This invention relates to a structural component for a building set, especially a toy building set.

Structural components of the aforesaid type are commercially available in the form of interconnecting bricks, beams, flat bars, etc. and are therefore known. In these structural components, the bore or each bore serves to couple together two structural components by means of a locking connecting member inserted into the bore. A plug and socket connecting member of this kind is known, e.g. from CH-A 658 887.

Furthermore, a connecting device comprising a pair of connecting members for the releasable, torsionally rigid connection of a plurality of elongated structural components in different angular positions, especially shafts and rods in a toy building set, is known from CH-A 655 247. The connecting members include a sleeve having a cylindrical upper surface, one end face of the sleeve having a toothed rim. Adjacent sleeves of this kind can consequently be brought into mutual torsionally rigid engagement via their toothed rims, the angular position of the sleeve being selected according to the tooth pitch of the toothed rims.

Finally, flat bars for a toy set are also commercially available, each having an end bore which is provided with a toothed rim surrounding the bore at its end face in order to obtain a torsionally rigid connection in a selected angular position with another structural component also having a toothed rim, e.g. with another further flat bar or a sleeve.

These known commercially available structural components have the essential disadvantage for a toy building set based on a

specific modular dimension or construction module that the toothed rims of the structural components in question cannot be designed as desired with respect to the thickness and longitudinal dimensions of the structural components. Consequently, when assembling a plurality of structural components by mutual engagement of their toothed rims, the said modular dimension of the building set cannot be maintained in many of the connections, making it substantially more difficult or even impossible to build certain toy models.

The aim of this invention is to provide a structural component of the type specified at the outset which has toothing in the region of the bore, so that the modular dimension can always be maintained in any desired assembly with another adjacent structural component.

The structural component according to the invention has the features specified in claim 1.

The structural component according to the invention has the advantage that the parts of the toothing of two structural components placed on top of one another projecting beyond the end faces of the bore are respectively received in the parts of the toothing of the structural components which project into the structural components or are situated in the annular recesses of the structural components. In this manner, in spite of the toothing, the opposing end faces of the bores of the two structural components come into contact with one another so that the modular dimension is generally maintained, i.e. the overall thickness or the overall length of the structural components lying on top of one another is invariably an integral multiple or an integral fraction of the modular

dimension.

The invention also relates to a building set consisting of structural components comprising a plurality of structural components according to the invention. The building set may also include other structural components having the features of the structural components according to the invention except that there is no toothing formed in the annular recess. In this manner, a structural component provided with the toothing can be assembled with the other structural component to form a movable hinge connection, the projecting part of the toothing of one structural component being received in the recess of the other structural component.

Embodiments of the invention will now be described in more detail with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a structural component according to the invention in the form of a rod, the toothing being situated in an annular groove forming the recess;

Figure 2 is a section along the line II-II of Fig. 1;

Figure 3 is a perspective view of a structural component in the form of a rod similar to Fig. 1, comprising an annular groove without toothing as the recess;

Figure 4 is a section along the line IV-IV of Fig. 3;

Figure 5 is a perspective view of one end region of a

rod similar to Fig. 1, although comprising an outer radial recess formed on the periphery;

Figure 6 is a perspective view of one end region of a rod similar to Fig. 1, although comprising an inner annular recess formed around the bore;

Figure 7 is a perspective view of a structural component consisting of a plurality of rod-shaped parts moulded in one piece and comprising toothing for static structures such as frameworks;

Figures 8A to 8D are perspective views of further embodiments of the structural components according to the invention in the form of sleeves comprising cylindrical bores and toothing;

Figures 9A to 9C are perspective views of further structural components according to the invention in the form of sleeves and comprising toothing, the bores of which have a cross-shaped section, and

Figures 10 and 11 are perspective views of two sleeves provided with a connecting piece, with or without toothing.

