May 28, 1946. T. C. RIEBE 2,400,952

SWITCHING KEY

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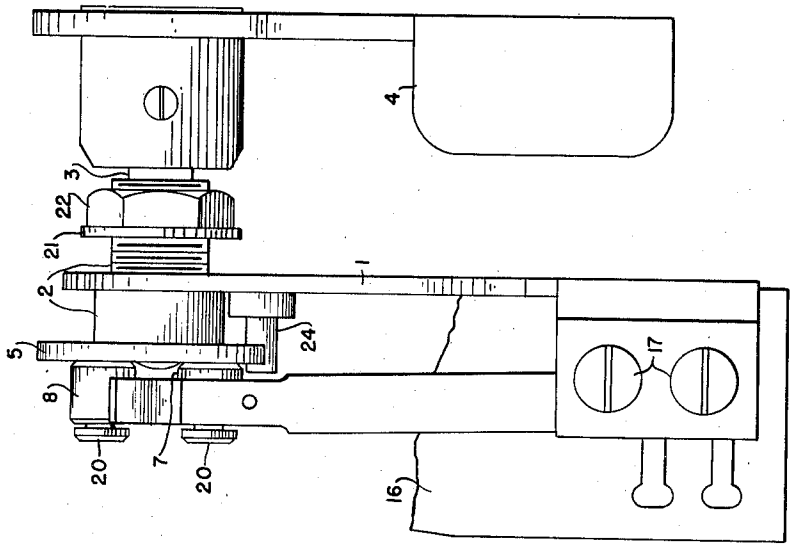


FIG. 2

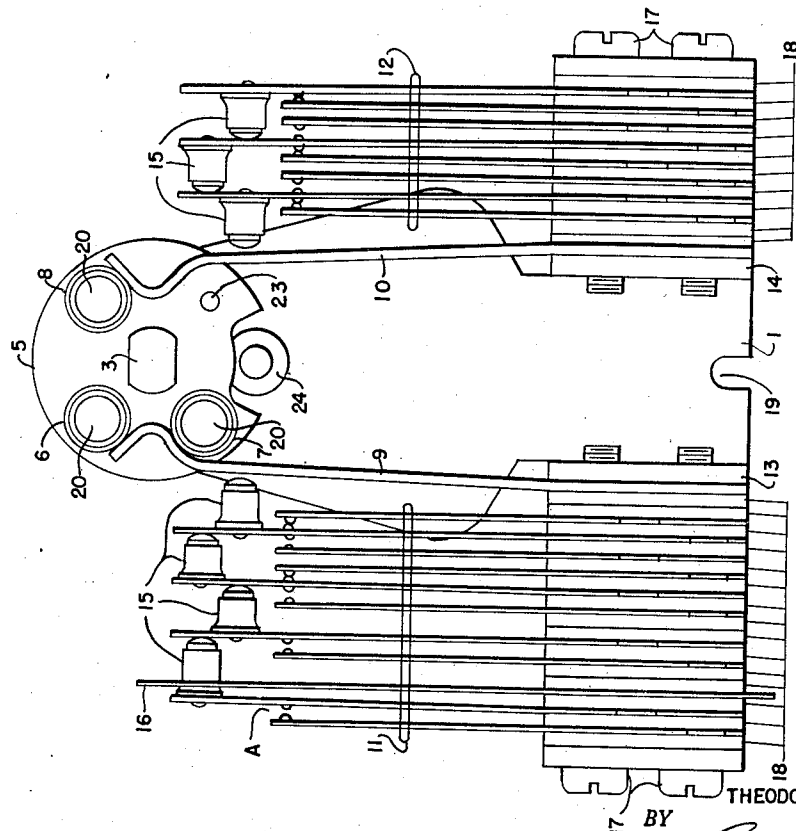


FIG. 1

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SWITCHING KEY

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11 Claims. (Cl. 179—176)

The present invention relates to circuit controlling devices in general, and more particularly to manually operable lever type switch keys such as are used in telephone, radio telephone, and other communication systems.

An object of the invention is to provide an improved heavy-duty lever type switch key capable of withstanding severe shocks and vibrations, and wherein new and novel means are employed for actuating the switch contact springs.

