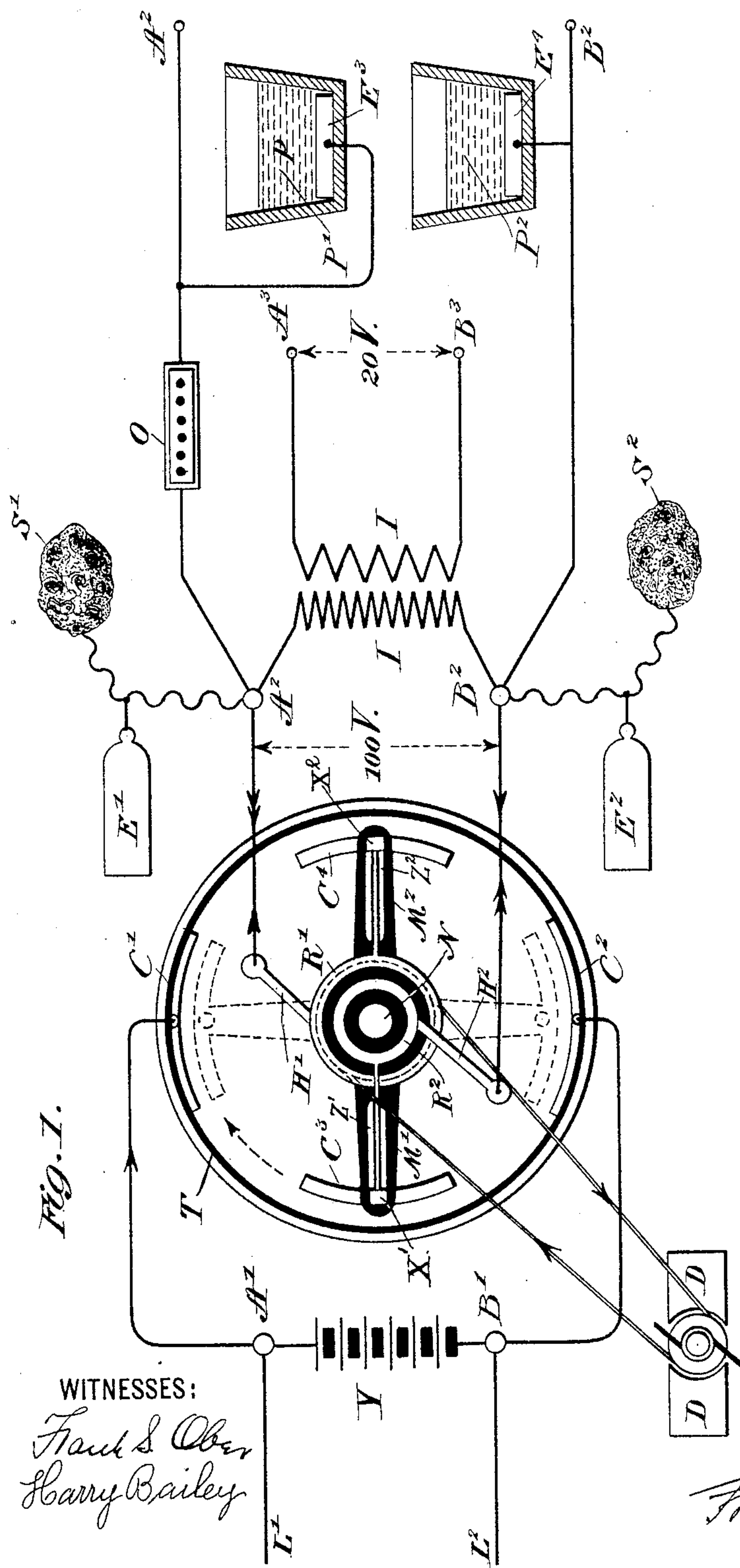


(No Model.)

F. J. PATTEN.
ELECTROTHERAPEUTICAL APPARATUS.

No. 584,957.

Patented June 22, 1897.



WITNESSES:
Frank S. Ober
Harry Bailey

Inventor:-
Francis J. Patten.

