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[54] **ELECTROSURGICAL APPARATUS TO**
COAGULATE BIOLOGICAL TISSUES
2 Claims, 4 Drawing Figs.

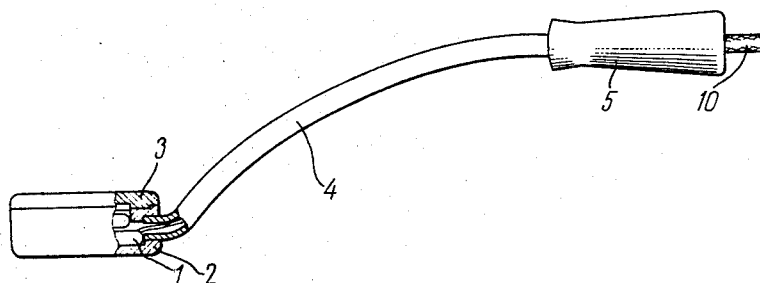
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ABSTRACT: An electrosurgical instrument comprises a box of heat-conducting metal with a cover thereon forming a hermetic enclosure in which there is contained in isolation a heating element and a temperature transmitter. A tubular holder is connected to the enclosure and to a handle and connectors pass through the holder and handle to a temperature-measuring circuit with an indicator and a switch control power circuit adapted for connection to a power source. The temperature-measuring circuit is connected to the transmitter and the power circuit is connected to the heating element, the power circuit and temperature-measuring circuit being contained in a common unit.



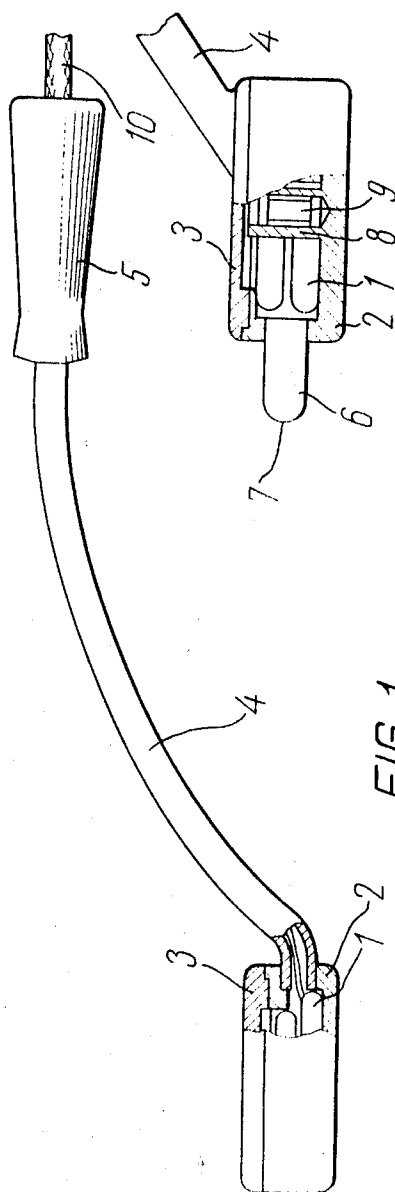
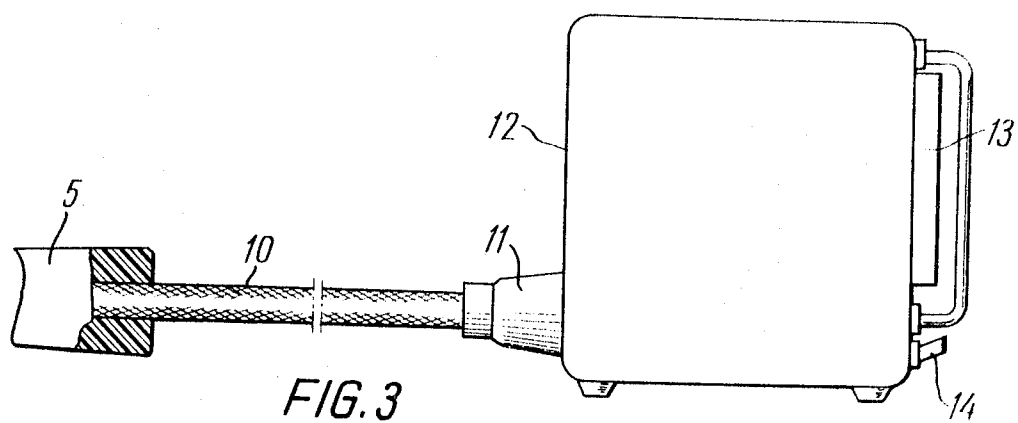
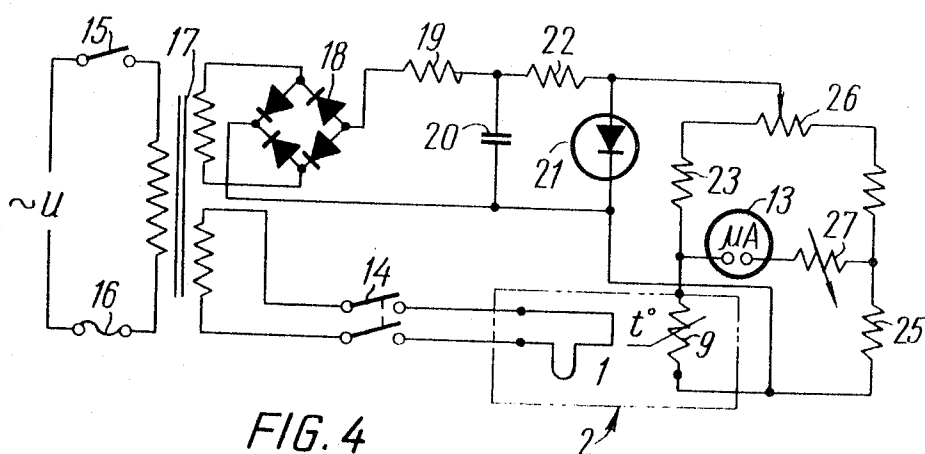


