Feb. 11, 1941. E. G. LODGE 2,231,540

RADIO CIRCUIT CONTROL UNIT

Filed Dec. 12, 1938

Fig. 1

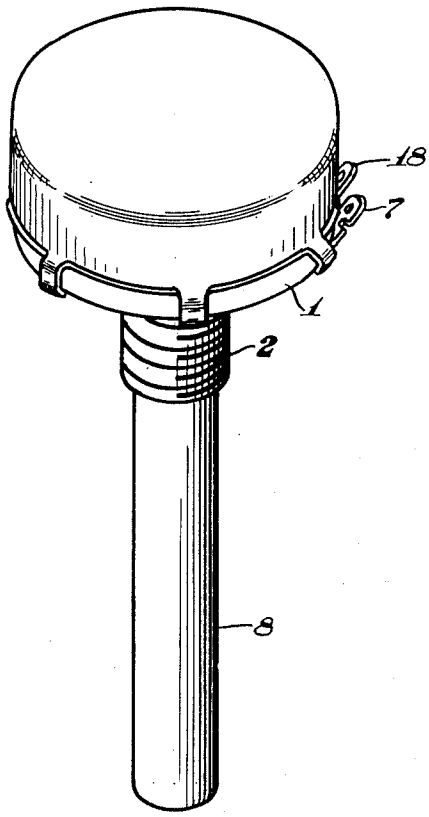
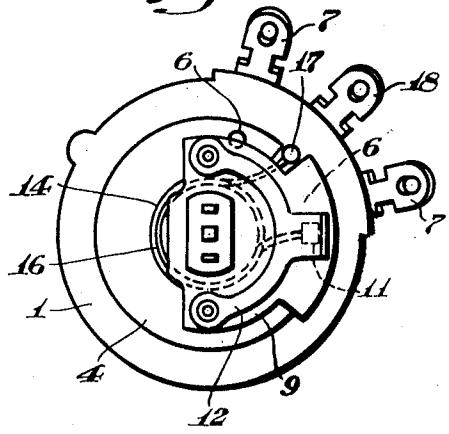


Fig. 3



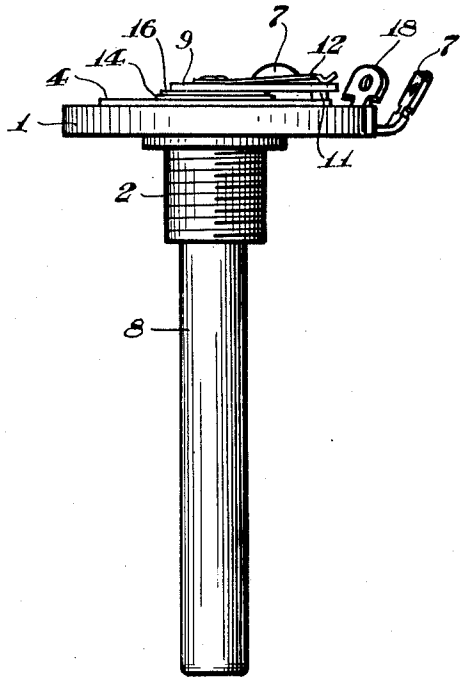


Fig. 2

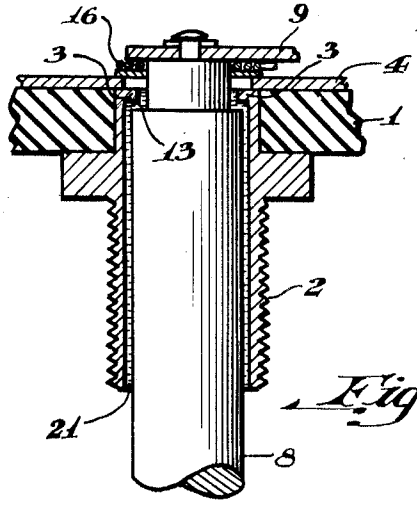


Fig. 4

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UNITED STATES PATENT OFFICE

2,231,540

RADIO CIRCUIT CONTROL UNIT

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Application December 12, 1938, Serial No. 245,102

2 Claims. (Cl. 201—55)

This invention relates to units for controlling electric circuits, and more particularly to volume controls and the like for radio circuits.

In the radio parts industry competition is very keen, and therefore any given improvement, no matter how small it may appear to an outsider, may be the factor that clinches an order for the improved parts. Two things that are considered by the radio industry in buying volume controls are the smoothness of operation of the control mechanically, and its quiet operation electrically in the volume control circuit. Other things being equal it would naturally be thought that a lubricant between the control shaft and the bushing in which it rotates would give as smooth operation as possible, but such is not the case. In some cases the lubricant actually makes the operation rougher than before. Likewise, the lubricant does not reduce noise caused by the contact shoe sliding over the resistance element. In automobile and radio sets, as well as in others which are exposed to wide temperature variations, the viscosity of the lubricant changes with the temperature and interferes with operation of the control at low temperatures and becomes so thin at the higher temperatures that it will not stay in place. In all cases the lubricant drys or hardens within a relatively short time.

It is among the objects of this invention to provide a radio circuit control unit which is extremely smooth and quiet in operation, and between the shaft and bushing of which a liquid film is used that stays in place and does not change its viscosity appreciably through a very wide temperature range, nor harden during the life of the control.

