

**Aug. 5, 1969**

G. G. YOUNG  
CONSTRUCTION SET

**3,458,949**

Filed May 21, 1965

2 Sheets-Sheet 1

**FIG. 1**

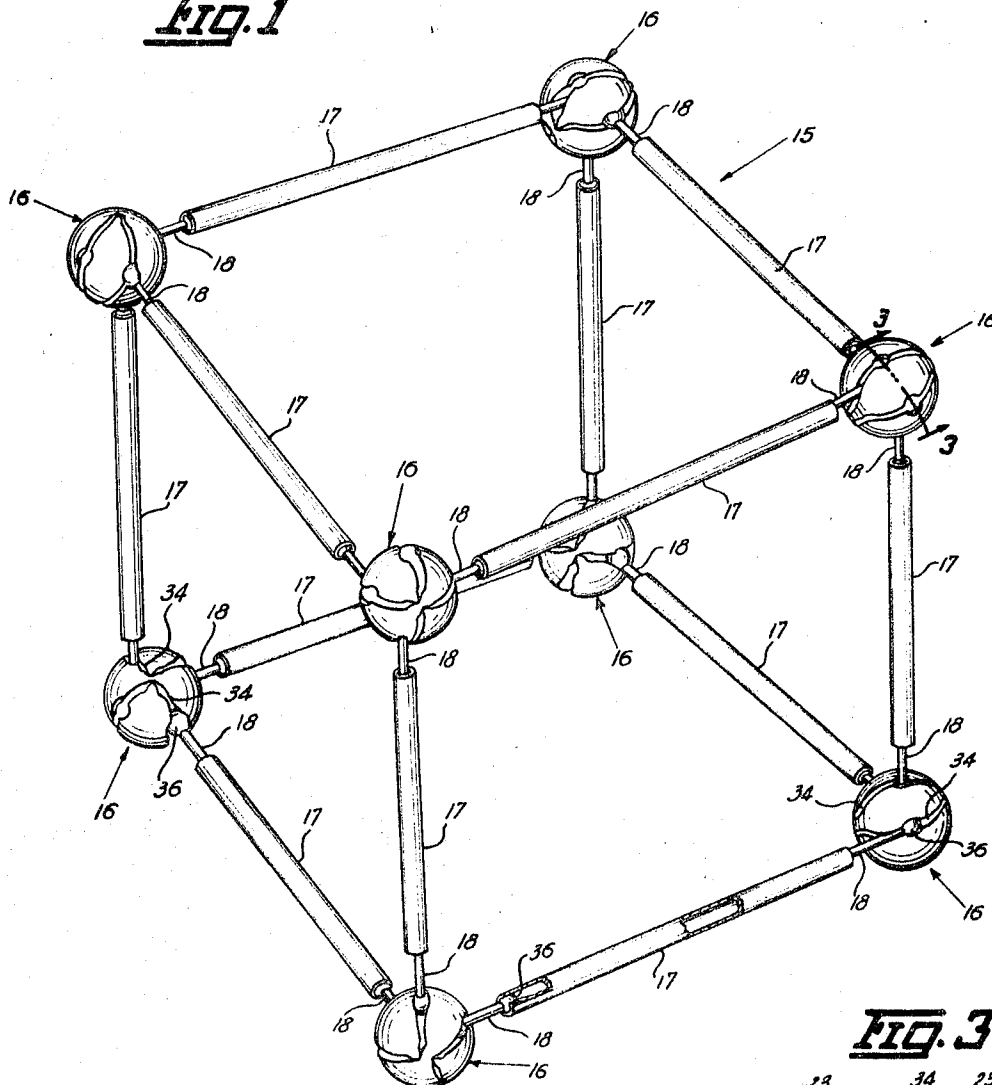


**Fig. 2**

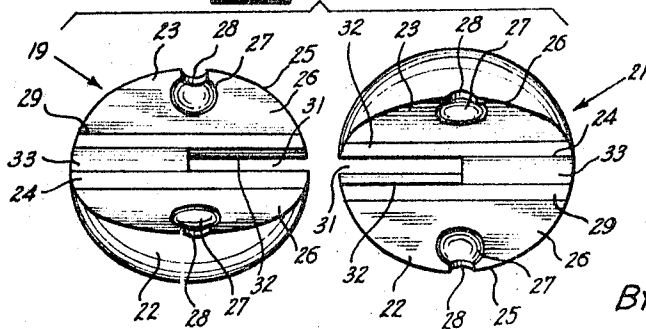
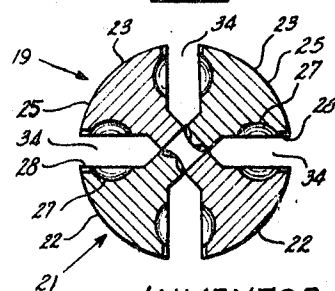


