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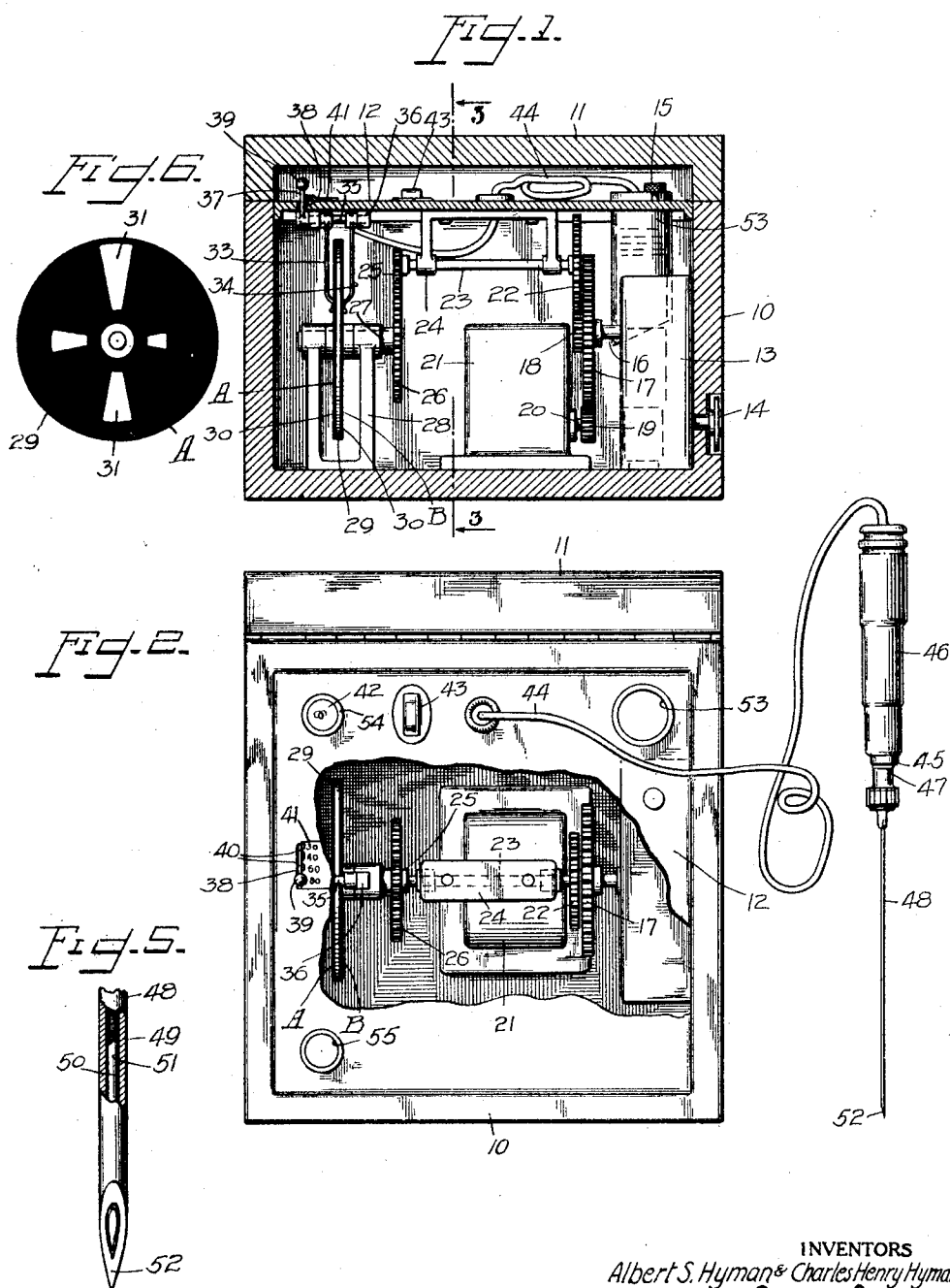
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ARTIFICIAL PACE MAKER FOR THE HEART

Filed March 12, 1930

2 Sheets-Sheet 1



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FIG. 3.

