Jan. 15, 1952 R. H. OLSON 2,582,270

CONTROL APPARATUS

Filed Jan. 12, 1945 2 SHEETS—SHEET 1

Fig. 1.

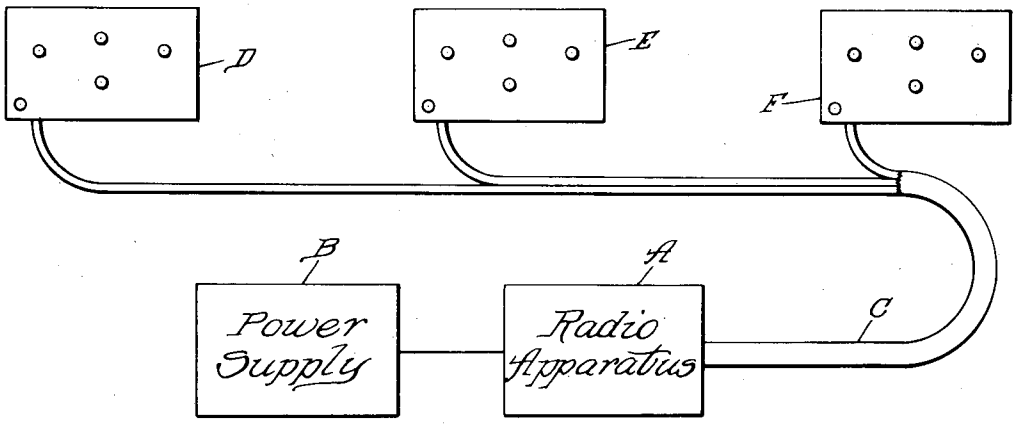


Fig. 2.

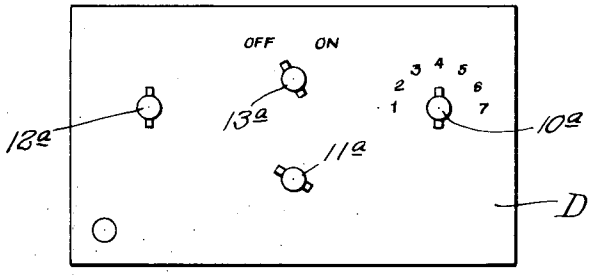
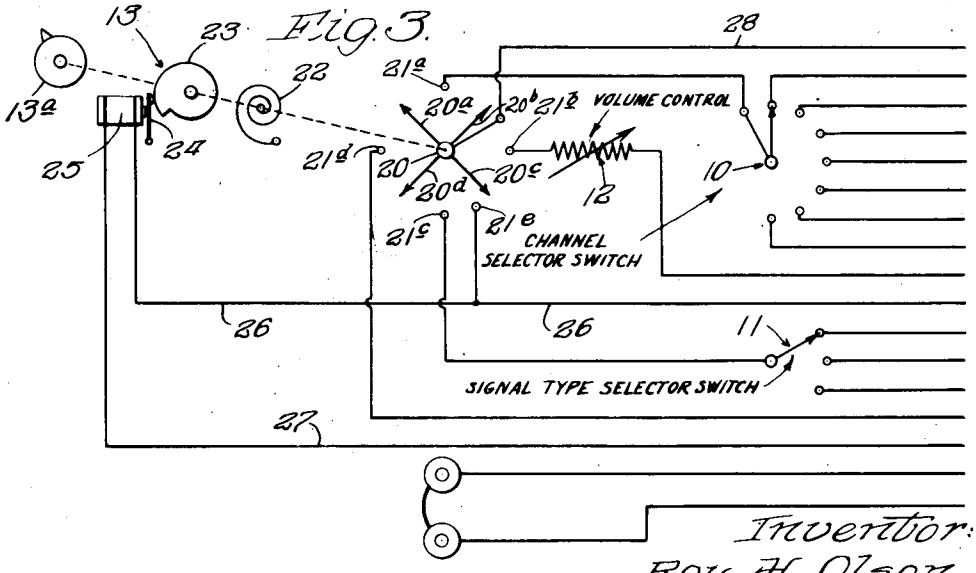


Fig. 3.



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Fig. 4.

