Nov. 8, 1938. H. C. PYE 2,135,843

MAGNETOGENERATOR

Filed April 13, 1936 2 Sheets-Sheet 1

FIG. 1

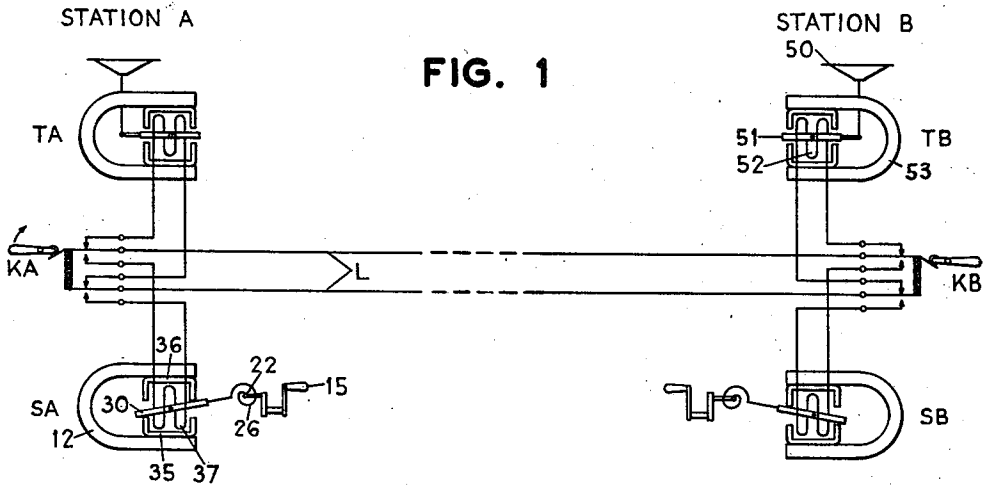


FIG. 9

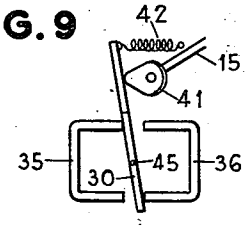


FIG. 10

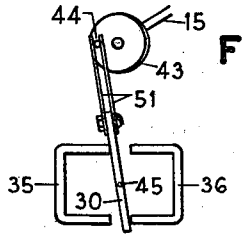


FIG. 11

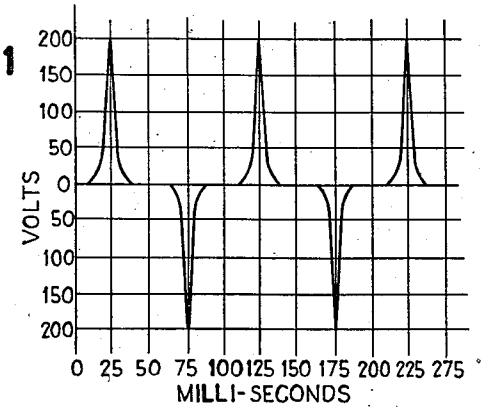
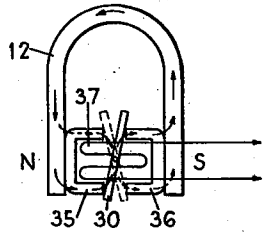


FIG. 12



INVENTOR.
HAROLD C. PYE

BY Chas. Tw. Candy.
ATTORNEY.

