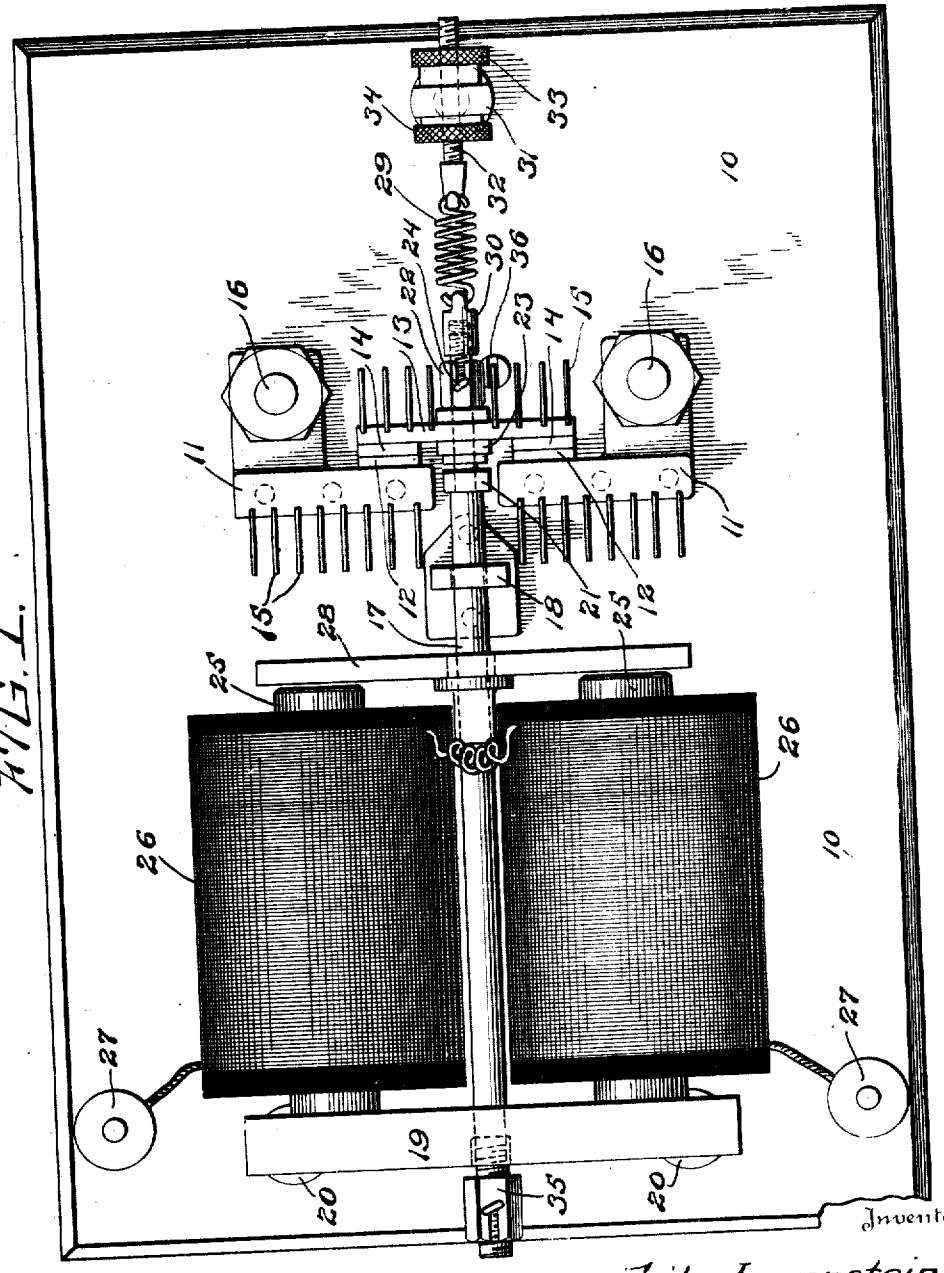
F. LOWENSTEIN & J. BROICH.
CIRCUIT MAKER AND BREAKER.
APPLICATION FILED NOV. 29, 1916.

1,291,039.

Patented Jan. 14, 1919.
2 SHEETS SHEET 1.

FIG. 1.



