Feb. 15, 1966 J. W. RYAN 3,234,689

DOLL CONSTRUCTION FOR NATURAL MOVEMENTS AND POSITIONS

Filed June 8, 1962 3 Sheets-Sheet 1

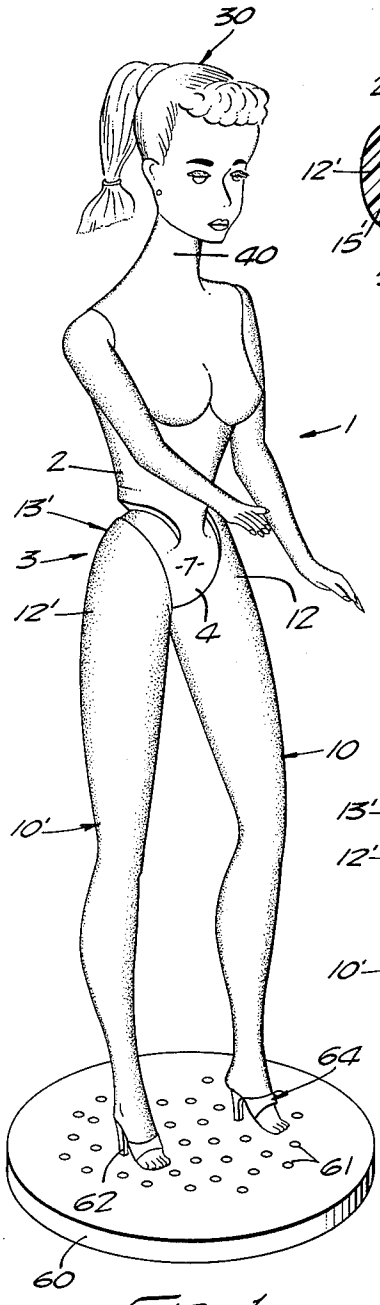


FIG. 1.

FIG. 8.

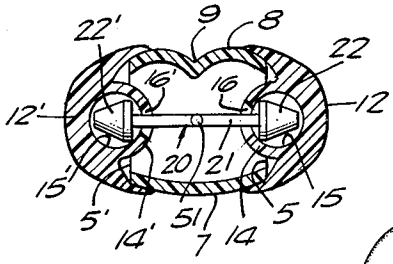
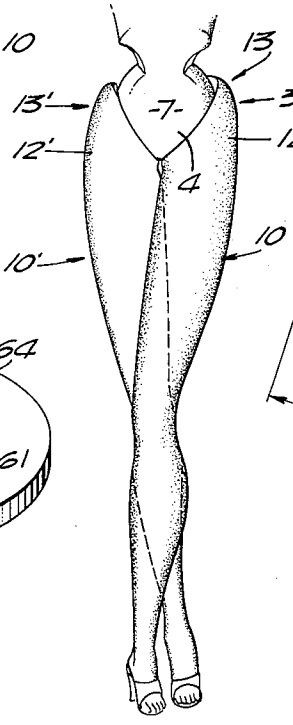


FIG. 5.



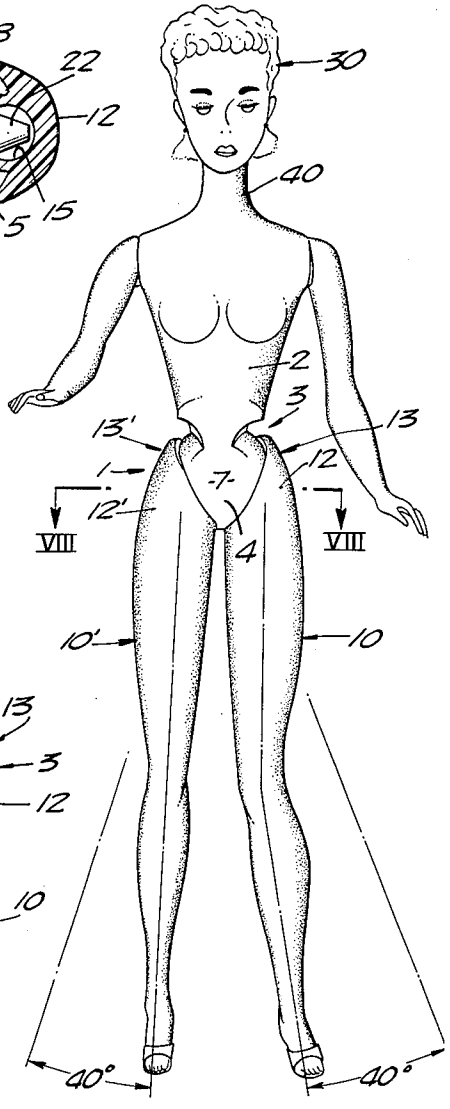


FIG. 2.