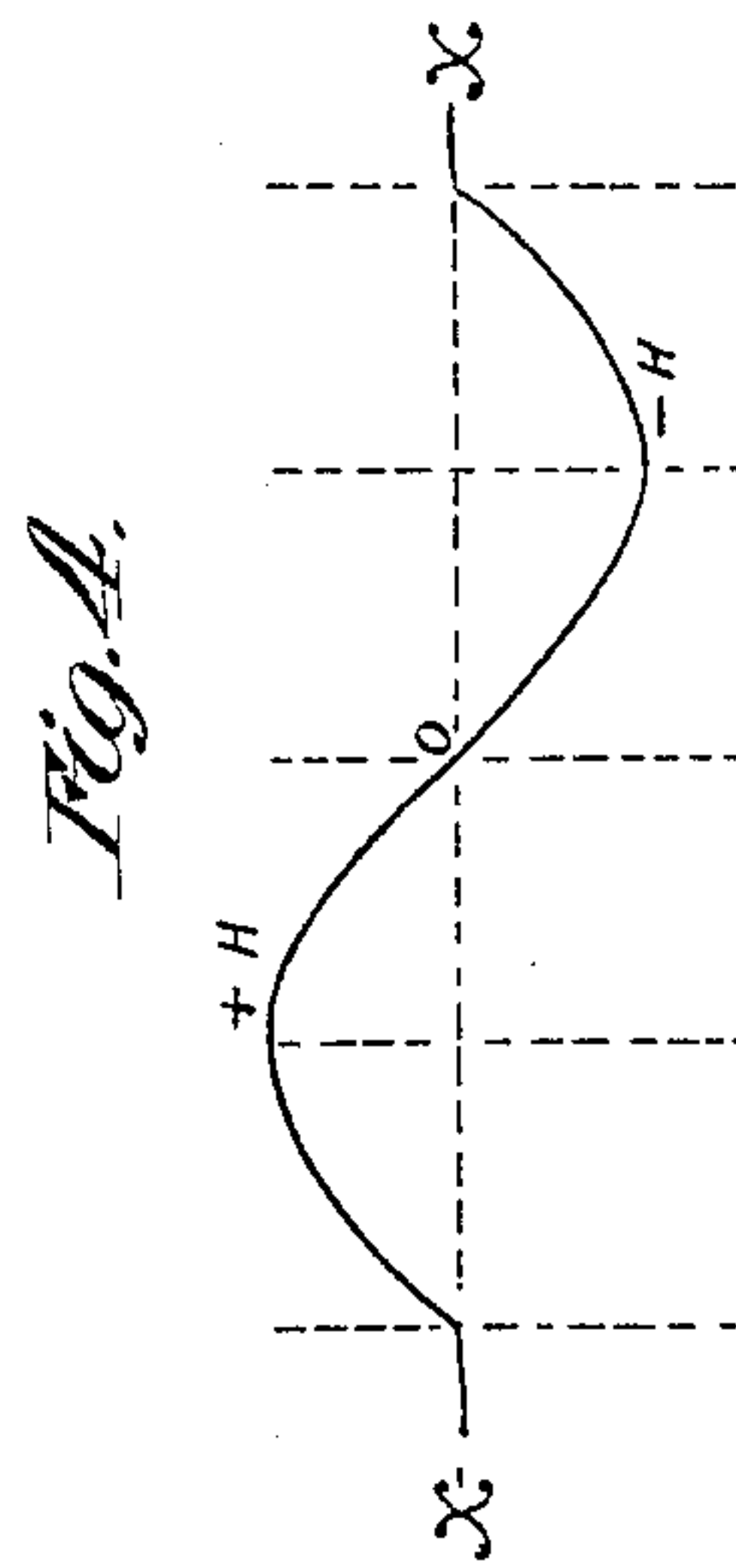


Fig. 4.

