July 13, 1937. G. MATEJKA 2,086,628

SWITCHING DEVICE

Filed April 10, 1935

FIG. 1

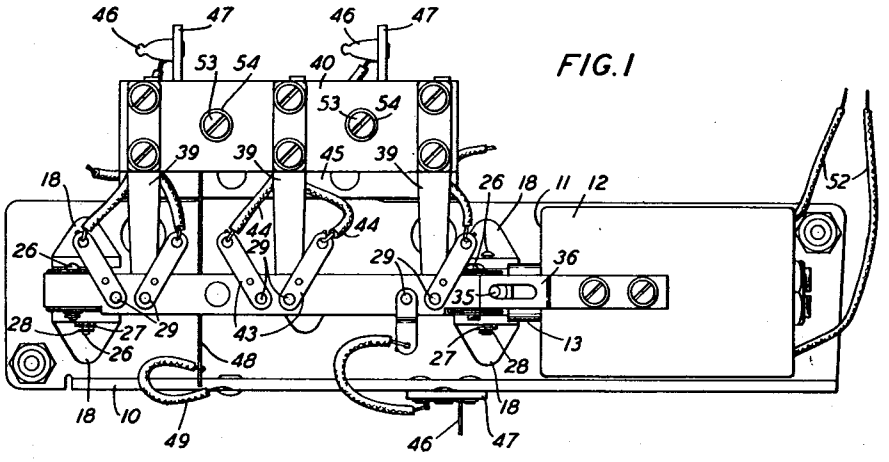


FIG. 2

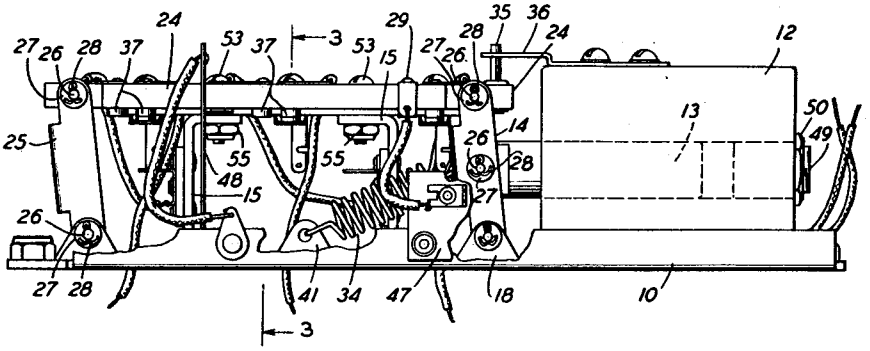
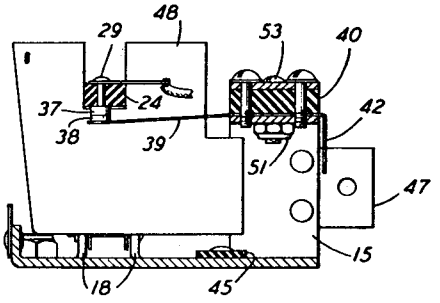


FIG. 3



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SWITCHING DEVICE

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3 Claims. (Cl. 200—104)

This invention relates to electric switching devices and particularly to switching devices of the type used in connection with aircraft radio receivers.

Though the conventional type of electric circuit controller or electromagnetic relay is generally called upon to satisfy precise circuit requirements, the switching device which functions in connection with aircraft radio equipment is confronted with requirements of a more exacting nature.

A relay or switching device of this type should be so designed as to permit reasonable spacing of the various circuits it controls in order to guard against any interaction thereof caused by close coupling; the contact elements should be of such a construction as to introduce no capacity effects when the relay is operated and the contact operating mechanism should be of such a nature as to insure a high degree of contact pressure under conditions of serious vibration to which the relay is subject.

It is the object of this invention to provide a simple, compact and durable switching device for aircraft radio equipment which satisfies the requirements set forth above.

This object is attained in accordance with a feature of the invention by the provision of relatively small movable contacts which are collectively mounted on a movable member of insulating material and adapted to be brought into engagement with their respective coacting stationary springs.

Another feature of the invention resides in a pantagraph mechanism interposed between the magnet plunger and the stationary springs and which, in part, constitutes the movable contact carrier and by virtue of which a wiping, vibrationless contact between the movable and stationary contacts is effected.

A further feature of the invention provides for a suitable separation of the stationary contacts with which the circuits controlled are associated, thereby preventing electrical coupling of the various circuits.

