A toy construction set comprising a plurality of rods each having a plurality of bores formed on an outer surface thereof and a plurality of connectors for connecting the plurality of rods to form a toy structure. Each connector has first, second and third rod members oriented in a generally zigzag configuration. The first rod member is provided at one end for insertion into a bore of a first ball. The second rod member is provided at an opposite end for insertion into a bore of a second ball. The third rod member extends between the first and second rod members. The central axes of the first and second rod members intersect at a center of the first ball at an angle of about 5° to about 45° and the third rod member extends along an arc intercepted by the angle. The toy construction set may also include rod-shaped, T-shaped and cross-shaped connectors.
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TOY CONSTRUCTION SET

CROSS-REFERENCE

This application claims the benefit of Hong Kong Short Term Patent Application No. 08107642.9, filed July 11, 2008, which is hereby incorporated by reference.

BACKGROUND

The present application relates to a toy construction set and, in particular, to a ball-and-rod type toy construction set.

A conventional ball-and-rod type toy construction set includes a number of straight rods and a number of balls for the construction of various toy structures. However, the toy structures formed by these straight rods and balls are rather limited despite the fact that each ball may have many openings facing different directions. Players using these conventional straight rods and balls are not able to form toy structures with features such as curves, loops and circles.

SUMMARY

A toy construction set is provided. In one aspect, the toy construction set includes a plurality of balls each having a plurality of bores formed on an outer surface thereof and a plurality of connectors for connecting the plurality of balls. Each connector has first, second and third rod members oriented in a generally zigzag configuration. The first rod member is provided at one end for insertion into a bore of a first ball. The second rod member is provided at an opposite end for insertion into a bore of a second ball. The third rod member extends between the first and second rod members. The central axes of the first and second rod members intersects at a center of the first ball at an angle of about 5° to about 45°, and the third rod member extends along an arc intercepted by the angle. The toy construction set may also include rod-shaped, T-shaped and cross-shaped connectors.

In another aspect, the toy construction set includes a plurality of objects each having a plurality of bores formed on an outer surface thereof and a plurality of connectors for connecting the plurality of objects. Each connector includes first,
second and third segments in generally zigzag configuration. The first segment is an end segment insertable into a bore of a first object. The second segment is another end segment insertable into a bore of a second object. The third segment is a middle segment connecting the first and second segments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1(a) is a side view of a zigzag-shaped connector with two rod members disposed at 15° according to an embodiment disclosed in the present application.

FIG. 1(b) is a front end view of the zigzag-shaped connector of FIG. 1(a).

FIG. 1(c) is a cross sectional view of the zigzag-shaped connector of FIG. 1(a).

FIG. 1(d) is a cross sectional view of the zigzag-shaped connector of FIG. 1(a) being inserted into a bore of a ball.

FIG. 2(a) is a side view of a zigzag-shaped connector with two rod members disposed at 30° according to an embodiment disclosed in the present application.

FIG. 2(b) is a front end view of the zigzag-shaped connector of FIG. 2(a).

FIG. 2(c) is a cross sectional view of the zigzag-shaped connector of FIG. 2(a).

FIG. 2(d) is a cross sectional view of the zigzag-shaped connector of FIG. 2(a) being inserted into a bore of a ball.

FIG. 3(a) is a front end view of a zigzag-shaped connector with two rod members disposed at 45° according to an embodiment disclosed in the present application.

FIG. 3(b) is a cross sectional view of the zigzag-shaped connector of FIG. 3(a).

FIG. 3(c) is a side view of the zigzag-shaped connector of FIG. 3(a).

FIG. 3(d) is a cross sectional view of the zigzag-shaped connector of FIG. 3(a) being inserted into a bore of a ball.

FIG. 4(a) is a cross sectional view of the ball according to an embodiment disclosed in the present application.

FIG. 4(b) is another cross sectional view of the ball.

FIG. 4(c) is a side view of the ball.

FIG. 5(a) shows the hexagonal shape of a bore provided on a ball of the ball-and-rod type toy construction set according to an embodiment disclosed in the present application.
FIG. 5(b) shows the circular cross section of a rod insertable into a bore of a ball of the ball-and-rod type toy construction set.

