United States Patent [19]

Smrcka

[11] 3,755,920

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[54] LEG FOR A TEST DUMMY

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[73] Assignee: **Alderson Research Laboratories, Inc.,** Stamford, Conn.

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[21] Appl. No.: **261,538**

[52] **U.S. Cl.** **35/17**

[51] **Int. Cl.** **G09b 23/30**

[58] **Field of Search** ..... 35/17; 280/150 B, 280/150 SB; 223/66, 68

[56] **References Cited**

UNITED STATES PATENTS

3,557,471 1/1971 Payne et al. 35/17

Primary Examiner—Harland S. Skogquist

Attorney—Garold E. Bramblett, Jr. et al.

[57] **ABSTRACT**

There is disclosed a leg for a test dummy which has a range of motion about the knee joint similar to that of the human and greater than the motion range of prior art legs. This is achieved by offsetting the simulated bone of the lower leg and molding a compressible cavity into the calf portion of the leg. The knee includes an impact housing connected directly to the upper leg bone structure so that knee impacts are not transmitted through the joint.

The foregoing abstract is not to be taken either as a complete exposition or as a limitation of the present invention. In order to understand the full nature and extent of the technical disclosure of this application, reference must be had to the following detailed description and the accompanying drawings as well as to the claims.

10 Claims, 4 Drawing Figures

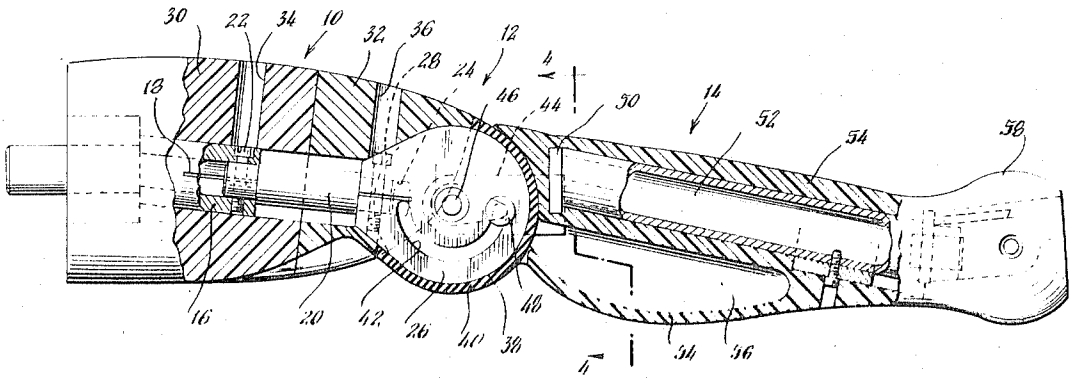

Fig. 1

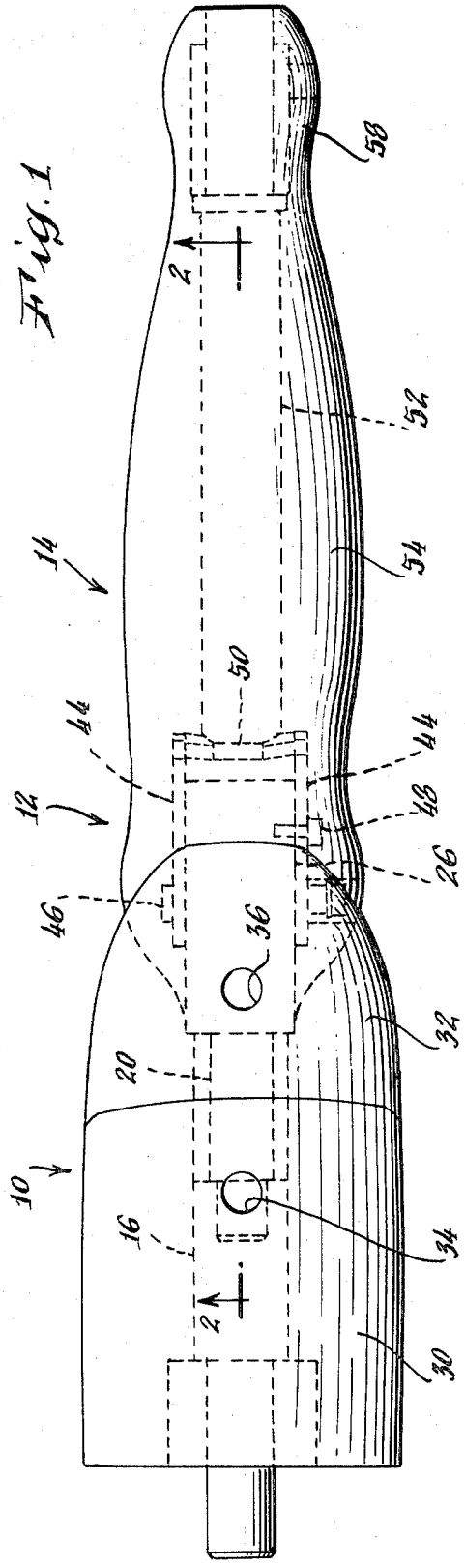
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Fig. 2

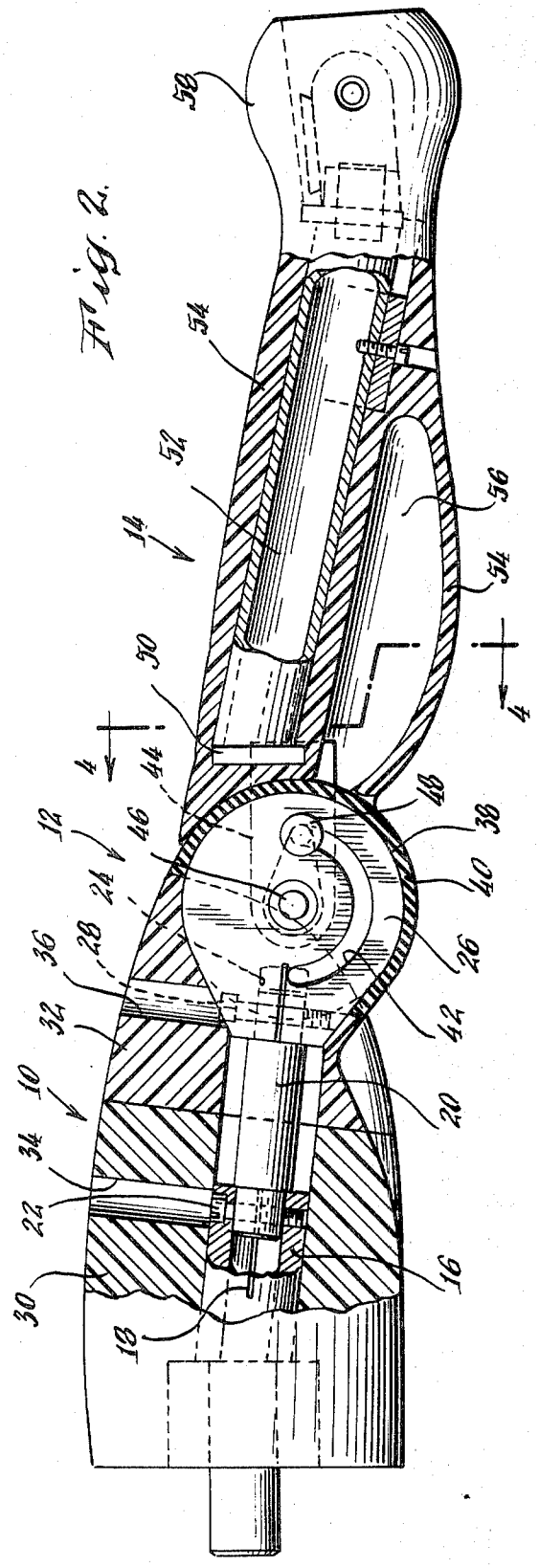
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Fig. 3

