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Ersek et al.

[11] **3,838,600**

[45] **Oct. 1, 1974**

[54] **SLEEVE FOR FEVER THERMOMETERS AND METHOD OF ATTACHING SAME**

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[73] Assignee: **Med General, Inc.,** Minneapolis, Minn.

[22] Filed: **Aug. 16, 1972**

[21] Appl. No.: **281,131**

[52] **U.S. Cl.** **73/373,** 206/16.5

[51] **Int. Cl.** **G01k 5/04**

[58] **Field of Search** 73/371, 374; 206/16.5

[56] **References Cited**

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Assistant Examiner—Daniel M. Yasich

[57] **ABSTRACT**

An improved sheathed fever thermometer and method of preparing the same wherein the thermometer structure, fabricated from glass, is encapsulated within a contoured sheath. The sheath is provided with a tapered wall thickness which increases from the bulb end to the tip end, with the tip end having a gripping tab which enables the user to grasp the tab for achieving enhanced motion for shaking down the conventional mercury column.

In the method of preparing the sheath, an improved mandrel is provided which permits the formation of a sheath having a wall thickness which tapers from the outer tip end to the bulb end. The application of a small quantity of water to the contacting surface between the mandrel and the sheath enhances the release of the individual mandrel fingers from the sheath structure. A vinyl plastisol has been found to be preferred for the sheath fabrication material.

4 Claims, 8 Drawing Figures

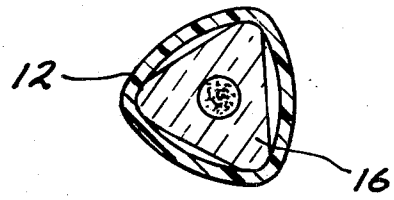
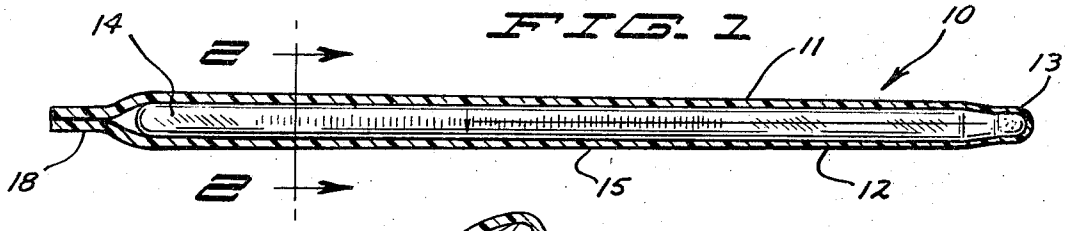