Nov. 8, 1938. H. C. PYE 2,135,843

MAGNETOGENERATOR

Filed April 13, 1936 2 Sheets-Sheet 2

FIG. 2

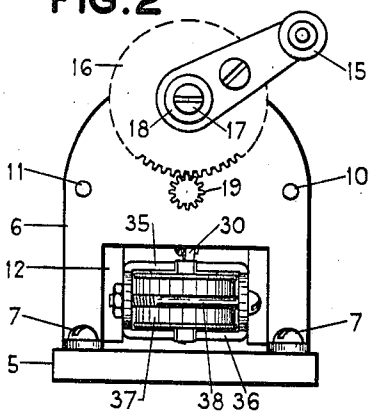


FIG. 3

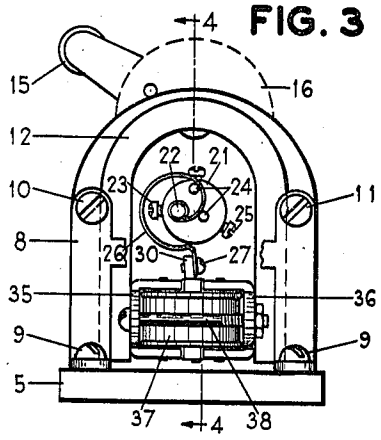


FIG. 4

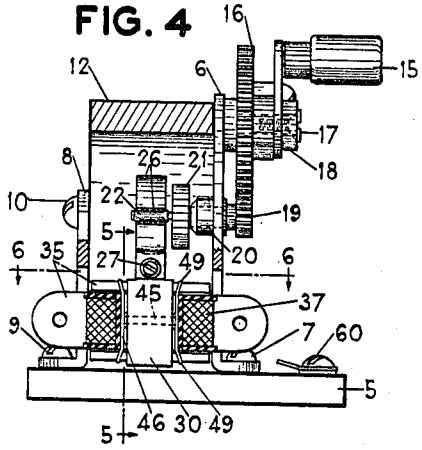


FIG. 5

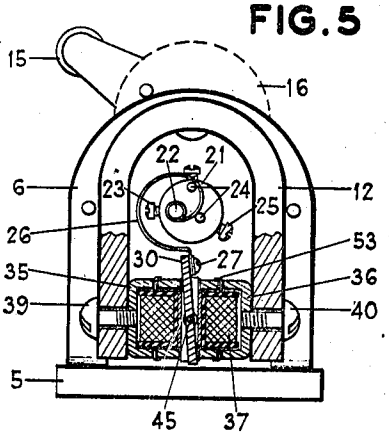
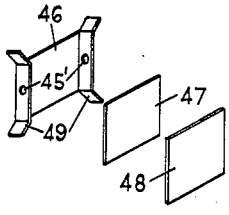


FIG. 6

FIG. 7



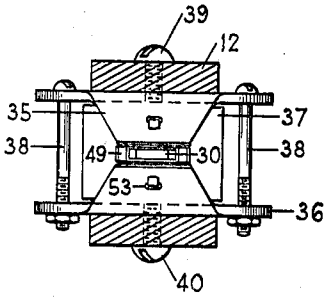
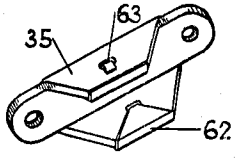


FIG. 8



INVENTOR.
HAROLD C. PYE

BY Chas. F. Randy.

ATTORNEY.

Patented Nov. 8, 1938 2,135,843

UNITED STATES PATENT OFFICE

2,135,843

MAGNETOGENERATOR

Harold C. Pye, Oak Park, Ill., assignor to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application April 13, 1936, Serial No. 74,151

14 Claims. (Cl. 171—252)

This invention relates in general to signalling apparatus and more particularly to an improved magneto signalling device or generator for use in connection with communication and signalling systems.

An object of the invention is to provide a signalling device for use in communication systems of the type that are operable without the use of batteries or other sources of energy, and wherein combination voice transmitting and receiving apparatus of the magnetic or sound-powered type is utilized for the actual speech transmission, and wherein the signalling device at a calling station is operable over a connecting line to actuate the magnetic telephone apparatus in a manner to signal the calling station.

A further object of the invention is to design a magneto generator of greatly simplified and compact construction having an output of sufficient power to actuate various signalling devices.

In previous types of magneto generators a rotatable armature revolving with the field coil and between the poles of a permanent magnet generated the currents for operating the distant signalling devices, such as drops, telephone bells, etc. In this form of magneto generator an alternating current is generated in the line which has a relatively smooth or gradual deviation from a pure sine wave front. This form of wave front is not suitable for audibly actuating the diaphragm of a receiver of the magnetic type, as the sound emissions are of low intensity because the acceleration of the rate of change of the current is too gradual to produce a rapid action of the diaphragm necessary to produce audible sound. It is accordingly a further object of the invention to design a magneto generator capable of producing a steep substantially linear wave front and resulting in a rapid rate of change of the current output so that the diaphragm is vigorously and rapidly actuated to produce a series of separated loud audible clicks of sufficient intensity to serve as a call signal.

In accordance with the foregoing object a feature of the invention resides in providing a magneto generator with a pivoted armature, a crank handle, and a flexible connection between the end of the armature and the crank whereby the armature is operated is an oscillatory manner by continuous forward rotation of the crank.

