

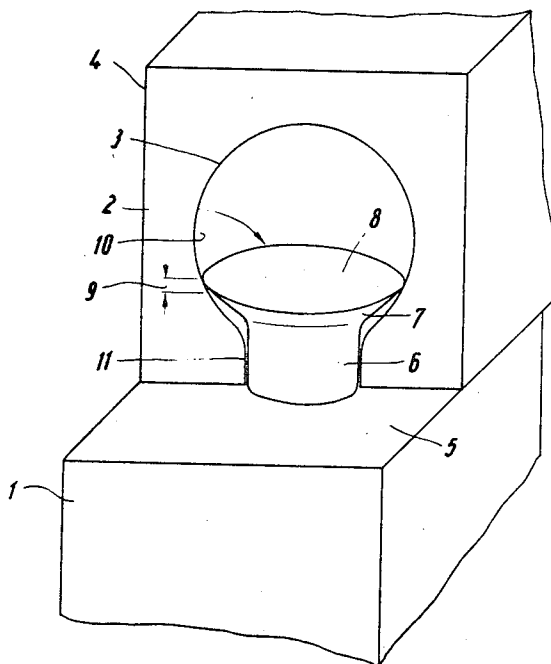
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[54] **TOY BUILDING KIT**
10 Claims, 1 Drawing Fig.

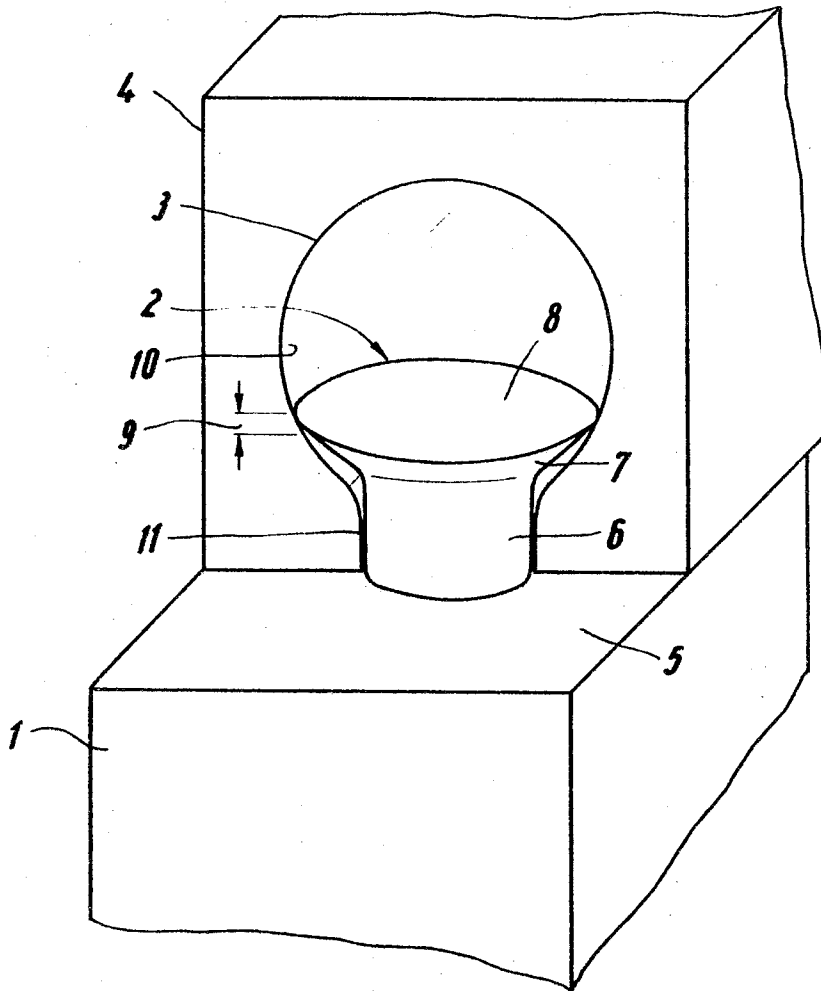
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 23, 24, 25, 26, 29

ABSTRACT: A toy building kit has several structural elements. Some of these have at least one undercut groove in an exposed surface and others have at least one coupling head provided on an exposed surface and matingly engageable with the undercut groove. Such coupling heads each comprise a first portion which projects from the respective structural element and which is provided on its free end remote from the structural element with a second portion resembling a section severed from a sphere in a plane which is at least substantially parallel to the general plane of the exposed face.