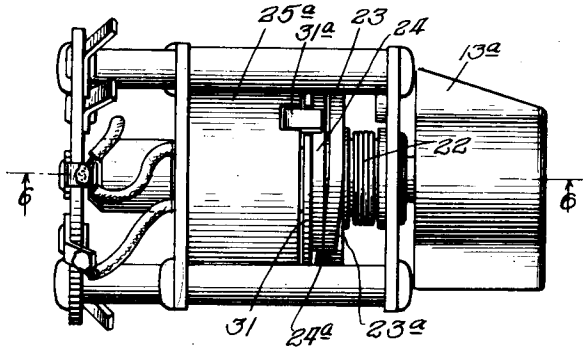


Fig. 5.

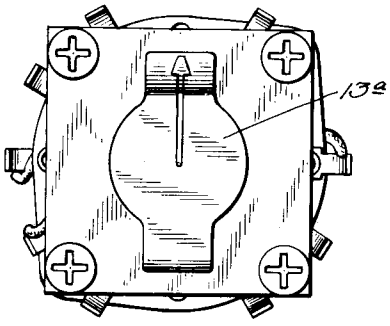


Fig. 6.

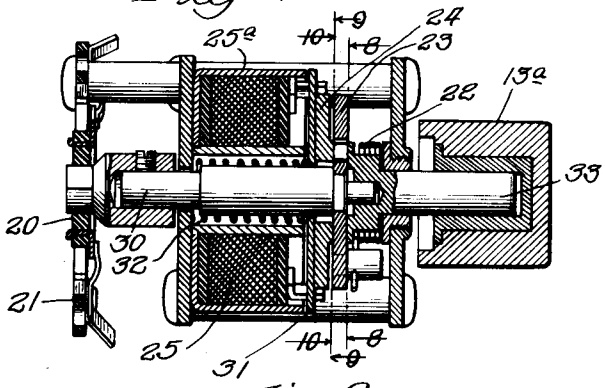


Fig. 7.

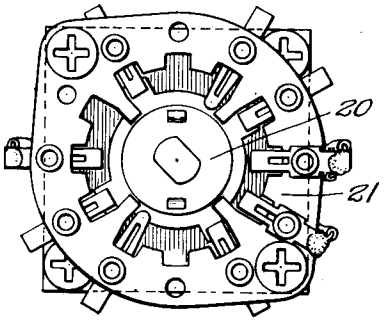


Fig. 8.

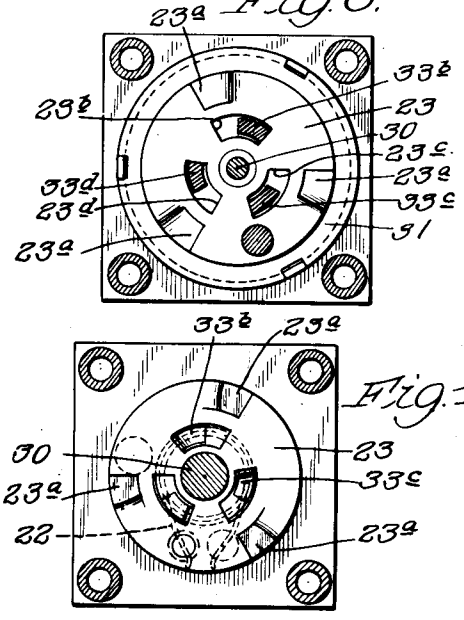


Fig. 9.

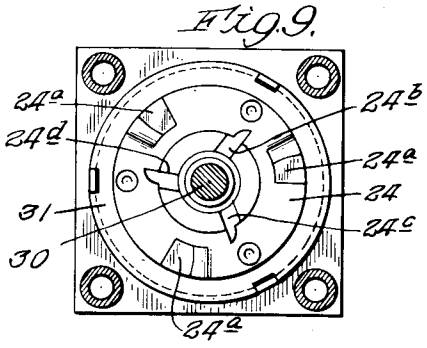


Fig. 10.

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UNITED STATES PATENT OFFICE

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CONTROL APPARATUS

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Application January 12, 1945, Serial No. 572,539

4 Claims. (Cl. 250—20)

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This invention relates to control apparatus, and more particularly to an arrangement providing remote control of radio apparatus.

