

The present invention relates to a double interaction switch comprising a series of contact assemblies able to be controlled by two levers, one monostable, the other bistable, which can each be moved from a first position to a second position respectively by a first and a second actuating member, the bistable lever being arranged so that it is able to be locked in its second position by locking means, the monostable lever being able to be moved into its second position when the bistable lever is also located in its second position, the actuation by the second member of the bistable lever, when it is located in its second position, causing its return to its first position and the return, under the action of the first member, of the monostable lever from its second position to its first position, when the bistable lever is located in its second position, causing the return of the bistable lever to its first position.

The invention relates in particular to electrical switching devices intended to equip telephone receiver sets and in particular those having a hands free operation, for which it is not necessary for the user to lift the handset in order to converse with the other party.

In a telephone receiver set, communication is generally established by way of a two-wire telephone line.

When the telephone receiver set is in the waiting, or inoperative position, the two-wire line is connected to the call warning device, generally a bell.

At the time of a telephone call actuating the warning device, the user lifts the handset and a switch disconnects the telephone line from the warning device in order to connect it to the communication members conventionally composed of a microphone and an ear-piece. Certain telephone

receiver sets comprise a device enabling the user to converse with the other party without having to lift the handset. Receivers of this type, commonly called "hands-free" receivers, comprise a bistable switch which, upon receiving the telephone call, disconnects, generally under the action of a push button operated by the user, the telephone line from the warning device in order to connect it to amplified communication members in particular comprising a microphone and a loud-speaker and enabling the user to converse whilst keeping his hands free or even allowing a conversation with more than one speaker. At the end of the conversation, the telephone line is disconnected from the communication members in order to be reconnected to the warning device by a new actuation of the bistable switch.

Telephone receiver sets are also currently on the market, in which the "hands free" function is combined with the conventional function of lifting/replacing the handset. Replacing the handset may operate the "hands free" switch by actuating its control push button by way of complicated mechanical returns.

A switch of the type mentioned above is already known from the document DE-A-2 830 661. However, the switch of this document has a considerable bulk, which is so because its locking and unlocking means are at least partly disposed outside the switch casing.

The document DE-A-3 529 652 also discloses a switch, which is quite similar to that of the type mentioned above, but is of complicated mechanical construction, is not very reliable and is expensive.

The present invention thus intends to improve the switches of the prior art and to propose a compact double interaction switch, of simple construction, which is reliable and economical.

To this end, the present invention relates to a switch of the type mentioned above, characterised by the fact that the said locking means comprise a rod provided with means arranged to cooperate with associated means of the bistable lever in order to lock it in its second position, the rod being mounted to pivot under the action, on the one hand, of means for the unlocking of the bistable lever and, on the other hand, of means for the unlocking of the monostable lever and thus releasing the means locking the rod from the associated means for locking the bistable lever.

Advantageously the levers are able to move along parallel axes and the locking rod is mounted to pivot in a plane parallel to the axes of movement of the levers.

Preferably, the rod supports a locking pin and the bistable lever has an associated V-shaped projection, the monostable lever has a projection disposed to cause a curved end of the locking rod to pivot and the bistable lever comprises a labyrinth with the walls of which the pin of the rod can cooperate so as to cause the rod to pivot, the projection being disposed inside the labyrinth.

The invention will be better understood by means of the ensuing Description of two preferred embodiments of the switch of the invention, more specifically intended for equipping a telephone receiver set provided with a warning bell, with a handset and its conventional lifting/replacing system, with an amplifier with its microphone and its loud-speaker and with its "hands free" control, with reference to the accompanying drawings in which:

Figure 1 is a sectional view of the first embodiment of the switch of the invention in combination with the corresponding electric wiring diagram;

Figure 2 is a perspective view of the switch of Figure 1;

Figure 3 shows two orthogonal views of a first embodiment of the contact strip;

Figure 4 shows two orthogonal views of a second embodiment of the contact strip;

Figure 5 is a partial view of the mechanism for the mutual locking/unlocking of the control of the handset and of the "hands free" control and

Figures 6a and 6b show two orthogonal views of a variation of the switch, equipped with levers for connection to the actuating devices of a telephone receiver set.