My invention is predicated in part upon my discovery that as a contact shoe slides over small irregularities or bumps on an apparently flat resistance element it is retarded and then allowed to jump ahead, and that these movements cause noisy electrical operation and are transmitted through the control shaft to give a feeling of rough mechanical operation. I have also discovered that if the control shaft is separated from the bushing in which it rotates by a liquid film having certain characteristics, such periodic jumping ahead of the shaft and contact shoe can be substantially eliminated.

In accordance with this invention a radio circuit control unit, such as a volume control, has a base member provided with an opening in which a bushing is rigidly mounted. An operating shaft is rotatably disposed in the bushing and is connected to a movable contact member which slidably engages means, such as a resistance element, mounted on the base member. I restrain the rotating shaft from intermittently jumping ahead as the contact member passes over irregularities in the resistance element by the use between the shaft and bushing of a liquid film that is highly cohesive and adheres to the shaft and bushing to such an extent as apparently to produce a dashpot effect. The film is highly viscous and resistant to drying or hardening, and its viscosity does not change noticeably within the range of temperatures ordinarily met with in the use of radio receiving sets.

The invention is illustrated in the accompanying drawing in which Fig. 1 is a perspective view of a volume control; Fig. 2 is a side view with the cover removed; Fig. 3 is a plan view; and Fig. 4 is an enlarged vertical section through the bushing showing the liquid film exaggerated in thickness.

Referring to the drawing, an insulating base member 1 is provided with a central opening in which one end of a threaded metal bushing 2 is molded. The inner end of the bushing has an inwardly projecting radial flange (Fig. 4). Mounted on the face of the base member opposite the one from which the bushing projects is an arcuate resistance element 4 of the flat carbonaceous type. The ends of this element are connected by rivets 6 to a pair of terminals 7 extending radially outwardly.

Rotatably disposed in the bushing is a metal shaft 8 the inner end of which rigidly carries an insulating arm 9 that overlies the resistance element. Above the element the arm is provided with an opening in which a generally U-shape contact member or shoe 11 is mounted (Fig. 2). There is enough clearance between the sides of the shoe and the walls of the opening to permit the contactor to slide vertically therein so that it can be pressed against the resistance element by means of a Y-shape spring 12 secured to control arm 9. This spring also serves to draw shaft 8 inwardly in bushing 2, this movement being limited by an annular shoulder 13 (Fig. 4) on the shaft which abuts against bushing flange 3. Encircling the shaft between the control arm and an insulating washer 14 is a coil of spring wire 16 one end of which is electrically connected to the contact shoe and the other end of which is connected by a rivet 17 to a third terminal member 18 between the terminals 7, as shown in Fig. 3.

In accordance with this invention liquid film

21, shown in exaggerated thickness in Fig. 4, separates the shaft from the bushing. The film is highly viscous and cohesive in character and is so tacky that it feels like mucilage. As the shaft is rotated, the contact shoe travels over the resistance element on the surface of which there are invariably small irregularities which the contactor strikes and slides over. Each irregularity offers resistance to rotation of the shaft, and the pressure built up overcoming this resistance has heretofore tended to cause the contactor and shaft to jump ahead as the contactor leaves an irregularity. The film described herein prevents this periodic jumping ahead because, apparently the highly viscous and cohesive film adheres to the shaft and bushing and restrains sudden rapid movement of the shaft by a dashpot effect. The result is that the shaft turns very smoothly. Due to this, the contact shoe does not travel jerkily over the resistance element, whereby noise in the volume control circuit is reduced.

Although I have described what I believe to be the manner in which this film functions, I do not wish to be limited to this explanation, because regardless of the reason for it the film produces a better operating control unit than appears to be obtainable with any other material that has been suggested or tried.

Another advantage of this film is that it stays in place and therefore continues to function. Furthermore, it does this regardless of the temperature under which the control unit is normally used because its viscosity does not change appreciably over a very wide temperature range. The film likewise does not dry or harden within a long period of time. A film having such characteristics may be produced by dipping the end of the control shaft, before assembly, in an oil sold by the Standard Oil Company of Pennsylvania and known as Univis Oil Exp. High V. I. No. 3000 at 100° F. Otherwise oils may have these same characteristics, but this is the only one of which I am aware at present.

According to the provisions of the patent statutes I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A variable resistance unit for radio circuits, comprising a base member provided with an opening, a resistance element mounted on said base at one side of said opening, a bushing rigidly mounted in the opening, an operating shaft rotatably disposed in the bushing, a movable contactor for slidably engaging the resistance element, means connecting the contactor to said shaft for actuation thereby, and a liquid film spacing the shaft from the bushing and being highly viscous and highly resistant to oxidizing, said film also being tacky for adhering to the shaft and bushing sufficiently to effectively restrain the shaft from intermittently jumping ahead as said contactor slides from one irregularity to another on said resistance element.

2. A variable resistance unit for radio circuits, comprising a base member provided with an opening, a resistance element mounted on said base at one side of said opening, a bushing rigidly mounted in the opening, an operating shaft rotatably disposed in the bushing, a movable contactor for slidably engaging the resistance element, means connecting the contactor to said shaft for actuation thereby, and a liquid film spacing the shaft from the bushing and being highly viscous and resistant to oxidizing, the viscosity of said film not changing appreciably between −10° F. and 150° F., said film staying in said bushing and also being highly cohesive and tacky whereby it adheres to the shaft and bushing sufficiently to effectively restrain the shaft from intermittently jumping ahead as said contactor slides from one irregularity to another on said resistance element.

EDMUND G. LODGE.