Witnesses
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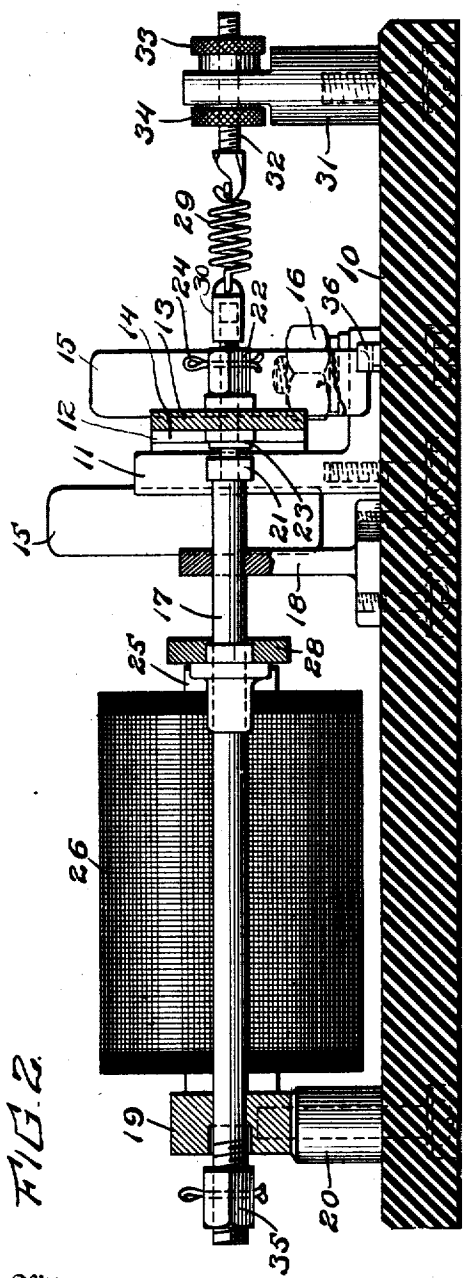


FIG. 2.

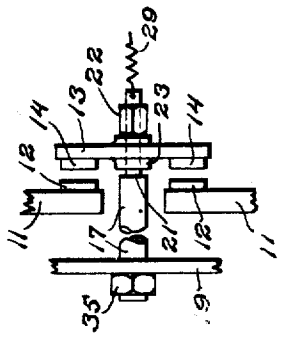


FIG. 6.

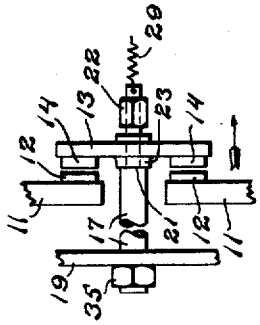


FIG. 5.

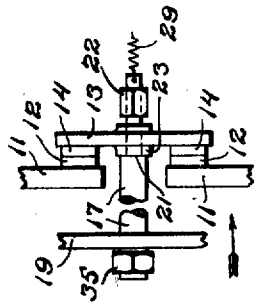


FIG. 4.

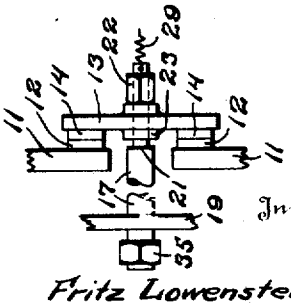


FIG. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

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CIRCUIT MAKER AND BREAKER.

1,291,039. Specification of Letters Patent. Patented Jan. 14, 1919.

Application filed November 29, 1916. Serial No. 134,124.

To all whom it may concern:

Be it known that we, FRITZ LOWENSTEIN and JOSEPH BROICH, citizens of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Circuit Makers and Breakers; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to circuit makers and breakers, and it relates more particularly to relay keys useful in the art of radio or wireless communication.

In sending wireless signals, the signal impulses are obtained by making and breaking an alternating current power supply circuit inductively related to the oscillation circuit or closed circuit of the system, which latter circuit in turn excites the antenna. The current in the power circuit of the usual 10 K. W. set amounts to 70 or 80 amperes, and in larger sets it is correspondingly heavier, so that there is considerable arcing when the circuit is broken. This arcing is very hard on the key terminals or contacts of the circuit-breaking device employed, which is ordinarily operated by a relay, and in practice a great deal of difficulty is experienced from the tendency of the contacts to stick together after they have been in use but a short time. With the heavier currents employed in the larger sets, this trouble is especially pronounced.

In order to minimize the effects of arcing, it is considered desirable in practice that the key terminals be separated suddenly and sharply, rather than gradually; and to this end devices have been proposed wherein the movable terminal is intended to be struck a sharp blow by means of a suitably actuated hammer member, when the circuit is to be broken. But devices of this general character heretofore available in the art have been far from satisfactory from a practical standpoint and they have not eliminated the trouble above noted.

