June 22, 1937. G. B. SEARS 2,084,657

ELECTRICAL APPARATUS

Filed Feb. 8, 1934

Fig. 7

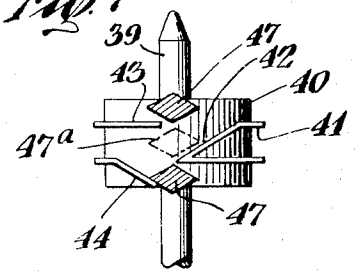


Fig. 2

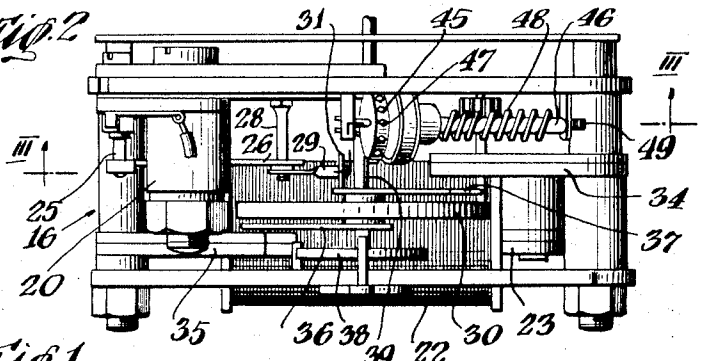


Fig. 1

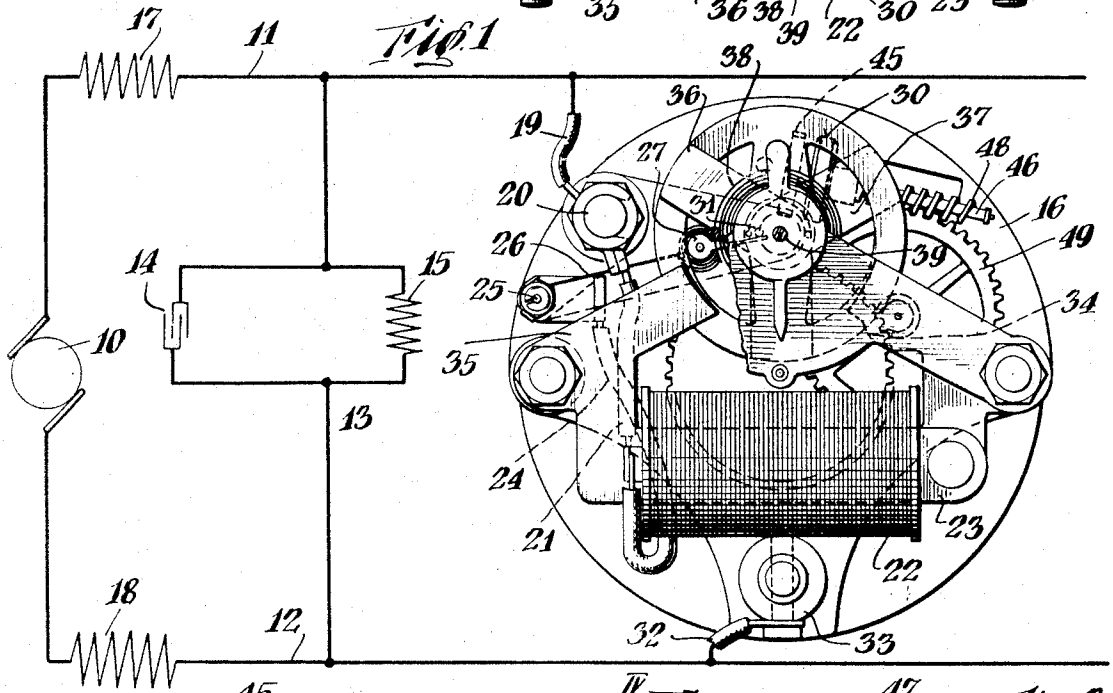


Fig. 4

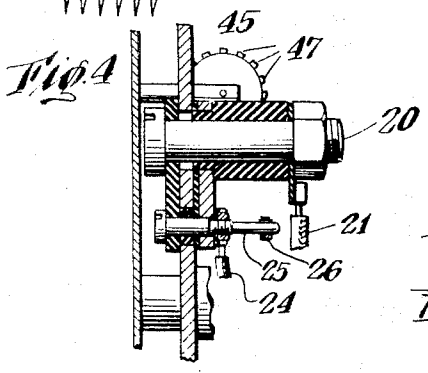


Fig. 3

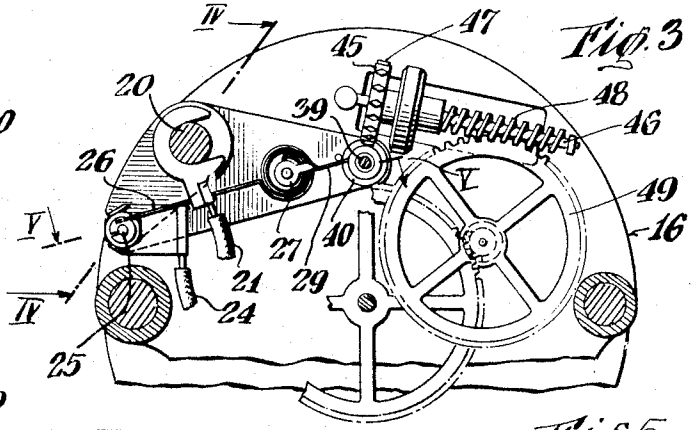


Fig. 6

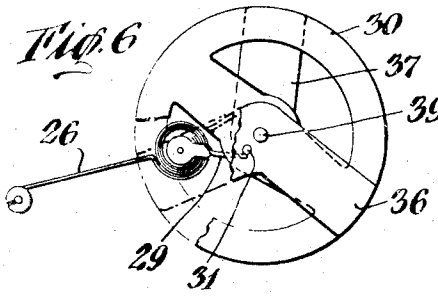
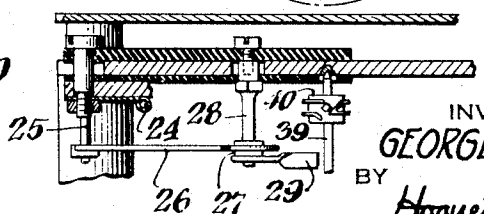


Fig. 5



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UNITED STATES PATENT OFFICE

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ELECTRICAL APPARATUS

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Application February 8, 1934, Serial No. 710,289

4 Claims. (Cl. 58—28)

This invention relates to electrical apparatus, and particularly electrical apparatus for utilizing electrical impulses, such as make and break apparatus. The invention is especially useful in connection with self-oscillating electric clocks, to which use, however, it is not restricted.

One object of the invention is to provide an apparatus which will serve as a reservoir from which large amounts of current can be taken in impulses without continuously drawing large amounts of current from the line supply. Another object is the provision of such apparatus in a form which will prevent sparking and arcing of the current as connections are made and broken. A further object is the provision of such an apparatus in a form which will enable it to be used with voltages of different magnitudes. Other objects will be apparent upon consideration of the present specification.

The invention is shown by way of illustration in its application to a self-oscillating clock, in the accompanying drawing, wherein:

Figure 1 is an elevation of an apparatus constructed in accordance with the invention, the electrical circuit being shown in diagrammatic form, and the self-oscillating clock being shown in rear elevation with the casing removed;

Figure 2 is a plan view of the self-oscillating clock illustrated in Figure 1;

Figure 3 is a vertical section of the clock taken on the line III—III of Figure 2;