JOHN W. RYAN
INVENTOR.

BY Albert M. Herzig

ATTORNEY

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DOLL CONSTRUCTION FOR NATURAL MOVEMENTS AND POSITIONS

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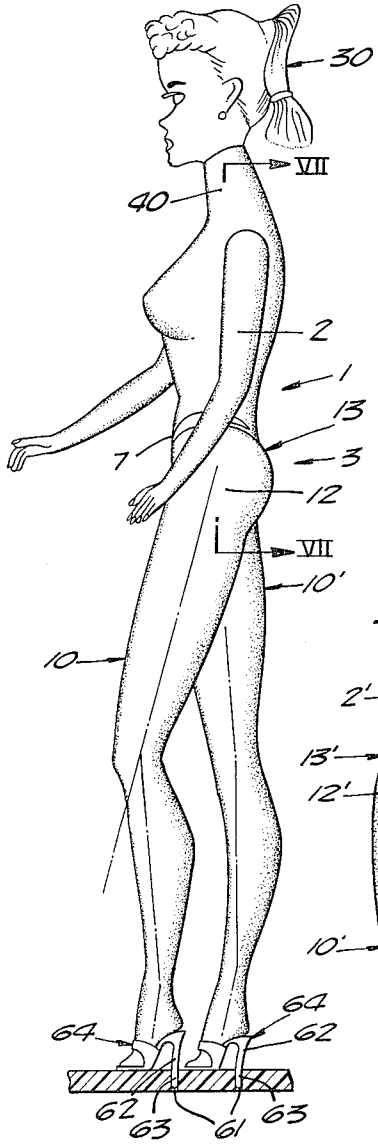


FIG. 3.

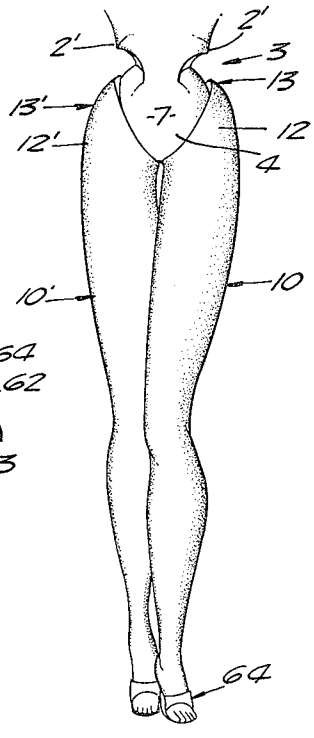


FIG. 6.

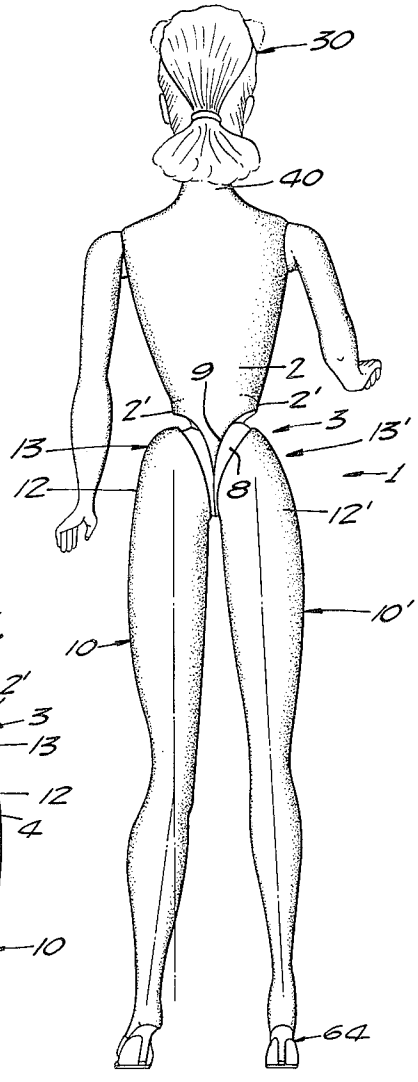


FIG. 4.