Another feature resides in providing a relatively stiff clock-spring connection between the armature and the crank handle whereby a rapid snapping action or vibration is imparted to the armature by the rotation of the handle in a forward direction.

A further feature resides in the particular means provided for pivotally supporting the armature.

An additional feature is concerned with the means whereby the crank handle is provided with adjustable means for imparting a variable stroke to the movement of the clock spring.

Other features and objects not particularly pointed out will be apparent from the detailed description together with the drawings showing an embodiment of the invention.

Referring now particularly to the drawings,

Fig. 1 illustrates an embodiment of the invention comprising a communication system consisting of two magnetic telephones and their associated magneto generators or signalling devices connected to a line through a switching key.

Fig. 2 illustrates a side view of a magneto generator according to the invention.

Fig. 3 is a rear view of Fig. 2 with certain parts cut away to show the internal mechanism.

Fig. 4 is a cross-sectional side view along the line 4—4 of Fig. 3 showing the construction of the internal parts of the apparatus.

Fig. 5 is a view similar to Fig. 3 along the lines 5—5 of Fig. 4 exposing certain portions of the apparatus.

Fig. 6 is a cross-sectional view along the line 6—6 of Fig. 5 showing the top view of the device.

Fig. 7 is a perspective view of the parts constituting the armature-mounting arrangement.

Fig. 8 is a perspective view of one of the pole pieces.

Fig. 9 is a modification of a method of actuating the armature.

Fig. 10 is a further modification showing another form of armature actuating means.

Fig. 11 is a graph showing the wave front and performance characteristics of the magneto generator; while

Fig. 12 is a schematic diagram of the magnetic circuit paths extending through the device.

Referring now particularly to Fig. 1 a magnetic type of telephone apparatus TA at station A is normally connected to the line conductors L thru closed contacts of the manually-operated key KA. Station B is similarly connected to the line through key KB. A magneto generator or signalling device SA, diagrammatically illustrated, is connected to the line conductors L through the operation of the key KA for purposes of signalling the station B. The signalling device SB at station

B is connected in a similar manner to the line L to signal station A.

The telephonic apparatus TA and TB is of the magnetic type well known in the art and comprising essentially a cone-shaped diaphragm 50 mechanically connected to a pivoted armature 51 positioned between the pole pieces of magnet 53 and surrounded by the coil 52. The device TB, for example, is arranged so that it is used as a combination transmitter and receiver. Speech waves impinging upon the diaphragm 50 actuate armature 51 between the pole pieces of magnet 53 and induce a current flow in the winding 52 which traverses the line conductors L and inversely actuates the telephone unit TA at station A as a receiver. The detail construction and operation of a telephone instrument of this type is disclosed in an application of Albert E. Woodruff, Serial No. 738,030, filed August 2, 1934. Magneto generator SA at station A generates a series of relatively low frequency impulses which are transmitted over the line conductors L through contacts of the keys KA and KB which are of the locking type, to actuate the diaphragm 50 of unit TB at station B in a manner corresponding to an audible signal device in order to attract the attention of the person at station B and advise him that he is being called. By providing the locking keys KA and KB the signalling generators SA and SB are associated with the line L only when the signalling action is to be performed. Restoration of key KA connects the telephone unit TA to the line L and conversation can ensue between stations A and B.

The detailed construction, assembly and operation of the magneto generator according to the invention will now be pointed out in detail.

The device as a unit may be mounted on any suitable support, preferably insulated, such as the base 5. A metal supporting plate 6 having a pair of legs is secured to the base 5 by means of screws 7 in each of the legs. Spaced opposite the metal plate 6 is an H-shaped metal bracket 8, the legs of which are secured to base 5 by screws 9. The brass bolts 10 and 11 extending through metal plate 6 and bracket 8 clamp permanent magnet 12 between them and hold it securely in position on the base 5. Plate 6 and bracket 8 are made of non-magnetic metal.