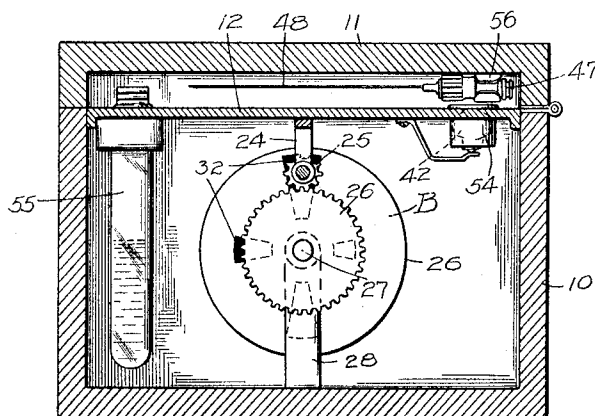
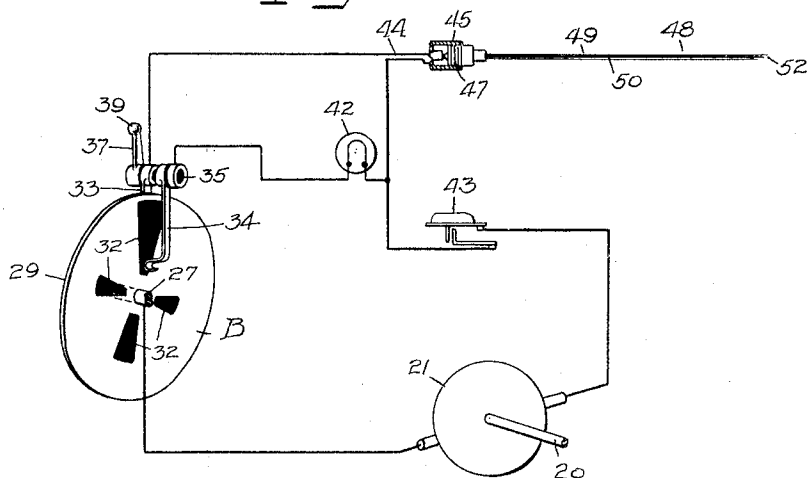


FIG. 4.



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ARTIFICIAL PACE MAKER FOR THE HEART

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This invention relates to the method of an apparatus for stimulating the heart which has ceased to function as a result of accident, electrocution, gas poisoning, ether anesthesia or shock of any kind, and which may be found in infants that are still born, by a special electric current approximating in strength, frequency and distribution the normal current of the heart.

Various methods have been utilized in the treatment of the normal heart which has stopped for any of the reasons pointed out above, and such known methods usually employ injections of certain cardiac remedies in the heart muscle or its environs. This treatment is proving successful in a substantial percentage of cases, but response appears to be due not so much to the special cardiac remedy used, as to the reaction of the heart muscle following directly upon the prick of the needle which precedes the injection. We base this assumption upon the fact that an almost endless number and variety of substances have resulted in practically the same response.

With the foregoing in mind, it is the principal object of this invention to stimulate the stopped heart by means of an electric current introduced into the heart whereby an artificial pacemaker is set up in the heart without the use of organic or inorganic substances. We accomplish this object by means of a method of procedure employing an instrument which is capable of being set into motion at an instant's notice to produce a special electric current flowing at any desired frequency and strength into a specially constructed needle for distribution directly into the resting heart to stimulate the same to normal and continued action.

One embodiment of the instrument which we contemplate using to carry out the steps of our invention is illustratively exemplified in the accompanying drawings, in which Figure 1 is a substantially sectional view of a complete kit and the instrumentalities used to produce and distribute the special electric current to the heart of the corpse; Figure 2 is a plan view of the kit showing parts broken away to disclose otherwise hidden

parts; Figure 3 is a substantially transverse sectional view taken on lines 3—3 of Figure 1; Figure 4 is a wiring diagram of the electric current generator and conductors; Figure 5 is a substantially longitudinal sectional view of the discharge end of the needle used to conduct the electric current; and Figure 6 is an elevational view of one side of the interrupter.

