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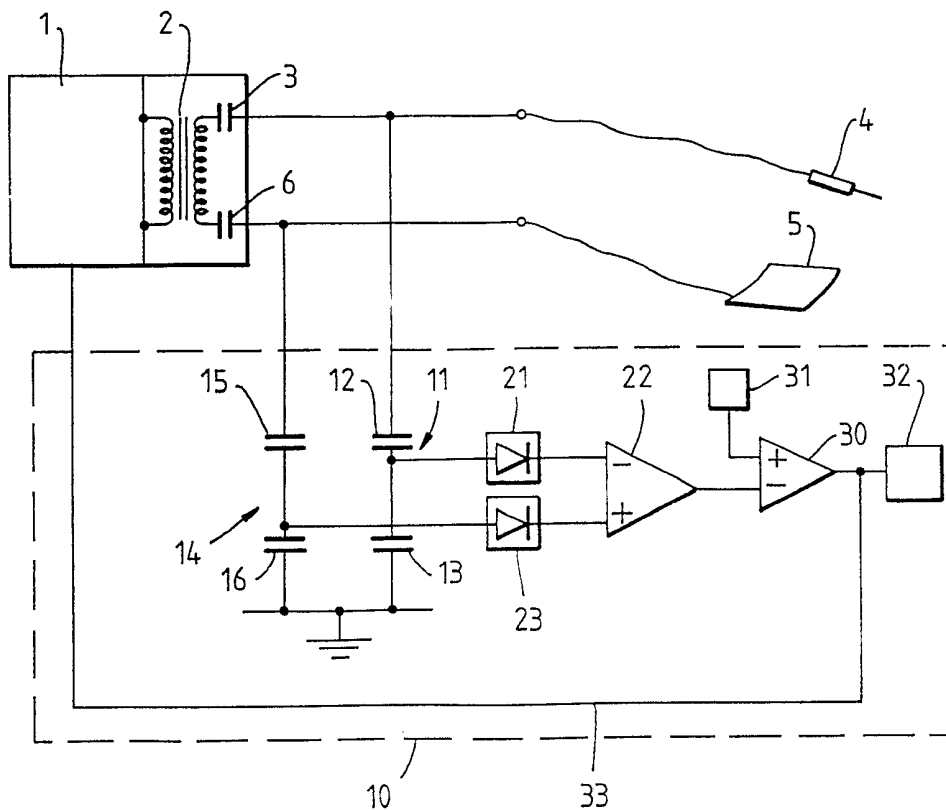
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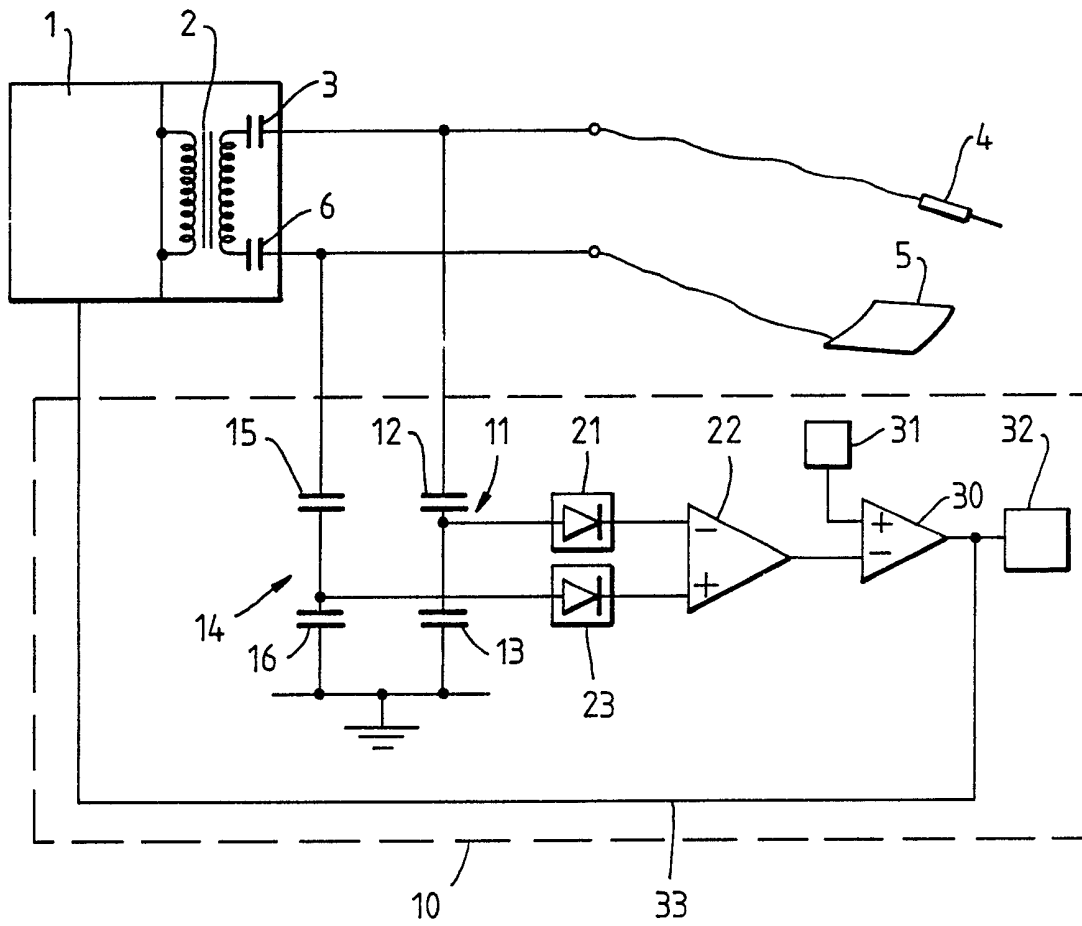
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(54) Electrosurgery equipment