JOHN W. RYAN
INVENTOR.

BY Albert M. Herzig

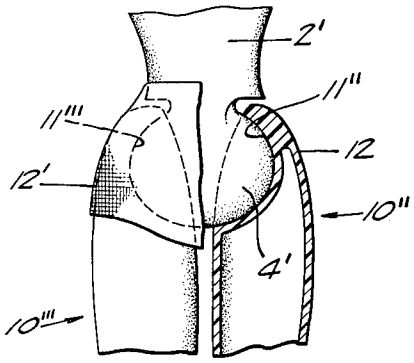
ATTORNEY

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DOLL CONSTRUCTION FOR NATURAL MOVEMENTS AND POSITIONS

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FIG. 10.



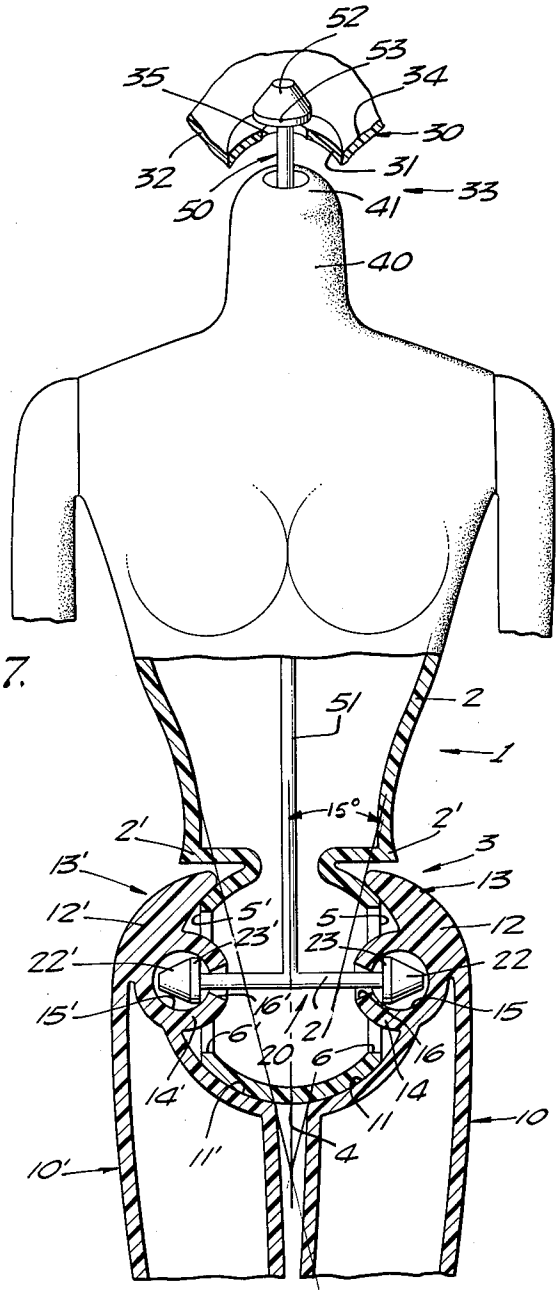


FIG. 7.

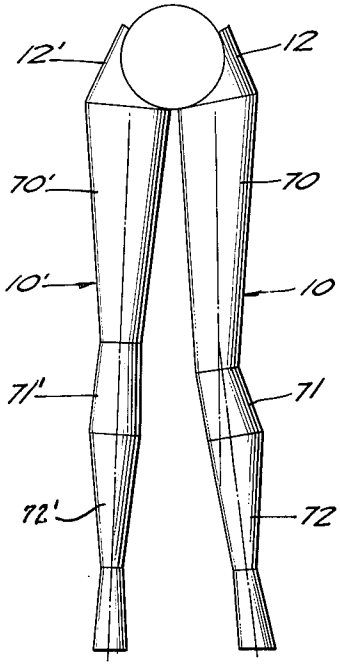


FIG. 9.

JOHN W. RYAN
INVENTOR.

