March 30, 1954 R. L. WALLACE, JR., ET AL 2,673,894

INTERLOCKING SWITCH FOR INTERCOMMUNICATION SYSTEMS

Filed Dec. 11, 1945 2 Sheets-Sheet 1

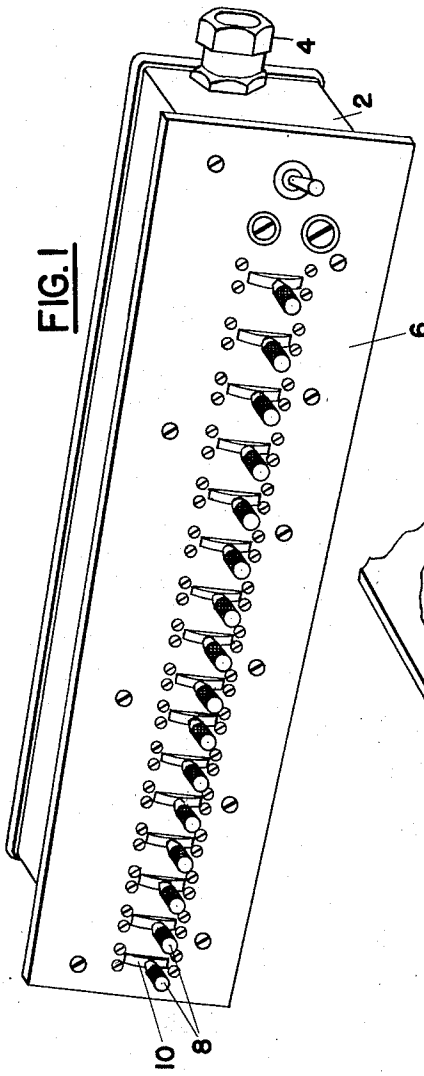


FIG. 1

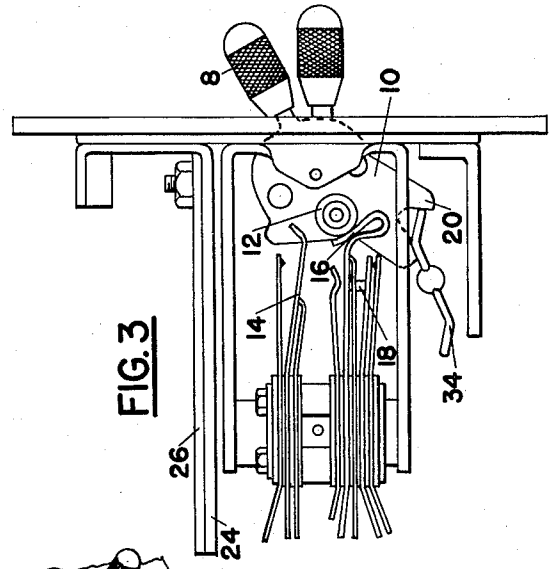


FIG. 3

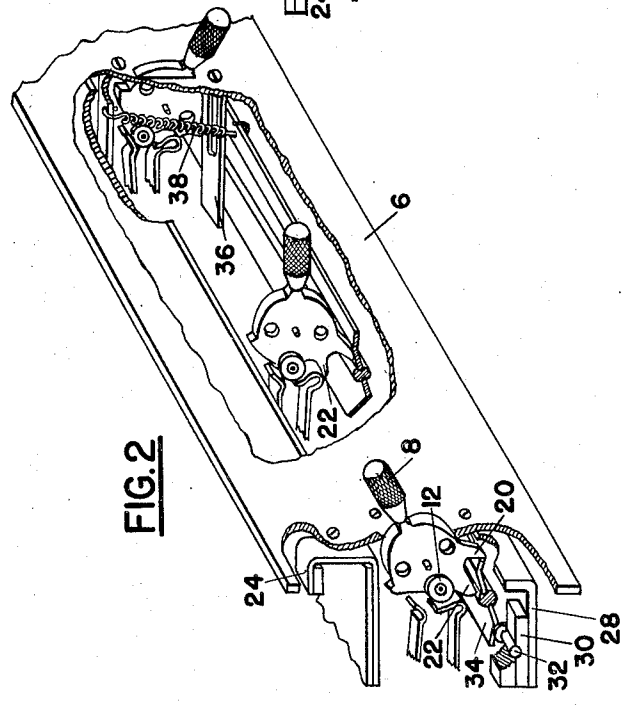


FIG. 2

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FIG. 4

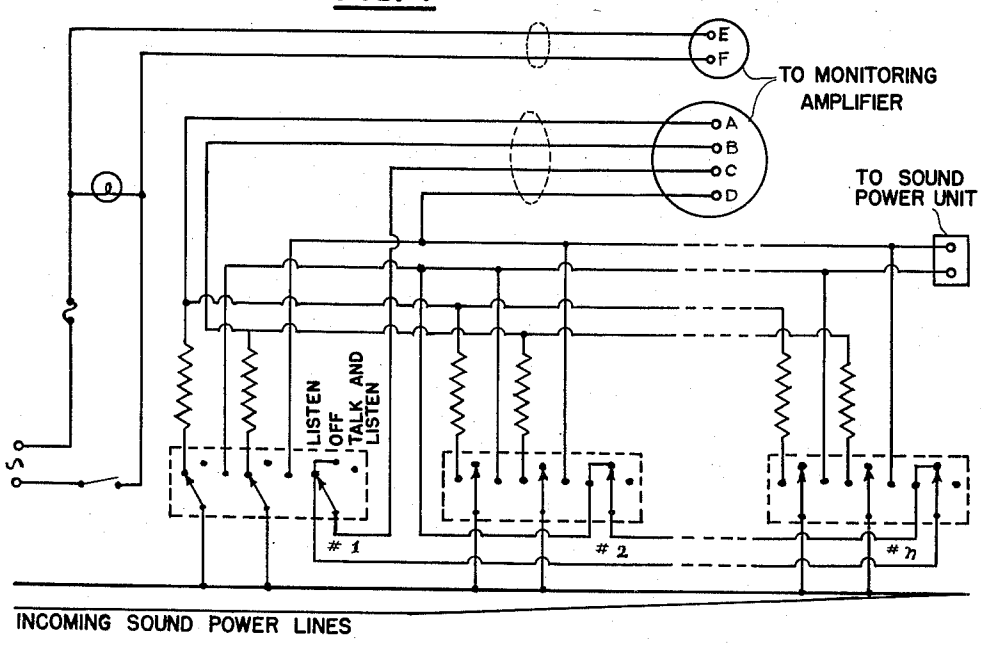
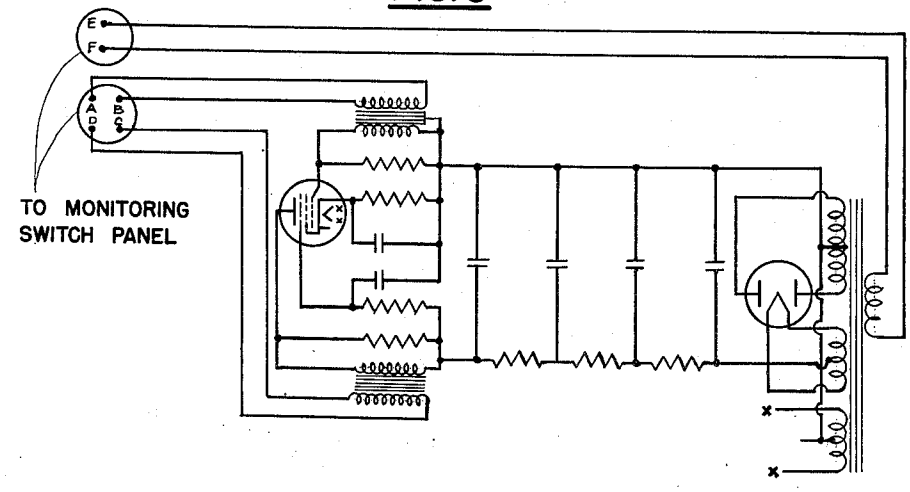


FIG. 5



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INTERLOCKING SWITCH FOR INTERCOMMUNICATION SYSTEMS

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2 Claims. (Cl. 179—1)

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This invention relates to electric switches and more specially to monitoring means for multiple cam type switches.

Operation of intercommunication systems, especially those in naval vessels, involves the use of sound-powered telephone instruments by many officers and men. Each man has available several circuits leading to different parts of a ship. Under conventional arrangements, each man is provided with one double-pole, single-throw snap switch for each available circuit. When he closes any one of these switches, he connects his headphones and microphone to the circuit corresponding to the switch closed but if he closes more than one switch at a time, he ties together the circuits corresponding to the closed switches. The result of this is that any one talking on any one of the circuits is heard by all listeners on all of the circuits which are tied together. Since under battle conditions the circuits are normally very busy, this tying of circuits together results in a most serious detriment to communication, and the use of several circuits tied together even for listening purposes only becomes impractical.

