

May 25, 1943.

R. C. MATHES
SWITCHING CONTACT

2,319,937

Filed March 15, 1941

2 Sheets-Sheet 1

FIG. 1

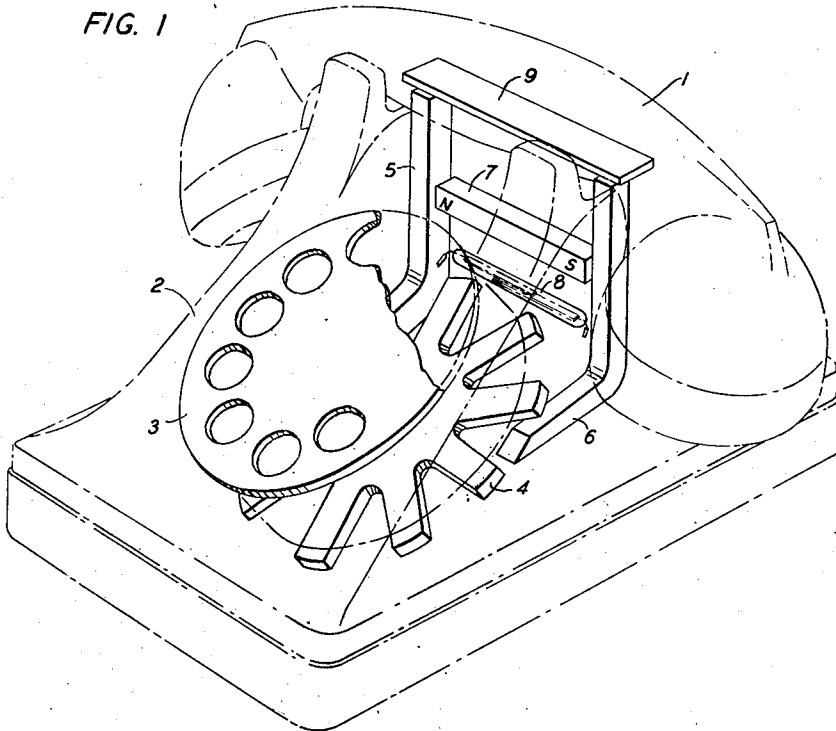
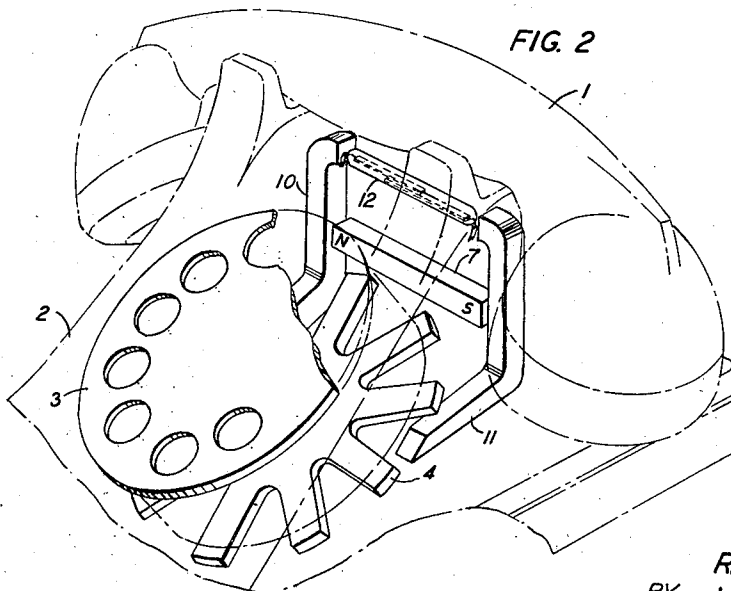


FIG. 2



INVENTOR
R. C. MATHES

BY *John A. Hall*
ATTORNEY

May 25, 1943.

