United States Patent [19]

Schendel

[11] **3,853,118**

[45] **Dec. 10, 1974**

[54] **SWELLING DETECTOR**

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[22] Filed: **Aug. 29, 1973**

[21] Appl. No.: **392,848**

[52] **U.S. Cl.** ..... **128/2 S**, 73/379 R

[51] **Int. Cl.** **A61b 5/10**

[58] **Field of Search** ... 128/2 S, 2 R, 2.05 E, 2.05 P; 73/379; 119/1

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[57] **ABSTRACT**

A swelling detector for detecting the swelling in a member of a patient's body which includes a pressure responsive transducer applied to the member for monitoring changes in the volume thereof.

1 Claim, 3 Drawing Figures

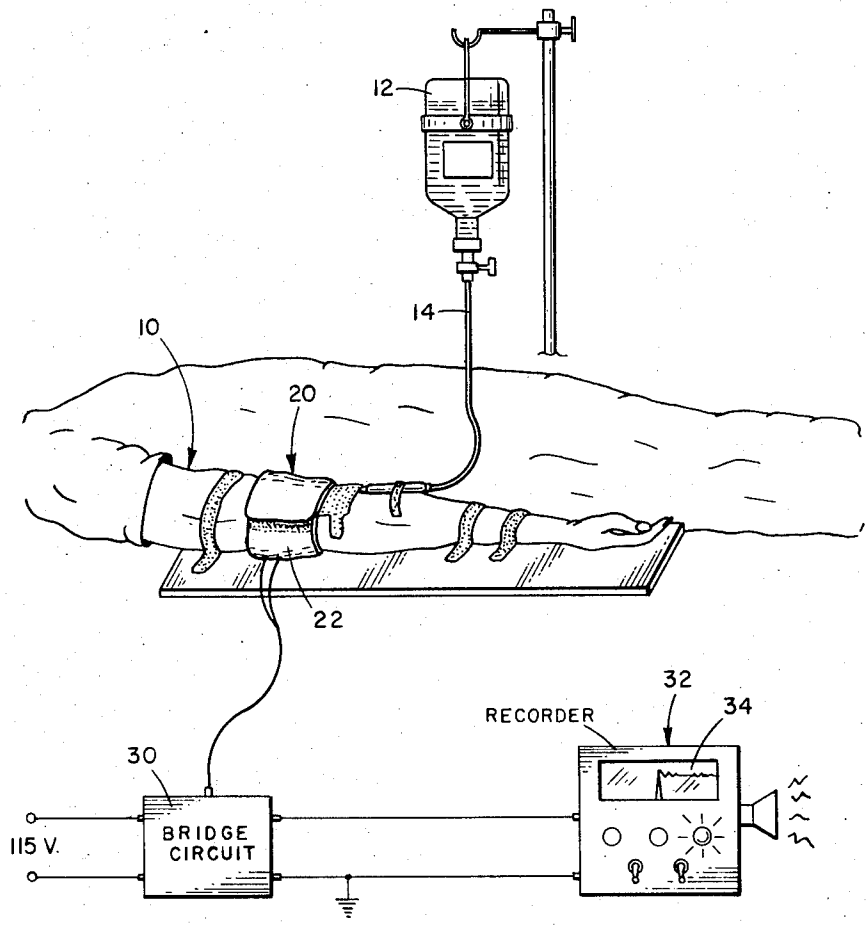
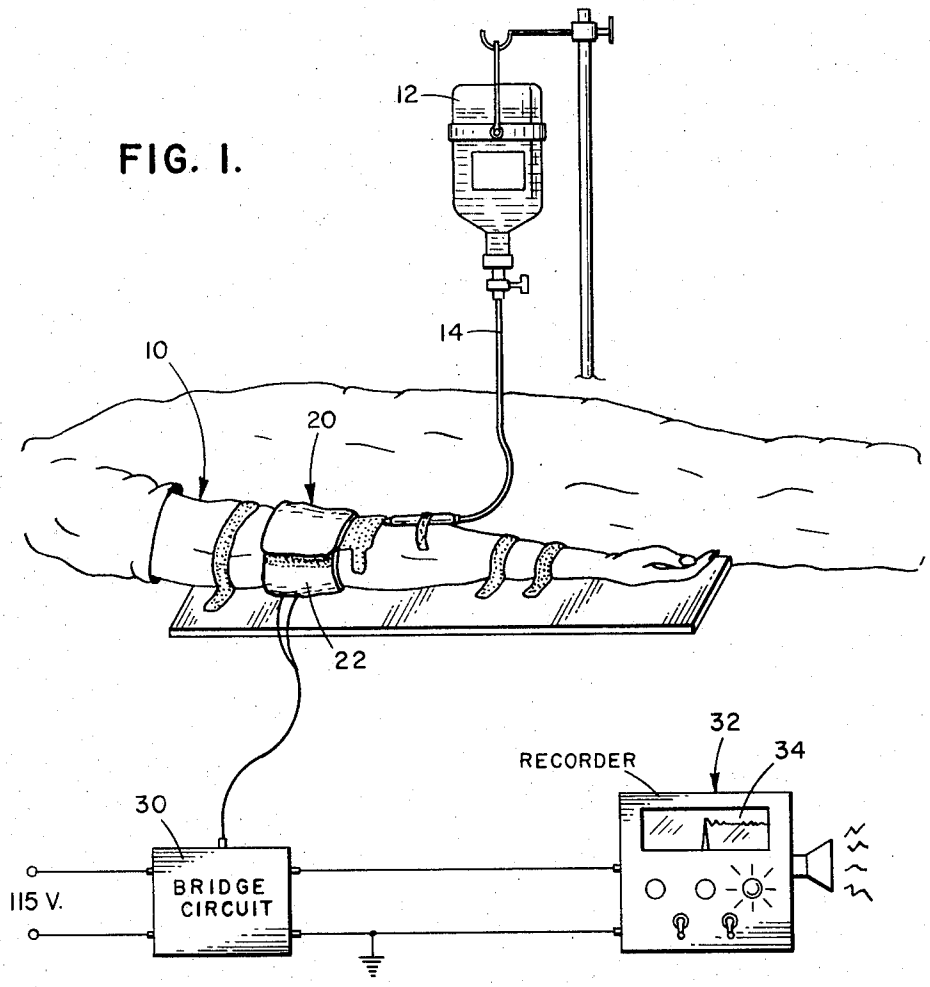