The principal object of the present invention is to overcome the difficulties mentioned and to provide a key of simple construction, free from the defects characterizing keys heretofore known, and capable of operating with much larger currents than it has before been considered practicable to use with relay keys.

In accordance with the invention the power circuit is made and broken by means of a key device having a movable terminal or contact element carried by an operating member reciprocable by suitable motor means to move said movable terminal into and out of circuit-closing position. By means of a lost motion connection between the movable terminal and the operating member the latter makes nearly its whole circuit-breaking movement before striking the movable terminal, thus attaining practically maximum velocity before impact and delivering a sharp hammer blow of high intensity to the movable terminal, which is thereupon suddenly knocked away from the coöperating terminal. The arrangement is such that the operating member travels only a very small distance after impact, while the movable terminal continues to travel after impact the full distance permitted by the aforesaid lost-motion connection. As will appear hereinafter, this type of construction makes it possible to combine maximum intensity of hammer blow with maximum efficiency of electromagnetic control, where the operating member is relay-controlled, as is generally the case.

The broad principles of the invention above set forth can evidently be embodied in different mechanical constructions; but for the sake of a concrete example, one form which the invention may take and which has proven eminently satisfactory in service is shown in the accompanying drawings, where—

Figure 1 is a plan view of relay key mechanism embodying the principles of the invention;

Fig. 2 is a longitudinal vertical section, parts being in elevation; and

Figs. 3 to 6 illustrate the operation of the key more or less diagrammatically.

Referring to the drawings, 10 represents a base of suitable insulating material upon which the instrument parts may conveniently be mounted. The key proper for making and breaking the power supply circuit comprises upright stationary metallic terminals 11 secured to the base and provided with contacts 12. The stationary terminals are adapted to be bridged by a movable metallic terminal 13, mounted in a manner

to be described later and carrying contacts 14 coöperating with contacts 12. In practice, the contacts 12 and 14 may be of silver. The described terminals and contacts constitute what are hereinafter termed contact members which coöperate by direct abutting engagement when in circuit-closing position. Metal fins 15 serve to dissipate the heat due to arcing. Bin ng posts 16 are provided whereby the key device may be connected in the power supply circuit of a wireless transmitter set. It will be seen that movement of the bridging terminal away from the compound stationary terminal opens the circuit at two points in series, thus distributing the arcing effect.

The movable bridging terminal is mounted on an actuating rod or plunger 17 which is supported for substantially rectilinear reciprocating movement in a bearing provided in pedestal 18, and another bearing provided in yoke 19 of an electromagnet, to be referred to later, which is carried by pedestals 20. The movable key terminal 13 is capable of limited sliding movement bodily lengthwise of the actuating rod, such movement being limited on one side by a fixed abutment 21, and on the other by an adjustable abutment 22, both abutments being mounted on the rod. Between said abutments the hub 23 of said movable terminal is free to slide. The adjustable abutment may be of any convenient type, but as here shown is in the form of a nut threaded on the actuating rod and slotted to receive a split pin 24 which may be inserted through a transverse hole in the actuating rod, whereby the nut may be held on said rod in any adjusted position.

In the present example, the motor means for operating the rod or plunger 17 to close the power supply circuit comprises a relay device including the magnet yoke 19 before mentioned, cores 25 and windings 26, the latter being connected to binding posts 27 for connection in a relay circuit including an operating key, not shown. The armature 28 is fast with the plunger 17 with respect to which the magnet cores are symmetrically disposed, and in the position shown the electromagnet is energized, the armature and rod being drawn into their limiting position toward the the left to close the power supply circuit against the tension of a spring 29, adjustably secured as by screw coupling 30 to the rod 17, and anchored to a post 31 by means of threaded hook-bolt 32, adjusting nut 33 and lock nut 34. Movement of the plunger 17 toward the right is limited by means of adjustable abutment or stop nut 35 which may be similar to abutment 22. Any convenient means may be used to prevent rotation of the movable terminal or contact member 13 on the plunger rod 17. The means here shown comprises a stud 36 slotted to provide a guide for one of the radiating fins 15.