FIG. 1



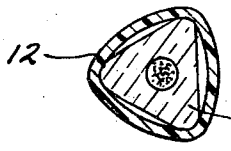


FIG. 2

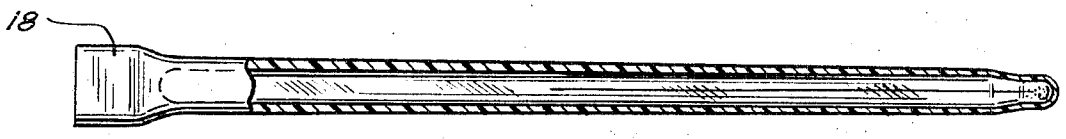


FIG. 3

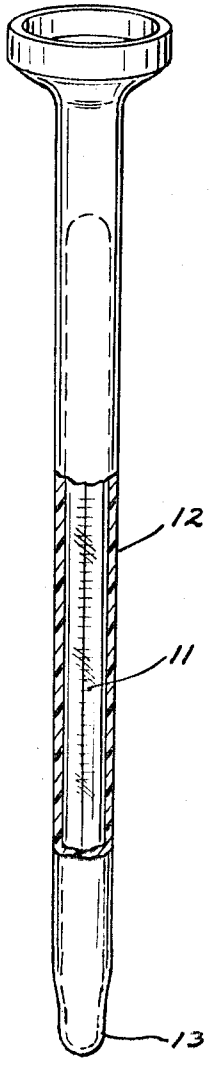


FIG. 4

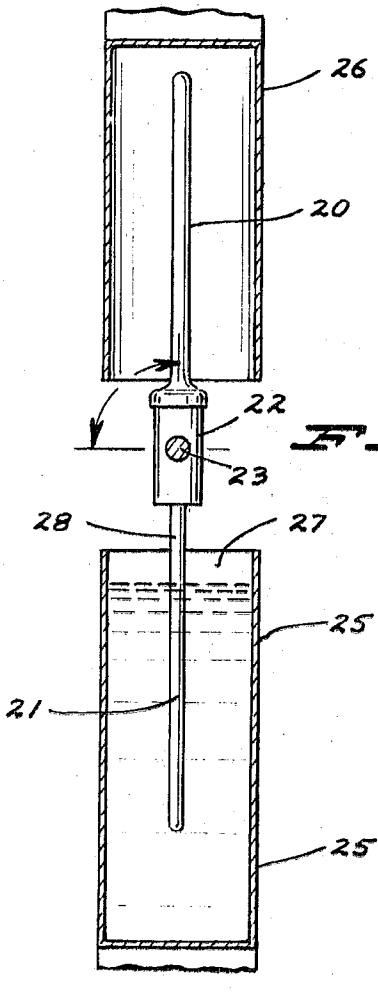
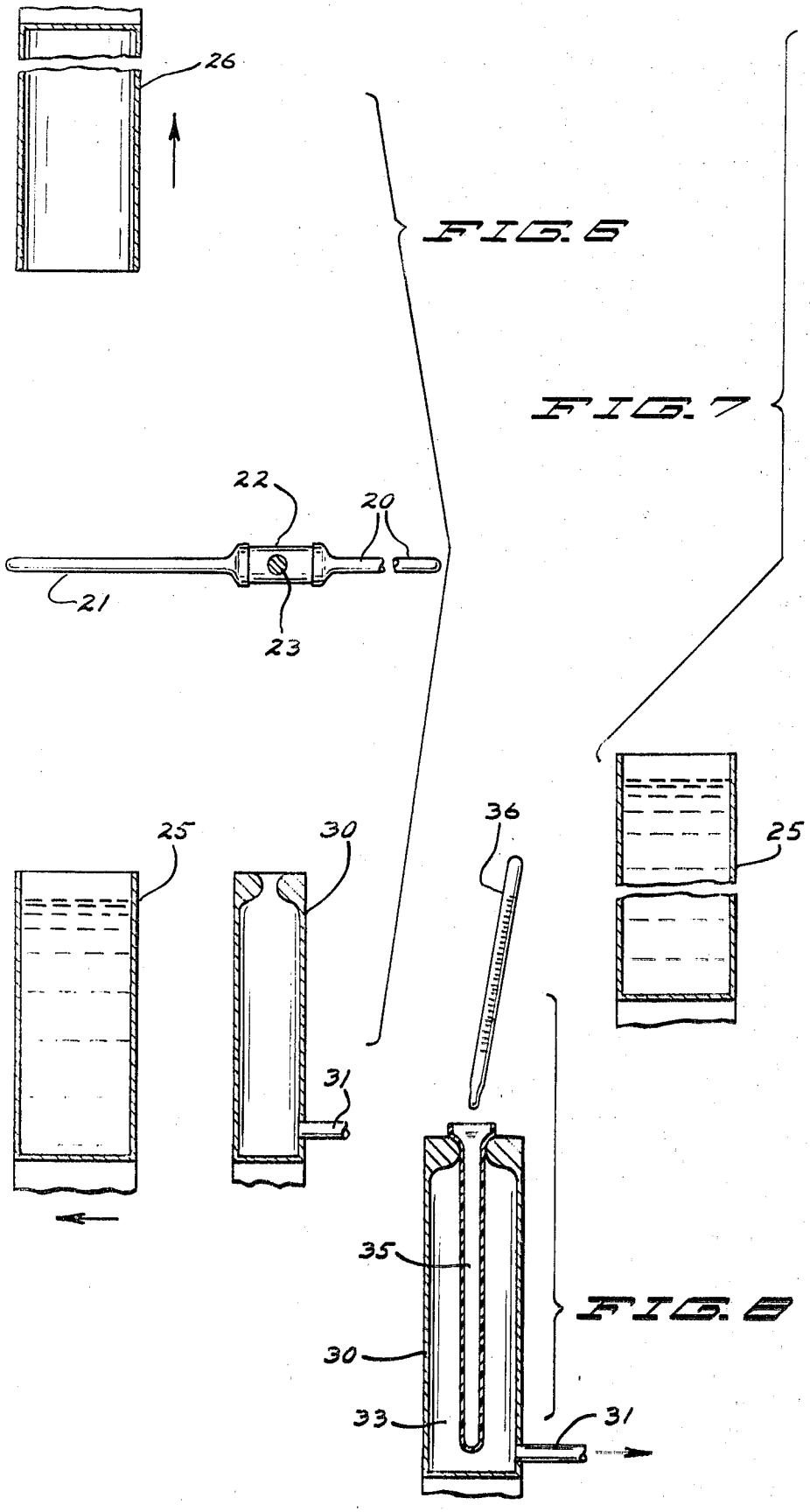


