

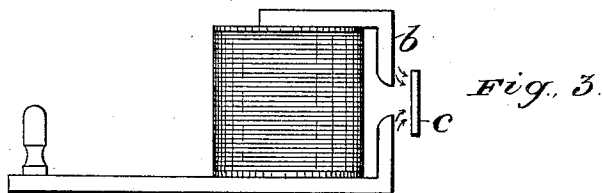
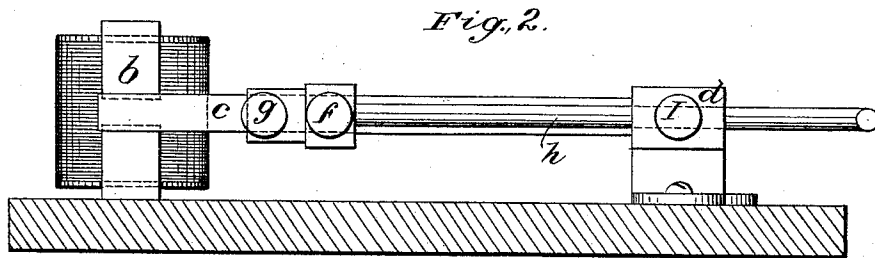
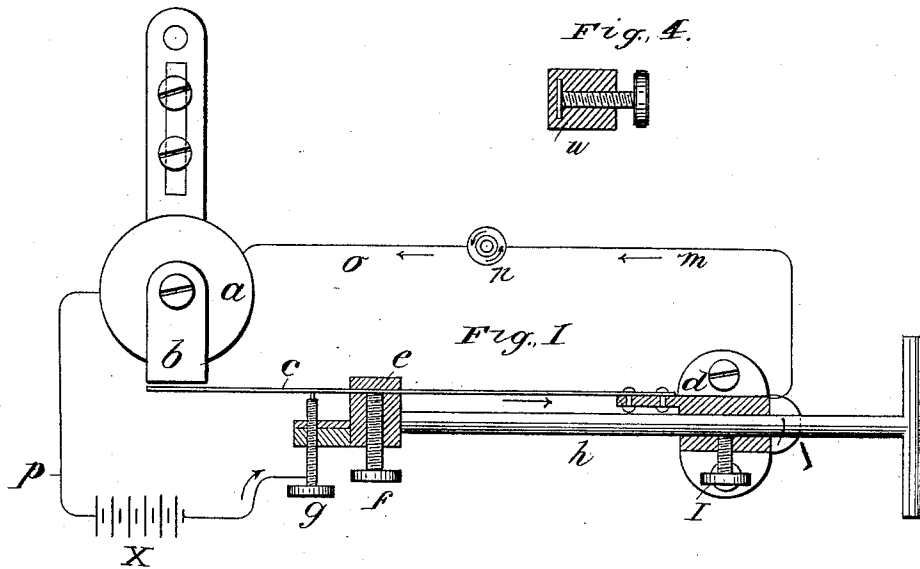
(No Model.)

L. W. DOWNES.

CIRCUIT BREAKER FOR ELECTROTHERAPEUTIC APPARATUS.

No. 524,165.

Patented Aug. 7, 1894.



Witnesses  
W. R. Edelen  
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# UNITED STATES PATENT OFFICE.

LOUIS WELTON DOWNES, OF PROVIDENCE, RHODE ISLAND.

## CIRCUIT-BREAKER FOR ELECTROTHERAPEUTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 524,165, dated August 7, 1894.

Application filed January 21, 1893. Serial No 459,139. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS WELTON DOWNES, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Electrotherapeutical Apparatus, of which the following is a specification.

My invention relates to apparatus for varying the periodicity of pulsations of an electric current such as is employed in an inductive coil for medical or other purposes.

In the electro-therapeutical treatment of nervous and similar diseases, which until a very recent time was purely empirical, the conditions necessary to produce favorable effects, have come, as the result of much study and investigation, to be better understood. One of the most important facts established is that beneficial effects are produced when the rate of pulsation of the current corresponds to or is in sympathy with the natural period of nerve-pulsation of the patient. This period is, in most cases, about two hundred and sixty-one per second, corresponding to middle C of the French musical scale. It differs, however, in different individuals, though it is always a very high rate. For the successful treatment, therefore, of cases of the kind referred to, the apparatus must be capable of producing a pulsatory current of high frequency, and it must also be capable of very nice and accurate adjustment over a wide range. No electro-therapeutical apparatus heretofore devised, and of which I have any knowledge, possesses these capacities which characterize and constitute the chief merit of the present invention.

An apparatus constructed in accordance with the present invention, and with which the described results have been accomplished in actual use, is illustrated in the accompanying drawings, in which—

Figure 1 is a top plan view partly in section, the circuit and other accessory parts being shown in diagram. Fig. 2 is a side elevation. Fig. 3 is a detail of the magnet and tongue, and Fig. 4 is a detail of an adjustable detachable weight for the tongue.