One feature of this invention is that it provides improved remote control for radio apparatus desired to be controlled from a plurality of spaced points; another feature of this invention is that it provides means for obtaining exclusive control of radio apparatus from a remote point regardless of the condition of other remote control units; still another feature of this invention is that any desired number of remote control units can be employed in a system without the redesign of the control apparatus or the addition of any components thereto; yet another feature of this invention is that there is no possibility of conflict of control from remote points, rendering any one control unit operative automatically rendering all other control units inoperative; a further feature of this invention is that no control units except the one in use draw power from the power source; and still a further feature of this invention is that it provides a latch with both manual and electrical release. Other features and advantages of this invention will be apparent from the following specification and the drawings, in which:

Figure 1 is a simple schematic illustration of an installation embodying my invention; Figure 2 is an enlarged view of the panel of one of the control units shown in Figure 1; Figure 3 is a circuit diagram, partly schematic, of one of my control unit arrangements; Figure 4 is a side elevational view of the latching switch embodied in each control unit for rendering it operative or inoperative to control the controlled apparatus, as radio equipment; Figure 5 is a front elevational view of the switch shown in Figure 4; Figure 6 is a sectional view along the line 6—6 of Figure 4; Figure 7 is a back elevational view of the switch, particularly showing the contacts or switch means proper; Figure 8 is a transverse sectional view along the line 8—8 of Figure 6; Figure 9 is a sectional view along the line 9—9 of Figure 6; and Figure 10 is a sectional view along the line 10—10 of Figure 6.

There are certain situations where it is desirable to be able to control a piece of apparatus in a desired manner from any of a plurality of control units in spaced points. Such an arrangement is desirable, for example, in connection with the radio apparatus of a mobile vehicle, and my invention will be described in connection with a remote control system as designed for control of radio apparatus in a large airplane, as a bomber, although it will be understood that my invention is capable of a wide number of other uses and that no limitations are to be drawn from the description of this one specific use.

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It has heretofore been customary in bombers, for example, to have an arrangement such that the radio apparatus may be operated by the radio man or by the pilot, the radio man usually effecting his control right at the apparatus and the pilot operating through a remote control unit which is operative only when the radio man has thrown a switch to cut out his local control. This has a number of disadvantages, and I have devised and am here disclosing and claiming a remote control system, and a latching switch for the control units thereof, such that any desired number of control units can be located throughout the airplane, and any one of such units can take over the control of the radio apparatus regardless of the situation at the radio apparatus or at any other control unit.

In an installation embodying my invention, for example, the pilot might have one remote control unit, the navigator another remote control unit, and a gunner toward the rear of the plane still another remote control unit. In fact, any desired number of control units can be hooked into the control cable in my arrangement, and a half dozen or more units may be scattered throughout a single airplane if desired. In any case, any person desiring to take over control of the radio apparatus need only turn the switch on his control unit to "on" position, this not only rendering his control unit operative to control apparatus but also rendering all other control units inoperative (even though the switches thereof may have been left in the "on" position). This is accomplished without the necessity of any complicated wiring arrangement for enabling one control unit to supersede a control unit rendered operative earlier but by a simple latching switch in each control unit which is adapted to be electrically turned to "off" position whenever any other control switch is turned to "on" position. In the normal bomber installation the radio apparatus is hooked into the intercommunication system in such a way that it forms a background of low audibility in the intercommunication units, so that everyone in the plane knows whether anyone is using the radio apparatus, and on which channel, at any particular time. Moreover, under the discipline of a trained bomber crew, anyone who wanted to take control of the radio apparatus away from the pilot or radio man would first request permission so to do over the intercommunication system, so that there would be no danger of improper handling of the radio ap-

paratus under normal conditions. If the radio man or anyone else is injured, however, the present installation enables anyone in the plane to take over control of the radio apparatus instantaneously without being thwarted by the position of the controls at the radio apparatus or at some other remote control unit.

In the particular embodiment of my invention illustrated in Figure 1, the radio apparatus A (as for example a radio receiver) and its power supply B would normally be located in a radio compartment or portion of the plane immediately behind the pilot's cockpit. A cable C of an appropriate number of wires (here shown as 17) provides operative circuit connections between the radio apparatus and power supply and a plurality of remote control units here shown as three and identified as D, E and F. Each of the remote control units is identical with the others, and accordingly only one such unit will be described in detail.

Referring now more particularly to Figures 2 and 3, the unit D is shown as having a channel selector switch 10 manually operated by the knob 10*a*; a switch arrangement 11 for conditioning the radio apparatus for the type of signal to be received as C. W., phone or M. C. W., this being manually operated by the knob 11*a*; a volume control rheostat 12 operated by the knob 12*a*; and a latching "off" and "on" switch 13 for rendering the control unit operative or inoperative to control the radio apparatus, this switch being adapted to be manually operated by the switch 13*a*. This switch is illustrated schematically in Figure 3 and in full structural detail in Figures 4–10. Before turning to these latter figures to describe the details of construction, the general principles of operation and construction of the latching switch will be described with reference to Figure 3.