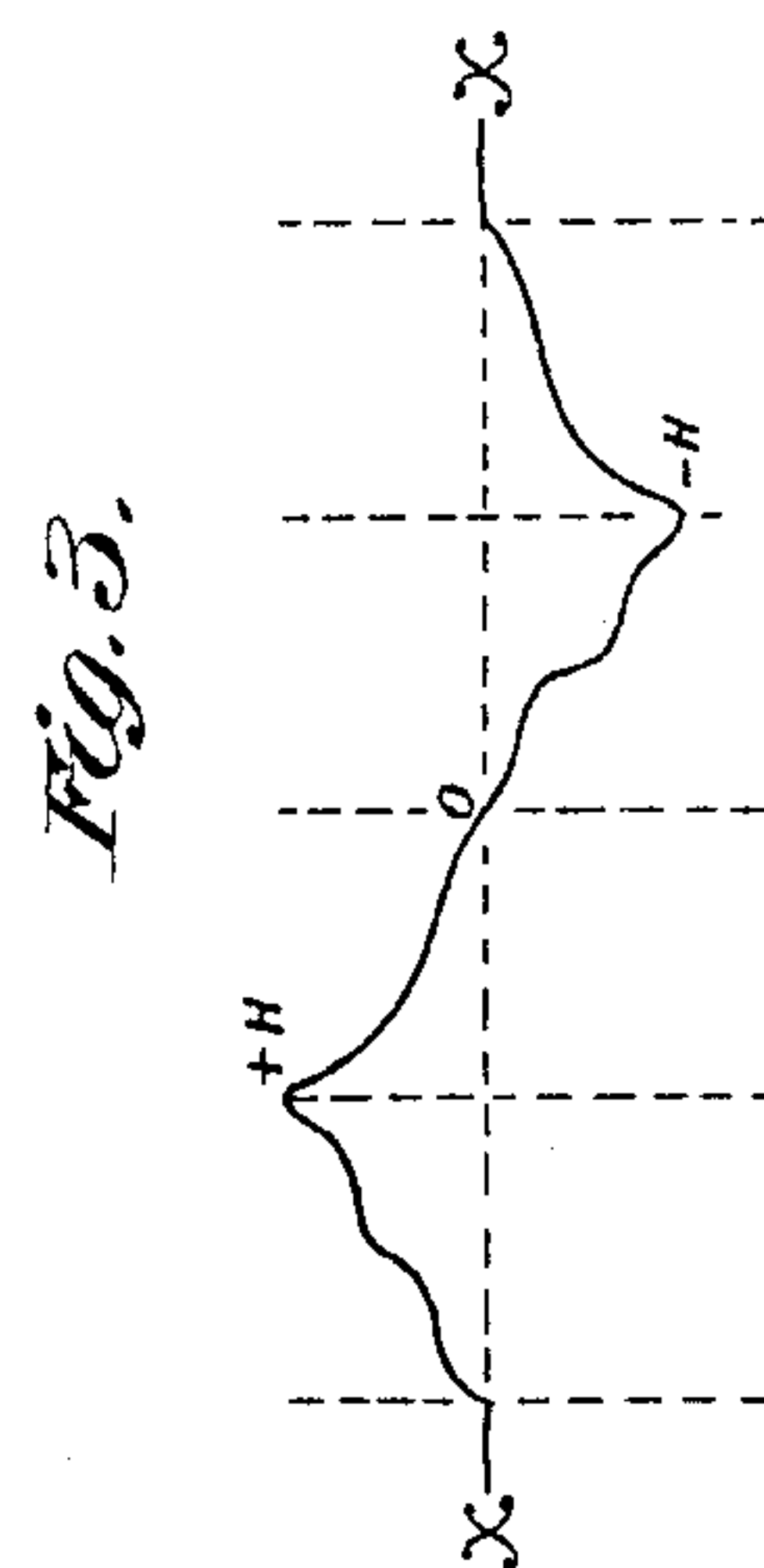


Fig. 3.

