

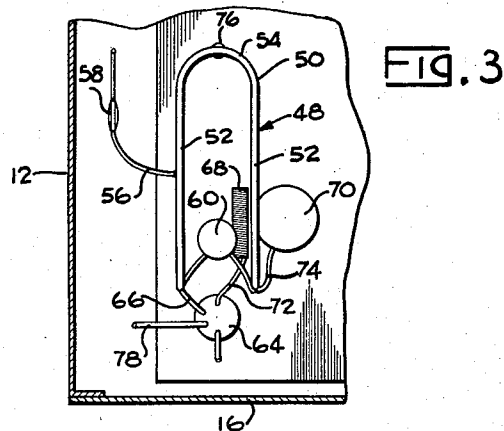
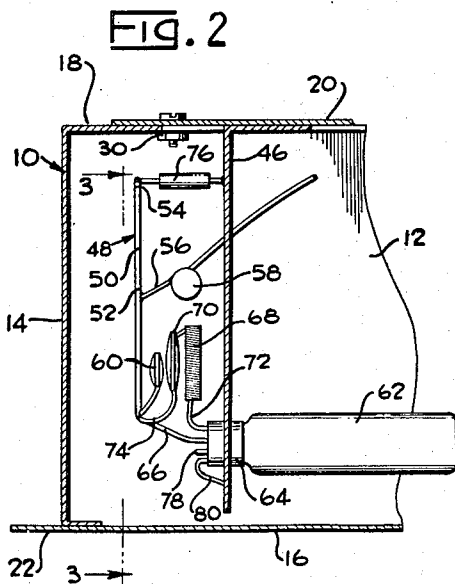
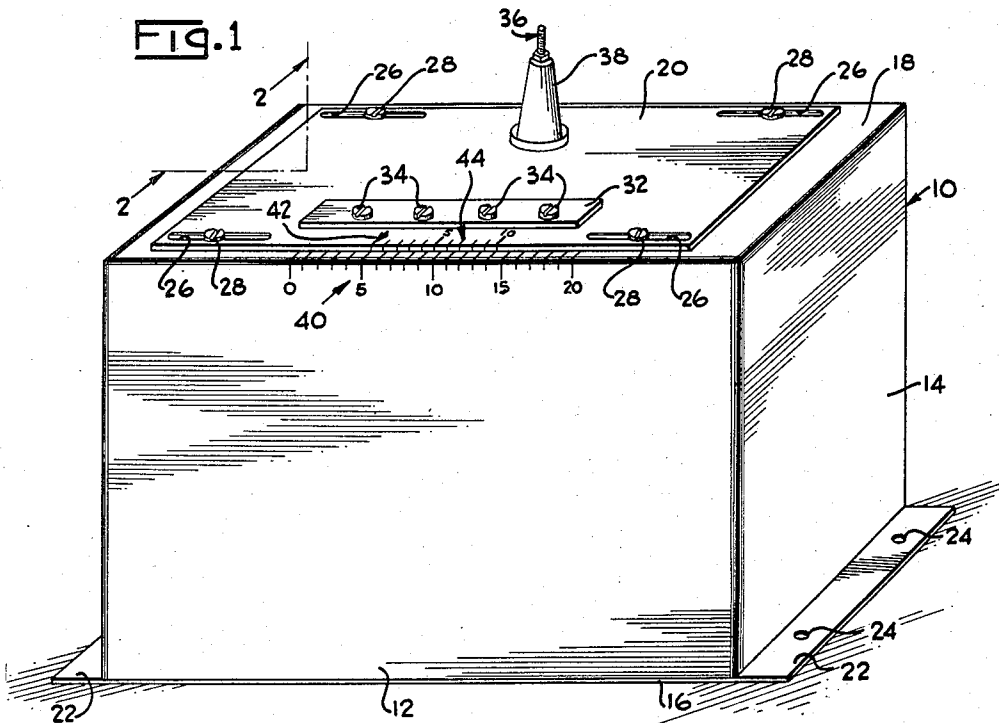
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RADIO FREQUENCY ADJUSTING MECHANISM

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RADIO FREQUENCY ADJUSTING MECHANISM

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1 Claim. (Cl. 250—40)

My present invention relates to means for trimming radio transmitters and receivers, and it relates particularly to a radio trimming adjustment mechanism in which the trimming is accomplished by merely moving a selectively movable portion of the radio housing without requiring any direct communication with the usual trimmer disposed within the housing.