The switch means or switch proper is here shown as comprising a rotatable switch element 20 having four contact fingers 20*a–d* adapted to cooperate with a plurality of corresponding fixed contacts 21*a–d* and an additional contact 21*e*. The switch is shown in its "off" position, rotation of the knob 13*a* in a clockwise direction serving to move the switch to "on" position, in which case the contact fingers 20*a–d* rest on the fixed contacts 21*a–d*. In moving from the "off" position shown to the "on" position it will be noted that the switch finger 20*c* momentarily engages the additional contact 21*e*, this serving to energize a release circuit for returning the switch of any other control unit to "off" position if it is in "on" position. A spring 22 serves to bias the switch means toward "off" position, as shown, and the shaft carrying the switch means has rigidly mounted thereon a rotatable latch member 23 adapted to cooperate with a movable catch member 24 to latch the switch in "on" position when it is manually moved to such position. The catch member 24 has electrically operative release means in the form of a magnet 25 associated with it, so that when the switch is latched in the "on" position energization of the release circuit (comprising the wires 26 and 27) causes unlatching or release of the latching arrangement and return of the switch to "off" position by virtue of the force of the spring 22.

If the operator handling control unit D has turned his switch manually to the "on" position, he may control the receiver in desired manner. Manipulation of the switch 10 enables him to select the channel for reception if the receiver is provided with automatic tuning or shaft positioning apparatus, as for example the kind shown in Arthur A. Collins Patent 2,285,414 of June 9, 1942; manipulation of the switch 11 enables the radio apparatus to be conditioned for the type of signal present on the channel selected; and operation of the volume control 12 enables the desired volume level to be secured. It will be apparent that turning the switch 13 to "on" position thus enables the control unit rendered operative to control the radio apparatus, as a radio receiver, in desired manner. On the other hand, if the operator of control unit D should leave such unit, or be injured, without turning the switch to "off" position, any other control unit can be caused to supersede the unit D and take over control of the radio apparatus. Movement of the switch in some other control unit toward "on" position would cause the switch means corresponding to the finger 20*c* and contact 21*e* to be momentarily closed, providing a path from the negative power supply wire 28, for example, through the wire 26 and the magnet 25 to the wire 27, which may be the positive side of the power supply circuit. Energization of the magnet 25 effects movement of the catch member 24 to the position shown in Figure 3, thus releasing the latch member 23 and allowing the switch in the unit D to return to the "off" position under the influence of the spring 22. On the other hand, as will be more fully apparent from the structural description to follow, the operator at the unit D may manually release the latch means and return the switch of his control unit to "off" position, by mere turning of the knob 13*a* in a counterclockwise direction.

Referring now more particularly to Figures 4–10, it will be seen that the rotatable switch member 20, cooperating with the fixed contact assembly 21, is mounted at the rear of a shaft 30 so as to be rotatable therewith. This shaft 30 passes through the magnet coil 25, the windings being within an outer shell 25*a* of magnetic material to increase the pull of the magnet. Mounted on the shaft 30 so as to be axially but non-rotatably movable is an armature member 31 having the catch member 24 rigidly attached thereto, this latter member being in the form of a disk or circular plate having tongue portions 24*a* stamped up to provide a catch shoulder. A pair of oppositely disposed lug portions, as the portion 31*a*, lie in slots in the shell 25*a* and serve to prevent rotation of the armature member 31, and thus of the latch member 23. The armature and catch member assembly is urged to the right (speaking with respect to Figure 6) by a spring 32, so that the catch shoulder 24*a* is adapted to engage latch shoulders 23*a* of the stamped in tongue portion of a latch disk or circular plate rigidly mounted on the shaft 30.