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TOY BUILDING KIT

BACKGROUND OF THE INVENTION

The present invention relates generally to toy building kits, and more particularly to toy building kits having matingly engageable male and female coupling portions.

It is a rather conventional expedient in recent years to provide toy building kits with matingly engageable undercut male and female coupling portions so that a child may connect the structural elements of such a kit without necessitating the use of tools, separate connectors or the like. In one known construction the female coupling portions are in form of an elongated undercut grooves, and the male coupling portions are in form of coupling projections or coupling heads which are matingly receivable in these undercut grooves, and which are similarly undercut. They have a neck or first portion projecting from the respective element on which they are provided, and carrying at its free end a head or second portion which is of polygonal cross section, usually quadratic. The connection effected between structural elements provided with such coupling portions is good. It has been found, however, that the insertion and moving lengthwise of a male coupling portion configured in this manner, into a groove which is undercut and which is intended to mate, presents difficulties for children, particularly for relatively young children. With male coupling portions so constructed it is evident that the entire width of the coupling portion will immediately fill the inlet end of the groove when insertion is attempted. This means that the male coupling portion must be properly aligned with respect to the inlet end, that is to the cross section of the groove, requiring a degree of skill which frequently is not yet possessed by smaller children. The problem becomes aggravated if the male coupling portion has—as is frequently the case in the interest of obtaining a tighter connection—a certain excess in its cross-sectional dimension over the corresponding dimension of the groove, even if this excess is small. Furthermore, in this known construction it is intended that when the male and female coupling portions mate they are to exert stress upon their respective associated structural elements in a sense urging the same into abutment, that is causing the surfaces on which the male and female coupling portions are respectively provided, to tightly abut one another. This is also in the interest of obtaining a tight connection between the structural elements. For this purpose the distance between the surface from which the coupling head projects and the area of the coupling head which, when inserted into an undercut groove, contacts the inner circumferential surface of the groove, is slightly smaller than the distance between the surface in which the groove is provided and the portion of the inner circumferential surface which will be contacted by the coupling head when the same is inserted. This evidently exerts pull or tension on the structural elements connected with one another. Finally, it has also been observed that if the coupling heads are rather small, a young child finds it difficult to align the coupling head with reference to the elongation of the undercut groove in the manner necessary to effect the entry of the coupling head into the open end of the groove. In fact, it is frequently observed that the smaller child does not even realize that such alignment is necessary. On the other hand, if the coupling heads are larger it is easier for the child to realize that such alignment is necessary, but the danger of tilting or skewing of the coupling head with reference to the groove on insertion into the same then exists.

Further difficulties have been found, particularly with reference to the use of such kits by smaller children, in the movement of the once inserted male coupling head along the groove, as a result of unavoidable tolerance variations. The coupling head may be rather tight in the groove and difficult to move along the same. On the other hand it may be relatively loose and the connection may then not be as tight as desired. For instance, if the structural elements and/or coupling heads are of certain materials, such as wood, it is either entirely im-

possible to maintain the necessary manufacturing tolerances or so difficult that it is economically impractical to do so. Added to this is the fact that in the finished structural element the dimensional tolerances usually vary in dependence upon ambient humidity due to swelling or contracting of the material of the element whereby again in undesired manner the seating or mating of the male coupling portions in the female coupling portions is effected. It is thus possible that the coupling head will at one time be relatively loose in a cooperating groove and at another time will be rather tight, for instance after a model erected has been left for a period of time. In fact, swelling due to an increased moisture content of the material of the elements can be caused not only by variations in the ambient humidity, but also by the fact that children have a tendency to place articles into their mouth so that they become wetted with saliva. There is, finally, the problem that wood—the preferred material from which structural elements for kits or toys for smaller children are made—is relatively rigid and has little elasticity, so that yielding of the material under the aforementioned circumstances is excluded and cannot provide relief.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to overcome the aforementioned disadvantages.

More particularly it is an object of the present invention to provide an improved toy building kit which is not possessed of these disadvantages.