An object of the invention, therefore, is to provide an improved switch arrangement and to devise monitoring means for preventing a plurality of circuits from becoming tied together. Another object of the invention is to provide a monitoring arrangement which permits the normal operation of circuits in a neutral position and further provides for listening in on several circuits simultaneously. The invention also is directed to providing a simple, efficient, durable and positive switch arrangement.

The nature of the invention and its objects will be more fully understood from the following description of the drawings and discussion relating thereto.

In the accompanying drawings:

Fig. 1 is a perspective view illustrating the monitoring device of the invention;

Fig. 2 is another perspective view, partly broken away, to reveal a multiple cam type switch arrangement in interlocked position;

Fig. 3 is a view in end elevation of the monitoring device;

Fig. 4 is a diagrammatic view illustrating three complete circuits controlled by the multiple cam switch arrangement of the invention; and

Fig. 5 is a diagrammatic view illustrating special circuits controlled by the cam switches in a "Listen" position.

The invention in general includes a special

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multiple interlocking cam switch arrangement, made up of a multiplicity of three-position cam switches. These switches are connected to sound-powered circuits, to a special vacuum tube amplifier, and to a set of sound-powered headphones. Each one of the cam switches is associated with a particular sound-powered circuit. The three possible positions of the switch may be designated as: "Listen," "Neutral," "Talk."

The switches and amplifying equipment are so designated and connected that as many switches as desired can be turned to the "Listen" position, allowing the operator using the device to hear all the conversations on all these circuits. At the same time, the design of the equipment is such that the operator cannot talk on any circuit for which the corresponding cam switch is turned to the "Listen" position; and furthermore, placing more than one switch in the "Listen" position does not cause associated circuits to be tied together. If a particular cam switch is turned to the "Neutral" position, then the corresponding sound-powered circuits are completely disconnected from the station at which this special cam switch is installed so that nothing can be said on this circuit or heard from it at this position.

If one of the cam switches is turned to the "Talk" position, then the microphone and headphones are connected directly to the corresponding circuit and are disconnected from all other circuits. The operator can then talk and listen on this circuit in exactly the same way that he is able to do with the conventional type of switch system. If the operator places two or more of the cam switches in the "Talk" position, this may tie together corresponding circuits, and cause the detriment to communication already noted. To safeguard against this, the various cam switches are mechanically interlocked in such a way that if any one of the cams is in the "Talk" position, turning any other of the cams to a "Talk" position restores the one which was already in that position to the "Neutral" position. This prevents the undesirable tying together of circuits.

Referring more in detail to the drawings, Fig. 1 denotes a rectangularly shaped container 2 which is provided at one end with a casing member 4 for leading conductors to the interior of the box or container. 6 denotes a panel or cover, adjustably secured to the container, through which projects a plurality of handles 8 which are integral with respective cam switch members 10, more clearly shown in Figs. 2 and 3. The cam

members 10 are provided with cam wheels 12 which are resiliently engaged at upper and lower sides respectively by means of contact springs as 14 and 16. The contact springs in a depressed position, such as that indicated in Fig. 3 for example, urges the contact points 18 against adjacent contact fingers, thus closing circuits therethrough. The cam members are formed with projecting portions 20 and 22 which are separated by means of an indentation in the manner indicated in Figs. 2 and 3. The springs 14 and 16 normally tend to maintain the cam in a position such as that assumed by the centrally located cam in Fig. 2 indicated as "Neutral."

24 refers to a bracket member attached to the inner side of the switch panel 6. Supported on the bracket is an instrument panel 26, carrying conductors for the necessary circuits connected to the contact members illustrated in the drawings. At the lower portion of the container 2 is another bracket member 28 which runs longitudinally of the container and at either end supports bearing members 30. Pivotally mounted in the bearing members is a shaft 32 which supports a locking bar 34, more clearly seen in Fig. 3. The locking bar 34 preferably consists of a relatively long strip of metal reverse y bent in the manner shown in the drawings, and is resillently maintained against a stop member 36 by means of a coil spring 38 attached to the bracket member 24 or at some other convenient point. The locking bar is thus normally held in a position such as that illustrated in Figs. 2 and 3, being free to rotate along an axis passing through the bearing members 32.

