May 18, 1943 G. A. HEAD 2,319,321

MAGNETIC DIAL

Filed March 15, 1941 3 Sheets-Sheet 1

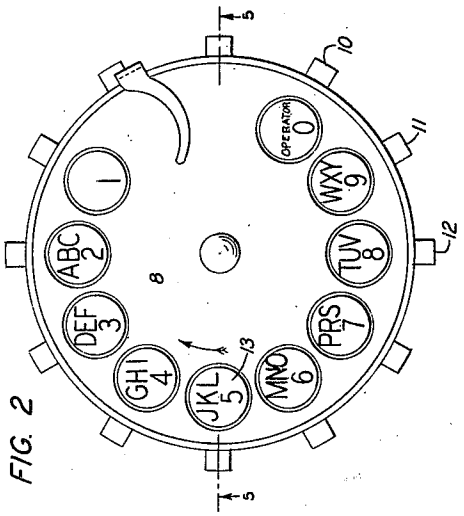

FIG. 2

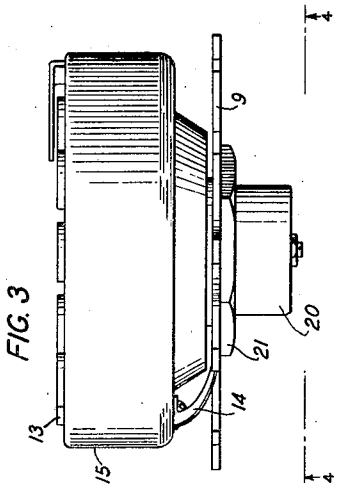

FIG. 3

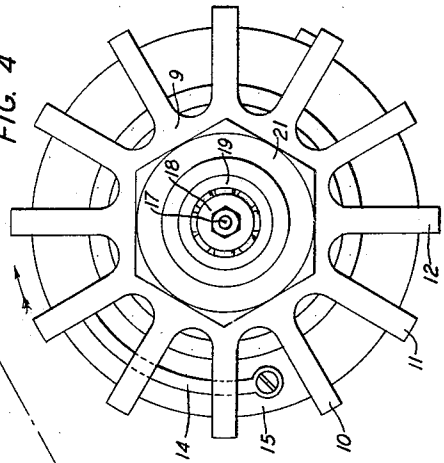

FIG. 4

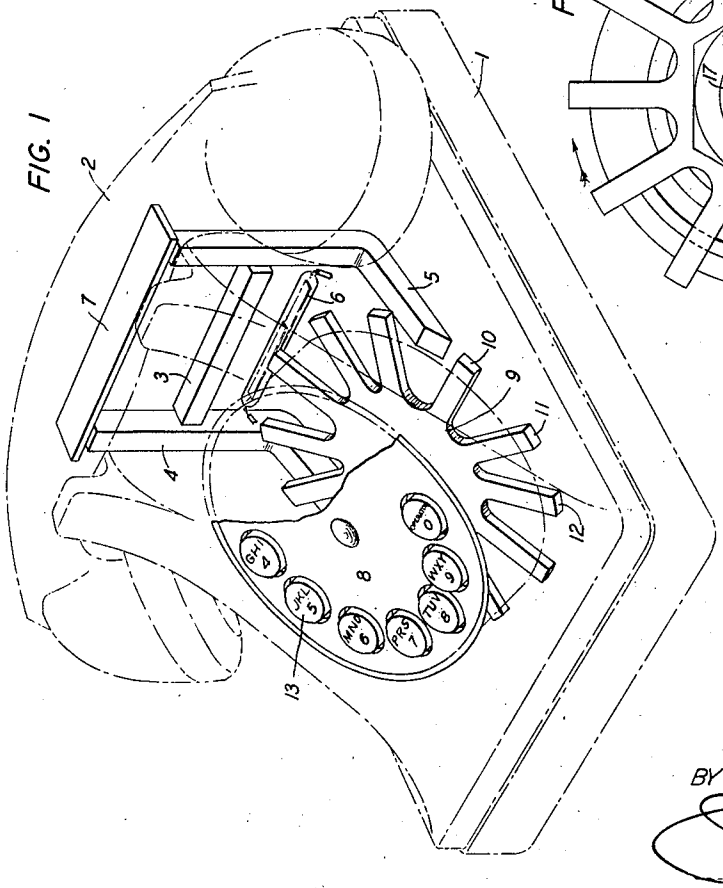

FIG. 1

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FIG. 5