FIG. 5


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FIG. 6
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FIG. 7
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FIG. 8

SLEEVE FOR FEVER THERMOMETERS AND METHOD OF ATTACHING SAME

BACKGROUND OF THE INVENTION

The present invention relates generally to an improved sheathed fever thermometer, and more specifically to a fever thermometer having a protective sheath enveloping the entire structure, wherein the sheath is fabricated from a tough, durable transparent film of predetermined configuration. The encapsulating film has a wall thickness which tapers from the tip end to the bulb end so as to provide substantial protection over the cylindrical barrel of the structure, while reducing the thermal resistance across the film in the area of the bulb. A further feature of the structure of the present invention includes the provision of a gripping tab adjacent the free tip end of the thermometer structure.

In the past, various methods, techniques, and apparatus have been proposed for the establishment of a sheath or enclosure about a conventional fever thermometer. These fever thermometer structures normally include an elongated barrel, cylindrical in form, having a generally centrally located capillary tube or bore, with this tube or bore portion terminating at one end in a reservoir bulb. The reservoir bulb contains a substance which responds dimensionally to temperature variations, and accordingly will expand in the bore upon exposure of the bulb to increases in temperature. The tip end of the thermometer is sealed, with the bore being evacuated to permit movement of the temperature responsive substance in the bulb portion.

Since fever thermometers typically are fabricated from glass, they are easily broken or cracked, and when this occurs, they pose a potential hazard to the user. However, the use of a covering sheath, while solving certain of the mechanical problems, may be found to add additional problems to the use of the device. For example, if a sheath is added which is made of heavy raw material, the optical, as well as thermal properties of the device may be adversely affected, with the mercury column becoming difficult to read because of the mismatch of indices of refraction, and with the response being impeded because of the added resistance to transmission of thermal energy. However, in connection with the aspects of the present invention, the optical properties are not adversely affected, and the sheath is provided with a thin wall structure adjacent the bulb end thereof in order to minimize the additional impedance to flow of thermal energy due to the interposition of the sheath thereon.

SUMMARY OF THE INVENTION

The present invention overcomes these disadvantages by the use of a sheath element over a conventional fever thermometer which provides substantial protection on the barrel portion of the thermometer, while providing minimal impedance to the transmission of thermal energy across the bulb zone. In addition, an upper tabular element is provided which enhances the shake-down characteristics of the unit. An additional feature of the present invention is the provision of a sheath which interposes little, if any, distortion of the mercury column of the fever thermometer, thereby enabling the user to read the column height, and accordingly the temperature reached with minimal distortion.