Figure 4 is a section on the line IV—IV of Figure 3 illustrating the construction of certain parts in detail;

Figure 5 is a section on the line V—V of Figure 3 illustrating other parts in detail;

Figure 6 shows separately the balance wheel, armature and contacts forming a part of the clock construction; and

Figure 7 is a detail of the mechanism whereby the clock work is actuated from the balance wheel and armature.

Important features of the present invention include resistances in the connecting circuit to control voltage supplied to the apparatus, a connection in the circuit in parallel with the make and break apparatus, which connection includes a condenser, and an arrangement of the make and break apparatus itself whereby contact is always made when the apparatus is not in operation.

Referring now more particularly to the drawing, it will be seen that they show a source of electro-motive force **10**, a conductor of positive current **11**, and a conductor of negative current **12**, the conductors being in series with the source of electro-motive force. A connection **13** is disposed between the conductors **11** and **12** and includes a condenser **14**. The connection **13** may also include a resistance **15** in parallel with the condenser **14**.

Make and break apparatus, here shown as a self-oscillating electric clock **16**, is also connected between the conductor of positive current **11** and the conductor of negative current **12** and is in parallel with the connection **13**. A resistance **17** is connected in series with the conductor of positive current **11** between the source of electro-motive force **10** and the connection **13**, and a resistance **18** is connected in series with the conductor of negative current **12** between the source of electro-motive force **10** and the connection **13**. By selecting the proper resistances **17** and **18** and by relating them properly to the resistance **15** in the connection **13**, the voltage impressed upon the make and break apparatus, here the clock **16**, may be adjusted over a wide range of voltages supplied by the source of electro-motive force **10**.

