

(No Model.)

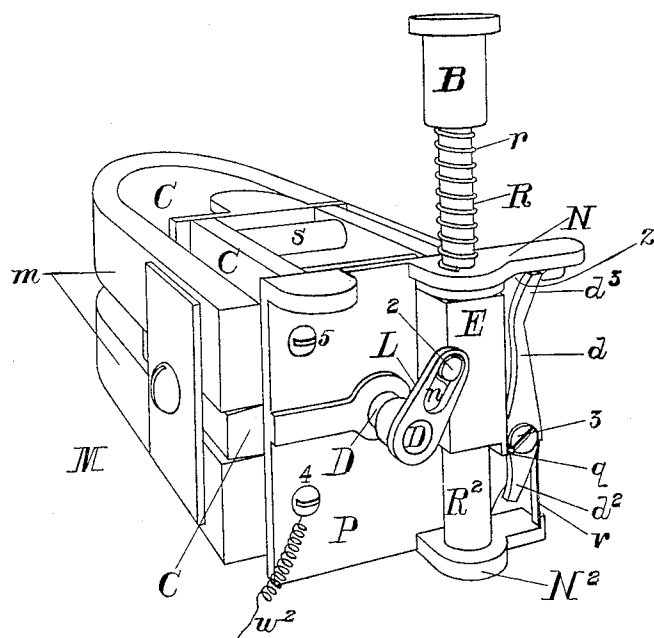
2 Sheets—Sheet 1.

A. S. WILLIAMS.  
MAGNETO ELECTRIC SIGNALING APPARATUS.

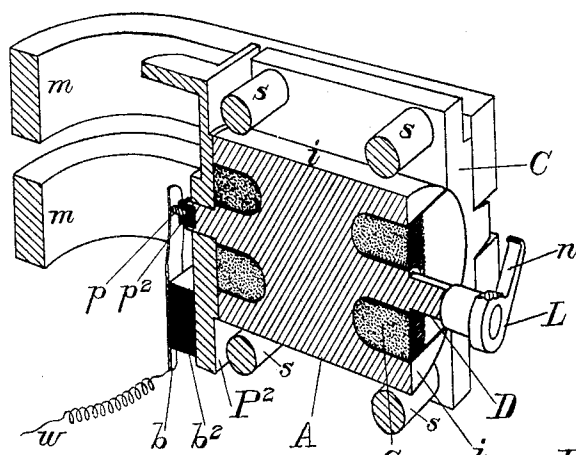
No. 596,418.

Patented Dec. 28, 1897.

*Fig. 1.*



*Fig. 2.*



Attest,  
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Inventor,

*Arthur S. Williams*

(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

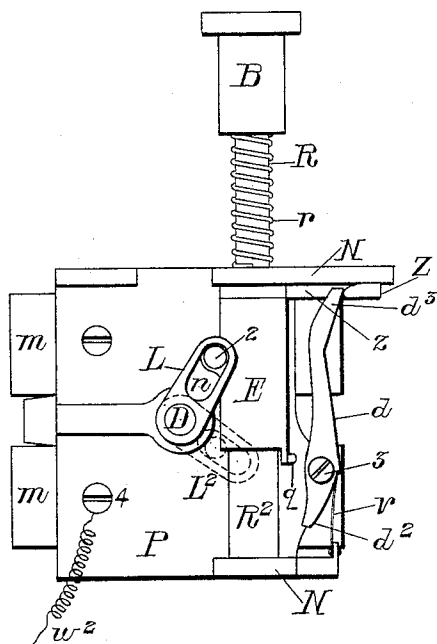


Fig. 4.

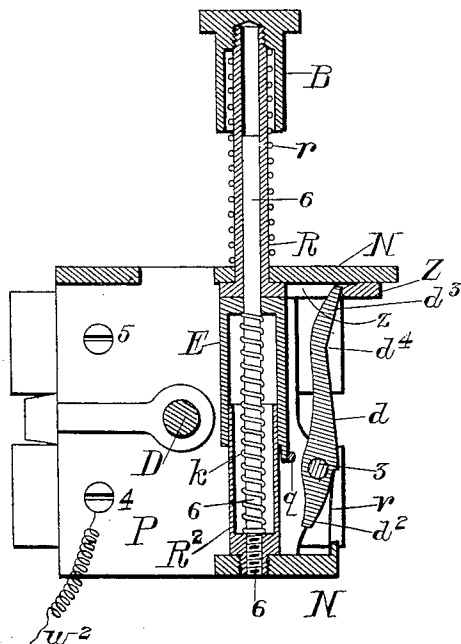
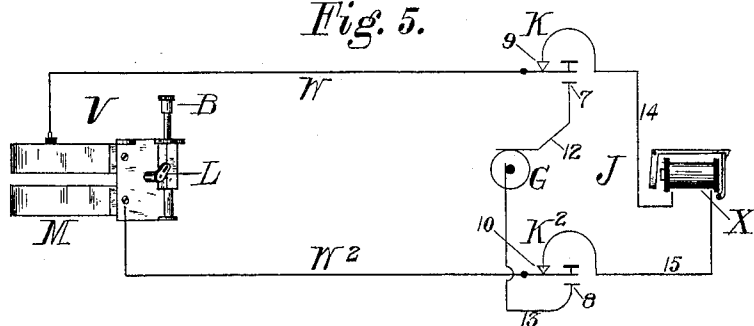


Fig. 5.