In preparing the improved sheath for thermometer encapsulation, and pursuant to the present invention, an optically clear polyvinyl chloride plastisol is employed, with a heated mandrel being employed for immersion in the plastisol. The retained plastisol is cured in an oven while remaining on the mandrel, with the mandrel being inverted so as to provide a tapered wall thickness which increases from the bulb end to the free tip end. Thereafter, the sheath is removed from the mandrel under the influence of vacuum, with water being employed between the mandrel and the plastisol surface to assist in expediting removal.

Therefore, it is a primary object of the present invention to provide an improved sheath for thermometers wherein the sheath is optically clear to assist in visual clarity, and wherein the portion of the sheath encapsulating the bulb end is thin in cross-section in order to assist in providing minimal impedance to transfer of thermal energy through the sheath well.

It is a further object of the present invention to provide an improved protective sheath for fever thermometers, wherein the sheath is mechanically durable, optically clear, and thermally conductive.

It is yet a further object of the present invention to provide an improved method and technique for the preparation of sheath enclosures for fever thermometers, and wherein the sheaths are formed from a moltened plastisol, and wherein the curing of the plastisol occurs in a manner permitting the plastisol to flow modestly so as to provide a tapered wall thickness which increases from the bulb end to the tip end.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of an encapsulated thermometer, with the view showing the fever thermometer in plan view, and with the sheath being shown in section;

FIG. **2** is a vertical sectional view taken along the line and in the direction of the arrows **2—2** of FIG. **1**;

FIG. **3** is a top plan view of the structure illustrated in FIG. **1**, with a portion of the protective sheath being shown broken away;

FIG. **4** is a perspective view of a partially completed sheath element prepared for use on a fever thermometer and pursuant to the various aspects of the present invention;

FIG. **5** is a schematic illustration of certain of the techniques employed in preparing a sheath component for encapsulation purposes;

FIG. **6** is a schematic illustration similar to FIG. **5**, and illustrating some additional apparatus employed in certain operations of sheath preparation pursuant to the present invention;

FIG. **7** is a schematic illustration of still a further operation utilized in connection with the sheath preparation; and

FIG. **8** is a schematic illustration showing the sheath in expanded form in a vacuum fixture and arranged to receive a fever thermometer therewithin.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Pursuant to the preferred embodiment of the present

invention, and with particular reference to FIGS. 1–3 of the drawings, the sheathed thermometer assembly generally designated **10** includes a conventional fever thermometer **11** along with a protective sheathing or coating **12** encapsulating the thermometer therewithin. As is apparent from the drawings, the thermometer structure per se includes a bulb portion **13** along with a tip end portion **14** separated by a cylindrical barrel, as indicated at **15.** As is conventional, the fever thermometer contains indicia indicative of the temperature reached by the indicating column of mercury which is retained in the bulb portion **13,** for direct transmission through the capillary zone **16** formed concentrically therewithin.

The fever thermometer **11** is normally cylindrical in configuration, however the term "cylindrical" is being utilized in a comprehensive sense since the cross-section of the structure is somewhat triangular in form, particularly as illustrated in FIG. **2.** With further attention being directed to FIG. **2,** it will be observed that the sheath **12** is in contact with the outer surface of the fever thermometer **11** at three equi-arcuately spaced points therearound, with the sheath being spaced outwardly from the thermometer surface at the intermittent points. It has been found that this spacing assists in clarity of the reading characteristics of the device, and the possible mismatching of indices of refraction do not seriously affect the readability of the encapsulated device.

The synthetic resin sheath is preferably fabricated from polyvinyl chloride plastisol, these materials being, of course, commercially available. Polyvinyl chloride plastisols are heat curable and, as such, form a cohesive integral sleeve. The nature of polyvinyl chloride plastisols is such that it is normally desirable to cure the sleeve prior to its making contact with the surface of the thermometer in order to avoid any over-heating of the fever thermometer device. For example, fever thermometers should not be subjected to temperatures above approximately 115° F. for any significant period of time inasmuch as they may be adversely affected by such exposure. Temperatures in the working range of the fever thermometers are, of course, normally utilized, such as, for example, temperatures up to 106° F.