FIG. 5(c) illustrates the frictional engagement of a rod of circular cross section of FIG. 5(b) being inserted into a bore of hexagonal cross section of FIG. 5(a).

FIG. 6(a) is a side view of a short rod-shaped connector according to an embodiment disclosed in the present application.

FIG. 6(b) is a front end view of the short rod-shaped connector of FIG. 6(a).

FIG. 6(c) is a cross sectional view of the short rod-shaped connector of FIG. 6(a).

FIG. 7(a) is a side view of a rod-shaped connector of medium length.

FIG. 7(b) is a front end view of the rod-shaped connector of FIG. 7(a).

FIG. 7(c) is a cross sectional view of the rod-shaped connector of FIG. 7(a).

FIG. 8(a) is a side view of a long rod-shaped connector.

FIG. 8(b) is a front end view of the long rod-shaped connector of FIG. 8(a).

FIG. 8(c) is a cross sectional view of the long rod-shaped connector of FIG. 8(a).

FIG. 9(a) is a side view of a T-shaped connector according to an embodiment disclosed in the present application.

FIG. 9(b) is a top view of the T-shaped connector of FIG. 9(a).

FIG. 9(c) is a cross sectional view of the T-shaped connector of FIG. 9(a).

FIG. 9(d) is a front view of the T-shaped connector of FIG. 9(a).

FIG. 10(a) is a front view of a cross-shaped connector according to an embodiment disclosed in the present application.

FIG. 10(b) is a side view of the cross-shaped connector of FIG. 10(a).

FIG. 10(c) is a cross sectional view of the cross-shaped connector of FIG. 10(a).

FIG. 11(a) is a front view of a cross-shaped connector according to another embodiment disclosed in the present application.

FIG. 11(b) is a side view of the cross-shaped connector of FIG. 11(a).

FIG. 11(c) is a cross sectional view of the cross-shaped connector of FIG. 11(a).

FIG. 12 is a perspective view of a ring-shaped ball-and-rod construction formed by twenty-four balls and twenty-four zigzag-shaped 15° connectors in FIG. 11(a).

FIG. 13 is a front view of the ring-shaped ball-and-rod construction of FIG. 12.
FIG. 14 is a perspective view of a ring-shaped ball-and-rod construction formed by twelve balls and twelve zigzag-shaped 30° connectors in FIG. 2(a).

FIG. 15 is a front view of the ring-shaped ball-and-rod construction of FIG. 14.

FIG. 16 is a perspective view of a ring-shaped ball-and-rod construction formed by eight balls and eight zigzag-shaped 45° connectors of FIG. 3(c).

FIG. 17 is a front view of the ring-shaped ball-and-rod construction of FIG. 16.

FIG. 18 is a perspective view of a heart-shaped ball-and-rod construction formed by balls and different connectors disclosed in the present application.

FIG. 19 is a front view of the heart-shaped ball-and-rod construction of FIG. 18.

FIG. 20 is a perspective view of an arrow-shaped ball-and-rod construction formed by balls and different connectors disclosed in the present application.

FIG. 21 is a front view of the arrow-shaped ball-and-rod construction of FIG. 20.

FIGS. 22-31 show the formation of toy structures of different sizes using balls and T-shaped connectors in FIG 9(d).

FIG. 32 shows the formation of a box-shaped structure using balls and long rod-shaped connectors in FIG 8(a).

FIGS. 33-35 show double-ring structures derived from single rings shown in FIGS. 12, 14 and 16.

FIGS. 36(a)-36(c) show a second embodiment of the rod-shaped connectors in FIGS. 6(a)-6(c), 7(a)-7(c), and 8(a)-8(c).

FIGS. 37(a)-37(c) show a second embodiment of the zigzag-shaped connectors in FIGS. 1(a)-1(c), 2(a)-2(c), and 3(a)-3(c).

FIGS. 38(a)-38(c) show a second embodiment of the cross-shaped and T-shaped connectors in FIGS. 9(a)-9(d), 10(a)-10(c), and 11(a)-11(c).

