

- [54] **COMPUTER CONTROLLED DEFIBRILLATOR**
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- [73] Assignee: **Health Technology Labs, Inc.**, Omaha, Nebr.
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- [52] U.S. Cl. **128/419 D**, 128/421, 128/423, 324/111
- [51] Int. Cl. **A61n 1/36**
- [58] Field of Search 128/419 D, 419 P, 128/419 R, 420, 421, 422, 423; 324/111

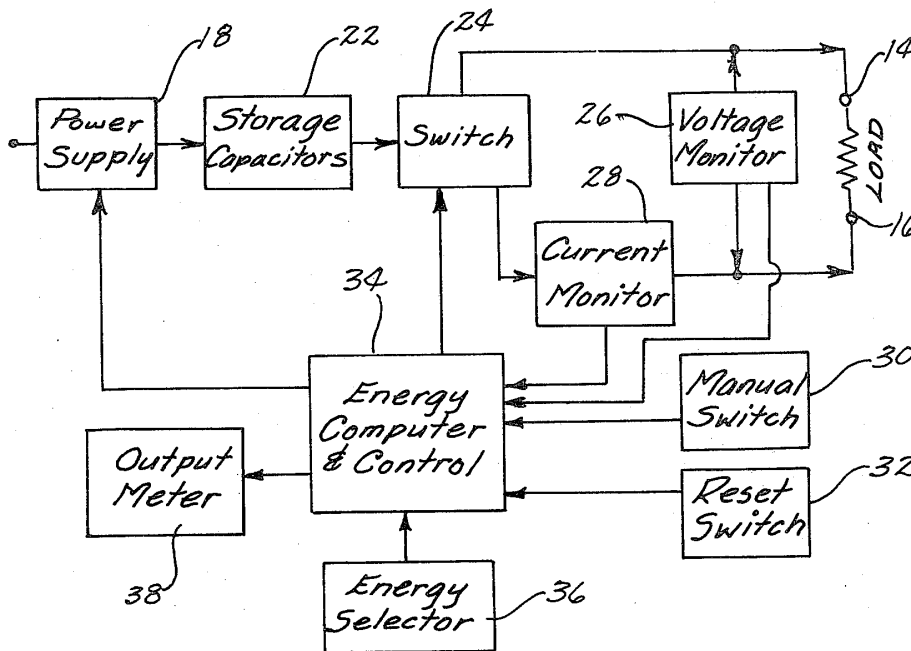
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 Attorney—Zarley, McKee & Thomte

[57] **ABSTRACT**
 A computer controlled defibrillator comprising a set

of electrodes which are engageable with a patient and which are connected to a source of electrical energy by a circuit means. The circuit means comprises storage capacitors, energy selector, computer, manual and reset switches, voltage monitor, current monitor, and output meter. The computer responds to certain external inputs, automatic and manual, and controls the output delivered to the patient. The energy selector permits the selection of the energy which is desired to be delivered to the patient. The sequence is started by closing the manual reset switch which zeroes the output meter and activates the power supply (electric energy) at a voltage which is dependent on the energy selector. The energy driven from the power supply is stored in the storage capacitors. The energy selector, which is manually set to the energy desired, also feeds an input to the computer. When the manual switch is activated, the computer causes the stored energy source to be connected to the patient through the electrodes. The current monitor and voltage monitor feed instantaneous signals to the computer which computes the energy as a continuous integration process. When the computer energy equals the selected energy, the computer causes the energy source to be disconnected from the patient. The total energy delivered to the patient is indicated as a steady reading on the output meter.

