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RECEIVER WITH NEARBY, OR REMOTE MOTOR TUNING AND WITH BAND WIDTH CONTROL

Filed May 24, 1941

Serial No. 394,993

2 Sheets—Sheet 1

Fig. 1

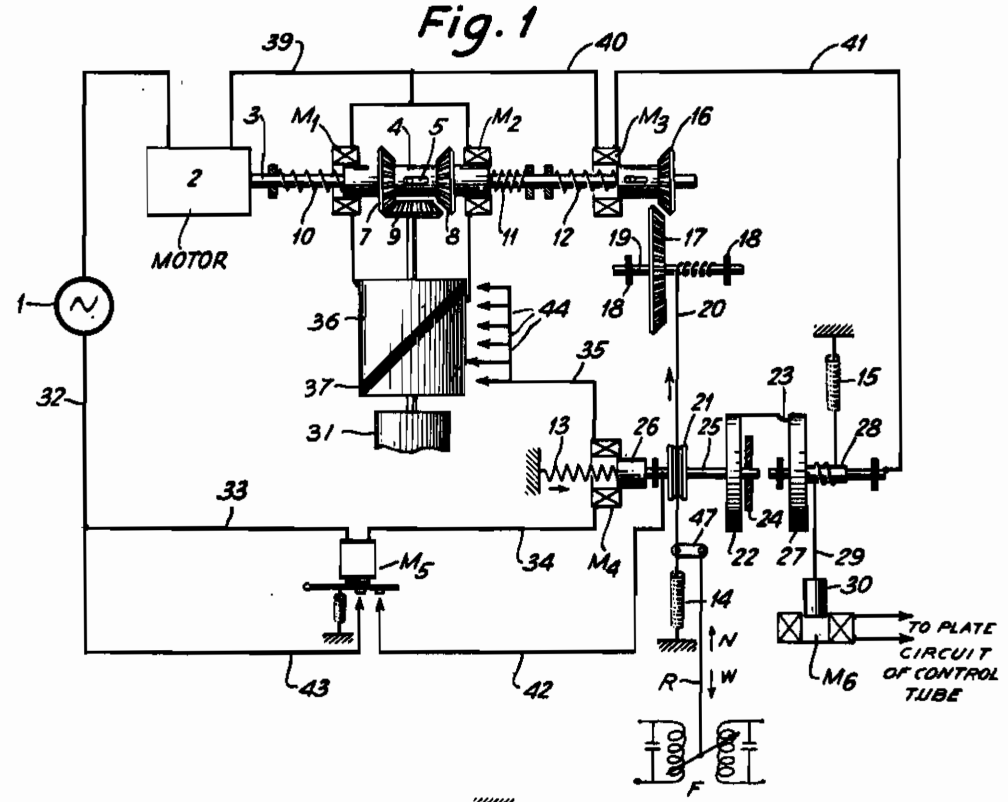

Fig. 2

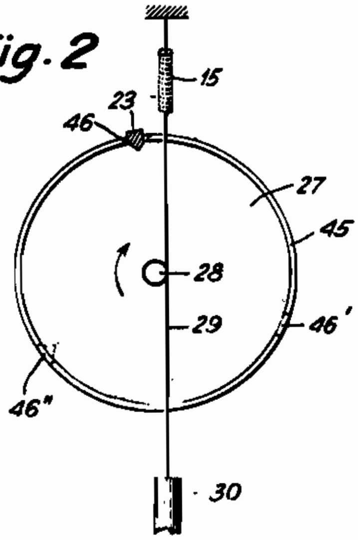

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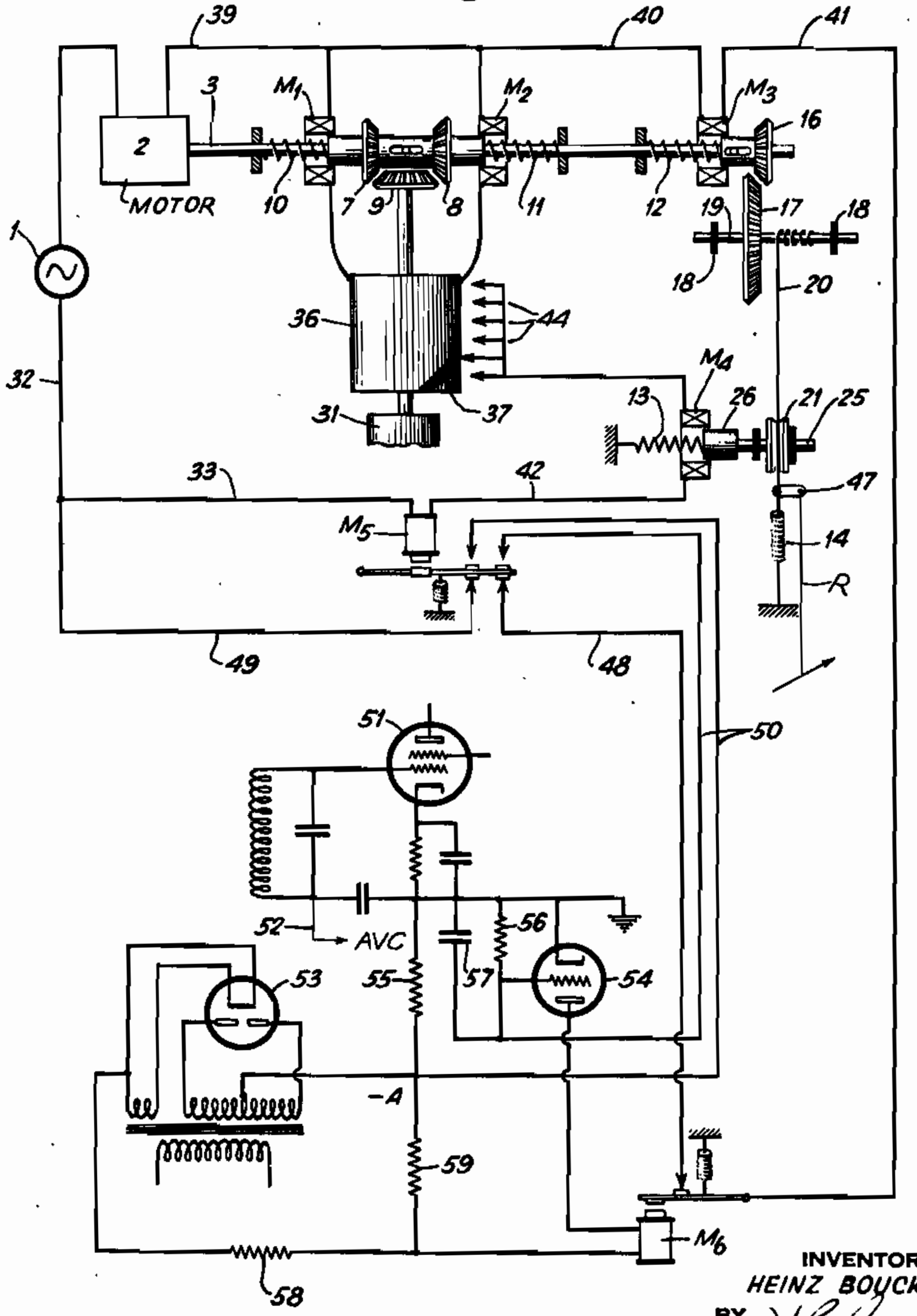
Fig. 3



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ALIEN PROPERTY CUSTODIAN

RECEIVER WITH NEARBY, OR REMOTE MOTOR TUNING AND WITH BAND WIDTH CONTROL

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It is known to tune a receiver by means of a motor in the vicinity of the receiver, or from a remote place, whereby the motor is switched-in for instance by means of push buttons assigned to the various stations and the motor is disconnected again, on receiving the desired position of tuning, by a contact disc which moves simultaneously with the motor and is in connection with the push buttons. The present invention deals with the problem of providing in such a receiver a band width control which operates automatically in dependence on the station which happens to be tuned to.

In accordance with the present invention, after the tuning is completed the tuning motor is automatically coupled from the tuning arrangement to the band width control device by means of a relay which has come to rest by the interrupted motor current so that the elements of the band width control are gradually moved in the sense of a decrease, or increase of the band width until the band width is reached which is determined by the power of the desired transmitter and/or nearby transmitter with the view to reducing the receiving power of nearby transmitters.

