

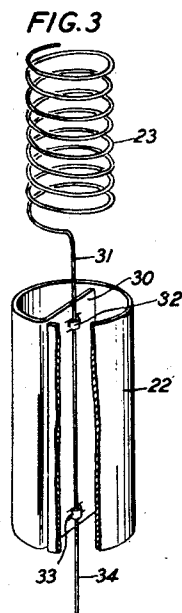
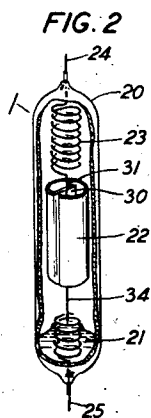
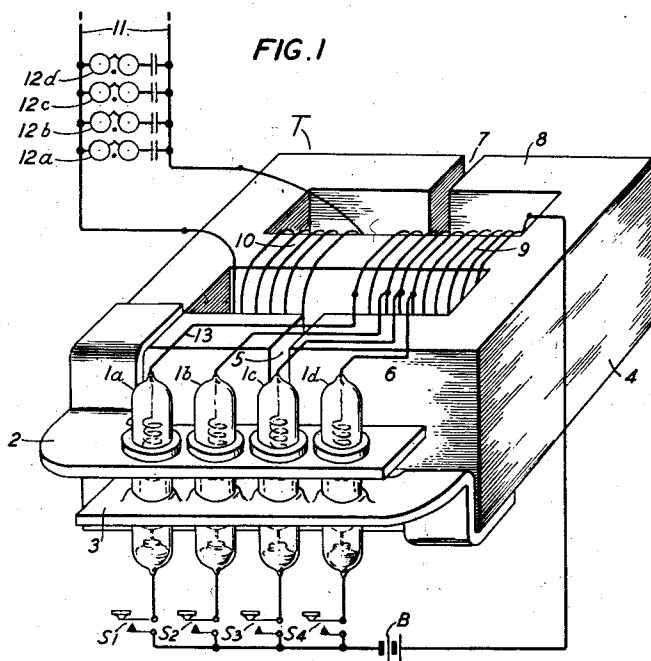
Feb. 29, 1944.

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2,342,781

COMBINED MERCURY INTERRUPTER AND TRANSFORMER

Filed Oct. 16, 1940



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2,342,781

COMBINED MERCURY INTERRUPTER AND TRANSFORMER

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Application October 18, 1940, Serial No. 361,401

2 Claims. (Cl. 177-380)

This invention relates to mercury contact interrupters and more particularly to combined units consisting of one or more interrupter switches associated with a transformer structure.

In a copending application Serial No. 362,305 filed in the name of C. E. Pollard on October 19, 1940, a mercury contact interrupter is described and claimed in which a magnetic armature is vertically displaceable in a magnetic field to alternately break and close a mercury contact, the field being provided by an electromagnet, the energizing circuit of which includes a battery, the magnet winding, the normally closed contacts of the mercury switch and the primary winding of a transformer, the secondary of which supplies alternating current to an output circuit.

A feature of the present invention resides in combining in a single unit the functions of the electromagnet and the transformer and mounting the mercury switch in such a manner with respect to the core of the transformer that when the switch contacts are closed the field produced by current flowing in the primary winding will cause the armature to be displaced to open the circuit permitting the armature to restore and reclose the switch contact which operation is repeated at a rate determined by the natural period of vibration of the armature, whereby a current of alternating character is produced in the secondary winding which may be utilized for the operation of telephone bells, electric motors, as a source of tone or for any other purpose where a substantially constant frequency source is required.

A further feature resides in combining a plurality of switching units, having differently tuned armatures, with a single transformer structure whereby the selective closure of the primary circuit through any one of the switches will generate an alternating current in the secondary winding which corresponds to the natural period of the switch armature connected in circuit.

Another feature of the invention resides in a specific structure for the switch armature in which a sheet of magnetic material is formed into a cylinder having a diametrically disposed partition to which an extension of the supporting spring is axially fastened to extend below the armature to contact with the mercury.

The invention will be understood from the following description and accompanying drawing, in which:

Fig. 1 illustrates a combined transformer and electromagnetically operated mercury interrupter switch structure mounting a plurality of mercury interrupter switches the armatures of which are adapted, when operated, to have different predetermined natural periods of vibration;

Fig. 2 shows the general structure of the interrupter switches; and

Fig. 3 shows the specific structure of one of such switch armatures.

Referring to the drawing the mercury switch interrupters 1a, 1b, 1c and 1d of Fig. 1 and shown in detail in Fig. 2 are the general type disclosed and claimed in the before-mentioned copending application of C. E. Pollard and consist of a glass tube 20 (Fig. 2) containing a pool of mercury 21 in the bottom thereof and a cylindrical armature 22 of magnetic material loosely suspended therein by means of a spring 23 and adapted, when at rest, to complete a circuit between top and bottom lead-in wires 24, 25 through the mercury and when caused to rise in the tube under the influence of a magnetic field to break contacts in the mercury and open the circuit.

A laminated transformer core 4 of the shell type has a central leg 5 and outer legs 6 and 7, each of which outer legs have respective air-gaps 8 and 9 therein.

Attached to the transformer core 4 are magnetic core extension members 2 and 3, so positioned and arranged that they form an auxiliary or shunt gap to the gap 8 in leg 6.

