

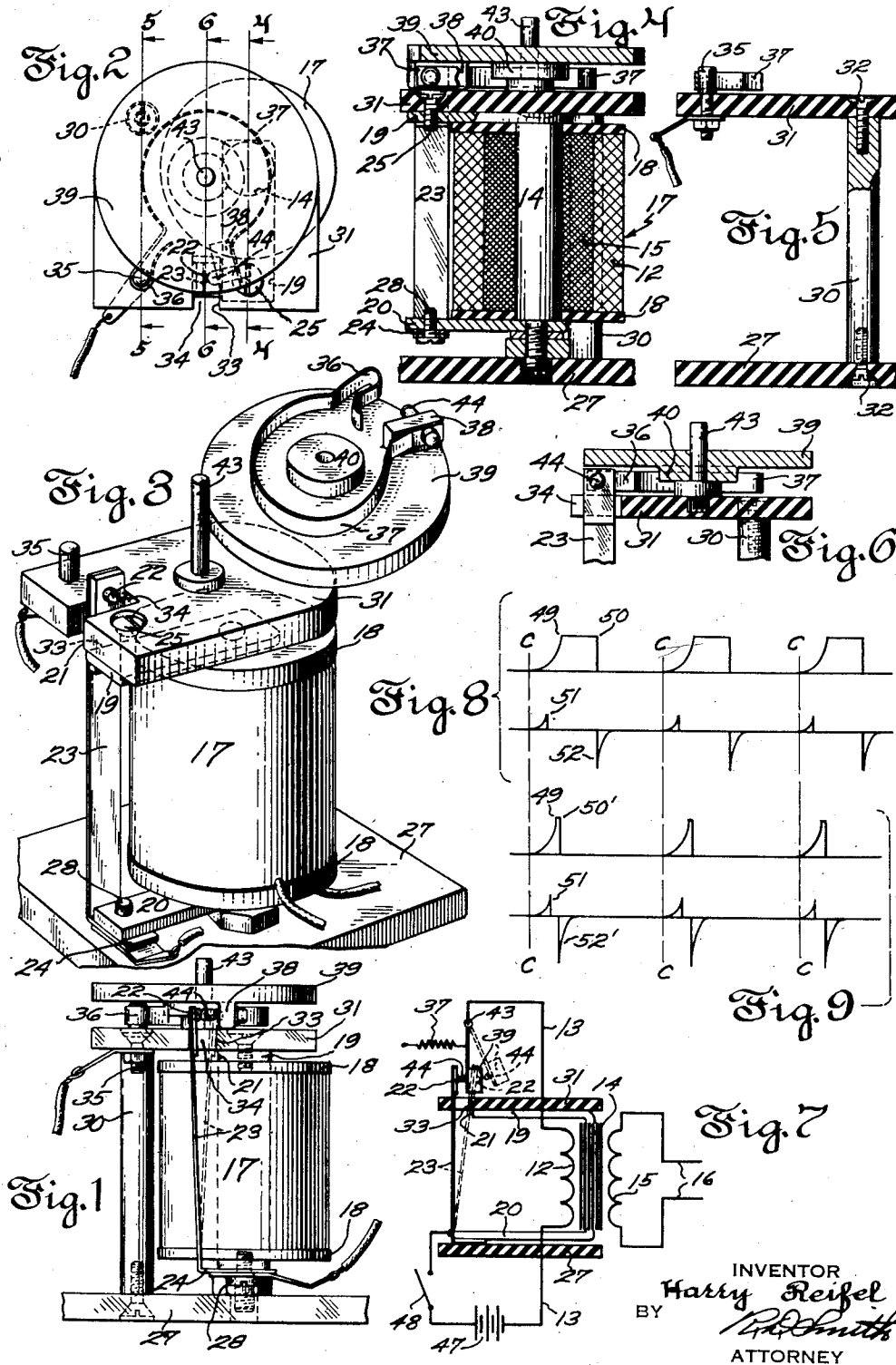
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H. REIFEL

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INPUT SAVING VIBRATORY INDUCTION COIL

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INVENTOR
Harry Reifel
BY *[Signature]*
ATTORNEY

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INPUT SAVING VIBRATORY INDUCTION COIL

Harry Reifel, Waltham, Mass., assignor to The A. C. Gilbert Company, New Haven, Conn., a corporation of Maryland

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1 Claim. (Cl. 321—49)

This invention relates to vibratory electric power supplies capable of inducing surges of relatively high peak potential in the secondary winding of an induction coil by means of automatically repeated build-up and decay of magnetic strength in the core of the coil occasioned by making and breaking a circuit through which the primary winding of the coil is supplied with unidirectional current of relatively very low potential.

Ordinarily the making and breaking of the primary circuit in a conventional power supply of the vibratory type is accomplished by contacts that are opened and closed in rapid succession merely by automatic resonant vibration of a resilient reed equipped with an armature that is magnetically attracted and released to impulse the reed. Ordinarily the reed breaks and remakes contacts once during each complete excursion or cycle of vibration thereof, the excursion comprising flexing of the reed in alternately opposite directions with about equal extent of movement at each side of its mean position.

