

Dec. 3, 1940.

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2,223,447

SHORT-WAVE RADIOTHERAPY SYSTEM

Filed July 23, 1936

2 Sheets-Sheet 1

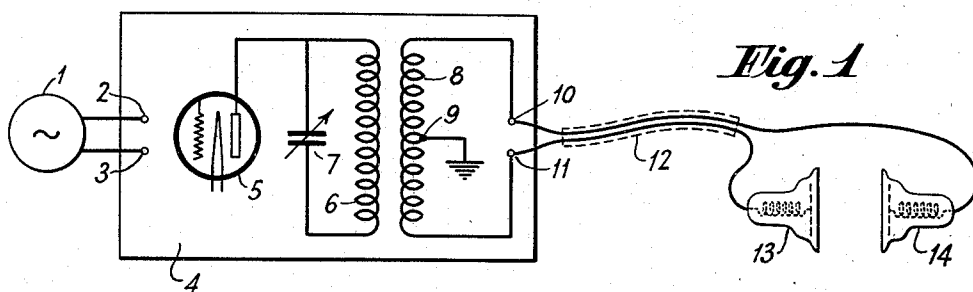


Fig. 2

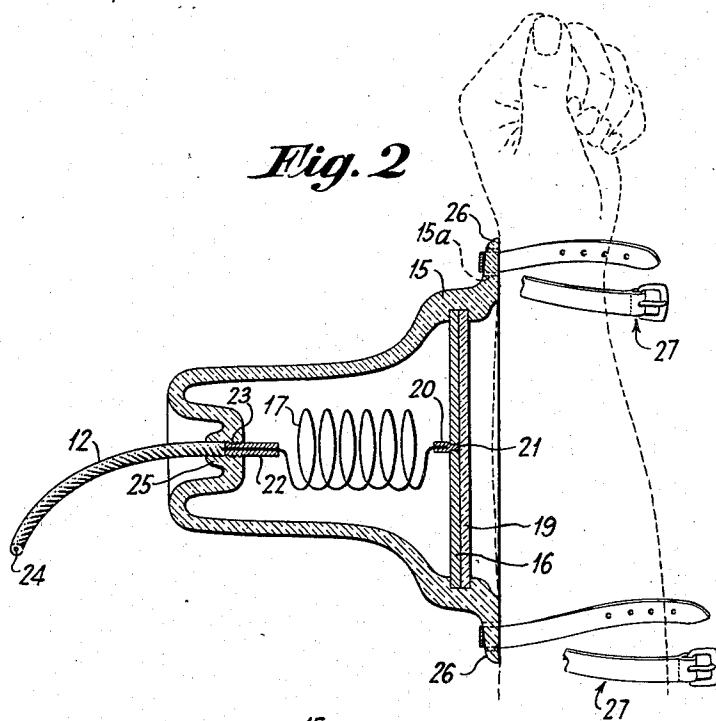
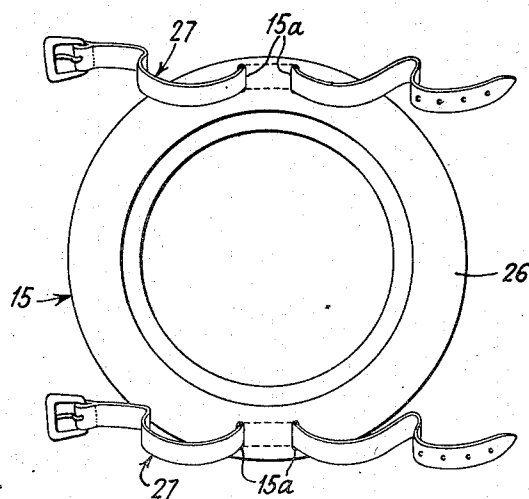


