

Dec. 22, 1942.

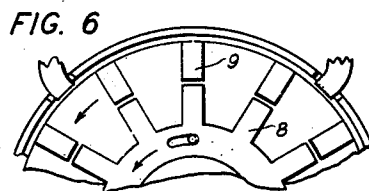
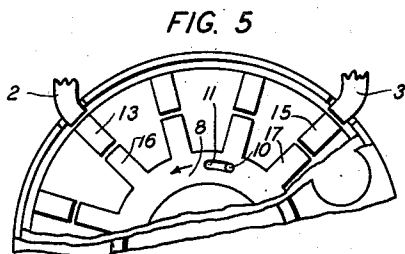
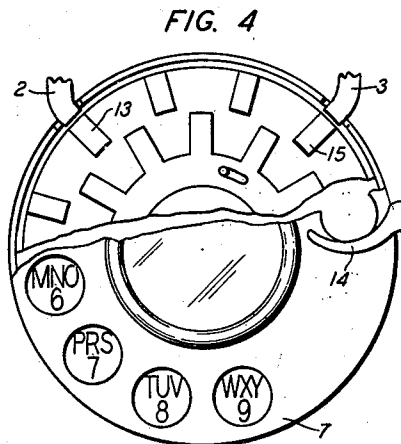
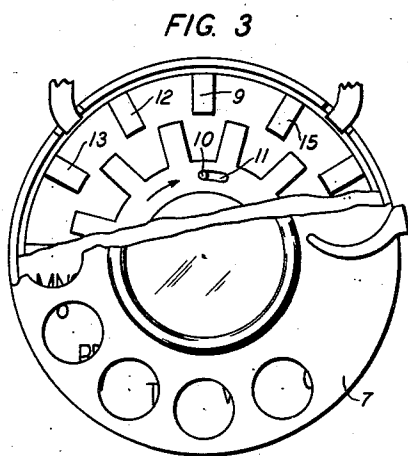
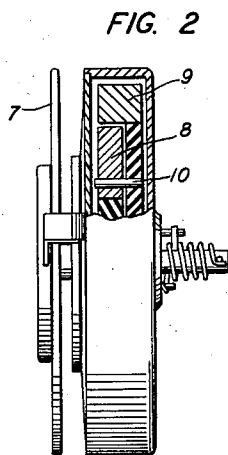
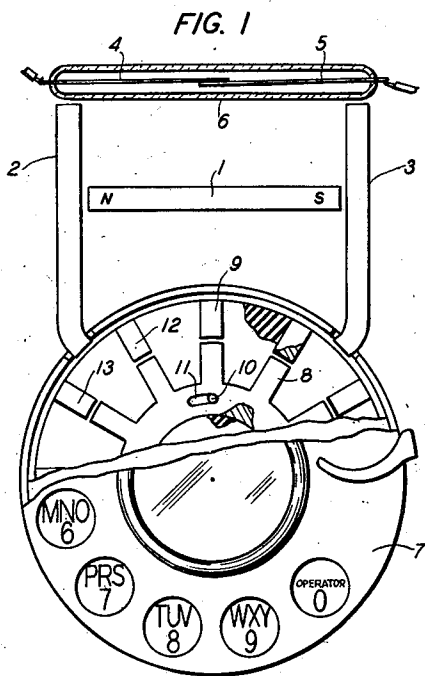
R. M. KALB

