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STRUCTURAL TOY KIT

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4 Claims. (Cl. 46—29)

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This application is a continuation-in-part of my application Serial No. 72,711, filed January 25, 1949, and now abandoned.

My present invention relates to improvements in structural toy kits comprising a plurality of rod elements of different length and coupling means or clamps for interconnecting the said rods.

Structural toy kits of the type described are known in the art, but have the disadvantage, from a structural point of view, that rods which do not run in the same direction, are superposed when interconnected, that is, that their axes do not intersect.

Such disadvantage is avoided by the assembly kit according to the present invention, in that the axes of the interconnected rods intersect in a common point.

A particular object of the invention is to provide a junction clamp of such structure that a plurality of rods are each firmly engaged and held even though the said rods may not be of exactly similar dimensions at the parts clamped.

A further object of the invention is to provide a junction clamp which is resiliently flexible so as to enable it to flex under pressure so as to compensate for irregularities of the dimension of cooperating parts so that all of the parts are firmly engaged.

Still another object of the invention is to provide a junction clamp which is open inwardly and has turned over edge portions, parts of which are removed so as to allow rapid and expeditious insertion and removal of rods with a minimum of loosening of the clamping screws.

A still further object of the invention is to provide a junction connecting clamp having a pair of, at least, partially rounded plate-like members, provided with overturned marginal portions extending toward each other, the edges of part of the rounded overturned marginal portions being free of recesses so as to allow angular adjustment of rod members connected thereto.

This and related objects are attained by the assembly kit components shown, in a plurality of forms, in the accompanying drawings, in which

Fig. 1 shows a rod element,

Fig. 2 a first form of clamp in a perspective view,

Fig. 3 a partially disassembled perspective view of a junction coupling involving six rod members,

Figs. 4, 4a, 4b and 5 show modified clamps.

Figs. 6 and 7 are a plan view and a cross-section of a clamp, in which the overturned marginal portions are provided with two sets of recesses for accommodating a central part of a rod where no grooves are located, and in which part of the overturned marginal portions are round and provided at various points with recesses for the connection of the ends of rods,

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Fig. 8 shows a further clamp for lateral connections to both sides of a rod member at both end portions of the clamp,

Fig. 9 is a sectional view of Fig. 8 on section line IX—IX,

Figs. 10 and 11 show in plan and vertical section, respectively, a further form of clamp in which the clamping plates are round and may be provided with recesses for receiving rods at various angles,

Fig. 12 is a sectional view of an embodiment similar to that of Figs. 10 and 11 except that the recesses in the overturned margins are omitted so that the rods can be secured at any desired angles,

Fig. 13 shows an elevation or plan of a juncture involving an axle box,

Fig. 14 is a perspective view of such an axle box,

Figs. 15–19 show views and cross-sections of rod members having different forms of terminal grooves,

Figs. 20 and 21 are side views of clamping parts having overturned marginal portions provided with points and cylindrical projections, respectively, adapted for use with rods having depressions according to Figs. 17 and 18, and Fig. 19 respectively,

Fig. 22 is a side view of a further modified form of junction clamp having a bolt member provided with a central bore,

Fig. 23 is a vertical sectional view of Fig. 22,

Fig. 24 is a top view of Fig. 22, a rod extending through the connector being shown in section,

Figs. 25 and 26 are side and end views of a connection system involving a clamp according to Fig. 5 combined with other connecting members.

The rod member 1 shown in Fig. 1 is of circular cross-section, but also may be of any other suitable cross-section such as a polygonal one, and is provided on its end portions with recesses in form of circular grooves 2 having radial limiting side walls 2a and 2b. The said recesses are spaced from the rod ends so that the remaining end portions or heads still have sufficient mechanical strength. The kit comprises rod members 1 of various lengths, which must be interconnected for erecting structures of any kind desired. To such end, clamps are provided, of which Fig. 2 shows a first form. Such clamp comprises two rectangular plates 3 and 4 of thin resilient material, the marginal portions 5 of which are bent off or overturned at right angles toward each other. Four semi-circular recesses 6 are provided in the marginal portions 5 so as to be engaged in the circular grooves 2 of the rod members 1. The design is such that the center lines of four interconnected rod members intersect each other in a common point. Of course, it is obvious that not all of the marginal portions need

be provided with recesses, and also that some may be provided with more than one recess. Also, as will be clear from further embodiments, to be described hereinafter, the clamping plates 3, 4 need not be rectangular but can be of any other shape such as circular or partially rounded. The said plates 3, 4 are interconnected by means of a screw 7 so as to form a box-like structure.

Because of the resilience of the plate members 3 and 4 they are able to bend slightly when clamping pressure is applied so as to compensate for any minor differences in the size of the shanks of the rod members 1 at the grooves 2 thereof, or other portions where clamping is applied, so that all of the rods engaged by a pair of plates are firmly clamped and will be caused to be retained in approximately the same plane.