For the purpose of actuating the magneto generator a manually-operated handle or crank 15 is provided. The handle 15 is rigidly secured to the large gear wheel 16 by means of screw 17 threaded into stud 18 which in turn is suitably fastened to plate 6 near the top thereof. A pinion gear 19 is meshed with gear 16 and is journaled by bearing 20 in plate 6 at one side thereof. A circular disc 21 at the other side of plate 6 is secured to gear 19 and rotates with it. On the front face of disc 21 a pin 22 is eccentrically secured by means of bolt 23 threaded in the side of the disc 21. Various eccentric positions are provided in disc 21 for securing pin 22, such as that shown at 24 in Fig. 3, the purpose of which will be hereinafter pointed out. A spiral-shaped, relatively stiff clock spring 26 has its inner end wrapped around pin 22. As is shown, the pin 22 may be provided with a sleeve in order to provide a better bearing surface for spring 26. The other end of spring 26 is fastened by means of screw 27 to the upper end of magnetic armature 30.

Further detailed parts of the magneto generator comprise a pair of oppositely disposed pole shoes 35 and 36, the general shape of which is clearly shown in Fig. 3, and between which the coil winding 37 is positioned. A pair of brass bolts 38 extending through ears formed on the pole pieces 35 and 36 hold the pole pieces and the coil 37 together in position. Screws 39 and 40 extending through holes near the ends of magnet 12 fasten the pole shoes 35 and 36 securely to the magnet and thereby form the whole into a compact unitary structure.

The magnetic armature 30 is pivotally supported in the center of the coil 37 by means of a pin 45 extending through the center of the armature. In order to form a rigid support for the armature and in order to limit its movement a non-magnetic chamber is formed in the center of coil 37 by means of the arrangement disclosed in Fig. 7. The armature bearing pin 45 extends through openings 45' formed in turned-up portions of the plate 46. A flat piece of insulating material 47 is placed across the ends and bridges the turned-up portions of plate 46 after which a metal plate 48 is placed on top of insulator 47. The assembly is then placed inside the opening of coil 37 and turned-up projections 49 are bent over to hold it in position and in addition provide a means whereby the opposing edges of pole pieces 35 and 36 are spaced apart, as seen in Fig. 6. The armature 30 is thereby positioned within a metallic chamber of non-magnetic material precluding rapid wearing away of the parts. The use of the insulating plate 47 electrically separating plate 48 from plate 46 prevents the formation of eddy currents within the structure when the armature is operating.

In order to prevent sticking of the magnetic armature 30 to the pole pieces brass shims 62 (Fig. 8) are provided on each of the faces of the pole shoes 35 and 36. These are secured in position by a bent-over projection in each shim extending through an opening 53 in the pole shoe.

In operating the device, the handle 15 is rapidly rotated in a forward direction thereby imparting rotary movement to gear 16 and this in turn gear 19, a suitable ratio of the gears being about 5 to 1. Gear 19 revolves disc 21 to which pin 22 is eccentrically secured. By referring to Fig. 5 it will be seen that as pin 22 is eccentrically rotated, spring 26 is tensioned with increasing force until pin 22 approaches approximately a vertical central line extending through the axis of gear 19. In this position sufficient tension is stored in spring 26 so as to overcome the magnetic pull exerted by the magnet 12 through pole shoe 35 at the upper end of armature 30 and pole shoe 36 at the lower end of the armature. The armature is consequently pulled away from this position with a rapid and snapping action, and as it approaches the opposite faces of pole shoes 35 and 36 the magnetic attraction of magnet 12 is exerted, pulling the armature against the opposite pole faces. As the handle 15 is further rotated pin 22 moves spring 26 in the opposite direction and to the position from which it was started. This again stores tension in spring 26 thereby pulling armature 30 away from its present position and back to the original position as shown in Fig. 5. Continued and rapid rotation of the crank 15 in its forward direction rapidly oscillates armature 30 between opposite faces of pole shoes 35 and 36.

In its initial position as illustrated in Fig. 5, armature 30 provides a magnetic circuit path for the flux of permanent magnet 12 to flow, extending through magnet 12, upper pole face of pole shoe 35, upper end of armature 30,

through armature 30, lower face of pole shoe 36 to the opposite pole of magnet 12. With the armature snapped to its opposite position as seen in Fig. 12 so that its upper end is in engagement with the upper pole face of pole shoe 36 and the lower end of armature 30 in engagement with the lower pole face of pole shoe 35, the flux flowing through armature 30 extends in the reverse direction. The rapid to-and-fro movement of the armature thereby alternately reverses the magnetic flux extending through the armature. These reversals of the magnetic flux generate a flow of alternating current through the windings of coil 37 surrounding the armature. With the armature in one of its positions the current which will momentarily flow through the windings will be of a particular polarity, positive or negative; with the armature snapped to its opposite position momentary current flow will be reversed and of the opposite polarity. It is, therefore, seen from this that rapid rotation of the handle 5 will produce a frequency of alternating current corresponding to the oscillations of the armature 30. Fig. 12 diagrammatically depicts the magnetic circuit paths as indicated by the arrows.