2,306,267

MAGNETIC DIAL

Filed March 15, 1941

2 Sheets-Sheet 1



INVENTOR
R. M. KALB

BY *John A. Hall*
ATTORNEY

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MAGNETIC DIAL

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2 Sheets-Sheet 2

FIG. 7

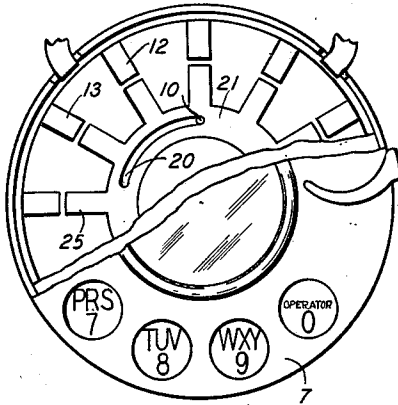


FIG. 8

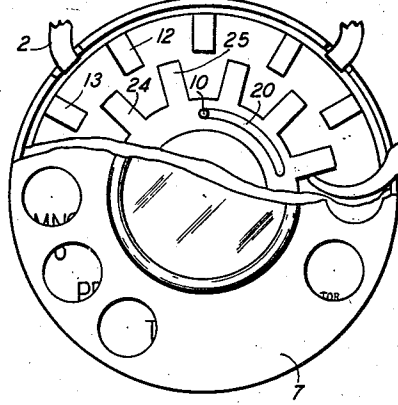


FIG. 9

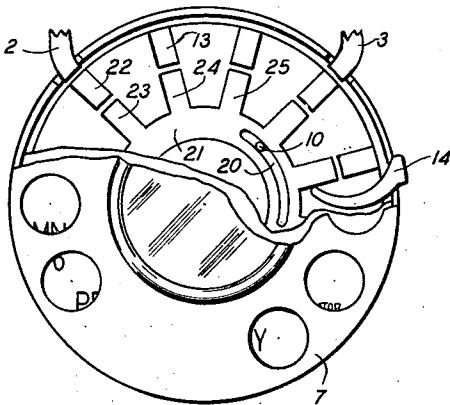
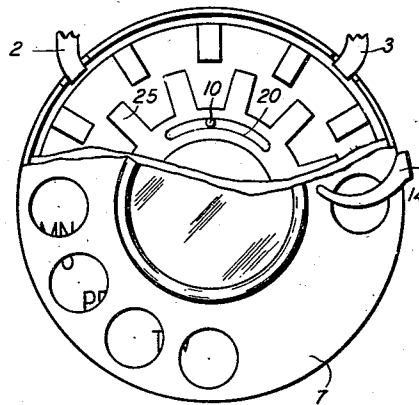


FIG. 10



INVENTOR
R. M. KALB

BY *John A. Hall*
ATTORNEY

UNITED STATES PATENT OFFICE

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MAGNETIC DIAL

Robert M. Kalb, Madison, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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9 Claims. (Cl. 179—90)

This invention relates to communication apparatus and particularly to the operation of switching contacts responsive to the usual signaling operations performed over such apparatus.

When applied to telephone apparatus the invention may be shortly defined as a magnetically operated dial, the object being to operate signaling contacts magnetically in response to the mechanical movement of a dial.

A more specific object is to provide means whereby a dial intended to be rotated in one direction while being set and rotated in the other direction while effectively operating to transmit signals will not interfere with the signaling circuit while being set. While this object in general describes the usual function of a dial, special and novel means have to be provided where the dial operates on the magnetic principle.

In accordance with this invention a magnetic circuit is provided and controlled by a dial which periodically alters such circuit to cause a periodic resulting electrical response. The dial operates to complete a magnetic circuit by moving a magnetic member into and out of the said magnetic circuit. Since this magnetic member moves in both directions of the dial a means to render it ineffective during movement in one direction must be provided.

In the preferred embodiment of the invention this means is a magnetic link which moves into position to render the dial effective in response to movement of the dial in a given direction. In other words, while the dial is being set this magnetic link remains in that position in which the dial is ineffective but as soon as the dial starts to revolve in the opposite direction this magnetic link moves into position to render the dial effective.

In one form of the invention the dial rotates a castellated armature or magnetic element which acts to complete a magnetic circuit periodically and a number of times depending on the extent of rotation of the dial. A second member forming extensions of the spokes of the castellated member rotates with the dial but on the setting movement these extension members are out of alignment with the fingers of the castellated member and therefore the main part of the magnetic circuit remains unaffected. However, on the return movement the extension members do not start to move until the spokes of the castellated member line up with them so that now the main part of the magnetic circuit is affected.

