Feb. 28, 1928. 1,660,794

W. HUDSON

LIGHT THERAPY APPLIANCE

Filed April 11, 1927 2 Sheets-Sheet 1

Fig. 1

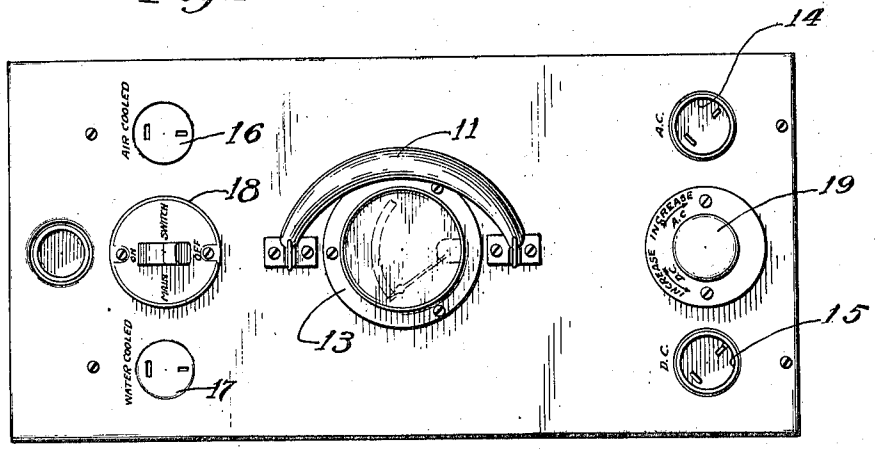
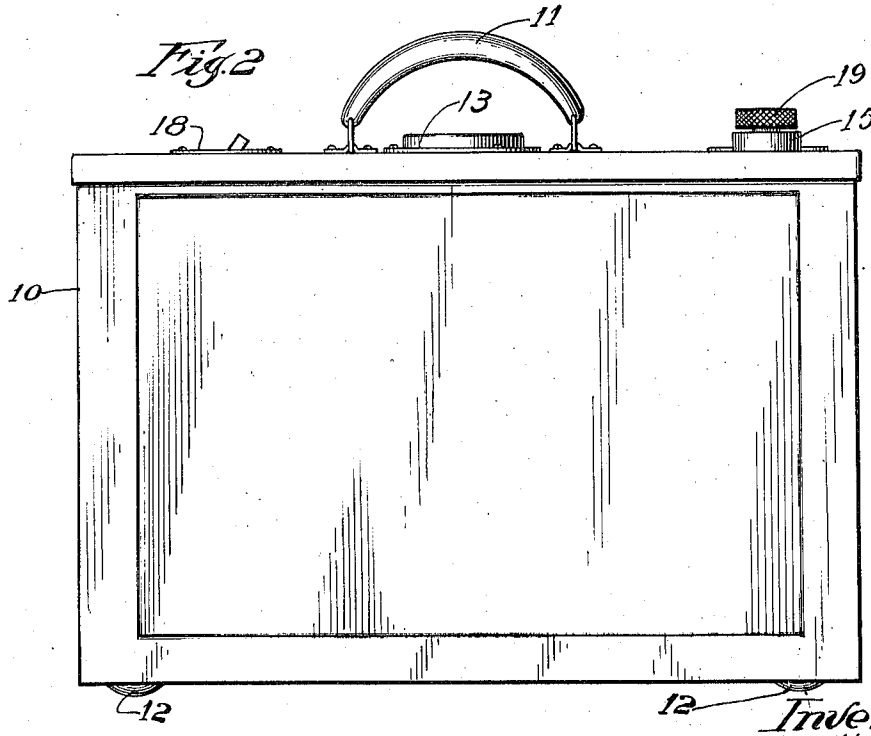