FIGS. 39(a)-(g) show different ball-and-rod constructions formed by balls connected by different shaped connectors disclosed in the present application.

FIG. 40 is a side view of a toy helicopter formed by balls connected by different rod-shaped connectors.

FIG. 41 is a top view of the toy helicopter of FIG. 40.
DETAILED DESCRIPTION

It should be understood that the ball-and-rod type toy construction set disclosed in the present application is not limited to the precise embodiments described below and that various changes and modifications thereof may be effected by one skilled in the art without departing from the spirit or scope of the appended claims. For example, elements and/or features of different illustrative embodiments may be combined with each other and/or substituted for each other within the scope of this disclosure and appended claims.

In addition, improvements and modifications which may become apparent to persons of ordinary skill in the art after reading this disclosure, the drawings, and the appended claims are deemed within the spirit and scope of the appended claims.

FIGS. 1(a)-1(d) show a first generally zigzag-shaped connector 20. The zigzag-shaped connector 20 may have three segments or rod members 21, 22, 23. The first rod member 21 is disposed at one end of the connector 20 for insertion into a bore 12 of a first ball 10. The second rod member 22 is disposed at another end of the connector 20 for insertion into a bore 12 of a second ball 10. The third rod member 23 is disposed in the middle of the connector 20 and connects the first and second rod members 21, 22.

A central axis X1 of the first rod member 21 intersects a central axis X2 of the second rod member 22 at an angle of about 15°. The third rod member 23 extends along an arc intercepted by the 15° angle.

As shown in FIG. 1(d), the central axis X1 of the first rod member 21 intersects a center of the first ball 10. The central axis X2 of the second rod member 22 intersects the central axis X1 of the first rod member 21 at the center of the ball 10 when the first rod member 21 is inserted into the bore 12 of the first ball 10.

The third rod member 23 extends along an outer surface of the first ball 10 with a curvature generally conforming to the outer surface of the first ball 10 when the first rod member 21 is inserted into the bore 12 of the first ball 10.

The first and second rod members 21, 22 are sized and shaped for frictionally engagement with an inner surface of the bores 12 of the first and second balls 10. According to an embodiment disclosed in the present application, the first and second rod members 21, 22 have a circular cross section, and the bores 12 of the balls 10 have a hexagonal cross section.
Each ball 10 has a plurality of bores 12 formed on an outer surface thereof. According to an embodiment disclosed in the present application, each ball 10 has six bores.

The first, second and third rod members 21, 22, 23 of the zigzag-shaped connector 20 may be made of plastic or any other suitable material having the same or different colors. The first, second and third rod members 21, 22, 23 may be integrally formed by conventional manufacturing process such as injection molding. The first, second and third segments may be disposed on a plane.

FIGS. 2(a)-2(d) show a second generally zigzag-shaped connector 30. The zigzag-shaped connector 30 has a first rod member 31 at one end thereof for insertion into a bore 12 of a first ball 10, a second rod member 32 at another end thereof for insertion into a bore 12 of a second ball 10, and a third rod member 33 connecting the first and second rod members 31, 32.

This second zigzag-shaped connector 30 is similar to the first zigzag-shaped connector 20 except that a central axis of the second rod member 32 intersects a central axis of the first rod member 31 at an angle of about 30°, and the third rod member 33 extends along an arc intercepted by the 30° angle.

FIGS. 3(a)-3(d) show a third generally zigzag-shaped connector 40. The zigzag-shaped connector 40 has a first rod member 41 at one end thereof for insertion into a bore 12 of a first ball 10, a second rod member 42 at another end thereof for insertion into a bore 12 of a second ball 10, and a third rod member 43 connecting the first and second rod members 41, 42.

This third zigzag-shaped connector 40 is similar to the first and second zigzag-shaped connectors 20, 30 except that a central axis of the second rod member 42 intersects a central axis of the first rod member 41 at an angle of about 45°, and the third rod member 43 extends along an arc intercepted by the 45° angle.