According to Fig. 1, a rod 1 has five cylindrical bores 2 and 3 of equal diameter, the axes of which are all situated in the

same plane of symmetry of the rod 1 and which are at a constant distance from one another, preferably equal to one module M of the building set. The overall length of the rod 1 is consequently 5 M and its width is M. The thickness of the rod 1 in the region of the three intermediate bores 2 is equal to 1/4 M. In the region of the two end bores 3, the rod 1 is reduced to half its thickness 1/8 M and has a flat surface 4 in this region. The rod 1 also has a flat surface 5 on the other side in the region of the end bores 3. The distance between the two flat surfaces 4 and 5 is therefore 1/8 M. The rod ends have rounded side faces 6 coaxial with the end bores 3. In the region of the intermediate bores 2, the rod 1 consists of a partition wall 7 and an integrally moulded rim 8 at either side, said rim having a width of 1/4 M, in order to achieve the aforementioned thickness of the rod 1 of 1/4 M. Each intermediate bore 2 is formed by a socket 9 integrally moulded with the partition wall 7, the sockets 9 being connected by means of ribs 10 to the adjacent sockets 9 and the rim 8. The intermediate bores 2 have a cylindrical counterbore 11 on either side for receiving a beaded edge of a plug element that can connect two rods 1 together or can connect one rod 1 to another structural component.

According to Figures 1 and 2, an annular groove 12 is formed on the flat surface 4 coaxial with the end bores 3. The annular groove 12 has a depth at least equal to half the thickness of the rod 1 in its stepped region around the end bores 3, or may be slightly larger, i.e. it is at least equal to 1/16 M. A toothed ring 13 having teeth 14 is integrally moulded with the base of the annular groove 12 to form radial toothing. The teeth 14 are at a constant angular distance from one another, the tooth pitch of the toothed ring 13 preferably being 15^{o}.

The toothed ring 13 therefore has 24 teeth. Furthermore, two diametrically opposite tooth flanks 15 are situated in the plane of symmetry containing the axes of all of the bores 2, 3. On the side with the flat surface 5 opposite the toothed ring 13, each end bore 3, like the intermediate bores 2, also has a cylindrical counterbore 11.

As is particularly clear from Fig. 2, the teeth 14 of the toothed ring 13 project beyond the flat surface 4. The height of the projecting part of the teeth 14 in this case of the rod 1 has a value of 1/16 M. In other words, half of the toothed ring 13 projects beyond the surface 14 and the other half projects into the rod 1, i.e. into the annular groove 12.

The rod 16 shown in Figures 3 and 4 differs from the rod 1 of Figures 1 and 2 in that the annular grove 12 is not provided with toothing, but is open on the side of the flat surface 4. The purpose of the rod 16 will be described hereinafter.

In order to connect two rods in the optional embodiments of Figures 1, 2 and 3, 4, the rods are placed on top of one another at each end bore 3 via the sides having the annular groove 12 and the toothed ring 13, i.e. via the flat surfaces 4, after which a plug element (not shown), e.g. a resilient sleeve provided with end beaded edges, is inserted through the aligned bores. According to the combination of rods 1, 16 used, the following situations arise:

1) In order to connect two rods 1 (Figures 1, 2), the latter can be placed on top of one another so that their toothed rings 13 mesh and they can be connected to the said plug element. The projecting part of the toothed ring 13 of one rod 1 then

comes to lie between the teeth 14 of the part of the toothed ring 13 of the other rod 1 situated in the annular groove 12, so that the flat surfaces 4 of the two rods 1 lie on top of one another. The two rods 1 can then either be flush or can form an angle with one another, the angle being selected in steps of 15^{o}. The selected angular range between the two rods 1 is a minimum of 60^{o}.

2) When connecting a rod 1 (Figures 1, 2) to a rod 16 (Figures 3, 4), the projecting part of the toothed ring 13 of the rod 1 is completely received in the annular groove 12 of the rod 16, so that once again the surfaces 4 of the two rods 1, 16 lie on top of one another. This gives a movable hinge connection.

3) When connecting two rods 16 (Figures 3, 4), the surfaces 4 of the two rods 16 lie on top of one another, their annular grooves 12 not performing any function. This once again gives a movable hinge connection.

All of the rod connections described offer the advantage that the modular dimension is maintained, as the end faces of the toothed rings 13 do not form bearing surfaces upon assembly, but only the flat surfaces 4. It is also clear from this that the two interconnected rods 1 and 16 come to be situated in the same plane.