Another object of the invention is to provide a two-way lever type switch key in which the manipulation of the operating lever to one of the two-way positions causes the actuation of only a certain number of the switch contact spring sets mounted on the key, and the manipulation of the operating lever to the other of the two-way positions causes the operation of all of the contact spring sets. This key arrangement is of particular value in a communication system incorporating a radio loud speaker and a telephone handset at each station. In such a communication system, with the key in the normal position, the contact spring sets connect the loudspeaker for receiving purposes and disconnect the transmitting circuits: Holding the operating lever of the key in one of the "operated" positions causes the contact spring sets to convert the loudspeaker into a microphone for transmitting purposes; and holding the operating lever in the other "operated" position causes the contact spring sets to disconnect the loudspeaker entirely and to connect the telephone hand set for transmitting purposes.

To those skilled in the art it is evident that in the communication system just described, it is necessary that certain contact spring sets of the key be actuated only when the operating lever of the key is held in one operated position, and that all of the contact spring sets be actuated with the operating lever is held in the other operated position. It is also evident that there are other requirements for a switch key wherein only certain contact spring sets are operated at one time and all of the spring sets are operated at other times.

A feature of the invention is that a shaft rotating in a bearing mounted in the frame of the key and turned in either direction by the manipulation of an operating lever provides the means for actuating the contact spring operating mechanism. This construction provides ruggedness, maximum durability, ease and smoothness of operation, these qualifications being inherent requirements of a heavy-duty switch key subjected to severe shock and vibratory operating conditions.

Another feature of the invention is that three separate cam rollers acting on a plurality of cam followers in a new and novel manner cause the operation of only certain contact spring sets when the operating lever is turned in one direction from the normal position, and cause the operation of all of the spring sets when the operating lever is turned in the opposite direction from the normal position. This operation is accomplished by having only one cam roller effective for operating certain cam followers when the operating lever is turned in one direction, and having the other two cam rollers effective for operating all of the cam followers when the operating lever is turned in the opposite direction. It should be understood at this time that this principle of cam roller and cam follower operation does not specifically necessitate the use of exactly three cam rollers, as other numbers of cam rollers may be employed to accomplish similar switching results.

A further feature of the invention is that a thin metallic plate is included in a contact spring pile-up between two spring sets and wired to a ground connection, to void electrostatic coupling between the two spring sets when one of the spring sets is included in a high level amplifier output circuit and the other spring set is in a low level circuit connected to the amplifier input. It is well known that if electrostatic coupling occurs with the described circuit conditions, such coupling would constitute feedback which would cause amplifier instability.

There are other objects and features of the invention having to do for the most part with the details in carrying out the foregoing. The various objects and features of the invention will be understood best upon a further perusal of the description in connection with the accompanying drawing which shows a preferred embodiment of the invention.

Referring now to the drawing,

Fig. 1 is a side view, in elevation, showing the contact spring assemblies, the cam followers, and the spacing relationship of the three cam rollers.

Fig. 2 is a side view, in elevation, showing in particular the supporting frame, the shaft, the plate on which the cam rollers are mounted, the bearing in the frame for the shaft, the operating lever handle, and the locknut means for securing the complete key assembly to a mounting surface.

Referring now to Figs. 1 and 2, a detailed description will now be given of the mechanical arrangement of the assembly, after which will fol-

low a description of the operation of the key in connection with one application of the invention.

The key assembly consists principally of a frame 1 supporting a bearing 2 (Fig. 2) in which a shaft 3 is rotated in either direction by means of lever handle 4, a plate 5 fixedly attached to the inner end of shaft 3 and turning as an integral unit with shaft 3 for moving cam rollers 6, 7 and 8 (Fig. 1) in an arc from the center point of shaft 3 in either direction, cam followers 9 and 10 with their tip, or loose, ends in the path of the cam rollers, two contact spring assemblies 11 and 12 mounted on brackets 13 and 14 respectively of frame 1, the fixed ends of cam followers 9 and 10 being included in the pile-ups of spring assemblies 11 and 12 respectively, and the loose ends of cam followers 9 and 10, when actuated by the cam rollers in response to the movement of plate 5, causing the operation of the contact springs through the medium of bushings 15. The positioning of the cam rollers 6, 7 and 8 is such that when lever handle 4 is turned in one direction, cam roller 6 causes cam follower 9 to operate spring assembly 11, the cam rollers 7 and 8 being ineffective in this operation; and when lever handle 4 is turned in the opposite direction, cam roller 7 causes cam follower 9 to operate spring assembly 11, and cam roller 8 causes cam follower 10 to operate spring assembly 12, cam roller 6 in this instance being ineffective. The movement of plate 5 in either direction from the normal position, when actuated by the manipulation of operating lever 4, is limited by the stop 24. The complete key assembly may be clamped to a suitable mounting by means of washer 21 and nut 22, and a pin on the mounting engages the slot 19 of frame 1 (Fig. 1) for positioning the assembly preparatory to tightening clamp nut 22.