4 Claims, 6 Drawing Figures



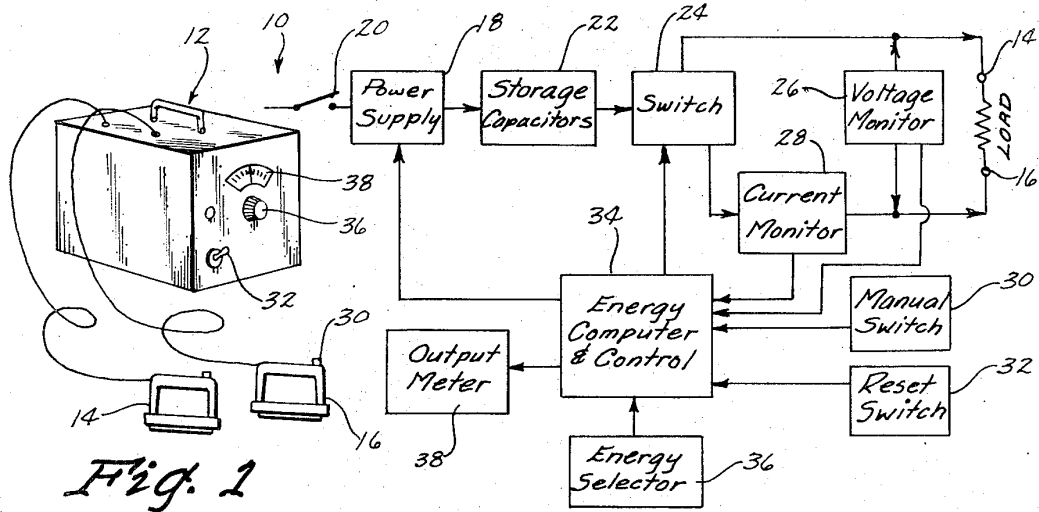


Fig. 1

Fig. 2

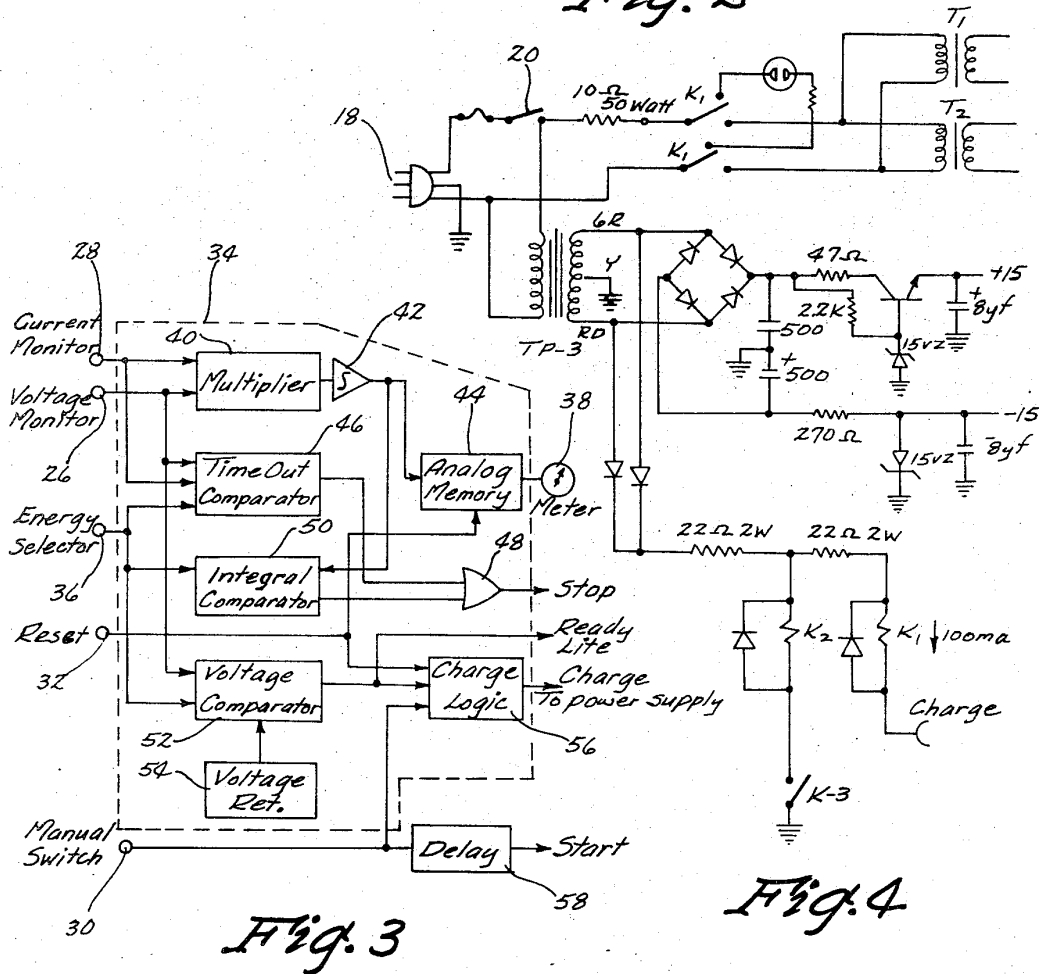


Fig. 3

Fig. 4

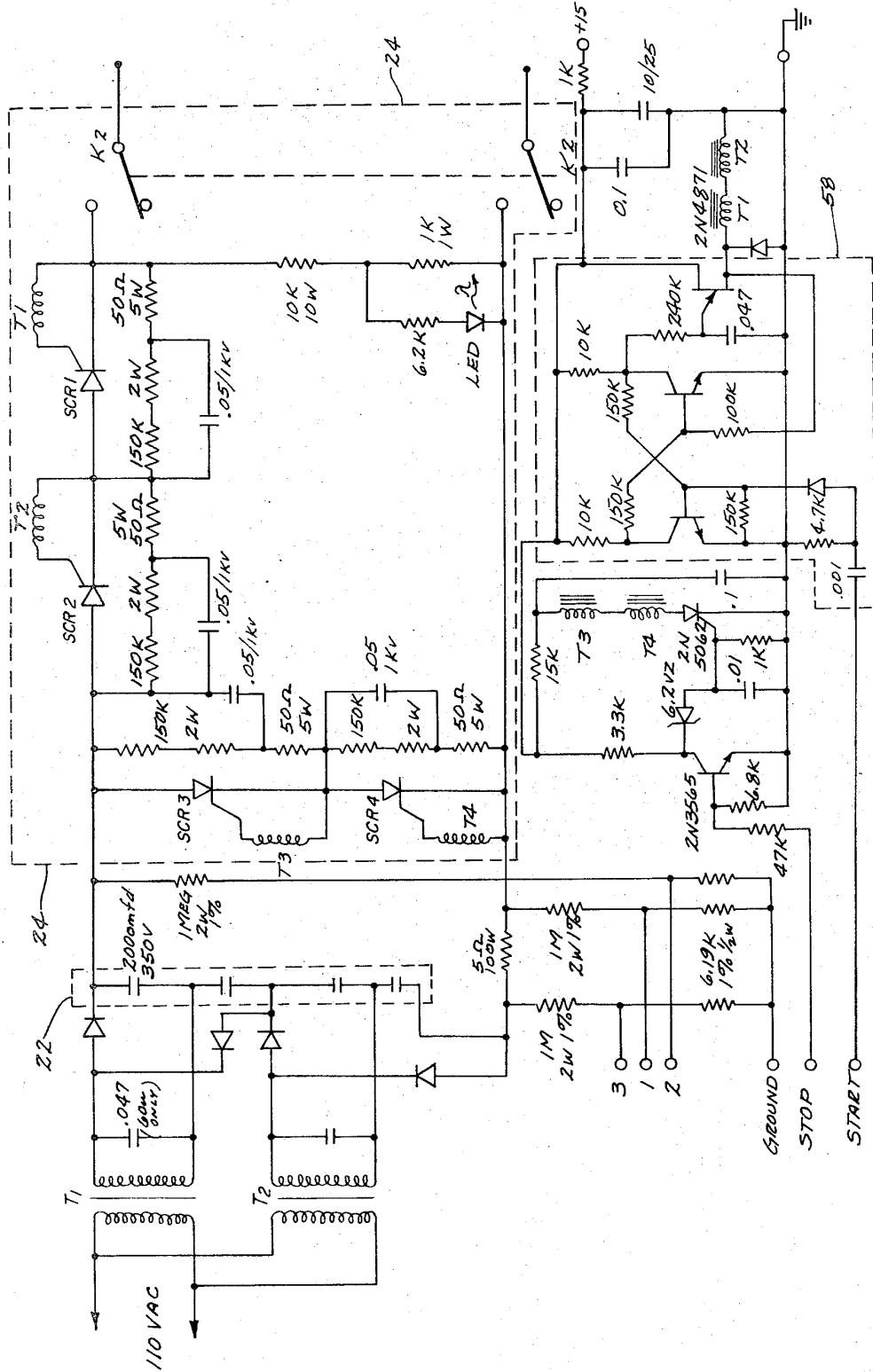


Fig. 5

COMPUTER CONTROLLED DEFIBRILLATOR

The use of DC defibrillators in emergency resuscitation has become well established. Limitations due to weight have prevented more widespread use of the defibrillators. Most clinical defibrillators depend on the storage and discharge of energy through a stable RLC combination, thus requiring accurate capacitance, inductance and resistance. The conventional defibrillators employ a pair of electrodes or paddles which are placed in contact with the patient's chest. A defibrillation or electrical pulse is then applied to the patient, through the electrodes, to momentarily stop the heart so that fibrillation of the heart is stopped. Since time is critical in defibrillation techniques, it is extremely important that a sufficiently large impulse be applied to the patient during the first attempt. A majority of the prior art devices employ some means for selecting the energy to be delivered to the patient. However, it has been found that these devices generally deliver a smaller or lower output to the patient than that which was selected. A further complication is that the resistance of the patients vary greatly. Thus, the operator could possibly determine that it was necessary to apply an impulse of 200 joules to the patient. Quite often, the variances in the defibrillator and the variable resistance of the patient will result in considerably less than 200 joules being applied to the patient. If the pulse is insufficient to momentarily stop the patient's heart, the patient could possibly die.

