July 30, 1968 E. H. BAXTER 3,394,490

JOINTED LIMB AND METHOD FOR MANUFACTURING THE SAME

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FIG. 1

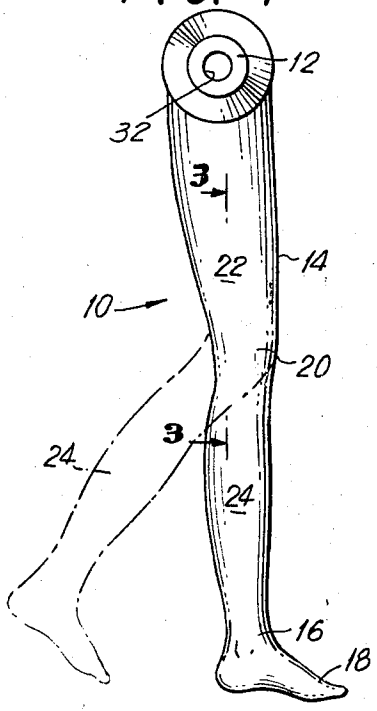



FIG. 2

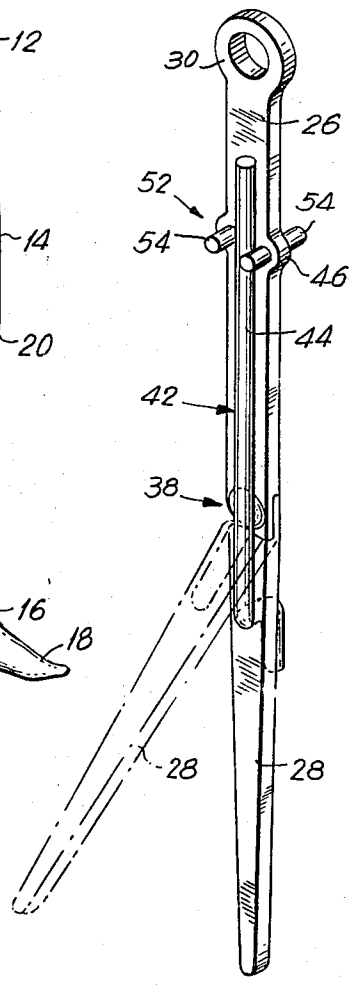



FIG. 4

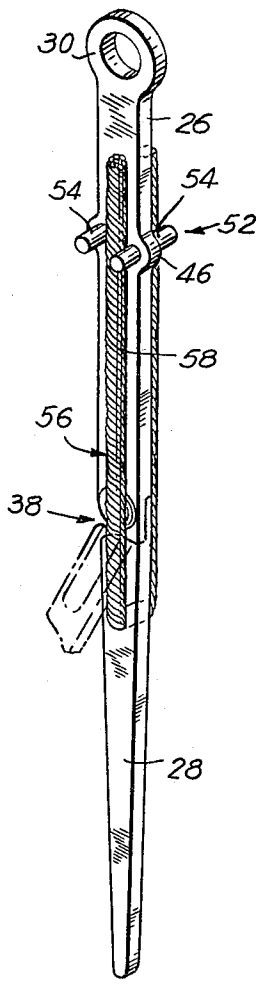
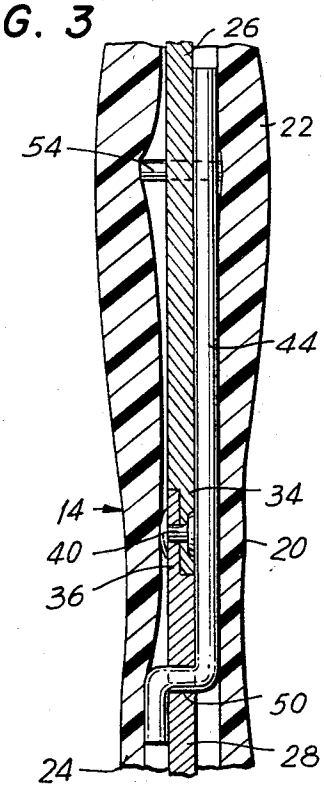



FIG. 3



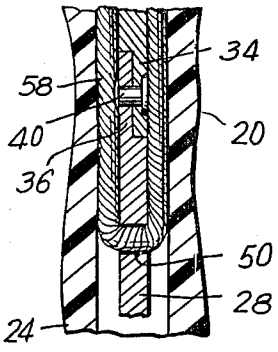




FIG. 5

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# JOINTED LIMB AND METHOD FOR MANUFACTURING THE SAME

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The present invention relates to jointed limbs.

In particular, the invention relates to jointed limbs which are adapted to form part of a figure which simulates a living being. Thus, the jointed limb of the invention may be an arm-simulating or leg-simulating structure for a figure which simulates a living being such as an animal or human being.