***Fig. 3***



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**FIG. 4**

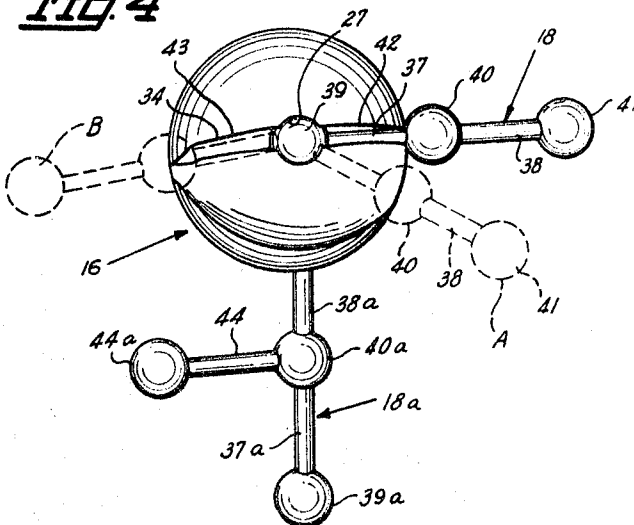


**FIG. 5**

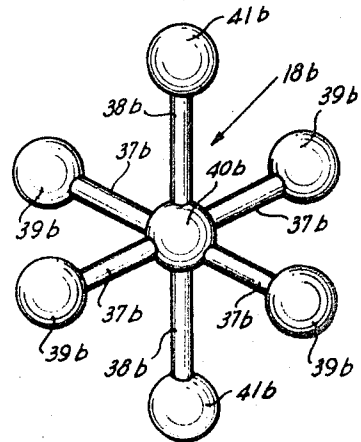


**FIG. 6**

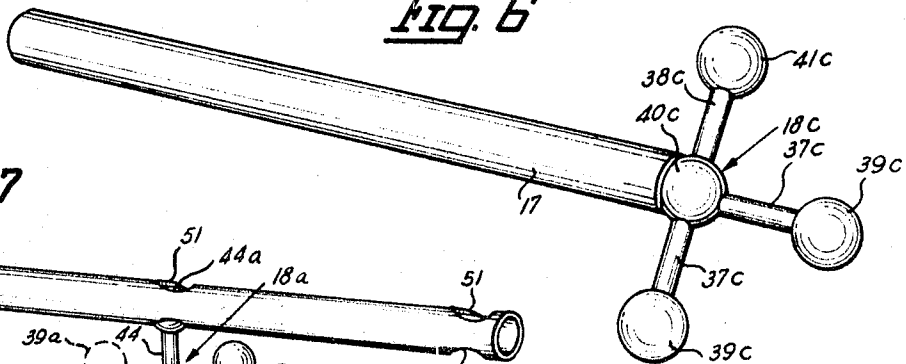


**FIG. 7**

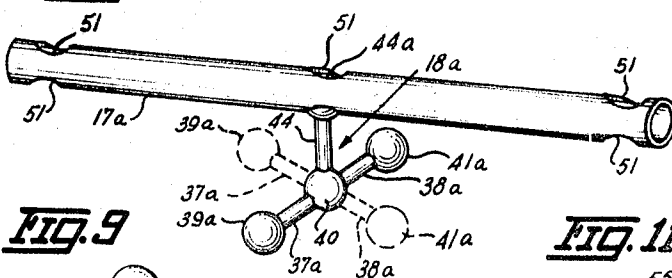


**FIG. 9**

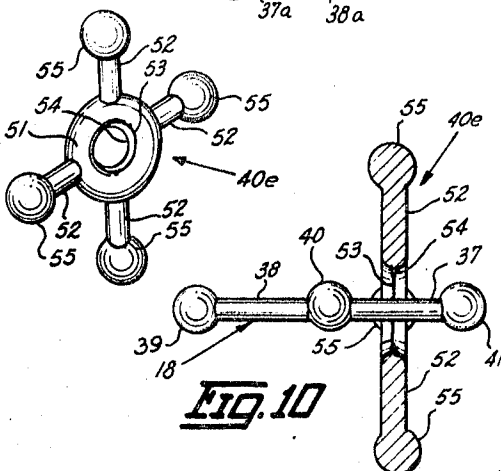


**FIG. 11**

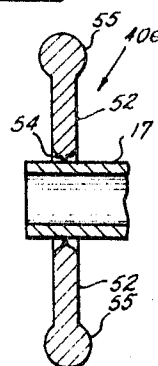
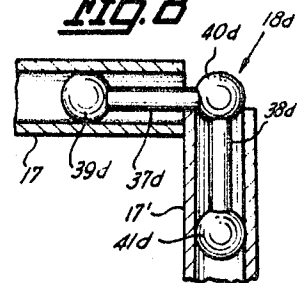


**FIG. 8**



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3,458,949

## CONSTRUCTION SET

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4 Claims

### ABSTRACT OF THE DISCLOSURE

The construction set includes a terminal unit of a spherical shape comprised of a pair of like interlocking members and having a plurality of circumferential grooves in its peripheral surface. The side walls of each groove, intermediate the ends of the groove, have transversely opposite cavities which form a ball receiving socket. Each connecting unit has a stem portion with ball members at the ends thereof. With a ball member frictionally received in a socket the stem portion is swingable through an angular distance of about 180 degrees within said groove from one side of the socket to the other side.

This invention relates generally to model construction devices and in particular to a construction set for constructing geometrical configurations, molecular models, chemical formulae and animals and toys for amusement and educational purposes.

An object of this invention is to provide an improved construction set for model building.

A further object of this invention is to provide a construction set for constructing a configuration with movable joints so that by merely being manipulated the constructed configuration can be changed to selectively form any one of a plurality of different configurations.

Another object of this invention is to provide a construction set adapted to build three dimensional instructional representations of molecules, chemical formulae or geometrical configurations.

Still a further object of this invention is to provide a spherical unit for a construction set which can be readily and inexpensively fabricated by utilizing a pair of like interlocking sections to form a plurality of ball receiving socket portions and associated groove sections for receiving, respectively, the ball portions and stem portions of connecting units.

Another object of this invention is to provide a construction set including a plurality of tubular tie rod members which are releasably connectable with spherical terminal units for swinging movement relative thereto through an angle of approximately 180°.

Still a further object of this invention is to provide a construction set having a plurality of terminal units frictionally connectable with connecting units which in turn are frictionally connectable with tubular tie rod members to provide for the construction of three dimensional representations the parts of which remain connected while being relatively movable.

Another object of this invention is to provide a construction set the parts of which can be constructed of different colored plastic or like material and readily connectable through ball and socket joints to construct a plurality of different educational and amusement devices.