The angle between the central axes XI, X2 of the first and second rod members 21, 22 can be about 5° to about 45°, though it is understood by one skilled in the art that the angle between the central axes XI, X2 of the first and second rod members 21, 22 may be less than 5° or more than 45°.

FIGS. 4(a)-4(c) are different views of the ball 10 of the ball-and-rod type toy construction set. According to the illustrated embodiment, each ball 10 may have six bores 12 formed on an outer surface thereof. The six bores 12 are disposed at an equal distance from one another along the three mutually perpendicular axes.
intersecting at the center of the ball 10. Each bore 12 may be in the form of a radially extending blind hole.

Although it has been shown that each ball 10 has six bores 12, it is understood that each ball 10 may have any number of bores. The balls 10 may be made of plastic or any other suitable material in any colors.

Although it has been shown that the objects to be connected by the connectors are spherical balls 10, it is understood that the objects to be connected may be in any other shape, such as polyhedron.

FIG. 5(a) shows the hexagonal shape of the bore 12 provided on the ball 10 of the ball-and-rod type toy construction set according to an embodiment disclosed in the present application. FIG. 5(b) shows the circular cross section of the first and second rod members 21, 22, 31, 32, 41, 42 insertable into the bore 12 of the ball 10. FIG. 5(c) illustrates the frictional engagement between the rod member 21, 22, 31, 32, 41, 42 and the bore 12 at six engaging points when the circular rod member 21, 22, 31, 32, 41, 42 is inserted into the hexagonal bore 12. The six engaging points vary each time the circular rod member 21, 22, 31, 32, 41, 42 is inserted into the hexagonal bore 12, so that the likelihood of premature wearing of the balls 10 and rod members 21, 22, 31, 32, 41, 42 can be reduced.

Although it has been shown that each rod member 21, 22 has a circular cross section and each bore 12 has a hexagonal cross section, it is understood by one skilled in the art that the rod members 21, 22 may be segments of any suitable cross sections, and the bores 12 may have other cross sections so long as the rod members 21, 22 can be inserted and frictionally engaged in the bores 12. For example, the bores 12 may have a circular cross section and each rod member 21, 22 may have a square cross section.

FIGS. 6(a)-6(c) show different views of a short rod-shaped connector 50 according to an embodiment disclosed in the present application. FIGS. 7(a)-7(c) show different views of a rod-shaped connector 52 of a medium length. FIGS. 8(a)-8(c) show different views of a long rod-shaped connector 54. Each rod-shaped connector 50, 52, 54 has two opposite rod members 56 for connection to two balls 10 respectively.

One or more projections 58 may be integrally formed in a central region of each connector for easy gripping by players.
FIGS. 9(a)-9(d) show different views of a T-shaped connector 60 according to an embodiment disclosed in the present application. Each T-shaped connector 60 has three rod members 62 for connection to three balls 10 respectively.

FIGS. 10(a)-10(c) show different views of a cross-shaped connector 70 according to an embodiment disclosed in the present application. FIGS. 11(a)-11(c) show different views of a cross-shaped connector 72 according to another embodiment disclosed in the present application. Each cross-shaped connector 70, 72 has four rod members 74 for connection to four balls respectively.

Circular toy structures can be constructed by the zigzag-shaped connectors 20, 30, and 40. FIGS. 12 and 13 show different views of a large ring-shaped structure formed by twenty-four balls 10 and twenty-four zigzag-shaped connectors 20 shown in FIG. 1(a). The first rod member 21 of the zigzag-shaped connector 20 is inserted into a bore 12 of a first ball 10, and the second rod member 22 is inserted into a bore of a second ball 10. Since the first rod member 21 and the second rod member 22 are disposed at an angle of 15°, the second ball 10 turns 15° with respect to the first ball 10. When all of the twenty-four balls 10 are connected together by twenty-four zigzag-shaped connectors 20, the twenty-four balls 10 turns a total of 360° to form a complete circular structure.