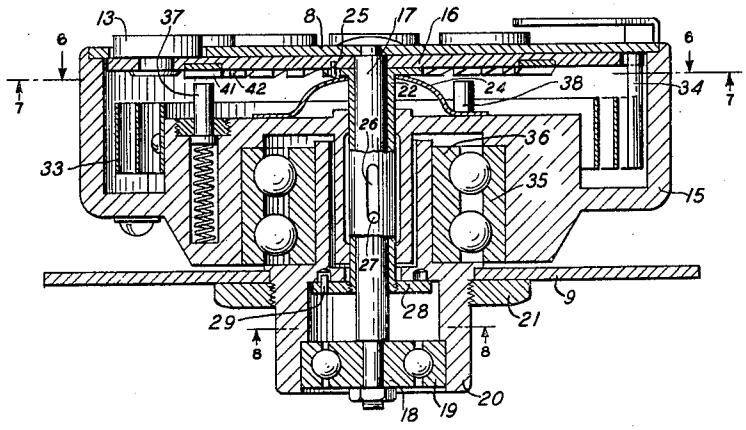

FIG. 6

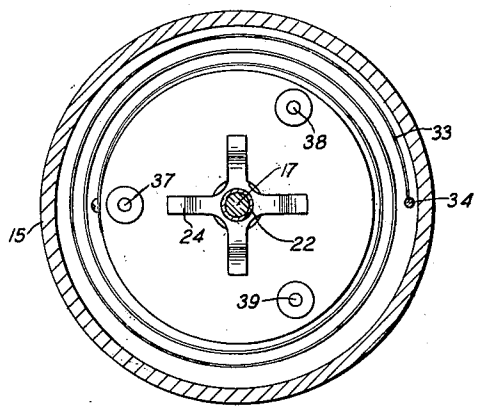

FIG. 7

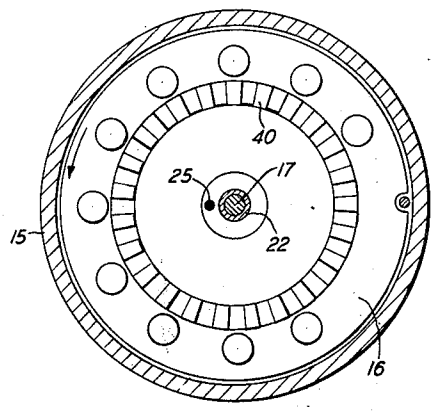

FIG. 8

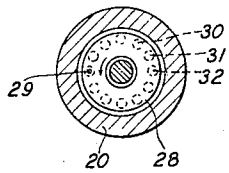

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FIG. 9

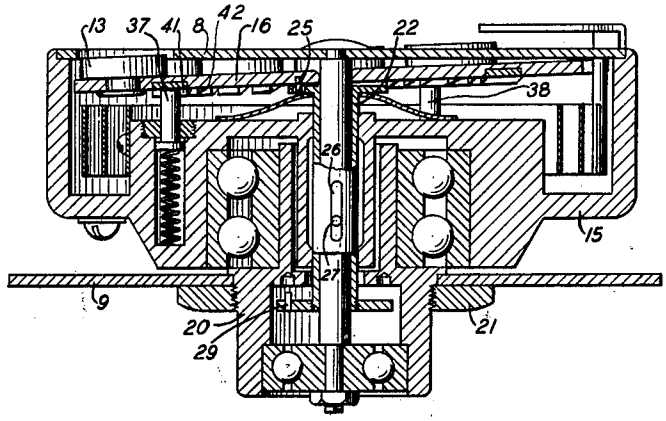
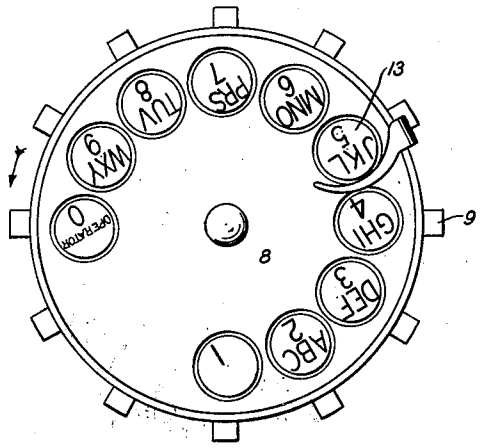


