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PATENTED JUNE 14, 1904.

R. VARLEY.  
INDUCTION COIL VIBRATOR.  
APPLICATION FILED JAN. 22, 1904.

NO MODEL.

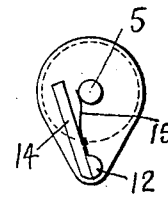
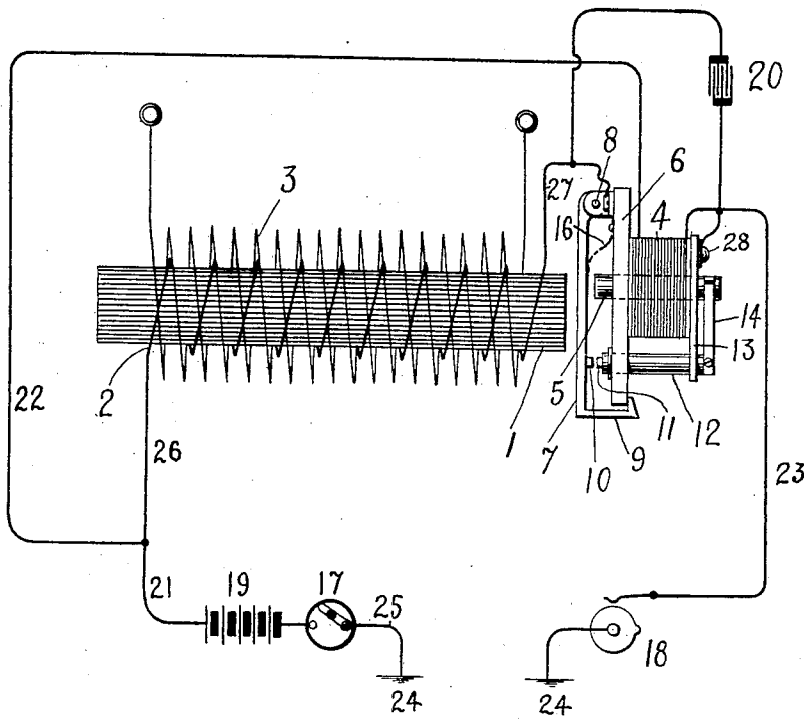


FIG. 2.

FIG. 1.

Witnesses  
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# UNITED STATES PATENT OFFICE.

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## INDUCTION-COIL VIBRATOR.

SPECIFICATION forming part of Letters Patent No. 762,776, dated June 14, 1904.

Application filed January 22, 1904. Serial No. 190,197. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Induction-Coil Vibrators, of which the following is a full, clear, and exact description.

This invention relates to vibratory circuit-controllers for induction-coils, the object being to provide a device which after being once properly constructed and adjusted will require no further adjustments or manual manipulation during use. A device possessing this desideratum obviously can be sealed in a suitable protective casing which will exclude moisture, dust, and foreign bodies generally, which in the ordinary unprotected devices are the cause of trouble at the electrical contacts. Ordinary vibrators cannot be practically sealed up, because they comprise a spring or springs which for various reasons must be adjusted from time to time, such adjustment being accomplished by means of screws that must be readily accessible for manipulation by hand or with a screw-driver.

A further object of this invention is to provide a vibrator whose contacts can never "stick," due to the welding effect of the arcing between the points. This feature is valuable both in a sealed and an open vibrator, but has a special value in the former, since it provides a remedy for a trouble which, if it was liable to occur, would make it impracticable to seal up the vibrator.

With these objects in view the invention consists in producing the vibration of the circuit-controlling element by the alternate action of two magnets so placed with respect to the vibrator as to move it in opposite directions, one of said magnets being the induction-coil and the other a small special magnet provided for the purpose. The vibrator is supported in a floating condition uninfluenced by springs, and the circuits are so arranged that the moment the current is turned on the vibrator will operate regardless of whether the contacts of the vibrator are closed or

open, for if closed the magnetic attraction of the induction-coil will influence it and if open the small magnet will influence it, and the movement due to either magnet will direct a controlling-current to the other, thus causing them to act alternately and establish a vibration of the vibratory element. It is therefore evident that since the vibration occurs without the aid of springs there is no element that requires adjustment after the device is once properly constructed. The other feature, to overcome the "sticking" should it occur, consists in providing for one of the contacts to slightly rotate or grind on the other at times during its operation, thus breaking down or destroying the cohesive tendency. A more complete description will now follow with reference to the accompanying drawings, in which—

Figure 1 is a conventional illustration and diagram of the apparatus and circuits constituting the invention, and Fig. 2 is a plan of the head of the auxiliary magnet.