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# UNITED STATES PATENT OFFICE.

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## MAGNETO-ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 596,418, dated December 28, 1897.

Application filed June 5, 1897. Serial No. 639,585. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR S. WILLIAMS, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Magneto-Electric Signaling Apparatus, of which the following is a specification.

This invention relates to magneto-electric machines, and particularly to that class which has been extensively employed in association with telephones for signaling purposes. Its object, primarily, is to provide a compact, efficient, and convenient call-generator well adapted for use with desk-telephone sets, which, dispensing with the ordinary crank or handle and speeding-gear, can be actuated by the simple operation of pressing a button; but a secondary and subsidiary object is to enable the same appliance to be used not only as a call-current generator and transmitter, but also as an audible signal-receiver or receptive device. In accomplishing these objects the usual field magnet and armature are retained, the former generally being a permanent U-magnet and the latter preferably of the Siemens or shuttle type. The armature or moving part of the generator, which supports the coils, instead of being organized, as usual, to revolve in the field of force by means of a handle and revolving gear, is adapted to be actuated positively in one direction by pressure applied to a knob, key, or button, which, through peculiar interposed driving mechanism, moves the said armature sharply into a new position, where it is held for an instant after the said pressure is removed, and then to be actuated reversely, but with an access of promptness and speed, by a motor-spring in which energy is stored by the foregoing act of pressure until the normal and resting position is resumed. In consequence of these oscillatory motions a high but transient electromotive force is generated in the coils, which in the closed line-circuit develops into a brief and strong current impulse, traversing the said circuit and operating the distinct annunciator or similar call-receiving instrument.

The invention consists, mainly, in the peculiar mechanism to which reference has

been made, which mechanism comprises a short slotted crank secured to the end of the armature-shaft and constituting a lever whereby the armature may be oscillated across the lines of force of the field-magnets, an actuating-block carrying a pin which plays in the lever-slot and is adapted to be moved in one direction manually by means of a press-button and in the reverse direction automatically by means of a spring in which energy is stored by the pressure of said button, a device adapted to momentarily detain the block and thereby the lever and armature in the position to which they are moved by operating the button, while the said button, relieved from pressure, is itself retracted, and means for automatically tripping the said detaining device at the proper moment, so that the retracting-spring may at such moment cause a reverse motion of the actuating-block, lever, and armature, causing the latter to oscillate with great speed back to its original position in the magnetic field.

Another phase of the invention, however, consists in placing the armature within the magnetic field in such relation to the direction of the lines of force that its resting condition shall be extremely unstable, and in associating it with any ordinary source of continuously-developed alternating call-currents, such as a standard magneto call-generator, located at another station, but placed in the said circuit, whereby the operation of the latter tends to produce successively reversed oscillations of the former, which thereby being caused to produce a rattling noise is enabled to act for the time as a call-receiver, so that a special call-bell may be dispensed with.

In the drawings accompanying and illustrating this specification, Figure 1 is a perspective view of the magneto-machine with the special actuating mechanism in the foreground. Fig. 2 is a longitudinal vertical section of the same, showing the unstable resting position of the armature. Fig. 3 is a front view of the actuating mechanism. Fig. 4 is a front vertical view of the same, mainly in section, taken immediately in rear of the armature shaft, crank, or lever and through

the actuating-block, press-button, and detaining device; and Fig. 5 is a diagram of an electric circuit and concomitant apparatus with which my magneto-machine may be associated and is combined.

In the drawings, M is the magneto-machine as a whole, *m* the field-magnets, and A the armature thereof. The said armature is shown as being mounted in suitable bearings in a cylinder C, placed in the magnetic field, which cylinder is composed of iron pole-pieces, one for each set of magnet-poles, united mechanically by brass studs *s*. The cylinder C is closed in front and rear by plates P P<sup>2</sup>, having central perforations, which form bearings for the journals of the armature-shaft D.