These and other features of the invention will be readily understood from the following detailed description made with reference to the accompanying drawing in which:

Fig. 1 shows a plan view of the switch in the normal or unoperated position;

Fig. 2 shows a side elevation of the switch with a part of the base cut away; and

Fig. 3 shows a vertical section on the line 3—3, Fig. 2, with certain parts removed.

Referring to the drawing more particularly, 10 is a base member of aluminum or other lightweight material, upon which the relay structure of this invention is supported. Upon one end portion of the base 10 is mounted a solenoid 11 encased in a metal shield 12. The solenoid plunger 13 has one end thereof normally protruding from the solenoid 11 and pivotally associated with the link 14 which constitutes one element of a pantagraph mechanism.

The pantagraph mechanism is made up of the links 14 and 25 and the cross-bar 24. The links 14 and 25 are trough-like in appearance and have each one end thereof pivotally secured between a pair of frame lugs 18, one pair of which is located on the base 10 immediately ahead of the solenoid 12 and the other pair near the end of base 10 furthest from the solenoid. The bar 24 which is of an insulating material, such as phenolized linen, pivotally interconnects the other ends of the links 14 and 25. The pivotal connection between the various elements of the pantagraph mechanism and between certain of such elements and their base supports or frame lugs 18 and the plunger 13 are made by means of bearing pins 26, washers 27 and cotter pins 28, the connection between the pantagraph mechanism and the solenoid plunger being made at substantially the mid-point of the link 14.

From the description thus far, it is apparent that any movement of the solenoid plunger 13 will be experienced by the pantagraph mechanism comprising elements 14, 24 and 25. As viewed in Figs. 1 and 2, the pantagraph mechanism moves to the right under the influence of the solenoid plunger 13 when the solenoid 11 is energized and to the left under the action of restoring spring 34 which has one end thereof secured to frame lug 41 and the other end to the link 14. A stop 36 mounted on the upper side of the shield 12 has a slotted portion thereon extending out over one end of the bar 24 upon which is mounted a finger 35 which moves in the slotted stop upon the actuation of the pantagraph. The return movement of the pantagraph, under the influence of spring 34, and accordingly the normal position of the pantagraph are governed by the position of the stop 36 with respect to the finger 35.

The bar 24 is equipped with a plurality of contacts 37, three pairs being shown in Figs. 1 and 2, each pair being suitably spaced so as to prevent interaction from close coupling. These contacts are firmly secured to the underside of bar 24 and may consist of metal pins 29 to each of which a

disc of contact metal such as platinum or other precious metal is welded.

The base 10 is provided with two integral upright projections or supports 15 to which there is secured a bracket 40 of insulating materal, such as phenolized linen, by means of screws 53, washers 54 and lock nuts 55, as shown. Three contact springs 39 are suitably spaced with respect to each other and to contacts 37 and are firmly attached to the underside of bracket 40 by means of screws, washers and clamp plates as illustrated in Fig. 3. Each spring 39, which may be of nickel-silver or any other suitable material, carries at its end a contact 38 of platinum or other precious metal. The bracket 40 is so disposed with respect to the pantagraph bar 24 that the contact 38 on spring 39 normally engages one of the contacts 37 of each of the three groups of contacts on the bar 24. The contacts 37 of each pair of contacts are so spaced that the mating contact 38 engages one contact 37 before being entirely disengaged from the other contact 37 when the bar 24 is actuated. In other words, a make-before-break engagement between contact 38 and contacts 37 is effected. At the extreme end of the movement of bar 24 to the right or to the left, contact 38 is in engagement with but one contact 37 of a pair. The springs 39 are pretensioned so as to insure proper pressure between the contacts 38 and 37.

Each contact 37 is provided with a terminal lug 43 and flexible lead 44 for connection to an external circuit. The lead from the right-hand contact 37 of each pair of such contacts passes through a fanning strip 45 of insulating material, such as phenolized linen, which is secured to the base 10. The leads from the left-hand contact 37 of each pair of such contacts is attached to a terminal 46, three such terminals being shown. Each terminal 46 is mounted on a piece of insulation 47 which is firmly secured to the base 10 in any suitable manner.

A metal shield 48 is secured to the bar 24 and is electrically connected by means of flexible lead 49 to the base 10. The shield 48 prevents electrical coupling between adjacent pairs of contacts 37 as well as between adjacent contact springs 39 between which the shield extends.

The extent of the movement of the iron plunger 13 in the solenoid 11 is governed by an iron, threaded adjustable stud 49 which extends into the solenoid. Lock nut 50 is employed to hold stud 49 in its adjusted position.

