

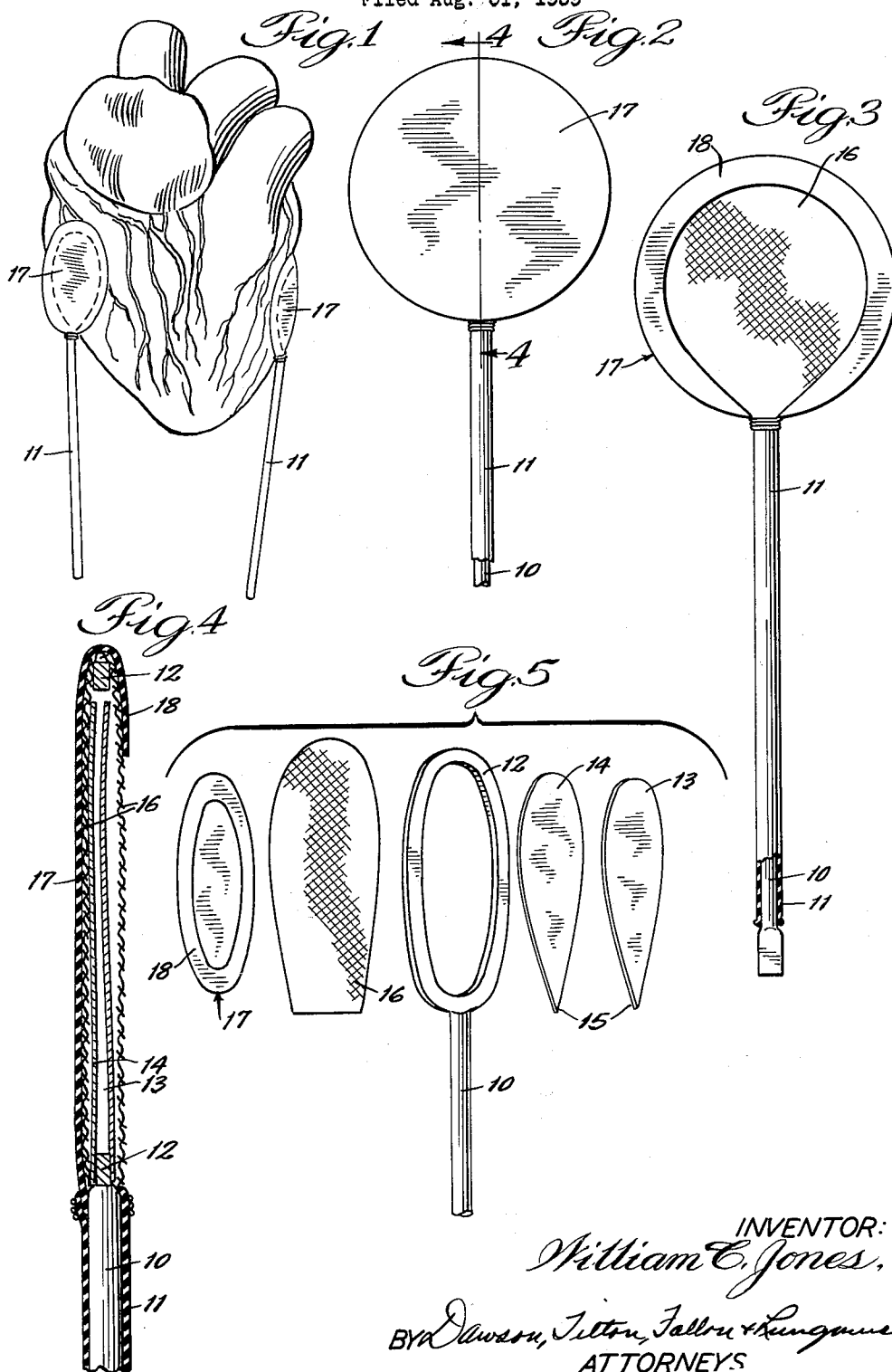
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TISSUE CONTACT ELECTRODE

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TISSUE CONTACT ELECTRODE

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This invention relates to a tissue contact electrode. The electrode is particularly useful in the treatment of the human heart during an operation to stop the action of the heart.

Electrodes have been employed during operations upon the heart to stop heart action by high voltage treatment, but considerable difficulty has been experienced in the making of broad contact with the irregular surfaces of the heart. Where contact is made over a very small area under the high voltage conditions employed, injury to the heart tissue occurs because the small area is exposed to a very high voltage discharge. Efforts to broaden the area contact while at the same time permitting the electrode to be placed against different irregular portions of the heart have not met with success.

An object of the present invention is to provide a tissue contact electrode which adapts itself to the irregular surfaces of the heart or other tissue against which it is applied while at the same time maintaining the contact over an extensive area. A further object is to provide an electrode of simple and inexpensive construction which may be applied at will to various portions of the heart or other irregular tissue material so as to provide wide and uniform contact therewith while at the same time shielding the electrode from contact with other adjacent tissue. Yet another object is to provide an electrode having a flexible or floating conductor surface adaptable under contact to the contour of the tissue against which it is pressed, while also providing a backing which insulates the rear portion of the electrode instrument and providing a variable front contact surface through which the electrode conductor is brought in contact with the tissue. A still further object is to provide, in combination with a flexible conductor, a fabric or gauze sleeve enclosing the same and made effective as a conductor by a liquid electrolyte. Other specific objects and advantages will appear as the specification proceeds.