Fig. 2



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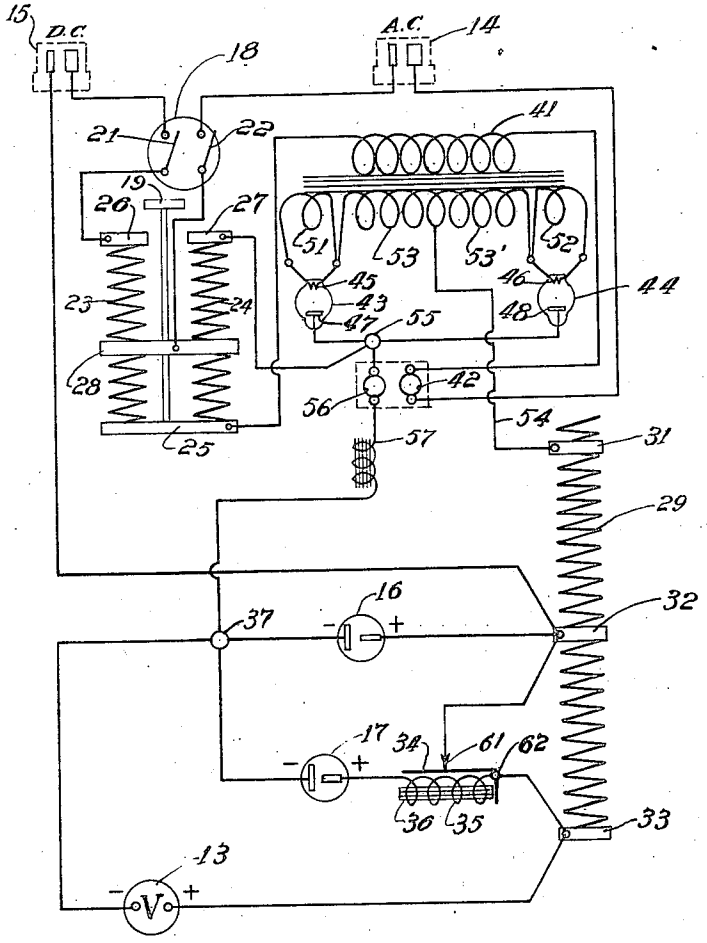
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Fig. 3



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UNITED STATES PATENT OFFICE.

WALTER HUDSON, OF MILTON, WISCONSIN, ASSIGNOR TO THE BURDICK CORPORATION, OF MILTON, WISCONSIN, A CORPORATION OF DELAWARE.

LIGHT-THERAPY APPLIANCE.

Application filed April 11, 1927. Serial No. 182,598.

My invention relates in general to a universal portable light therapy appliance and more particularly to an electrical circuit for use in such an appliance.

Ultra-violet light has become an important agent in therapeutics. General application of ultra-violet light is usually effected by "air cooled" lamps and localized treatment by "water cooled" lamps. The mercury arc burners or tubes adapted for use in air cooled lamps require a different voltage for the applied direct current than do the burners or tubes for water cooled lamps. Heretofore the size and weight of the equipment employed and its limitations as to type of current usable therewith (i. e. direct or alternating) rendered it non-portable although it might be moved to some extent locally. Consequently, because of the non-portability of the equipment, ultra-violet light treatments have been often unattainable by patients who could not be taken to a hospital or a doctor's office. In sparsely settled and country communities this condition has been especially prevalent.

Among the objects of the present invention is the production of a universal, portable light therapy unit.

Another object is the provision of a therapeutic unit capable of operation with either alternating or direct current.

A further object is the provision of combination equipment capable of being employed with either alternating or direct current and sufficiently light in weight and compact to be easily carried.

An embodiment of the invention is illustrated in the accompanying drawing wherein

Fig. 1 is a plan view of a portable cabinet or box in which the current controlling portion of the appliance is housed;

Fig. 2 is a side elevational view of the apparatus box shown in Fig. 1, and

Fig. 3 is a diagrammatic illustration of the circuit employed.