FIG. 1.



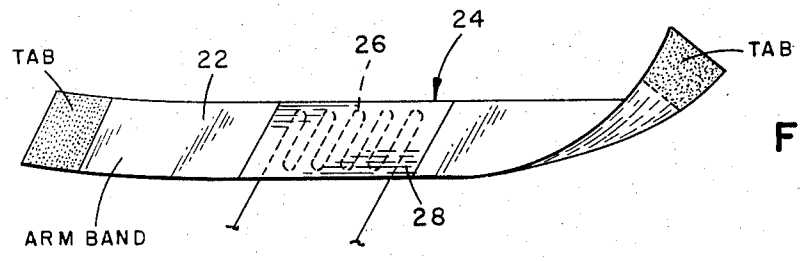


FIG. 2.

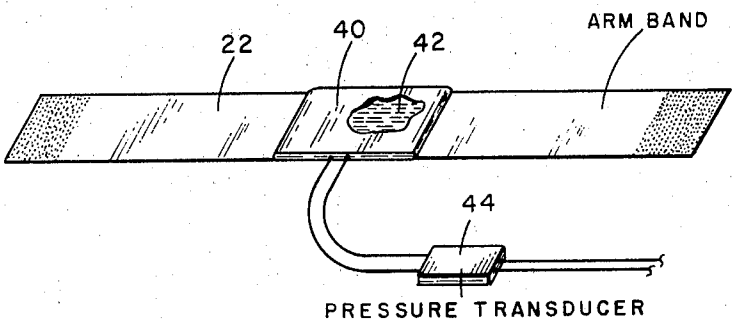


FIG. 3.