The invention is shown, in an illustrative embodiment, by the accompanying drawings, in which—

Fig. 1 is a front view in elevation of a human heart to which is applied electrodes embodying my invention; Fig. 2, a broken rear view in elevation of the electrode structure; Fig. 3, a front view in elevation of the electrode structure; Fig. 4, an enlarged detail sectional view, the section being taken as indicated at line 4—4 of Fig. 2; and Fig. 5, an exploded perspective view showing the components of the electrode in spaced-apart relation.

In the illustration given, 10 designates an electrode stem of brass or other suitable conductive material and preferably enclosed within an insulating sleeve 11. The stem is connected by suitable connections to a source of electric current.

The upper end of the stem 10 is welded, brazed, or otherwise secured to a support ring 12 of brass, copper, or other suitable conducting material, and the ring may be of circular, oblong, square, or other suitable shape for receiving the flexible contact components which will now be described.

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To the ring 12 is secured a pair of foil members 13 and 14, preferably consisting of conductive material such as aluminum, aluminum alloy, etc., and the foil sheets preferably fit uniformly within the interior of the ring 12. The foil members 13 and 14 preferably have tapered end portions 15 which are preferably wrapped around the ring 12 to secure them firmly to the ring. If desired, the end portions 15 may be integral, and after being looped around the ring 12, the end portions may be bent over against the ring to lock the pieces firmly upon the ring. With this arrangement, the electrode foil members 13 and 14 are supported in a floating position and their highly flexible character permits them to adapt their contour to the contour of the heart or other tissue against which they may be pressed.

I prefer to enclose the ring 12 and the members 13 and 14 therein with a gauze sock or sheath 16, and the lower end of the sheath may be tied with thread about the neck of the stem 10. In order to prevent loose threads from being exposed, I prefer to turn the gauze bag 16, after it has been formed, inside out so that the raw or sewn edges of the bag will be on the interior of the bag. With the sheath or bag 16 in place, I next secure an insulation backing 17, preferably formed of latex, flexible plastic, etc., around the ring 12 and sheath 16, as shown best in Fig. 4. Preferably, the insulating backing 17 is brought forwardly around the front of the ring 12 and inwardly thereof so as to provide the insulation about a portion of the front of the instrument and leaving only an inner surface of the sheath 16 exposed, as shown best in Fig. 3. The front border portion 18 of the insulation backing 17 may be varied to increase or diminish the exposed surface of the gauze 16, as may be observed from Fig. 3.

The backing 17 of latex, Teflon, or other insulating plastic material, not only serves as an insulation but also as a rear support for pressing the electrode foil members 13 and 14 forward in the contacting operation. In this action, the backing 17 moves to a convex shape, as illustrated in Fig. 1, so that in such contacting position the flexible but sturdy insulating backing 17 is in a dish position, holding the electrodes 13 and 14 and the enclosing sheath 16 in a position tightly engaging the tissue of the heart, etc.

In the operation of the electrodes as, for example, when the action of the heart is to be stopped, saline solution is applied to the gauze sheath 16 of each electrode so as to provide a liquid electrolyte or conductor, and the contacts are brought to the position illustrated in Fig. 1, a voltage such as, for example, 160 volts, being applied through the electrodes. The current flows through the stem 10, ring 12, foil conductors 13 and 14 and the conductive liquid electrolyte to the tissue so as to give an extensive uniform current flow over a wide area. Even though the heart or tissue has very irregular surfaces, it is found that the electrode adapts itself to such surfaces so that there is no localized overtreatment. At the same time, the flexible backing 17 protects tissue about the heart, etc. from injury, and the treatment is concentrated upon the selected tissue.

While I have shown a backing and foil contact members which will assume a dish shape in contact with tissue, it will be understood that these members may, if desired, be formed in a concave or dish shape initially. I prefer, however, to have the flexible materials as described, which will assume the dish and other shapes necessary for maintaining the wide area of uniform contact as above described, the parts assuming the dish or other irregular shape only when pressed against the heart or other tissue.

If desired, the sheath 16 may be impregnated along

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the rear side and border portions with latex or other insulating material to form the backing 17.

While, in the foregoing specification, I have set forth a specific structure in considerable detail for the purpose of illustrating the invention, it will be understood that such details may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. A tissue contact electrode, comprising a conductor stem, a conductor ring carried by said stem at one end thereof, a flexible conductor sheet anchored to said ring and extending within said ring, and a flexible insulating envelope secured to said ring and enclosing the rear side thereof.

2. The structure of claim 1 in which a gauze sheath extends over said ring and within said envelope.

3. An electrode adapted for contact with a human heart, comprising a conductor stem, a conductor ring carried by said stem, a flexible conductor sheet anchored to said ring and extending within said ring, a flexible sheath enclosing said ring and conductor sheet and

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moistened with a liquid electrolyte, and an insulating backing member enclosing said ring and the rear portion of said sheath.

4. An electrode adapted for contact with the heart, comprising a stem conductor, a conductor ring carried by said stem, a pair of flexible conductor sheets extending within said ring and having portions wrapped about said ring, a flexible porous sheath extending about said ring and conductor sheets and adapted to be moistened with saline solution, and a resilient insulating backing enclosing said ring and the rear portion of said sheath.

5. The structure of claim 4 in which said conductor sheets are formed of metal foil.

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