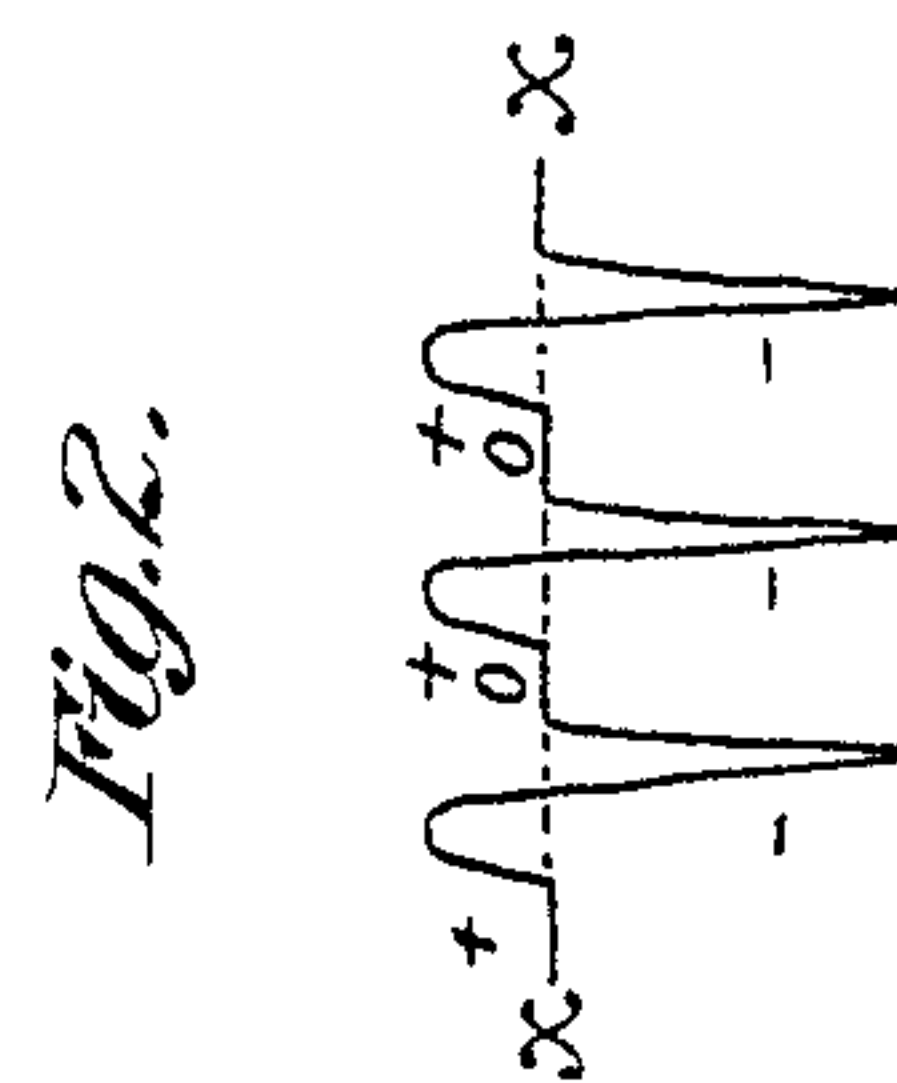


Fig. 2.

UNITED STATES PATENT OFFICE.

FRANCIS JARVIS PATTEN, OF NEW YORK, N. Y.

ELECTROTHERAPEUTICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 584,957, dated June 22, 1897.

Application filed September 30, 1896. Serial No. 607,401. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS JARVIS PATTEN, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electrotherapeutical Apparatus and Methods of Administering the Electric Current to the Human Subject, of which the following is a description.

My invention consists in a system or method of applying electricity to the human subject, as well as a new combination of apparatus by means of which the desired result is obtained.

The purpose of the system is to make electrical treatment by shock less unpleasant and distressful than it has heretofore been.

The apparatus and system is made plain by the accompanying drawings, in which—

Figure 1 represents by diagram the apparatus used, and Figs. 2, 3, and 4 illustrate the principles applied. Fig. 2 is an irregular broken curve drawn with reference to a line of symmetry xx , called in electrotechnics the "zero" or "time" line, and this curve represents in a general way the changing electromotive force or voltage given by an ordinary induction-coil used in medical applications of electricity.

There is first a positive wave (indicated + in the figure) above the zero-line. This is broken off suddenly and is immediately followed by a much more powerful negative wave of shorter duration though of greater intensity. (Indicated — in the figure.) Then follows a break or complete interruption of current, (indicated 0 in the figure,) and then the same cycle is repeated, all taking place in rapid succession many times a second. Such a current is styled an "interrupted reversed" current, and it is supposed to be the sudden interruptions and violent reversals of electromotive force that cause to a large extent the painful sensations that invariably accompany any application of the faradaic current to the person by means of the ordinary induction apparatus.

The electromotive-force curve of an alternating-current dynamo exhibits, more or less, the same characteristics, because it is also produced by induction apparatus in which iron is present, and magnetism plays a part in producing the electromotive force just as

when a galvanic battery is used with an induction-coil.

Any apparatus depending upon magnetic induction or having iron cores to the generating-circuits will give an irregular voltage curve like that indicated in Fig. 3, which represents a common form of electromotive-force curve of an alternating-current dynamo.

The curve of electromotive force produced by revolving a coil of wire in a uniform magnetic field, the revolving coil being free from iron, is shown in Fig. 4, which is a true sine curve, rising gradually from the zero value to a positive maximum value, (+ H,) and, going from this value to zero, attains a corresponding negative maximum, (— H,) without interruption or break whatever, the change being a gradual and uniform one throughout. With such a uniformly-varying current much higher voltages can be applied to the human system without distress or inconvenience than if an interrupted current is given with its violent reversals of electromotive force. Much, however, depends upon the periodicity or frequency of alternation of the current applied, which is generally too rapid.

A very slowly alternating current of approximate sine form, Fig. 4, seems best adapted to medical use. The apparatus I have devised to produce this current is shown by diagram in Fig. 1. It is designed to give a uniform and smoothly-changing voltage like that indicated by the curve in Fig. 4. The apparatus is also designed to make this current or transform and reconstruct it from most any convenient source of direct current, such as the electric-light mains leading into a house or the terminals of a galvanic battery.