R. C. MATHES

2,319,937

SWITCHING CONTACT

Filed March 15, 1941

2 Sheets-Sheet 2

FIG. 3

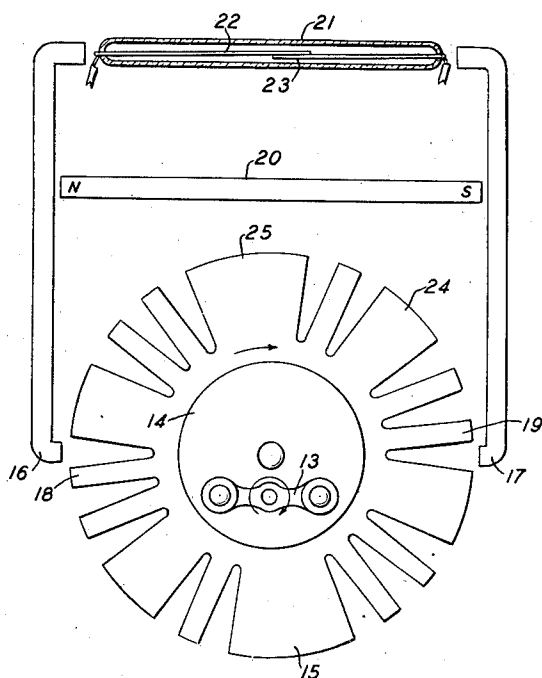
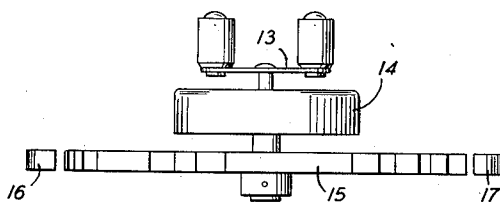


FIG. 4



INVENTOR
R. C. MATHES

BY

John A. Stall
ATTORNEY

UNITED STATES PATENT OFFICE

2,319,937

SWITCHING CONTACT

Robert C. Mathes, Maplewood, N. J., assignor to
Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application March 15, 1941, Serial No. 383,563

10 Claims. (Cl. 179—90)

This invention relates to signaling systems and particularly to the operation of switching contacts for signaling by control of an electrical circuit.

The object of the invention is to improve the construction and functioning of such apparatus by insuring the positive operation of the switching contacts, eliminating moving mechanical parts and using sealed contacts which are protected against corrosion and the other ills of open air contacts.

The invention may generally be defined as magnetic switching since it is the object of the invention to operate the electrical contacts for controlling the signaling path by performing a signaling operation which primarily changes a magnetic circuit. Through the use of magnetically operated contact devices such as the sealed reed and mercury contacts, among others, the control of the signaling circuit may be carried out under more favorable conditions than heretofore.

When applied to telephone apparatus the invention may be defined as relating to magnetic dialing and magnetic switchhook operation since while the signals in existing systems are created by the direct action of mechanical means for the dialing and switchhook operations in the method proposed the intervening control is purely magnetic.

Generally stated a magnetic circuit is provided in the support or cradle for the telephone, such circuit including a set of magnetically operated switching contacts. Through the use of a magnetic element in the telephone the field of a permanent magnet in the said magnetic circuit is sufficiently diverted from the said magnetically operated contacts to allow them to release when the telephone is placed on its cradle. A dialing device comprising means to periodically and magnetically shunt that part of the said magnetic circuit affected by the magnetic element in the telephone is provided. When the telephone is on its cradle this dialing device is ineffective since the magnetic contacts have already been released. However, when the telephone has been removed from its cradle the contacts are in their operated positions and then the dialing device becomes effective to periodically sufficiently divert the field of the permanent magnet from such contacts whereupon they operate to periodically open and close the line circuit, since in this case the line circuit is affected by both the switchhook and dialing operations.

In one form of the invention a simple magnetic circuit operating in response to the movement of a dial is provided. In another form a magnetic circuit responsive to both switchhook and dialing operations is employed. In still another form a magnetic circuit is employed in a well-

known type of signal transmitter by which impulses of different length and in code are transmitted. The invention may be further applied to other types of signal transmitters.

5 The magnetically operated contacts may be of any well-known form, though herein sealed contacts are shown as being preferable to mere magnetically movable open contacts. Since applicant does not claim any particular type of contact device it may be noted that among many others, the contacts of the following examples of the prior art may be usefully employed.