This results in the primary winding of the induction coil being deenergized by opening of the reed vibrated contacts for a time interval about equal to the period that the primary winding remains energized after the reclosing of such contacts. During most of the time that the primary circuit remains energized the induction coil is consuming a full flow of supply current. Heretofore this duration of current flow in the primary has amounted to about half the total time cycle of the reed vibration. During this half cycle no build-up nor decay of magnetic flux is taking place in the core of the induction coil. Hence much of the aforesaid consumption of direct current in the primary winding is wasted because it neither causes nor is accompanied by any induction of potentials, positive or negative, in the secondary winding of the induction coil for use in a utilization circuit.

An object of the present improvements is to prevent the waste of unproductive direct current consumption in the primary winding of a vibratory power supply above mentioned without, as a result thereof, sacrificing any output of power from the secondary winding.

A contributory object is to reduce the time during which current is drawn through the primary of the induction coil to a considerably smaller proportion of the cycle of vibration of the contact motivating reed than the usual fifty percent of such time cycle.

Another object is to attain an undiminished output of power from the secondary winding of a vibratory induction coil when the rated input of direct current into the primary winding is lowered for the purpose of permitting the primary winding to be composed of wire of smaller diameter without undue heating effect. A consequent advantage of the reduced heating effect is that it enables the secondary winding to be placed for greater efficiency directly about the core of the induction coil between the core and the primary winding.

These and related objects of the invention will become clear in greater particular from the following description

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of an illustrative embodiment of the invention having reference to the accompanying drawings wherein:

Fig. 1 is a view in elevation showing one form of vibratory power supply adapted to operate in the electrical system of Fig. 7 in accordance with the invention.

Fig. 2 is a plan view of the device shown in Fig. 1.

Fig. 3 is an exploded perspective view showing the time lag oscillator removed from its pivot in Fig. 1 and inverted.

Figs. 4, 5 and 6 are fragmentary views taken in section on the planes 4—4, 5—5 and 6—6, respectively, in Fig. 2, looking in the direction of the arrows.

Fig. 7 is a schematic diagram of electric circuits incorporating the vibratory power supply of Figs. 1 to 6, inclusive.

Figs. 8 and 9 are diagrams of wave shapes explanative of current variation occurring simultaneously in the primary and secondary windings of a vibratory induction coil.

The secondary winding 15 of induction coil 17 is in a utilization circuit 16 and directly surrounds the upright stationary magnet core staff 14 of ferrous metal being immediately adjacent thereto, while the primary winding 12 is in a supply circuit 13 and externally surrounds the secondary winding. This is a reversal of the usual relative positioning of primary and secondary windings in a vibratory induction coil made possible by this invention and for advantageous purposes hereinafter explained.

Core staff 14 is fast and rigid at its top and bottom ends with pole arms in the form of magnet bars 19 and 20 respectively. The top magnet bar 19 as shown in Fig. 1 extends outward from the core staff 14 so that its edge presents a magnetic pole face 21 which flanks and sets up in its immediate vicinity a magnetic zone. In this zone there is mounted for oscillation with relatively short amplitude the upstanding spring leaf armature or reed 23. This reed comprises an electrically and magnetically conductive spring leaf of resilient ferrous material. The foot end 24 of reed 23 is anchored by being clamped between the insulative base 27 of the induction coil and the aforesaid magnet bar 20 by means of a screw 28. Reed 23 carries an impulsing contact 22 at its upper free vibratory end. The length of reed 23 bridges the gap between magnet bars 19 and 20.

Fastened to the top of magnet bar 19 by a screw 25 and deriving its support from the base 27, assisted by a frame post 30 fastened by screws 32, there is a platform 31 of insulative material having a notch 34 cut in its edge. Notch 34 is occupied by the top end portion of reed 23 and its carried contact 22 which vibrate crosswise of the notch. The resilience in reed 23 biases the contact 22 toward the left in Figs. 1 and 2 wherein it bears against the left edge of notch 34. From this position of rest the armature is movable in the magnetic zone of magnet bar 19 between loci of relatively weak and relatively strong magnetic flux in positions of the armature represented respectively by full lines and broken lines in Fig. 7.

Platform 31 has fixed thereon an upstanding stud 35 that is electrically conductive and about which there is loosely hooked in a manner to swivel freely thereon the free end 36 of the leaf spring 37 of a recoil device that is shown displaced and inverted at the top of Fig. 3. The other end of spring 37 is fast to a lug 38 fixed on the bottom surface of a balance wheel 39 that is turned upside down in Fig. 3. Hub 40 of the balance wheel has a free rotary fit on an upstanding stationary pintle 43 fixed on platform 31. Preferably balance wheel 39 is of brass or of some other relatively heavy non-magnetic material. The lug 38 thereon carries an impulsed contact 44 which makes and breaks contacts with the reed carried impulsing contact 22.

