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Klausner

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[54] **APPARATUS AND METHODS RELATING TO SUPPORT OF THE FOREARM**

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[52] **U.S. Cl.** ..... **128/77,** 128/87 A, 128/94

[51] **Int. Cl.** **A61f 5/10**

[58] **Field of Search** 128/77, 87, 89, 94, 83, 128/84

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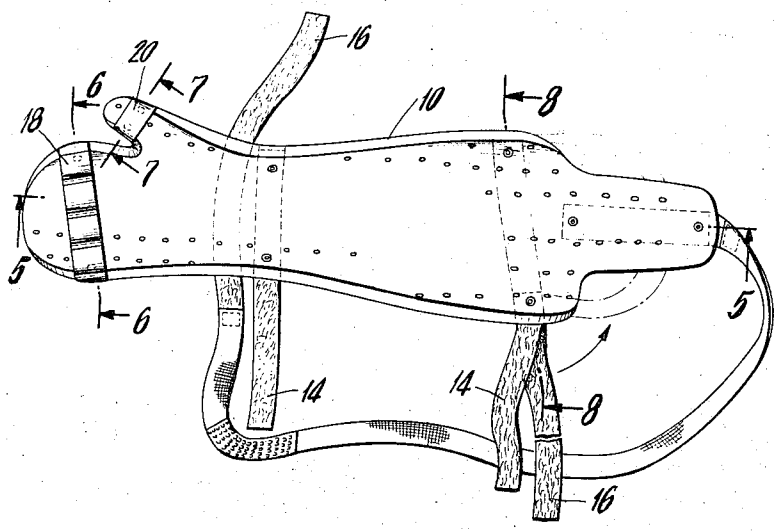
[57] **ABSTRACT**

An apparatus and methods are disclosed which relate to supporting the forearm by means of a resilient, semi-rigid support member adapted to partially encircle and conform generally to the shape of said forearm when said forearm is positioned adjacent to the chest wall or body with the forearm pronated and the wrist and hand held in a functional position, said support member also including means adapted to retain said support member generally against the body or chest wall.