10 Cox, 2,207,506, July 9, 1940; Leece et al., 2,029,266, Jan. 29, 1936; Ellwood et al., 2,187,115, Jan. 16, 1940; Harrison et al., Serial No. 302,526, filed Nov. 2, 1939.

15 A feature of the invention is a magnetic circuit including a permanent magnet normally arranged to operate a set of magnetically responsive circuit contacts in combination with signaling means including a magnetic element constructed and arranged upon each signaling operation to sufficiently divert the field of said permanent magnet from said contacts to allow them to release.

20 Another feature of the invention is a combined magnetic circuit for performing a plurality of signaling operations whereby a first signaling operation is automatically prevented until a second signaling operation has been performed. Specifically a dialing operation is automatically prevented until a switchhook operation has been performed.

25 Another feature of the invention is the use of a movable element as part of a magnetic circuit which will so affect the said magnetic circuit as to cause a response by magnetically operated circuit contacts, either periodically or according to a predetermined pattern of equally or unequally timed operations.

30 Other features will appear in the following description.

35 The drawings consist of two sheets, one having two figures representing in skeletonized form a telephone instrument comprising a handset, a cradle therefor, a dial and a magnetic circuit for operating a set of contact elements, and another sheet having two figures representing in diagrammatic form a signal transmitter operated by a twist of the handle, such as the well-known messenger call boxes.

40 Fig. 1 shows an arrangement in which the magnetic circuit is effected both by the movement of the handset and the movement of the dial;

45 Fig. 2 shows a similar arrangement in which the magnetic circuit is effected only by the dial;

50 Fig. 3 is a diagrammatic showing of a signal transmitter which will send a train of pulses of unequal length; and

Fig. 4 is an end view of the essential elements of the device of Fig. 3.

In Figs. 1 and 2 a telephone handset 1 and the cradle 2 therefor are shown in broken line outlines. In both figures, also, a dial 3 is indicated together with a castellated armature 4 moved by the dial. The term "castellated armature" used herein and in the appended claims will be understood as a spoked member of the general design and appearance of the member 4, the term "castellated" being intended to be generic in nature and to cover variations in this device including one in which the ends of the spokes might be turned up at a position normal to the plane of the member and thus plainly resemble the generally understood contour of the battlement of a castle.

In Fig. 1 a pair of soft iron elements 5 and 6 are indicated as mounted within the cradle 2. A permanent magnet 7 is mounted in the cradle with air gaps between its ends and the soft iron elements 5 and 6. A set of contacts 8 is mounted between the soft iron elements 5 and 6 in a position parallel to the permanent magnet 7. This contact set is here represented as a sealed reed contact device of the type developed by Ellwood and shown in the Ellwood patent hereinbefore noted. It consists of a glass tube in which two magnetic reeds are placed in such a position that when a magnetic field is passing therethrough, these reeds will be attracted to each other and will make an electrical contact therebetween. It will be understood, of course, that the contact device 8 is representative and may represent a plurality of such contacts if the circuit in which they are used calls for a plurality of circuits to be opened and closed. Another soft iron element 9 is mounted within the handset 1 in such a position that when the handset 1 is resting on its cradle as shown, it will sufficiently divert the field of the permanent magnet 7 through the upper portions of the soft iron elements 5 and 6 so that the flux threading the magnetic reeds of the device 8 will be so reduced that the reeds will return to their normal position in which the circuit therethrough is opened.

The dial 3 operates a castellated armature 4 also of soft iron or other low reluctance magnetic material. In the position shown the air gaps between the lower ends of the soft iron pieces 5 and 6 and the spokes of the castellated armature 4 are so great that the field of the permanent magnet 7 is not sufficiently affected by the armature 4 to release the contacts of the device 8. Upon rotation of the dial, however, the spokes of the castellated armature 4 will periodically sufficiently shunt the magnetic circuit so as to allow the contacts of the device 8 to open. With the handset of its cradle in the position shown the dial will be ineffective as the soft iron armature 9 already sufficiently diverts the field of the permanent magnet 7 to open the contacts of the device 8. However, when the handset is removed from the cradle 2 and the air gap between the armature 9 and the pieces 5 and 6 has become so great that the magnetic circuit is not affected thereby, then the movement of the castellated armature 4 becomes effective. Therefore, during the rotation of the dial 3 and the coincident movement of the castellated armature 4 the contacts in the device 8 are periodically opened and closed and will perform the same functions as the contacts on an ordinary dial.