Assuming the parts to be in the position shown in Figs. 1, 2 and 3, with the electromagnet energized to force the movable contact member against the compound stationary contact member and thus to close the circuit controlled by the key, suppose the circuit energizing the electromagnet to be broken by release of the operating key (not shown). The magnet will thereupon be deënergized and the plunger rod 17 will be drawn sharply to the right by spring 29. Owing to the lost motion connection between the plunger rod and the movable contact member, the plunger rod will travel a certain distance, in this instance the major portion of its movement, before the abutment 21 strikes the hub of the movable contact member, which latter up to this instant therefore remains stationary. The relative position of the parts at this instant is shown diagrammatically in Fig. 4. After impact the plunger rod continues to travel a short distance and is then arrested by abutment of the stop 35 against the yoke 19, as indicated in Fig. 5. In this slight further travel of the plunger rod, the movable contact member is of course carried therewith, but owing to the force of the impact, said movable contact member is driven a further distance, sliding along the plunger rod 17 until it is arrested by the abutment 22 as shown in Fig. 6. In this position the contacts 12 and 14 are separated by the full distance permitted by the parts for the particular adjustment illustrated.

When the operating key in the relay circuit is again closed, the electromagnet is energized and the plunger rod is drawn back toward the left against the tension of spring 29 and the gap between the contacts 12 and 14 is closed.

In practice the position of the armature 28 on the rod 17 is such, and the abutment 22 is so adjusted, that in circuit closing position the movable contact member is pulled firmly against the stationary contact member, while the armature 28 does not quite touch the cores 25. When desired, a disk of paper or the like (not shown) may be placed between each of the cores 25 of the armature in order to prevent any possibility of their sticking together. The width of the gap between the contacts 12 and 14 is adjustable by varying the position of the stop 35, the total travel of the plunger rod being equal to the width of said gap. For the best operation of the mechanism, the plunger rod should travel nearly its entire throw before the abutment 21 strikes the hub of the movable contact member. In this way the rod attains a considerable velocity and can impart to the movable contact member a relatively large amount of energy in

the form of a sharp hammer blow. Accordingly, the abutments 21 and 22 should be so located that the lost motion between the plunger rod and the movable contact member is slightly less in extent than the total throw of the plunger rod. In a concrete example, the maximum desired gap between contacts 12 and 14, and hence the total throw of the plunger, may be $\frac{1}{4}$ of an inch; and the movable contact member may travel $\frac{3}{32}$ of an inch relative to the plunger rod between the abutments 21 and 22. Under these conditions the plunger rod travels $\frac{1}{32}$ of an inch in passing from the position illustrated in Fig. 3 to that illustrated in Fig. 4. In Fig. 5 it has traveled $\frac{1}{32}$ of an inch farther and has come to rest, while the movable contact member has been carried $\frac{1}{32}$ of an inch away from the stationary contact member, the force of the blow causing it then to continue $\frac{3}{32}$ of an inch farther into the open position of Fig. 6.

It will be observed that in the construction illustrated, the parts are so constructed and arranged with relation to each other that a maximum hammer effect can be attained with a given mass or weight; and furthermore that the construction is of such rigid character that when the parts have been adjusted in position to give a desired effect, such position is not altered by bending of flexible parts. This permits of an accuracy of adjustment, and a maintenance of such accuracy, not attainable in devices heretofore proposed. It will be noted also that this construction makes possible the use of a relatively very light but rigid movable contact member which, in conjunction with the mechanically correct arrangement of the plunger rod whose mass is concentrated to the best advantage for the end in view, contributes to the efficiency of the hammer effect secured. A further notable advantage is that an efficient hammer effect is secured with a very small magnetic movement of the armature 28. This evidently makes for efficiency in the electromagnetic control.

What we claim is:—

1. In a circuit maker and breaker, the combination, with a stationary contact member and a movable contact member coöperating therewith to make or break a circuit, of means movable in one direction to force said movable contact member against said stationary contact member, and movable in an opposite direction to drive said movable contact member away from the stationary contact member, the arrangement being such that in effecting the latter movement, said means travels a part of its course independently of said movable contact member, then hits the latter a sharp blow, and then stops, while the movable contact member continues to travel a predetermined distance away from the stationary contact member, the total travel of said movable contact member and of said means being substantially the same.

2. A circuit maker and breaker comprising, in combination, relatively movable terminals, an actuating member having a lost motion connection to one of said terminals, and reciprocable to move the same into and out of contact with the other terminal, said lost motion connection defining the permissible relative movement of said terminals, impelling means for said actuating member, and stop means for limiting the movement of said actuating member, the arrangement being such that said actuating member completes the major portion of its circuit-breaking movement before striking the movable terminal and is then positively stopped, while the movable terminal continues to travel the distance permitted by the lost motion connection.