In Fig. 1, A' B' are the terminals of such a source of current, L' L² representing the lighting-mains of the house, and Y a galvanic battery. T T represent a tub or vessel made of insulating material filled with acidulated water.

At diametrically opposite sides of the tub and placed against its walls on the inside are two electrodes C' C², made of carbon or metal, to which leads from the source of current to be used are connected.

At the center of the tub a vertical spindle N carries a revolving arm M' M², also of insulating material, which during use of the

apparatus is revolved slowly by clockwork or by a motor, (indicated at D D, Fig. 1,) a belt from which drives the arms M' M² at a comparatively slow rate of speed, not more than 5 a few times a second. These arms carry at their extremities other electrodes C³ C⁴, the distance of which from the spindle N can be adjusted from a position in which, while revolving, they will just clear or pass the fixed 10 electrodes C' C² on the walls of the tub to a position that leaves a considerable distance between them on passing. This is made practicable by providing longitudinal slots Z' Z² in the arms M' M², of insulating material, 15 through which pins of conducting material pass that support the revolving electrodes C³ C⁴. These pins have nuts X' X² at their heads above the arms M' M² by which the movable electrodes may be secured at any 20 point along their respective slots, thus fixing their distance from the spindle N and from the electrodes C' C² in passing them. The spindle also carries two insulated ring-contacts R' and R², against which bear the brushes 25 or sliding contacts H' H², the rings being connected, as shown, to the two revolving electrodes C³ C⁴, one to each, while other leads from the brushes H' H² go to independent operating-circuits connected to the terminals 30 A² B².

Different devices for applying the current may be attached to these main terminals A² B² of the operating-circuits. Thus E' E² represent ordinary hand-electrodes, S' S² sponge 35 electrodes, and P' P² are pails or vessels of water having electrodes E³ E⁴ inside. These are filled with slightly-acidulated water, and by immersing the hands or feet in them the current can be sent through the upper or 40 lower extremities of the body.

Of course any form of electrodes may be used to apply the current to the subject, either through the medium of water or by direct application of the electrode to the person. 45 son.

The system will now be clearly understood. It consists, in general terms, in transforming any ordinary direct current to a uniformly and smoothly alternating one without prolonged zero periods or interruptions, its voltage being represented preferably by a sine curve and the frequency being lower than that ordinarily generated by dynamo-electric machinery. This is accomplished by passing 55 the original current through a slowly-revolving liquid commutator or current-reverser, which, I think, is the only device that will give a perfectly unbroken and uniformly varying alternating current, devoid of any sudden reactions or change of voltage. 60

Tracing the circuits in Fig. 1, it is evident that if the movable electrodes C³ C⁴ are revolved then a direct current supplied to the leads connected to A' B' will become an alternating current in the circuits connected to the 65 brushes H' H² or terminals A² B².

An ordinary metallic reversing-commutator will not, however, serve the purpose, because there would always be more or less violent reactions and change of voltage at every 70 passage of the brush from one segment of such a commutator to the next. In fact, the slightest sparking at the brushes indicates such reaction and a non-interrupting or absolutely sparkless current-reverser must be used for 75 this purpose.

I have shown the apparatus connected either to the house-mains for lighting or to the terminals of a battery. It is understood, of course, that the water in the liquid commu- 80 tator can be used as a rheostat or resistance to diminish the voltage, if that of the source is too high, this being done by simply moving the electrodes C³ C⁴ in toward the spindle and so increasing the water-resistance between 85 the fixed and moving electrodes on passing. On the other hand, if the voltage of the battery Y is too low, the transformed alternating current can be passed through the coreless induction-coil I I, Fig. 1, and any desired 90 increase of voltage given it.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is the following:

1. In electrotherapeutic apparatus a source 95 of electric energy, leads therefrom to the terminals of a current-reversing apparatus adapted to transform said current to a uniformly and gradually alternating unbroken current and leads from said current-reversing 100 apparatus to devices for applying said transformed current to the human subject substantially as described.

2. In electrotherapeutic apparatus a current-reversing device consisting of a system 105 of fixed and revoluble electrodes, both immersed in a liquid conductor, the fixed and revoluble electrodes being connected to independent electric circuits and means for revolving the movable electrodes with respect 110 to and in proximity to the fixed electrodes, substantially as described.

In testimony that I claim the foregoing as my invention I have hereunto set my hand, in the presence of two witnesses, this 28th day 115 of September, 1896.

FRANCIS JARVIS PATTEN.

Witnesses:

GEORGE H. BENNETT,
A. LEONARD HALL.