Although my present invention is not necessarily limited in its field of use in connection with radio transmitters and receivers, it is particularly adaptable for use in connection with small radio transmitters and receivers which control the operation of garage doors. In such radio controlled garage door installations, the garage door is selectively moved between its open and closed positions by means of a motor driven garage door operator. The radio receiver unit is positioned in the garage and is operatively connected to the garage door operator, so that when the receiver receives radio signals from a transmitter tuned to the same frequency, it will cause movement of the garage door.

The transmitter is mounted on an automobile that is housed in the garage, being positioned normally either under the hood or in front of the radiator. The selective manipulation of a button or switch inside of the automobile will actuate the transmitter to cause it to transmit the radio signals that are received by the receiver for causing actuation of the garage door.

Normally the receiver unit within the garage will be factory adjusted to the desired frequency, and the transmitter, located in the automobile, will be tuned to the receiver frequency by adjustment of a suitable trimmer disposed in the transmitter.

Conventional prior art trimmers used for this purpose are the usual trimming condenser disposed within the radio housing and accessible through an opening in the housing by means of a tuning wand, screwdriver or the like; or the conventional iron core tuning slug which is likewise adjusted by means of a tuning wand, screwdriver or the like, and which is likewise normally disposed inside of the radio housing and accessible through an opening in the housing.

These garage door operator radios are in the high frequency range, the presently used ones operating at frequencies of between about one hundred fifty (150) and three hundred (300) megacycles, with even higher frequencies to be used in the near future. The use of these high frequencies causes tuning or trimming adjustments to be highly critical. This causes a number of serious problems when conventional prior art trimmers are used.

Thus, while a carpenter or garage door hanger is essential to the installation of a garage door operator, and is therefore the man who usually installs the garage door operator radios, he is not at all qualified to handle critically adjustable electronic equipment. Thus, such a man will almost invariably attempt to tune the radio with a screwdriver having some metal in it, rather than

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with the tuning wand which is almost essential for the proper tuning of such radios. This will, of course, make it extremely difficult for him to tune the transmitter to the same radio frequency as the receiver.

Anyone tuning such radios by the conventional trimming means, and particularly such a carpenter or garage door hanger, is very likely to get the trimmer far away from the desired frequency, and in this circumstance it is extremely difficult to get back into the correct frequency range, as there is no fixed setting or any other way which the tuner has of determining approximately where the trimmer should be when the correct frequency is reached.

Usually it is very difficult to tune the transmitter located under the hood or in front of the radiator of the car at night, because of the inaccessibility of the usual trimming adjustment. In this circumstance a flashlight is usually required, and a tuning wand must then be fitted through an aperture in the radio housing into the adjusting device.

Another serious problem in connection with prior art trimming devices is that openings were present in the radio housing. This permitted road dirt, water splashing up from underneath the automobile, oil fumes and the like to enter into the housing, which altered the impedance of the radio frequency tank circuit, thus changing the frequency so that adjustment was required. One prior art attempt to avoid this problem was to provide a polystyrene shaft operatively connected to the trimmer, which extended out through a wall of the housing, with suitable sealing means. However, this device was too costly, and any dirt, carbon or the like which deposited on it altered the frequency of the tank circuit.

The above and other problems in connection with conventional prior art trimmers caused garage door operator radios embodying these conventional prior art trimmers to be frequently out of adjustment, so that the garage door either could not be operated at all, or could not be operated at the desired distance. This resulted in frequent expensive calls by radio repair men capable of handling such sensitive equipment.

In view of these and other problems, it is an object of my present invention to provide trimming adjustment means for radio transmitters and receivers in which the adjustment is accomplished by merely moving a selectively movable portion of the radio housing, without requiring any direct communication with a trimmer within the housing.

Another object of my present invention is to provide trimming adjustment means of the character described in which the radio housing can be completely sealed and shielded, with the trimming adjustment being accomplished by merely moving a selectively movable portion of the radio housing.

Another object of my present invention is to provide trimming adjustment means of the character described which merely requires the mechanical movement of a movable portion of the radio housing, whereby no particular skill is required for tuning; and in which the tuning movement of the movable portion of the housing is not at all critical.

Another object of my present invention is to provide trimming adjustment means of the character described which includes a setting scale between the movable and fixed portions of the housing, whereby the person tuning the radio will at all times know approximately where the frequency is relative to the trimming range, and will not become "lost."