9 Claims, 8 Drawing Figures



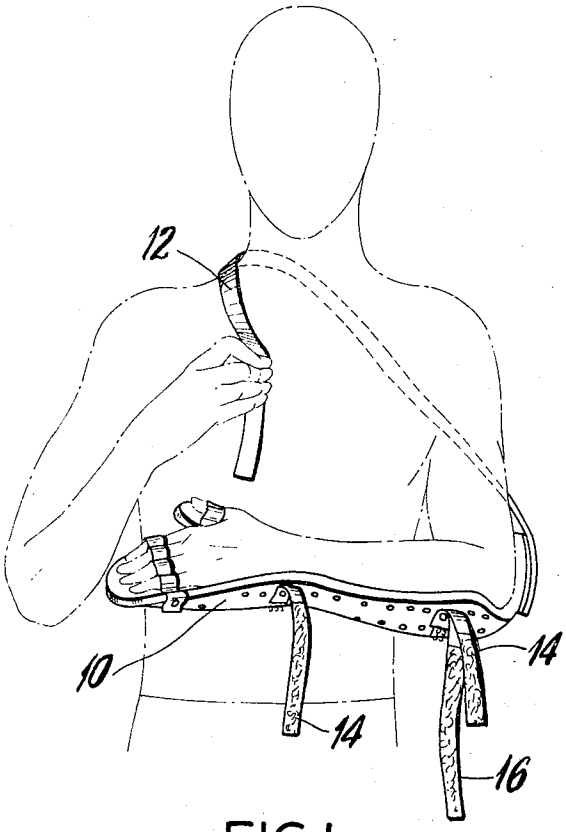


FIG.1

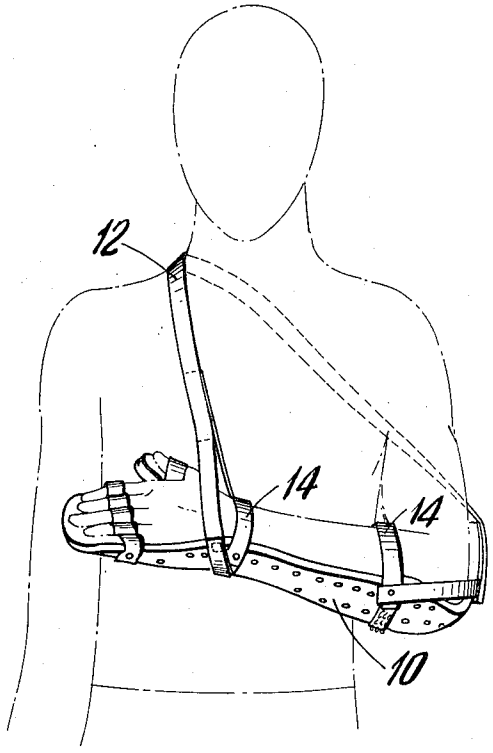


FIG.2

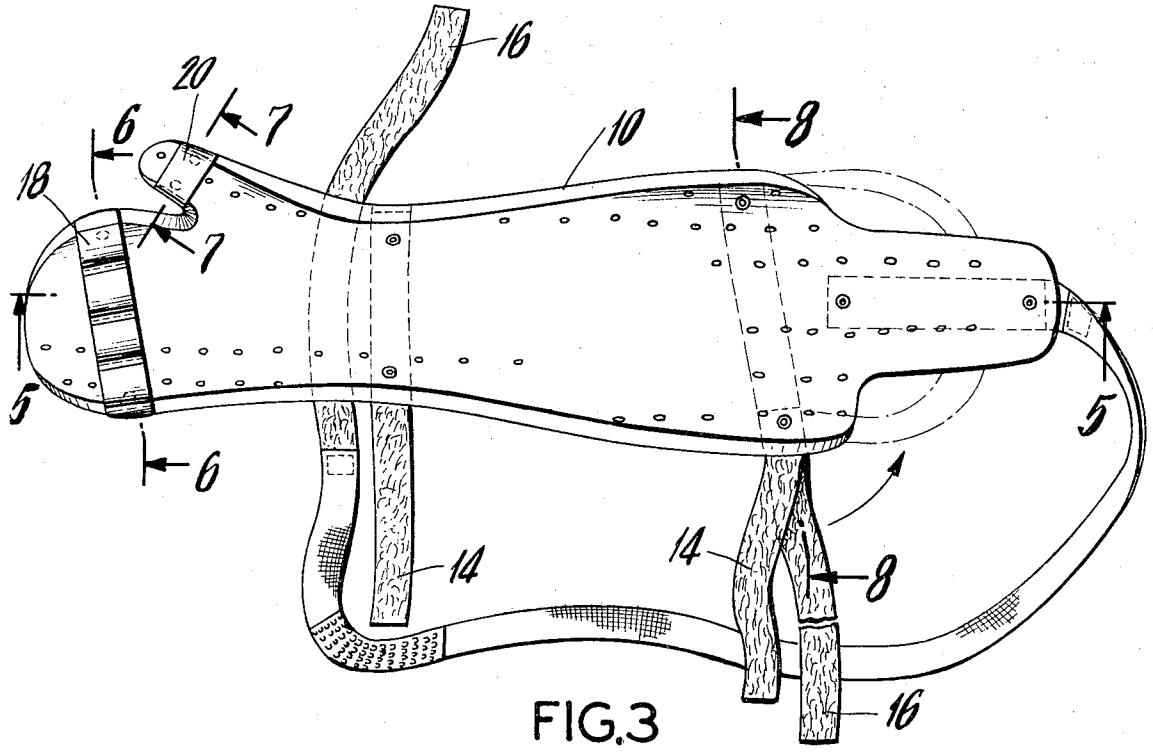


FIG.3

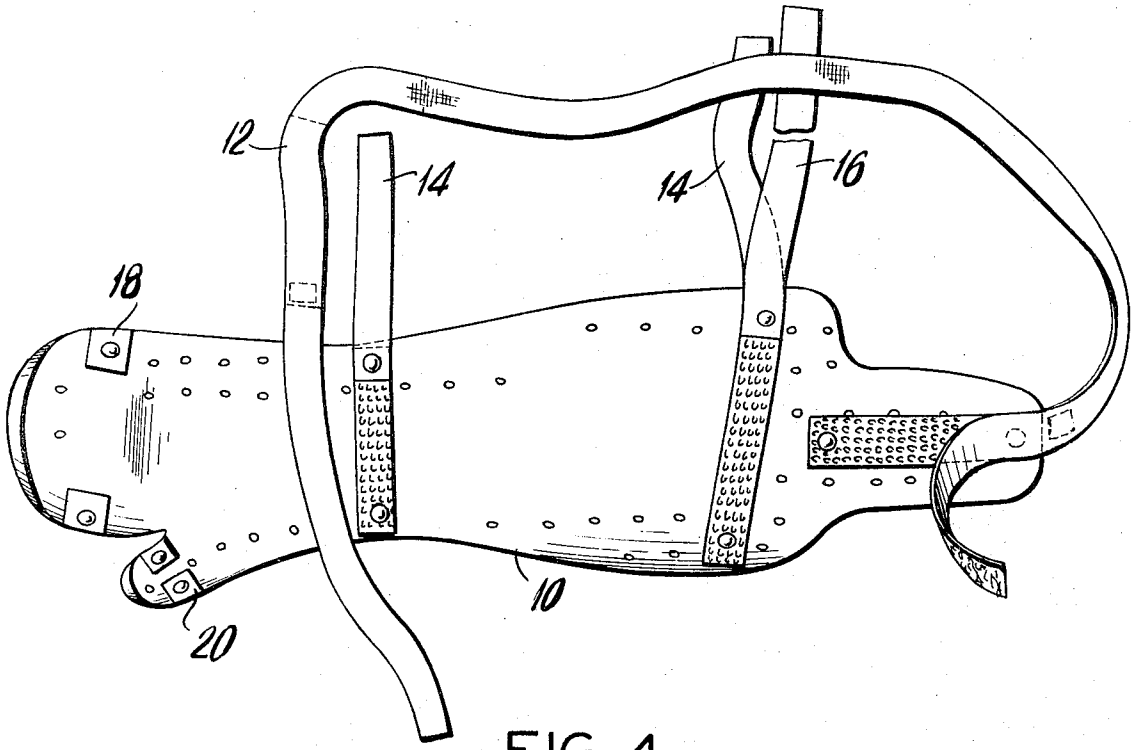


FIG. 4

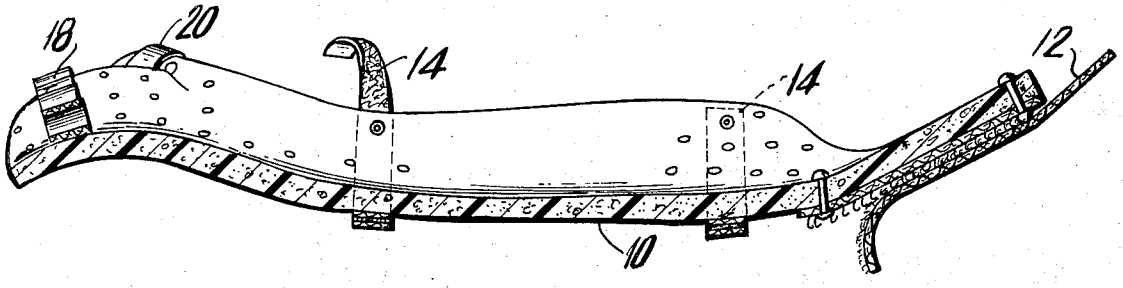


FIG. 5

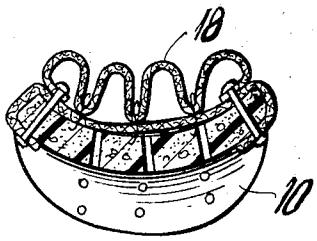


FIG. 6

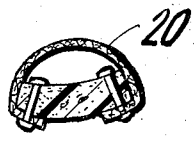


FIG. 7

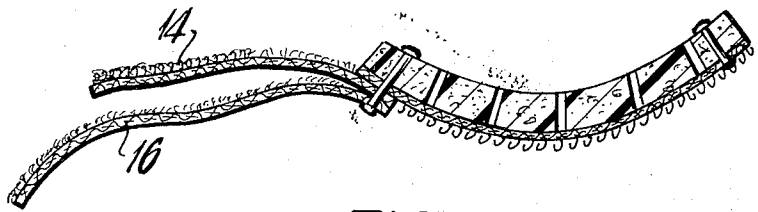


FIG. 8

APPARATUS AND METHODS RELATING TO SUPPORT OF THE FOREARM

This invention relates to a novel support for the forearm, including the elbow and hand. The support inherently relieves stress on the shoulder joint by transferring a part of the weight of the arm to the collar bone, neck or other part of the body to which retaining means may be affixed. While not limited thereto, it is especially useful in supporting the arm of a hemiplegic as its resilient characteristics and configuration provide an excellent means of supporting the affected limb of such an individual.

BACKGROUND OF THE INVENTION

It is well known in the prior art to employ a sling for supporting the forearm of a patient who has almost any type of injury or disability which restricts the normal manipulation of the arm and may induce a painful sublaxation of the shoulder. Many prior art slings are constructed of fabric or straps which have permitted the arm to hang limply with the weight of the arm causing pressure to be applied around the sides of the arm by the fabric or straps of the sling which pass upwardly to engage the neck or shoulder. The structure of these slings has usually resulted in the arm being positioned with the palm facing towards the body of the patient. These factors contribute to the discomfort associated with prolonged