FIG. 2

FIG. 1



ELECTROSURGICAL APPARATUS TO COAGULATE BIOLOGICAL TISSUES

The present invention relates generally to surgical apparatus and instruments and more particularly to electrosurgical apparatus to coagulate biological tissues.

Known in the art are apparatus termed galvanocauters and thermocauters whose tips or prongs are adapted to be heated with an electric arc or with an electric heater to coagulate biological tissues.

A disadvantage inherent in the aforesaid apparatus resides in that their application in surgical operations involving the use of dangerously explosive narcotic mixtures may result in possible accidental combustion of the latter caused by a heated-up tip or an electric spark.

Moreover, the employment of the aforementioned apparatus to coagulate a large-area biological tissue, e.g. to stop parenchymatous bleeding from the lung (pneumorrhagia parenchymatosa), occupies much time since only a very small area of the tissue under treatment is liable to coagulate upon contacting the heated-up tips or the electrodes of the apparatus involved. As a result, a superfluous loss of blood in the patient under operation occurs.

A further disadvantage of said apparatus is that their application may lead to the necrosis of the area under treatment that penetrates for a considerable depth and is caused by high temperatures involved in cauterization which is undesirable in coagulation process.

In keeping with the foregoing an object of the invention is the development of an electrosurgical apparatus to coagulate biological tissues which will ensure full safety when used in surgical operations involving the employment of dangerously explosive narcotic mixtures and will be capable of quickly and reliably coagulating the superficial layer of both large- and small-area biological tissues to be treated.

With a view to achieving this object, in an electrosurgical apparatus to coagulate biological tissues by virtue of an electric heater, according to the invention the latter is essentially a closed metal box provided with a holder and adapted to accommodate a heating element therein.

The aforesaid box is provided with a pin-shaped projection to coagulate the local areas of the biological tissue being treated.

Said object is achieved also by the fact that there is a recess inside said box to accommodate a temperature transmitter thus isolated from said heating element.