As shown in Figure 2, the switch of the invention comprises a parallelepipedal casing 1, in this case made of rigid plastics material, comprising a base 2, two large sides 3 and two small sides 4 and a lid 5. Each small edge of the sides of the casing is extended by a foot 6 comprising at the end a substantially triangular lug intended for the mounting, in this case by clipping, of the switch to its support, in general, the printed circuit of the telephone receiver. The base 2 is provided with the number of holes necessary to facilitate the passage of the extensions, mentioned hereafter, of the contact strips and to allow their connection advantageously by soldering, to the printed circuit of the receiver. Each of the small sides 4 is provided with an opening 8, 9 to allow the passage of the control means 30, 40 of the contact strips: on the one side, the monostable means 30 transmitting the control of the handset, on the other side, the bistable means 40 connected for example to a push button ensuring the "hands free" function. The lid 5 is fixed by the clipping in this case of four lugs 12 on four pivots 13 provided on the large sides 3 of the casing, close to the edges for connection to the small

sides 4. With reference to Figure 1, the inside of the casing 1 comprises a single block of electrical contact means 21, 22, 23, 24, the actuating means 30, 40 for said same contacts, the device for the mutual locking and unlocking of said actuating means and means 32, 42 for restoring the position of said actuating means.

The electrical contact means in this case comprise in succession and along planes parallel to the small sides 4 of the casing 1, a single contact 21, two reversing contacts 22, 23, a single contact 24.

Each single contact 21, 24 comprises a first flexible metallic strip 211, in the form of a fork having two parallel arms 212, 213. Fixed to each, in a substantially central position, in this case by soldering, is a contact-piece 214, in this case cut out from a metal profile, the base 215 of the fork being held by gripping between protuberances 29 projecting from the bottom of the casing. An elongation 216 of the base 215 extends perpendicularly to the arms 212, 213 and is engaged in a hole provided in the base 2 of the casing, between the protuberances 29, in order to facilitate its soldering to the printed circuit supporting the switch.

Each single contact 21, 24 also comprises a second flexible metal strip 241 similar to the first strip 211 but having shorter parallel arms and comprising contact-pieces disposed substantially at the end of said arms opposite the contacts of the strips 211 in order to ensure electrical contact when they are brought into mutual contact.

Each of the two reversing contacts 22, 23 comprises a flexible strip 221, similar to the strips 211 of the single contacts 21, 24, with the only difference the fact that each arm in addition comprises a contact-piece 224

symmetrical with the piece 214 with respect to the plane of the arm. Each reversing contact also comprises a flexible strip 241, identical to the flexible strip 241 of the single contacts, and a flexible strip 251, similar to the flexible strip 241, but whereof each arm comprises an electrical contact-piece 234 situated in a symmetrical position with respect to the plane of the strip.

The first control means 30 comprise a lever substantially in the shape of a parallelepiped which is very elongated and of substantially square cross-section, which is mounted to move in translation along an axis parallel to the large sides 3 of the casing 1 in a plane close to the lid 5 of said casing 1, guided by two studs 26, 27 projecting from the base 2 of said casing 1 and passing through one of the small sides 4 of said casing 1.

The lever 30 comprises protuberances 31 in the shape of teeth perpendicular to the side of the lever 30 facing the bottom of the casing and whereof the ends bear against said base in order to retain the lever 30 along its plane of mobility. These protuberances cooperate by contact with the ends of the contact strips of great length 211, 221 of the contacts 22, 23, 24 in order to establish, when initiating the translation of the lever 30, the opening or closing of said contacts as will be described hereafter.

Spring return means, in this case a spring 32 tends to restore the lever 30 to its stable position, i.e., according to Figure 1, to the position projecting to the maximum extent towards the right, by a projection 33 of said lever forming a stop, bearing against the inner wall of the side of the casing through which the lever 30 passes.