use of a sling. In addition with hemiplegic patients they do not provide adequate shoulder support or any relief from the spasticity frequently noted in these patients. The wrist and hand have not been supported in the functional position in prior art slings, if in fact they have been supported at all.

The present invention provides a support for the forearm, including the elbow and hand which is lightweight and may be made to conform generally to the shape of an individual patient's limb. The hand is maintained in a natural relaxed and functional position. In hemiplegic patients, shoulder sublaxation, wrist drop and flexion deformities may be prevented and deformities resulting from spasticity are prevented or relieved as the forearm, including the elbow, the wrist and the hand are supported in the functional position. Shoulder pain is also relieved.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front view of a patient who is fitting himself with the novel support according to the invention.

FIG. 2 is a front view of a patient with the support of the invention fitted in place.

FIG. 3 is a top plan view of the support of the invention.

FIG. 4 is a bottom plan view of the support of the invention.

FIG. 5 is a sectional view of the support of the invention taken along line 5—5 of FIG. 3.

FIG. 6 is a sectional view of the support of the invention taken along line 6—6 of FIG. 3.

FIG. 7 is a sectional view of the support of the invention taken along line 7—7 of FIG. 3.

FIG. 8 is a sectional view of the support of the invention taken along line 8—8 of FIG. 3.

DESCRIPTION OF THE INVENTION

The invention provides an apparatus which relieves