Fig. 3



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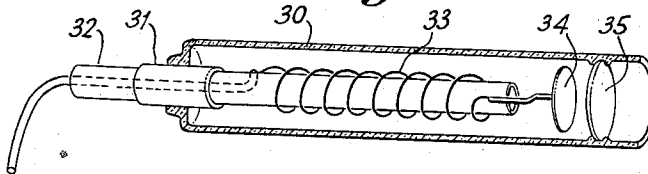
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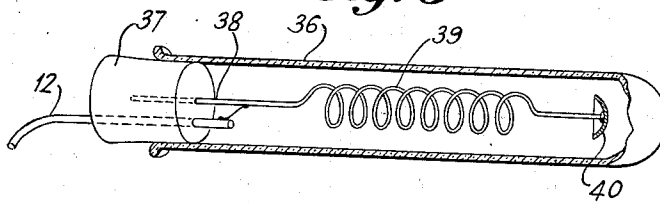
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*Fig. 4*



*Fig. 5*



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## UNITED STATES PATENT OFFICE

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## SHORT-WAVE RADIOTHERAPY SYSTEM

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6 Claims. (Cl. 128—422)

This invention relates to a system of diathermy or short-wave radiotherapy.

On object of this invention is to improve the present system and apparatus for curing certain diseases by the use of short wave radiotherapy apparatus.

Another object of this invention is to reduce the risks which are ever-present to the patient while being treated.

A further object of this invention is to provide a means whereby undesired radio frequency radiation may be minimized.

A feature of this invention is the relatively low voltage required in the lines connecting the radio frequency generating apparatus to the applicators.

The present system of radiotherapy in its ordinary routine use is subject to several objectionable defects, such as the burn hazards to the patient's skin, and also various insulation difficulties are frequently encountered. Also, the long cable generally employed gives use to undesired radio frequency radiation.

Briefly, this invention comprises a radiotherapy machine as is well known in the medical science, the machine being altered in such a manner that the output portion or the high frequency resonating system is divided into two parts, so that the cable connecting from the machine to the applicator or applicators is maintained at a low voltage by means of a low-loss cable or cables, the other portion of the resonant circuit being completed at the applicator or applicators, by providing lumped inductance for magnification of the voltage at the applicator or applicators.

This invention will be best be understood by referring to the accompanying drawings, in which:

Fig. 1 is a circuit diagram of this invention;

Fig. 2 is a sectional detail of an improved applicator;

Fig. 3 is a front elevation of Fig. 2;

Fig. 4 is a sectional detail of an improved small applicator; while

Fig. 5 is a sectional detail of a modification of Fig. 4.

Referring now in detail to the drawings, 1 indicates an alternating current source which is connected at terminals 2 and 3 to the diathermy machine 4 which contains the high frequency apparatus, such as oscillator tube 5, primary inductance 6 and resonant tuning condenser 7. An output coil 8 is grounded at the center point 9 and its ends are connected to output terminals 10

and 11. The inductance and the capacitive values of members 6, 7 and 8 are so chosen that the output voltage at the terminals 10 and 11 is substantially reduced below the voltage across 6.

In order to keep the radiation energy losses at a minimum, terminals 10 and 11 are connected through a low capacity cable 12 to the applicators 13 and 14. Applicators 13 and 14 are each identical in structure and are shown in detail by Figs. 2 and 3 in which an outer pear-shaped casing 15 which is made of any suitable insulating material, such as hard rubber or any phenol condensation product, for example "Bakelite," contains the resonating portion of the radio frequency circuit, including a condenser plate or electrode 16 and inductance 17. The condenser plate or electrode 16 is secured in the flange-like portion 25 in the front of casing 15 and is retained in place by a groove in said casing. The condenser plate is covered in front by a thin insulator 19. Inductance 17 may be supported by a stud-like metallic member 20 which is fastened to condenser plate 16 in any suitable manner, such as by riveting at point 21. The other end of inductance-coil 17 is secured by an insulating stud 22 which is fastened to the end portion of casing 15 at point 23. The inductance 17 and condenser electrode 16 are connected to the machine 4 by a lead or conductor 24 which is secured within the high frequency cable 12, cable 12 being securely fastened to a point 25 on casing 15. Flange 26 on the casing 15 serves to space the condenser plate 16 from the patient's body and is provided with slots 15a and means for holding the applicator to the patient, such as by the use of straps 27 passing through slots 15a.