A further object of my present invention is to provide trimming adjustment means of the character described which includes a vernier scale operative between the movable and fixed portions of the housing, whereby extremely accurate tuning adjustment is possible. This vernier scale

permits the frequency to be re-set to any predetermined frequency (such as the original factory setting) with considerable accuracy.

An additional object of my present invention is to provide trimming adjustment means of the character described in which the trimming is accomplished by relative movement between the radio frequency tank circuit and a fixed metal plate upon relative movement between the movable and fixed portions of the radio housing.

Other objects and advantages of my present invention will be apparent from the following description and claims, the novelty of my invention consisting in the features of construction, the combinations of parts, the novel relations of the members and the relative proportioning, disposition and operation thereof, all as is more completely described herein and as is more particularly pointed out in the appended claims.

In the accompanying drawings, forming a part of my present specification;

Figure 1 is a perspective view of a radio device (either transmitter or receiver) embodying my present invention.

Figure 2 is a fractional vertical section along the line 2—2 in Figure 1 illustrating my presently preferred radio frequency tank circuit mounting.

Figure 3 is a vertical section along the line 3—3 in Figure 2 showing another view of my presently preferred tank circuit.

Referring to my drawings, I have illustrated my present invention in connection with a transmitter unit adapted to be mounted in an automobile, for actuating a corresponding receiver unit to open or close a garage door automatically. It is to be understood, however, that my present invention is usable in connection with the receiver unit, or in connection with other types of radio equipment, for the trimming adjustment thereof. I will use the term "radio unit" in the claims annexed hereto to designate either a transmitter unit or a receiver unit.

The radio unit shown in the drawings is completely encased in and shielded by a housing 10 which includes parallel side members 12, parallel end members 14 and a bottom member 16 integrally attached to side members 12 and end members 14.

A flange 18, which is horizontal, extends inwardly from the upper edges of side members 12 and end members 14, to form a seat upon which rectangular lid member 20 is disposed. The lid member 20 will overlap flange 18 on all sides, in all of the positions of lid member 20, whereby the sensitive portions of the radio unit will at all times be completely shielded from any metallic or other objects which might alter the frequency of the unit, and whereby dirt, water, oil fumes and the like are prevented from reaching the sensitive parts of the radio unit.

I provide parallel slots 26 through lid member 20, with one of the slots 26 near each of the four corners of lid member 20. Slots 26 are substantially parallel to the side members 12, and are disposed directly above the side portions of flange 18, to permit screws (or bolts) 28 to pass through the respective slots 26 and to be threadedly engaged in the side portions of flange 18. If it is desired, the threaded connection between screws 28 and flange 18 may be strengthened by integrally attaching respective nuts 30 to the underside of flange 18 where the respective screws 28 engage flange 18.

By this means, when screws 28 are slightly loosened, lid member 20 may be slid back and forth on flange 18, and may be selectively locked in any desired position on flange 18 by merely tightening the screws 28 again.

If it is desired, the screws 28 may include upward extensions such as wings (not shown) that may be readily manipulated between the fingers of the operator.

I provide the usual terminal board 32 on lid member 20, board 32 carrying the usual spaced terminals 34 to which the power and actuating signal are applied.

An antenna post 36 extends upwardly from lid member 20, and is completely insulated from lid member 20 as it passes therethrough by the conventional ceramic insulator 38.

The exact position of lid member 20 relative to the rest of housing 10 is indicated on a numbered scale 40 along the upper edge of one of the side members 12 and the adjacent portion of flange 18, by means of an indicating arrow 42 on lid member 20. In order to greatly increase the accuracy with which the position of lid member 20 may be determined, I provide a vernier scale 44 to the right of indicating arrow 42 on lid member 20.

Although I have shown scale 40 to be on the base portion of housing 10, with indicating arrow 42 and vernier scale 44 on the lid member 20, it is to be understood that these may be reversed without departing from my present invention.

A chassis plate member 46 is integrally attached to the underside of lid member 20, and extends downwardly into the housing 10, preferably parallel to and substantially spaced from one of the end members 14.

The radio frequency tank circuit 48 is mounted on chassis plate member 46 between chassis plate member 46 and end member 14 of the housing 10. In the high frequency range of garage door operator radio units, my preferred tank circuit 48 comprises a single loop member 50 having a pair of generally parallel legs 52 that are joined together at one end by a curved end portion 54.

The antenna lead 56 connects to one of the legs 52 about midway along its length, and is provided with the usual coupling condenser 58.

The band setting condenser 60 is operatively connected between the free ends of legs 52.