stress on the shoulder by supporting the forearm; including the elbow, the wrist and the hand; said apparatus comprising a resilient semi-rigid support member adapted to partially encircle and conform generally to the shape of the partially encircled forearm when the forearm is positioned against the chest wall or body preferably in a generally orthogonal position relative to the upper arm with the forearm pronated with the wrist and hand in a functional position. The support member also includes means adapted to retain said support member generally in said position.

The preferred means for retaining the support member in an orthogonal position or in any position against the chest wall or body is an elongated strap which is adapted to be affixed to the support at the area where the elbow is supported and extends around the neck of the patient down to and around the distal end of the support. By the distal end of the support is meant the end at which the hand is supported. The straps may be attached preferably by a pressure sensitive device such as a Velcro pile and Velcro hook to facilitate connection of the support by the patient without the aid of others.

The main structural part of the support may be constructed exclusively of a polymeric foam material that is resilient and semi-rigid. By the term resilient is meant to describe the physical property of a material which is deformable by the pressure exerted by the weight of a limb and which will tend to recover its size and shape after the weight of the arm is removed. By the term semi-rigid is meant to describe the physical property of a material which is flexible but which has sufficient stiffness to provide substantial support to a limb. Suitable foams having these properties include selected polyurethanes foams, polyethylene foams, vinyl foams and the like.