In the drawings *a* represents an electro-magnet having poles *b, b* bent toward each other so as to concentrate the lines of magnetic force

at or near a given point. A vibrating tongue *c* formed of a flexible metallic strip is secured rigidly at one end to a bracket *d* its free end extending to within close proximity of the poles *b b* of the magnet *a*, which latter may be adjusted toward and away from the tongue to increase or diminish the intensity of the magnetic field, the force of which is concentrated at the tongue by the arrangement of the poles of the armature, (as indicated by the arrows in Fig. 3). It is to be noted that the vibrating tongue is not of the hammer type, ordinarily used, which is ineffective in the production of vibrations of very high rapidity owing to the effect of the metallic block or armature secured to the end of the tongue. The tongue employed by me is a straight metallic strip, preferably of uniform dimensions throughout, and without any enlargements at its free end.

A rod *h* arranged parallel with the tongue *c* is adjustably secured in an opening extending through the bracket *d* by a set screw *i*. At one end rod *h* carries a block *e* having a slot therethrough in which the tongue *c* slidingly engages and in which it is clamped by a set screw *f*, thus preventing the vibration of the free end of the tongue beyond such point. Carried by the block *e* is an adjustable insulated contact screw *g* adapted to make contact with the tongue *c* when the same is in its normal condition. The block *e* and rod *h* are suitably insulated from the tongue *c* and bracket *d* respectively.

The circuit connections of the apparatus are as follows:—from the positive pole of the battery *x* to the contact screw *g*, to the tongue *c*, along tongue *c* to the bracket *d*, thence through wire *m*, through the induction coil *n* (of a construction common to such apparatus) by wire *o* to electro-magnet *a*, through the electro-magnet and thence to the negative pole of the battery, by wire *p*. The electro-magnet *a* becoming energized by the passage of the current attracts the tongue *c*, drawing the latter away from contact with screw *g*, thereby breaking the current, whereupon the electro-magnet *a* immediately becoming demagnetized releases the tongue *c* which springs back into contact with screw *g* again completing the circuit. This making and breaking of the primary circuit takes place

in rapid succession producing pulsations therein, the rapidity of which is dependent upon the rapidity with which the tongue *c* vibrates. These pulsations in the primary circuit produce corresponding pulsations in the secondary circuit, as is well understood.

The rapidity of vibration of the tongue *c* and hence the pulsations of the current may be varied by varying the vibrating length of the tongue *c* which is accomplished by loosening set screws *I* and *f* and shifting the position of the block *e* and again tightening the set screws.

In my apparatus in order to obtain the widest possible range of vibration of the tongue, I provide for the adjustment of the block *e* from the fixed end of the tongue to within close proximity of the poles *b, b* of the magnet, thus enabling the production of vibrations of the greatest rapidity. An idea of the range of vibrations which may be obtained in this manner will be gathered when it is stated that with my apparatus, starting with vibrations so slow as to be counted by the eye, they can be increased gradually to over forty-one thousand per minute, when a distinct musical note is sounded corresponding with the octave of the *F* next above middle *C* of the musical scale, the number of vibrations and note being ascertained by comparison with a tuning fork or other musical instrument.

An important feature of my invention is the arrangement of the contact screw *g* movable with and situated as near to the block *e* as possible so that the amplitude of vibration of the tongue at the contact screw will be sufficient to break the circuit. It is desirable to have the distance between the block *e* and the contact screw as small as possible in order to reduce to a minimum the shock produced by the tongue coming in contact with the end of the screw, which increases with the increase in the amplitude of vibration of the tongue; such shock tending to produce unevenness and irregularity in the vibrations.

I provide means for adjusting the magnet toward and away from the tongue *c* for varying the field strength of the magnet without changing the exciting current, which is undesirable since it also affects the induced cur-

rent. This is important for the reason that the field strength required varies with the length of tongue, a short tongue requiring greater magnetic strength.

If for any purpose it may be desired to use the apparatus to produce very slowly pulsating currents the weight *w* (see Fig. 4) may be clamped on the tongue *c* increasing the amplitude of and hence decreasing the rapidity of vibration of the tongue.

Having thus described my invention, what I claim as new is—

1. In an electro-therapeutical apparatus, the combination with an electro-magnet, of a vibrating tongue consisting of a metallic strip without enlargements or projections at its free end, which end is arranged in proximity to said magnet, an electrical circuit adapted to be made and broken by the vibration of said tongue, and a clamp adjustable along said tongue to regulate the vibrating length thereof, substantially as described.

2. In a therapeutical apparatus, the combination with an electro-magnet, of a thin flexible tongue having its free end in proximity to said magnet and having a high normal rate of vibration, as specified, a clamp adjustable along said tongue to vary the vibrating length thereof, a contact pin or point for the tongue arranged close to and movable with said clamp, and an electrical circuit extending through said electro-magnet and having its terminals in the tongue and contact pin respectively, said circuit being made and broken by the vibrations of the tongue, substantially as described.

3. In an electro-therapeutical apparatus the combination with an electro-magnet having its poles bent inwardly toward each other so as to concentrate its magnetic force at or near a given point and a flexible tongue having its free end arranged in proximity to said poles, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LOUIS WELTON DOWNES.

Witnesses:

AUGUSTUS O. BOURN, Jr.,  
HOWARD E. BARLOW.