1 indicates the core of a Ruhmkorff or other induction-coil, of which 2 is the primary winding and 3 the secondary winding.

4 is a small auxiliary electromagnet having its core 5 projecting through a plate 6, of fiber or other suitable insulating material, and facing a circuit-controlling plate 7. The plate 7 is hinged at 8 and stands between the core 1 and the pole 5, as shown. Thus the magnetic attraction of the core and the pole 5 has an opposite effect upon the plate 7, one tending to pull it in one direction and the other in the opposite direction. The plate 7 has a hooked end 9, which engages with the end of plate 6 to limit its movement under the attraction of the core 1. Plate 7 also carries a contact-point 10, which faces another contact-point 11 on the end of an iron post 12, passing through the plate 6. Post 12 also passes through a brass plate 13 on the outer end of magnet 4 and has attached to its outer end an iron arm 14, which extends within attractive distance and to one side of the projecting rear end of the core 5. Between this arm and the end of the core a light spring 15 is interposed to move the arm

away from the core when the magnet is de-energized. The post 12 is capable of rocking in its bearings in plates 6 and 13, which it does by reason of the attraction of the magnet 4 and the spring 15. The arm 14 and post 12 at the same time serve as a portion of the magnetic circuit of magnet 4.

The plate 7 is simply suspended or supported in a floating condition between the two cores 1 and 5 and is operative when entirely free from the influence of springs; but I prefer to insert a very light spring 16 between the plate 6 and the plate 7 to normally hold the contacts 10 and 11 open and the hook 9 against the plate 5 for a purpose which will hereinafter appear.

This device is especially designed for use in connection with explosion-engines, either stationary or such as are used on automobiles, and I have provided in connection with it the hand-switch 17 and the mechanical closer 18, which is usually placed on one of the shafts of the engine to close the circuit of the primary winding when the secondary current is needed in the cycle to create the spark. The usual battery 19 and condenser 20 are also provided.

The operation and the electric circuits will now be described. The switch 17 being closed, when the circuit-controller 18 closes current from the battery will flow by wires 21 and 22, electromagnet 4, wire 23, circuit-controller 18, the frame of the machine or ground 24, and wire 25 to battery. At the same time the circuit through the primary winding 2 is open, since the contacts 10 and 11 in series therewith, as will hereinafter appear, are separated. Magnet 4 being thus energized, its core 5 strongly attracts plate 7 and closes the contacts 10 and 11, thus closing the circuit through the primary winding, as follows: from the battery 19 by wires 21 and 26, primary winding 2, wire 27, plate 7, contacts 10 and 11, post 12, plate 13, binding-post 28, attached to said plate, wire 23 to the circuit-controller 18, ground 24, and wire 25 to battery. Current thus flowing through the primary winding will produce a much stronger magnetism in the core 1 than now exists in the magnet 4. Plate 7 will therefore be moved in the reverse direction by core 1 and open the primary circuit at 10 and 11. This will result in cutting out the primary coil and again throwing the full current through magnet 4, when the operation before mentioned is repeated, the result being a rapid vibration of the plate 7 and consequent interruptions of the primary current, which will give the required sparking at the terminals of the secondary winding. The vibrations will continue as long as the circuit is closed at 18, and if the circuit-controller 18 is omitted from the organization the vibrations will continue as long as the switch 17 is closed. The condenser 20 being connected on one side with the plate 7 and on the other with the plate 13 is in shunt to the

two contacts, as usual. Each time the magnet 4 gets the current the arm 14 is attracted and rocks the post 12. This results in a grinding of the contacts at the moment they come together, which cleans them and insures a low-resistance connection. When magnet 4 is de-energized by the opening of the circuit at the controller 18, arm 14 is forced away from core 5 by spring 15, the post 12 being rocked in the opposite direction. As this occurs at the instant when the core 1 attracts plate 7, it will break down any welding or cohesion of the contacts 10 and 11 and prevent any tendency of them to stick.

It will thus be seen that this invention provides a vibrator for induction-coils which is moved in both directions by magnetic attraction and that the force exercised by the magnet 4 will be much stronger than would be possible with any spring that could be used, so that the contacts are closed with a great deal of force, and if it should be desired to immerse them in oil they would still be operative, since the power of the magnet is sufficient to force the oil aside to obtain good contact. When the spring 16 is used to hold the contacts normally separated, it will be seen that at the instant the circuit is closed at 18 the magnet 4 brings the contacts together with a blow. This is sufficient to crush any foreign particle that may have been deposited on the faces of the contacts and insure perfect metallic connection at the first stroke of the vibration, which results in a good spark at the secondary at the first parting of the contacts.