Referring to the method of carrying out our invention, it will be assumed that the practitioner is confronted with the problem of restoring a stopped heart to its normal functioning. The heart which has stopped is in healthy condition but because of severe shock or other unusual cause has ceased to beat. In other words, the human pace maker is no longer setting up the electrical impulses in the heart. Let it be assumed that these electric current impulses at a certain potential are normally discharged at the rate of seventy-two times a minute. Having ascertained these facts by known methods which form no part of this invention, the pulsator regulator of the instrument is set at 72 and the speed of the generator element is set to produce the required current. The end of the needle, from which these current impulses are discharged, is then injected into the heart, with the current turned on. As a result the needle which carries the desired current begins to stimulate the heart to action and maintain the necessary flow of electric impulses to the organ until its natural pace maker has regained capacity sufficient to again set up normal electrical impulses in the heart.

Referring now to the drawings, and to the embodiment of an instrument for carrying out the steps of our invention and the production of an artificial pacemaker for the heart, 10 denotes a suitable case having a deep body receptacle and a cover 11 hinged thereto along one side of the open end. The top of the body 10 is provided with an instrument board 12. Mounted upon the floor of the body portion 10 and located against one side wall is a spring motor 13, which has not been detailed because any type of motor may be used, but which is preferably wound up by means of a

key 14 accessible from the exterior of the casing 10, as illustratively exemplified in Figure 1. A speed regulator within the motor 13 is controlled from the instrument board 12 by a thumb screw 15. The driving shaft 16 of the motor carries a spur gear 17 and pinion gear 18, the spur gear 17 meshing with a pinion gear 19 on the shaft 20 of a motor generator 21, which is mounted on the floor of the casing 10 adjacent its mid portion. The pinion gear 18 is in mesh with a spur gear 22 carried at one end of a shaft 23 mounted in a pair of hangers 24 depending from the under face of the board 12. The other end of the shaft 23 carries a pinion 25 which is in mesh with a spur gear 26, turning a shaft 27 mounted in the bearings of an upright yoke shaped hanger 28. Mounted on the shaft 27 between its bearings is an upright interrupter disc 29 which comprises a metal current conducting member having an insulating coating 30 on each face, said coating being removed at certain segmental portions to provide contacts 31. The side of the disc referred to as the shock side A is illustrated particularly in Figure 6, and consists of four radially disposed segmentally shaped contacts 31, each being of a different length as regards the outer periphery of the disc. The reverse side or signal face B is illustrated in Figures 3 and 4, and consists of four radially disposed segmental shaped insulated areas 32 which correspond exactly in shape and position to the contacts 31 on the reverse side A of the disc.

A pair of separate contacts or brushes 33 and 34 are mounted upon a shaft 35 directly above the vertical center of the disc 29 so that each contact is in contact with one of the sides of the disc. These contacts 33 and 34 are insulated from each other and respectively they contact with sides A and B. The shaft 35 is mounted to turn in brackets 36 on the under face of the board 12 and at one end carries an arm 37 which projects upwardly through a slot 38 in the board 12 and is provided with a ball 39 at the extreme end, and which engages in notches 40 of a plate 41 mounted on the board 12 and graduated to indicate the different number of pulsations resulting from the different settings of the contacts with respect to their contacting surfaces. Normally the settings would read from 20 to 80 or so pulsations per minute. The brush 33 carries the shock impulses which are set up by the contacts 31 and the relative position of the brush with respect thereto. The contacts 31 on the signal face B transmit the current through the brush 34 to a lamp or signal 42 which is made to glow when the shock contact is open as a consequence of the alternate positions of the contact surfaces 31 on opposite sides of the interrupter disc. A suitable switch 43 is disposed in the circuit as shown in Figures 1, 2 and 4, and the switch and

lamp 42 are mounted in suitable positions on the instrument board 12.

The current from the generator 21 passing through the switch 43 and interrupter is conveyed by means of a long cable 44 to an electric socket 45 mounted in the end of a handle 46. The socket 45 is of well known construction and is adopted to receive a screw terminal 47 of an electrical needle 48. The needle consists of two electrodes, one an outer tubular sleeve 49 for one current and the other a metal core 50 surrounded by an insulating sheath 51 disposed throughout the bore of the sleeve 49. The point 52 of the needle is formed preferably by truncating its free end, as illustratively exemplified in Figure 5. It will be clear that with the two parts 49 and 50 in electrical connection with the negative and positive current from the generator there will be a flow of current through the electrodes of the needle and conductive elements of the heart whenever the interrupter closes the circuit, the intervals of such closures being determined by the setting of the brush 33 with respect to the center of the disc 29.