SWELLING DETECTOR

BACKGROUND OF THE INVENTION

Intravenous alimentation is extensively used in hospitals on patients of various ages including infants. When an intravenous needle accidentally moves out of the blood vessel, the liquid being delivered spreads into the surrounding tissues causing painful swelling thereof. When such abnormal delivery is detected at an early stage, the liquid-delivery means can be stopped and the swelling prevented.

Accordingly, it is a broad object of the present invention to provide a swelling detector for use on portions of a patient's body for detecting swelling thereof.

SUMMARY OF THE INVENTION

This invention provides a swelling detector for detecting the swelling in a patient's body member to which liquid-delivering means are inserted into a blood vessel thereof for delivering liquid thereto. A pressure-responsive element is constructed and arranged to be attached to the member, near the liquid-delivering means, for detecting a change in the pressure exerted by the member. The output signal from the pressure-responsive detector is indicative of the swelling of the member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic representation of the swelling detector of the present invention;

FIG. **2** shows one type of pressure transducer that can be used in the detector of FIG. **1**; and

FIG. **3** shows another type of pressure transducer.

Referring now to FIGS. **1** and **2** of the drawings, there is shown a portion of a body of a patient, such as an arm **10,** to which is coupled an intravenous feeding device **12** from which a suitable liquid is fed through a conduit **14** into a needle (not shown) inserted in a blood vessel of the patient.

Under normal operating conditions the needle remains in the blood vessel and the liquid is fed into the blood circulation system of the patient. Under abnormal operating conditions, however, the needle may withdraw from the blood vessel thereby causing the supplied liquid to spread into adjacent tissues resulting in swelling thereof.

The swelling is almost instantaneous and accordingly it is desired to detect an intravenous-feeding abnormality as soon as the swelling starts. The swelling detector, generally designated as **20,** typically includes but is not limited to a band or tape **22** to which is secured a pressure transducer generally designated as **24** for measuring the change in pressure produced by the expansion

of the body member. The pressure transducer is arranged to produce an output warning signal which can be mechanically, optically, or electronically amplified.

One type of pressure transducer (FIG. **2**) that can be employed is a strain gauge **26,** say of the bonded electric resistance type, consisting of a length of fine wire, say 0.001 inch in diameter formed into a grid and cemented between two pieces of thin paper **28.** The strain gauge is suitably cemented to the band **22.** As the band becomes stretched due to the swelling, the wire grid faithfully follows the deformations of the band in tension, and the length and cross-sectional area of the wire change. This causes the electrical resistance of the wire to change. Even though this resistance change is small, often a fraction of an ohm, a suitable bridge network **30** can be used to detect such small variations. The strain gauge is sensitive enough to detect strains as low as 0.0001 inch per inch or better.

The bridge network **30** can be made to feed an alarm signal to a central station **32** having a recorder **34** for continuously monitoring the condition of one or more swelling detectors **20** on patients in the hospital. A suitable visual or audio alarm can be obtained from the recorder upon the occurrence of an abnormality in a patient's intravenous feeding system.

Pressure-responsive elements other than strain gauges can of course be employed. For example, it may be desirable to employ a pressure detector (FIG. **3**) containing a fluid **42** (gas or liquid) in an envelope **40** and to monitor with a pressure transducer **44** the pressure variations in the fluid in response to an expansion in the patient's body member caused by swelling. Other variations will readily become apparent to those skilled in the art.

What is claimed is:

1. In a method for delivering a liquid through a needle into a blood vessel of a patient's arm whereby under normal conditions the needle remains in the blood vessel and the liquid is fed into the blood circulation system of the patient, and under abnormal conditions, the needle withdraws from the blood vessel thereby causing the supplied liquid to spread into adjacent tissues, the spreading of the liquid resulting in swelling of the arm, said method comprising:

attaching a band around said arm near said needle, the band containing a fluid chamber, the pressure of said fluid in said chamber increasing with the swelling of said arm,

coupling a pressure transducer to said chamber for detecting the pressure increase in said chamber, and converting the pressure increase to a warning signal of said abnormal conditions.

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