BY Albert M. Herzig

ATTORNEY

United States Patent Office 3,234,689 Patented Feb. 15, 1966

3,234,689

DOLL CONSTRUCTION FOR NATURAL MOVEMENTS AND POSITIONS

John W. Ryan, Bel Air, Calif., assignor to Mattel, Inc., Hawthorne, Calif., a corporation of California

Filed June 8, 1962, Ser. No. 201,059
14 Claims. (Cl. 46—161)

The present invention refers to a novel doll construction adapted to attain numerous natural movements and positions. More particularly, the present invention relates to doll construction which is adapted to permit the doll trunk appandages, i.e. the doll's arms, legs, and head, to reproduce closely the movement and positions of the human body. The term "trunk" is used to designate herein the central portion or torso of the body.

As is generally known, the construction of dolls for children's toys is a well developed art with many varieties of dolls, both male and female, having been produced. One of the main problems involved in production of dolls has been the achievement of a realistic reproduction of humans, particularly the movements and positions of the human appendages. It has been found particularly difficult to reproduce the various movements and positions of human appendages simply and inexpnesively, since such appendages are normally free to move in many different directions and to obtain a wide range of positions. For example, the human leg may rotate parallel to a plane bisecting the human trunk up to an angle of at least about 40 degrees to said bisecting plane and about its longitudinal axis.

A common solution to the problem of simulating the movement of the human appendages, such as legs, is to rotate the leg about an axis perpendicular to a plane bisecting the human trunk and passing through the lower portion of the trunk. However, such a solution permits the rotation of the leg only in a plane parallel to the side of the body. Many other forms of joints have been utilized, but they normally have only a similarly limited degree of movement and consequently make such movement look very unnatural. Also, many of the prior art doll joints, in order to obtain even such limited freedom of movement required joint elements having sharp edges and other irregularities. Consequently, many of these joints bore little resemblance to the smooth contour of the corresponding joints of the human body. In addition, such prior art in all joints could maintain the positions of the human appendages over only a much more limited range of positions than the range of movement of the appendages. For example, prior art doll legs could be rotated sideways to a large angle but required external force to maintain such positions. Also, prior art dolls a straight-out position. Such leg positions combined normally utilized symmetrical pairs of legs rigidly set in with the limited movement of the hip joint made the doll assume very stiff and unnatural poses.

Consequently, an object of the present invention is a doll construction which is adapted to permit the doll appendages to reproduce closely the natural movements and positions of the human body appendages.

Another object of the present invention is a doll joint having a smooth contour closely resembling the corresponding portion of the human body over a wide range of positions of the appendage.

Still another object of the present invention is a doll construction which is simple and inexpensive to manufacture and yet result in a rugged, long-lasting construction.

Still another object of the present invention is a doll with legs adapted to permit the doll to assume numerous natural positions.

Other objects and advantages of the present invention will be readily apparent from the following description and drawings which illustrate exemplary embodiments of the present invention.

In general, the present invention involves a doll construction adapted to permit the doll appendages, particularly its legs, to reproduce closely the movements and positions of the human body appendages. The doll of the present invention involves an appendage attached to the doll trunk having a curved recess therein extending over substantially the whole inner surface of the portion of the appendage adjacent to the doll trunk. Such recess has substantially the same radius of curvature as has the trunk portion to which it is attached. The outer surface of said portion of the appendage preferably has substantially the same radius of curvature adjacent to the adjoining trunk portion as said trunk portion. The doll's trunk has a portion adjacent said appendage having a boss with a curved surface matingly received in said appendage recess and the recesses cover about 20% to 40% of the total surface area of said boss. The trunk portion is adapted to form with the appendage portion a joint having a substantially smooth contour closely resembling the corresponding region of the human body over a wide range of appendage positions and having substantially uniform frictional forces maintaining the appendage position over the entire range of appendage positions. The present invention also includes fastening means for maintaining said trunk boss and appendage recess in mating frictional relationship. The joint and fastening means are adapted to permit the appendage to independently rotate parallel to a plane bisecting the doll trunk, angularly to said bisecting plane up to an angle of at least about 40 degrees and about the longitudinal axis of said appendage. Also, the doll arms may be constructed and fastened to the doll the same way as the legs and head.

In order to facilitate an understanding of the doll construction of the present invention, reference will now be made to the appended drawings of specific embodiments of the present invention. Such drawings should not be construed as limiting the invention which is properly set forth in the appended claims.