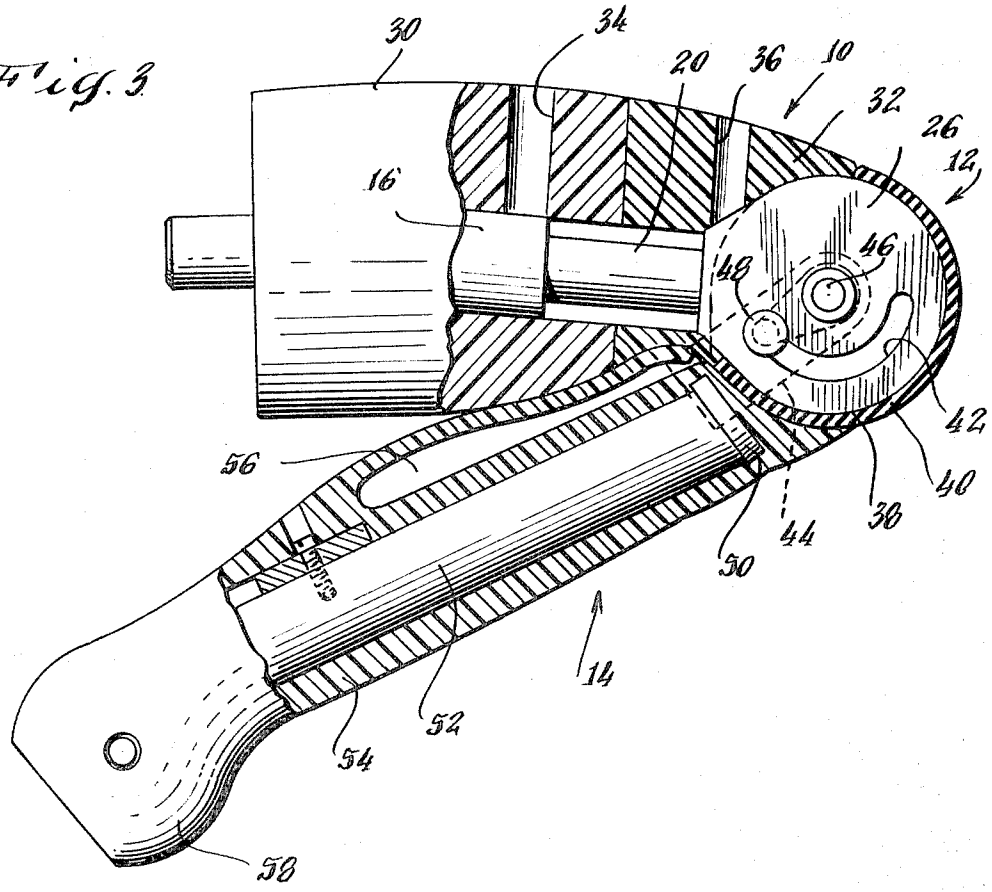
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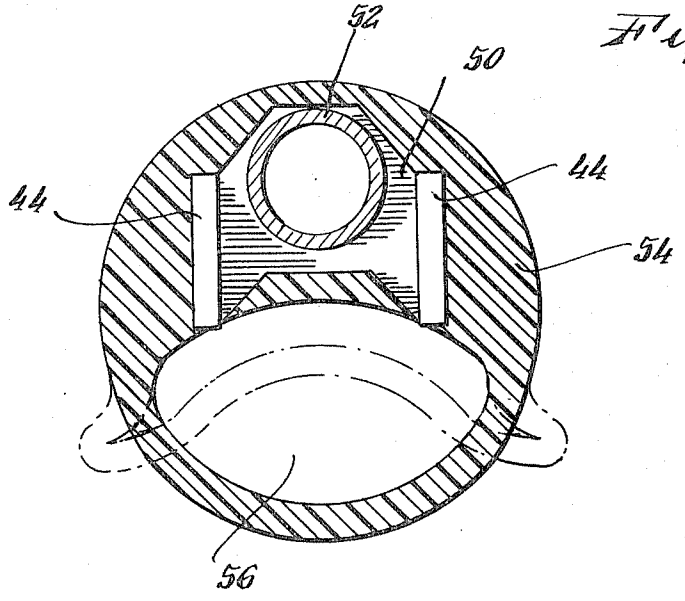
Fig. 4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LEG FOR A TEST DUMMY