The end of the support which is intended to be used at the upper end of the forearm and around the elbow is preferably constructed so that it is approximately from one-fourth to three-fourths, or one-half as wide as the width of the support at its widest point. The narrowed, elbow receiving end, facilitates the shaping of the semi-rigid material so that it may be custom fitted to the length of each individual patient's forearm. This feature also prevents the distortion of the shape of the main part of the support between the hand and the upper forearm.

The support of the invention may be custom fitted to each patient as described hereinafter or may be made in three or four or more standard sizes which will be adjustable to practically any individual by means of the specially shaped elbow portion.

The main structural part of the support may be optionally provided with a plurality of apertures which extend from the upper to the lower surface thereof. These apertures provide a means of reducing the total weight of the support although the primary objective is to allow the evaporation of perspiration from the supported limb while allowing air to circulate and keep the limb cool.

The apertures may be made by drilling or punching holes in the main structural part. The configuration of the holes and spacing thereof is not critical provided that the size, number and spacing should not adversely affect the structural integrity of the support so that the support will lose its desired configuration.

The support is advantageously provided with suitable means to retain the forearm within the main structural part. These means will usually comprise one or more straps which are spaced at strategic locations on the support. These straps may be provided with suitable fasteners to permit the patient to secure the forearm within the support in an optimum position without assistance. For this purpose, a pressure sensitive device may be employed. The support may be made in any color with any design or may be covered with printed fabrics to secure patient acceptance. The hand may also be secured to the support by means of a single or multiple loop arrangement of fabric or other suitable material such as plastic strips, elastic webbing and the like. When the support is to be used by a hemiplegic individual such as a victim of a cerebral vascular accident, the use of means to secure the finger and thumb to the surface of the main structural support is believed to be especially advantageous as it helps to prevent and treat the spasticity of the hand commonly seen in such individuals.

This invention also provides a novel method of supporting the forearm, including the elbow and hand, of a patient. The method comprises supporting the forearm in a resilient, semi-rigid support member adapted to partially encircle and conform generally to the shape of said partially encircled forearm when said forearm is positioned against the chest wall or body preferably in an orthogonal position relative to the upper arm with the forearm pronated and the wrist and hand in a functional position and employing means to retain said support member generally in said orthogonal position by attaching said support to the patients' clothing or body.

Generally it is preferred to position the support so that the hand will be elevated slightly above the level of the elbow. This is done to assist circulation and prevent undue stress on the shoulder, wrist or hand. The term "functional position" refers to the position of the wrist and hand where the wrist is articulated so that the hand is slightly raised and the fingers slightly flexed.

The term "generally orthogonal" is used to describe an optimum position for the forearm in relation to the upper arm. It is not used to define a right angle but an angle which approximates a right angle and may vary from an acute to an obtuse angle of inclusion between the forearm and upper arm.

When the hand is immobilized, the preferred geometric articulation for the joints of the shoulder and arm are as follows; the wrist should be in about 20° dorsiflexion, the metacarpo-phalangeal joints in about 45° flexion (at about 135°), the proximal interphalangeal joints at about 30° (at about 150°), and the distal interphalangeal joints at about 20° flexion (at about 160°). The thumb should be in half palmer abduction and half opposition, the interphalangeal joint in a few degrees of flexion. The elbow should be at 90° flexion and the mid-prone position and the shoulder at about 45° abduction, about 30° flexion and in neutral rotation.

Pronation or pronated as used herein is meant to describe the position of the forearm when it is rotated toward the midline of the body with the thumb of the hand next to the body.

A novel method for the prevention and relief of deformities resulting from spasticity in the hand of a hemiplegic patient is also provided by this invention. This method is based on supporting the forearm, including the albow, wrist and hand by means of a resilient semi-rigid support member which is adapted to encircle and conform generally to the shape of said partially encircled forearm when said forearm is positioned against the body or chest wall preferably orthogonal to the upper arm with the forearm pronated and the wrist and hand in a functional position with the fingers and thumb held to the support member by retaining means and employing means adapted to retain said support member generally in said orthogonal position.