The structural component 17 a detail of the region of the end bore 3 of which is shown in Fig. 5 has essentially the same design as the structural component 1 of Fig. 1. The difference here is that instead of the annular groove 12 there is an annular recess 18 which extends partially beyond the rim between the flat surface 4 and the rounded side face 6 coaxial

with the end bore 3. This recess 18 is also provided with a toothed ring 13.

The structural component 19 a detail of which is shown in Fig. 6 has an annular recess 20 provided with the toothed ring, said recess being formed between the flat surface 4 and the end bore 3.

Fig. 7 shows a perspective view of another structural component 21 based on the assembly of a plurality of rods 1 of Figures 1, 2. The one-piece structural component shown in Fig. 7 is substantially in the shape of an isosceles triangle having a rod-shaped base 22 and two rod-shaped sides 23 and 24. The base 22 and the sides 23 and 24 are of identical design apart from their respective end regions. The end regions of the base 22, which simultaneously form one of the end regions of the two sides 23 and 24 have the design of the end regions of the rod 1 of Figures 1, 2 containing the end bores. The other coinciding end regions of the sides 23, 24 are provided with integrally moulded butt straps 25 and 26 which are in turn of identical design to the end regions of the rod 1 of Figures 1, 2. It is clear that the building element 21, particularly with respect to its end regions, is designed to be connected to other structural components of the same type or to rods 1 or 16 according to Figures 1 and 3 in order to obtain a flat lattice structure, e.g. a framework.

Further embodiments of structural components according to the invention are shown in perspective in Figures 8A to 8D, these all being disc- or sleeve-shaped and having a cylindrical bore 27. All of the structural components also have the annular groove 12 on one or both end faces and the toothed ring 13 of

Fig. 1 partly projecting and partly counterbored into the annular groove 12.

The structural component 28 of Fig. 8A is disc-shaped. It thickness, without taking account of the projecting part of the toothed ring 13, is an integral fraction of the module M of the building set, in this case, e.g. 1/8 M. The structural component 29 of Fig, 8B differs from the structural component 28 of Fig. 8A only by its greater thickness, which in this case is 1/4 M. In addition, the structural component 29 is also provided on its other end face with an annular groove (not visible in Fig. 8B) and a toothed ring 13.

The structural component 30 of Fig. 8C corresponds to the structural component of Fig. 8A, but is also provided with an integrally moulded, cylindrical connecting piece 31 through which the bore 27 also passes. This sleeve-shaped structural component 30 also has a height which is equal to an integral fraction of the module M, is equal to the module M or is an integral multiple of the module M.

The sleeve-shaped structural component 32 of Fig. 8D has a disc-shaped structural component 28 according to Fig. 8A in each of its two end regions. The two disc-shaped structural components 28 are connected together by means of an integrally moulded cylindrical connecting piece 31 according to Fig. 8C. The overall height of the structural component 32 (without taking account of the projecting parts of the toothed rings 13) is also selected in the manner already mentioned to conform to the module.

The structural components illustrated in Figures 8A to 8D are

also provided with cylindrical counterbores 11 for receiving a beaded edge of a plug element.

The structural components 33, 34 and 35 shown in perspective in Figures 9A, 9B and 9C essentially correspond to the structural components 28, 30 and 32 of Figures 8A, 8C and 8D. The difference is that their bores 36 are not cylindrical, but have a cross-shaped section. For manufacturing reasons, the connecting piece 37 (Figures 9B, 9C) is therefore not cylindrical, but cross-shaped. Consequently, the radial inner wall 38 of the annular groove 12 is likewise not cylindrical, but cross-shaped.

Figures 10 and 11 show two similar structural components of the type according to the invention in perspective. Each structural component 39 and 40 has a sleeve-shaped part 41 which is provided on its upper surface with the annular groove 12. A connecting piece 42 for a cross pin is integrally moulded with the sleeve-shaped part 41. The connecting piece 42 consists of a socket 43 having a bore 44 with a cross-shaped section for receiving the cross pin.

A flange 45 is integrally moulded with the socket 43. A clamp 46 which is slipped axially over the cross pin and can be locked in a desired position on the cross pin surrounds the flange 45 in a rotatable manner.

