BLOOD DETECTING DEVICE

Inventor: Wendell V. Clipp, 900 Robertson Academy Rd., Nashville, Tenn. 37220

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Primary Examiner—Aldrich F. Medbery
Attorney, Agent, or Firm—Harrington A. Lackey

ABSTRACT

A blood detecting device including an elongated, flexible tape member comprising an electrical insulating member supporting a pair of electrical conductors connected to a circuit including a source of electrical energy and an electrically energized signal for application to an area likely to be exposed to the flow of blood, such as the body of a human or animal or to conduits of blood in blood handling apparatus.

1 Claim, 5 Drawing Figures
BLOOD DETECTING DEVICE

BACKGROUND OF THE INVENTION

This invention relates to a blood detecting device, and more particularly to an electrical blood detecting device.

Heretofore, the detection of bleeding in human or animal patients, or the leakage of blood from blood-handling apparatus, has been detected by human observation. One particular need for such detection is in the process known as dialysis of patients having kidney failure. Such detection is necessary, not only upon the bandaged areas of the patients, but also upon the various conduits and joints handling the flow of blood in the dialysis machines. The dialysis process is only one example of numerous situations in which the automatic detection of blood is needed.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a blood-detecting device including an insulating member supporting a pair of spaced conductors which form an open switch in an electrical circuit including an electrical energy source, such as a battery, and an electrically energized signal means of any type whether visual or audible. When the insulating member is secured in a position where it is exposed to the flow of blood, the liquid blood bridges the open gap between the conductors. Since blood is an electrolyte, it electrically closes or short-circuits the conductors to energize the signal means to warn of the presence of blood.

The insulating material may be any type of material which supports the conductors in spaced relationship, and preferably which is non-toxic. Preferably, the permeable insulating material should be a flexible fabric, such as cloth or a bandage, so that it may conform to the area exposed to the possible flow of blood, such as the limb of a human or animal patient or a blood tube, upon which the flexible insulating member may be wrapped, or otherwise secured.

The electrical conductors may be in the form of small aluminum strips which may be secured by adhesive to a flexible bandage or other type of insulating fabric.

The signal means and the electrical voltage supply may be small enough to be portable, or even small enough to be secured directly to the patient, or they may be large and sophisticated enough to form the components of an electronic monitoring system for an entire hospital.

BREIF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one form of the blood-detecting device in which all of the components are mounted on the arm of a human patient;

FIG. 2 is a schematic diagram of a blood-detecting device in which the signal means is a bell;

FIG. 3 is a section taken along the line 3-3 of FIG. 2;

FIG. 4 is a schematic diagram of a modified form of the invention in which the signal means is a central alarm system; and

FIG. 5 is a section taken along the line 5-5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in more detail, the blood-detecting device 10 made in accordance with this invention includes an electrical insulating material, which may be permeable to the flow of blood, such as a flexible sheet of textile fabric in the form of an elongated gauze bandage strip 11. In FIG. 1, the gauze bandage strip 11 is long enough to be wrapped about the forearm 12 of a human patient to cover an incision or wound from which bleeding would be likely to occur. The gauze bandage 11 may be wrapped upon itself and secured by any convenient means, such as adhesive tape 13. Bandage clips may also be used if desired.

Fixed to the gauze bandage 11 by any convenient means, such as an adhesive, to form an elongated, flexible tape member, are a pair of electrical conductors in the form of aluminum foil strips 14 and 15. These foil strips 14 and 15 are parallel to each other on one surface of the bandage strip 11 and spaced apart sufficiently that there will be no electrical contact between the conductors 14 and 15 so long as the bandage 11 is dry. As disclosed in FIG. 1, the conductor strips 14 and 15 extend the entire length of the bandage 11.

One end of the conductor 14 is connected to an electrode 16, while one end of the conductor 15 is connected to an electrode 17. Both electrodes 16 and 17 are connected in the electrical circuit 18. Connected in series in the electrical circuit 18 is a source of electrical energy, such as battery 19, and an electrically energized signal member, such as the electric lamp 20, in FIG. 1. In FIG. 1, the battery 19 and the lamp 20 are small enough, that is sufficiently miniaturized, that both may be secured to the forearm 12 adjacent the bandage 11 by a securing member, such as adhesive tape 21.

Thus, assuming that a medical patient recovering from surgery in a hospital room has an open wound in his forearm subject to possible bleeding, then the device 10 is applied to the forearm 12 as illustrated in FIG. 1. Bandage 11 is wrapped around the forearm covering the wound and secured by adhesive tape 13, or other securing means. If the electrodes 16 and 17 are detachable, they are connected into the circuit 18 and to the conductors 14 and 15. The battery 19 and lamp 20 are also secured to the forearm 12 by the adhesive tape 21.