In the drawings, FIG.1 is a perspective view of the preferred embodiment of the present invention.

FIG. 2 is a front view of the doll shown in FIG. 1.

FIG. 3 is a side view of the doll shown in FIG. 1.

FIG. 4 is a rear view of the doll shown in FIG. 1.

FIG. 5 is a variation of the front view shown in FIG. 2 wherein the legs are shown crossed.

FIG. 6 is another variation of the front view shown in FIG. 2 wherein the legs are shown with the feet placed on a substantially straight line.

FIG. 7 is an enlarged cross-sectional view of the hip portion of FIG. 3 taken along the lines VII—VII of FIG. 3.

FIG. 8 is a cross-sectional view of FIG. 2 taken along the lines VIII—VIII of FIG. 2.

FIG. 9 is a geometrical representation of the hip and leg portions of the preferred embodiment of the present invention.

FIG. 10 is a partial cross-sectional view of the hip portion of a doll showing another embodiment of the present invention.

In FIGS. 1–8, the doll **1** has legs **10** and **10'** respectively attached to its trunk **2**. Legs **10** and **10'** have substantially spherical recesses **11** and **11'** respectively therein extending over substantially the whole inner surface of the upper portions of the legs **10** and **10'** adjacent to the doll trunk **2**. The pelvic portion **3** of trunk **2** adjacent legs **10** and **10'** has a single generally spheroidal boss **4** matingly received in the leg recesses **11** and **11'** with

said recesses covering about 40% to 80% of the spheroidal surface defined by said boss **4**. The resulting edges of recesses **11** and **11'** are flexible and the edges of said recesses **11** and **11'** lie in planes at an angle in the range of about 5 degrees to 25 degrees to a fore-and-aft vertical plane bisecting the doll trunk when the axis of the doll trunk and the upper portions of the legs are oriented perpendicular to a flat surface on which the doll is standing (see FIG. 7, for example, where the angle is approximately 15°). More particularly, boss **4** has a horizontal cardioidal cross section as shown in FIG. 8 although it may also be described as generally elliptical. The pelvic portion **3** is adapted to form with the upper portions **12** and **12'** of legs **10** and **10'** joints **13** and **13'** respectively having substantially smooth contours closely resembling the corresponding hip joints of the human body over the usual range of leg positions and having substantially uniform frictional forces maintaining the leg position over the entire range of such leg positions. The recesses **11** and **11'** have substantially the same radius of curvature as the lateral portions of boss **4** and the outer surfaces of upper portions **12** and **12'** have substantially the same radius of curvature adjacent to the adjoining portions of boss **4** as said boss portions.

Recesses **11** and **11'** of legs **10** and **10'** have knobs **14** and **14'** respectively projecting inwardly from their central portions. Boss **4** has truncated portions **5** and **5'** with substantially circular holes **6** and **6'** respectively therethrough for receiving the recess knobs **14** and **14'** respectively. The holes **6** and **6'** and knobs **14** and **14'** are adapted to limit the rotation of legs **10** and **10'** angularly to a plane bisecting the doll trunk and to limit the rotation of the legs about their longitudinal axis to ranges natural to the human body. Thus the legs **10** and **10'** as shown in FIG. 2 may be rotated angularly to the plane bisecting the doll trunk to an angle of about 40 degrees. Similarly, the legs **10** and **10'** may be rotated about their longitudinal axis, either rearwardly or frontwardly, into abutting relationship.

Fastening means **20** for maintaining the pelvic boss **4** and the leg recesses **11** and **11'** in mating frictional relationship include an elastic bar **21** having frusto-conical end portions **22** and **22'** respectively with the bases of said end portions **23** and **23'** respectively being attached to the bar **21**. The end portions **22** and **22'** are received in substantially spherical cavities **15** and **15'** in the knobs **14** and **14'** respectively and the entrances **16** and **16'** of cavities **15** and **15'** respectively have frusto-conical shape slightly smaller than the conical end portions **22** and **22'**. Consequently, when the conical end portions **22** and **22'** are inserted in said cavities, they are compressed and then expanded to become engaged within the cavities. Such engagement permits rotation of the legs **10** and **10'** into numerous natural positions and forms sufficient frictional contact between the adjoining trunk and leg surfaces so that such positions are maintained without the aid of external force. The hip joints **13** and **13'** and the fastening means **20** are adapted to permit legs **10** and **10'** to independently rotate laterally of the doll trunk up to an angle of at least about 40 degrees and also about their own longitudinal axes into mutual abutting relationship.