Another important feature of the clamping plates is that the bent over marginal portions are at right angles to the main planes of the respective plates so that the inner faces of opposed margins of the plate pairs approach each other in the same plane, at right angles to the main planes of the respective plates. The thickness of the marginal portions is approximately equal to but not greater than, the width of the grooves 2 of the rods 1. These inner walls therefore form flat faces against which the radial faces 2*a* and 2*b* of the sides of the grooves 2 of the rod members 1 engage and by which the rods are held vertically disposed relative thereto. The diameter of the head 8 of screw 7 suitably equals that of the rods and the diameter of the screw shank suitably equals that of the rod member at the point of groove 2. Such a screw 7 may be used for connecting a further clamp 9 to the clamp 10 (Fig. 3). By screwing a pin 11, one end of which is provided with inside threads, and the other end with a circular groove 2, onto the end of screw 7, a further clamp 12 may be connected to the pin 11, that is, rod members extending in six directions may be interconnected so that their axes intersect in one common point.

In the example shown in Fig. 4, the marginal portions at opposite edges of the two clamping plates are cut off at 13, laterally of the recesses 6, so as to permit introduction of the rod ends laterally between the said plates with only a slight loosening of the screw 7. In the example shown in Fig. 5, the corners of the overturned marginal portion 5 are cut off similarly for the same purpose.

The clamp shown in Figs. 4*a*, 4*b* differs from that shown in Fig. 2 in that it comprises only two recesses for co-axially connecting two rod members 1 and the width of the plates 3', 4' corresponds approximately to the diameter of the rod members.

In Figs. 6 and 7 a clamping member 15 is used for securing secondary rod members 17 to a rod member 18 at a point intermediate of its ends. In such a clamping member, the overturned marginal portions of the clamping plates are provided with two opposite recesses 14 for passing the rod 18 therethrough and with further recesses 16 for retaining the secondary rods 17.

The said recesses 16 (Fig. 7) also could be omitted from the clamping plates, thus affording any angular deflection desired for the secondary rods with respect to the said rod member 18, this being possible by reason of the edge portion 19 being rounded.

Fig. 8 shows a form of clamp which provides the connection of secondary rods on both sides

of a rod member 18. This arrangement is shown in a sectional view in Fig. 9 on line IX—IX of Fig. 8.

In Figs. 10 and 11, clamps 20 are shown, the plates 21 of which are circular and may contain in their right angular overturned marginal portions recesses which are angularly spaced at 45° each for interconnecting, for example, eight radially disposed rod members 22. The said recesses also could be omitted so as not to limit the lateral angular adjustment of the rods clamped between the plate edges to the said 45°. When further rod members are to be connected at right angles to the said radial rods, such may be done by means of the screw 7, on the threaded end of which a pin 11, similar to that of Fig. 3, is screwed, and a further clamp 23 is secured to the said pin. The head of the screw is provided with a circular groove, similar to that shown in Fig. 13 at 28, for engaging the clamping plates of a further clamp 24.

Figure 12 is a view similar Fig. 11 except that the overturned marginal portions are not provided with recesses, so that the rods clamped thereby can be adjusted laterally angularly to any suitable angles around the periphery when the screw is slightly loosened.

Should it be desired to incorporate a bearing in the structure built up of the rods, an axle box 25 having threaded radial bores 26 is used, as shown in Figs. 13 and 14. Screws 27 having circumferential grooves 28 forming heads thereon, are engageable, in the said bores, the said heads being held, in the manner described above, between the plates of the clamps 29 or 30.

Instead of providing an annular groove 2 in the end portions of the rods 1, the recesses also could be formed by grooves 34 (Figs. 15, 16) extending at right angles to the rod axis or by conical or pyramidal notches 35 (Figs. 17, 18) or by transverse cylindrical bores 36 (Fig. 19) in which correspondingly adapted lugs or snugs provided on the edge of the clamp are engageable.

In Fig. 20 a clamping connection is shown which has on the edges of the overturned marginal portions, of the clamping plate 3', 4' pointed projections 35' adapted to engage and fit in the depressions in the ends portions of the rods shown in Figs. 17 and 18.

In Fig. 21, the edges of the overturned marginal portions of the clamping plates 3'', 4'' are provided with cylindrical projections adapted to engage and fit in the cylindrical depressions 36 of rods shown in Fig. 19.

In the embodiment depicted in Figs. 22–24 inclusive, provision is made for mounting a clamping connector rotatably upon a rod member. The said connector may contain one or more rods clamped therein and hence it is possible to provide for the rotatable mounting of various assembled structures.