Further objects, features and advantages of this inven-

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tion will become apparent from the following description when taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a geometric model representing a cube made from the construction set of this invention and including spherical terminal units at the corners thereof releasably attached with tubular tie rods through connecting units;

FIG. 2 is an enlarged exploded perspective view of a spherical terminal unit;

FIG. 3 is an enlarged sectional detail view of a terminal unit as seen along the line 3-3 in FIG. 1;

FIG. 4 is an enlarged elevational view of a spherical terminal unit shown in assembly relation with a two and a three stem connecting unit;

FIG. 5 is a perspective view of a six stem connecting unit;

FIG. 6 is a perspective view showing a tubular tie rod member in assembly relation with a four stem connecting unit;

FIG. 7 is a perspective view of a modified form of tubular tie rod shown in assembly relation with a three stem connecting unit;

FIG. 8 is a sectional detail view showing a pair of tubular tie rod members connected in right angular relation by a modified form of a two stem connecting unit;

FIG. 9 is a perspective view of a four stem rotatable or hub connecting unit;

FIG. 10 is a detail sectional view showing the hub connecting unit of FIG. 9 in rotatable assembly with a two stem connecting unit; and

FIG. 11 is a detail sectional view showing the hub connecting unit of FIG. 9 in a fixed assembly relation with a tubular tie rod member.

With reference to the drawings there is shown in FIG. 1 a geometrical model of a cube, designated generally as 15, made by the construction set of this invention. This cube model 15 is comprised of a plurality of spherically-shaped terminal units 16 illustrated as being four in number and with a unit 16 located at each corner of the cube model 15. The sides of the cube model 15 consist of a plurality of tubular tie rod members 17 the opposite ends of which are releasably attached to adjacent terminal units 16 by connecting units 18. Since the terminal units 16 are of a like construction only one thereof will be described in detail with like numbers being used to indicate corresponding parts in the units 16.

A terminal unit 16 (FIGS. 2 and 3) is comprised of a pair of similar interlocking members 19 and 21 each of which includes a pair of diametrically opposite like spherical wedge sections 22 and 23 interconnected by a flat connecting bar or section 24. Only the member 19 will be described in detail with like parts of the member 21 indicated by like numerals. The side surfaces 26 of each wedge section 22 and 23 intermediate the ends thereof and adjacent to the convex edge 25 thereof is formed with a spherical cavity 27. A guide groove 28 of an arcuate shape in transverse section and extended between the outer or convex edge 25 and a cavity 27 is of a width and depth less than the diameter and depth, respectively, of a cavity 27. The side surfaces 26 of a wedge section 22 and 23 terminate at the connecting bar 24 with the terminal lines or junctions being indicated at 29.

As best shown in FIG. 2 the bar 24 of the member 19

connects the wedge sections 22 and 23 over about one-half of its length and is cut away over the remaining portion of its length to form an elongated longitudinally extended central notch or slot 31. The side walls 32 of the slot 31 constitute guides for a purpose to appear later. Also, as illustrated in FIG. 3, it is seen that the side walls 32 are of a tapered construction transversely thereof so that the width of the slot 31 is less than the thickness of the connecting bar 24. The connected length of the connecting bar 24 between the wedge sections 22 and 23 is formed in its opposite side surfaces with grooves or guideways 33 which are in longitudinal alignment with the slot 31.

In the assembly of the members 19 and 21 to form a terminal unit 16 these members are positioned, as shown in FIG. 2, in relatively normal planes with the open ends of the slots 31 adjacent to each other. On initial movement of the members 19 and 21 toward each other the side walls 32 of the grooves 31 guidably engage each other. On a continued movement of the members 19 and 21 toward each other the side walls 32 for the slot 31 on one of the members 19 and 21 are frictionally received within the guide grooves 33 of the other members 19 and 21, with the assembled position of the members 19 and 21 being completed on abutting engagement of the inner ends of the slots 31.