(57) Electrosurgery equipment has an alarm circuit 10 for detecting when a return plate electrode 5 is incorrectly attached. Capacitive dividers 11 and 14 are connected between earth and each of the r.f. supply line to the active electrode 4 and the return line from the plate electrode 5. The outputs of the capacitive dividers are supplied through respective rectifiers 21 and 23 to the two inputs of a differential amplifier 22 which provides an output to one input of a comparator 30. When the output of the amplifier 22 rises above a reference source 31, an alarm signal is produced which inhibits the power supply 1 and gives an audible alarm.





ELECTROSURGERY EQUIPMENT

This invention relates to electrosurgery equipment .

Electrosurgery equipment is used to perform cutting or coagulation operations during surgery. Radio frequency current is supplied to an active, hand-held electrode that the surgeon manipulates in order to perform the operation. Current is returned to the electrosurgery generator via a large area plate which is attached to a part of the patient's body. The large area of the return plate ensures that there is a low current density in this region, so that the patient's tissue is not damaged.

One of the problems with electrosurgery equipment of this kind is that the return electrode may separate from the patient so that the contact area is reduced. This can lead to burning of the tissue in the regions where the plate and patient tissue contact. One way of overcoming this problem is to use a return plate electrode that is divided into two parts which are isolated electrically from one another. When the plate is in good contact with the patient's tissue, there will be a low resistance between the two parts of the electrode. By monitoring the resistance between the two parts of the electrode it is possible to detect when the electrode becomes separated from the patient and to cause an alarm or disconnection of the power supply. The problem with this arrangement, however, is that it is necessary to use a special plate electrode.

It is an object of the present invention to provide equipment that does not require a special plate electrode.

According to one aspect of the present invention there is provided electrosurgery equipment including an r.f. power supply arranged to supply power to an active electrode and having a return path via a large area plate electrode, means for measuring the difference between the voltage on the active electrode with respect to earth and the plate electrode with respect to earth, and means for providing an alarm signal when the voltage on the plate electrode rises relative to the active electrode by more than a predetermined amount with respect to earth.

The alarm signal may be provided to inhibit the output from the power supply. The voltage difference measuring means may include a first capacitive divider connected between the active electrode and earth and a second capacitive divider connected between the plate electrode and earth. The equipment may include a differential amplifier having one input connected with the first capacitive divider and another input connected with the second capacitive divider. The equipment may include a comparator that receives at one input the output of the differential amplifier and at another input a reference signal, the comparator being arranged to provide the alarm signal when the output of the differential amplifier rises above the reference signal.

Electrosurgery equipment in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawing which shows the equipment schematically.