In case of a remote operation of the receiver it is already known first to employ the tuning motor for the tuning and then for setting the volume, but the re-coupling and switching of the motor to the second end was done by a switch to be operated at will. In contrast therewith in the present invention the difference is that firstly the tuning motor instead of adjusting the volume, carries out a control of the band width and secondly instead of this performance being carried out by a manual control it is done in a fully automatic fashion after the tuning is completed.

The idea of the present invention is put into practice in that the time period during which the motor acts mechanically upon the control elements of the band width moving them from one limit value in the sense of an increase, or decrease, is determined by the value of the receiving field strength of the transmitter tuned to, i. e. in dependence on the volume control potential or in dependence on the ratio between the field strength of the desired transmitter and that of the neighboring transmitter, or on both values. In the last-mentioned cases the intensity of the 9 kHz local oscillation whistling can be considered as a measure for the said time period. The control of the time of action of the motor on the control of the band width can be obtained through mechanical means by setting a contact disc by means of the band width control potential, as well as with the aid of a time constant organ charged by the control potential. The figures 1 and 2 show an example for the first measure and the figure 3 shows a construction for the second measure.

The arrangement according to Figure 1 operates as follows: The shaft **3** of the motor **2** which is fed from the current source **1** has three bevel gears (**7**, **8** and **18**) so mounted thereon that they can be axially moved, whereby the bevel gears **7**, or **8** which are connected with each other serve for the clockwise turning or counter clockwise turning of the tuning means **31**. This coupling is effected by the magnet coils M_1, or M_2 which are adapted to pull inwards against the pressure of the springs **10**, or **11** the magnetic hollow shaft **4** supporting the bevel gears **7** and **8**. The rotational force of the shaft **3** is transmitted to the hollow shaft across a pin which engages in the slot **5** of said hollow shaft. Whether the bevel gear **7** or **8** is coupled with the bevel gear **9** and thus with the tuning means **31** depends on the position which the drub **36** has with respect to the key, or groups of keys **44** having been depressed for the purpose of tuning. The surface of the drum is divided into two conducting surface parts in a manner known as such and which are electrically separated by an insulating strip **37** extending obliquely to the shaft, whereby the one surface part is connected to an end of the coil M_1 while the other part is conductively connected to an end of the coil M_2. In the position of the switch herein shown, the contact next to the bottom contact is depressed whereby the magnet coil M_2 is switched-in which forces the bevel gear **7** against the bevel gear **9** thus turning the drum until the depressed contact on reaching the insulating strip interrupts the circuit. This circuit extends from the motor **2** along the line **39** across M_1, or M_2 to the drum **36** from there through the contact group **44**, across the line **35**, to a further magnet coil M_4 whose purpose will be described below, and from there across the line **34** to a further magnet coil M_5 which pertains to a relay. From there the current returns to the current source **1** through the lines **33** and **32**.

After the tuning is completed among other things also the relay coil M_5 which falls off with delay has no longer current. Thus the line **43** will be connected with the line **42** and the motor will be switched in again. However, since the coils M_1 and M_2 receive no current while the bevel gear **9** takes up the position in the center between the bevel gears **7** and **9**, the tuning will in no ways be affected. Now the current passes from the motor across the lines 39 and 40 to the magnet coil M_3 which draws in the armature joined with the bevel gear 16, thus coupling the bevel gear 16 with a larger bevel gear 17 which turns about the shaft 19 supported in the bearings 18. From the magnet coil M_3 the current then passes across the line 41, the disc 27 with the aid of the contact 23 gliding on said disc, then across the shaft 25 to the line 42, 43, 32 and thence to the current source 1.