FIGS. 14 and 15 are different view of a medium ring-shaped structure formed by twelve balls 10 and twelve zigzag-shaped connectors 30 shown in FIG. 2(a). The first rod member 31 of the zigzag-shaped connector 30 is inserted into a bore 12 of a first ball 10, and the second rod member 32 is inserted into a bore of a second ball 10. Since the first rod member 31 and the second rod member 32 are disposed at an angle of 30°, the second ball 10 turns 30° with respect to the first ball 10. When all of the twelve balls 10 are connected together by twelve zigzag-shaped connectors 30, the twelve balls 10 turns a total of 360° to form a complete circular structure.

FIGS. 16 and 17 are different views of a small ring-shaped structure formed by eight balls 10 and eight zigzag-shaped 45° connectors 40 shown in FIG. 3(c). The first rod member 41 of the zigzag-shaped connector 40 is inserted into a bore 12 of a first ball 10, and the second rod member 42 is inserted into a bore of a second ball 10. Since the first rod member 41 and the second rod member 42 are disposed at an angle of 45°, the second ball 10 turns 45° with respect to the first ball 10. When all of the eight balls 10 are connected together by eight zigzag-shaped connectors 40, the eight balls 10 turns a total of 360° to form a complete circular structure.
FIGS. 18 and 19 are different views of a heart-shaped structure formed by a plurality of balls 10, zigzag-shaped connectors 20, 30, 40, and T-shaped connector 60 disclosed in the present application. It can be seen that the 15° zigzag-shaped connectors 20 are used to form the lower part of the heart-shaped structure where the balls 10 make slight turns, the 30° zigzag-shaped connectors 30 are used to form the upper part of the heart-shaped structure where the balls 10 make moderate turns, and the 45° zigzag-shaped connectors 40 are used in forming the part of the heart-shaped structure where the balls 10 make sharp turns.

FIGS. 20 and 21 are different views of an arrow-shaped structure formed by a plurality of balls 10, zigzag-shaped connectors 40, T-shaped connectors 60, rod-shaped connectors 50, and cross-shaped connectors 72 disclosed in the present application.

FIGS. 22 and 23 show the construction of a toy structure using four T-shaped connectors 60 shown in FIG. 9(d) and five balls 10. FIGS. 24 and 25 show the construction of a similar but longer/larger toy structure using six T-shaped connectors 60 and six balls 10. FIGS. 26 and 27 show the construction of a similar but longer/larger toy structure using eight T-shaped connectors 60 and seven balls 10. FIGS. 28 and 29 show the construction of a similar but longer/larger toy structure using nine T-shaped connectors 60 and nine balls 10. FIGS. 30 and 31 show the construction of a similar but longer/larger toy structure using twelve T-shaped connectors 60 and twelve balls 10. Much longer and larger toy structures can be constructed if desired.

FIG. 32 shows the formation of a box-shaped structure using eight balls 10 and twelve long rod-shaped connectors 54 shown in FIG 8(a).

FIGS. 33-35 show double-ring structures built from the single-ring structures shown in FIGS. 12, 14 and 16.

FIGS. 36(a)-36(c) show a second embodiment of the rod-shaped connectors 103, 103', 103'' in FIGS. 6(a), 7(a), and 8(a). FIGS. 37(a)-36(c) show a second embodiment of the zigzag-shaped connectors 106, 106', 106'' in FIGS. 1(a), 2(a), and 3(c). FIGS. 38(a)-38(c) show a second embodiment of the cross-shaped and T-shaped connectors 104, 105, 105' in FIGS. 9(d) and 11(a). As illustrated in FIG. 37(a), a free end of each rod member 102 of a connector 106 has a longitudinally extending diametric slot 108 defining two longitudinally extending deflectable arms 107. A projection may be integrally formed on an outer surface of the deflectable arms 107.
for frictional engagement with an inner surface of a bore 101 of a ball 100 when the rod member 102 is inserted into the bore 101 and the arms 107 are inwardly deflected.

FIGS. 39(a)-(g) show different ball-and-rod constructions formed by a plurality of balls 100 and different shaped connectors 103, 104, 105, 106, 106', 106".

FIGS. 40 and 41 are different views of a toy helicopter formed by a plurality of balls 100 and different rod-shaped connectors 103, 103', 103" shown in FIGS. 36(a)-(c).