FIG. 10



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UNITED STATES PATENT OFFICE

2,319,321

MAGNETIC DIAL

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Application March 15, 1941, Serial No. 383,519

4 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 would cause electrical response during movement in either direction it must be restrained from moving during the dial setting movement.

In the preferred embodiment of the invention the said magnetic member is a castellated armature which is normally mechanically connected to and movable with the finger wheel of the dial. An auxiliary finger operated member is provided which under finger pressure will break the said normal mechanical connection between the finger wheel and the castellated armature so that the finger wheel may be moved to a selected position without moving the castellated armature. When the dial has been set and the finger removed the auxiliary finger operated member restores to normal, the normal mechanical connection is reestablished and signals are transmitted during the return movement of the dial. A ratchet and pawl device is provided so that the signal transmitting movement of the dial cannot commence until the said normal mechanical connection between said finger wheel and said castellated armature has been reestablished.

The said ratchet and pawl arrangement also performs another useful function in that it operates as an antiforcing device. By this means the finger wheel is locked against the signal transmitting movement until the finger has been removed whereby the dial is allowed to return at its own rate and may not be forced.

The said auxiliary finger operated member is in the form of a plurality of push buttons each protruding through a finger hole of the finger wheel so that in operating the dial the operator must perforce operate this auxiliary member before effective hold may be taken of said finger wheel.

A feature of the invention is a dial having a push button protruding through each hole of a finger wheel. Unless one of these buttons is pushed the dial cannot be rotated in the setting direction and unless this button is released at the end of the setting movement the return movement of the dial will not take place.

Another feature of the invention is an antiforcing device comprising a push button in each finger hole of a dial finger wheel, pressure on which will defeat any attempt of an operator to accelerate the return or signal transmitting movement of the dial.

It will be understood that the features of this invention may as readily be applied to the conventional type dial in which the impulse circuit is periodically broken by a mechanical cam or other circuit controlling element.

Other features will appear in the following description.

The drawings consist of three sheets having ten figures thereon showing various views of the dial embodying the features of the present invention.

Fig. 1 shows a telephone instrument mostly in outline indicating the magnetic circuit operated by the dial and the position of the cooperating parts thereof;

Fig. 2 shows a face view of the dial;

Fig. 3 shows a side view of the dial;

Fig. 4 is a bottom view of the dial indicated by the broken lines 4—4 in Fig. 3;

Fig. 5 is a cross-sectional view of the dial indicated by the broken lines 5—5 in Fig. 2;

Fig. 6 is a partial sectional view indicated by the broken lines 6—6 in Fig. 5;

Fig. 7 is another partial view indicated by the broken lines 7—7 in Fig. 5;

Fig. 8 is a cross-sectional view of a part of the dial indicated by the broken lines 8—8 in Fig. 5;

Fig. 9 is a cross-sectional view of the dial similar to that shown in Fig. 5 indicating the position of the parts during the operation thereof by a subscriber;

Fig. 10 is a face view of the dial similar to Fig. 2 but showing the position of the parts as the dial has been rotated by a subscriber to transmit the digit 5.