As so far described, the operation of the apparatus will be plain. The voltage and current coming upon the apparatus may be adjusted between considerable limits by means of the resistances **17** and **18**. As contact is made by the make and break apparatus, the condenser **14** will discharge, giving an increased electrical impulse. Contact then being broken by the make and break apparatus, no current will flow through the latter, but current will flow through the connection **13**, part of it passing through the resistance **15** while the condenser **14** charges. Contact again being made through the make and break apparatus, the condenser **14** will again discharge, giving a second impulse.

The self-oscillating clock **16**, which is the make and break apparatus illustrated in the present embodiment, is a clock of the general character of that described in Patent No. 1,826,719, granted October 13, 1931 to Constant Battegay. Positive current from the conductor **11** passes through a wire **19** to an insulated binding post **20**, the function of which is merely to effect contact between the wire **19** and a lead wire **21**. The lead wire **21** connects with one end of the winding **22** of an electro-magnet **23**, which will later be described in detail. A second lead wire **24** connects the other end of the electro-magnet winding **22** with a second insulated binding post **25**. The binding post **25** carries one end of a spring conductor **26** which is wound in helical form about a hub **27** journaled upon an insulated post **28**.

A leaf contact member 29 is carried by the hub 27 with which it is rigidly connected and with which it turns. A balance wheel 30 journaled in the frame of the clock 16 in the usual way carries a contacting pin 31 in such position that as the balance wheel turns the contacting pin 31 will press against the leaf contact member 29, turning past the latter with a wiping motion in both directions as the balance wheel oscillates. The balance wheel 30 being in contact with the frame of the clock carries the electrical circuit to the clock frame every time the contacting pin 31 touches the leaf contact member 29. A wire 32 makes electrical contact with the clock frame through a binding post 33 which it connects with the conductor of negative current 12, thus completing the circuit.

From the foregoing description it will be evident that every time the contacting pin 31 touches the leaf contact member 29 current will flow through the winding 22 of the electro-magnet 23, thus energizing the latter. Furthermore, every time the contacting pin 31 swings out of contact with the leaf contact member 29, the circuit through the electro-magnet winding is broken and the electro-magnet is de-energized.

The construction of the electro-magnet and the armature which it actuates and which is carried by the balance wheel 30 is preferably as follows: The electro-magnet core 23 extends beyond the winding 22 and is bowed inwardly as at 34 and 35, the end 34 extending on one side of the balance wheel 30 and the end 35 extending on the other side. The balance wheel 30 carries an armature which comprises two elements 36 and 37, each of which has two arms forming an obtuse angle. The two armature elements 36 and 37 are so disposed that two of their non-homologous arms are superimposed and their other two arms extend away from each other at an obtuse angle. A hair spring 38 is connected with the frame of the clock 16 and with the balance wheel 30 in a manner which is well known in clock construction, and tends to maintain the balance wheel in a position with the connecting pin 31 in contact with the leaf contact member 29, and with the leg of the armature which extends between the electro-magnet ends slightly nearer one end. Thus, when current flows through the circuit, the electro-magnet will be energized and its ends 34 and 35 will be affected with opposite polarities. The armature will then be impelled toward the electro-magnet ends 34 and 35 in such wise as to turn the balance wheel against the force exerted by the hair spring 38. As the balance wheel turns, the connecting pin 31 will leave the leaf contact member 29, thus breaking the electric circuit. Thereupon, the electro-magnet will become de-energized, its pull upon the armature will cease and the hair spring will return the balance wheel to its former position, closing the circuit and again energizing the electro-magnet. Because of the mechanical inertia of the balance wheel, the hair spring will turn it past its normal position of rest as contact is made and cause the parts of the armature to swing away from the ends of the electro-magnet by which they were last influenced and nearer to the ends by which they were not influenced as a result of the previous electrical contact. The magnetic action will therefore be in the opposite sense than that previously experienced by the armature and the balance wheel will momentarily be turned in the opposite direction. The connecting pin 31 again breaking contact with the leaf contact member 29, the magnetic action will cease and the hair spring 38 will impel the balance wheel in the opposite direction until contact is made. Thus, the balance wheel and the armature will oscillate.