Still more specifically the movable magnetic link comprises a castellated member having a plurality of spokes for partly completing the magnetic circuit, a cooperating member having an equal number of magnetic parts constituting extensions of said spokes and a lost motion linkage between said castellated member and said cooperating member. In its normal position said cooperating member holds the said extensions out of alignment with other parts of said magnetic circuit so that the magnetic circuit is not affected by the initial movement of the said castellated member. When the lost motion linkage causes engagement between said castellated member and said cooperating member and during the subsequent simultaneous movement of these two members the relative positions of the spokes and the magnetic parts of the cooperating member are at all times such that the magnetic circuit is maintained open. At the extreme end of the setting motion of the magnetic link, the magnetic parts of the cooperating member are positioned in alignment with other parts of the magnetic circuit and they remain in this position during the return or signal transmitting motion of the dial until the lost motion linkage again causes engagement between the castellated member and the cooperating member. Subsequently throughout the remainder of the signal transmitting motion of the dial the magnetic parts of the cooperating member and the spokes of the castellated member travel together whereby each time the magnetic parts of the cooperating member come into alignment with other parts of the magnetic circuit, such circuit is completed and the circuit contacts are released.

In one form of the invention the lost motion device is constructed and arranged to cause engagement between said castellated member and said cooperating member as soon as the spokes have moved out of their normal position of alignment with the magnetic parts of said castellated member. In this case, the signal transmitter will faithfully transit any series of signals desired including one or more pulses.

In another form of the invention the lost motion device is constructed and arranged to delay engagement between the castellated member and the cooperating member until the spokes of the castellated member have passed one or more of the magnetic parts of the cooperating member whereby a dial is produced which will transmit signals of only digits above a given number. For instance, if the lost motion device is constructed and arranged so that these spokes pass

two of the magnetic parts of the cooperating member before engaging this member then if the dial is set to transmit signals of either one or two pulses the cooperating member will not have been moved from its normal position and therefore the castellated member on its return or signal transmitting movement will fail to affect the magnetic circuit with the result that no signals will be sent. If, however, the dial is set to transmit a signal of three pulses, then the castellated member will engage the cooperating member and set the magnetic parts thereof in alignment with the other parts of the magnetic circuit. Thereupon this cooperating member will remain stationary until two spokes of the castellated member in its return movement have lined up with the aligned portions of the cooperating member and the other part of the magnetic circuit. Therefore, the first two pulses of the three-pulse train are generated while the cooperating member remains stationary and the third pulse is generated while the castellated member and the cooperating member are moving together with the spokes of the one and the magnetic parts of the other in alignment.

Appropriate frictional or other restraining means will be employed to hold the cooperating member stationary except when such cooperating member is engaged by the castellated armature in either the forward or return movement thereof.

Where a dial is thus arranged so that even if set it will not transmit a signal of two pulses it will likewise not transmit a signal of one pulse. In accordance with this invention any desired arrangement may be made, such for instance, as a dial which will only transmit signals of seven or more pulses.

The magnetic circuit employed comprises permanent magnetic and soft iron elements and magnetically operated circuit contacts. Normally the field of the permanent magnet causes the contacts to operate. When, however, the dial is effectively operating the field of the permanent magnet is periodically sufficiently diverted from the said contacts to allow them to periodically release.

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. The pulse length may be regulated by proportioning the dimensions of the spokes of the castellated armature, the magnetic parts of the cooperating member and the pole-pieces of the magnetic circuit and by properly shaping the ends thereof.

A feature of the invention is a magnetic circuit including a pair of movable members which both move simultaneously in the same direction but only become effective to affect the said magnetic circuit when moving in a given direction.

Another feature is a magnetic circuit including a pair of movable members which in a given relative position act to affect said magnetic circuit combined with means to move said members in two directions but to bring them into said relative position only while moving in one of said directions.