In Fig. 1, the numeral 1 indicated that part of the telephone instrument on which the dial is mounted and which performs the functions of a cradle for the handset 2. Mounted within the housing 1 is a magnetic circuit consisting essentially of a magnet 3 which may be a permanent magnet or an electromagnet and two soft iron pieces 4 and 5. The soft iron pieces are separated from the magnet 3 by appropriately designed air-gaps which are essential in the operation of this type of circuit. A magnetically responsive contact device 6 indicated here as an Ellwood unit is mounted so as to be effected by this magnetic circuit. A soft iron armature 7 is mounted within the handset 2. With the handset removed from its cradle and with the dial in the position shown, the field of the magnet 3 will find its way through the magnetic parts of the contact device 6 with the result that the reeds therein will move toward each other and make a circuit contact which will be equivalent to the contact usually made when the receiver of a telephone is removed from its hook. When the handset 2 is replaced on its cradle, as for instance, in the position shown, the magnetic armature 7 sufficiently diverts the field of the magnet 3 from the magnetic parts of the contact device 6 to allow the circuit therethrough to open.

The dial consists generally of a finger wheel 8 operating a magnetic armature 9 having a plurality of spokes 10, 11, 12, etc. The part 9 may be termed a castellated armature and is of the low reluctance magnetic material of the same nature as the soft iron pieces 4 and 5. In the position shown, the magnetic circuit between the lower ends of the pieces 4 and 5 is open. During the movement of the castellated armature 9, the spokes of this member periodically close the magnetic circuit with the same result achieved as when the handset is placed on its cradle and the magnetic armature is in the position shown. Therefore, when the handset is removed from its cradle the circuit through contact set 6 is closed. During this time if the dial is operated, due to the movement of the castellated armature 9 with its spokes periodically closing the magnetic circuit the field of the magnet 3 is periodically sufficiently diverted from the magnetic contact device 6 so that the final result is a periodic opening of the circuit therethrough. Thus, dial pulses are produced and transmitted.

It will be realized that through proper shaping of the spokes 10, 11 and 12 through their position in relation to the lower ends of the soft iron pieces 4 and 5, the nature of the pulses produced may be accurately determined.

The dial as indicated in Fig. 2 has much the same appearance as the well-known commercial telephone dial. One outstanding difference is that each finger hole instead of being an actual hole in which a subscriber may insert his finger has a button protruding therethrough which must be pushed downwardly before the subscriber may engage the finger wheel to rotate it in the usual manner. The numeral 13 indicates the push button for the digit 5 and for the letters J, K and L.

In Fig. 3, a spring 14 should be noted. This spring is firmly attached to the housing 15 of the dial and has a free end cooperating with the spokes of the castellated armature 9. It will be noted that this spring is in such a position that the castellated armature cannot turn in a clockwise direction but will be free to turn in a counterclockwise direction. Viewed as it is in Fig. 4, it will be noted that this spring acts in the capacity of a dog while the spokes of the castellated armature act as the teeth of a ratchet.

Turning now to Figs. 5 to 8 where details of the dial are shown, it will be noted that the housing 15 supports a finger hole plate 8. Just under this plate is a movable plate 16 carrying the push buttons such as 13. A shaft 17 is fixed at its upper end in plate 8 and secured at its lower end in a ball bearing race comprising the parts 18 and 19. The part 19 is secured to a movable part of the dial 20 to which the castellated armature 9 is secured by a nut 21. A sleeve 22 is placed about the shaft 17 and at its under end is held upwardly by a spring 24. A pin 25 holds a part of the sleeve 22 in engagement with the push button plate 16. Through a slot and pin arrangement connecting the shaft 17 and the sleeve 22, the sleeve may move longitudinally along the shaft 17. The slot is indicated by the numeral 26 and the pin which is secured to the shaft 17 is indicated by the numeral 27. As shown in Fig. 5, the sleeve 22 is at its upward limit of travel. At the lower end of the sleeve 22 a flange 28 is secured thereto carrying a pin 29 which cooperates with a plurality of recesses 30, 31 and 32, for instance, as shown in Fig. 8.