It is apparent, therefore, that the invention is applicable to dolls, mannequins, and similar articles such as robots and toys, for example.

One of the objects of the invention is to provide a jointed limb of the above type which is incapable of assuming an unnatural condition.

Another object of the invention is to provide a jointed limb which will reliably remain in whatever condition it is displaced to by the operator.

Furthermore, it is an object of the invention to provide a jointed limb with a simple rugged structure which has components which will not easily break and which at the same time can easily be manipulated by the operator to assume any desired natural condition.

Also, the objects of the invention include the provision of a method of manufacturing the jointed limb in such a way that the components thereof are readily assembled and retained in their assembled condition.

Primarily, the jointed limb of the invention includes an outer elongated hollow member which is bendable and which has an intermediate joint-simulating portion and a pair of limb portions extending in opposite directions from the intermediate portion. A pair of substantially rigid elongated inserts are respectively situated in and extend along the limb portions, and these inserts have ends situated adjacent to each other at the region of the intermediate portion of the elongated member. A connecting means pivotally interconnects these ends of the inserts so that they are turnable one with respect to the other, and this connecting means limits the movement of the inserts, and the limb portions therewith, exclusively to natural movements. According to one of the more important features of the invention, an elongated, substantially non-elastic, deformable means extends along the inserts in the interior of the elongated member and engages the inserts at portions thereof which are spaced from their ends which are interconnected by the connecting means, the outer elongated member when bent at its intermediate portion turning the inserts with respect to each other and also deforming the deformable means which will remain in its deformed condition to retain the jointed limb in the condition to which it is bent.

The invention is illustrated by way of example in the accompanying drawings which form part of the application and in which:

FIG. 1 is a side elevation of a jointed limb of the invention showing in dot-dash lines a position to which the jointed limb may be displaced;

FIG. 2 is a perspective illustration on an enlarged scale, as compared to FIG. 1, of one embodiment of a structure which is situated in the interior of the member shown in FIG. 1;

FIG. 3 is a fragmentary transverse section showing the structure of FIG. 2 within the member of FIG. 1, FIG. 3 being taken along line 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 is a perspective illustration of another embodiment of a structure which can be situated in the interior of the member of FIG. 1; and

FIG. 5 is a fragmentary transverse sectional view showing part of the structure of FIG. 4 situated in the interior of a member such as that of FIG. 1.



Referring now to FIG. 1, there is shown therein a jointed limb **10** which in the illustrated example simulates the leg of a human being. This jointed limb may form part of a doll, for example. For this purpose the jointed limb **10** includes at its upper end portion a conventional connecting structure **12** by which it is connected in a known way to the pelvic region of the figure.

The limb **10** includes an elongated hollow member **14** made of a soft elastic plastic material so that it has a "feel" similar to that of the flesh of a human being. This elongated hollow member **14** has an opening at its upper end, and this opening is not visible in FIG. 1 since it is situated behind the connecting structure **12**. Through this opening access may be had to the elongated hollow interior of the limb **14**. This limb **14** is hollow down to the region of the ankle **16**. The foot **18** may be solid.

The elongated hollow limb **14** is thus easily bendable and since it is elastic it has an inherent resiliency which tends to return the limb **14** to the position thereof shown in solids lines in FIG. 1. Intermediate its ends the limb **14** has an intermediate joint-simulating portion **20** which, in the illustrated example, simulates a knee of the leg. The limb **14** thus has an upper limb portion **22** extending in one direction from the intermediate portion **20** and a lower limb portion **24** extending in the other direction from the intermediate portion **20**. During use of the structure the operator can bend the limb **14** at its intermediate portion **20** so as to displace the limb portions **22** and **24** one with respect to the other. In the example shown in FIG. 1 the lower limb portion **24** is shown displaced to the dot-dash line position with respect to the other limb portion **22**.

The structure which is shown in FIG. 2 is adapted to be situated in the interior of the limb **14**, and this structure is fragmentarily illustrated within the limb **14** in FIG. 3 where the limb **14** also is fragmentarily illustrated. This structure of FIG. 2 includes an upper elongated substantially rigid insert **26** and a lower elongated substantially rigid insert **28**. The upper insert **26** has, at its upper end, an eye **30** whose central opening is adapted to be aligned with the central opening **32** (FIG. 1) of the upper end portion **12** of the limb **10**. The inserts **26** and **28** may be made, for example, of die cast zinc parts.

As is apparent from FIG. 3, the upper insert **26** extends along the hollow interior of the upper limb portion **22** while the lower insert **28** extends along the hollow interior of the lower limb portion **24**. These inserts respectively have ends **34** and **36** situated adjacent each other at the region of the intermediate joint-simulating portion **20** of the limb **14**.