Still more particularly it is an object of the invention to provide an improved toy building kit having cooperating undercut male and female coupling portions, and wherein the male coupling portions can be readily and without any skill inserted into the female coupling portions, with the aforementioned difficulties relative to tolerance variations and dimensional variations due to swelling of the material being avoided while the coupling portions yet provide for a tight connection between connected structural elements.

An additional object of the invention is to provide such a kit wherein the cooperating male and female coupling portions can be readily manipulated by even small children having as yet little manipulative skill and inadequately developed coordination.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in a toy building kit which, briefly stated, comprises a first structural element having a plurality of exposed surfaces and being provided in at least one of these with at least one undercut groove. A second structural element has a plurality of exposed faces and is provided on at least one of the exposed faces with at least coupling head which is matingly engageable with the undercut groove. The male coupling head comprises a first portion projecting from the exposed face and has a free end remote from the latter. A second portion of the male coupling head is provided on and projects from this free end and resembles a section severed from a sphere in a plane which is at least substantially parallel to the general plane of the exposed face. A coupling head so configured abuts against the inner circumferential surface of the undercut groove only in a region which is relatively near to the exposed surface from which the groove extends inwardly.

The cross section of the second portion at least is circular. The cross section of the first portion or neck of the coupling projection may be circular or generally rounded, but it may also be polygonal, for instance quadratic. Because of the particular configuration of the second portion which, as pointed out, is circular in cross section, insertion of the coupling projection into the open end of an undercut coupling groove provides for self-alignment of the coupling projection with reference to the groove, because immediately upon insertion it is not the entire width of the second portion which fills the groove, but only after the second portion is received half way in the open end will its full or entire width fill the open end of

the groove. Until such time the circular outer periphery of the second portion will provide for gradual alignment of the coupling projection with reference to the open end of the groove as the second portion is being inserted thereinto. On the other hand, the part-spherical configuration of the second portion assures that the coupling projection can be introduced without any manipulative skill and with little force into the open end of the groove even if it is desired that the relationship between the groove and the coupling projection be such that the two connected structural elements be urged into abutment with one another.

The free end face of the second portion faces away from the face of its structural element on which the coupling projection is provided. It is located in the aforementioned plane which is at least substantially parallel to the general plane of the exposed face and is thus in a position in which it includes with the part-spherical outer surface of the second portion a relatively acute angle. Because of this the margin of the second portion in the region of the juncture between this end face and the part-spherical outer surface of the second portion is yieldable and thus permits a compensation for dimensional variations or tolerance variations.

The ability to yield which is desired for the second portion may be enhanced by making the end face of the second portion concavely curved in the direction towards the exposed face on which the coupling projection is provided.

According to the invention the part-spherical outer surface of the second portion is to contact the inner circumferential surface bounding the groove only in the region near the exposed surface in which the groove is provided. Thus, when the male coupling projection is received in a cooperating groove, forces acting upon the coupling projection will act upon the latter only in the aforementioned region in which it is deformable. Thus, if due to dimensional tolerance variations the coupling projection is shorter than intended in the direction normal to the exposed face from which it projects, then its marginal zone is inwardly deflected by engagement with the circumferential surface of the groove. The contact with this surface is springy so that even under these circumstances the coupling projection can still be readily shifted lengthwise of the groove without requiring extraordinary force, that is force which goes beyond what can be expected from a small child, and despite this a firm and tight connection between the thus-coupled structural elements is obtained.

The present invention is particularly advantageous with respect to rather large coupling projections whose size and massive configuration would not ordinarily provide—particularly in materials such as wood—the necessary yieldability which is desired.

If it is desired that once the coupling projection is inserted into a corresponding groove, the two elements be capable of being rotated with reference to one another about an axis defined by the first portion, then the neck or first portion may be generally rounded, such as of circular cross section. If, on the other hand, such rotation is to be prevented than it is desirable for the cross section of the first portion to be polygonal, preferably quadratic.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE is a diagrammatic illustration showing one embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the FIGURE reference numeral 1 identifies a first structural element, of which a building kit may comprise any

desired number. It has a plurality of exposed faces at least one of which is provided with a projecting male coupling portion or coupling projection 2 which is still to be described in more detail. Reference numeral 4 identifies a further structural element of which the toy building kit may also comprise a desired number and which is provided with a plurality of exposed surfaces at least one of which is provided with an undercut elongated groove 3 of substantially circular cross section, as illustrated. Of course, any of the structural elements 1 and 4 may be provided with both the coupling projections 2 and the undercut grooves 3.