In the position shown in Fig. 5, the dial is free to rotate counter-clockwise in its signal transmitting movement through the engagement of the pin 29 with one of the recesses 30 in the member 20, the castellated armature 9 is caused to move. A spiral spring 33 secured at one end to the housing 15 and at its other end to the finger hole plate 8 by a pin 34 will provide the motive power for returning the dial to its normal position. The member 20 is held in cooperative relationship with the housing 15 by a ball bearing race consisting of the members 35 and 36 carrying the usual ball bearings. When the dial is operated by a subscriber a push button, by way of example, number 13, is depressed as shown in Fig. 9 until the operator gets his finger into the finger wheel 8 sufficiently to move it in a clockwise direction. At this time, the push button plate 16 is tilted but through the pin 25 still engaging the flange of the sleeve 22 and through the pin and slot arrangement comprising the slot 26 and the pin 27, the sleeve of the shaft may be rotated. However, the downward movement of the sleeve has removed the pin 29 from one of the holes provided in the member 20 so that the member 20 and, therefore, the castellated armature 9 will not move during the dial setting operation. Therefore, the finger wheel 8 may be freely rotated to the position shown, for instance, in Fig. 10 for the purpose of transmitting the digit 5.

It will be noted that a number of spring pressed plungers 37, 38 and 39 are secured in the housing 15. These plungers cooperate with a rack 40 shown in Fig. 7 and indicated by teeth 41 and 42 in Figs. 5 and 9. As the subscriber depresses the push button 13 and presently moves the dial in its clockwise direction to the position indicated in Fig. 10, the pins such as 37 will engage the rack 40 but will not hinder the clockwise movement of the finger wheel. However, when the movement is completed, these pins will prevent the return (counter-clockwise) movement of the finger wheel until the sleeve 22 has moved upward sufficiently for the pin 29 to engage one of the cooperating recesses in the member 20. This means practically that the finger must be taken from the finger wheel before the return or signal trans-

mitting motion of the dial may take place. The operator, therefore, will be unable to force the dial backward. Three pins **37**, **38** and **49** are provided so that the rack **40** may be surely engaged through the depression of any one of the push buttons of the dial.

What is claimed is:

1. In signaling apparatus, a signal transmitter movable in one direction for setting said apparatus to transmit any one of a plurality of different signals and movable in the opposite direction for transmitting the selected signal comprising a finger wheel having means associated therewith operable by pressure exerted thereon by an operator's finger for disconnecting said finger wheel from the other parts of said transmitter and for locking said finger wheel against motion in the said signal transmitting direction.

2. In signaling apparatus, a signal transmitter having a finger wheel movable in one direction for setting said apparatus to transmit any one of a plurality of different signals, and movable in the opposite direction for transmitting the selected signal, means associated with said finger wheel for transmitting said signals, and means comprising a plurality of push buttons each protruding through a finger hole of said finger wheel for disconnecting said associated means from said finger wheel.

3. In signaling apparatus, a signal transmitter having a finger wheel movable in one direction for setting said apparatus to transmit any one of a plurality of different signals and movable in the opposite direction for transmitting the selected signal, means associated with said finger wheel for transmitting said signals, means comprising a plurality of push buttons each protruding through a finger hole of said finger wheel for mechanically disconnecting said associated means from said finger wheel and a ratchet and pawl arrangement formed in part on said last means for locking said finger wheel against movement in said signal transmitting direction.

4. In signaling apparatus, a signal transmitter having a finger wheel movable in one direction for setting said apparatus to transmit any one of a plurality of different signals and movable in the opposite direction for transmitting the selected signal, a magnetic circuit including magnetically operated signal circuit contacts and a movable magnetic armature normally mechanically connected to said finger wheel, means comprising a plurality of push buttons each protruding through a finger hole of said finger wheel for opening said normal mechanical connection during said setting movement of said finger wheel and a ratchet and pawl device rendered effective by pressure on any one of said push buttons for locking said apparatus against movement in said signal transmitting direction.

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