An embodiment of the present invention is illustrated in the accompanying drawings, wherein:

FIG. 1 is a diagrammatic view, partly in section, of the working portion of the electrosurgical instrument for coagulating biological tissues, according to the invention;

FIG. 2 is an alternative embodiment of the instrument box incorporating a projection and provided with a recess to accommodate a temperature transmitter, according to the invention;

FIG. 3 diagrammatically shows partly in section, the connection of the electric measuring unit to a cable connected to a handle; and

FIG. 4 is a circuit diagram of the electric measuring unit of the instrument, according to the invention.

As it can be seen from FIGS. 1 and 2, the electrosurgical instrument to coagulate biological tissues, according to the invention, comprises an electric heating element 1 mounted inside a box 2 which is made of a heat-conducting metal and is hermetically closed with a cover 3. The box 2 with the cover 3 can be a parallelepiped or cylinder with chambered or rounded-off edges thereof.

Secured on the box 2 (FIG. 1) or on the cover 3 (FIG. 2) is a holder made as a tube 4 one of whose ends is adapted to communicate with the inner space of the box 2, whereas the other free end of the tube carries a handle 5 (FIG. 2). The shape of the tube 4 in FIG. 1 is selected to suit the purpose of convenience in manipulating the instrument during intrathorax operations.

A pin-shaped projection 6 is provided on the outside of one of the walls of the box 2 (FIG. 2), the free end 7 of projection 6 being rounded.

Provision is made inside the box 2 for a recess 8 to accommodate a temperature transmitter 9 isolated from the heating element 1.

Both the heating element 1 and the temperature transmitter 9 are connected to an electric measuring unit 12 by way of a flexible cable 10 (FIG. 3) running inside the tube 4 and the handle 5, and through the intermediary of a plug-and-socket connector 11. The unit 12 incorporates a temperature-measuring circuit incorporating an indicator 13 whose scale is calibrated in terms of degrees Centigrade.

Additionally, the unit 12 incorporates a device for switching the heating element 1, on and off said device being made, in particular, as a switch 14. As an alternative said element can be controlled automatically.

The apparatus disclosed herein functions as follows.

Prior to starting the coagulation procedure, the unit 12 is to be connected to the power source, e.g. an AC network, whereupon the heating element 1 is switched on through the use of the switch 14. Then the degree of heating of the metal box 2 is controlled by reading the scale of the indicator 13. Once the box 2 has been heated to the required temperature, the tissue under treatment is caused to coagulate through the contact of the surface of the box 2 therewith. To treat small-area biological tissues, as well as those located in relatively inaccessible places, use is made of the rounded surface 7 of the projections 6. As the box 2 cools, the heating element is periodically switched on. The thermal capacity of the metal of the box 2, is sufficient to ensure that the box does not become appreciably cooled within the time interval spent for performing an operation and, therefore, needs reheating.

The electric parameters of the heating element 1 are so selected that the steady-state temperature of the box is below the critical ignition point of the narcotic mixture used. Practically, when treating parenchymatous tissue the box is expediently heated up to 100° to 110° C. and in the case of muscular tissue, up to 110° to 140° C.

The duration of the coagulation procedure by the herein disclosed instrument when used, e.g., to stop parenchymatous bleeding (in particular, in the case of the lung ablation or of variously extended pleurectomy), is 5 to 15 sec.

What we claim is:

1. An electrosurgical instrument comprising a box of heat-conducting metal, a cover on said box and forming a hermetic enclosure therewith, a tubular holder having one end connected to said enclosure and an opposite remote end, a handle connected to said remote end of the holder, a heating element in said enclosure, said enclosure defining a recess isolated from said heating element, a temperature transmitter in said recess, connector means passing through said holder and handle and connected to said heating element and temperature transmitter, and a unit connected to said connector means and disposed beyond said handle, said unit including a temperature-measuring circuit with indicator means connected to said transmitter and means for selectively connecting the heating element to a power source.

2. An instrument as claimed in claim 1 comprising a projecting pin connected to and extending from said enclosure to coagulate local areas of biological tissue being treated.