From the circuits above traced it will be seen that the primary winding is in series with the battery and the contacts, while the magnet-coil 4 is in a closed shunt around the battery. Magnet 4 is therefore constantly energized while the vibrator is active; but the resistance of the primary winding is so much less than that of the magnet that the magnetism induced in the core of the induction-coil when the primary winding-circuit is closed at the contacts overcomes that of magnet 4 in the same manner that it would overcome an opposing spring; but since the plate is constantly under the strain of magnet 4 it is in a condition to at once reverse its motion when the induction-coil ceases its pull, which therefore produces a high rate of vibration. By thus dispensing with springs it will be noted that the adjusting-screws for springs are also eliminated and no adjustments of any kind are necessary, since the operation of the device does not depend upon adjustments. By avoiding the necessity of using adjusting-screws it becomes possible to inclose all parts of the device in a sealed casing to exclude dust, moisture, and for general protection. Hence difficulties arising from foreign particles lodging between the contacts are largely avoided. The rotating contact-point is ob-

viously not an essential feature of the device; but it adds to the certainty of the operation, since excessive arcing between the contacts sometimes causes them to stick or "freeze," and this cannot occur when the grinding contact is used. It may here be noted that if the relative resistance of the magnet 4 to the primary winding is such as to result in the almost complete demagnetization of magnet 4 each time the primary circuit is closed the post 12 will be rocked at each stroke of the armature and not merely at the beginning and ending of each of its periods of vibration, as hereinbefore described. This can be taken advantage of in induction-coils used for other purposes and also where the circuits are otherwise arranged.

Plate 7 may be constructed and supported in any manner to partake of a to-and-fro motion; but in all cases where the position of the coil is such that gravity will not normally hold the contacts open it is preferable to use the small spring 16 to perform that office for the purpose stated. Its tension, however, is so small as to be a negligible quantity during the activity of the vibrator.

Having described my invention, I claim—

1. The combination with an induction-coil of a vibrator therefor actuated in opposite directions respectively by two electromagnets, one of which is the induction-coil itself.

2. The combination of an induction-coil, a springless vibrator and an electromagnet, the vibrator being actuated alternately by the magnetism of the induction-coil and that of the electromagnet, for the purpose set forth.

3. The combination of an induction-coil, an electromagnet and a floating vibrator supported between the induction-coil and the magnet and adapted to be moved in opposite directions respectively by the same.

4. The combination of an induction-coil, an electromagnet and a floating vibrator, said vibrator being within the magnetic influence of both the coil and the magnet and means whereby the vibrator will be moved in opposite directions by said coil and magnet.

5. The combination of an induction-coil, an electromagnet, a vibrator oppositely influenced by said induction-coil and magnet, the circuit of the magnet being continuous and the primary circuit of the induction-coil be-

ing interrupted during the activity of the vibrator.

6. The combination of an induction-coil, a vibrator adapted to interrupt the primary circuit of said coil and being moved in one direction by the magnetic attraction of said coil and a continuously-energized electromagnet acting upon the vibrator in opposition to the induction-coil.

7. The combination of an induction-coil, a source of electricity, a vibrator, contacts controlled by the vibrator and an electromagnet, the vibrator being adapted to be moved in opposite directions by the magnetism of the induction-coil and that of the electromagnet, the primary winding of the induction-coil, the battery and the contacts being connected in series and the electromagnet being in a closed shunt around the battery.

8. The combination of an induction-coil, a vibrator therefor, a pair of contacts controlled by said vibrator and in series with the primary winding of the induction-coil, said contacts being normally separated and means for closing said contacts when the current is turned on.

9. The combination of an induction-coil, a vibrator therefor, a pair of contacts controlled by said vibrator and in series with the primary winding of the induction-coil, said contacts being normally separated and an electromagnet for closing said contacts.

10. The combination of a vibrator, a pair of contacts controlled thereby and means for twisting or rotating one of the contacts while they are together.

11. The combination of a vibrator, a pair of contacts controlled thereby, an electromagnet adapted to actuate the vibrator and means controlled by the magnet for twisting one of the contacts.

12. The combination of a vibrator, an electromagnet adapted to actuate the same, a rocking post actuated by said magnet and a pair of contacts, one of which is carried by the vibrator and the other by the post.

In witness whereof I subscribe my signature in presence of two witnesses.

RICHARD VARLEY.

Witnesses:

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