In the structural component 39 of Fig. 10, in accordance with the rod 1 of Fig, 1. a toothed ring 13 is formed in the annular groove 12, while the structural component 40 of Fig. 11, in accordance with the rod 16 of Fig. 3, only has the annular groove 12. In both structural components 39, 40, the annular

groove 12 is open at the side in the partial region 47 directed towards the bores 44 of the socket 43, i.e. the radial outer side wall of the annular groove 12 is missing in the partial region 47. In a corresponding manner, in the structural component 39, the toothed ring 13 does not extend beyond the partial region 47.

CLAIMS

1. Structural component for a building set, especially for a toy building set, comprising at least one bore (3) which is defined at either end by flat end surfaces (4, 5) perpendicular to the axis of the bore (3) and surrounding the bore (3), said flat surfaces serving as bearing surfaces for other adjacent structural components and being at a distance from one another which is equal to an integral multiple or an integral fraction of a modular dimension M of the building set, wherein uniform radial toothing (13) is formed on at least a first end surface (4) of the two end surfaces (4, 5) of the bore (3) coaxial with the bore (3), half of the teeth (14) of which project beyond the first end surface (4) in the axial direction of the bore (13) and the other half of the teeth of which are situated in an annular recess (12, 18, 20) open towards the first end surface (4).

2. Structural component according to claim 1, characterised in that the radial toothing (13) is formed on the two end surfaces (4, 5).

3. Structural component according to claim 1 or claim 2, characterised in that the radial toothing (13) only extends over a partial angular range of the annular recess (12).

4. Structural component according to one of claims 1 to 3, characterised in that the radial toothing (13) has a tooth pitch of 15^{o}.

* C L M S *

5. Structural component according to claim 4, characterised in that a tooth flank (15) of the radial toothing (13) is aligned with a preferential direction of the structural component, and in particular coincides with the plane of symmetry of the structural component.

6. Structural component according to one of claims 1 to 5, characterised in that the annular recess is an annular groove (12), so that the first end surface (4) of the bore (3) is situated on either side of the annular groove (12) in the radial direction.

7. Structural component according to one of claims 1 to 5, characterised in that the annular recess (18) is formed around a lateral outer surface (6) of the structural component (17), so that the first end surface (4) of the bore (3) is situated within the recess (18) in the radial direction.

8. Structural component according to one of claims 1 to 5, characterised in that the annular recess (20) is formed around the bore (3), so that the first end surface (4) of the bore (3) is situated outside the recess (20) in the radial direction.

9. Structural component according to one of claims 1 to 8, characterised in that the depth of the recess (12, 18, 20) in the axial direction of the bore (3) is at least approximately an integral fraction of the distance between the two end surfaces (4, 5) of the bore (3).

10. Building set consisting of structural components comprising

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a plurality of first structural components according to one of claims 1 to 9.

11. Building set according to claim 10, characterised in that it includes other structural components (16, 40) comprising at least one bore (3) which is defined at either end by flat end surfaces (4, 5) perpendicular to the axis of the bore (3), said end surfaces serving as bearing surfaces for other adjacent structural components and being at a distance from one another which is equal to an integral multiple or an integral fraction of a modular dimension M of the building set, and in which other structural components (16) an annular recess (12; 18; 20) open towards the first end surface (4) is formed on at least a first end surface (4) of the two end surfaces (4, 5) of the bore (3) for receiving the teeth (14) projecting beyond the first end surface (4) of the first structural components.

12. Building set according to claim 11, characterised in that the annular recess of the other structural components (16, 40) is an annular groove (12), so that the first end surface (4) of the bore (3) is situated on either side of the annular groove (12) in the radial direction.

13. Building set according to claim 11, characterised in that the annular recess (18) of the other structural components (16, 40) is formed around a lateral outer surface (6) of the structural components, so that the first end surface (4) of the bore (3) is situated within the recess (18) in the radial direction.

14. Building set according to claim 11, characterised in that

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the annular recess (20) of the other structural components (16, 40) is formed around the bore (3), so that the first end surface (4) of the bore (3) is situated outside the recess (20) in the radial direction.

15. Building set according to one of claims 12 to 14, characterised in that the depth of the recess (12; 18; 20) of the other structural components (16, 40) in the axial direction of the bore (3) is at least approximately an integral fraction of the distance between the two end surfaces (4, 5) of the bore (3).

* C L M S *