The use of an impulsed contact that is spring loaded and ballasted for causing it to be flung apart from an activated

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contact by impulsing action of the latter, so as to consume time before returning into contact therewith, has been proposed in connection only with vibrators whose sole purpose and function is to produce reciprocative mechanical motion of a bell hammer, signal element or other physical element to be moved by magnetic force. The incorporation of a ballasted, impulsed, oscillatory contact in an induction coil for inducing a stepped up potential in the secondary of the latter with increased efficiency in the conversion of direct to alternating current is believed new with this invention. The advantages are represented graphically in the comparative wave diagrams of Figs. 8 and 9.

In Fig. 8 the upper graph when scanned from left to right represents the typical performance of a conventional vibratory induction coil as to time of build up of current and consequent magnetization of core 14, the time of maintainance of same, and the time of decay of same in the primary winding 12. Such electrical performance would directly follow each energizing of the primary during each cycle of conventional vibratory contact action extending from C to C in Fig. 8. The lower graph in Fig. 8 shows corresponding potentials that are simultaneously induced in the secondary 15 of the induction coil.

In the operation of my improved induction coil, when unidirectional current at low voltage from battery 47 is supplied to primary 12 through normally closed oscillatory contacts 22, 44 by manually closing supply switch 48, the current begins at C to build up to a peak value in the primary until it reaches maximum value at point 49 in the wave curve, maintaining this value for only a fraction of the time it is maintained in Fig. 8, namely only until point 50' is reached in the time cycle. Thereupon occurs a sudden drop of current in primary 12 from its peak value to zero. Simultaneously in Fig. 9 there has been induced the same positive potential 51 in secondary 15 as is represented in the lower graph in Fig. 8, which potential as in Fig. 9 drops sharply back to zero when the build up of current value in the primary ceases, namely at the point 49. At point 50' in the curve of Fig. 9, contact 44 is flung to the right away from contact 22 because the latter becomes abruptly stopped in its movement at its broken line position shown in Figs. 1 and 7 wherein the magnetically attracted swing of reed 23 is checked by the right edge 33 of notch 34 in the insulative platform 31.

Beyond points 50 and 50' in the wave cycle in Figs. 8 and 9, respectively, all electrical values in the primary remain at zero. But in this interval, under the present improvements, contact 44, ballasted by balance wheel 39 which carries it, continues swinging counterclockwise in Fig. 2 about its pivot 43 under the dynamic inertia imparted to it by contact 22 until the balance wheel decelerates and is brought to a stop by the increasing tension imposed on its loading spring 37. Spring 37 then returns balance wheel 39 clockwise until contact 44 remakes the primary circuit by again meeting contact 22, which latter in the meantime has been returned from its broken line position to its normal full line position by the biasing tension in reed 23.

A mere comparison of Figs. 8 and 9 shows that during each cycle in applicant's improved induction coil a fully equivalent aggregate of potentials has been induced in the secondary 15 by maintainance of peak current or aggregate of current consumption in the primary 12 for only a fraction of the usual proportion of the wave cycle. This has the resultant advantage of increasing the ratio of input energy to the output making possible a reduction of 30% to 50% in current drain upon the battery or other source

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of D. C. operating power with a given A. C. generation of power. It also permits the primary winding to be composed of wire of smaller diameter without undue heating wherefore the secondary winding 15 can be placed for greater efficiency directly about the core staff 14 between the same and the primary winding 12.

Stop 21 will be located so that reed armature reaches it just at the point 50' in the time cycle of Fig. 9, and its location can be made different to accord with different lengths of time required for the insurge of primary current to reach its peak in induction coils of differing specification.

Impulsed contact 44 may be carried by any of a variety of excursion performing, spring loaded ballasted oscillating elements as for instance a resilient reed carrying a ballast equivalent for the mass of balance wheel 39 to provide dynamic inertia and biased to a stopped position on the frame by its own resilience or by some extraneous application of spring power coil connecting the reed to the frame.

These and other obvious modifications of the exact shapes and arrangements of parts herein proposed for illustrating the invention come within the intended scope of coverage of the appended claim.

I claim:

In a step-up current inducing electric system, a vibratory circuit interrupter including the combination with transformer windings of, a C-shaped magnet core having a median staff portion of substantial extent most of whose length is encompassed by said solenoid windings and having pole arms spaced apart by the length of said staff portion branching laterally therefrom at respectively opposite ends thereof, a reciprocative armature bridging the space between said core arms in a manner to couple the same magnetically, one of said windings being a primary winding and the other of said windings being a secondary winding positioned between said primary winding and said staff portion of said magnet core, mutually engaging and separable impulsing and impulsed make-and-break contacts in series with said primary winding whereby a flow of current is alternately built up and allowed to decay therein, said impulsing contact being impellably related to said armature and said impulsed contact being free to exceed the extent of impulsing movement of said impulsing contact when impulsed thereby, stop means operative to arrest said armature during movement thereof toward one of said core arms while the armature is impelling said impulsing contact in impulsing direction whereby said impulsed contact is cast away from said impulsing contact to break the said primary circuit, and a time delay recoil device cooperative with said impulsed contact arranged yieldingly and resiliently to oppose separating movement of the latter from said impulsing contact and to return said impulsed contact automatically into contact with said impulsing contact after a period of delay during which no current flows nor is consumed in said primary winding.

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