Another feature of the invention is a magnetic circuit normally having an air-gap great enough to produce a given magnetic effect combined with a pair of rotatable magnetic members for shortening said air-gap to produce another given magnetic effect, with means for maintaining said first given magnetic effect during rota-

tion of said members in one direction and for periodically producing said other given magnetic effect during rotation of said members in the opposite direction.

Another feature of the invention is a signal transmitter which may be set to transmit any desired signal but which will fail to transmit certain signals even though so set.

It will be apparent that the principles of this invention may be applied to other types of signal transmitters such as those for sending coded trains of pulses, those for sending trains of unequal length pulses and so forth.

Other features will appear in the following description.

The drawings consist of two sheets having a total of ten figures showing the dial of the present invention diagrammatically partly cut away and partly in section.

Fig. 1 shows the dial in its normal position with a diagram illustrating the arrangement of the magnetic circuit with which the dial cooperates;

Fig. 2 is a side view of the dial partly in section;

Figs. 3, 4, 5 and 6 show the dial in different positions and illustrate by these showings the manner in which it operates; and

Figs. 7, 8, 9 and 10 show a modified dial in various positions. The dial of these figures is arranged so that it will not transmit the digits 1 and 2 but will transmit all other digits.

The dial of the present invention operates on the magnetic principle. There is a permanent magnet 1 which is a source of magnetomotive force. This, of course, could as well be an electromagnet and it will be understood hereinafter that when a magnet is spoken of it is in the sense of a source of magnetomotive force which may come either from a permanent magnet or an electromagnet. Situated at each pole of this permanent magnet 1 there is a soft iron piece 2 and 3 separated from the magnet 1 by air-gaps forming an essential part of the magnetic circuit. With the dial in the position shown in Fig. 1 and for reasons which are believed to be apparent, the field of the magnet 1 will extend mainly through the magnetic members 4 and 5 of the sealed reed contact device 6 and thereby cause the overlapping ends of these reeds to approach each other and make a contact therebetween. Since the reeds 4 and 5 are sealed through the ends of the evacuated vessel 6, the external portions thereof may be connected to an electrical circuit and through their action control such electrical circuit. The dial is intended to periodically shunt the magnetic circuit thereby sufficiently diverting the field of the magnet 1 through the dial and from the magnetic elements 4 and 5 so that these will return to their normal positions in which the electric circuit therethrough is broken.

The dial consists essentially of a finger wheel 7, a castellated armature 8 and a cooperating member consisting of a rotating part carrying a number of magnetic parts such as 9, 12 and 13. The castellated armature 8 is securely attached to the finger wheel 7 and rotates in either direction therewith. The cooperating member is provided with pin 10 which operates in a slot 11 in the castellated armature 8. The castellated armature 8 is provided with a number of spokes and the cooperating member is provided with a like number of cooperating magnetic parts such as those numbered 9, 12 and 13. In the normal po-

sition of the dial with the magnetic parts 9, 12 and 13 placed as shown and the spokes of the castellated armature 3 placed as shown, the magnetic circuit from the extremity of the piece 2 to the extremity of the piece 3 through the dial is of such high reluctance that the contacts of the devices 6 are not affected thereby.

Figs. 3 to 6, inclusive, show the action of the dial as it is set to transmit the digit 1. In Fig. 3 the finger wheel and the castellated armature 8 have been rotated in a clockwise direction just far enough so that the end of the slot 11 has just come in contact with pin 10 to begin to move the cooperating member also in a clockwise direction. In Fig. 4 the position is shown as the finger of the operator engages the finger stop 14. In this position the magnetic part 13 has come to such a position that it forms an extension of the soft iron piece 2 and the magnetic part 15 has come to a similar position in which it forms an extension of the magnetic part 3. The castellated armature 8, however, is still in such a position that the magnetic circuit is not affected.