The vacuum tube 62 is mounted in the conventional tube socket 64 that is, in turn, mounted on chassis plate member 46.

A lead 66 operatively connects the free end of one of the legs 52 to the grid of tube 62.

A radio frequency choke 68 and a coupling condenser 70 are connected in series, with lead 72 from choke 68 being operatively connected to the plate of tube 62, and with lead 74 from coupling condenser 70 being operatively connected to the free end of the other leg 52.

The usual grid resistor 76 is operatively connected between the center of the curved end portion 54 of loop member 50 and chassis member 46, which is at ground potential.

The plate of vacuum tube 62 is supplied with the usual D. C. plate voltage from a suitable source of supply (not shown). Also, the cathode of tube 62 is heated by current supplied through lead 78 from another suitable source of D. C. supply. The cathode is grounded to chassis member 46 by lead 80.

Tank circuit 48 is adjusted to the correct frequency at the factory by pinching the loop member 50, with the vernier scale 44 being approximately centrally located on the primary scale 40. The channel number (garage door operator radio units being divided into a plurality of channels), and the exact vernier reading of indicating arrow 42 on primary scale 40 are both stamped or otherwise indicated on lid member 20 for the correct frequency in tank circuit 48 to cause the unit to match its corresponding receiver unit.

Under normal operation of the unit, the housing 10 will remain completely closed at all times, so that no dirt, water, oil fumes or other foreign matter can enter the housing 10 to alter the frequency.

In the event that the frequency must be adjusted to compensate for any frequency variation which arises between the transmitter and receiver, all that is necessary is to loosen screws 28 and shift lid member 20 to the left or to the right until the required new frequency is

reached. Then, the screws 23 are again tightened. Normally, a relatively accurate adjustment can be made, because of the fact that a relatively large amount of movement of lid member 20 causes only a relatively small frequency shift, due to the fact that loop member 50 is substantially spaced from end member 14, with which it, in effect, forms a trimmer condenser. The sensitivity of the adjustment may be controlled by the spacing of loop member 50 from end member 14, the adjustment being more sensitive if loop member 50 is closer to end member 14. A typical spacing between loop member 50 and end member 14 will be between about one-half ($\frac{1}{2}$) inch and five-eighths ($\frac{5}{8}$) inch. The sensitivity of the adjustment may likewise be controlled by control of the "Q" of the circuit, the higher the "Q," the more sensitive the adjustment.

In the event that the person adjusting the device "loses" the frequency of the receiver, all that is necessary is to reset the indicating arrow 42 to the factory setting stamped on lid 20, and start again. This completely eliminates the usual waste of time in hunting about to again find the range with conventional trimming devices.

Since lid 20 completely shields the sensitive circuits within housing 10 while the adjustment is being made, there will be no "drift" of the frequency after the adjustment is completed when the operator removes his hand or tool from the device. Obviously, no special tuning wands or the like are necessary for adjusting my device, and it can be readily adjusted even in very poor light and under very difficult circumstances.

It is to be noted that conventional practice in garage door radio control units is to utilize a quarter wave antenna. This antenna is not at all sensitive at its base, where it joins antenna post 36, so that manipulation of lid 20 does not cause alteration of the frequency through antenna impedance variations.

It is to be understood that the form of my invention herein shown and described is my preferred embodiment and that various changes in the shape, size and arrange-

ment of parts may be resorted to without departing from the spirit of my invention, or the scope of my appended claim.

I claim:

- 5 A trimming device for a radio frequency unit including a housing, an opening in said housing, a metal cover plate slidably mounted on said housing and disposed across said opening, a radio frequency tank circuit member disposed within said housing, and a conducting member disposed within said housing in spaced relationship to said tank circuit member, one of said members being fixedly mounted relative to said housing and the other said member being fixedly mounted relative to said cover plate, whereby said members are relatively movable upon sliding movement of said cover plate on said housing, said cover plate is substantially larger than said opening in said housing, and stop means operatively engageable between said cover plate and said housing to cause said cover plate to completely cover said opening at all positions between the limits of travel of said cover plate on said housing, said stop means including a plurality of parallel slots in said cover plate, and a threaded clamp member passing through each of said slots and threadedly engageable in said housing, said threaded clamp members being
- 10 threadedly movable between loosened positions in which said cover plate may slide between its limits of travel at which the ends of said slots abut against said clamp members, and tightened positions in which said clamp members clamp said cover plate tightly against said housing.
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