Second control means 40 comprise a slide, or lever, which is very elongated and also mounted to move in translation along an axis parallel to the large sides 3 of the

casing 1, in a plane close to the lid 5, guided by two studs 27, 28 and passing through the other of the small sides 4 of the casing 1. The width of the slide 40 is substantially equal to the internal thickness of the casing 1 in order to be guided by the **inner sides** of the base 2 and of the lid 5 of the casing 1.

The slide 40 comprises four stops 41 in the form of a crenellation rising over the entire width of the slide 40 in planes parallel to each other and at right angles to the axis of translation of the slide 40. Three of the stops 41 cooperate with the ends of the large contact strips 21, 22, 23, in order to establish, when the translation of the lever 40 is implemented, the opening or closing of these contacts as will be described hereafter. A fourth stop 41 cooperates by contact with the stud 27 in order to limit the travel into the projecting position of the slide 40. Spring return means, in this case a spring 42, tends to restore the slide 40 to the projecting position.

An impression 43, in the form of a labyrinth, is provided in the plane of the base of the slide 40 substantially towards its end inside the casing 1.

The labyrinth 43 comprises, substantially in the central position, a locking projection or ramp 44, of V-shape with asymmetrical arms, the contours of this projection 44 and the walls of the labyrinth 43 cooperating by contact with a pin 51 of a pivoting member 50 for the mutual locking/unlocking of the control members 30, 40.

The locking/unlocking member 50 is in the form of a lever whereof one of the ends 52 is curved in the form of a lip having a cam profile in order to cooperate by contact with the projection 33 of the lever 30.

The pin 51, projecting perpendicularly to the pivoting plane of the member 50, is kept engaged in the labyrinth 43 by the action of a resilient semi-rigid rod 53 in this case fixed by force-fitting in an internal protuberance 54 of the casing 1.

The rod 53 allows the lever 50 to move in a plane parallel to the base 2 of the casing 1 by an angle having as its apex the point of attachment of said rod, but does not allow any translation of the lever 50 along its longitudinal axis. With reference to Figure 1, the lever 30, i.e. the monostable control means associated with the telephone handset, is shown in the retracted position, i.e. the handset replaced, the lever 40, i.e. the bistable control means associated with the "hands free" function, is shown in the projecting position which corresponds to waiting for a telephone call. The contact 21 makes it possible to connect the telephone line to the electronic circuit A of the microphone and of the loud-speaker of the hands free position, the contact 24 makes it possible to connect the telephone line to the circuit C of the telephone handset, the two reversing contacts 22, 23 making it possible to switch the telephone line from the circuit of the warning bell B to at least one of the conversation circuits A or C used.

From the arrangement of Figure 1, telephone waiting for a call, the following sequences may occur: the bell B rings, if the user lifts the handset, the lever 30 passes into the projecting position, the contact 24 closes, the contacts 22, 23 are reversed, conversation is established.

If the user had used the hands free lever 40 by actuating it towards the retracted position, the lever 40 would have closed the contact 21 and reversed the contacts 22, 23 and the ramp 44 would have arrived behind the pin 51

after having caused the rod 53 to pivot, the pin 51 arriving between the two arms of the V of the projection 44. The user may use the handset C and the hands free device A at the same time.

When the "hands free" lever 40 is in the retracted position, locked by its ramp 44 on the pin 51, a new pressure on the latter causes the pin 51 to travel through the labyrinth 43 and in particular its ramp 43' which causes the rod 53 to pivot and unlocks the lever 40 which returns to the projecting position.

Similarly, when the "hands free" lever 40 is in the retracted position, and the lever 30 is in the projecting position, with the handset lifted, by replacing the handset, the projection 33 cooperates by contact with the profile 52 which pivots slightly in a plane parallel to that of the base 2 of the casing 1, the pin 51 is then released from the projection 44 and releases the lever 40 in the unlocked position, i.e. the projecting position.