The equipment herein shown and described is particularly adapted to be used in a small suitcase-like cabinet or box which has an adjustable standard and reflector for the air cooled lamps. However, since the arrangement of apparatus within the box and the lamp support are not essential to my present invention they are not disclosed in detail herein. A suitable arrangement for the equipment is set forth in an application of Fritz A. Anderson (Case 8) executed March 29, 1927, Serial No. 182,692, and filed Apr. 11, 1927.

In the current controlling unit of the appliance the apparatus is mounted in a box shaped somewhat like a suitcase and provided with a handle similar to the usual suitcase handle. Electrical service inlet connectors are provided for both direct and alternating current and the necessary resistances are used to reduce the voltage to the value required in a given case. The resistance is varied by turning a knob at the top of the box, and the voltage impressed across the terminals of the lamp tube or burner indicated by a suitable instrument also secured to the top of the box and visible from the outside thereof. A main switch opens or closes both the alternating and direct current circuits and outlet connectors are provided so that current can be supplied to a water cooled lamp or an air cooled lamp as desired. The air cooled lamp is usually employed for the general application of ultra violet rays and a common form thereof, as a rule, operates at about 75 volts; while the water cooled lamp is used for the local application of ultra violet rays and a common form thereof operates at approximately 55 volts. In the arrangement of the variable resistance for controlling the voltage, one portion of the resistance element is connected with the direct current circuit, while another portion thereof is connected to the alternating current circuit, the contacting arm of the variable resistance being included in both circuits.

The cabinet for the control unit comprises a box-like structure 10 provided with a carrying handle 11 and having rollers 12—12 which permit the box to be moved along the floor with a minimum of friction. A voltmeter 13 indicates the voltage impressed across either the water cooled lamp circuit or the air cooled lamp circuit, depending upon which is being used from a power source either direct or alternating. The manner in which it is connected in the circuit will be described later.

Sockets 14 and 15 which are illustrated to be of the slip terminal type, are adapted to connect the unit with either a source of alternating current or a source of direct current as required, and plug sockets 16 and 17

are provided for connection of the air cooled and water cooled lamp respectively. A main switch 18 is designed to open and close the alternating and direct current circuits simultaneously. Provision of a single switch in this way helps to lighten the weight of the unit and at the same time render it less complicated to the user thereof. The control rheostat is operated by means of a knob 19 located on the top of the box and adapted to be turned in a clockwise direction to decrease the resistance in the alternating current line, thereby increasing the voltage applied to the lamp when the source is alternating current; or to increase the resistance in the direct current line and thereby decrease the voltage applied to the lamp when the source is direct current. Turning knob 19 in a reverse direction has the opposite effect. The manner in which this effect is obtained will be understood from a further description of the circuit.

Fig. 3 diagrammatically shows the arrangement of the circuits. The inlet connector for the source of alternating current is illustrated at 14, while the inlet connector for direct current is indicated at 15. The main or line switch 18 is provided with two knife contacts 21 and 22 which close the direct and alternating current circuits, respectively.

A pair of resistance elements 23 and 24 are formed of a plurality of convolutions or turns of suitable resistance wire and have at one end a common terminal 25, while at the other ends thereof, separate terminals 26 and 27 are provided. Across, and contacting with both resistance elements is a rheostat arm 28 controlled by knob 19. The air cooled lamp outlet connector 16 and water cooled lamp outlet connector 17 are adapted to furnish a connection (either of the screw or slip terminal types) whereby current modified by the current controlling unit may be transmitted to an appropriate mercury arc burner or tube of the air and water cooled types. A ballast is provided with terminals 31, 32 and 33, each of which may be manually re-located but which have no connection to the outside of the box to permit adjustment during operation of the unit. These terminals are designed for the purpose of making semi-permanent adjustments, such as may be necessary when the unit is used with sources of alternating current supply at different voltages.

