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MAGNETIC CRADLE SWITCH

2,673,252

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2 Sheets-Sheet 1

FIG. 1

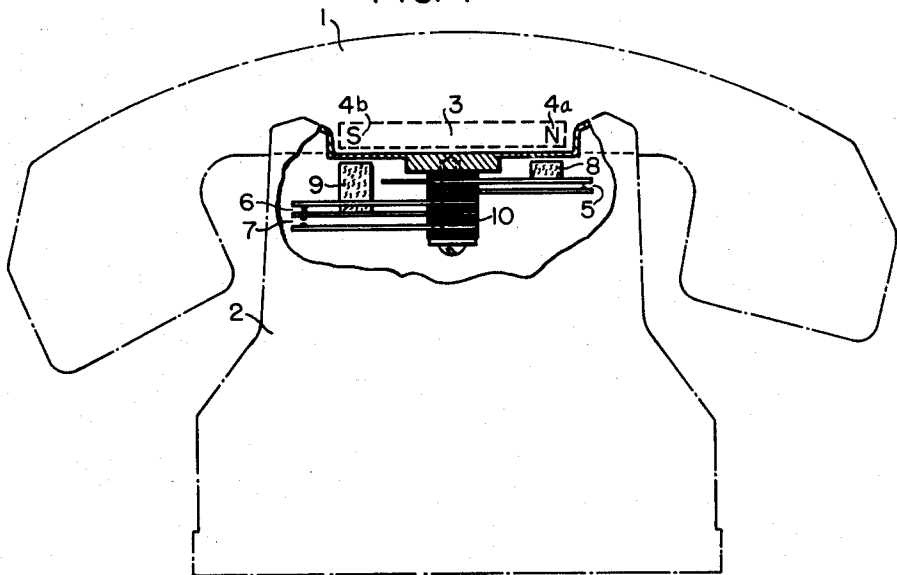
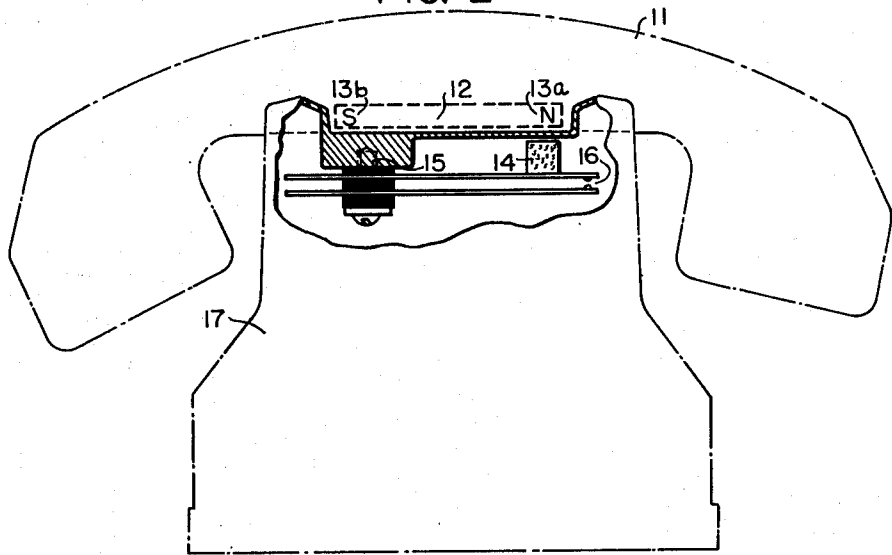


FIG. 2



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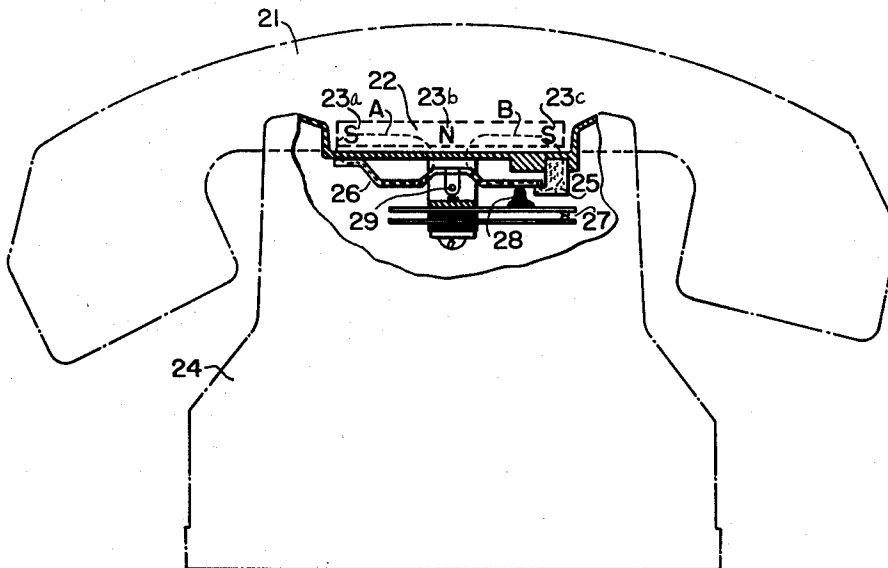
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2 Sheets-Sheet 2

FIG. 3



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MAGNETIC CRADLE SWITCH

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6 Claims. (Cl. 179—159)

1

This invention relates in general to communication apparatus and, in particular, to the operation of the switching contacts preparatory to the use of such apparatus.