It will be understood that some means such as a one-way slip clutch or ratchet for insuring that

the castellated armature 4 will affect the magnetic circuit only during the return movement of the dial 3 will be provided but since specific means of this nature are not part of the present invention, they will not be illustrated and described herein.

Fig. 2 shows an alternative arrangement in which the dial only affects the contacts. Herein a pair of soft iron elements 10 and 11 correspond to the soft iron elements 5 and 6 of Fig. 1. A magnetically operated contact device 12 is shown at one extremity of the soft iron elements 10 and 11 and the castellated armature 4 is shown as associated with the other extremities of these elements. The permanent magnet 7 is placed part-way between the extremities of the soft iron pieces 10 and 11. In the position shown the field of the magnet 7 will thread the magnetic elements of the contact device 12 in sufficient force to close the circuit controlled thereby. Upon the operation of the dial the spokes of the castellated armature 4 will periodically shunt the magnetic circuit and sufficiently divert the field of the permanent magnet 7 from the contact device 12 to allow the contacts therein to open and thus the contacts of the device 12 will operate in the same manner as the ordinary contacts of a dial.

It will be observed that instead of a castellated armature with a separate pair of poles for each dial unit, an armature with a fewer number of poles (two, for example) can be made to serve the same purpose with the intervention of a suitable ratio gear drive between the dial and the armature. By especially shaped armatures any arbitrary train of contact operations may be set up instead of simple trains of equal pulses.

By way of example, an impulse transmitter like that shown in Patent 1,306,054 granted June 10, 1919 to J. C. Field may be constructed using the present magnetic switching principle. A transmitter of this nature useful in an indicating system such as that shown in Patent 1,709,067, granted April 16, 1929, to J. C. Field may be constructed. In Figs. 3 and 4 such a transmitter is shown. In these figures a handle 13 is used to operate the transmitter. Through a suitable train of gears 14 an armature 15 may be caused to move past the pole-pieces 16 and 17. If the spokes 18 and 19, for instance, come into operative relation with the pole-pieces 16 and 17, respectively, the field of the permanent magnet 20 is sufficiently diverted from the contact device 21 to allow the circuit normally made between the reeds 22 and 23 to be opened.

It will be noted that the spoke 19 is small in dimension, that the spoke 24 is larger and that the spoke 25 is still larger. That means that the open circuit period produced when the spoke 19 is in operative relation with the pole-piece 17 will be of short duration, that the condition produced by the spoke 24 will be of longer duration and that the condition produced by the spoke 25 will be of still longer duration.

It will also be obvious that a device of this nature need not necessarily be controlled by an operator but may be controlled by the movement of some piece of machinery such, for instance, as the movement of a railroad semaphore for the purpose of sending answer-back signals.

Other uses for the signal transmitter of the present invention working on the magnetic switching principle will occur to those skilled in the art.

What is claimed is:

1. In communication apparatus, a supporting

structure, sound translating apparatus removably supported thereon, a magnetic circuit in said supporting structure including a source of magnetomotive force, magnetically operated circuit contacts normally operated by said source of magnetomotive force and means for sufficiently diverting the field from said contacts to cause their release, said means consisting of a spoked member for mechanically and repeatedly interposing a path of low reluctance in said magnetic circuit.

2. In communication apparatus, a supporting structure, sound translating apparatus removably supported thereon, a magnetic circuit in said supporting structure including a source of magnetomotive force, magnetically operated circuit contacts normally operated by said source of magnetomotive force and a plurality of low reluctance elements for interposition in said circuit for sufficiently diverting the field from said contacts to cause their release, one of said elements being mechanically controlled to repeatedly affect said circuit, and another of said elements being carried by said sound translating apparatus and positioned therein to affect said circuit when said sound translating apparatus is in its normal position on said supporting structure.