In addition to the other instrumentalities already described the board 12 is provided with a tubular holder 53 which is mounted in upright position in one corner of the board as illustrated in Figures 1 and 2, and which receives the handle 46 after the needle has been removed. Another corner of the board 12 carries the light socket 54 for the light 42 and a third corner is provided with a carrier for a bottle 55 containing a sterilizing fluid for use on the needles before use. The needles themselves when not in use are carried in suitable clips 56 mounted in the cover 11 as illustrated in Figure 3.

In the construction and arrangement of an instrument for carrying out my method of stimulating the heart to normal action, I have shown an electric generator, but this may be substituted by a battery and induction coil for producing the necessary current or it is even within practical bounds to utilize the ordinary light current by interposing suitable electrical instruments in the circuit for the purpose of providing therefrom the special electric current which would approximate in strength the normal current of the heart. In some instances the point of the needle would prove more efficient if it were curved and for this purpose the materials of which the needle is made may be of gold or other equally ductile metal which is capable of being readily bent or curved. The needle if made of steel will be given its desired curve in the making.

In the operation of the device, the motor 13 is set into motion and through it the generator and interrupter disc 29 which sets up a series of impulses in the circuit leading to the signal lamp 42 and electrodes of the

needle 48. The glow is on in the lamp 42 when the current is cut off from the needle and vice versa, and it is these impulses discharging into the needle which must be regulated by the manipulation of the lever or arm 37 to approximate in frequency the normal current in the heart. By thrusting the point of the needle into the stopped heart this current generated in the generator is transmitted at the proper impulse into the heart and becomes an artificial pacemaker therefor.

Having now described our invention what we claim and desire to secure by Letters Patent is:

1. An instrument for producing a special electric current for the purpose described, comprising a source of electric current, an interrupter for the flow of said current in a circuit, means for regulating the said interruptions and an electrode needle for first piercing the human heart and then introducing and discharging the impulses of said current directly into the heart structure, said interrupter comprising a rotary metal disc in the circuit from the source of current, said disc having insulated areas on opposite faces cut away to expose segmental sections of the disc, the exposed sections on one side thereof corresponding in position and area to the insulated area of the other side, a pair of brushes in contact with opposite faces of the disc and insulated from each other to pick up the interrupted flow of current from both sides of the disc, a signal in the circuit from one brush, the other brush supplying current in impulses to said introducing and discharging means.

2. An instrument for producing a special electric current for the purpose described, comprising a source of electric current, an interrupter for the flow of said current in a circuit, means for regulating the said interruptions, and an electrode needle for first piercing the human heart and then introducing and discharging the impulses of said current directly into the heart structure, in which the means for discharging the current into the heart comprises a needle having a metal core to carry one current, an insulating sheath embracing said core, and a metal sleeve embracing the sheath and carrying the other current, said core and sleeve being exposed at the end of the needle for contact and discharge of their currents into the heart.

3. An electric needle for the purpose described, comprising a shank to receive negative and positive currents, a metal tubular member mounted in said shank and connected with one of the currents, a metal core within said tubular member and connected with the other current through the shank, and an insulating sheath between the two metal parts, said parts being pointed at the free end of the needle and exposed for contact with the heart.

4. In a device for the purpose described, the combination of a spring motor, a current generator driven by said motor, for creating a source of current, a circuit from the generator, an interrupter in said circuit comprising a rotary disc driven from said motor, and having segmental contacting surfaces on one face and corresponding insulated surfaces on the other face, said contacting surfaces being of varying lengths from the center of the disc, a brush picking up the interrupted electric current from each side of the disc, means for adjusting the relation of the brushes to their respective contacting surfaces to regulate the durations of said interruptions in the current, a signal lamp in the circuit from the one brush, and an electrical needle in the circuit from the other brush for introducing and discharging negative and positive currents into the heart.

In testimony whereof they have affixed their signatures.

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