The members 19 and 21 are thus frictionally interlocked by the straddling engagement of the slot side walls 32 on one of the members 19 and 21 with a connecting bar 24 of the other of the members 19 and 21. When thus assembled the spherical wedge or quadrant sections 22 and 23 are separated by axially extended grooves 34 (FIGS. 1 and 3) having side walls formed by adjacent side surfaces 26 on adjacent wedge sections 22 and 23 and bottom walls formed by the exposed portions of the connecting bar sections 24. The grooves 34 are arranged in diametrically opposed pairs and with each pair of grooves 34 lying in a common plane extended through an axis of the spherical terminal unit 16. The bottom walls of the grooves 34 extend parallel to the axis of a terminal unit 16 and are of a length substantially equal to the diameter of a unit 16. The side walls of each groove 34 includes the convex edges 25 so that each groove 34 has a depth at a cavity 27 substantially equal to the radius of a terminal unit 16.

The cavities 27 in adjacent side surfaces 26 of adjacent wedge sections 22 and 23 are positioned opposite each other and coact to form sockets for receiving the ball portions 36 of a connecting unit 18 (FIG. 1). The guide grooves 28 (FIGS. 2 and 3) in the adjacent side surfaces 26 of adjacent wedge sections 22 and 23 form a guideway for facilitating the entrance of the ball portions 36 into the sockets 27.

A connecting unit 18 includes a cylindrical body member (FIGS. 1 and 4) comprised of a pair of axially aligned stem sections 37 and 38 the inner ends of which are joined in a central or intermediate ball portion 40. The outer ends of the stem sections 37 and 38 are formed with ball portions 39 and 41, respectively. The stem sections 37 and 38 have a diameter less than the width of a groove 34 in a terminal unit 16 and the ball portions 39 and 41 at the outer ends of the stem sections 37 and 38, respectively, are frictionally receivable within a socket formed by opposed cavities 27.

A tie rod member 17 is of a cylindrical tubular shape with an inner diameter substantially equal to the diameter of the ball portions 39 and 41 whereby to frictionally receive a ball portion 39 and 41 in an end thereof.

The terminal units 16, connecting units 18 and tie rod members 17 are formed of a plastic or like resilient material and may be made in different colors to better illustrate the parts in a model representation of molecules, chemical formulae and geometrical configurations.

In constructing the cube model 15, shown in FIG. 1, the ball portions of three connecting units 18 are inserted

within three of the ball receiving sockets of a terminal unit 16. This insertion of a ball portion 39 or 41 for frictional reception in a terminal socket is facilitated by the entry guideway formed by corresponding pairs of guide grooves 28. Additionally the interlocked assembly of the terminal unit members 19 and 21 provides for their yieldable relative movement circumferentially of a terminal unit 16.

With a ball portion 39 or 41 received within a terminal socket a connecting unit 18 is secured for swivel movement relative to a corresponding terminal unit 16. By virtue of the intersection of a ball receiving socket by a groove 34 and the forming of the stem sections 37 and 38 for reception within a groove 34 a connecting unit is swingable through an angle of substantially 180°. This swingable movement is illustrated in FIG. 4 wherein a connecting unit 18, shown in full lines, has its stem section 37 received within a section 42 of the groove 34 located to one side of the socket. In the dotted line position, indicated at A, the stem section 37 is removed from the groove 34 and in the dotted line position of the connecting unit 18 shown at B, the stem section 37 is received within the groove section 43. Thus the connecting unit 18, in its position shown in dotted lines at B, is in axial alignment with and 180° removed from its full line position.

With reference to FIG. 1 the connecting units 18, connected to each terminal unit 16, are relatively movable to corner forming positions. The free ones of the ball portions 39 or 41 are then insertable within corresponding end sections of the tubular tie rod members 17. In this assembly a ball portion 39 or 41, the center ball portion 40 and a stem 37 or 38 are all received within a tie rod member 17. The bearing engagement of the inner peripheral surface of a tie rod member 17 with a pair of spaced ball portions namely, the ball portion 40 and one of the ball portions 39 and 41, maintains the tie rod 17 and connecting unit 18 in axial alignment and against relative lateral tipping movement.