The hand is preferably elevated above the level of the elbow as in the method of providing support to the forearm but individual patients may prefer alternate positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, wherein a patient is shown with the support apparatus of the invention, the main structural part **10** or support member, is shown fitted to the forearm, including the elbow and hand. The strap **12** is shown in FIG. 2 in the normal use position where it extends around the elbow **14** up and over the shoulder to where it is fastened at the wrist area **16.** FIG. 3 shows a top plan view of the support apparatus. This apparatus is constructed from a cross-linked polyethylene foam of closed cell construction having a specific gravity of 0.04, and having three-sixteenths inch holes on a 1 inch square grid. It is first cut to the general outline of FIG. 3 and then heated to 200°F. Thereafter it is shaped to conform to the forearm of a patient who is protected from the heat by suitable clothing. After the support cools and sets it is removed and support strap **12** and retention straps **14** are riveted in place. Also en elbow retaining strap **16** is provided to permit custom fitting of the support to different individuals who have different size arms. These straps are of lightweight woven cotton or nylon and are provided with pressure or contact sensitive Velcro hooks and pile for fastening to the patient. Thereafter, (or before) spaced loops **18** for the fingers and individual loop **20** are sewn, adhesively bonded or riveted in place.

FIGS. **4, 5, 6, 7** and **8** provide details of the construction of the support by sections taken through the indicated points of FIG. **3.**

A male patient, age 53, who was a right hemiplegic (CVA) was fitted with the support shown in FIGS. **1–3.** He reported that this shoulder did not sublux and increased comfort was noticed as compared to prior use of a conventional sling made of an open mesh fabric.

A female patient, age 53, who was a left hemiplegic as a result of an embolic blockage at the bifurcation of the right common carotid artery was fitted with the support shown in FIGS. **1–3.** Contracture did not develop and wrist and shoulder pain, which had been a previous problem, subsided so as to eliminate the necessity for analgesics.

The term "forearm" as used hereinabove is meant to include the distal portion of the arm, including the area from the elbow to the wrist.

Although the preferred embodiments of the invention have been described hereinabove, there is no intent to limit the invention thereto, but it is intended to cover all variations thereof within the purview of those

skilled in the art and as defined by the appended claims.

I claim:

1. An apparatus for supporting the forearm, including the elbow and hand, of a patient which comprises a resilient semi-rigid support member constructed from a polymeric foam material and adapted to partially encircle and conform generally to the shape of the partially encircled forearm when said forearm is pronated with the wrist and hand held in a functional position, said support member having for receiving the elbow an extension that is narrower than the width of the support at its widest point, means adapted to detachably affix said support member to the forearm, including the hand and elbow of a patient, means for securing the fingers and thumb to the surface of said support, said support member having means attached to the support member for retaining said support member against the body with the forearm supported in a generally orthogonal position to the upperarm.

2. An apparatus as defined in claim 1 wherein said means attached to the support member comprise an elongated strap which is adapted to be affixed to the support at the area wherein the elbow is supported and extends around the neck of the patient down to and around the distal end of said support.

3. An apparatus as defined in claim 1 wherein said resilient semi-rigid support member is perforated by a plurality of apertures extending from the upper to the lower surface thereof.

4. An apparatus as defined in claim 1 wherein the means for securing the fingers and thumb to the surface of said support comprise loops of fabric sized to the individual fingers and thumb.

5. An apparatus as defined in claim 1 wherein said polymeric foam material is a polyethylene foam material.

6. A method of supporting the forearm, including the elbow and hand, of a patient, which comprises supporting said forearm in a support as defined in claim 1.

7. A method as defined in claim 6 wherein the forearm, including the elbow and hand, are supported so that the hand is elevated above the elbow.

8. A method as defined in claim 6 wherein the support member is retained generally in said position by an elongated strap which is affixed to the support at the area wherein the elbow is supported and extends up and around the neck of the patient and down to the distal end of said support.

9. A method as defined in claim 6 wherein the fingers and thumb are secured to the surface of said support by loops of fabric.

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