In Fig. 5 the position of the parts is shown after the finger has been removed from the No. 1 finger hole and the finger wheel and the armature 8 have started to rotated backward in a counter-clockwise direction. Now it will be noted that practically a closed magnetic circuit may be traced from the soft iron piece 2 through the magnetic part 13, spoke 16 of the castellated armature 8 through the body of the castellated armature 8, spoke 17, magnetic part 15 to the soft iron piece 3. In this position the field of the magnet 1 will be sufficiently diverted from the contact device 6 so that the circuit through this device will be opened. This condition, however, is transient and only lasts for an instant as the right-hand end of the slot 11 has now engaged the pin 10 and the castellated armature 8 and cooperating piece now begin to move backward together in a counter-clockwise direction until they reach the position shown in Fig. 6. Fig. 6 is actually a duplicate of Fig. 1 and shows the normal position of the parts.

If a digit of higher value is dialed then the condition shown in Figs. 5 and 6 will alternately be established so that if the digit 5, by way of example, is dialed, then the magnetic circuit traced for diverting the field of magnet 1 from the contact device 6 will be established five times in rapid succession whereby the circuit through the magnetic reeds 4 and 5 will be opened five times in succession and produce the same result as the contacts on an ordinary dial.

In Fig. 7 it will be noted that the slot 20 is provided in the castellated armature 21 which is long enough to allow the finger wheel to be set for digits 1 and 2 without engaging the pin 10 at the end of the slot 20. Therefore, when either digit 1 or 2 is dialed the cooperating piece will not move the magnetic parts 12 and 13 from their normal position so that neither during the setting nor the return movement of the dial will the magnetic circuit be affected. Therefore, since the cooperating piece does not move neither of these digits will be transmitted. Fig. 7 shows the normal position of the parts and Fig. 8 shows the position in dialing any digit above 2 at the point where the left-hand end of the slot 20 has engaged the pin 10. Thus if the digit 3 is being dialed, it will be noted that the cooperating piece has just been engaged and that at the end of this movement the magnetic part 13 will move into association with the soft iron part 2.

In Fig. 9 the position of the parts is shown after the digit 4 has been dialed and the castellated armature 21 has started to revolve backward in a counter-clockwise direction. The magnetic part 22 has been moved into association with the soft iron part 2 and the spoke 23 of the castellated armature 21 has also moved into position so that the magnetic circuit is now established to sufficiently divert the field of magnet 1 from the contact device 6. Thereafter the cooperating piece carrying the magnetic parts 13 and 22 will remain stationary until the right-hand end of the slot 20 has engaged the pin 10. During this time, however, spokes 23 and 24 will have passed the magnetic part 22 and will have completed the effective magnetic circuit. When spoke 25 gets to this point the end of the slot 20 will engage the pin 10 and the two parts will then travel backward together. Thus when the dial is arranged to refuse to transmit the digits 1 and 2 the magnetic circuit will be completed on the dialing of all other digits twice while the cooperating member is stationary, and the remaining number of times in accordance with the digit dialed while the cooperating part and the castellated armature 21 are travelling together.

In Fig. 10 the relative positions of the parts are shown after the digit 2 has been dialed and during the return or counter-clockwise movement of the castellated armature.

What is claimed is:

1. In signaling apparatus, a signal transmitter comprising a magnetic circuit including magnetically operated circuit contacts, a magnetic link in said circuit movable in one direction for setting said transmitter to transmit a given signal and movable in the opposite direction to transmit said given signal and means for rendering said magnetic link effective only while moving in said opposite direction.

2. In signaling apparatus, a signal transmitter comprising a magnetic circuit having an air-gap sufficiently great to produce a given magnetic effect, combined with a pair of rotatable magnetic members for shortening said air-gap to produce another given magnetic effect, with means for maintaining said first given magnetic effect during rotation of said members in one direction and for periodically producing said other given magnetic effect during rotation of said members in the opposite direction and a set of magnetically operated signal circuit contacts responsive to said various magnetic effects.