By placing pin 22 in any of the holes 24 in disc 21 and turning in the screws 25 the tension of spring 26 when operated to oscillate armature 30 may be varied, so that different degrees of force may be applied to the armature to snap it from one position to the other; less tension in the spring producing a slight lag in the movement of the armature.

Fig. 9 illustrates a modification wherein a manually-operated and rotatable member 15 directly actuates a cam member 41 which in turn is adapted to impart an oscillatory movement to armature 30. Spring 42 attached to the end of armature 30 pulls the armature to its opposite position when operated by cam 41. The rotation of cam 41 thereby moves armature 30 on its pivot 45 rapidly between opposite pole faces of pole shoes 35 and 36.

Figure 10 illustrates a further modification whereby a disc 43 rotated by a member 15 in any suitable manner, has a pin 44 eccentrically supported on it between a pair of springs 51, secured to the end of armature 30. Rotation of disc 43 and pin 44 snaps the armature 30 between the pole faces alternately, the springs 51 flexing slightly at each operation.

When the signalling generator just described and which may be SA is connected to the line L of Fig. 1 by key KA and operated, an alternating current is transmitted over the line conductors thru the closed contacts of key KB and the winding 52 of the unit TB. The diaphragm 50 is thereby actuated to produce an audible sound of sufficient intensity to attract the attention of a person at station B. A wave form of the current output of the generator is illustrated in Fig. 11. This graph indicates in milliseconds the voltage output of the generator when the handle is actuated at normal speed, the sharp peaks indicating the manner in which the diaphragm 50 is actuated. The wave front, it is seen, is extremely steep and of substantially linear form resulting in a strong and rapid actuation of the diaphragm and, therefore, a loud, clear sound emission at the called station.

Due to the novel construction, the magneto generator is suitable for operation in connection with the operation of polarized ringers at telephone substations, drops at operator's switchboard, flashing over of space discharge lamps, and other means whereby an alternating current is required to actuate electromagnetic apparatus.

The invention likewise contemplates an arrangement whereby instead of providing a rotating handle for operating the armature in an oscillatory manner it may be directly connected to a manually-operated push button or key so that a single actuation of the key will snap the armature over to its opposite position while a tension spring will restore it. In this manner a certain polarity of current will be transmitted over a line circuit to operate polarized electrical apparatus while the release of the key will transmit the opposite polarity of current and restore the apparatus. This is useful for the remote control of apparatus or switching means.

What is claimed is:

1. In a magneto generator, an armature, a rotatable operating member, a flexible spring connecting said armature and said operating member, and means responsive to the operation of said operating member for controlling said flexible spring in a manner to impart an oscillatory movement to said armature.

2. In a magneto generator, an armature, a rotatable operating member, a flexible spring connected at one end to said armature, the other end of said spring being eccentrically connected with said operating member, the rotation of said operating member controlling said flexible spring so as to move said armature in a reciprocatory manner.

3. In a magneto generator, the combination of a rotatable operating member, an armature, and a flexible member connecting said armature with said rotatable member, means responsive to the rotation of said rotatable member for controlling said flexible member in a manner to operate said armature in a reciprocatory manner, and a coil winding surrounding said armature.

4. In a magneto generator, the combination of a permanent magnet having pole shoes, a magnetic armature pivoted between said pole shoes, a rotatable member, a flexible member connecting said armature and said rotatable member, the continuous operation of said rotatable member in one direction controlling said flexible member so as to continuously oscillate said magnetic armature between said pole shoes, and a coil winding between said pole shoes and surrounding said armature.

5. In a magneto generator, a permanent magnet having a pair of pole shoes, an armature pivoted between said pole shoes, a magnetic circuit path for the flux extending through said armature in one direction and holding the opposite ends of said armature in engagement with opposite ones of said pole shoes, said magnetic path through said armature being reversed when the armature ends are moved into engagement with the opposite pole shoes, a rotatable operating member, a spring member connecting said armature and said operating member, the rotation of said operating member in one continuous direction oscillating said armature between said pole shoes through the medium of said spring member, said spring exerting a yielding force on said armature until the magnetic pull of the pole shoes on the armature is overcome and the magnetic force of the opposite pole shoes is exerted to pull the armature into engagement with said opposite pole shoes against the yielding force of said spring member.