BACKGROUND OF THE INVENTION

This invention relates to test dummies of the type utilized in aviation and automotive crash research. More particularly, it relates to a leg construction for such dummies which permits expanded motion about the knee joint and allows knee impact loads to be transmitted directly to the femur rather than through the knee joint.

In prior art dummies, the normal bulge of the calf upon making contact with the thigh, prevented the knee joint from flexing through the full 160° range of the normal human knee. Furthermore, in prior art constructions, impact loads on the knee with the leg in a bent position are transmitted through the knee joint causing frequent damage and inaccurate measurements at the femur.

Accordingly, it is a primary object of the present invention to provide a leg for a test dummy having a knee flexion range similar to that of the human and wherein impact loads on the flexed knee are transmitted directly to the femur rather than through the knee joint regardless of lower leg position. Other objects, features, and advantages will become apparent from the following description and the appended claims.

SUMMARY OF THE INVENTION

A leg for a test dummy is provided which includes an upper leg member, a lower leg member, and a knee joint there-between. The lower leg member includes a simulated leg bone having a resilient covering which simulates flesh. The covering defines a compressible cavity in the calf portion.

BRIEF DESCRIPTION OF THE DRAWINGS

A full understanding of this invention will be had from the following description with reference to the figures of the attached drawings wherein:

FIG. 1 is a top view of a leg constructed in accordance with this invention;

FIG. 2 is a cross section taken substantially along the line 2—2 of FIG. 1;

FIG. 3 is a partial cross section of the leg of this invention shown in its flexed configuration; and

FIG. 4 is an enlarged cross section taken substantially along the line 4—4 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With particular reference to FIGS. 1 and 2, there is illustrated a leg in accordance with this invention comprising an upper leg assembly **10**, a knee assembly **12**, and a lower leg **14**. The upper leg assembly **10** comprises a metallic tube **16** having a slot **18** at its end. A link rod **20** having reduced diameter ends has one of those ends inserted into tube **16** where it is secured by a socket head cap screw **22**. The other end of link rod **20** is inserted in a socket **24** defined by a cast metal impact housing **26** which forms one element of the knee assembly **12**. The end of the link rod **20** is secured to the housing **26** by means of a second cap screw **28**. Simulated flesh is provided by upper **30** and lower **32** segments of vinyl skin and foam which are provided with suitable passages **34, 36** for access to the screws.

The housing **26** of the knee assembly **12** is essentially cylindrical, describing a smooth surface of revolution

38 covered with solid vinyl skin **40**. One side of housing **26** defines a semicircular aperture **42**. The remaining portion of the knee assembly **12** comprises a pair of spaced bars **44** positioned on opposite sides of housing **26** and pivotable about a shaft **46**. The internal construction of the knee joint forms no part of this invention and, accordingly, is not illustrated. However, it may be of the type disclosed in a co-pending application of Samuel W. Alderson entitled "Variable Friction Hinge" Ser. No. 155,811, filed June 23, 1971 and assigned to the same assignee as the present invention. A screw **48** carried by one of the bars **44** is positioned to traverse the aperture **42** to provide a limit stop at its two extremes.