When applied to telephone sets the invention may be defined as relating to magnetic rather than mechanical means for operation of the cradle switch, the object being to improve the construction, arrangement and functioning of subscribers' telephones, by insuring the positive operation of the switching contacts and eliminating moving mechanical parts. One of the prime features of this magnetic switching device is its capability of operating a plurality of spring contacts rather than one or two very light springs. Some of the advantages of this invention are: cradle switch cannot be disconnected accidentally or deliberately while phone is in use; cradle switch shuts off before the handset comes to rest entirely on the cradle, thus eliminating the unpleasant, loud noise heard by the party who may still have the receiver to his ear; cradle switch can be completely enclosed and consequently free from possible intrusion of dust or other foreign material that may interfere with its operation; and sparks created by switch will be unable to ignite any gases present in the surrounding atmosphere.

Basically the invention makes use of the well known attraction and repulsion properties that permanent magnets exert on elements of magnetic material—soft iron in the instant case. These soft iron pole pieces physically move when influenced by the close proximity of the fixed permanent magnet and therefore open or close the switching contacts.

The above features, as well as others, will be more particularly pointed out in the ensuing specification and appended claims, reference being had to the accompanying drawings in which Fig. 1 shows a sectional view of one embodiment wherein actuation of the pole pieces directly operates the switching contacts.

Figure 2 shows another embodiment, similar to that as shown in Fig. 1 with the difference that only one of the pole pieces is movable.

Figure 3 shows still another embodiment wherein two separate magnetic circuits impart a double action to operate the switching contacts.

The numerals on the three drawings designate the parts which are described below.

The operation of the arrangement as illustrated in Fig. 1 is as follows: When the handset 1 is on the cradle 2 the soft iron pole pieces 8

2

and 9 are attracted by ends 4a and 4b, respectively, of permanent magnet 3 and consequently physically rise. Inasmuch as one contact spring is attached to each pole piece 8 and 9, the contacts 5 on the right break while the contacts 6 and 7 on the left make and break, respectively, when the pole pieces are attracted and raised. Thus, the normal position, namely when the handset 1 is on the cradle 2, will be with contacts 5 and 7 open and 6 closed. Upon removal of the handset 1 from the cradle 2 the mutual magnetic attraction or influence no longer exists. Without an attraction force to hold pole pieces 8 and 9 against the normal downward tensional force of the springs, the contact springs will consequently deflect downward from the mounting point 10 and thus make contacts 5 and 7 while opening contacts 6. Therefore, the position of the contacts when the handset is removed from the cradle will be 5 and 7 closed and 6 open.

The operation of the arrangement as shown in Fig. 2 is essentially the same as the operation of that as shown in Fig. 1, with the exception that only one pole piece, namely 14, is movable. When the handset 11 is placed on the cradle 17 the soft iron pole piece 14 is attracted by permanent magnet 12 and physically raised—breaking contacts 16. Therefore, the normal position of 16 will be open. Pole piece 15 in conjunction with the reed contact spring (also of magnetic material), pole piece 14, and permanent magnet 12 form the complete magnetic circuit. Fixed pole piece 15 will provide a low reluctance path when the handset 11 is on the cradle and therefore lengthen the life of the magnetism in the permanent magnet 12. When the handset 11 is removed from the cradle 17 the absence of the magnetic influence of permanent magnet 12 will cause soft iron pole piece 14 and associated springs to lower and make contacts 16. Therefore, contacts 16 will be closed when handset 11 is removed.

The operation of the arrangement as illustrated in Fig. 3 is as follows: When the handset 21 is on the cradle 24, the heavy soft iron rocker arm 26 will be rotated clockwise stopping on the shoulder of fixed soft iron pole piece 25. This operation is caused by two forces. Due to the magnetic properties of soft iron (high permeability and low reluctance) the proximity of permanent magnet 22 will induce temporary poles on each end of 25—north at the top and south at the bottom. Thus, the attraction property of the south end 23c of permanent magnet 22 will be transferred to the bottom or shoulder of fixed

pole piece 25. The right hand end of rocker arm 26 being of magnetic material will consequently be attracted to the shoulder of 25 in the same manner as it would have been attracted to 23c. This is one action to effect a clockwise rotation of the soft iron rocker arm 26. The other action will come directly from the attraction of 23a for the left end of rocker arm 26. This left end will be moved upward due to one magnetic circuit A while simultaneously the right end of rocker arm 26 will move downward due to the second magnetic circuit B. This clockwise movement of rocker arm 26 will be transferred by buffer 28, attached to the upper reed spring, to that same reed spring. Thus, the normal position (handset 21 placed on cradle 24) will be with contacts 27 closed. It will be noted that in order to accomplish the necessary two separate magnetic circuits the permanent magnet 22 must be magnetized as shown in Fig. 3—namely, like poles 23a and 23c with an opposite common pole at 23b. It should also be noted that a plurality of permanent magnets could be used with their poles arranged accordingly. Upon removal of the handset the magnetic influence no longer affects either the right or left end of rocker arm 26 and the normal upward spring tension of the top reed spring will raise the right end of rocker arm 26. Therefore, when the handset 21 is removed contacts 27 will be open.