In operation, when any one of the cam switches is turned to the "Talk" and "Listen" position, the forward edge of the locking bar is engaged in the indentation between the projections 20 and 22 so that the cam switch is interlocked with the bar 34. This is illustrated by the first cam switch at the extreme lefthand side of Fig. 2. Now if a cam switch in a "Neutral" position, such as that illustrated by the centrally located cam in Fig. 2 is turned to the "Talk" and "Listen" position, cam portion 20 will come to bear against the locking bar before the switch has been completely turned into position; and as the switch is turned further, the locking bar will be rotated in a clockwise direction as view in Fig. 3, which automatically releases the cam portion 20 of the locked cam switch, and the contact springs 14 and 16 instantly urge the released cam into a "Neutral" position, thus preventing the two circuits from being tied together.

It will be observed that it is possible to turn any one cam switch sufficiently far from the "Neutral" position so that the locking bar releases any other interlocked cam but not sufficiently far as to lock the switch being manipulated. An alternate method consists in providing a special release lever located through the instrument panel and connected to the locking bar 34 in such a way that when the lever is depressed, the locking bar is caused to pivot throughout an arc sufficient to release all locked switches.

In Fig. 4 we have illustrated a circuit diagram for three circuits controlled by cam switches which can be interlocked so that movement of any one switch into a "Talk" and "Listen" position automatically returns previously interlocked switches to a "Neutral" position.

A third possible location of the cam switches is obtained in a "Listen" position such as that indicated by the switch at the extreme righthand side of Fig. 2. Independent circuits are provided which are controlled by the cam switches in the "Listen" position and into these circuits are connected resistive attenuation pads and a simple one-stage monitoring amplifier as has been diagrammatically illustrated in Fig. 5. This arrangement permits the wearer of headphones connected to a circuit closed by its respective switch to hear whatever conversations take place in the circuit. No mechanical interlocking is provided on this side of the switch. The operator can listen on whatever circuits he chooses and on as many as he chooses. The resistive attenuation pads function to isolate the circuits from one another so that although the operator can hear all that is said on all circuits which he is monitoring, other people on the circuits hear only those messages which originate in the circuit to which they are connected. Thus the operator can listen at the monitoring station on as many circuits as he chooses without interfering with the normal operation of these circuits.

An alternative form of the interlocking mechanism can be obtained by a slight modification of the shape of the cam and of the locking bar. In a modified form of cam, the points 20 and 22 of Fig. 3 are rounded and are separated by a shallow rounded indentation. The locking bar is modified by reversing the direction of the bends in it which can be seen in Fig. 3 and making these bends somewhat more abrupt.

The advantage obtained by this modified construction relates to the manipulation necessary to restore a key from the "Talk" position to the "Neutral" position. With the locking arrangement shown in Figs. 2 and 3, a key which is in the "Talk" position can be restored to the "Neutral" position only by partially closing some other key or by manipulating a release button. The modified arrangement described above is such that any key can be returned from the "Talk" to the "Neutral" position by manipulating the handle of the key which it is desired to return.

While we have shown a preferred embodiment of our invention, it should be understood that various changes and modifications may be made, in keeping with the spirit of the invention as outlined by the appended claims.

Having thus described our invention, what we claim is:

1. As an article of manufacture a monitoring device for an intercommunication system comprising a housing, a switch panel located at one side of the housing, electrical conductors in the housing for connecting with a p urality of intercommunication sound-powered circuits, a plurality of cam switches for controlling respective circuits, said cam switches having handles projecting outwardly from the said panel, a locking bar extending throughout the housing, said bar being resiliently engaged against the cam switches, said cam switches being formed with projections adapted to provide for the cam switches being interlocked by means of the bar, other projections on the cam switches adapted to rotate the bar when the handles are moved, and spring means for returning the cam switches to a "Neutral" position when disengaged from the locking bar upon rotation thereof.

2. An intercommunication system including sound-powered circuits and a monitor station, said monitor station comprising a plurality of three position cam switches each connected to one of said circuits, an amplifier having an output, an input to said amplifier for each of said

circuits, each of the inputs including isolation impedance means, a sound-powered unit, a first position of each of said switches connecting its associated circuit with said sound-powered unit, a second position of each of said switches connecting its associated circuit to the corresponding input of said amplifier and the output of said amplifier to said sound-powered unit, and a third position of each of said switches disconnecting its associated circuit from said monitor station, locking bar means for interlocking any one of said cam switches when placed in said first position, and means for releasing the interlocked switch when any one of the other cam switches is moved from said third position to said first position.

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