A connecting means **38** interconnects the ends **34** and **36** of the inserts for pivotal movement while limiting the turning of the inserts, one with respect to the other, only to movement which is capable of simulating natural movement of the limb. Thus, the connecting means **38** includes a rivet **40** which extends through aligned openings of the overlapping ends **34** and **36** and which has opposed enlarged head ends retaining the piovt pin **40** connected with the inserts **26** and **28**. This connecting means also includes substantially rectangular overlapping end portions **34** and **36** which abut one against the other when the inserts have the extended condition shown in solid lines in FIG. 2, so as to prevent the upper insert from turning forwardly with respect to the lower insert beyond the position shown in FIG. 2 and so as also to prevent the lower insert from turning forwardly with respect to the upper insert beyond the position shown in FIG. 2. However, either one of these inserts is free to turn rear-

wardly with respect to the other insert. In this way the connecting means **38** inhibits unnatural positions for the jointed limb **10**. Of course, when the inserts are in the limb **14**, the limb portions **22** and **24** will necessarily be constrained to move with the inserts **26** and **28**, respectively.

The structure of the invention also includes an elongated, substantially non-elastic deformable means **42** which in the example of FIGS. 2 and 3 is in the form of an elongated wire **44** which in the illustrated example has but a single strand. The wire **44** may be made, for example, of soft iron or copper so that it can be bent back and forth a large number of times. The wire **44** engages the inserts **26** and **28** at the portions **46** and **48**, thereof, respectively, and except for its engagement with these portions of the inserts the deformable means **42** has no positive connection with the inserts. Thus, the wire **44** extends freely along the inserts, and has a free, floating relationship with respect to the connecting means **38**.

The portion **48** of the insert **28** is formed with an opening **50** (FIG. 3) through which the wire **44** passes, and after passing through this opening the wire **44** extends away from the insert **26**. At the portion **46** of the insert **26**, a guide means **52** is provided to guide the wire **44** for free sliding movement relative to the insert **26**. This guide means **52**, which is carried by the insert **26** is in the form of a pair of pins **54** fixed to and projecting from the opposed faces of the insert **26**. The wire **44** passes freely through the pair of pins on one side of the insert **26**, as is apparent from FIGS. 2 and 3.

The inserts **26** and **28** of FIGS. 4 and 5 are identical with those of FIGS. 2 and 3, and an identical connecting means **38** provides the pivotal interconnection between the inserts **26** and **28** of FIGS. 4 and 5. However, in this embodiment the elongated deformable means **56** is in the form of an elongated wire **58** which may be made of the same material as the wire **44** but which includes a plurality of strands which are twisted together. Furthermore, it will be noted that the guide means **52** carried by the insert **26** of FIG. 4 is identical with that of FIG. 2. However, in this case the wire **58**, after passing through the opening **50** (FIG. 5) passes upwardly along the opposite side of the inserts and between the pair of pins **54** at the opposite side of the insert **26**.

It is to be understood that the wire **44** could be made of a plurality of twisted strands and that the wire **58** could be made of a single strand, if desired.

The inserts **26** and **28** together with the deformable means, whether the deformable means **42** or the deformable means **56**, are situated in the hollow interior of the limb **14** with a fairly snug fit. Thus, as is apparent from FIGS. 3 and 5, the inner surface of the hollow member **14** presses resiliently against the inserts and the deformable means, and in this way when the inserts are turned one with respect to the other the wire will bend in the general region of the connecting means **38** inasmuch as the limb **14** itself will bend at its joint portion **20** which engages the deformable means to retain the latter in the general region of the inserts and conforming generally to the configuration into which the limb is displaced by the operator. As a result of this feature there will be no localized sharp bending of the deformable means, so that repeated bending thereof at one precise location is avoided and the life of the deformable means is greatly prolonged in this way.

The limb **14**, due to its resilient nature, will have a tendency to return to the solid line position of FIG. 1 irrespective of the position into which it is displaced by the operator. However, the deformable means **42** or **56**, while having no particular resiliency, nevertheless provides a resistance to bending which is great enough to prevent return of the limb to its initial condition as a result of its own resiliency, and in this way the limb will remain in whatever condition it is displaced to by the operator. In the case of FIG. 4, the substantially U-shaped deformable means will bend at both of its legs, while in the case of FIG. 2 the single leg of the deformable means will bend in the region of the connecting means **38**.



The limb **14** is rotationally molded in any suitable mold in a manner well known in the art so as to have the hollow interior shown in FIGS. 3 and 5. In accordance with one of the methods of the invention, after the limb is molded the inserts, which have previously been assembled by the connecting means **38** and to which the deformable means **42** or **56** has already been connected, are inserted into the hollow interior of the limb through the open top end thereof. Although the parts have a snug fit in the interior of the limb, they nevertheless can be readily pushed in, and the inner surface of the limb will have intimate contact with the inserts and deformable means. Because of this frictional engagement between the inner surface of the limb and the inserts and deformable means, the latter parts will be reliably retained in the interior of the limb without requiring any additional fastening structure.