The levers of the switch described above may act together or separately on all or part of the same contacts. This makes it possible to achieve common or separate electrical functions and to reduce the number of contacts necessary for achieving all the desired functions.

The number of contacts may be modified in order to adapt the device to the specific requirements of each telephone receiver set. The switch of the invention makes it possible to provide a compact electromechanical assembly combining the functions of two separate switch units and having determining facilities of implementation for the designer of telephone receiver sets. Thus, in particular, setting the control means in translation, in a plane parallel to that of the printed circuit on which the switch is

mounted, does not necessitate the positioning of the switch precisely below the hands free push button when the space is inadequate. Thus, the return springs of the control means are again incorporated in the switch as well as the device for the mutual locking/unlocking of these means.

Another advantage of the invention resides in the quality of the electrical contacts. They may in fact be coated with precious materials, such as silver or gold, and be formed on two contact-pieces in parallel. If the simultaneousness of their movements is not absolutely obtained, the first of the two contact-pieces which closes and which will thus be the last to open, absorbs the entire current load with the risks involved, in particular wear, sparking, deposits of carbon and the second of the two contact-pieces which closes, which will thus be the first to open, ensures a high quality of contact. Another advantage of the switch of the invention is also to be able to adapt easily, for example by changing the lid 5, to the mechanical requirements or requirements of size of the various telephone receiver sets on the market. Figures 6a and 6b illustrate a variation of the switch of the invention, with a lid which comprises two fork-joints 61, 62, on each of which is pivoted a lever cooperating, 163, with the monostable control means 30, in order to move it in translation, and with the lifting/replacing device, the other 64, with the bistable control means 40, in order to move it in translation, and with the "hands free" device. In this case, the lid 5 comprises six fixing lugs instead of four, as described previously, in order to increase the rigidity thereof.

In this way, and still in this case, by simple changing of the upper lid, one can obtain support and pivot points for the levers which transmit the movements from the outer actuating points of the telephone set (handset and hands-free button).



Claims

1. Double interaction switch comprising a series of contact assemblies (21-24) controllable by two levers (30, 40), one (30) being monostable, the other (40) being bistable, each being movable from a first position to a second position respectively by a first and second actuating member, the bistable lever (40) being arranged to be able to be locked in its second position by locking means (43, 44, 50-53), the monostable lever (30) being able to be moved to its second position when the bistable lever (40) is also in its second position, actuation by the second member of the bistable lever (40), when it is in its second position, causing its return to its first position, and the return, under the action of the first member, of the monostable lever (30) from its second position to its first position, when the bistable lever (40) is in its second position, causing the return of the bistable lever (40) to its first position, switch characterised by the fact that said locking means comprise a rod (53, 50) provided with means (51) arranged for cooperating with associated means (44) of the bistable lever (40) for locking it in its second position, the rod (53, 50) being mounted for pivoting under the action, on the one hand, of means (43) for unlocking the bistable lever (40) and, on the other hand, of means (33) for unlocking the monostable lever (30) and thus releasing the means (51) locking the rod (53, 50) from the associated means (44) for locking the bistable lever (40).

2. Switch according to Claim 1, in which the levers (30, 40) are movable along parallel axes and the locking rod (53, 50) is mounted to pivot in a plane parallel to the axes of movement of the levers (30, 40).

3. Switch according to one of Claims 1 and 2, in which the rod (50, 53) supports a locking pin (51) and, the



bistable lever (40) has an associated V-shaped projection (44).

4. Switch according to one of Claims 1 to 3, in which the monostable lever (30) has a projection (33) disposed to cause a curved end (52) of the locking rod (53, 50) to pivot.

5. Switch according to one of Claims 3 and 4, in which the bistable lever (40) comprises a labyrinth (43) having walls with which the pin (51) of the rod (50, 53) may cooperate so as to cause the rod (50, 53) to pivot.

6. Switch according to Claim 5, in which the projection (44) is disposed inside the labyrinth (43).