3. In a circuit maker and breaker, the combination, with an electromagnet, a reciprocably mounted plunger rod arranged to be moved in one direction by said electromagnet, and resilient means constantly tending to move said rod in the opposite direction, of two abutment members on said rod, a movable contact member slidably mounted on said rod and free to move longitudinally thereon within the limits defined by said abutment members, a stationary contact member against which said movable contact member is pressed by one of said abutment members when the electromagnet is energized, a stop member arranged to limit movement of the rod by said spring when the electromagnet is deënergized, the position of said stop member relative to the second of said abutment members being such that, when the electromagnet is deënergized, the movable contact member remains stationary until the plunger rod has completed a predetermined major portion of its total travel permitted by said stop member, whereupon said movable contact member is struck by such second abutment member, being thereby knocked away from the stationary contact and against the first mentioned abutment member.

4. A relay key comprising, in combination, a fixed contact member, a movable contact member coöperating therewith, a plunger rod carrying said movable contact member, two abutments on said rod between which said movable contact member is bodily slidable, an electromagnet energizable to draw said rod in one direction and thereby to force the movable contact against the fixed contact by means of one of said abutments, a spring acting to move said plunger rod in the opposite direction when the electromagnet is deënergized and thereby to cause the second abutment to strike the mov-

able contact member a hammer blow and to drive it along the plunger rod toward the first abutment, and means for arresting the rod before the movable terminal reaches said first abutment.

5. A relay key comprising, in combination, a stationary contact member, a movable contact member arranged to coöperate therewith by abutting engagement, a plunger rod carrying said movable contact member and mounted for substantially rectilinear reciprocation, two abutments on said rod between which said movable contact member is free to slide, an armature secured to said rod, an electromagnetic device having a pair of cores coöperating with said armature and symmetrically disposed with respect to said rod, said electromagnetic device acting, when energized, to attract said armature and thereby to force said movable contact member into engagement with said stationary contact member through the agency of one of said abutments, means operable to move said plunger rod in the opposite direction, when the electromagnet device is deënergized, and thereby to cause the second abutment to strike said movable contact member a hammer blow, and means for limiting such movement of the plunger rod.

6. A relay key comprising, in combination, a stationary contact member, a rectilinearly reciprocable plunger rod having a limited throw and provided with a pair of spaced abutments, a second contact member mounted on said plunger rod and free to slide longitudinally thereof between said abutments, such sliding movement being limited by said abutments to a distance somewhat less than the throw of said plunger rod, electromagnetic means operating when energized to move said plunger rod into one limiting position and thereby to force said movable contact member into operative engagement with the stationary contact member through the agency of one of said abutments, and means operable to move said plunger rod sharply into its opposite limiting position upon deënergization of said electromagnetic means, and thereby to cause the second abutment to strike said movable contact member a hammer blow.

7. A relay key comprising, in combination, a stationary contact member, a rectilinearly reciprocable plunger rod having a limited throw and provided with a pair of spaced abutments, a second contact member mounted on said plunger rod and free to slide longitudinally thereof between said abutments, such sliding movement being limited by said abutments to a distance somewhat less than the throw of said plunger rod, electromagnetic means operating when energized to move said plunger rod into one limiting position and thereby to force said movable contact member into operative engagement with the stationary contact member through the agency of one of said abutments, and means operable to move said plunger rod sharply into its opposite limiting position upon deënergization of said electromagnetic means and thereby to cause the second abutment to strike said movable contact member a hammer blow, the throw of said plunger rod and the relative positions of said abutments thereon being adjustable.

8. A relay key comprising, in combination, a stationary contact member, a rectilinearly reciprocable plunger rod having a throw limited to a minor fraction of an inch, said rod carrying a pair of spaced abutments, a second contact member mounted on said plunger rod and free to slide longitudinally thereof between said abutments, such sliding movement being limited by said abutments, to a distance somewhat less than the throw of said plunger rod, electromagnetic means operating when energized to move said plunger rod into one limiting position and thereby to force said movable contact member into operative engagement with the stationary contact member through the agency of one of said abutments, and means operable to move said plunger rod sharply into its opposite limiting position upon deënergization of said electromagnetic means and thereby to cause the second abutment to strike said movable contact member a hammer blow, the throw of said plunger rod and the relative positions of said abutments thereon being adjustable.

9. In a circuit maker and breaker, the combination, with coöperating contact members adapted to make a circuit by direct abutting engagement and to break such circuit by relative separating movement which is substantially rectilinear, of means movable in one direction to effect abutting engagement of said contact members, and movable in another direction to separate said contact members substantially rectilinearly, the arrangement being such that in performing the latter movement, said means travels a part of its course independently, then strikes one of said contact members a sharp blow, and then stops, while said contact members undergo a predetermined rectilinear separation.

In testimony whereof we hereunto affix our signatures.

FRITZ LOWENSTEIN.
JOSEPH BROICH.