The front section **7** of pelvic portion **3** has a radius of curvature substantially larger than the remaining portions of the pelvic boss so that the doll as a whole has only a slightly curved stomach which does not protrude beyond the front of the legs. The rear section **8** of pelvic portion **3** has a central vertical crevice **9** with rounded edges so that the crevice is adapted to receive the upper leg portions when the legs are rotated rearwardly about their longitudinal axis. The contour of front section **7** and rear section **8** forms a pelvic boss having a horizontal generally cardioidal cross-section as shown in FIG. 8.

The side waist portions **2'** of the doll trunk **2** flare outwardly and downwardly in the direction of the pelvic portions and are then undercut inwardly to permit the free rotation of legs **10** and **10'**. The undercut of the side waist portions **2'** is generally horizontal but preferably downward to fit the displacement of the upper portions of the legs **10** and **10'** when they are swung outwardly at an angle to a fore-and-aft vertical plane bisecting the doll trunk. The legs **10** and **10'** are rigid; however, preferably one of the legs, e.g. leg **10** is bent at an angle in the range of about 10 degrees to 30 degrees; for example, about 20 degrees in a plane parallel to a plane bisecting the doll trunk when the upper leg portion is maintained parallel to said bisecting plane. Preferably, the lower leg portion of said bent leg, i.e. the portion below the knee, is also bent at an angle in the range of about 1 degree to 15 degrees; for example, about 10 degrees in a plane angularly to a plane bisecting the doll body when the upper leg portion is maintained parallel to said bisecting plane. The combination of at least one bent leg and the hip joints of the present invention are adapted to permit the doll to assume numerous natural positions, such as being able to cross her legs (FIG. 5) or to assume the standard poses of fashion models, e.g. FIGS. 1–4 or placing the feet on a substantially straight line, one in front of the other (FIG. 6).

It has been found that the ratio of the length of the doll trunk to the diameter of the pelvic boss should fall within a definite range so that the doll may be able to closely reproduce the movement and positions of the human legs while retaining natural human proportions and contours. This range has been found to be about 2.4 to 4.0. Specifically, when the doll trunk is about 3–3½ inches in length, the pelvic boss should range about ⅞–1¼ inches in diameter, and preferably the diameter is about 1–1⅛ inches.

The head **30** attached to the doll trunk **2** has a spherical recess **31** in the portion **32** attached to the neck portion **40** of doll trunk **2**. The neck portion **40** of trunk **2** adjacent to the head **30** has a spherical top **41** matingly received in the head recess **31**. The neck portion **40** is adapted to form with the adjacent portion **32** of the head **30**, a joint **33** having a smooth contour closely resembling the corresponding neck joint of the human body. The neck top **41** and the head recess **31** are maintained in mating relationship by means of an elastic fastening means **50**. Fastening means **50** is adapted to permit the head **30** to rotate independently in a plane parallel to a plane bisecting the doll trunk, angularly to said bisecting plane up to an angle of at least about 40 degrees and about the longitudinal axis of the head **30**. Fastening means **50** includes an elastic bar **51** which may be attached to bar **21** or to means connecting the arms (not shown). Bar **51** has a conical end portion **52** with a base **53** attached to bar **51**. Conical end portion **52** is received in cavity **34** in the portion **32** of the head **30** matingly fitted to the adjoining neck portion **41**. The entrance **35** of the cavity **34** has a frusto-conical shape slightly smaller than the conical end portion **52** of bar **51**. Consequently, when the conical end portion **52** is inserted into cavity **34** it is compressed and then expanded to become engaged therewith while permitting the rotation of the head and maintaining of the head in any desired position.

In addition, doll **1** may stand on a platform **60** having a plurality of holes **61** therein. Conveniently the doll **1** is selectively engaged in holes **61** by means of elongations **63** of its shoe heels **62**. Alternatively, the shoes **64** may have additional downwardly directed pegs (not shown) thereon for rotatably mounting the doll **1** on platform **60**. By so mounting the doll of the present invention on a platform the various doll leg positions may be accurately arranged in any desired manner and the doll will remain standing in such position. Also many variations of each position may be obtained merely by rotating the doll trunk which causes the legs to adjust

to the trunk position while the feet remain in fixed positions. In other words, one or more pegs between the heel or sole and platform may be provided.