While the ball-and-rod type toy construction set disclosed in the present application has been shown and described with particular references to a number of preferred embodiments thereof, it should be noted that various other changes or modifications may be made without departing from the scope of the appended claims.
What is claimed is:

1. A toy construction set comprising:
   (a) a plurality of balls each comprising a plurality of bores formed on an outer surface thereof;
   (b) a plurality of connectors for connecting said plurality of balls, each connector comprising first, second and third rod members in generally zigzag configuration, said first rod member being disposed at one end for insertion into a bore of a first ball, said second rod member being disposed at another end for insertion into a bore of a second ball, and said third rod member being disposed in the middle and connecting said first and second rod members;
   (c) wherein a central axis of said first rod member intersects a central axis of said second rod member at an angle of about 5° to about 45°, and said third rod member extends along an arc intercepted by said angle.

2. The toy construction set as claimed in claim 1, wherein said angle is about 15°.

3. The toy construction set as claimed in claim 1, wherein said angle is about 30°.

4. The toy construction set as claimed in claim 1, wherein said angle is about 45°.

5. The toy construction set as claimed in claim 1, wherein said central axis of said first rod member intersects said central axis of said second rod member at a center of said first ball when said first rod member is inserted into said bore of said first ball.

6. The toy construction set as claimed in claim 1, wherein said third rod member extends along an outer surface of said first ball with a curvature generally conforming to said outer surface when said first rod member is inserted into said bore of said first ball.

7. The toy construction set as claimed in claim 1, wherein said first and second rod members are sized and shaped for frictionally engagement with an inner surface of said bores of said first and second balls.
8. The toy construction set as claimed in claim 1, wherein said bores of said first and second balls comprise a hexagonal cross section.

9. The toy construction set as claimed in claim 1, wherein each ball comprises six bores.

10. A toy construction set comprising:
    (a) a plurality of objects each comprising a plurality of bores formed on an outer surface thereof; and
    (b) plurality of connectors for connecting said plurality of objects, each connector comprising first, second and third segments in generally zigzag configuration, said first segment being an end segment insertable into a bore of a first object, said second segment being another end segment insertable into a bore of a second object, and said third segment being a middle segment connecting said first and second segments.

11. The toy construction set as claimed in claim 10, wherein a central axis of said first segment intersects a central axis of said second segment at an angle of about 5° to about 45°.

12. The toy construction set as claimed in claim 11, wherein said angle is about 15°.

13. The toy construction set as claimed in claim 11, wherein said angle is about 30°.

14. The toy construction set as claimed in claim 11, wherein said angle is about 45°.

15. The toy construction set as claimed in claim 11, wherein said third segment extends along an arc intercepted by said angle.

16. The toy construction set as claimed in claim 11, wherein said central axis of said first segment intersects said central axis of said second segment substantially at a center of said first object when said first segment is inserted into said bore of said first object.
17. The toy construction set as claimed in claim 11, wherein said third segment extends along an outer surface of said first object with a curvature generally conforming to said outer surface when said first segment is inserted into said bore of said first object.

18. The toy construction set as claimed in claim 10, wherein said first and second segments are sized and shaped for frictionally engagement with an inner surface of said bores of said first and second objects.

19. The toy construction set as claimed in claim 10, wherein said bores of said first and second objects comprise a hexagonal cross section.

20. The toy construction set as claimed in claim 10, wherein a free end of each of said first and second segments comprises a longitudinally extending diametric slot defining two longitudinally extending deflectable arms, and a projection integrally formed on an outer surface of said deflectable arms for frictional engagement with an inner surface of said bore when each of said first and second segments is inserted into said bore and said arms are inwardly deflected.
INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER

A63H33/12 (2006 01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC A63H33/12, A63H33/10, A63H33/08, A63H33/06, A63H33/04, A63F9/-, G09B23/26, G09B23/-.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ, CNPAT, toy, construct+, build-, ball, sphere, bore, hole, socket, cavity, rod, strut, zigzag, flexuous, zig, connect+, join+

C DOCUMENTS CONSIDERED TO BE RELEVANT

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* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

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Date of mailing of the international search report

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