According to the invention, therefore, a very simple construction of switching key has been evolved wherein only the contact springs on one side of the key are actuated when the lever handle is turned in one direction from the center, or normal, position, and the contact springs on both sides of the key actuated when the lever handle is turned in the opposite direction from the normal position. The parts constituting the key assembly are so designed and interrelated that the key may be operated smoothly and easily without fault regardless of severe shocks and vibrations.

In Fig. 1, contact spring assemblies 11 and 12 are shown mounted directly on brackets 13 and 14 respectively of frame 1 and held in place by means of machine screws 17 carried through the assembly of springs and insulators 18, but it should be understood that this method of mounting is typical only and that any well known method of assembling and mounting the contact springs may be employed. In Fig. 2, the cam rollers 6, 7 and 8 are limited to a length which permits the mounting of only one cam follower with its associated contact spring assembly on each half of frame 1, but it is obvious that the length of the cam rollers 6, 7 and 8 may be increased to permit the mounting of more than one cam follower and contact spring pile-up on each of the brackets 13 and 14 of frame 1.

The cam rollers 6, 7 and 8 are attached to plate 5 by means of flat headed shaft pins 20 (Fig. 2), which shaft pins may be fastened permanently to plate 5 by riveting or may be removably fastened by threading or other detachable means. Plate 5 may be fitted with additional holes such as 23 (Fig. 1) for providing additional mounting positions whereby the number of cam rollers may be varied or the spacings between the cam rollers changed for producing other operations of the contact spring assemblies than the operations described in this specification. The cam rollers 6, 7 and 8 operate cam followers 9 and 10 with a rolling motion and, therefore, friction between these parts is practically eliminated, thus contributing to the easy and smooth operation of lever handle 4.

The bushings 15, through which cam followers 9 and 10 actuate the contact springs, are riveted to the master contact springs and staggered in each assembly in the manner shown in Fig. 1 to avoid having the rivet heads cause possible inaccurate operation of the contact springs. This method of bushing attachment, however, is not necessarily essential as any well known method of attaching bushings to springs may be employed.

A blank, or dummy, plate 16 (Fig. 1) is included in the contact spring assembly between the end spring set and the adjacent spring set. This dummy plate 16 is provided for the purpose of preventing electrostatic coupling between the circuits connected to the spring sets, and is wired to a ground connection for conducting induced currents to ground.

It should be understood that the key assembly arrangement outlined in the preceding specification is but one embodiment of the invention, and that various changes or modifications may be carried out to accomplish the desired results, as will be apparent to those skilled in the art.

One application of the switch key relates to a communication system wherein a loud speaker of the radio type and a telephone handset are provided at each station. The switch key is connected in such a manner that with the lever handle 4 in the center, or normal, position the loudspeaker is alive for receiving purposes, and the transmitting circuit is open. When the attendant at the station wishes to transmit on a loud speaker basis, he turns lever handle 4 from the center position and holds it in the position which causes cam roller 6 to operate spring assembly 11 through the medium of cam follower 9. With lever handle 4 held in this position, the operation of spring assembly 11 by cam roller 6 has changed the circuit arrangement of the loud speaker so that the loud speaker is disconnected for receiving and is made available as a microphone for transmitting. Releasing lever handle 4 will permit cam follower 9 acting on cam roller 6 to restore the key to the center position, thereby disconnecting the transmitting circuit and re-establishing the loud speaker for receiving. Receiving via the loud speaker is, therefore, accomplished with lever handle 4 in the center position, and transmitting via the loud speaker with lever handle 4 held in the position in which spring assembly 11 is operated.

Spring set A of assembly 11 is in the high level amplifier output circuit, and the other spring sets are in low level circuits connected to the amplifier input. To avoid electrostatic coupling between spring set A and the other spring sets which would permit feedback and thereby cause amplifier instability, spring set A is shielded electrically from the other springs by means of the plate 16 which is wired to a ground connection.

Should the attendant prefer to use the telephone handset for transmitting instead of the loud speaker, he turns lever handle 4 from the center position and holds it in the position which causes cam roller 7 to operate spring assembly

11 through the medium of cam follower 9, and cam roller 8 to operate spring assembly 12 through the medium of cam follower 10. With lever handle 4 held in this position, the loud speaker is disconnected for receiving and the telephone handset transmitter is connected to the transmitting circuit in lieu of converting the loud speaker into a microphone. The telephone handset transmitter utilizes the same transmitting circuit which is used when the loud speaker serves as a microphone and, therefore, it is necessary to operate both spring assemblies 11 and 12 when using the handset transmitter for transmitting, in order to switch the proper circuit connections.