3. In communication apparatus, a supporting structure, sound translating apparatus removably supported thereon, a magnetic circuit in said supporting structure including a source of magnetomotive force, magnetically operated circuit contacts normally operated by said source of magnetomotive force and a plurality of low reluctance elements for interposition in said circuit for sufficiently diverting the field from said contacts to cause their release, one of said elements being mechanically controlled to repeatedly affect said circuit, and another of said elements being carried by said sound translating apparatus and positioned therein to affect said circuit when said sound translating apparatus is in its normal position on said supporting structure, said magnetic circuit being constructed and arranged to render said first element ineffective when said second element is effectively interposed in said circuit.

4. In communication apparatus, a supporting structure, sound translating apparatus removably supported thereon, a magnetic circuit located partly in said sound translating apparatus and partly in said supporting structure, said magnetic circuit including permanent magnetic and soft iron elements and magnetically operated circuit contacts, said contacts being operated by said permanent magnetic element, said part of said magnetic circuit in said sound translating apparatus acting when said sound translating apparatus is resting on said support to sufficiently divert the field of said permanent magnet from said contacts to allow them to release and another element of said magnetic circuit being arranged to operate mechanically to periodically sufficiently divert the field of said permanent magnet from said contacts to allow them to release.

5. In communication apparatus, a supporting structure, sound translating apparatus removably supported thereon, a magnetic circuit located partly in said sound translating apparatus and partly in said supporting structure, said magnetic circuit including permanent magnetic

and soft iron elements and magnetically operated circuit contacts, said contacts being operated by said permanent magnetic element, said part of said magnetic circuit in said sound translating apparatus acting when said sound translating apparatus is resting on said support to sufficiently divert the field of said permanent magnet from said contacts to allow them to release, and another element of said magnetic circuit being in the form of a spoked member rotatably mounted and controlled mechanically by a signal device, said spoked member in certain positions thereof acting to complete a branch of said magnetic circuit to sufficiently divert the field of said permanent magnet from said contacts to allow said contacts to release and in alternate positions thereof acting to open said branch of said magnetic circuit to allow the field of said permanent magnet to operate said contacts.

6. In combination, a telephone including a handset and a cradle therefor, a dial mounted on said cradle, a set of magnetically operated circuit contacts, magnetic means in said handset to operate said contacts and magnetic means controlled by said dial to operate said contacts.

7. In combination, a telephone including a handset and a cradle therefor, a dial mounted on said cradle, a set of magnetically operated circuit contacts, magnetic means in said handset to operate said contacts, magnetic means controlled by said dial to operate said contacts and means whereby said dial is rendered ineffective while said handset is resting on said cradle.

8. In communication apparatus, a dial for sending trains of impulses comprising sealed contacts, a magnetic circuit insensitive to external magnetic influence for working said contacts consisting of an inductor type relay structure and a spoked member controlled by said dial for changing the reluctance relations of said inductor type relay structure.

9. In communication apparatus, a magnetic circuit insensitive to external magnetic influence consisting of an inductor type relay structure, a set of sealed contacts controlled by said magnetic structure, a dial, a spoked member for controlling said magnetic structure to operate said contacts to send trains of impulses, a telephone handset, and a magnetic element in said handset to also control said magnetic structure to operate said contacts in accordance with the movement of said handset to and from its normal position.

10. A contact control device consisting of a magnetic circuit including a source of magnetomotive force, magnetically operated circuit contacts normally operated by said source of magnetomotive force and means for sufficiently diverting the field from said contacts to cause their release, said means consisting of a mechanically movable element permanently associated with and mounted in cooperative relationship with the said other elements of said magnetic circuit for repeatedly interposing a path of low reluctance in said magnetic circuit for creating a corresponding train of impulses, said mechanically movable element being arranged and adjusted to interpose a path of low reluctance in said magnetic circuit at a rate in the order of ten to twenty times per second.

ROBERT C. MATHES.