The ends of the armature-coils *a* are or may be connected, one with the contact-spring *b*, by means of the point *p*, mounted in an insulating-bushing *p*<sup>2</sup> in the rear end of the armature-shaft to which it is attached, and the other to the metal work of the said shaft, and consequently to the machine itself. One leading-out wire *w* may therefore be attached to the spring *b*, secured to the non-conducting block *b*<sup>2</sup>, while the other, *w*<sup>2</sup>, may be fastened to any convenient part of the said metal work—as, for instance, to the screw 4 of the plate P.

To the armature-shaft D is secured a short crank or lever L, having, as shown, a slot *n*, in which plays a pin 2, projecting from the actuating-block E. This pin 2 may be formed integral or in one casting with the said block E, which is placed under a plunger or spindle R, surmounted and operated by the press-button B and surrounded or otherwise controlled in its return movement by the retracting spring *r*.

The actuating-block E may be made tubular, and a guide-rod 6 may run through it and also through the spindle R. The movement of the block E, however, is further guided by a cylindrical tube R<sup>2</sup>, with which it may telescope, and while it is arranged to be moved in one direction by the direct impact of the button B and the spindle R thereof it is, when relieved from the pressure of said button, adapted to be automatically impelled in the opposite direction by the retracting-spring *k*, which surrounds the guide-rod 6 within the block E and its tubular guide R<sup>2</sup>, the said spring having energy stored up in it in virtue of the compression exercised thereon by the pressure of the button B.

The plate N may serve as an outside guide for the tubular spindle R, which is enlarged below the said plate to limit its upward progress and which, moreover, is provided with a lateral projection Z, having a recess or slot *z* cut therein, for a purpose which presently will appear.

In close proximity to the side of the actuating-block E a detaining device or detent *d* is jointed on a screw-pin 3. Below the said joint-pin the said device is provided with a square end or catch *d*<sup>2</sup>, adapted to engage a

projection or stop-pin *q*, affixed to the lower edge of the actuating-block when the latter has been forced to its lowest position. Above the joint-pin 3 the detaining device is extended by a tailpiece *d*<sup>3</sup>, projecting into the recess or slot *z* and normally resting against the outermost wall thereof, which thus is enabled to serve as a back limit-stop for the said detaining device. This device has a spring *v* constantly pressing against the outer side of its lower end, which, however, is prevented under resting conditions from moving inwardly by the above-mentioned contact of the tailpiece *d*<sup>3</sup> with the said limit-stop; but if the button be depressed the said rear wall of the recess *z* moves in a straight line, and as the approximate surface of the tailpiece trends sharply in an inward direction the pressure-spring *v* continually presses the end *d*<sup>2</sup> inwardly and the tailpiece *d*<sup>3</sup> outwardly until the recess-wall passes the point *d*<sup>4</sup>, when it parts company altogether with the detent *d*. When the button B is pressed down nearly as low as it will go, the projecting pin *q* passes beyond the catch *d*<sup>2</sup> of the detaining device, and the actuating-block E is thus, when the pressure of the button-plunger is relaxed, momentarily held in its lowest position by engagement with said catch.

In Fig. 5 the magneto-machine M at one station V is shown as being connected in an electric circuit with direct and return conductors W W<sup>2</sup>, leading to another station J, where it includes a call-receiving device, shown as an annunciator X, adapted to respond to the brief and sharp impulse of current which the generator M produces. At the station J is likewise located a suitable source G of continuously-developed alternating electric currents, represented by a well-understood conventional symbol indicating an ordinary or standard magneto call-generator. K K<sup>2</sup> are call-keys connected with the two wires of the main circuit and pressing normally against back contacts-tops 9 and 10, to which extension-conductors 14 15, leading to the annunciator X, are attached. The said keys are also provided with front contacts 7 8, which are in electric connection by wires 12 and 13 with the two poles, respectively, of the alternating-generator G. If the keys K K<sup>2</sup> are pressed, the alternating call-currents of the generator G are directed over the main conductors W, and reaching station V pass there through the coil of the armature A of the machine M.

It will be seen by reference to Fig. 2 that the overlapping wings *i* of the shuttle-shaped iron core of the armature A, when the machine is at rest, are in a position at a right angle to the polar faces of the field-magnet. Such position is a very unstable one. Hence the rapidly-alternating call-currents from the distant generator G, in circulating through the armature-coils of the machine M, set up rapidly-changing polarities in the said core and cause the same to vibrate or oscillate vig-

orously, and thereby to produce a rattling noise adapted to serve as an audible call-signal.