The coupling head 2 will be seen to be matingly received in the undercut groove 3 through whose open end it has been inserted. It comprises a first portion or neck 6 which projects from the exposed face 5 of the element 1 and which is formed at its free end remote from the exposed face 5 with a head or second portion 7 resembling a segment cut from a sphere on a line which is located in a plane extending in substantial parallelism with the exposed face 5. In other words, if one assumes that the portion 7 were to be initially configured as a sphere, the particular illustrated configuration of the portion 7 is obtained by severing the sphere in a plane extending in parallelism or at least substantial parallelism with the exposed face 5 and removing the remainder of the sphere, leaving only the illustrated segment behind which constitutes the portion 7. This portion 7 is provided with an end face 8 facing away from the exposed face 5. It will be seen that the portion 7 engages the inner circumferential surface 10 of the groove 3 only in a region 9 which is near the exposed surface 8 of the structural element 4. In the illustrated embodiment the first portion or neck 6 is of circular cross-sectional configuration and contacts the edges 11 of the groove which are bounded by planar surface portions.

It will be appreciated, however, that the inner circumferential surface of the groove 3 can also be in form of planar surface portions without detracting from the concept according to the present invention. The desired advantages of the present invention are achieved also if the head or second portion 7 deviates slight—but not significantly—from the part-spherical configuration which has been illustrated in the FIGURE. In erecting certain model constructions it may be desirable or advantageous to arrest coupled structural elements in certain locations with reference to one another. This can be achieved by configuring the cross section of the first portion 6 so that it is rounded and constitutes in effect a wedging means, that is by making the cross section of rounded but noncircular configuration so that, with the coupling projection 2 inserted into a groove 3, the elements 1 and 4 will be turned with reference to one another about an axis defined by the portions 6 until the same becomes wedged into engagement with the edges 11. If, on the other hand, the cross-sectional configuration of the portion 6 is circular as in the exemplary embodiment herein discussed, the elements 1 and 4 can be freely turned with reference to one another whereas, if the cross-sectional configuration of the portion 6 is polygonal—preferably quadratic—any turning movement of the elements 1 and 4 with reference to one another is entirely precluded.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a toy building kit, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

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What I claim as new and desire to be protected by Letters Patent is set forth in the appended claims:

1. In a toy building kit, in combination, a first structural element having a plurality of exposed surfaces; at least one undercut groove provided in at least one of said exposed surfaces; a second structural element having a plurality of exposed faces; and at least one coupling head provided on at least one of said exposed faces and matingly engageable with said undercut groove, said coupling head comprising a first portion projecting from said exposed face and having a free end remote from the latter, and a second portion provided on and projecting from said free end and resembling a section severed from a sphere in a plane which is at least substantially parallel to the general plane of said exposed face.

2. In a kit as defined in claim 1, said groove having at least one open end, and said coupling head being insertable through said open end in direction lengthwise of said groove.

3. In a kit as defined in claim 1, said second portion having a planar surface directed away from said exposed face.

4. In a kit as defined in claim 1, said second portion having an endface directed away from said exposed face and being concave in direction towards the same.

5. In a kit as defined in claim 1, said first portion having a

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polygonal cross section.

6. In a kit as defined in claim 5, wherein the cross section of said first portion is quadratic.

7. In a kit as defined in claim 1, said first portion having a rounded cross section.

8. In a kit as defined in claim 7, wherein the cross section of said first portion is circular.

9. In a kit as defined in claim 1, said groove comprising an outer slot-shaped portion extending inwardly from said one exposed surface and being bounded by two transversely spaced outer surface portions, and an inner portion bounded by an inner circumferential surface portion making with said outer surface portions and being of divergent-convergent cross section in direction inwardly away from said outer portion; and said second portions being configured so as to contact said inner surface portion only in the region of the juncture of the same with said outer surface portions.

10. In a kit as defined in claim 9, wherein the spacing between said outer surface portions is greater than the maximum cross-sectional dimension of said first portion of said coupling head.

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