The magnet coil M_6 which tends to pull an armature 30 into itself is energized by the plate current, or cathode current of the control tubes which current is to determine the time during which the motor is to turn for the control of the band width. The armature 30 has a cord 29 fastened thereto which is several times wound about the shaft 28 of the said disc 27 and which is tensioned by a spring 15. The disc 27 carries on its circumference a conductive ring which is interrupted by a grooved place 46 (Figure 2) of insulating material. The position of said grooved place 46 shown in Figure 2 is assumed at receiving a local station where the current passing through the coil M_6 has a minimum value. When tuning to a more distant station, the current increases, the armature 30 will be attracted and the disc 27 turns in the direction of the arrow shown in Figure 2. The grooved place 46 assumes hereby for instance the position 46′, or the position 46″ in case of a still weaker station. This signifies that the circuit is closed by means of the contact glider 23 and that therefore the disc 17 will be driven. Consequently, the cord 20 tensioned by a spring 14 and wound around a wheel 21 will be unwound, thereby turning the wheel 21 and at the same time the device for controlling the band width but which is not shown in the drawing.

This wheel 21 is coupled through the shaft 25 with the disc 22 on which the contact 23 is conductively mounted. Furthermore, a magnet armature 26 is mounted on the shaft 25 and which can be drawn into the magnet coil M_4. As long as M_4 is without current, i. e. during the control of the band width and thereafter, the spring 13 forces itself against the armature 26 and thereby against the shaft 25 with the effect that the disc 22 is pressed against the fixed disc 24. By providing sufficient roughness of the surfaces of 22 and 24 which face each other (for instance rubber layer) the brake force is increased to such an extent that on the one hand, it will not be overcome by the downward pull of the springs 14 which are more or less tensioned in the course of the control, and that on the other hand, a turning of the disc 22 by means of the motor 1 in the opposite direction will be possible.

The pulled, or rotary parts of the elements for the control of the band width are connected with the wheel 21, or with the disc 22, or with the part of the cord 20 residing between the spring 14 and the wheel 21. For instance, a pulling rod connected with the coupling coils of the band filters and actuating the latter, can be so connected with the point 47 that the further the said point moves in the direction towards the wheel 21, the narrower becomes the band width. Meantime also the disc 22 turns and therewith the contact 23 in the clockwise sense (Figure 2) and the more so the further the groove 46 has moved likewise in the clockwise direction. Thus the band width will reduce its width the more, the weaker the station tuned to. If the contact arrives in the notch, the circuit will be interrupted and the elements of the band width control remain in the assumed position. On account of the arrested contact also the disc 27 remains in position despite eventual variations in the control performance.

Now if by depressing another push button another station is tuned to, then by means of the relay M_5 also at this place the circuit effective for the control of the band width will be interrupted and at the same time the attracted armature 26 of the magnet M_4 removes somewhat the disc 22 including the contact 23 from the disc 24 so that the spring 14 can set the elements of the band width control into the initial position, i. e. to maximum band width in the present example of construction. Obviously, through a slight modification of the arrangement the latter can be so adapted that the narrowest band width serves as initial position (in the example of construction described at the end of the description—this bringing back into the initial position is not required).

In the present example it is not advisable to insert a friction coupling between the disc 17 and its shaft in order to avoid that the cord 20 will eventually be tensioned too much.

The arrangement according to Figure 3 is to a large extent identical with the arrangement shown in Figure 1. However, the arrangement is shown at the moment in which the tuning is completed and the control of the band width takes place. As in the case of Figure 1, the tuning circuit is closed across the magnet coil M_4 and relay M_5. In the arrangement the shaft 25 has no longer the disc 22 and contact bar 23 and furthermore the device shown separately in Figure 2 is no longer present. Just as in the case of Figure 1, the elements for the band width control are driven by the wheel 21, or cord drive 20 (point 47).

As regards the tuning circuit there exists in the circuit of Figure 3 as compared with that of Figure 1 the sole difference that the relay coil M_5 instead of pertaining to a switch-off relay, belongs to a reversing relay. There is however an essential difference as regards the effective circuit for the band width control. On reaching the proper tuning position the release of the armature from the relay M_5 effects the closing of the circuit for the band width control across the lines 49, 48 and 41 and across the contact of the relay M_5 at the right bottom of the figure. The magnet M_3 effects in the manner already described, the coupling of the bevel gear 16 with the bevel gear 17.