In the operation of the magneto-machine  
 5 M as a signal-transmitter it is only necessary for the telephone-subscriber to depress the call-button B as far as it will go and then to release it. This action pushes down the plunger R and the block E, and the pin 2 of the  
 10 latter, playing in the slot *n* of the short lever L, forces the said lever into a new position, (indicated by the dotted lines,) and of course moves the armature A within the field of the magnets *m* for a portion of a revolution.  
 15 Meanwhile the projecting pin *g*, carried by the block E, has passed below the end *d*<sup>2</sup> of the detaining device *d*, which, freed from the restraint of rear wall of the recess *z*, has, in obedience to spring *v*, moved outwardly at its  
 20 upper end and inwardly at its lower end until the said lower end *d*<sup>2</sup> is brought into a position directly above and in the line of retreat of the pin *g*. The retracting-springs *r* and *k* of the plunger R and the actuating-block E, having both been compressed, are both in tension,  
 25 energy having been made potential in them by the act of depressing the button B. As soon, however, as the pressure upon the button is relaxed the spring *r* comes into action and retracts the said button. The button and  
 30 its spindle are retracted for a short distance without exercising any effect on the block E and the mechanism controlled thereby, and the said block therefore remains an instant in or nearly in its lowest position, where obviously it must stay until the end *d*<sup>2</sup> of the  
 35 detent *d* is withdrawn from the rear of the pin *g*; but before the plunger R has recoiled very far the rear surface of the slot or recess  
 40 *z* in the plate Z, extending from it, acting as a hook, engages the tailpiece *d*<sup>3</sup> of the detaining device at a point immediately above the apex *d*<sup>4</sup> of the bend thereof, and, throwing  
 45 moves the end *d*<sup>2</sup> backward and out of the path of the pin *g*. The actuating-block E is thus freed and the retracting-spring *k* permitted to expand, which it does with considerable vigor, the block E and lever L returning  
 50 to their normal position suddenly and with great velocity. The armature A, carrying the generator-coils *a*, is thus moved or oscillated at a high speed across the lines of force of the magnet *m* and an electric-current impulse under a high electromotive force is thus  
 55 generated within the said coils, which, passing through the circuit with which they may be connected, is well adapted for operation of the signal-receiving device X at the central or other station.

60 The motion which ordinarily can be imparted to an armature capable of revolving directly by the depression of a key or button is too slow to eventuate in a current sufficiently strong to reliably send the signal; but  
 65 by making the return motion of the armature independent of the manual action of the op-

erator, so organizing the mechanism that the press-button spindle and armature-actuating block have in their return strokes no direct  
 70 association, the latter being dependent upon the former only for the withdrawal of the detaining device, and by providing the said actuating-block with an independently-operating retracting-spring I am enabled to impart  
 75 a motive impulse to the machine-armature, which, though of brief duration, is of sufficiently great speed for the generation of the required current and for the efficient and trustworthy operation of the distant signal. 80

I claim—

1. In a telephone signaling apparatus, and in combination with the field-magnet and armature thereof; a key or press-button and a motor-spring adapted to successively move  
 85 the said armature in opposite directions, respectively; and a detaining device controlling and acting to delay the operation of said spring, and itself controlled by the said press-button; substantially as set forth. 90

2. The combination substantially as herein specified, in a telephone signaling magneto-machine, of the movable armature and the coils thereof; with a key or button, and plunger, constituting means for operating the said  
 95 armature in one direction; a motor-spring adapted to be energized by the pressure of said key, and placed in operative relation to the said armature to produce a return movement thereof; a detaining device for the said  
 100 spring arranged to temporarily maintain the compression thereof, when the pressure on said key is relaxed, and delay the return motion of the armature; and means for automatically tripping the said detaining device, and for suddenly releasing the said motor-spring; whereby the armature is enabled to oscillate with great velocity in returning to its normal position, for the purposes set forth. 105

3. In a magneto-machine for telephone signaling, the combination of the armature thereof; with actuating mechanism comprising a slotted lever or crank secured to the armature-shaft; an actuating-block carrying a pin which plays in the slot of said lever; a  
 110 key or press-button detachably associated with said block, and organized when pressed to move the same in the direction of such pressure; a motor-spring compressible by the operation of said key, and adapted to move the said actuating-block reversely when the said  
 115 key-pressure is relaxed; a detent engaging a projection of said actuating-block to delay the return movement thereof; a retracting-spring for the key or press-button, acting to independently retract the same when pressure thereon is no longer exercised; and a tripping device for the said detent controlled by the said key in its independent return movement, all substantially as herein specified. 120  
 125  
 130

4. In a telephone signaling system, the combination of a main circuit; a source of continuously-developed alternating call-currents connected therewith at a station thereof; and

a magneto-electric machine having its armature mounted in the magnetic field in such relation to the direction of the lines of force of such field, that its resting condition shall  
5 be unstable, connected with the said circuit at another station thereof; whereby the said magneto-machine may be made responsive as a receiving instrument, to the currents of the first-named source, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 1st day of June, 1897.

ARTHUR S. WILLIAMS.

Witnesses:

THOMAS D. LOCKWOOD,  
JOSEPH A. GATELY.