The present invention relates to a radio remote control system adapted for remotely controlling the tuning, volume, tone and power supply of radio receiving apparatus and the like, without the use of wire connections with the remote controlling point of points.

It is an object of the present invention to provide an improved system for generating and utilizing low frequency, low power waves for radio remote control including simplified apparatus of low cost, whereby it is adapted for use with low cost radio receiving apparatus and the like.

It is also an object of the invention to provide a radio remote control system wherein the remote control portion thereof may be provided as a portable unit without external power supply connections and without battery or other power supply source therein.

It is desirable and necessary in connection with radio remote control systems to provide for the remote control of a plurality of functions. Systems heretofore known have the disadvantage of requiring a power supply connection or a portable small battery in the remote control unit and for the separation of the various functions at the receiving portion of the system, require a plurality of filter circuits corresponding in number to the desired number of functions.

It is, therefore, a further object of the invention to provide an improved radio remote control system of the type referred to, wherein a plurality of separate functions may be controlled remotely and selectively without the use of filter networks at either the transmitting or receiving portions of the system.

In accordance with the invention, one or more vibrating reeds are provided in a remote control unit, corresponding in number to the number of functions to be controlled selectively, the reeds being tuned to vibrate at differing audio frequencies in a range, for example, from 60 to 5,000 cycles per second, and with a corresponding number of similarly tuned vibrating reeds at the controlled apparatus or receiver.

The vibration of the reeds at the remote control point is caused to generate audio frequency waves which are picked up at the receiving portion of the system where they are amplified and applied to polarized relay devices in the control circuits of the apparatus to be controlled. The relays comprise correspondingly tuned reeds at the receiving point and individually respond to the received control waves whereby selective filter circuits are eliminated.

By utilizing the vibration of the reeds at the remote control point to generate audio frequency voltages, power supply connections and internal batteries or the like for the remote control apparatus are eliminated. The low frequency waves are of low power and create no interference with radio apparatus and the like located nearby.

The invention will be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing:

Figure 1 is a schematic circuit diagram of the remote control portion of a radio remote control system embodying the invention;

Figure 2 is a side view of a portion of one of the transmitting devices shown in figure 1, to illustrate its operation more clearly; and

Figure 3 is a simplified schematic circuit diagram of the controlled or receiving portion of a radio remote control system embodying the invention.

Referring to the drawing, a plurality of tuned vibratory reeds 5 and 6 are provided in a remote control unit 7, and a corresponding number of tuned vibratory reeds 8 and 9 are provided at the receiving portion of the system. The reeds 5 and 6 are tuned to vibrate at the same frequency \( f_1 \), while the reeds 8 and 9 are tuned to vibrate at a second frequency \( f_2 \). Any suitable number of pairs of reeds may be provided to operate at differing frequencies in the audio frequency range, as required to control a greater number of functions.

The reeds 5 and 6 are fixed at one end 10 to vibrate between the poles 11 of permanent magnets 12. The reeds are provided with pickup coils 13 and 14 associated with the poles of the electromagnets, which receive a voltage when the reeds are caused to vibrate between the poles 11. The coils are connected in parallel across an output circuit 15 which terminates in a radiator or loop antenna 16.

The reeds are caused to vibrate by being plucked at the free ends and this action may be arranged for push-button control, as shown in Figure 2, wherein the end of the reed 5 is positioned to be engaged by a finger 17 carried by a push-rod 18 connected with a push button 19. The push button 19 is depressed against the action of a spring 20 and causes the finger 17 to pluck or snap the end of the reed, causing it to vibrate at the predetermined frequency to which it is tuned. Voltage at that frequency is picked up by the associated pickup coil 13 or 14, is applied to the radiator or loop 16.
The energy radiated from the loop 16 is picked up at the receiving point a short distance away, by a receiving loop 25 and is amplified through an amplifier 26 connected with the loop through a suitable coupling means such as a transformer 27. The output circuit 28 of the amplifier is connected with the operating coils 29 and 30 of relay devices indicated at 31 and 32, in which the vibratory reeds 8 and 9 are the armature elements. Suitable contact elements 33 and 34 are arranged to be closed when the reeds are actuated, to control circuits 35 and 36 in any suitable radio tuning or other control system, as indicated generally at 37. Circuits providing tuning volume and other control functions are well known and since the specific actuating means does not form part of the present invention, further description is believed to be unnecessary.

While two tuned reeds are shown in the transmitting devices or remote control unit, and a corresponding number in the receiving portion of the system, as previously referred to, additional reeds may be provided at the transmitting and receiving portion of the system, one for each desired function to be controlled.

From the foregoing description, it will be seen that, when a button 19 is pressed at the remote control point, one of the reeds is forced from its position of equilibrium and, upon being released, vibrates at its natural frequency $f_1$ or $f_2$. The vibration of the reed induces a voltage in the pickup coil 13 or 14 which causes a current to flow through the transmitting radiator or loop 16 at the frequency of the reed which has been actuated.

The signal $f_1$ or $f_2$ is picked up by the receiving loop 25 and is preferably amplified substantially 60 lb, and being applied to the relay devices in parallel, the tuned reed or armature responsive to the transmitted frequency responds thereto without the necessity for filter circuits or selector switch means. This causes a control circuit to be energized or deenergized, depending upon arrangement of the contact elements 33 and 34 contained in the relay devices.

A further advantage of this system lies in the fact that no tuned circuits are required or provided, and no batteries or other power source is required at the remote control point or within the remote control unit. The latter may be relatively simple in construction and of small size, since it must be only large enough to accommodate the several vibrating reed transmitters and the transmitting loop.

Furthermore, since the controlling impulses are transmitted by electric waves at audio frequency and of low power, the penetration of the waves to great distances for causing disturbance is prevented. For the transmission of controlling impulses across a room or over a relatively short distance of a few feet, the system of the present invention provides substantially no external radiation. The armatures of the control relays are tuned to the frequencies of the transmitting reeds, so that no filters are required.

I claim as my invention:

In a radio remote control system, a manually portable remote control unit operable without battery or external power supply means including a plurality of tuned vibratory reed elements each responsive to a different audio frequency, permanent magnet means providing a magnetic field for and a fixed electric pickup coil associated with each of said reed elements, individual manually operable push-button means for selectively engaging and mechanically actuating each of said reed elements to cause vibration thereof in said field and the generation of electrical waves in the associated coil, a loop antenna in said unit connected directly with each of said coils for the radiation of energy from each of said vibratory reed elements as the sole energy source for electric wave radiation through said loop antenna.

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