If the patient is awake, but is so anesthetized that he would normally not feel blood flowing from his wound, and particularly if the wound was on the backside of his forearm, then the detecting device 10 would be energized when the blood permeated the bandage 11 sufficiently to electrically bridge the space between the conductors 14 and 15, thereby closing the circuit 18 and energizing the lamp 20. The illuminated lamp 20 would call the patient's attention to his situation, and he could immediately depress the call-button to summon a nurse to remedy the bleeding.

If the patient is asleep, the illuminated lamp 20 could be observed by a nurse making her rounds of the rooms. It is also possible that the heat from the illuminated lamp 20 might be great enough upon the patient's forearm 12 to awaken the patient and alert him to the bleeding.

FIG. 2 discloses a modified detecting device 30 including all of the elements of the device 10 except that
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a bell 24 has been substituted for the lamp 20. The bell 24 could be small enough to be mounted on the patient’s arm in a manner similar to the device 10 in FIG. 1, or it could be a larger bell adapted to be mounted in any position where it could be heard by the patient, or by the nurse. The bell 24 could even be located at a remote location for centralized monitoring.

The circuit 18 could also be energized by the substitution of an electrical connector, in place of the battery 19, which could be inserted in a mating receptacle in the existing house circuit. Of course, if the house circuit is A.C., then a transformer must be included in the circuit 18 in order to convert the A.C. current to D.C. current if the signal member is D.C.-operated.

FIG. 4 discloses a modified detector 40 in which any type of central alarm system 25 is substituted for the lamp 20 or the bell 24 for monitoring at a remote station. Also, in the device 40, the conductors 14' and 15' (FIG. 5) are fixed on opposite sides or faces of the gauze sheet 11 so that the conductors 14' and 15' are separated only by the thickness of the bandage 11 to form an elongated, flexible tape member. Of course, the conductors 14' and 15' could be staggered on opposite sides of the bandage 11 to increase the spacing between conductors to make it less sensitive.

The detecting device 10 would also be adaptable for applying to wounds on animals so that any bleeding of the animal could be detected by visual or audible means, even when the animal is not in the immediate vicinity of its master or the veterinarian.

The flexible insulating member 11 could be of any other material adaptable for wrapping conduits or tubes through which blood flows in machines or apparatus adapted for the handling of blood, such as a dialysis machine. A detector device, such as 10, could be positioned in areas of particular vulnerability, such as connecting joints which might accidentally become loosened, or about blood tubes in which the walls are unusually thin to detect possible rupture of the tube. Such devices would be invaluable for blood-handling machines, such as dialysis machines, where they are installed in the home, and where only limited personnel are available for observing and monitoring the machine.

Devices such as 10, 30 and 40 could also be applied to blood containers at sensitive or vulnerable points to leakage, in storage or in actual use. It will also be understood that numerous types of signal devices could be used in addition to electric lamps and bells, such as various types of electronic sound-emitting devices, or an electrically energized shocking device to be applied to some portion of the patient’s body to provide a stimulating warning.

It is also important that all of the components, particularly the insulating member, conductors and electrodes be sterile and non-toxic to blood.

What is claimed is:

1. A blood detecting device comprising:
a. an elongated, flexible tape member, the length of said tape member being substantially greater than its width, and said tape member being long enough and flexible enough to wrap spirally around the limb of a patient or a blood tube,
b. said tape member comprising an elongated, flexible, electrical insulating strip of substantially uniform width, relatively thin, and having opposite faces,
c. said tape member further comprising a pair of elongated, flexible, electrical conductor strips of substantially uniform width, of substantially the same length as said insulating strip, and impermeable to fluids,
d. adhesive means permanently fixing said conductor strips on the opposite faces of, and longitudinally coextensive with, said insulating strip, so that said conductor strips are spaced opposite each other and are separated only by the thickness of said insulating strip,
e. said conductor strips having first longitudinal edges in alignment along the thickness of said insulating strip, and second longitudinal edges in alignment along the thickness of said insulating strip, each of said edges being adjacent and spaced apart a distance not exceeding said thickness,
f. electrically energizable signal means connected to said conductor strips,
g. means for supplying an electrical voltage across said conductor strips, and
h. means for securing said tape member wrapped about the limb of a patient or a blood tube, likely to be exposed to the flow of blood, so that the presence of blood between the aligned longitudinal edges of said conductor strips will short-circuit said conductor strips to energize said signal means.

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