These three illustrations show only three mechanical spring combinations but quite obviously any arrangement desired may be employed and the appended claims will still apply.

It will be noted that in all three illustrations the soft iron pole pieces need not protrude out from the actual supporting surface of the cradle and may be covered with some non-magnetic material. Consequently, the entire switching mechanism can be enclosed and made air tight.

It should be understood that where a permanent magnet is shown herein an electromagnet may be as easily substituted. It is only necessary to have a source of magnetomotive force and hence all references to a permanent magnet should be understood to broadly cover the use of a magnetic structure acting as such a source of magnetomotive force.

What is claimed is:

1. In communication apparatus comprising a hand telephone and a supporting structure therefor, a permanent magnet imbedded in said hand telephone the extreme ends of which permanent magnet are like poles with opposite like poles therebetween, a fixed magnetic element within said supporting structure, a rocker arm made of magnetic material mounted within said supporting structure and pivoted centrally, a set of contact springs within said supporting structure, a pair of magnetic circuits formed by said elements when said hand telephone is resting in its normal position on said support, one of said circuits including one end of said permanent magnet and one end of said rocker arm, the other circuit including the other end of said permanent magnet, said fixed magnetic element, and the other end of said rocker arm, said permanent magnet causing a flux to pass through one of said circuits to thereby cause one end of said rocker arm to be attracted and physically moved toward said fixed magnetic element in one rotational direction and said permanent magnet also causing a flux to pass through the other of said circuits to thereby cause the other end of said rocker arm to be attracted to said permanent magnet in the

same rotational direction, both actions combining to operate said contact springs.

2. In communication apparatus as claimed in claim 1, a buffer linking said sets of contact springs and said rocker arm whereby movement of said rocker arm is transferred to said contact springs.

3. In communication apparatus comprising a hand telephone and a supporting structure therefor, permanent magnet means imbedded in said hand telephone, a fixed magnetic element within said supporting structure, a rocker arm made of magnetic material mounted within said supporting structure and pivoted centrally, a set of contact springs within said supporting structure, a magnetic circuit including said fixed magnetic element formed when said hand telephone is resting in its normal position on said support, the field of said permanent magnet means being in a direction such as to induce a temporary magnetic flux in said fixed magnetic element to thereby cause one end of said rocker arm to be attracted and physically moved toward said fixed magnetic element in one rotational direction, another magnetic circuit including the other end of said rocker arm formed also when said hand telephone is resting in its normal position on said support, the field of said permanent magnet means also being in a direction such as to simultaneously cause the other end of said rocker arm to be attracted to said permanent magnet means in the same rotational direction, both actions combining to operate said contact springs.

4. In a communication apparatus, the combination comprising a hand telephone, a supporting structure therefor, a permanent magnet imbedded in said hand telephone, a fixed magnetic element within said supporting structure, a set of contact springs mounted within said support, a movable magnetic element mounted within said supporting structure and pivoted approximately in the center and controlling the movement of said contact springs, a magnetic circuit including a plurality of air gaps, said fixed magnetic element, and said movable magnetic element, formed when said hand telephone is resting in its normal position on said support, the field of said permanent magnet concentrated in said circuit through said pivoted magnetic element and said fixed magnetic element within said support when said telephone is resting on said support, said field being in a direction to cause said movable element to rotate and move said contacts to their normal unoperated position.

5. In communication apparatus, a hand telephone, a supporting structure therefor, a permanent magnet imbedded in said hand telephone, a rocker arm made of magnetic material within said supporting structure and pivoted centrally, a set of contact springs mounted within said supporting structure, a pair of magnetic circuits formed when said hand telephone is placed on said supporting structure, each of said circuits including an end of said rocker arm, the field of said permanent magnet being of such a direction as to cause a flux to be induced in one of said circuits to cause one end of said rocker arm to be moved downward and to cause a flux to be induced in the other of said circuits to simultaneously cause the other end of said rocker arm to be moved upward, both actions combining to operate said contact springs.

6. In communication apparatus comprising a hand telephone and a supporting structure therefor, permanent magnet means imbedded in said

5

hand telephone, a rocker arm made of magnetic material mounted within said supporting structure and pivoted centrally, a set of contact springs within said supporting structure, a pair of separate and distinct magnetic paths formed when said hand telephone is placed on said supporting structure, each path including one half of said rocker arm, said permanent magnet means having a polarity such as to cause a flux to be induced in both of said paths when said hand telephone is placed on said supporting structure, the flux in one of said paths causing the said half of said rocker arm in that path to be moved in one rotational direction, the flux in the other of said paths causing the said other

6

half of said rocker arm in that path to be moved in the same rotational direction about its pivot point, said actions combining to rotate said rocker arm to thereby operate said contact springs.

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