The time during which the motor acts upon the elements of the band width control is determined by the duration of the discharge of the condenser 57 across the resistor 56, namely as follows: The tube 51 represents a controlled high frequency tube, or intermediate frequency tube of the receiver whose grid circuit has at arrow 52 the volume control potential applied thereto in the customary manner. The end of the cathode resistance of this tube which faces away from the cathode is placed at ground, or at the mass. Between this point and the minus pole of the line section designated by 53 a resistance 55 is inserted which is passed by the cathode current of the tube 51, or by the sum of the cathode currents of all controlled tubes. In order to prevent the plate current of the non-controlled tube (oscillator stage, or end stage for instance) from passing likewise across the resistance 55, the cathode resistances of said non-controlled tube are placed directly at the minus pole A. By means of a parallel condenser for the resistance 55 but which is not shown in the drawing this resistance is bridged as regards high frequency and audio-frequency.

The direct potential appearing at the resistance 55 is higher, the lower the field strength of the station tuned to. Since in the state of rest of the drive device this potential has its negative pole placed at the grid of the auxiliary tube 54 across the lines 50, the said tube is blocked and no current passes through the relay M_6. Now, through the release of the armature of the relay M_5 at the start of the control of the band width, the lines 50 are separated, the condenser 57 will be discharged across the high-ohmic resistance 56 and a strong plate current begins to flow in the auxiliary tube 54 after a certain time period which depends on the value of the initial potential at the condenser 57 as well as on the dimensions of the condenser 57 and of the resistance 56 whereby said current terminates, by means of the relay M_6 through the falling-off of the relay M_5, the setting operation of the band width in the position shown. In this circuit the plate potential and therewith the value of the plate current which flows at the de-blocked state of the auxiliary tube 54 will be set by the resistances 58 and 59.

The following dimensions for the R—C member are given by way of example: Condenser $57=1\mu F$, resistance 56=3 megohm.

Moreover sufficient time must be available in order that on reaching the correct tuning position the condenser 57 can charge itself across the lines 50 to the potential value corresponding with the received station. Thus, when the proper tuning position is reached the relay M_5 shall not open the circuit 50 instantaneously, but instead with a certain delay such as for instance 0.3 to 0.5 sec.

In the case of motor tuning it is customary to disconnect in some way parts of the receiver so as to render inaudible the frequencies existing between the station last tuned to and the station being tuned to. Also in the case of the control device according to the present invention the same measure will preferably be resorted to and the reproducing organ switched-in after the tuning is completed. It will however, be unnecessary to wait with the switching-in of the reproducing apparatus until the control of the band width is completed, because this control does not disturb the reception.

The present invention affords the control of the band width in all high frequency and intermediate frequency stages since through the motor a sufficient driving power and setting power is available.

Simultaneously with the setting of the band width a control of the receiving power can be carried out in that on receiving powerful stations a small fraction of the antenna potential arrives at the control grid of the first tube as compared with the reception of weaker stations. In this way it is accomplished that an excessive control of the first tube and thus a source of distortions then no longer unavoidable, is entirely eliminated. For this control there may be employed for instance a variable inductive coupling, or an ohmic resistance, or a capacitive rotary voltage divider. This control element is required to respond only in the range of especially high field strengths, while leaving the coupling of the antenna constant below a certain limit value of the field strength, namely at values where the danger of excessive control no longer exists. On the other hand, an influencing extending throughout the entire range of the field intensity affords the advantage of an additional balancing of the volume.

In the examples of construction described above, it was presupposed that the motor can turn the elements of the band width control in a single direction only such that during the tuning performance for another station the elements of the band width control must always be returned again into the initial position. This bringing back becomes superfluous if the contact disc 27 in Figure 1 which is moved by the band width control potential into the position corresponding with the desired station, is divided at two insulated places into two parts as in the case of the contact drum 36 whereby each of the said parts is placed in series with a respective coupling magnet for different drive devices for the elements of the band width control. In this case the coupling magnet M_3 in Figure 1 is replaced by two magnets which effect as in the case of the magnets M_1 and M_2 a reversing of the direction of rotation of the disc 17 and thus a reversing of the movement of the elements of the band width control. The input terminals of the two magnets serving for this purpose are then connected, together with the line 40 and the output terminals, with the two parts of the split insulating disc 27 across respective lines (instead of across the line 41). The disc 22 is then fixedly coupled with the disc 17, for instance by employing a common shaft, and the following parts will be omitted: 13, M_4, 26, 14, 21, 20 and 24.

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