The knob 13*a* is mounted on a stub shaft 33 coaxial with the shaft 30 but not rigidly connected thereto, and the spring 22 normally urges this shaft in a counterclockwise direction. The inner end of this shaft 33 is provided with a plurality of fingers, here identified as the fingers 33*b–d* received in corresponding slots 23*b–d* in the plate 23. The slots are of substantially greater arcuate length than the width of the fingers received thereby, so that there is a lost motion connection between the shaft 33 and (through the plate 23) the shaft 30. As may be best seen in Figure 10, the inner ends of these fingers 33*b–d* are tapered, lying at an angle with the plane transverse to the shaft 30. These cam fingers

are adapted to cooperate with the radial spider portions 24b-d best seen in Figure 9, so that counterclockwise rotation of the cam fingers from the position shown in Figure 8 to the limit of their movement in the slots effects axial movement of the catch plate 24 to the left (speaking with respect to Figure 6) toward the magnet. This manually effected movement is sufficient to disengage the shoulders 23a and 24a and result in the spring 22 rotating the entire mechanism to the "off" position. It will thus be apparent that grasping the knob 13a and rotating it clockwise will turn the switch to "on" position, the action of the spring 32 causing engagement of the shoulders 23a and 24a to latch the switch in such position. If the operator of that control unit wishes to turn the switch off, the first few degrees of counterclockwise rotation of the knob 13a operates through the manual release means just described to disengage the latching surface and permit the parts to return to "off" position.

On the other hand if the operator of any particular control unit has left the switch of his unit in the "on" position, rotation of the switch of any other control unit to "on" position momentarily energizes the magnet 25 and electrically effects release of the latching means and return of the switch to "off" position. It will be readily apparent that energization of the magnet 25 provides an axial pull upon the armature member 31, this pull being arranged to be greater than the resistance of spring 32, so that the catch member 24 and armature 31 move to the left sufficiently to disengage the shoulders 23a and 24a. Because of the constant rotative tension of the spring 22, this release action results in the switch mechanism returning to "off" position when it is unlatched. Since the contact finger and fixed contact operative to effect the unlatching action are only momentarily in contact with each other, there is no power used in the magnets of the switches of the control units, or in any portion of the control units, when the same are inoperative to control the radio apparatus. The release magnets are energized briefly during turning of any switch to "on" position, and this coincides with a brief energization effected by some other switch returning to "off" position. The switch being turned to "on" position is still being manually operated and has not yet been latched when the switch of some other unit returns to "off" position, so that the brief energization of the magnet of the switch being turned to "on" position comes at a time when it does not interfere with the subsequent latching of the switch in "on" position.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In a latching switch of the character described, apparatus including: switch means rotatable between "on" and "off" positions, said means including a shaft; spring means urging said switch means toward one of such positions; a latch member plate coaxial with said shaft and rigidly connected to and rotatable with said switch; a catch member plate coaxial with said shaft and axially but not rotatably movable and adapted to be engaged by said latch member for holding said switch in the other of said positions; a single manual operating member for moving said switch means to the position in which it is adapted to be latched and for manually moving said catch member to release said latch member when desired; and magnetic means for moving said catch member to release said latch member.

2. In a latching switch of the character described, apparatus including: switch means rotatable between "on" and "off" positions; spring means urging said switch means toward one of said positions; a shaft on which said switch means is rigidly mounted; a latch member disk rigidly mounted on said shaft and spaced from said switch means; a catch member disk axially and not rotatable movable and mounted between said switch means and latch member disk and adjacent the latter, the catch member being adapted to be engaged by the latch member for holding the switch means in the other of said positions; a knob mounted on said shaft and having a lost motion connection for moving said switch means against the urging of said spring, the knob having operatively associated therewith means for mechanically moving said catch member disk axially to release said latch member disk; and electrically operative means for axially moving said catch member disk to release said latch member disk, this means comprising a coil surrounding said shaft between the switch means and the catch member disk.

3. In radio apparatus having a plurality of spaced control units operatively connected to the radio apparatus, control means for each unit including: means for rendering the unit operative to control the radio apparatus and for simultaneously rendering a previous operative control unit inoperative, this means comprising a switch, spring means urging said switch toward one position, latch means for holding said switch away from said position, manually operative release means for releasing said latch means, and separate electrically operative release means for releasing said latch means, the electrically operative release means in all of the control units being interconnected and each switch including contacts operating all of said electrically operative release means upon moving of said switch manually to a position rendering its control unit operative.

4. In radio apparatus having a plurality of spaced control units operatively connected to the radio apparatus, control means for each unit including: means for rendering the unit operative to control the radio apparatus and for simultaneously rendering a previous operative control unit inoperative, this means comprising a switch, spring means urging said switch toward one position, latch means for holding said switch away from said position, manually operative release means for releasing said latch means, and separate electrically operative release means for releasing said latch means, each switch including contacts for completing a release circuit upon moving of said switch manually to a position rendering its control unit operative, at least the previously operative control unit having its electrically operative release means in said release circuit for releasing its latch means upon said moving of said switch manually.

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