Fig. 4 shows a single electrode system utilizing a small cylindrical electrode which is especially suitable for treatment of highly localized ailments, such as dental or other oral afflictions. The small electrode system comprises a cylinder 30 of insulating material having a bushing 31 also of insulating material for mechanically supporting an inner centrally located applicator tube 32 which is of low loss insulating material and serves the dual function of a handle and a winding form for the coil 33. One end of coil 33 is connected to an output lead 12, the other end terminating at the metallic electrode 34. As one of the ends of tube 30 is open, a mica safety disc 35 is provided to protect the patient from coming in direct contact with metallic electrode 34.

Fig. 5 illustrates another embodiment which is a modification of Fig. 4 which is simple in its

general construction. It comprises a glass tube 36 open at one end and closed at the other. The open end is closed by an insulation member 37 of high grade rubber having an aperture 38 for supporting a heavy self-supporting coil 39 which is terminated with a curved or semi-spherical electrode 40.

The operation of this improved system is similar to that of any well-known diathermy machine, except that the magnification of the voltage is maintained chiefly at the extreme end of the applicator, instead of in the machine itself. The applicators serve to resonate the output circuit and the voltage is built up in them rather than in the machine so that the connecting cable or cables may be held at a relatively low potential thus protecting both the patient and the physician operating the same, as well as reducing insulation losses. This makes possible the use of a low capacity flexible cable for connection from machine to the electrodes. Undesired radio frequency radiation which causes disturbances in local radio receivers is also substantially reduced.

While only a few modifications are shown, it is distinctly understood that the construction is capable of taking other forms and should not be limited to the forms shown, except by such limitations as are clearly imposed in the appended claims.

What is claimed is:

1. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, an applicator comprising a bell-shaped insulating casing, having a flanged end with means to fasten said applicator to a portion of the human body, a lumped inductance within said casing, a support member for said lumped inductance located at one end of said insulating casing, and a condenser electrode connected in series with said lumped inductance and located within said casing at an end opposite said support member.

2. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, an applicator comprising a bell-shaped insulating casing having a flanged end, a condenser plate mounted near said flanged end, and means for fastening, spacing and insulating said condenser plate from a portion of the human body, an inductance connected in series with said condenser plate and supported at an end opposite said condenser plate within said insulating casing.

3. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, applicators respectively connected to the respective ones of the output terminals of said source of radio frequency power which is maintained at a low potential point, each one of said applicators comprising an insulating casing, an inductance coil within said casing, a condenser plate located at one end of said casing and supported thereby, said inductance coil and said condenser plate being connected in series so as to form a resonant circuit, an insulating cover surrounding the front portion of said condenser plate, and an insulating spacing rim portion extending beyond said condenser plate.

4. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, applicator respectively connected to the respective ones of the output terminals of said source of radio frequency power which is maintained at a low potential point, each one of said applicators comprising an insulating casing, an inductance coil within said casing, a condenser plate located at one end of said casing and supported thereby, said inductance coil and said condenser plate being connected in series so as to form a resonant circuit, an insulating cover surrounding the front portion of said condenser plate, and an insulating spacing rim portion extending beyond said condenser plate.

5. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, applicators respectively connected to the respective ones of the output terminals of said source of radio frequency power which is maintained at a low potential point, each one of said applicators comprising an insulating casing, an inductance coil within said casing, a condenser plate located at one end of said casing and supported thereby, said inductance coil and said condenser plate being connected in series so as to form a resonant circuit, an insulating cover surrounding the front portion of said condenser plate, and an insulating spacing rim portion extending beyond said condenser plate.

6. A short wave radiotherapy system comprising a source of radio frequency power the output source of which comprises a pair of terminals maintained at a low potential point, an applicator comprising a bell-shaped insulating casing having a flanged end and a pair of slots located thereon, a condenser plate mounted near said flanged end, and means for fastening, spacing and insulating said condenser plate from a portion of the human body, a pair of retaining members located in said slots, an inductance connected in series with said condenser plate and supported at an end opposite said condenser plate within said insulating casing.

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