said drum being selectively turnable under the control of the clutch assembly, which includes a pulley on a shaft 11 thereof and drivingly connecting the clutch assembly with the drum driving pulley.

A ferris wheel structure adapted to be built from parts heretofore described is shown in Figs. 61, 62 and 63. Said ferris wheel comprises a supporting framework erected on a suitable support base. Said framework comprises a pair of spaced structures each built up of parts including flange elements 45 forming feet, and supporting coupling elements 34 and 39 of the sort shown in Figs. 23 and 28, the parts being interconnected by rods 11 and coupling devices of the sort shown in Fig. 3 or 4. The support structures may include square plates 68 of the sort shown in Fig. 51, and may also include a superstructure comprising rod elements 11 interconnected with the square plate 68 and with a triangular plate 67 of the sort shown in Fig. 50, said

triangular plate being supported vertically above the square plate on a structure comprising connectors 32, 35, 43 and coupling devices of the sort shown in Fig. 3 or 4, the framework being connected to the square and triangular plates by clevis elements 28 and connectors of the sort shown in Figs. 9 and 15.

The spaced apart structures may be braced and spaced by rods interconnecting the corresponding elements 39 of said spaced structures. Plank elements 71 may be applied as flooring between the spaced members 11 of said spaced structures. At the front of the base structure, a platform may be built comprising members 15 and 20" erected on the frame elements 39, said platform utilizing elements 43 of the sort shown in Fig. 32, and elements carried by the elements 43 and supporting plank members 71 therebetween to form a platform.

The wheel structure may comprise a hub element 54 carrying connectors 20" radiating therefrom, said hub element being turnable on a rod member 11, journaled in the aligned openings of the triangular plate members 67 of the supporting frame. Said rod element 11 may also carry a pulley 52 secured thereto, said pulley being drivingly connected, as by means of a belt with another pulley 52 on a connector 20" supported in the central openings of the square plates of the base. This pulley in turn may be drivingly connected with an electric motor 103 through a clutch assembly of the sort shown in Fig. 58 in the manner described in connection with the motor and clutch assembly in the derrick structure shown in Fig. 59, the motor and clutch assembly being supported on the support base.

The wheel structure may comprise rod elements 11 on the radially extending hub mounted coupling members 20", the outer ends of the radiating members 11 being fitted with clevis elements 28, by means of coupling members 20". The clevis members in turn may be connected to the apical portions of triangular plate members 67 of the sort shown in Fig. 50, as by means of fastening members of the sort shown in Figs. 9 and 15. The remaining corners of such triangular plates may be interconnected, as by means of clevis members 28, secured to the plates and interconnected by means of connecting members of the sort shown in Figs. 4 and 12, the opposite ends of which may carry spacing washers, if necessary.

Like the base structure, the wheel comprises a pair of identical wheel structures spaced apart on the wheel axel rod 11, and ferris wheel cars, as shown more particularly in Fig. 63 of the drawings, may be assembled and mounted between corresponding triangular plates of the spaced wheel structures. These cars may each comprise a rod member 11 connected at its opposite ends in coupling members 35, the outwardly facing ends of the said coupling members 35 being in abutting relationship with the spaced triangular plates and being pivotally secured in the openings 71 medially of the longer sides of the triangular plates, the pivotal connection being made by fastening members of the sort shown in Fig. 7. The carriage members may also include members of the sort shown in Fig. 4 secured in the medial socketed embossments of the members 35 and carrying connecting members 43, the same in turn carrying elements of the sort shown in Fig. 11. Plank members 71 may be applied between the spaced members to complete the carriage structure.

While two sample structures have been illustrated in Figs. 59 through 64, it will be obvious that innumerable other combinations and permutations may be produced from the parts herein described, the number of different structures being limited only by the imagination of the user.

It will be apparent, also, that the parts described are adapted to be manufactured inexpensively, most of the parts being capable of production on automatic screw making machinery. The sheet metal parts are adapted for production by inexpensive stamping methods, while the rods 11 may be produced cheaply in various selected lengths by merely cutting up standard tube stock in the lengths desired. The various parts, of course, may be made of any suitable or preferred material, including plastic material. It is preferable, however, to make the parts of metal; and, in the interests of lightweight parts for construction purposes, it is preferable to make the elements 11, at least, of aluminum. The other parts also may be advantageously fabricated in aluminum for toy purposes.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the forms herein disclosed being preferred embodiments for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A construction toy set having structural elements adapted for selective connection in multifarious combination, including rod-like structural elements formed with internally threaded cylindrical end sockets of like diameter, and compound connecting means for joining said elements, said connecting means comprising a pair of parts, formed for screw threaded interconnection and including a main connector part having a cylindrical body portion of external diameter equal to that of the said rod-like elements, said body portion having a coaxial socket opening at one end thereof, and an integral coaxial stem, on and extending outwardly of the other end of said body portion, said coaxial socket being formed with internal screw threads identical in pitch, diameter, and sectional profile to the threads of said end sockets, said compound connector including also a cooperating connector part having a medial cylindrical portion of external diameter equal to that of said body portion, and integral axially aligned stem portions on and extending outwardly of the opposite ends of said medial portion, at least one of said stem portions comprising a threaded stud formed for snug threaded engagement within said end sockets or within said coaxial socket, the other of said stem portions and said integral coaxial stem forming mounting stems sized to snugly fit into the mounting sockets of said structural elements, at least one of said mounting stems being longitudinally split, at and inwardly of its end, for snug, frictional, and radially resilient interfitment in a said mounting socket of a structural element.