A relay is provided in the unit for the control of the water cooled lamp, in a manner to be described. The relay comprises an armature 34 and a solenoid 35, and included therewith a core 36 may be provided, if required. For the purpose of connecting the leads to the two lamp outlet connectors, a terminal 37 is employed.

A rectifier, in general similar to that disclosed in my copending application, Serial No. 27,673, filed May 4, 1925, is provided with a transformer having a primary winding 41. A fuse 42 may be inserted in the primary circuit. Two electronic valves of the vacuum tube type, 43 and 44, are provided with cathodes 45 and 46, and the usual anodes 47 and 48 respectively. The cathodes are heated by induced current from the transformer, exciting windings 51 and 52 being included as secondary windings of the transformer and being electrically connected to the cathodes 45 and 46, respectively. The main secondary winding of the transformer comprises two sections 53 and 53′, one end of which is connected to a common conductor 54 and the other ends thereof connected to the heated cathodes 45 and 46. A terminal 55 has leads therefrom to the two anodes 47 and 48 for receiving the current therefrom in rectified form, and a fuse 56 is provided for the protection of the rectified current circuit. A reactance 57 for the purpose of smoothing out the flow of rectified current, is also provided.

By means of the apparatus described, either direct or alternating current may be received by the unit and translated into the proper value of direct current for use by either a water cooled or an air cooled therapeutic lamp attached to the proper outlet connector 16 or 17.

Assume first that inlet connector 15 is connected to a source of direct current and that an air cooled lamp is connected to outlet connector 16. The current flow will then be from inlet 15 through knife switch 21, terminal 26, a portion of resistance 23, rheostat arm 28, resistance 24, terminal 27, terminal 55, fuse 56, reactance 57, terminal 27 to outlet 16, and thence to the air cooled lamp generator, back to outlet 16 to terminal 32 on resistance 29 and back to D. C. inlet 15.

Now assume that the source is direct current and that a water cooled lamp is to be connected with the water cooled lamp outlet 17. The current will then follow the same path as when the air cooled lamp is used up to the terminal 37 but from terminal 37 the flow is through outlet 17 to the element of the water cooled lamp and thence it can follow one of two paths, depending upon the characteristics of the lamp. During the "build-up" period an excess volume of current is desirable to shorten the building up period. The relay automatically controls the cutting in and out of the portion of resistance 29 between terminals 32 and 33. During the build-up period armature 34 is attracted to solenoid 35 thereby making contact with terminal 61. The armature being in electrical contact with the relay coil current will then flow through the relay coil to terminal 62, contact point 61 to terminal

32 and thence to inlet 15. When the build-up period has progressed so that the internal resistance of the water-cooled lamp is high and the voltage drop is correspondingly greater, armature 34 will no longer be attracted by the relay coil and contact with connection 61 will be broken. The section of resistance 29 between terminals 32 and 33 is thus automatically inserted into the lamp circuit and further diminishes the voltage impressed across the terminals of the lamp. Thus the building-up period for the lamp is shortened.

When an alternating current source of supply is employed the current flow is from one terminal of inlet connector 14 through the alternating current fuse 42 to primary winding 41 of the transformer, common terminal 25, a portion of resistance elements 23 and 24, rheostat arm 28, knife switch 22 and return to the other terminal of the alternating current inlet connector 14.

The rectified current flows alternately from the two sides of the rectifier in the manner described in my copending application referred to above, to terminal 55. The left-hand side of the rectifier circuit is sufficiently illustrative and reference may be had thereto. The induced current flow is from secondary winding 53 to cathode 45 heated by the excitation winding 51. The electronic flow across the valve is to anode 47 and thence to terminal 55, the current flow being only in the one direction. Thence the circuit extends through fuse 56, reactance 57 and thence to terminal 37. The balance of the circuit is the same as when a direct current source of supply is used with the exception of the addition of a portion of resistance element 29 between terminals 31 and 32. The return of the rectified current is from terminal 31 through connector 54 to the common terminal connecting secondary windings 53 and 53′ of the transformer.