3. In signaling apparatus, a signal transmitter comprising a magnetic circuit including a pair of movable magnetic members constructed and arranged to affect said magnetic circuit when placed in a given relative position, means to simultaneously move said members, means to bring said members into said given relative position when said members are moving in one given direction and a set of magnetically operated signal circuit contacts responsive to said magnetic circuit.

4. In signaling apparatus, a signal transmitter comprising a magnetic circuit including magnetically operated circuit contacts, a magnetic link in said circuit movable in one direction for setting said transmitter to transmit a given signal and movable in the opposite direction to transmit said given signal, said magnetic link comprising a compound structure including a spoked magnetic device whose spokes in their movement partly complete a branch of said magnetic circuit and a member having a plurality

of magnetic parts equal in number to the number of spokes of said spoked device normally out of alignment with said spokes and means for bringing said magnetic parts into alignment with said spokes to wholly complete said branch of said magnetic circuit.

5. In signaling apparatus, a signal transmitter comprising a magnetic circuit including magnetically operated circuit contacts, a magnetic link in said circuit movable in one direction for setting said transmitter to transmit a given signal and movable in the opposite direction to transmit said given signal, said magnetic link comprising a compound structure including a spoked magnetic device whose spokes in their movement partly complete a branch of said magnetic circuit and a member having a plurality of magnetic parts constituting extensions of the said spokes of said spoked device with a lost motion linkage between said spoked device and said member whereby when said extensions of the said spokes are aligned with said spokes the said branch of said magnetic circuit will be wholly completed, said extensions being normally out of alignment with said spokes, means for maintaining said normal relation during the setting of said transmitter, means responsive to the said setting of said transmitter for moving said extensions into alignment with the remainder of said magnetic circuit, means including said lost motion linkage for maintaining the said set position of said extensions during the signal transmitting movement of said magnetic link until the said spokes have come into alignment with said extensions and means for thereafter maintaining said alignment between said extensions and said spokes during the remainder of the said signal transmitting movement.

6. In signaling apparatus, a signal transmitter comprising a magnetic circuit including magnetically operated circuit contacts, a magnetic link in said circuit movable in one direction for setting said transmitter to transmit a given signal and movable in the opposite direction to transmit said given signal, said magnetic link comprising a compound structure including a spoked magnetic member having a plurality of spokes for partly completing a branch of said magnetic circuit and a cooperating member having a like plurality of magnetic parts constituting extensions of the said spokes of said spoked

member, a lost motion linkage between said spoked member and said cooperating member whereby in the normal position of said parts and during the setting motion thereof said magnetic circuit will be maintained open, whereby said cooperating member at the end of said setting motion will be positioned in alignment with other members of said magnetic circuit and will remain in such aligned position until said spoked member in its signal transmitting movement and through the said lost motion linkage engages said cooperating member and whereby the said spokes of said spoked member and said magnetic parts of said cooperating member remain in alignment during the remainder of the said signal transmitting movement of said magnetic link.

7. In signaling apparatus, a signal transmitter for transmitting signals of varying numbers of pulses, a dial for selectively setting said transmitter, a cooperating member having a normal position, a lost motion linkage between said dial and said cooperating member and signaling means responsive to said dial only when said cooperating member has been moved off normal in a setting operation of said dial.

8. In a signaling apparatus, a signal transmitter for transmitting signals of varying numbers of pulses only above a given number, comprising a dial for selectively setting said transmitter for signals which said transmitter may not send as well as signals which said transmitter may send, a cooperating member having a normal position constructed and arranged to move from said normal position when engaged by said dial, a lost motion linkage between said dial and said cooperating member arranged to cause engagement between said dial and said cooperating member only when said dial is set for a signal which said transmitter may send, and means jointly controlled by said dial and said cooperating member for transmitting signals.

9. In a signaling apparatus a device as claimed in claim 6 in which said lost motion device comprises a pin and slot arrangement, the said slot being of such dimension that the movement of said spoked member exceeds the motion thereof necessary for setting said magnetic link to control the transmission of certain signals before engagement between said spoked member and said cooperating member takes place.

ROBERT M. KALB.