A terminal unit 16 is adapted for connection with connecting units having a varying number of stem sections and associated ball portions. Thus in FIG. 4 the spherical terminal member 16 is shown connected with the two stem connecting unit 18 and with a three stem connecting unit 18a. The stem sections 37a and 38a of the unit 18a are arranged in axial alignment with a stem section 44 extended normal thereto. The inner ends of the stem sections 37a, 38a and 44 are joined together in a ball portion 40a of a size substantially equal to the ball portions formed at the outer ends of the stems 37a, 38b and 44, with only the ball portions 39a and 44a corresponding, respectively, to the stem sections 37a and 44 being shown.

In FIG. 5 there is illustrated a six stem connecting unit 18b. The stem sections 37b lie in a common plane and are arranged in diametrically opposed pairs so as to be angularly spaced 90° apart. The stem sections 38b are in axial alignment and lie in a plane normal to the plane of the stem sections 37b. The inner ends of all of the stem sections 37b and 38b are connected together in a central ball portion 40b. The outer ends of the stem sections 37b and 38b are integrally formed with ball portions 39b and 41b, respectively.

FIG. 6 shows a four stem connecting unit 18c in assembly relation with the end of a tie rod member 17. The connecting unit 18c consists of axially aligned pairs of stem sections 37c and 38c all arranged in a common plane and angularly spaced 90° apart. The inner ends of the stem sections 37c and 38c are connected at a central ball portion 40c and with ball portions 39c and 41c being formed at the outer ends of the stem sections 37c and 38c, respectively.

In FIG. 7 there is illustrated a modified form of the tie rod member 17 in assembly relation with the three stem connecting unit 18a. The modified tie rod member 17a is formed with a series of transversely aligned holes 51 in its side wall. These openings 51 are of a diameter to fric-

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tionally receive therethrough one of the ball portions at the outer ends of the stem members 37a, 38a and 44. The ball portion 44a corresponding to the stem 44 is illustrated in FIG. 7 as being frictionally received within an intermediate portion of a tie rod member 17a, with the stem section 44 extended transversely of the member 17a. The ball portion 44a is thus frictionally engaged by the side walls of the opposed openings 51 for swivel movement of the connecting unit 18a relative to the tie rod member 17a as indicated in dotted lines.

FIG. 8 shows a pair of tie rod members 17 connected in a right angle relation by a two stem connecting unit 18d of a right angle shape. The unit 18d is comprised of a pair of stem sections 37d and 38d arranged at right angles to each other and having their inner ends connected to an intermediate ball portion 40d. Ball portions 39d and 41d are formed at the outer ends of the stem sections 37d and 38d, respectively.

As shown in FIG. 8 the tie rod member indicated as 17' has received therein the ball portion 41d, stem 38d and a portion of the intermediate ball portion 40d. The tie rod member 17 contains the ball portion 39d and the major portion of the stem section 37d, the reception of which within the member 17 is limited by the abutting engagement of the adjacent ends of the tie rod members 17 and 17'. By virtue of the reception of the ball portions 40d and 41d within the tie rod member 17', the reception of the ball portion 39d within the tie rod member 17 and the abutting engagement of the ends of the tie rod members, there is provided a substantially rigid right angle connection between the tie rod members 17 and 17'.

FIG. 9 illustrates a four stem rotatable or hub connecting unit 40e. This unit includes a body member or hub 51 integrally formed with spokes or stem sections 52, four in number and angularly spaced 90° apart. The bore 53 of the hub 51 is substantially equal to the outer diameter of a tie rod member 17. The side wall of the bore 53, intermediate its ends, is formed with an inwardly extended yieldable annular flanges 54 having what might be called a feather construction. The flange 54 has an inner diameter substantially equal to the diameter of the ball portions formed at the outer ends of the stem sections of the connecting units shown in FIGS. 4 through 9.

As shown in FIG. 10 the connecting unit 40e is illustrated in rotatable assembly relation with a two stem connecting unit 18. In this assembly the ball portion 39 has been extended through the bore 53 so that the connecting unit 40e is rotatably supported on the stem section 38 between the ball portion 39 and the central ball portion 40 with the flange 54 maintaining the connecting unit 40e on the stem section 38.