The electrosurgery equipment includes a conventional r.f. power supply 1 which provides an r.f. output via a transformer 2 and a capacitor 3 to an active, hand-held electrode 4. Return current from the patient is supplied via a large area flexible plate electrode 5 which is secured firmly to a part of the patient. The return current is supplied back to the transformer 2 via a second capacitor 6.

The equipment also includes an alarm circuit 10 which monitors correct attachment of the return plate 5 to the patient. The alarm circuit 10 includes a first capacitive divider 11 comprising a series connection of two capacitors 12 and 13 connected at one end to the supply line to the active electrode 4 and at the other end to earth. A second capacitive divider 14 comprising a series connection of two capacitors 15 and 16 is connected at one end to the return line from the plate 5 and at the other end to earth. The a.c. voltage at a point between the two capacitors 12 and 13 in the first divider 11 is rectified by a rectifier circuit 21 to produce a d.c. voltage which is applied to one input of a differential amplifier 22. Similarly, the a.c. voltage at a point between the capacitors 15 and 16 in the second divider 14 is rectified by a rectifier circuit 23 to produce a d.c. voltage which is applied to the other input of the differential amplifier 22. The differential amplifier 22 amplifies the difference between the two d.c. voltages. The output of the differential amplifier 22 is connected to one input of a comparator 30 which receives a reference voltage at its other input from a voltage source 31. The output from the comparator 30 is connected to an audible alarm 32 and to the power supply 1 via line 33.

When the plate 5 is properly attached to the patient, the patient's body provides a capacitance between the plate and earth of the order of hundreds of picofarads. This causes the a.c. voltage between the plate 5 and earth to remain low.

If the plate 5 becomes detached, or the active electrode 4 is earthed, the a.c. voltage on the plate with respect to earth will rise relative to the voltage on the active electrode.

The rectifier circuits 21 and 23 and the gain of the differential amplifier 22 are arranged such that, when the plate 5 is properly attached to the patient and the active electrode 4 is not earthed, the output from the differential amplifier is below the reference voltage. When, however, the plate 5 becomes detached, or the active electrode 4 becomes earthed, the output from the differential amplifier 22 rises above the reference level and causes the comparator 30 to generate an alarm signal.

The alarm signal is supplied both to the audible alarm 32, to provide a sound that alerts the surgeon, and to the power supply 1 to disable the output and terminate the supply of current to the patient, thereby reducing the risk of burns to the patient.

It will be appreciated that the equipment need not employ capacitive dividers but could have alternative means for measuring the difference between the voltages on the active electrode and plate electrode.

It can be seen that present invention enables an alarm signal to be produced without the need to use special electrodes.

CLAIMS

1. Electrosurgery equipment including an r.f. power supply arranged to supply power to an active electrode and having a return path via a large area plate electrode, means for measuring the difference between the voltage on the active electrode with respect to earth and the plate electrode with respect to earth, and means for providing an alarm signal when the voltage on the plate electrode rises relative to the active electrode by more than a predetermined amount with respect to earth.

2. Electrosurgery equipment according to Claim 1, wherein the alarm signal is provided to inhibit the output from the power supply.

3. Electrosurgery equipment according to Claim 1 or 2, wherein the voltage difference measuring means includes a first capacitive divider connected between the active electrode and earth and a second capacitive divider connected between the plate electrode and earth.

4. Electrosurgery equipment according to Claim 3, including a differential amplifier having one input connected with the first capacitive divider and another input connected with the second capacitive divider.
5. Electrosurgery equipment according to Claim 4, including a comparator that receives at one input the output of the differential amplifier and at another input a reference signal, and wherein the comparator is arranged to provide the alarm signal when the output of the differential amplifier rises above the reference signal.
6. Electrosurgery equipment substantially as hereinbefore described with reference to the accompanying drawing.
7. Any novel feature or combination of features as hereinbefore described.

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Search Examiner

R S CLARK

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

12.11.92

Documents considered relevant following a search in respect of claims

ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 0855459 A (KEELER OPTICAL) line 66 page 1 to line 2 page 2 and lines 43-46 on page 2	1,2
X	US 3923063 A (ANDREWS ET AL) line 62 column 2 to line 9 column 3	1,2



Category	Identity of document and relevant passages	Relevant to claim(s).

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).