As has been explained above, the discharge of the condenser 14 will augment the action of the electrical impulses, and therefore the action of the electro-magnet. Furthermore, the condenser, by beginning to charge immediately when contact is broken, will act to prevent sparking or arcing across the contacts.

The spindle 39 which carries the balance wheel and the armature has a small cam wheel 40 thereon, which is best illustrated in Figure 7. A cam 41 carried on the periphery of the cam wheel 40 is formed by bending a single wire so that one end 42 thereof forms a nose, one edge of which constitutes a ramp. The ends of the wire are brought around the cam wheel 40, one end 43 extending in continuation of what appears to be the top of the ramp in the illustration shown in Figure 7, and the other end 44 opposite the point of the nose being bent outwardly to form a second ramp opposite the point of the nose and standing at an angle to the ramp 42. A pinion wheel 45 is disposed adjacent the cam wheel 40, being carried upon a spindle 46 lying at right angles to the spindle which carries the balance wheel 30. Diamond-shaped teeth 47 on the pinion wheel 45 provide for turning this wheel in a manner which will now be described. As the cam wheel 40 revolves in one direction, namely to the right as viewed in Figure 7, the ramp 44 thereon engages a face of an adjacent diamond-shaped tooth 47 on the pinion wheel 45 and slides along this face thus turning the pinion wheel (upwardly as viewed in Figure 7). The motion of the cam wheel 40 continues until the diamond-shaped tooth has been moved into the position illustrated in broken lines at 47*a*. In this motion the end 43 of the cam wire 41 follows that of the ramp 44 and extends into such a position that the diamond-shaped tooth 47 which has just been acted upon cannot proceed beyond it. As the balance wheel 30 oscillates in the opposite direction, the ramp 42 adjacent the nose formed by bending the wire 41, slides along a second face of the diamond-shaped tooth 47, and as this motion continues the end 43 of the wire 38 turns out of the way and the ramp 42 turns the pinion wheel 42 through another sector as the oscillation of the balance wheel continues. The balance wheel then oscillating in the other direction, acts as before described and moves yet another diamond-shaped tooth 47 in the manner already described. Thus, as the balance wheel 30 oscillates, the pinion wheel 45 moves step by step in one direction only, turning the spindle 46 which carries it.

A spiral wire 48 wound about the spindle 46 serves as a helical tooth whereby turning of the spindle 46 may turn the first gear wheel 49 of the clock mechanism (see Figure 1). Thus, oscillation of the armature and of the balance wheel 30 operates the clock mechanism.

From the example of the invention which has been illustrated and described, it will be evident that the invention provides an apparatus which will transform electrical energy into impulses for its operation in convenient and efficient manner. It will also be recognized that the invention eliminates sparking at the contacts and consequent damage to or destruction of the latter. Furthermore, it will be seen that the apparatus may be used, generally speaking, with the voltage which is available.

The embodiment of the invention here illustrated and particularly described is presented merely as an example of how the invention may be applied. Other forms differing in detail but not in principle will readily suggest themselves to those skilled in the art. With this understanding, I claim:

1. An electrical circuit comprising a conductor of positive current, a conductor of negative current, a connection between said conductors including a condenser and a resistance in parallel, and a self-oscillating electric clock in circuit between said conductors in parallel with said connection.

2. An electrical circuit comprising a source of electro-motive force, a conductor of positive current associated with said source of electro-motive force, a conductor of negative current associated with said source of electro-motive force, a connection between said conductors including a condenser and a resistance in parallel, a resistance in series with said conductor of positive current between said source of electro-motive force and said connection, a resistance in series with said conductor of negative current between said source of electro-motive force and said connection, and a self-oscillating electric clock in circuit between said conductors in parallel with said connection.

3. The combination of a self-oscillating electric clock and an electrical circuit connected thereto for supplying electrical impulses to operate said clock, said circuit comprising a source of direct current, circuit connections between said clock and the positive and negative terminals of said current source, a condenser and a resistance connected in parallel between said circuit connections for acting as a secondary source of power for supplying electrical impulses of a predetermined proper value to said clock.

4. The combination of an electric clock operable on direct current and an electrical circuit connected thereto for constantly supplying a voltage of predetermined value to operate said clock, said circuit comprising a source of direct current of a voltage of greater magnitude than is required to actually operate said clock, circuit connections between said clock and the positive and negative terminals of said current source, a condenser and a resistor connected in parallel between said current source and said clock, the capacity and resistance of said condenser and resistor, respectively, being such that the proper amount of voltage required to operate said clock is supplied to the clock at all times.

GEORGE B. SEARS.