6. In a magneto generator, a pair of magnetized

pole shoes, an armature pivoted for oscillatory movement between opposite ones of said pole shoes, a rotatable member, a spiral spring member having one end connected to said armature, the other end of said spring being eccentrically connected to said rotatable member, the operation of said rotatable member flexing said spring member against the magnetic pull exerted by said pole shoes on said armature until said pull is overcome whereby said armature is moved to its alternate position between the pole shoes, and a coil winding surrounding said armature.

7. In a magneto generator, as claimed in claim 6 in which the eccentric connection of the spring member and the rotating member is adjustable so that the pull exerted by the spring member on the armature is variable.

8. In an electromagnetic device a magnetic armature, a non-magnetic armature chamber surrounding said armature, means for pivotally supporting said armature in said chamber, a coil winding surrounding said armature chamber, and means for preventing the formation of eddy currents in said chamber when said magnetic armature is operated between said pole shoes to induce a flow of current in said coil winding.

9. In an electromagnetic device, a magnetic armature, an armature chamber surrounding said armature and formed of non-magnetic material, means for pivotally supporting said armature in said chamber, said chamber having gaps therein to preclude the formation of eddy currents in said device, pole shoes spaced opposite the ends of said armature for magnetically attracting the same, and a coil winding surrounding said armature chamber.

10. In an electromagnetic device, a coil winding, an armature chamber extending through the center of said coil winding, an armature extending through said chamber and pivoted therein, said armature chamber comprising a channel-shaped member with turned-up ends forming a means for supporting the armature, and a plate bridging the channel ends.

11. An armature chamber for an electromagnetic device comprising a channel-shaped member having means in its turned-up ends for pivotally supporting the armature, a plate member bridging the turned-up ends of said channel member, and an insulating plate interposed between said channel member and said plate member.

12. A generator comprising, in combination, a magnetic structure including a plurality of pole faces, an armature mounted for movement between two positions to form in each position a substantially closed magnetic circuit which includes said armature and two of said pole faces of opposite polarity, a coil inductively coupled to said armature, said armature being so arranged with respect to said pole faces that the direction of flux traversing said armature is reversed when said armature is moved from one of its two positions to the other, whereby voltage pulses of opposite polarity are induced in said coil during continued movement of said armature between said two positions, and means so arranged as to exert an increasing force on said armature, when said armature is in either of said two positions, until the magnetic pull of the adjacent pole face on the armature is overcome and then to snap said armature to the other of said two positions, whereby said pulses are characterized by a relatively steep wave front.

13. A generator comprising, in combination, a magnetic structure including a plurality of pole faces, an armature mounted for movement between two positions to form in each position a substantially closed magnetic circuit which includes said armature and two of said pole faces of opposite polarity, a coil inductively coupled to said armature, said armature being so arranged with respect to said pole faces that the direction of flux traversing said armature is reversed when said armature is moved from one of its two positions to the other, whereby voltage pulses of opposite polarity are induced in said coil during continued movement of said armature between said two positions, an operating member, a spring member mechanically connected between said operating member and said armature, and means including said spring member for snapping said armature between said two positions during operation of said operating member, whereby said pulses are characterized by a relatively steep wave front.

14. A generator comprising, in combination, a magnetic structure including a plurality of pole faces, an armature mounted for movement between two positions to form in each position a substantially closed magnetic circuit which includes said armature and two of said pole faces of opposite polarity, a coil inductively coupled to said armature, said armature being so arranged with respect to said pole faces that the direction of flux traversing said armature is reversed when said armature is moved from one of its two positions to the other, whereby voltage pulses of opposite polarity are induced in said coil during continued movement of said armature between said two positions, an operating member, a spring member connecting said armature and said operating member, whereby continuous movement of said operating member is effective continuously to move said armature between said two positions, said spring member being so arranged as to exert an increasing force on said armature, when said armature is in either of said two positions, until the magnetic pull of the adjacent pole face on the armature is overcome and then to snap said armature to the other of said two positions, whereby said pulses are characterized by a relatively steep wave front.

HAROLD C. PYE.