Electrical connection to the solenoid 11 is made by means of the lead 52.

The relay of this invention has particular utility in connection with aircraft radio receivers in providing, for example, means for effecting the instantaneous switching between any frequency to which the receiver may be tuned and a particular landing beam frequency which enables the pilot to correctly maneuver his plane in effecting a landing. In Fig. 1, the right-hand terminal or contact 29 of each of the three pairs of movable contacts will be connected to the regular tuning circuit of the radio receiver and with the solenoid 11 deenergized, the tuning circuits are connected to the receiver by way of the contact springs 39. Should it be necessary to effect a landing, the solenoid 11 will be energized in any well-known manner to cause the left-hand contact 29 of each pair of movable contacts to be moved into engagement with the stationary contact springs 39 in place of the right-hand contact 29. This shift of contacts substitutes different tuning circuits for the regular tuning circuits of the receiver which are pre-tuned to the particular frequency of the landing beam. Such a switching expedient enables the pilot to instantaneously condition the receiver for picking up the landing beam frequency without disturbing the setting of the regular tuning circuit.

In order to guard against interaction of the various circuits caused by electrical coupling, the stationary springs 39 are widely separated from each other, as are also the other terminal points of the several circuits.

The shield 48, shown interposed between the center and left-hand pairs of contacts 29, prevents electrical coupling between these adjacent pairs of contacts. The movable contacts 37 are relatively small thereby introducing no capacity effects when the relay is operated. The contact springs 39 are of such dimensions as to insure and maintain a high degree of contact pressure under conditions of serious vibrations and the sliding engagement of the contact elements insures clean contacting surfaces as well as positive non-chattering contact.

What is claimed is:

1. An electromagnetically operated switch comprising a base plate, a solenoid mounted on said base plate and having a plunger movable in the direction of the longitudinal axis of said base plate, a contact carrier, a link pivotally connecting one end of said carrier with said base plate, a second link pivotally connecting the other end of said carrier with said base plate and having its mid-point pivotally associated with the plunger of said solenoid whereby any movement of said plunger is transmitted to said contact carrier, a plurality of spaced stationary springs disposed at right angles to said contact carrier and mounted on said base plate, a contact mounted on each of said springs and normally tensioned against a corresponding one of the contacts on said contact carrier whereby any movement of said carrier results in a wiping engagement of said contacts, and means for electrostatically separating adjacent contacts from each other, said means comprising a shield interposed between adjacent stationary springs and mounted on and movable with said contact carrier.

2. An electromagnetically operated switch comprising a base plate, a solenoid mounted on said base plate and having a plunger movable in the direction of the longitudinal axis of said base plate, a contact carrier, a link pivotally connecting one end of said carrier with said base plate, a second link pivotally connecting the other end of said carrier with said base plate and having its mid-point pivotally associated with the plunger of said solenoid whereby any movement of said plunger is transmitted to said contact carrier, a plurality of spaced stationary springs disposed at right angles to said contact carrier and mounted on said base plate, a contact mounted on each of said springs and normally tensioned against a corresponding one of the contacts on said contact carrier whereby any movement of said carrier results in a wiping action between said contacts, a shield interposed between adjacent contacts and mounted on said carrier for preventing electrical coupling of the circuits associated with said contacts, and a flexible lead connecting said shield to said base plate.

3. An electromagnetically operated switch particularly adapted for service with aircraft radio

receiving equipment, comprising a base plate, a solenoid mounted on said base plate, an electrostatic shield supported on said base plate and housing said solenoid, the plunger of said solenoid being movable in the direction of the longitudinal axis of said base plate, an insulating contact carrier, a link pivotally connecting one end of said carrier with said base plate, a second link pivotally connecting the other end of said carrier with said base plate and having its mid-point pivotally associated with the plunger of said solenoid whereby any movement of said plunger is transmitted to said contact carrier, a plurality of widely spaced stationary springs disposed at right angles to said contact carrier and supported by said base plate, a contact mounted on each of said springs and normally tensioned against a corresponding one of the contacts on said contact carrier whereby any movement of said carrier results in a wiping action between said contacts, a shield interposed between adjacent contacts and mounted on said carrier for preventing electrical coupling of the circuits associated with said contacts, a spring for maintaining said plunger and said carrier in normal position and against whose action said plunger operates to actuate said contact carrier and means including a pin mounted on said carrier and a slotted element mounted on the shield housing said solenoid, for limiting the longitudinal movement of said carrier and preventing side play thereof during its actuation.

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