By arranging the equipment and circuit connections so that much of the apparatus serves whether the source is alternating or direct and the lamp is air cooled or water cooled, the weight of the completed unit is reduced to such an extent that it can readily be carried from place to place after the manner of an ordinary suitcase.

Having thus illustrated and described an embodiment of my invention, what I claim and desire to secure by United States Letters Patent is as follows:

1. In a therapeutic appliance for the purpose described, an inlet for alternating current, an inlet for direct current, a resistance element comprising a plurality of turns of resistance wire, and having one end connected to the direct current circuit and the other end connected to the alternating current circuit and a regulator arm engaging said resistance and having a connection to both the direct current and alternating current line, whereby a portion of the resistance is included in the direct current circuit and another portion of said resistance in included in the alternating current circuit.

2. In a therapeutic appliance for the purpose described, separate inlets for alternating and direct current, a common resistance having portions thereof for each type of current, an alternating current rectifier, an outlet for a water-cooled lamp, an outlet for an air-cooled lamp, and a connection from both the alternating and direct current sources to both of said outlets.

3. In a therapeutic appliance for the purpose described, inlets for both alternating and direct current, a circuit connected to each of said inlets, a compound switch operating to open or close both of said circuits simultaneously, a rectifier including a transformer, having a primary and secondary winding, the primary winding included in the circuit connected with the alternating current inlet, a resistance having terminals at both ends thereof, an adjustable arm for contacting with varying portions of the resistance, the arm being connected in both of said circuits and one of the terminals on the resistance connected to each of the circuits whereby one portion of the resistance is in the direct current circuit and another portion of the resistance is in the alternating current circuit, a circuit for rectified current, including the secondary winding of the transformer, outlet for a water-cooled lamp, outlet for an air cooled lamp, and connections from the direct current circuit and from the rectified current circuit to both of the outlets.

4. The therapeutic appliance defined in claim 3 in combination with a reactance in the connection between the direct and rectified current circuits and said lamp outlets.

5. The therapeutic appliance defined in claim 3 in combination with an additional resistance element and connections through different parts of said element for each of the circuits through the two outlets.

6. The therapeutic appliance defined in claim 3 in combination with an additional resistance element, connections through different portions of said element for each of the circuits through the two outlets, and means for varying the amount of the resistance in one of the outlet circuits so that the resistance in the previously mentioned variable resistance element may be reduced.

7. In a therapeutic appliance for the purpose described, inlets for both direct and alternating current, a variable resistance, a semi-fixed resistance, an outlet for a water-cooled lamp, an outlet for an air-cooled lamp, a circuit including the direct current inlet, the two lamp outlets and a portion of

both of the resistances, an alternating current rectifier, and a circuit including said rectifier, the variable resistance, two lamp outlets and a portion of the fixed resistance.

8. A therapeutic appliance as defined in claim 7 in which the variable resistance is adjustable to various operating conditions by means of a controlling knob of easy access, and the portion of the semi-variable resistance in the various circuits may be set to suit different current supply conditions.

9. In a therapeutic appliance for the purpose described, a direct current circuit including a variable resistance, a reactance, an outlet for a water cooled lamp, an outlet for an air cooled lamp and a semi-fixed resistance, an alternating current circuit including a variable resistance common to the direct current circuit and a rectifier, and a rectified current circuit including the same reactance, water-cooled lamp outlet, air-cooled lamp outlet, and semi-fixed resistance included in the said direct current circuit.

10. The therapeutic appliance defined in claim 9, including a relay common to both the direct and rectified current circuits, and designed to control the portion of the semi-fixed resistance included in the water-cooled lamp circuit, the resistance being automatically increased when the internal resistance of the lamp has reached its operating value.

In witness whereof, I hereunto subscribe my name this 29th day of March, 1927.

WALTER HUDSON.