The lower leg **14** is secured to the knee assembly **12** by means of a plate **50** which is welded between the bars **44**. The plate **50** is shaped as shown in FIG. **4** so as to be offset toward the front of the leg. Welded to this offset portion of plate **50** is one end of a metal tube **52** which forms the simulated lower leg bone. The lower leg flesh is simulated by vinyl skin and foam **54**. This flesh differs from prior art constructions in that the calf portion defines a cavity **56** which occupies a portion of the space left free by the forward positioning of the tube **52**. The lower leg **14** terminates in an ankle joint **58** which forms no part of the present invention and, accordingly, need not be further described.

The extended range of motion provided by the leg of this invention will be best appreciated by reference to FIGS. **3** and **4**. As will be noted therein, the cavity **56** may be compressed by contact of the flesh **54** with the flesh of the thigh. This results in the lower leg being rotatable through an arc of 160° which exceeds the motion available in prior art devices and closely approximates that of the human leg.

An important additional advantage of the leg of this invention arises from the knee construction. As previously explained, the housing **26** is a strong cast impact member connected directly to the upper leg. As will be apparent from FIG. **3**, when the leg is bent, any impact loads on the knee will be transmitted directly to the link rod **20** thereby avoiding damage to the knee hinge and permitting more accurate load measurements. As a further advantage, there is greater flexibility in the choice of femur load measuring systems. This is achieved by use of the link rod **20** which is an exact dummy for commercially available femur load cells and which can also be used for strain gauging. Access to the link rod is facilitated by the separable upper leg flesh segments **30, 32**. This construction allows easy replacement of the link rod **20** or measuring devices between the impact housing **26** and the upper leg bone by the removal of the two screws **22, 28**.

It is believed that the advantages of this invention will now be apparent to those skilled in the art. It will also be apparent that a number of variations and modifications may be made in this invention without departing from its spirit and scope. Accordingly, the foregoing description is to be construed as illustrative only, rather than limiting. This invention is limited only by the scope of the following claims.

I claim:

1. A leg for a test dummy which comprises: an upper leg member; a knee joint secured to the upper leg member; and a lower leg member secured to said knee joint including a simulated lower leg bone having a resilient

covering simulating flesh, said covering defining a compressible cavity in the calf portion.

2. The leg of claim **1** wherein said simulated lower leg bone is offset forwardly from a line extending between the center of rotation of the knee joint and the ankle.

3. The leg of claim **1** wherein said knee joint comprises: an impact housing secured to said upper leg member and having a substantially cylindrical surface of revolution adjacent said lower leg member; first and second bars pivotally secured to opposite sides of said housing to rotate about the axis of revolution; and a plate member secured between said bars and to said lower leg bone.

4. The leg of claim **3** wherein said plate member and said simulated lower leg bone are offset forwardly from a line extending between the center of rotation of the knee joint and the ankle.

5. The leg of claim **1** wherein said upper leg member comprises: a tube forming a portion of a simulated upper leg bone; a link rod forming another portion of the simulated upper leg bone; means for detechably securing one end of said link rod to said tube; and means for detachably securing the other end of said link rod to said knee joint.

6. The leg of claim **5** wherein said upper leg member further comprises: first and second simulated leg flesh segments abutting intermediate said securing means.

7. A leg for a test dummy which comprises: an upper leg member; an impact housing secured to said upper leg member and having a substantially cylindrical surface of revolution; first and second bars pivotally secured to opposite sides of said housing to rotate about the axis of revolution; and a lower leg member secured to said first and second bars for rotation adjacent said surface of revolution.

8. The leg of claim **7** wherein said upper leg member comprises: a tube forming a portion of a simulated upper leg bone; a link rod forming another portion of the simulated upper leg bone; means for detachably securing one end of said link rod to said tube; and means for detachably securing the other end of said link rod to said impact housing.

9. The leg of claim **8** wherein said lower leg member comprises a simulated lower leg bone offset forwardly from a line extending between the axis of rotation of said bars and the ankle.

10. The leg of claim **9** wherein said lower leg member comprises a resilient covering simulating flesh, said covering defining a compressible cavity in the calf portion.

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