In FIG. 9, a geometrical representation of the legs of the preferred embodiment of the present invention is shown to illustrate their preferred proportions in relation to the hips and the result of bending the right leg. The thigh portions **70** and **70'** of legs **10** and **10'** respectively are frusto-conical in shape with their bases adjacent upper leg portions **12** and **12'** respectively. The ratio of the diameter of the base to the diameters of the apexes of the thigh portions **70** and **70'** is in the range of about 1.6 to 2.7, while the ratio of their heights to the diameters of their bases is in the range of about 2.2 to 3.3. The knee portions **71** and **71'** of legs **10** and **10'** respectively are frusto-conical in shape with their apexes at the knee adjacent the thigh portions **70** and **70'** respectively. The ratio of the diameter of the bases to the diameters of the apexes of the knee portions **71** and **71'** is in the range of about 0.8 to 1.9, while the ratio of their heights to the diameters of their bases is in the range of about 1.2 to 2.3.

Finally, the calf portions **72** and **72'** of legs **10** and **10'** respectively are frusto-conical in shape with their bases adjacent the bases of the knee portions **71** and **71'** respectively. The ratio of the diameters of the bases to the diameters of the apexes of the calf portions **72** and **72'** is in the range of about 2.1 to 3.2, while the ratio of their heights to the diameters of their bases in the range of about 2.0 to 3.1

In FIG. 10 is illustrated the doll construction of the present invention wherein the boss **4'** is substantially elliptical and the fastening means is an elastic garment **80** worm by the doll. The elastic garment **80** is stretched to cover the upper leg portions **12** and **12'** adjacent to the doll trunk **2'** and the adjoining portion of the doll trunk, i.e. boss **4'**.

Also, the recesses **11''** and **11'''** of the legs **10''** and **10'''** respectively are simply matingly received on the pelvic boss in such fashion that the legs can be rotated forward and backward and side to side or any combination of such movements. In addition, each of the legs may be rotated about its longitudinal axis while the hip joint maintains a substantially smooth contour closely resembling the hip joint of the human body. Similarly, the frictional forces are maintained substantially uniform for each leg position over the entire range of leg positions.

There are many features in the present invention which clearly show the significant advance the present invention represents over the prior art. Consequently, only a few of the more outstanding features will be pointed out to illustrate the unexpected and unusual results attained by the present invention.

One of the features of the present invention is the joint between the leg and the pelvic portion of the doll body. Such hip joint is adapted to permit the leg to reproduce closely the movement of the human leg while retaining a substantially smooth contour closely resembling the human hip joint. By utilizing a single, substantially spherical boss on the doll trunk fitted into recesses in the upper portions of the legs, the hip movement is closely reproduced and maintained over a wide range of leg positions. In addition, by utilizing a pelvic boss having a horizontal cardioidal cross-section, both the normal contour of the body and the normal movement of the hip joint are more closely obtained. By the use of such hip joint the legs may be moved quite freely to the front and to the back into abutting relationship, but their movement is more restricted from side to side and about their longitudinal axis. It should be noted that such action fits relatively close to the freedom of movement of the normal hip joint.

Another feature of the present invention is that the hip joint of the present invention in combination with the bent form of at least one of the legs permits the legs to obtain a wide range of positions, such as crossing the legs, putting the feet one in front of the other on a substantially straight line, and many other positions. In addition, the hip configuration permits the joint to maintain substantially the same frictional engagement over the whole range of its leg positions. For example, one of the legs may be bent upwardly to the side to an angle of, say, 30 degrees, and such position is maintained without the aid of external force.

Still another feature of the present invention, as illustrated in the drawings, is the proportion and location of the various parts of the doll of the present invention. Thus, for example, the proportions of the leg contours and the pelvic boss are preferably adapted to facilitate the movement and positioning of the legs. Similarly, the straight line connecting the pelvic boss to the horizontal axis between the doll shoulders is preferably located behind the doll trunk axis to facilitate the upright positioning of the doll trunk while the leg positions are varied over a wide range.