In Figs. 22–24 numeral 40 refers to the shank of a bolt 41 which is provided with a head 42 which may be knurled on its outer periphery 43 and may have a transverse slot 45 in its end surface for engagement by a screw driver. At the end portion of the bolt shank opposite the head, screw threads 46 are provided for engagement with a nut 47. The bolt is provided with an axial bore (Fig. 24) which extends entirely therethrough from end to end and the diameter of the said bore is sufficient for the insertion of a rod 1, so that the bolt and rod are relatively rotatable. Upon the shank of the bolt between the head and nut are arranged two similar plate-shaped clamp-

ing members 50, 51 of resilient material, each of which is provided with a central circular opening 52 of sufficient size to accommodate the bolt shank. These plate-like clamping members are illustrated as being circular and have right angularly overturned marginal portions 54, which are assembled with the flanges, formed thereby, extending towards each other. As the clamping members are of the same size the portions of the flanges approach each other in the same planes respectively, that is, not in overlapping relation.

The circular flanges of the clamping plates are able to engage rod members extending in any desired angular directions, and the said rods can be adjusted in position simply by sliding their heads laterally around the flanges when the nut is slightly loosened.

When a desired assembly of parts has been placed in clamping relationship with a clamping member according to Figs. 22–24, the rod 1 may be inserted through the bore of bolt 41 so that the whole assembly is rotatably mounted on said rod. This adds considerably to the structural attainments which may be secured with the toy construction set according to the invention.

In Figs. 25 and 26 the link is formed as a closed steel strip, the straight portion 11' of which is clamped between the web 4a of the clamp A and the rod 3a, while the remaining portion 12' is arcuate. The pitch or sag of the latter is such as to firmly locate a rod thereby. The arcuate portion 12', further, serves for clamping thereto coupling elements for further rods in any desired angular arrangement. Such coupling element is shown at 13a and comprises, as described above and shown in Fig. 5, two shell-like half portions of which the edges facing each other comprise four semi-circular recesses 14' engageable in annular grooves on the rod ends. The said half portions are clamped securely to the arcuate portion 12' and to the rod ends. In this manner, rods 16' lying in the same plane as the rod 3a may be connected to the rod 3a at any angle thereto. The arcuate portion 12' suitably is provided with a longitudinal slot in order to use same for locating a plate.

A structural toy kit comprising a plurality of rods and clamps as described, affords a great number and variety of readily disconnectible connections.

I claim:

1. A toy construction set comprising a plurality of rods of uniform diameter throughout their length, both ends of said rods being provided with an annular groove dividing each rod into a body portion and a head portion at either end thereof, a clamping device for removably interconnecting said rods, said device including two substantially rectangular clamping plates, a screw extending through both plates for urging said plates towards each other, said clamping plates having the marginal portions bent-off at right angles towards each other, opposite edges of said marginal portions being provided with pairs of registering recesses adapted to engage said annular groove at the end of a rod, said clamping plates having cut off corner portions whereby said head portion of a rod may be laterally introduced in between said two clamping plates, while the edges of the marginal portions engage said annular groove in the rod.

2. A toy construction set comprising a plurality of rods of uniform diameter throughout their length, both ends of said rods being provided with an annular groove dividing each rod into a body portion and a head portion at either end thereof, a clamping device for removably interconnecting said rods, said device including two clamping plates, a screw extending through both plates for urging said plates towards each other, said clamping plates having the marginal portions bent-off at right angles towards each other, opposite edges of said marginal portions being provided with pairs of registering recesses adapted to engage said annular groove at the end of a rod, said clamping plates having cut off corner portions whereby said head portion of a rod may be laterally introduced in between said two clamping plates, while the edges of the marginal portions engage said annular groove in the rod.

3. A toy construction kit comprising a plurality of rods to be connected together, said rods having at least one of their end portions of equal transverse size, said end portions of said rods having depressions formed therein slightly spaced from the ends, a clamp for holding said rods in connected arrangement, said clamp comprising a pair of similar plate-shaped members of resilient material having their outer marginal portions right angularly overturned to form perpendicular flanges, said plate-shaped members having central openings formed therein, a bolt having a head and a shank provided with screw threads at its end portion opposite said head, said plate-shaped members being arranged on said bolt with the bolt extending through the openings therein and with their flanges extending towards each other, a nut on said bolt for pressing said plate-shaped members towards each other with the flanges engaging in the depressions in the end portions of said rods, said bolt having an axial through-extending bore of approximately the same size but not smaller than an end portion of one of said rods so that said clamp and the elements connected thereby in assembled relation can be rotatably mounted by inserting a rod end through said bore.

4. A toy construction set comprising a plurality of rods having approximately uniform diameter at their end portions, said end portions each being provided with an annular groove slightly spaced from the extreme ends, a clamping device for removably interconnecting said rods, said device including two plate-shaped members, a screw extending through both plate-shaped members for urging said members towards each other, said plate-shaped members having their marginal portions bent-off towards each other, opposed edges of some of said marginal portions being provided with pairs of registering recesses for engaging in the grooves in the end portions of said rods, said clamping plates having cut off corner portions whereby said head portion of a rod may be laterally introduced in between said two clamping plates, while the edges of the marginal portions engaged said annular groove in the rod.

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