Having described the invention, what is considered new and desired to be protected by Letters Patent is set forth in the following claims.

What is claimed is:

1. In a key for switching electrical circuits, a plurality of switch spring sets, means for operating said spring sets, a lever having a center position and adapted to be moved in either of opposite directions for actuating said means, said means operating only certain of said spring sets when said lever is moved in one direction from the center position, and operating all of said spring sets when said lever is moved in the opposite direction from the center position.

2. In a key for switching electrical circuits, a plurality of switch spring sets, a cam mechanism, a hand lever having a center position and adapted to be moved in either of opposite directions for operating said cam mechanism, the moving of said lever in one direction from said center position causing said cam mechanism to actuate only certain of said spring sets, and the moving of said lever in the other direction from said center position causing said cam mechanism to actuate all of said spring sets.

3. In a key for switching electrical circuits, a plurality of switch spring sets, a plurality of cams for operating said spring sets, each of said cams controlling the operation of a certain number of said springs sets, an operating lever adapted to be moved in either of opposite directions for actuating certain of said cams, the moving of said lever in one direction causing only one of said cams to operate its associated spring sets, and the moving of said lever in the opposite direction causing other of said cams to operate all of said spring sets.

4. In a switch key, a supporting frame, a rotatable plate, an operating lever having a normal position with respect to said frame for turning said plate in one direction or the opposite direction, a plurality of cam rollers mounted on said plate, a plurality of cam followers operated by said cam rollers responsive to the moving of said lever from the normal position, certain of said cam followers operated when said lever is moved in one direction from said normal position and all of said cam followers operated when said lever is moved in the opposite direction from said normal position, and a plurality of switch contact springs, said cam followers controlling the operation of said contact springs.

5. In a switch key, a supporting frame, a rotatable plate, an operating lever having a normal position with respect to said frame for turning said plate in either of opposite directions, three cam rollers mounted on said plate equidistant from the center point of said plate, a plurality of cam followers operated by said cam rollers when said lever is moved from said normal position, said cam rollers and said cam followers so positioned with respect to each other that the moving of said lever in one direction from said normal position causes only one of said rollers to operate certain of said cam followers, the moving of said lever in the opposite direction from said normal position causes the other two of said cam rollers to operate all said cam followers, and a plurality of switch contact springs, the operation of said contact springs being controlled by said cam followers.

6. In a switch key, spring assemblies, a rotatable plate, means for rotating said plate, a series of cams on said plate for operating said spring assemblies, said cams removably mounted on said plate and having different mounting positions whereby the number of cams may be decreased or increased or the spacings between the cams varied to produce different operations of said spring assemblies.

7. In a switch key, a plate, means for rotating said plate, a series of holes in said plate, removable cams mounted in certain or all of said holes, spring assemblies mounted tangentially to said plate in the path of said cams, a certain positioning of said cams in said holes causing certain operations of said spring assemblies when said plate is rotated, said holes providing means for changing the positioning of said cams to cause other operations of said spring assemblies when said plate is rotated.

8. In a switch key structure, a supporting frame, a plurality of contact spring sets mounted in a pile-up on said frame, a metallic plate included in said pile-up between the end set and the adjacent set of said spring sets for voiding electrostatic coupling between said spring sets, said plate wired to a ground connection for conducting induced currents to ground.

9. In a switch key, a supporting frame, a plurality of contact spring sets mounted in a pile-up on said frame, a metallic plate included in said pile-up between the end set and the adjacent set of said spring sets for voiding electrostatic coupling between said spring sets, said plate wired to a ground connection for conducting induced currents to ground, means for actuating said spring sets, and an operating lever for causing said means to actuate said spring sets.

10. In a switching arrangement, a plurality of spring assemblies, a rotatable plate, a plurality of cams projecting from the surface of said plate, means for rotating said plate, rotation of said plate in one direction causing certain of said cams to operate only part of said assemblies, and rotation of said plate in another direction causing certain of said cams to operate all of said assemblies.

11. In a switching arrangement, a plate, means for rotating said plate in both directions, a series of cams on said plate, a series of spring assemblies mounted tangentially to said plate in the path of said cams, the rotation of said plate in one direction causing one of said cams to operate one of said spring assemblies and another of said cams to operate other of said spring assemblies, and the rotation of said plate in the other direction causing another of said cams to operate said one spring assembly without operating the said other spring assemblies.

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