2. A construction toy set having structural elements adapted for selective connection in multifarious combination, including rod-like structural elements formed with internally threaded cylindrical end sockets of like diameter, and compound connecting means for joining said elements, said connecting means comprising a pair

of parts, formed for screw threaded interconnection and including a main connector part having a cylindrical body portion of external diameter equal to that of the said rod-like elements, said body portion having a coaxial socket opening at one end thereof, and an integral coaxial stem, on and extending outwardly of the other end of said body portion, said coaxial socket being formed with internal screw threads identical in pitch, diameter and sectional profile to the threads of said end sockets, said compound connector including also a cooperating connector part having a medial cylindrical portion of external diameter equal to that of said body portion, and integral axially aligned stem portions on and extending outwardly of the opposite ends of said medial portion, at least one of said stem portions comprising a threaded stud formed for snug threaded engagement within said end sockets or within said coaxial socket, the other of said stem portions and said integral coaxial stem forming mounting stems sized to snugly fit into the mounting sockets of said structural elements, the mounting sockets of the structural elements and the said coaxial socket of said main connector part being of like internal diameter and the mounting sockets being formed internally with screw threads identical, in pitch, diameter and sectional profile, with the internal threads of said coaxial socket, one of said mounting stems comprising a screw-threaded stud of size and configuration identical to the first above-mentioned stud and being adapted for snug threaded engagement removably in a said mounting socket, and the other of said mounting stems being longitudinally split at and inwardly of its end, for snug, frictional, radially resilient interfitment in a said mounting socket.

3. Compound connector means for the interconnection, in multifarious combination, of structural elements of a construction toy set, in which such structural elements are provided with cylindrical mounting sockets, said connector means comprising a pair of interconnecting parts, including a part having a medial circular disk portion and integral axially aligned, oppositely extending stem portions on and disposed concentrically of said disk, one of said stem portions comprising a threaded stud, and a cooperating part having a cylindrical body portion of external diameter equal to that of said disk and formed with an internally threaded coaxial socket, opening at one end of said body portion and sized to snugly receive said threaded stud, and an integral coaxial attachment stem on and extending outwardly of the opposite end of said body portion, said attachment stem and the other stem of said connector part forming mounting stems sized to snugly fit into the sockets of said structural elements to connect the same with said connector means, at least one of said mounting stems being longitudinally split at and inwardly of its end for snug, frictional, radially resilient interfitment in a said mounting socket of a structural element.

4. Compound connector means for the interconnection, in multifarious combination, of structural elements of a construction toy set, in which such structural elements are provided with cylindrical internally threaded mounting sockets, comprising a pair of connector elements and a connector part having a medial circular disk portion and integral axially aligned, oppositely extending threaded stem portions, on and disposed concentrically with respect to said disk portion and sized for threading engagement in said mounting sock-

ets of the structural elements, said connector elements each having a cylindrical body portion of external diameter equal to that of said disk portion and formed with an internally threaded socket opening at one end of said body portion and sized to threadingly receive a said stem portion and an integral attachment stem on and extending outwardly of the opposite end of said body portion in coaxial alignment with the threaded socket therein, said integral attachment stem of each of said connector elements being sized to snugly fit into the sockets of said structural elements, the attachment stem of at least one of said connector elements being longitudinally split, at and inwardly of its end, for snug frictional and radially resilient interfitment in the mounting sockets of the structural elements.

5. Compound connector means for the interconnection, in multifarious combination, of structural elements of a construction toy set, in which such structural elements are provided with cylindrical internally threaded mounting sockets, comprising a pair of connector elements and a connector part having a medial circular disk portion and integral axially aligned, oppositely extending threaded stem portions, on and disposed concentrically with respect to said disk portion and sized for threading engagement in said mounting sockets of the structural elements, said connector elements each having a cylindrical body portion of external diameter equal to that of said disk portion and formed with an internally threaded socket opening at one end of said body portion and sized to threadingly receive a said stem portion and an integral attachment stem on and extending outwardly of the opposite end of said body portion in coaxial alignment with the threaded socket therein, said integral attachment stem of each of said connector elements being sized to snugly fit into the sockets of said structural elements, the attachment stem of one of said connector elements comprising a threaded stud sized for threading engagement in the mounting sockets of the structural elements, the attachment stem of the other of said elements being longitudinally split, at and inwardly of its end, for snug frictional and radially resilient interfitment in the mounting sockets of the structural elements.

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