In FIG. 11 the end of a tie rod member 17 is shown inserted within the bore 53. This insertion is permitted by virtue of the yieldable deflection of the feather flange 54 which then functions to frictionally hold the connecting unit 40a in a fixed position on the tie rod member 17.

It is seen therefore that the construction set of this invention is comprised of a relatively few number of parts each of which is capable of being economically and inexpensively produced and cooperable to provide for the construction of a plurality of widely varying configurations and model representations. Additionally, and since all of the parts can be made from a plastic or like material such parts can be relatively colored to produce any color scheme desired to better represent and illustrate the components in a constructed model.

I claim:

1. A construction set comprising:

- (a) a plurality of sphere members each of which is divided into quadrant sections and with adjacent quadrant sections separated by a groove, means connecting said quadrants to form said sphere member,
- (b) each pair of oppositely arrangement grooves lying in a common diametrically extended plane,
- (c) each groove having side walls formed intermediate

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the ends thereof with recessed coacting portions to define a ball portion receiving socket, and

- (d) a plurality of connecting units each of which has at least a pair of spaced ball portions on a stem, with a connecting unit being movably connected with a sphere member on insertion of a ball portion thereon within a socket of a sphere member, with the positioning of said stem in said groove providing for the movement of a connected connecting unit through an angle of 180°.

2. For use in a construction set:

- (a) spherical unit comprised of a pair of like interlocking members,
- (b) each member integrally formed with a pair of oppositely arranged quadrant sections connected together by an intermediate bar section,
- (c) each bar section having a cut away portion over about one-half the length thereof, and
- (d) with said pair of members frictionally interlocked on reception of a bar portion on one of said members within the cutaway portion of the other member,
- (e) with opposing sides of adjacent quadrant sections being spaced apart and formed intermediate the ends thereof with oppositely arranged cavity portions to define a ball receiving socket between adjacent quadrant sections, and
- (f) a connecting unit including a stem portion with a ball member on at least one end thereof, said ball member frictionally receivable in a socket with said stem portion selectively receivable within the space to opposite sides of said socket.

3. For use in a construction set, a terminal unit which comprises:

- (a) a spherical member comprised of a pair of interlocked members,
- (b) each member integrally formed with a pair of diametrically opposite spherical wedge sections having the inner adjacent edges thereof connected together over only a portion of the lengths thereof with a flat connecting section whereby to form a space between the remaining portion of the lengths thereof, said flat connecting section having a thickness substantially equal to the width of said space,
- (c) each side surface of a wedge section intermediate the ends and adjacent the outer edge thereof being formed with a semispherical cavity whereby on insertion of a connecting section on one member within a space of the other member said pair of members are frictionally interlocked to form said spherical member, with adjacent side surfaces of said wedge sections defining grooves and the cavities in adjacent side surfaces forming a ball receiving socket, and
- (d) a connecting unit including a stem portion with a ball member on at least one end thereof, said ball member frictionally receivable in a socket with said stem selectively receivable within the portions of a groove to opposite sides of said socket.

4. A construction set including:

- (a) a spherical member comprised of four spherical wedge sections having inner adjacent edges thereof adjacent to and parallel with a common diametrical axis of said sphere, means connecting said wedge sections to form said spherical member,
- (b) the adjacent side surfaces of adjacent wedge sections being in a parallel spaced relation to form grooves extended in the direction of said axis,
- (c) with said adjacent side surfaces intermediate the ends thereof and adjacent the peripheral surface of the sphere member being formed with a ball receiving socket, and
- (d) connecting units each of which includes a body member having at least a pair of stem portions each of which has a ball member at the outer end thereof,

said ball member frictionally receivable in said socket  
with said stem portion selectively receivable within  
said groove on opposite sides of said socket.

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U.S. Cl. X.R.

35—18; 46—29