The interrupter switches 1a, 1b, 1c and 1d are positioned in openings in the core extension member 2, 3 in such a manner that normally the individual armatures 22 of the switches are slightly below center so that when the transformer core 4 is energized flux across the gap between core extensions 2 and 3 tends to raise the armatures thereby breaking contact with the mercury. The circuit for energizing the transformer and operating the interrupter switches comprises a battery or other source of direct current B, a winding 9 on the central leg of the core, selecting keys S1, S2, S3 and S4 and the corresponding interrupters 1a, 1b, 1c and 1d, the upper terminals of which are connected to different portions of winding 9 for the purpose of compensating for changes in impedance due to the different frequencies of the interrupters as determined by the natural periods of the different armatures.

A secondary or output winding 10 is also wound on the central leg of the transformer to which an output or work circuit 11 may be

connected which work circuit may comprise differently tuned devices, such as telephone ringers which are to be selectively operated.

The operation of the interrupter transformer unit is as follows: Assuming that the armatures of switches 1a, 1b, 1c and 1d are constructed to have natural vibration periods of 16⅓, 33⅓, 50 and 66⅔ cycles per second, respectively, and that the telephone ringers 12a, 12b, 12c and 12d are each tuned to respond to a different one of these frequencies, i. e., ringer 12a tuned to respond to a frequency of 16⅓ cycles, 12b to 33⅓ cycles, etc. Now, if it is desired to actuate ringer 12a key S1 will be closed thereby completing a circuit from the source B over contacts of the key S1, mercury contacts of interrupter switch 1a, conductor 13, winding 9 of the transformer and back to the source B, whereupon a magnetic flux will be established across the air-gap 5 and between the core extensions 2 and 3, in parallel, thereby causing the armature of interrupter switch 1a to rise and break contact with its corresponding pool of mercury which opens the circuit previously traced thereby causing a cessation of the flux in the transformer core and permitting the armature of interrupter 1a to restore and remake contact with the mercury whereupon the foregoing operating cycle is repeated. This cycle continues to repeat as long as key S1 is closed at the predetermined rate, i. e., 16⅓ vibrations per second. The alternately increasing and decreasing flux in the transformer core occasioned by interruptions of the circuit by switch 1a causes an alternating current of 16⅓ cycles to be induced in the secondary or output winding 10 of the transformer which frequency flowing in the output circuit or line 11 will cause the correspondingly tuned ringer 12a to respond to the exclusion of the other three ringers which are tuned to other frequencies. Operation of any one of the other keys S2, S3 or S4 will cause the armatures of the corresponding interrupter switches to vibrate and actuate the correspondingly tuned ringers.

In accordance with a second feature of the invention a specific and improved structure for the armature 22 of the switches 1a, 1b, 1c and 1d is shown in Fig. 3, which armature is formed, from a single sheet of magnetic material, into a cylinder having a diametrically disposed partition 30 to which an extension 31 of the supporting spring 23 is axially fastened by means of punched lugs 32, 33, the extension member 31 being carried below the cylinder to form a contact member 34 for engagement with the mercury. In constructing these armatures the spring 23 having an extension 31 is first formed, together with a proper size flat sheet of magnetic material having punched lugs 32 and 33, after which the spring extension 31 is inserted under the lugs 32, 33 and the lugs pressed down to hold the extension wire

31 in position, following which the flat sheet is rolled into the cylindrical shape desired.

What is claimed is:

1. In a multifrequency generator in combination, an iron transformer core having an air-gap therein and primary and secondary windings thereon, an output circuit connected to said secondary winding, a plurality of mercury contact interrupters each comprising a magnetic armature flexibly suspended and vertically movable within a sealed vessel having a pool of mercury at the bottom, each of said armatures having a different predetermined natural period of vibration, a member connected to and movable with each armature normally in contact with the mercury at the bottom of the respective vessel, magnetic extension members for said core formed to provide a secondary air-gap in parallel with said first air-gap and to support said plurality of interrupter vessels in such a position that the armatures thereof in their normal position partially shunt the secondary air-gap formed by said extension members, a source of direct current and selective means for connecting said source and the primary winding in series with any one of said mercury contacts, whereby said core is energized to move the armature of the interrupter, associated with the connected mercury contacts, into a position to break the contact and deenergize the core thus permitting the contacts to reclose and reenergize the core which cycle is repeated at the rate predetermined therefor, during the interval the source is connected.

2. In a multifrequency generator in combination, a transformer core having an air-gap therein, primary and secondary windings on said core, an output circuit connected to said secondary winding, magnetic extension members for the opposing poles of said core formed in such a manner as to have their free ends superimposed to form a secondary air-gap in parallel with said first air-gap, said superimposed ends being provided with a plurality of aligned openings, a plurality of sealed vessels each containing a pool of mercury in the bottom, vertically supported in said openings, each of said vessels also containing a magnetic armature flexibly supported and vertically movable therein and tuned to have a characteristic natural period of vibrations different from the others, a contact member connected to and movable with each of said armatures and normally contacting the respective pool of mercury, said vessels being so positioned in said aligned openings that each armature in its normal position partially, but not completely, shunts said secondary air-gap, a source of direct current, and means for connecting said source in circuit with said primary winding over any one of said mercury contacts.

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