Turning now to some additional features of the structure, and with particular attention being directed to FIGS. **1** and **3** of the drawings, the upper tip end of the sheath, such as is illustrated at **18** is in the form of a generally rectangularly formed tab. This tab **18** is formed by virtue of heat-sealing the sheath for a length extending beyond the tip end **14** of the fever thermometer **11,** this tab forming a desirable function for the structure. A user, by gripping the tab **18,** may more easily and readily "shake-down" the thermometer so as to permit re-use.

Turning now to the technique for preparing the sheath, and with particular reference to FIGS. **5–8** of the drawings, it will be appreciated that the sheath device is initially prepared on a suitable mandrel structure, cured to completion, and thereafter the mandrel is removed and the sheath is prepared for reception of the thermometer. The details of the preparation operation will be described hereinafter.

As is indicated in FIG. **5,** mandrels **20** and **21** are mounted on a rotatable retaining member **22** which is mounted for axial rotation on shaft **23.** The operation further includes a synthetic resin retaining receptacle **25,** along with a heating chamber **26** disposed at 180° from the receptacle **25.** A charge of a heat curable synthetic resin is received within receptacle **25,** such as is indicated at **27.** In this stage of the operation, the individual mandrels, such as mandrel **21,** is immersed in the receptacle **25** so as to become coated with synthetic resin to a desired extent, such as, for example, up to a level indicated at **28.** The mandrel is heated in order to promote adherence of the plastisol onto the mandrel surface when dipped therewithin. For most purposes, a mandrel temperature of about 400° F. is preferred for dipping, this temperature achieving a uniform controllable thickness of sheath in the plastisol mixture employed.

While various polyvinyl chloride plastisols may be utilized, one which has been found particularly useful in connection with the preparation of sheaths for use in the present invention is identified as Vinacron VP–892871 and available from Loes Enterprises of Minneapolis, Minn. It will be appreciated that other plastisol coatings may be employed as well, however that polyvinyl chloride plastisol identified hereinabove is useful for the purpose of the present invention.

Turning now to FIG. **6** of the drawings, an additional operational stage is illustrated. In this figure, the mandrels are coated with the cured plastisol, having been removed from reciprocably movable heating chamber **26,** and arranged to be received within the vacuum removal fixture **30,** as illustrated in the bottom portion of FIG. **6.** It will be appreciated that the individual sheaths may be subjected to initial removal operations while the devices are being prepared for further treatment and exposure to the vacuum chamber **30.** FIG. **6** is, therefore, an intermediate stage of operation between those operations illustrated in FIGS. **5** and **7.**

Turning now to FIG. **7,** the cured sheath is being prepared for introduction in the vacuum fixture **30,** wherein the vacuum generated by evacuation line **31,** which is coupled to a vacuum source, expands the sheath about the circumference of the base mandrel. In this operation, a receiving flange or ring is shown at **32** for providing the locking seal which enables a vacuum to be drawn within the chamber **33** of vacuum fixture **30.** This exposure to vacuum both removes the sheath from the mandrel and prepares the sheath for reception of the thermometer. It has been further found that the removal operation may be expedited if water is interposed between the inner sheath surface and the outer mandrel surface. The availability of water at this stage of the operation has been found to achieve a greater rate of separation between the sheath surface and the mandrel surface.

With attention now being directed to FIG. **8,** the mandrel is removed from the expanded sheath, which is illustrated at **35** in FIG. **8,** and thermometer **36** is placed therewithin. The tip sealing operation is performed in a conventional fashion, with the sheath being preferably rendered of uniform diameter prior to sealing. As is apparent, the open top of the sleeve element is sealed upon itself in order to both close the sleeve, and form an ear tab element adjacent the tip end of the encapsulated fever thermometer.