Still another feature of the present invention is the unusual fastening means which may be combined with the joint of the present invention. For example, by utilizing the fastening means illustrated in FIGS. 7 and 8, freedom of movement of the appendages is obtained very simply while maintaining uniform frictional engagement with the adjoining trunk portion. Also the fastening means shown in FIG. 10 permits simple exchange of legs on the doll, e.g. legs have different degrees of bending.

It will be understood that the foregoing description and drawings are only illustrative of the present invention and it is not intended that the invention be limited thereto. Many other specific embodiments of the present invention will be obvious to one skilled in the art in view of this disclosure. All substitutions, alterations and modifications of the present invention which come within the scope of the following claims or to which the present invention is readily susceptible without departing from the spirit of the scope of this disclosure are considered part of the present invention.

I claim:

1. In a doll construction: a body having a trunk; the lower extremity of said trunk comprising a single bulbous boss with substantially the entire outer surface thereof defining a smooth and continuously convex surface of generally spheroid shape; a pair of legs, each having a concave recess extending over substantially the entire inner surface of the upper portion thereof, each recess receiving a lateral portion of said bulbous boss and being substantially complementary in shape to the surface thereof with said recesses each covering about 20% to 40% of the external surface area of said boss; the juncture between the outer surface of the upper portion of each leg and the boundary edge of its recess defining a relatively thin edge and said outer surface being configured to substantially the same curvature as the adjacent exposed portions of said boss and adjacent portions of said body to define therewith a surface closely simulating the surface of the pelvic region of a human body; and fastening means holding said boss and recesses in frictional mating relation while permitting said legs to swing in any direction independently of each other on said boss and laterally outwardly from a fore-and-aft vertical plane bisecting said doll trunk up to an angle of at least about 40 degrees from said plane.

2. A doll construction as defined in claim **1** wherein the boundary edge of each recess lies in a plane at an angle in the range of about 5 degrees to 25 degrees to said fore-and-aft plane bisecting the doll trunk when the axis of said doll trunk and the upper portion of the legs adjacent to the doll trunk are oriented perpendicularly to a flat surface on which the doll is standing.

3. A doll construction as defined in claim **1** wherein said boss is substantially circular in vertical section in a plane extending laterally of said trunk.

4. A doll construction as defined in claim **1** wherein

said boss is formed with its laterally opposed sides truncated.

5. A doll construction as defined in claim 1 wherein said boss is generally elliptical in horizontal section.

6. A doll construction as defined in claim 1 wherein said fastening means is a removable elastic garment worn by the doll and stretched to embrace said upper portions of said legs and said bulbous boss.

7. A doll construction as defined in claim 1 wherein said boss has an opening extending laterally therethrough the lateral extremities of which are substantially circular, a knob projecting from the central portion of each leg recess and into said bore, said bore and knob functioning to limit the said swinging of the legs outwardly of said plane and about the longitudinal axes of said legs to ranges natural to the human body.

8. A doll construction as defined in claim 1 wherein the ratio of the length of the doll trunk to the diameter of said bulbous boss is in the range of about 2.4 to 4.0.

9. A doll construction as defined in claim 1 wherein the front surface of said bulbous boss has a substantially larger radius of curvature than the remainder thereof.

10. A doll construction as defined in claim 1 wherein the rear surface of said bulbous boss has a central vertical crevice with rounded edges adapted to receive the rear edges of said upper leg portions when the legs are rotated rearwardly about their longitudinal axes.

11. A doll construction as defined in claim 1 wherein said bulbous boss has a horizontal cardioidal cross section.

12. A doll construction as defined in claim 1 wherein the side waist portion of the doll trunk adjacent said bulbous boss is undercut inwardly to accommodate the upper portions of the legs when said legs are swung outwardly of said plane.

13. A doll construction as defined in claim 1 wherein said legs are rigid, with the lower portion of one of said legs being bent, at the knee thereof, at an angle in the range of about 10 degrees to 30 degrees relative to the upper portion thereof.

14. A doll construction as defined in claim 13 wherein the lower portion of the bent leg is further bent laterally outwardly at an angle in the range of about 1 degree to 15 degrees to said upper leg portion.

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RICHARD C. PINKHAM, *Primary Examiner.*

DELBERT B. LOWE, *Examiner.*