It is also a feature of the invention to manufacture the structure according to a method which includes placing the assembled inserts and deformable means in the interior of the mold before the plastic is rotationally molded. According to this latter method the plastic which forms the limb **14** is molded directly about and encloses the inserts and the deformable means, so that with this method when the limb is molded it will be finished with the structure of FIGS. 2 and 4 already situated in the interior of the limb engaged by the inner surface thereof.

The inner soft surface of the plastic limb enables it to conform readily to the configuration of the inserts and deformable means.

Thus, with the structure of the invention the plastic limb itself will retain the wire in its proper position in close relationship to the hinged inserts. This construction is incapable of providing any unnatural bending which could result from the use of a simple wire without any additional structure in the interior of the limb. With a construction of this latter type it would be possible to give the limb odd, unnatural, disjointed twisting and bending. Such unnatural manipulations are prevented with the structure of the invention.

Of course, while the invention has been disclosed as applied to a leg-simulating limb, it could equally well be applied to an arm-simulating limb, in which case the intermediate portion **20** would be the elbow of the limb.

What is claimed is:

**1.** For use in a figure which simulates a living being, a jointed limb comprising an elongated, hollow, bendable, limb-simulating member having an intermediate joint-simulating portion and a pair of limb portions respectively extending in opposite directions away from said intermediate portion, a pair of elongated substantially rigid inserts situated within and extending along said limb portions, respectively, said inserts respectively having ends adjacent to each other and situated in the region of said intermediate portion of said member, connecting means situated in said member at said intermediate portion thereof and connecting said ends of said inserts to each other for pivotal movement of said inserts one with respect to the other, so that said limb portions of said member will bend one with respect to the other at said intermediate joint-simulating portion of said member, said connecting means limiting turning of said inserts one with respect to the other and thus of said limb portions, one with respect to the other, exclusively to natural movement of said limb portions relative to each other, and elongated, deformable, substantially non-elastic means situated in and extending along the interior of said elongated hollow member and engaging said inserts at portions thereof spaced substantially from said ends thereof, said deformable means, except for said engagement with said portions of said inserts, extending freely along said inserts

without having any positive connection thereto, said elongated hollow member when bent at said intermediate joint portion thereof turning at least one of said inserts with respect to the other and deforming said elongated deformable means to a configuration determined by the extent of bending of said hollow member, and said deformable means retaining said inserts and said limb portions at any angular relationship with respect to each other into which they are displaced.

2. A jointed limb as recited in claim 1 and wherein said elongated hollow member is made of a non-metallic material.

3. A jointed limb as recited in claim 2 and wherein said elongated hollow member is made of an elastic plastic, and said deformable means having a resistance to bending which is sufficient to retain said member in its bent condition in opposition to the inherent resiliency thereof.

4. A jointed limb as recited in claim 1 and wherein said elongated deformable means is in the form of a wire.

5. A jointed limb as recited in claim 4 and wherein said wire has a single strand.

6. A jointed limb as recited in claim 4 and wherein said wire is made up of a plurality of strands which are twisted together.

7. A jointed limb as recited in claim 1 and wherein one of said inserts is formed at its portion engaged by said deformable means with an opening through which said deformable means extends and the other of said inserts carries at its portion engaged by said deformable means a guide means guiding said deformable means for longitudinal shifting movement along said other insert.

8. A jointed limb as recited in claim 7 and wherein said guide means includes a pair of pins fixed to and projecting from said other insert and between which said elongated deformable means freely extends.

9. A jointed limb as recited in claim 8 and wherein said elongated deformable means after passing through said opening of said one insert extends away from said other insert.

10. A jointed limb as recited in claim 8 and wherein said pins extend through and beyond said other insert to project from opposed faces thereof and said elongated deformable means extending through said opening and along opposed faces of both inserts and through the pairs of pins at the opposed faces of said other insert.

11. A jointed limb as recited in claim 1 and wherein said elongated hollow member is made of an elastic material substantially softer than said inserts and having an inner surface engaging said deformable means.

12. A jointed limb as recited in claim 1 and wherein said elongated hollow member simulates the appearance of a leg of a human being, and said intermediate joint-simulating portion simulating a knee of the leg.



**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,761,244 | 9/1956 | Weih | 46—173 X |
| 2,835,076 | 5/1958 | Weih | 46—173 X |
| 3,277,601 | 10/1966 | Ryan | 46—163 X |
| 3,350,812 | 11/1967 | Lindsay et al. | 46—163 X |


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