It will be appreciated, therefore, that the operations for preparing the sheath include an initial heating of a mandrel to a suitable temperature, such as a temperature of 400° F. prior to immersion in the plastisol. Fol-

lowing this immersion, the plastisol is cured in oven enclosure **26,** with the bulb end of the sheath being disposed above the tip end while curing, in order to achieve the tapered wall thickness from bulb end to tip end. Upon completion of cure, and rendering the polyvinyl material optically clear, the sheath is placed in sealed relationship to vacuum chamber **33** of vacuum fixture **30,** and when vacuum is applied to the device, the sheath expands so as to permit removal of the mandrel fingers and ultimate insertion of the thermometer therewithin.

The details of the sheath are illustrated in FIG. **4** of the drawings, with a portion being cut away so as to illustrate the details of the sheath. For example, the taper extends from the tip end to the bulb end with a wall thickness of about 5–8 mils being desired in the bulb end, and with a wall thickness of between about 12 and 15 mils being useful in the barrel portion of the structure. The bulb end of the sheath is also necked down in order to reduce the tendency to retain air and thus form bubbles between the bulb surface and the wall of the sheath **12.** The presence of air spaces in this area will, of course, impede the transfer of thermal energy and thus retard the rate of response of the fever thermometer while in use.

Water has been found to be a desirable material for assisting removal of the sheath from the mandrel surface. Water may be evacuated from the sheath, prior to insertion of the thermometer, at temperatures ranging from between about 94° F. and 96° F. This out-gasing of water may be accomplished without adversely affecting the characteristics of the finished sheath.

The polyvinyl chloride plastisol employed is one which, in addition to being optically clear, provides a Shore hardness in the range of between 70 and 90 durometers. A preferred reading is 80, which provides the durability required for the finished product.

In order to verify a complete cure of the plastisol, it will be noted that the plastisol remains milky colored or opaque until cured, and then is rendered clear. If the cure is continued beyond completion, the hardened polyvinyl chloride may become amber, and thus less desirable from a durability standpoint.

As has been indicated in FIG. **2,** the sheath walls are spaced from the shank of the barrel of fever thermometer **11,** thus providing a gap area therealong. This gap, in addition to providing enhanced optical properties, aids in mechanical properties of the device in rendering the structure more shatterproof, by providing a certain degree of resiliency. This zone also assists in the shock absorbing features of the device should it be dropped upon a hard surface such as a floor or the like.

2. We claim:

1. Sheathed fever thermometer means comprising:

a. a fever thermometer comprising a glass barrel having a tip end and a bulb end;

b. a protective sheath means encapsulating said fever thermometer and comprising a generally tubular plastic sheath with an integral closed base covering said bulb end and an outwardly extending sealed tab ear tip end covering said tip end providing a thermometer shake down capability; and

c. said plastic sheath means having a tapered cross-sectional wall thickness increasing from said bulb end to said tip end, said wall thickness of the bulb end ranging from **5** to **8** mils.

2. The sheathed fever thermometer means as defined in claim **1** being particularly characterized in that said sealed tab ear forms a gripping ear at the tip end of said sheathed fever thermometer means.

3. The sheathed fever thermometer means as defined in claim **1** being particularly characterized in that said sheath has a normal inner peripheral dimension which exceeds the outer peripheral dimension of said fever thermometer to form a gap therebetween, said sheath being heat sealed upon itself to form a closed envelope and with an outwardly extending tab disposed adjacent said tip end.

4. The sheathed fever thermometer means as defined in claim **3** being particularly characterized in that said sheath means is formed of curved polyvinyl chloride.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,838,600 Dated October 1, 1974

Inventor(s) Robert A. Ersek and Donald E. Wall

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 7, "in" (First occurrence) should read -- the --. Line 12, the numeral "2." should be deleted. Line 40, "curved" should read -- cured --.

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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