Therefore, it is a principal object of this invention to provide an improved defibrillator.

A further object of this invention is to provide a defibrillator wherein the energy delivered to the patient substantially equals the selected energy.

A further object of this invention is to provide a defibrillator including a circuit means having an energy computer and control which computes the energy delivered to the patient and causes the energy source to be disconnected from the patient when the computed energy substantially equals the selected energy.

A further object of this invention is to provide a defibrillator which delivers the selected energy to the patient regardless of the resistance of the patient.

A further object of this invention is to provide a defibrillator which is light weight and portable.

A further object of this invention is to provide a defibrillator which is economical of manufacture, durable in use and refined in appearance.

These and other objects will be apparent to those skilled in the art.

This invention consists in the construction, arrangements, and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of the defibrillator of this invention.

FIG. 2 is a block diagram of the electrical circuitry of the defibrillator.

FIG. 3 is a block diagram illustrating the components of the energy computer and control and its relationship with other components of the device.

FIG. 4 is a schematic view of a portion of the circuitry of the invention.

FIG. 5 is a schematic view of more of the circuitry of the invention; and

FIG. 6 is a schematic view of more of the electrical circuitry of the invention.

The defibrillator of this invention is referred to generally by the reference numeral 10 and comprises a portable housing 12 having a pair of electrodes or paddles 14 and 16 connected to the circuitry therein as will be described in more detail hereinafter. The electrodes or paddles 14 and 16 are engageable with the patient to deliver a predetermined energy output to the patient to momentarily stop the patient's heart so that fibrillation of the heart is stopped.

The circuitry of the defibrillator is depicted in schematic form in FIG. 2 wherein the numeral 18 refers to a 110 VAC power supply having a switch 20 associated therewith. The power supply 18 is electrically connected to the storage capacitors 22 which are adapted to store energy derived from the power supply 18. A "switch" mechanism 24 is connected to the storage capacitors 22. Mechanism 24 is connected to the electrodes 14 and 16 as seen in FIG. 2 and to a voltage monitor means 26 and current monitor means 28. Manual switch 30 and reset switch 32 are connected to the energy computer and control means 34. Energy selector 36 is also connected to the computer and control means 34 as is the output meter 38. Energy selector 36 may be comprised of a conventional rotatable dial or the like for setting the energy to be delivered to the patient.

The energy computer and control means 34 is illustrated in schematic form in FIG. 3. In FIG. 3, it can be seen that the current monitor 28 and voltage monitor 26 are electrically connected to the Multiplier 40 and that the Multiplier 40 is connected to an Integrator 42. Integrator 42 is connected to an Analog Memory 44 which is connected to the meter 38. The current monitor 28 and the voltage monitor 26 are also connected to a Time Out Comparator which is connected to the OR gate 48. The energy selector 36 is connected to the Time Out Comparator 46, Integral Comparator 50 and Voltage Comparator 52. The Integral Comparator 50 is connected to the OR gate 48 and to the Integrator 42 as depicted in FIG. 3. Voltage Comparator 52 is connected to the Voltage Reference 54 and to the Charge Logic 56. The Multiplier 40 is also connected to the Voltage Comparator 52.

The reset switch 32 is electrically connected to the Analog Memory 44 and to the Charge Logic 56 while the manual switch 30 is connected to the Delay-Start 58 and to the Charge Logic 56.

The heart of the control mechanism in the defibrillator is the energy computer and control 34 which responds to certain external inputs, manual and automatic, and controls the output delivered to the patient. In operation, the manual reset 32 starts the sequence by zeroing the output meter 38 and activating the power supply 18 at a voltage which is dependent on the energy selector 36. Thus, if it were desired to deliver an impulse of 200 joules to the patient, the energy selector 36 would be set at 200 joules. The energy derived from the power supply 18 is stored in the storage capacitors 22. The energy selector 36, which is manually set to the energy desired, also feeds an input to the energy computer and control 34. The electrodes or paddles 14 and 16 are then placed into contact with the patient and the

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